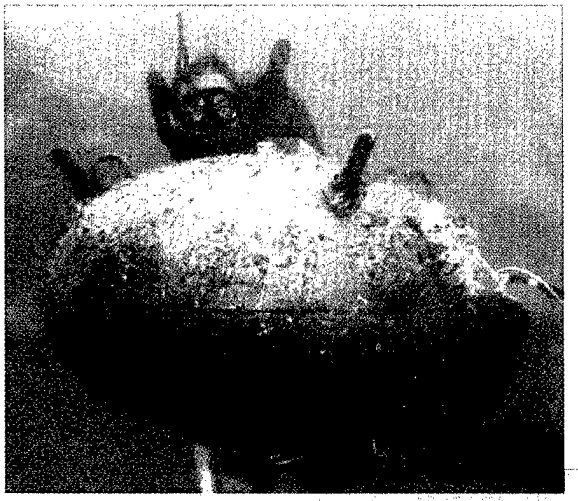
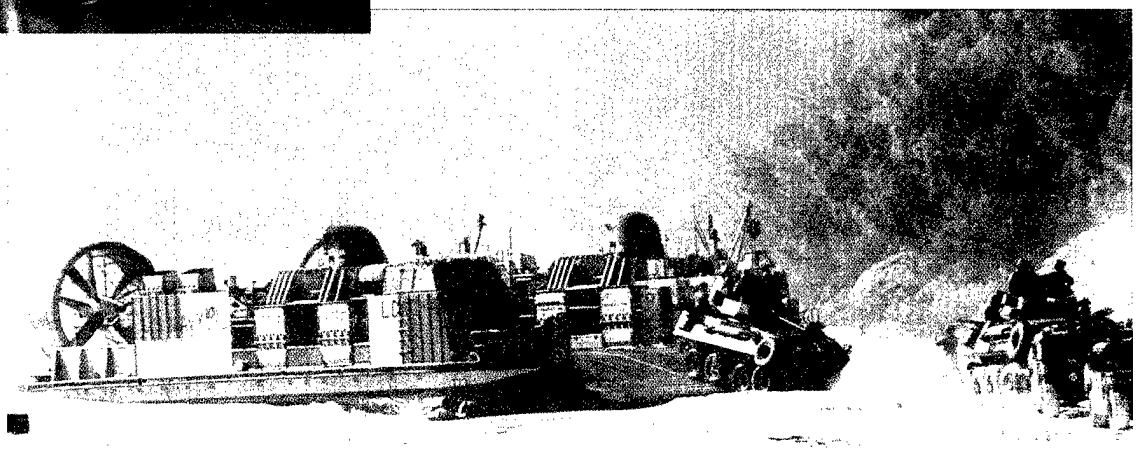
FINAL ENVIRONMENTAL IMPACT STATEMENT

MILITARY TRAINING IN THE MARIANAS

VOLUME TWO
Appendices





19990707 009

U.S. Pacific Command
June 1999

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MILITARY TRAINING IN THE MARIANAS

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Appendix A-1
Notice of Intent

ervice Corps, what can the Corporation do to further the mission, vision, and goals that engage Americans of all ages and backgrounds in community-based ice?

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 6050–28–P

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.
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; fax (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 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, 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

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.

Dated: November 14, 1995.

Patricia L. Toppings,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

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 B

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. 9013, 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 B

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
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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

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NCTAMS
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FPO AP96537-1805

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Ernst & Young
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Tamuning, Guam 96911

Mark O. Rudo
Archaeologist
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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
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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
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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

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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
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Agana Heights, Guam 96919

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Administrator
Guam Coastal Management Program
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USDA Aphis Animal Damage Control
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Priscilla Dela Cruz
Deputy Managing Director
Marianas Visitors Bureau
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Saipan, MP 96950

Commanding Officer
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USAR Marianas
56 Ammon Avenue
Barrigada Heights, Guam 96913

Deparment of Parks & Recreation
Historic Resources Division
P.O. Box 2950
Agana, Guam 96910

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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

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CNMI Commonwealth Utility Corp (CUC)
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Herman Guerrero
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Chairperson
Committee on Federal and Foreign Affairs
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Speaker/Chairman
Committee Electrical Power & Consumer Protection
Suite 222 Julale Shopping Center
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Adelup Complex
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Mr. Eugene Nitta
Protected Species Program Coordinator
National Marine Fisheries Service
U.S. Deparment of Commerce
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Administrative Director
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Agana, Guam 96910

Mr. Juan B. Rosario
Director
Civil Defense/Guam Emergency Service Office
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Agana, Guam 96910

Mr. John M. Quinata
Director
Customs & Quarantine
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Tiya,n Guam 96913

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Mr. A.J. Shelton
Director
Deparment of Parks and Recreation
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Mr. Dennis Rodriguez
Director
Deparment of Public Health and Social Services
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Agana, Guam 96910

M.r Gil A. Shinohara
Director
Deparment of Public Works
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Tamuning, Guam 96911

Mr. Darryl Taggerty
Director
Disaster Recovery Office
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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

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Acting Fire Chief
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Agana, Guam 96910

Mr. Ramon Q. Sudo
Adjutant General
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Mr. Jack S. Shimizu
Chief of Police
Guam Police Department
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GMF Guam 96921

Mr. Richard Young
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Guam Power Authority
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Agana, Guam 96910

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254 Martyr Street
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101 N Street
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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. Satiyan 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 Documents

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.

Commonwealth Now

- 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 traing 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. Shanley
Date: 8 December 1995

Name and Address (please print): JAN M. Shanley
MARIANAS AUDUBON SOCIETY
PO BOX 4425
AGANA, GU 96910

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

PRODLAN 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

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: David 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
Caller Box 10007 2nd Floor Morgen Building,
San Jose, Saipan MP 96950
FACSIMILE

CABLE ADDRESS: GOV'T NMI SAIPAN
TELS (670) 234-6623/7310
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. Kuku'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 EngineerSing 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 I 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 these 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
Telephone: (671) 475-6296/7
Facsimile: (671) 472-9626

RECEIVED
1996 FEB 12 P 2:21
BUREAU OF PLANNING GUAM

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 the FEIS

FEIS MAILING LIST

1. MILITARY COMMANDS

COMMANDER
ATTN N4
US NAVAL FORCES MARIANAS
PSC 455 BOX 42
FPO AP 96540-1500

COMMANDER
ATTN N4A
US NAVAL FORCES MARIANAS
PSC 455 BOX 42
FPO AP 96540-1500

COMMANDER
ATTN MR ROY TSUTSUI CODE N451
US NAVAL FORCES MARIANAS
PSC 455 BOX 30
FPO AP 96540-1500

COMMANDER
ATTN MR BROCK DURIG CODE N452
US NAVAL FORCES MARIANAS
PSC 455 BOX 30
FPO AP 96540-1500

COMMANDING OFFICER
NAVCOMTELSTA GUAM
PSC 488 BOX 101
FPO AP 96537-1802

COMMANDING OFFICER
ATTN TRAINING OFFICER
NAVAL SPECIAL WARFARE UNIT ONE
PSC 455 BOX 182
FPO AP 96540-1182

CHIEF
US ARMY READINESS GROUP PACIFIC GUAM
BLDG 50 AMMON AVE
RADIO BARRIGADA
FPO AP 96540

COMMANDER
ATTN CODE N00J
US NAVAL FORCES MARIANAS
PSC 455 BOX 34
FPO AP 96540-1500

COMMANDER
ATTN N45
US NAVAL FORCES MARIANAS
PSC 455 BOX 30
FPO AP 96540-1500

COMMANDER
ATTN MR JENNINGS BUNN CODE N455
US NAVAL FORCES MARIANAS
PSC 455 BOX 30
FPO AP 96540-1500

COMMANDER
ATTN MS LESLIE MORTON CODE N456
US NAVAL FORCES MARIANAS
PSC 455 BOX 30
FPO AP 96540-1500

COMMANDING OFFICER
EXPLOSIVE ORDNANCE DISPOSAL
MOBILE UNIT FIVE
UNIT NR 25499
FPO AP 96601-4591

COMMANDING OFFICER
US NMCB 40
CAMP COVINGTON GUAM
FPO AP 96601-4981

OFFICER IN CHARGE
NAVAL CONSTRUCTION BRIGADE DET GUAM
FPO AP 96540-2970

COMMANDING OFFICER
HEADQUARTERS COMPANY
USAR MARIANAS
56 AMMON AVE
BARRIGADA HEIGHTS GU 96913

COMMANDER
36TH CES CEV
UNIT 14007
APO AP 96543-4007

COMMANDER
36TH LG CC
UNIT 14043
APO AP 96543-4043

COMMANDER
36TH SPTG CC
UNIT 14041
APO AP 96543-4041

COMMANDER
36TH ABW CC
UNIT 14003
APO AP 96543-4003

COMMANDER
ATTN J3
SPECIAL OPERATIONS COMMAND PACIFIC
BOX 64046
CAMP HM SMITH HI 96861-4046

COMMANDER
ATTN TRAINING OFFICER
HELICOPTER COMBAT SUPPORT SQUADRON FIVE
UNIT 14052 BOX 51
APO AP 96543-4052 COMMANDER

COMMANDING OFFICER
HQ 1ST BN 294TH INFANTRY LIGHT
FORT JUAN MUNA
622 EAST HARMON INDUSTRIAL PARK
TAMUNING GU 96911-4421

COMMANDER
ATTN MS HEIDI HIRSH
36TH CES CEV
UNIT 14007
APO AP 96543-4007

COMMANDER
36TH OSS CC
UNIT 14035
APO AP 96543-4035

COMMANDER
36TH CES CC
UNIT 14007
APO AP 96543-4007

COMMANDER
ATTN GU ARO T
GUAM TERRITORIAL AREA COMMAND
622 EAST HARMON INDUSTRIAL PARK
TAMUNING GU 96911-4421

COMMANDER
ATTN J4
SPECIAL OPERATIONS COMMAND PACIFIC
BOX 64046
CAMP HM SMITH HI 96861-4046

COMMANDER
ATTN APOP EX
USARPAC
FORT SHAFTER HI 96858-5100

COMMANDER
ATTN APOP TR
USARPAC
FORT SHAFTER HI 96858-5100

COMMANDING GENERAL
ATTN MR THOMAS C ALAKSA
III MEF SOTG
UNIT 35605 CAMP HANSEN
FPO AP 96606-5605

COMMANDING OFFICER
ATTN S 3
31ST MARINE EXPEDITIONARY UNIT FMF
UNIT 35821
FPO AP 96606-5621

COMMANDER
ATTN APEN
USARPAC
FORT SHAFTER HI 96858-5100

COMMANDER IN CHIEF
ATTN J35
USCINCPAC
BOX 28
CAMP HM SMITH HI 96861-5025

COMMANDING OFFICER
ATTN BMC GLENN WOODBURY
USCG PACIFIC AREA TRAINING TEAM
BLDG 18 COAST GUARD ISL
ALAMEDA CA 94501-5100

COMMARFORPAC
ATTN G3
BOX 64118
CAMP HM SMITH HI 96861-5025

COMMANDER IN CHIEF
ATTN J44
USCINCPAC
BOX 28
CAMP HM SMITH HI 96861-5025

COMMANDER IN CHIEF
ATTN FLEET ENVIRONMENTAL OFFICE CODE N465
CINCPACFLT
250 MAKALAPA DR BLDG 251
PEARL HARBOR HI 96860

COMMARFORPAC
ATTN G4
BOX 64118
CAMP HM SMITH HI 96861-5025

COMMARFORPAC
ATTN G5
BOX 64118
CAMP HM SMITH HI 96861-5025

COMMANDER IN CHIEF
ATTN FLEET ENVIRONMENTAL OFFICE CODE 46541
CINCPACFLT
250 MAKALAPA DR BLDG 251
PEARL HARBOR HI 96860-7000

COMMANDER IN CHIEF
ATTN FLEET EXERCISE OFFICER CODE N328
CINCPACFLT
250 MAKALAPA DR BLDG 352
PEARL HARBOR HI 96860

COMNAVSPECWARCOM
ATTN MR SAM CALLICOAT CODE 08
FORCE SAFETY PROGRAM MANAGER
2000 TRIDENT WY
SAN DIEGO CA 92155-5599

DEFENSE TECHNICAL INFORMATION CENTER
DTIC CUSTOMER SERVICE HELP DESK DTIC BLS
8725 JOHN J KINGMAN RD STE 0944
FORT BELVOIR VA 22060-6218

COMMANDER IN CHIEF
FLEET TRAINING AND READINESS OFFICER N344
CINCPACFLT
250 MAKALAPA DR BLDG 352
PEARL HARBOR HI 96860

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25 E ST STE D306
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GUAM ARMY NATIONAL GUARD
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ATTN APIX EN
9TH REGIONAL SUPPORT COMMAND
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CHIEF
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ROTA US ARMY RESERVE
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VETERANS AFFAIRS
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9TH REGIONAL SUPPORT COMMAND
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COMMANDING GENERAL
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III MARINE EXPEDITIONARY FORCE FMF
UNIT 35601
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ADVISORY COUNCIL ON HISTORIC PRESERVATION
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PROTECTED SPECIES PROGRAM COORDINATOR
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MR JUDSON J FEDER
NATIONAL OCEANIC AND ATMOSPHERIC
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RESTON VA 20192

MS FIONA QUALLS
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WATER RESOURCES DIVISION
PO BOX 59
TINIAN MP 96952

HONORABLE ROBERT A UNDERWOOD
US HOUSE OF REPRESENTATIVES
ATTN MS T P SCHROEDER CHIEF OF STAFF
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WASHINGTON D C 20515-5301

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GMF GU 96921

MR ROGER DIROSA
US DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
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DEDEDO GU 96921

MR VINCE LEON GUERRERO
DISTRICT DIRECTOR
US HOUSE OF REPRESENTATIVES GUAM DISTRICT
120 FATHER DUENAS AVE STE 107
HAGATNA GU 96910

MS KITTY M SIMONDS
WESTERN PACIFIC REGIONAL
FISHERY MANAGEMENT COUNCIL
1164 BISHOP ST STE 1400
HONOLULU HI 96813

MR ROBERT SCHROEDER
WESTERN PACIFIC REGIONAL FISHERY
MANAGEMENT COUNCIL
1164 BISHOP ST STE 1400
HONOLULU HI 96813

3. GOVGUAM AGENCIES

MR JOE T SAN AUGUSTIN
ADMINISTRATOR
BRAC 95 GOVGUAM STEERING COMMITTEE
BOX 2950
HAGATNA GU 96910

MR MICHAEL L HAM ADMINISTRATOR
BUREAU OF PLANNING
GUAM COASTAL MANAGEMENT PROGRAM
PO BOX 2950
AGANA GU 96932

MR CRAIG LEON GUERRERO
CHIEF PLANNER
BUREAU OF PLANNING
PO BOX 2950
AGANA GU 96932

MR JOSEPH M BORJA
ADMINISTRATIVE DIRECTOR
CHAMORRO LAND TRUST COMMISSION
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HAGATNA GU 96932

MR BENEDICK J G REYES
ADMINISTRATOR
CIVIL DEFENSE EMERGENCY SERVICES OFFICE
PO BOX 2877
HAGATNA GU 96932

MR BENNY CABRERA
CIVIL DEFENSE EMERGENCY SERVICE OFFICE
PO BOX 2877
HAGATNA GU 96932

MR FRANCISCO P SAN NICHOLAS DIRECTOR
DEPARTMENT OF AGRICULTURE
DIVISION OF AQUATIC AND WILDLIFE RESOURCES
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Appendix A-8
Public Hearings Summary

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
Guam Training Issues			
Flight tracks/public safety		Request for clarification on issue of public safety & commercial flight tracks. Appreciate when there is military compliance.	Training selection criteria includes public safety and civilian/military flight flight integration discussed for Guam, Rota and Tinian
No fly zone	Civil Defense	All of Guam should be a "no fly zone" for any tactical missions (helos okay but fighter jets & missiles not).	Flying zones are already established to control activities above or near the commercial and military airports. Not an EIS issue.
Final decision	Guam Historic Preservation	Will FEIS be the final deciding factor for the approval of proposed training?	The FEIS will recommend the proposed training activities that are environmentally suitable. The military base commander remains the ultimate decision maker. Agency consultations will continue as necessary.
U/W demolition	CNMI DEQ	Will it occur in areas around other islands besides Guam?	At present U/W demolition training is identified as a Guam training activity only.
Use of 10 lb. Charges	Guam DAWR	Please discuss use of 10# charges in Outer Apra Harbor. There were previous attempts to decrease use to less than 10#.	FEIS recommends a limit of 10 lbs charges for EOD MU-5 deepwater demolition training.
Charges/ simulators	Guam DAWR	Can certification requirement be revised so EOD not required to train w/ 10# &20# charges? Or use simulators instead? This would alleviate use of large charges in Apra Harbor. (concern about fish/turtle kills, impacts on rec use, safety)	EOD MU-5 will continue to use 10 lb charges.
Apra Harbor training-public safety	Steve Lander, Guam	Concern that Apra Harbor training will occur on daily basis. Concentrated use by divers/ fishermen would impact those activities. Could coordinate w/ Dept of Parks & Rec. For safe shared use, must notify public w/ signage.	Infrequent training activities affect other harbor users. Protocols to establish early and official notifications are in place.
20 lb. U/W Demo Charges	Guam EPA	Need info on specific type of 20# charge used/freq of training & reason for use. Wants info on concussion caused. Safety fan of 1/2 mile would shut down all outer harbor uses. UXO on Tokai Maru could be set off. Use outer harbor past reef instead.	FEIS provides information requested and recommends retention of 10 lb charges as maximum.
20 lb. U/W Demo Charges	Guam Historic Preservation	Concern over questionable effects of charges & potential impact on Tokai Maru depth charges, which haven't been removed or rendered harmless. Perhaps do this thru a military training exercise?	FEIS provides information regarding the deepwater EOD demolition site and sunken cultural resources.
River insertions-need info	Guam EPA	Include more info in EIS regarding river insertions (e.g., how far up they'll go, the type of water craft used, etc.).	Proposals to train on more than the Atantano River (on government property) are no longer proposed actions
River insertions-historical impacts	Guam EPA	EIS should include more info on river insertions. May be historically signif resources on rivers' shores. Need to coordinate with cultural and historical resource agencies during the NEPA process.	The proposal to use the Ylig and Talafofo rivers for training is no longer a recommended activity.
Firing range at Orote/public safety	Guam EPA	Public safety concern over new firing/maneuver range at Orote Point. A 50 caliber could affect fishermen in the area. How will mariners be warned? Furthest distance shells could travel? Cease all marine traffic prior to training.	Orote Peninsula ranges will not be used for live-fire with the .50 cal sniper rifle or machine gun.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
RRR- historic landmark	Historic Preservation Office and Guam DAWR	NW Field eligible for nomination as national historic landmark in Nat Reg. Compatible w/ training? Coordinate with Natural Historical Preservation Office.	USAF, PACDIV, and HPO are coordinating RRR site selection to avoid an adverse effect on a National Historic Landmark.
RRR training	Historic Preservation Office and Guam DAWR	Concern about effect of rapid runway repair (at NW Field) on nearby US Wildlife Refuge. Possible effects of dust and noise. Potential impacts on endangered spp in the area.	RRR does not involve demolition training. Excavation and repair is conducted on three small craters. The training area will not be near Mariana crow nesting sites.
LCACs/ reef impacts	Guam EPA	Include discussion of effect of LCAC weight on the reef (i.e., amt of air pressure in pounds per sq. inch).	A marine survey has been conducted to assess potential impacts to shallow coral. See Appendix C-5 for details.
Alternate LCAC landing area	Guam DAWR	Old Wives Beach may be a more suitable alt LCAC landing site, rather than Dadi Beach.	Beach evaluations recommend Dry Dock Island, Polaris Point and Toyland Beach for LCAC landings.
Dadi Beach biota	Guam EPA	EIS erroneously suggests no live marine biota at Dadi. EIS must verify or disquality info currently presented.	Follow-up evaluations will be conducted as well as compliance with demolition training protocol. LCAC landings will not be conducted until additional information is evaluated.
Increased level of training	Historic Preservation Office	Why need for increased level of training, esp at a time of base closures & downgrading? Needs to justify this in EIS.	EIS intent is not to support "increased training" but to fully identify the training that is being requested and conducted by resident and transient units.
Alternatives	Historic Preservation Office	EIS doesn't adequately explain how the preferred alt is the best. A fourth alt is suggested that consiers deletion or modification of the 3rd alt (the "mitigated set").	Alternatives have been modified. The preferred alternative at each training site is the result of the analysis and includes all mitigation and training management measures to ensure no significant impacts occur.
Troop movement in Ord Annex	Peter Melyan, Guam	Concern about troop unit movements in Ord Annex, which is imp watershed for Fena Dam. Still fairly pristine, with rich biodiversity & "natural" vegetation. Concern about siltation/vegetatn disturbance. Restrict access to training or limit to small troops.	Training constraints for the Ordnance Annex are established and monitored by the environmental and safety staffs.
SMS Cormoran	Historic Preservation Office	The SMS Cormoran, a German ship wreck in Apra Harbor, is listed on the National Register of Historic Places.	Protection of underwater cultural resources is a criterion in selecting underwater training sites.
Sniper range/ hiking trail	Historic Preservation Office and David Lotz	Proposed range at Ord Annex requires closure of popular hiking trail, used year-round. Would be major impact on public recreation. Strongly recommended to leave trail open by relocating firing pts, reconfiguring fan, or realigning trail corridor.	The trail remains open. The proposed range development has been modified to ensure no potential encroachment on the trail.
Sniper range/carabou	Guam EPA	Sniper range at Ordnance Annex may affect wild carabou.	Unlikely since sniper training involves single shot, well-aimed direct fire at designated targets.
Hiking trail-ecotourism	David Lotz, Guam	Take southern end of mtn trail out of sniper range arc. Boonie stompers have had problems in past coordinating w/ military to get on base. Request advance notification, at least 4 months in advance, of activities for next 6 months to a year.	Conflict between trail and range SDZ has been resolved. The trail remains open.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
Hiking trail-ecotourism	David Lotz	Also want a designated contact person & warning signs posted. Historically trail has had unrestricted access.	Trail remains open. Government Property signs are posted.
Shape of range fan	Mark Lander, Guam	Request for clarification of narrow shape of sniper range safety fan at head of target area. Suggested range be pulled back to the right side.	Range orientation has been accomplished.
Alternative range locations	David Lotz	EIS should discuss alternate locations evaluated for the sniper range & explanation why those were less appropriate than the preferred alternative.	Appropriate range sites have been evaluated. Sniper training is also being conducted on the Orote Peninsula Known Distance Range.
Sniper location	David Lotz	Was decision for use of this particular sniper range location made by the Navy Seals?	NSWU-1 worked with Naval Facilities Engineering Command and COMNAVMARIANAS to develop the concept which must be approved and certified by NAVFAC.
Latte sites	Steve Lander	EIS needs to include discussion of mitigation for damage to latte stone sites in Ord Annex.	Latte sets are in defilade. Lines of fire will avoid latte set locations.
Tinian issues:			
Support base camps	Fred Dela Cruz	Concern about potential relocation of ranchers in MLA due to base support camp site activities.	Recommended base camp will not affect ranchers in the MLA. Camp will be placed with IBB.
AAV landings	Ellen Ikehara	Glad none will be landing at Unai Chulu.	No suitable AAV beach has been identified in the MLA.
AAV training Unai Babui	CNMI FWS DLNR and DEQ	Need extensive biological studies of the shoreline area. Concern about impacts of AAVs, esp since Internat'l Yr of Coral Reef. Disclose # & frequency of AAV landings, how turbidity affected, & why new training being added.	Study protocol has been developed, but March 99 site visit disclosed enough information to rule out Unai Babui for AAV landings.
AAV impacts/ mitigation	CNMI Coastal Resource Management (CRM)	Concerned about tracked vehicles on reef. FEIS should include additional discussion re: additional mitigation measures for coastal preservation (besides just minimizing impacts). Education a possible mitigation measure.	No longer an issue for AAV landings. Unai Chulu marine survey determined no significant impacts to coral by LCACs. LCUs do not land on any of Tinian's coral beaches.
AAV landings on Babui	CNMI CRM	Why doesn't Unai Chulu offer favorable conditions compared with Unai Babui?	Extensive shallow coral beds would be damaged by AAVs.
Coral at Babui	CNMI FWS	Questioned how it was determined that only 1-3% of coral is live at Unai Babui.	The shallow spurs and nearshore ledge that would have been contacted by landing AAVs is practically devoid of coral. The deeper grooves are not.
Ferry boat at Babui	Fred Dela Cruz	Desire for shared use of Babui channel for AAV and ferry boat operations. Will military evaluate the envirt'l impacts of the ferry boat?	Extensive spurs and grooves make AAV landings unfavorable.
Waste disposal	Fred Dela Cruz	Questioned why there is waste storage and shipment to Guam. Request for study to develop waste disposal site on Tinian military land for joint use by military & civilians. (Mike Fitz noted: 2 prior requests to CNMI for 2 diff areas in LBA)	Military training wastes will continue to be removed from Tinian.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
Negative impact on tourism	Fred Dela Cruz	Noted that buy-back areas support tourism, which is an economic boost for Tinian. Concern of negative impact of military uniforms & historic bomb hole (remove it?) on tourists.	Tandem Thrust 99 is an example of coordinating military activities and tourism without significant (negative) impacts. Positive economic impacts were evident.
Small businesses	Fred Dela Cruz	Needs to be more ability for locals to compete for contracts w/ military. Insurance liability requirements too high for small local businesses.	Issue being addressed by COMNAVMARIANAS.
Mortar range	Mike Fitzgerald, Military Asst to Mayor	Spans only access road on NE side of island. Therefore potential loss of access to entire N Field area. Also, military needs to be held accountable for & repair any road damage resulting from training.	These concerns are also expressed in the EIS. The mortar range is no longer a preferred alternative.
Commuter flights/rifle range	Michael Muna, Saipan	Public safety concern that rifle range is in flight path of Cherokee air routes. Discuss the coordination allowing for both uses. Include notification of day and night training activities.	These concerns are also expressed in the EIS. The small arms fire and maneuver range is no longer a preferred alternative.
Range: safety fan	CNMI DEQ	How is safety fan for conceptual firing range determined?	Information on range development passed to DEQ. Issue of range development on Tinian is moot.
Erosion/runoff	CNMI DEQ	Concern about erosion/runoff associated with live fire training. Could impact nearshore waters. INclude info in EIS on frequency of operations & potential impacts.	Range development is no longer recommended.
Rifle/mortar ranges	CNMI FWS	Concern about size of these ranges. Recommended that siting for firing range be limited to one area of coast (i.e., not both the E & W coasts) so less area impacted.	Range development is no longer recommended.
Range: safety concerns	CNMI DEQ	Safety issues of EMUA range training in relation to ocean recreation activities on Tinian, which will likely increase. What does "3 miles out" really mean to the average boater?	Range development is no longer recommended.
Shell casings	CNMI DEQ	Are shell casings cleaned up after firing activities?	Range development is no longer recommended.
Blowhole	CNMI DEQ	Will blowhole be closed due to training?	Restricted access to the blowhole is not anticipated since it lies to the flank of normal training areas on North Field. Range development and potential conflicts with a range SDZ no longer apply.
UXO range	Mike Fitzgerald & Ellen Ikehara	Former impact range needs to be fenced & have signs posted. Dangerous area, esp since # tourists & residents is increasing, & since residents collect sea crabs & medicinal plants in the vicinity.	Inactive range is fenced and UXO warning signs are posted.
Firing range	Steve Lander, Guam	Conceptual firing range may negatively impact the main tourist access road heading north.	Range development is no longer recommended.
EMUA barrier	Mike Fitzgerald	Safety concern. Better not to have a permanent structure. Remove barricade at end of exercise to avoid accidents (w/ speeding cars, etc).	EIS also recommends no permanent gates due to safety and cost concerns. Temporary barriers and sentries are sufficient.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
shooting house vs historic sites	Mike Fitzgerald	Appropriate to use a historic site as a shooting house? Include discussion in EIS. (In past, construction of small monuments in N Field has been denied due to historic sites.)	Proposed action has been coordinated with the Historic Preservation Officer. Protocols to evaluate impacts will be enacted.
Shooting house concerns	David Lotz, Guam	Has public safety & historical preservation concerns regarding proposed shooting house training.	Shooting House and Breacher Trainer development is no longer recommended. Safety radius at World War II structures during live-fire training is established. Training is normally conducted at night.
Restricted access	Ellen Ikehara	Concern about restricted access to EMUA during non-training periods. Please provide 30-day advance notice of restricted access times.	Advance coordination will be conducted with CNMI officials and the Tinian Mayors' Military Representative as much in advance as possible with thirty days considered as reasonable.
Turtle feeding grounds	Ellen Ikehara	Concern impact fan of live fire range may encroach in turtle feeding area. Also noted that Tinian not only island w/ turtle feeding grounds (this info missing from Guam/Rota maps).	Range development is not recommended.
Cargo troop paradrops	Michael Muna, Saipan	Discuss these in the text. Concern they'll interfere w/ the flight traffic pattern btwn Saipan & Tinian. Include details on communication & timing.	EIS discusses planning, coordination, and air space control conducted by the military and the FAA.
North Field traffic patterns	Michael Muna, Saipan	Request for detailed info on traffic patterns for activities in North Field.	EIS identifies North Field runways used by fixed-wing and helicopters. Flight tracks are coordinated with the FAA.
Simulation models	CNMI DEQ	Suggested to use simulation models for firing range activities.	Live-fire range training will be conducted on Guam. Training simulators are used in locations that offer no ranges. MILES system is often used during field maneuvers to record "hits" by lasers
Mixed use airspace	Michael Muna, Saipan	Concern over increase in future Tinian flights (for casino, etc). Address cumulative impacts of increased airspace use, increase in flight tracks/patterns, etc.	Increased activities on Tinian are identified in the EIS as factors that will influence all future training activities.
Commuter flights/VOA, etc.	Mike Fitzgerald	Concern that between live fire range and VOA antennas, flight path too narrow for commuter flights.	The IBB and commercial flight activities are functioning without conflict.
VOA EMR hazard	Michael Muna, Saipan	Concern about VOA tower and impacts of irradiation. Need public education component so info about health hazards is provided.	Information passed to Tinian Mayor's office for discussions with IBB. EIS has determined that outside of the antenna field (which is a restricted area) there is no EMR hazard to persons, fuel, or ordnance.
Rota Issues			
Training notification		Proper notification prior to exercises is appreciated/requested, including after airport hours. Include specifics of notification in Final EIS.	NSWU-1 and COMNAVMARIANAS will continue to coordinate training support activities in advance with the Rota municipal government.
NVG training and endangered species		Concern over impacts to wildlife (endangered crows & bats) due to flight times and low altitude of flights.	The need to use the Rota Airport for NVG training no longer exists. Confined landing sites have been provided on NW Field, AAFB.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
NVG-flight tracks		Include info on military flight patterns with respect to commuter flight patterns. Concern for public safety at new Rota Resort, north of NVG flight tracks.	NVG training is no longer recommended.
No concerns	CNMI CRM	DEIS well written. No concerns about proposed actions on Rota.	Nice to hear.
Double meetings	CNMI CRM	Displeasure with scheduling of two meetings per island, since CRM must attend all meetings.	Conducting two meetings is for the convenience of the citizens who may not be able to leave work to attend a daytime session.
Seabird colonies		A Natural Resource Conservation Plan should be developed for protection of seabird colonies, which would also provide a nesting site for crows/bats.	Not an EIS issue with no flight activities proposed. CNMI for action.
Relocate crows?		Include in Final EIS discussion of/reference to Section 10 of ESA, which offers possibility of relocating crows to a conservation area (the newly created Sabanatan (?) wildlife sanctuary).	CNMI for action.
Combat swimmer training		Discuss use of chemicals/flares for repelling sharks & description of combat swimmer training if trainees come ashore.	NSWU-1 uses Rota for training support and not for amphibious raids.
Medevac training		Public safety concerns if Medevac training occurs on school grounds during school hours. Should restrict landings/trainings to Health Compound during school hrs. ID communication channels.	HC-5 medevac support to Rota is not a training issue. Selection of LZs is conducted by the municipality.
General satisfaction		In general, existing military training occurs in a satisfactory manner.	NSWU-1 plans to continue to maintain good relationships in exchange for the excellent support that has been provided to them.
Harbor dredging		Military was informed of a project currently being planned to dredge the harbor that may prohibit normal military activities.	COMNAVMARIANAS for action.
Notification of research	CNMI DLNR, Rota	Would like assurance that any research on Rota is coordinated with DLNR.	The EIS does not propose any research projects. Item passed to COMNAVMARIANAS for action as appropriate.
FDM/Saipan Issues			
Notification of agencies	CNMI Governor's Office	FEIS should ID which resource agencies will be notified in advance of military training exercises & to what level of detail they'll be notified.	COMNAVMARIANAS has initiated periodic discussions with CRM, DLNR, and DEQ representatives to identify and resolve problems, or to development protocols. The Tinian Mayor's office (Military Representative) has been identified as the Point-of-Contact for coordinating military training schedules and requests.
Notification of public	CNMI CRM	Need continued public notification for activities on FDM.	Agreed. NOTMAR and NOTAM process ensuring information to the Emergency Management Office will continue.

Mariana Training DEIS:
Public Hearing Comments

TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
Advisory council	CNMI Governor's Office	Formal consultation btwn military and local residents would encourage community support. Ex group is the Civilian/Military Advisory Council (they could give the 30-day advance training warnings too). Note: POC for group= CNMI Governor	A COMNAVMARIANAS/CNMI working group has been established.
Move truck targets	CNMI DPW	Booby birds located on windward side of FDM, so move the truck convoy target area from there.	Target locations and impact areas have been modified to eliminate targeting known nesting areas.
FDM future clean-up	CNMI CRM	Consider that FDM will, at some point, be returned to CNMI. Be careful now so clean-up later is easier.	No comment.
Bombing impacts	CNMI DEQ	Clarified that removing ground training on FDM from mitigated set of alts will not decrease bombing impacts on FDM. Rather, just increases personnel safety.	EIS does not recommend any ground training on FDM. Extent of bombing and Naval Gunfire is determined via Biological Opinions from USFWS.
FDM airway	Michael Muna, Saipan	Public safety concern regarding the airpath over FDM.	NOTMAR and NOTAM process remains in effect.
Conservation of marine resources	Albert Deleon Guerrero, DEQ	Concern over fish kills from bombs detonating underwater. Long-term coral conservation & longitudinal studies should be considered, as should marine resource conservation (esp since fishing so popular there).	Annual coral studies are scheduled. Other mitigation measures are being reviewed by the COMNAVMARIANAS/CNMI working group.
Fishing near FDM	Ray Mafnas, Saipan	Curtail training on FDM between April and July, which are the best months for subsistence fishing for Saipan residents. (Note: usually fish SE & SW sides of FDM, as close as 300-500 yards off the island.)	FDM training is based on training unit operational schedules and deployments.
Fishermen safety	Ray Mafnas, Saipan	Fishermen safety an issue since not all fisherment receive notification of training on FDM, & since they take shelter form storms on FDM. Post warning signs on island to educate about UXO & include info in boat registration/ licenses.	Signs on the island are not recommended. Education programs at the marinas are recommended.
Megapodes	CNMI FWS	Increased populations & more specific mitigation for the megapode are desired. Military should provide a statement of committment to enhance moorhen populations.	Navy and USFWS are engaged in habitat and species enhancements on Sarigan.
BTS target checks	CNMI FWS	Question whether targets on FDM will be checked for the BTS.	Target materials are subject to BTS inspection protocol. Old auto and truck bodies that were difficult to inspect will no longer be used.
BTS Plan	CNMI FWS	Need a description of BTS containment plan. High pressure cleaning w/ a steam jenny used at AAFB. Inspection now being done to determine if this type of cleaning is successful. Fumigation (w/ methyl bromine, for ex) is a possibility.	BTS protocol is published in the EIS. See Appendix E.
BTS Plan update	CNMI FWS and CRM	New info about BTS containment is available from ADC (Scott Vogt will send). Needs to be a protocol in text to incorporate the latest & best info into our BTS Control/Interdiction Plan.	See Appendix E of the EIS.

Mariana Training DEIS:
Public Hearing Comments

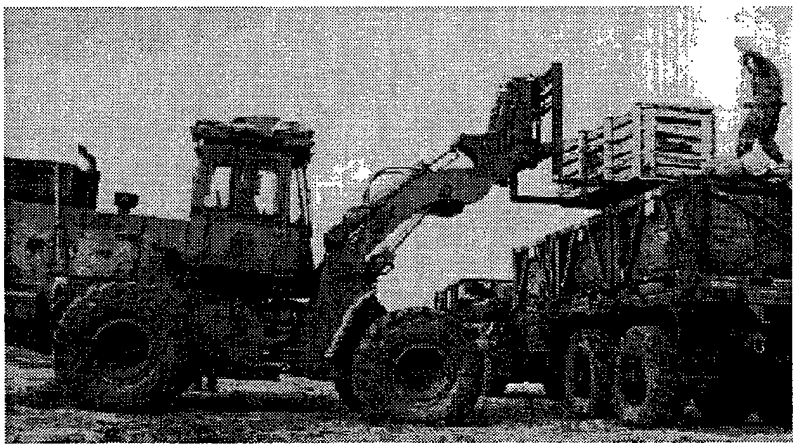
TOPIC	Commenting Agency or Individual	SPECIFIC COMMENTS	DISPOSITION
Turtle nesting period	CNMI FWS	He clarified green sea turtles nest between March and May/June.	Potential impacts are to Tinian training beaches. A Navy biologist will inspect these beaches immediately prior to training to safeguard any turtle nesting sites.

Appendix B
Technical Descriptions and and Photographs of Training

B-1: Field Maneuver and Logistics Photos
B-2: Field Maneuvers Technical Information Table
B-3: Aviation Photos
B-4: Aviation Training Technical Information Table
B-5: Amphibious Landing Photos
B-6: Assault Amphibian Vehicle (AAV) Photo
B-7: AAV Impacts on Land and Water Surfaces
B-8: Landing Craft Air Cushion (LCAC) Photos
B-9: LCAC Impact on Land and Water Surfaces
B-10: Amphibious Landing Craft and Vehicles Technical Information Table
B-11: Live-Fire and Underwater Demolition Photos
B-12: Shooting House Photo
B-13: Firing Range and Weapon Technical Information Table
B-14: Known Distance Range Surface Danger Zone Schematic
B-15: Ballistic Trajectory Schematic
B-16: Aerial Bombardment and Naval Gunfire Photos
B-17: FDM Bombing Photo

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

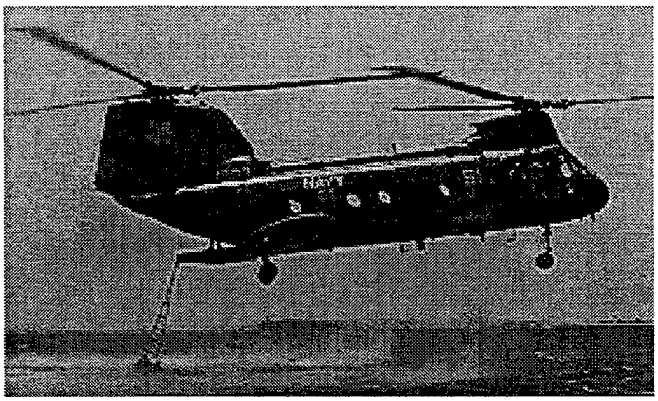
B-1: FIELD MANEUVER AND LOGISTICS PHOTOS

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

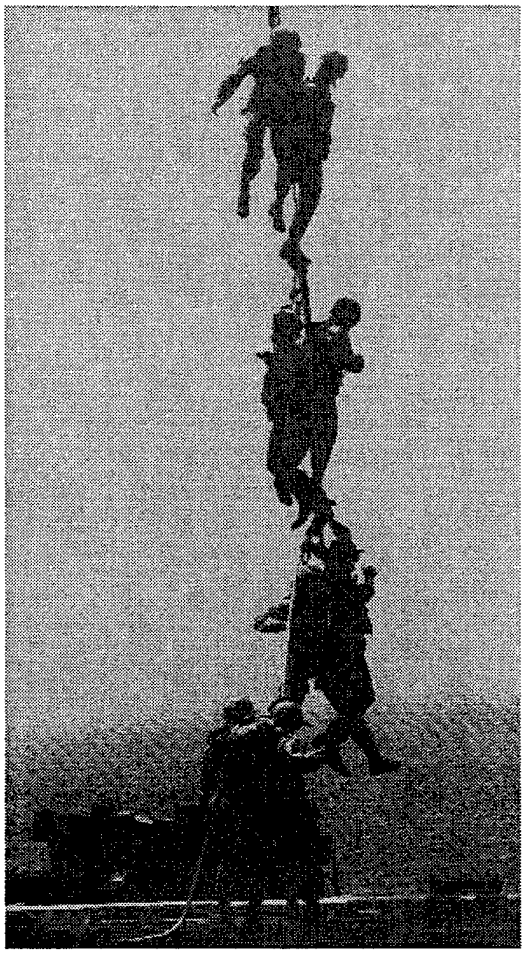
Table B-2 Field Maneuvers Technical Information

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



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.



Special purpose insertion and extraction (SPIE) training

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

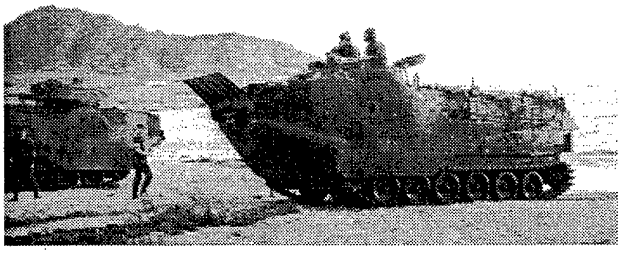
B-3: AVIATION PHOTOS

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

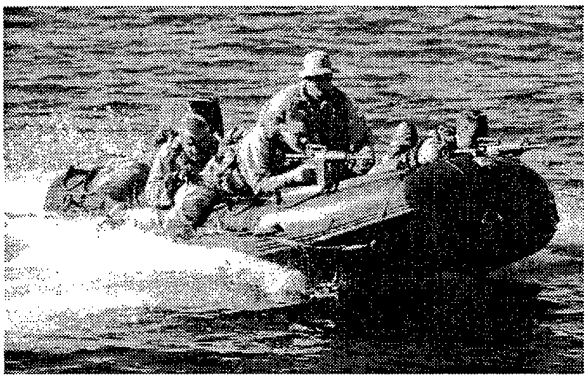
Table B-4 Aviation Training Technical Information

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

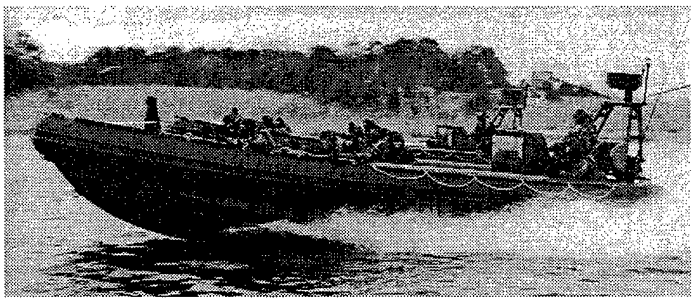
SEAL wading ashore



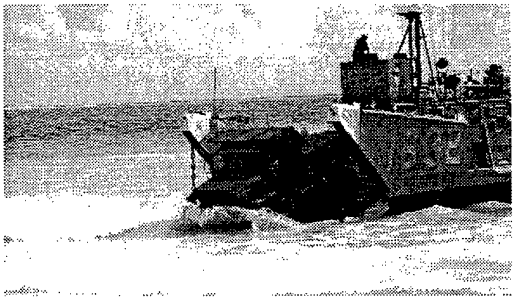
AAV lands on beach



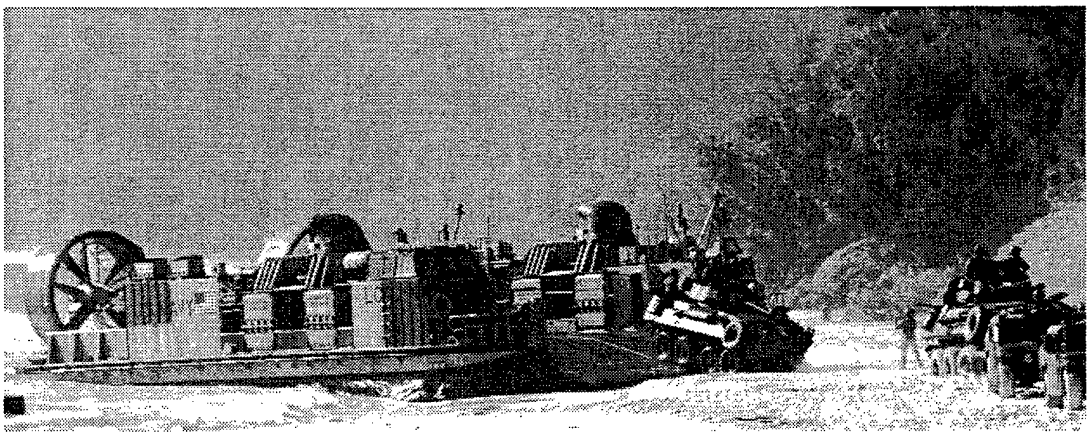
Marine reconnaissance team aboard a CRRC



SEALs aboard two RHIBs



5 ton dump 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

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

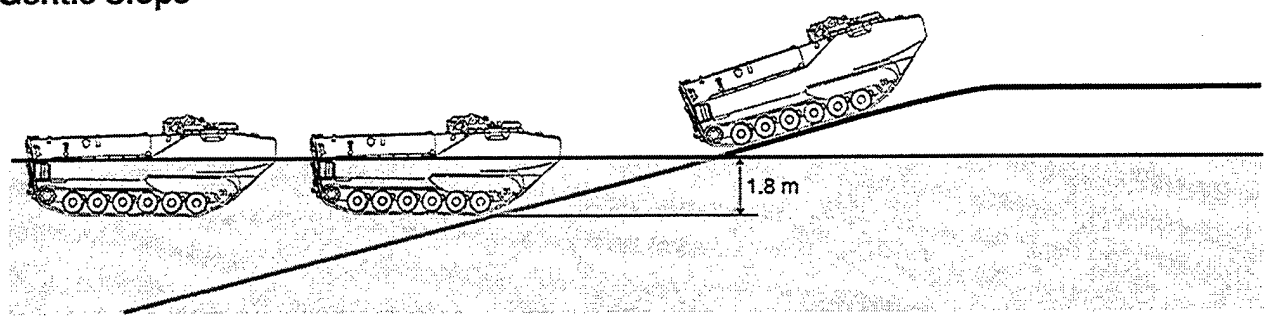
The AAV is designed to carry 21 combat-equipped troops or 4500 kg of cargo. Using an eight cylinder, multi-fuel engine, the vehicle can cruise at 30 to 50 kilometers per hour (kph) on land, and at about 10 kph on water. Its maximum speed is 70 kph on land and 13 kph on water. Armament consists of a turret 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.

B-6: ASSAULT AMPHIBIAN VEHICLE (AAV)

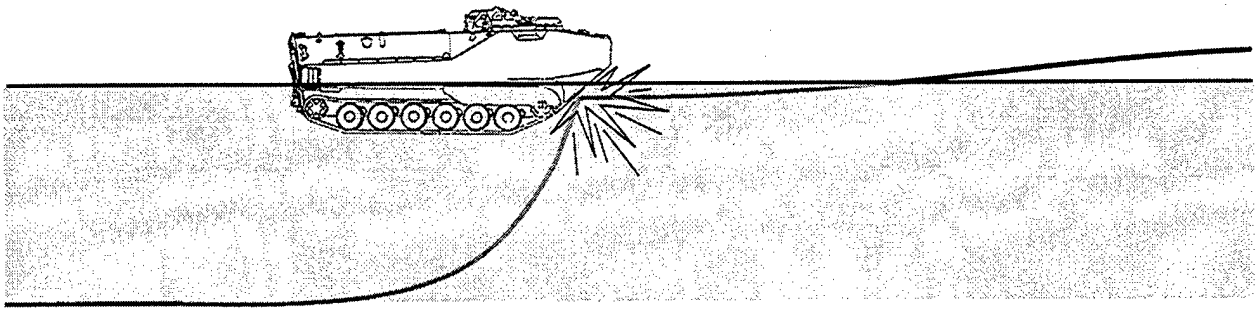
AAV CONTACTING VARIOUS SURFACES

Gentle Slope



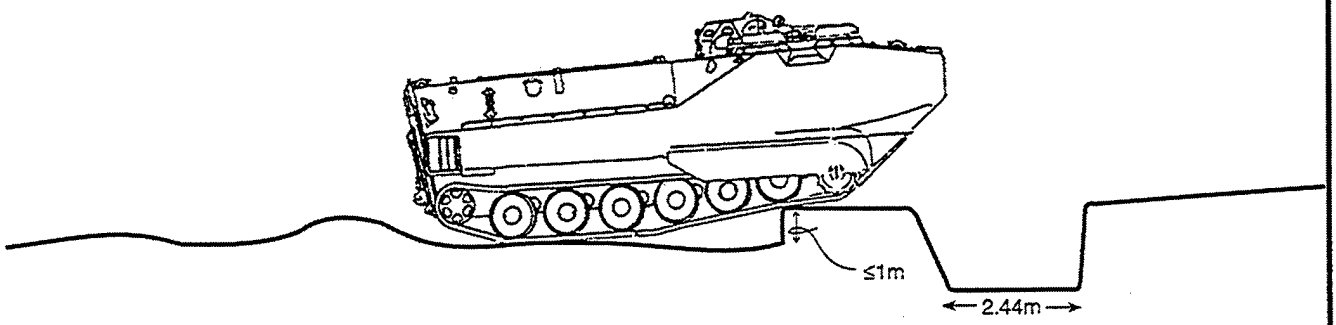
Preferable beach approach: tracks contact substrate gradually in water at least 1.8m deep.

Submerged or Jutting Substrate



Poor beach approach: Vehicle hull instead of tracks makes initial contact on underwater ledge.

Land Obstacles



AAV track suspension allows it to climb vertical obstacles of up to 1m, and cross ditches as wide as 2.44m (8 feet).

Source: USMC FMFM 9-2: "Amphibious Vehicles" dated 23 April 1981

B-7: AAV IMPACTS ON LAND AND WATER SURFACES

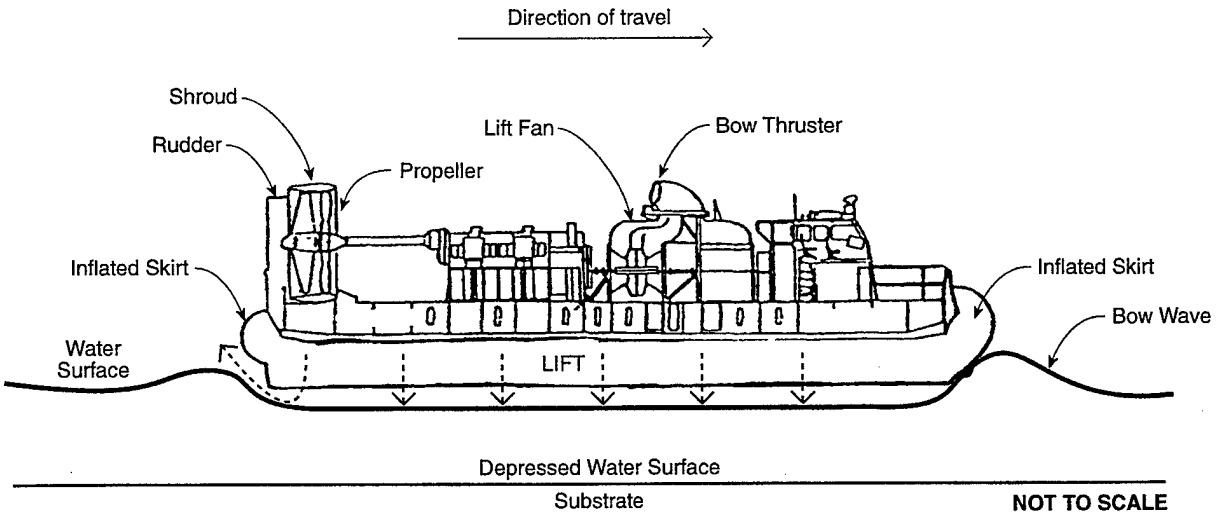
FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

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.

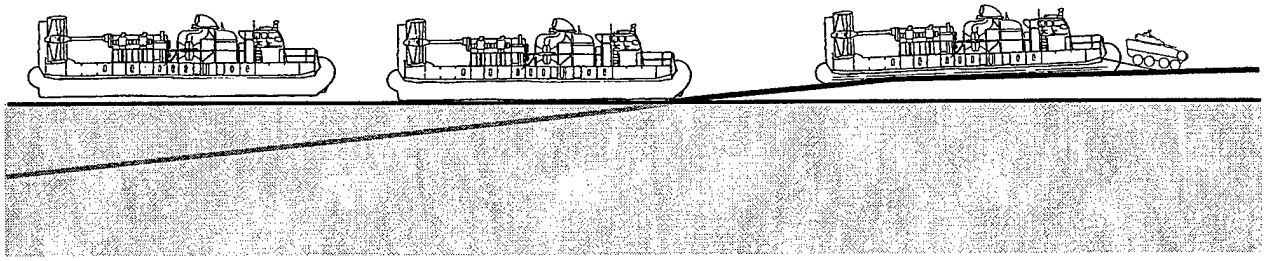
B-8: LANDING CRAFT AIR CUSHION (LCAC)

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

LCAC EFFECTS ON WATER SURFACE



LCAC fans propel air downward, inflating the tube-like skirt and lifting the vehicle above the surface with air escaping along the edges of the inflatable skirt. 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

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

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.

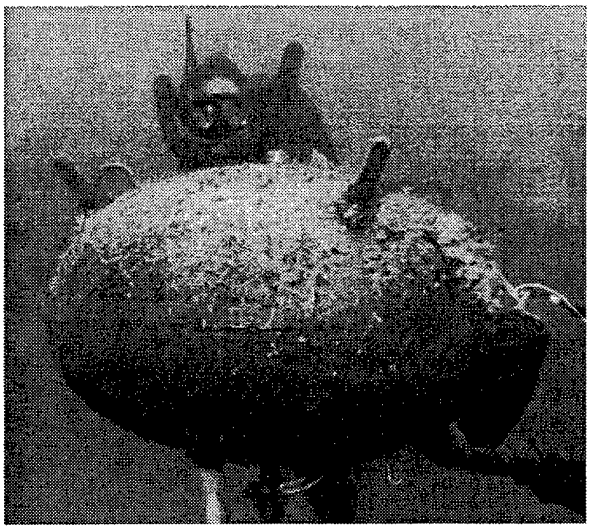
Notes: 1. Craft and Vehicle Data Sheets use English measurements.

2. AAV weight, on vehicle equipment, and weaponry vary with the Communications and Recovery vehicle variants

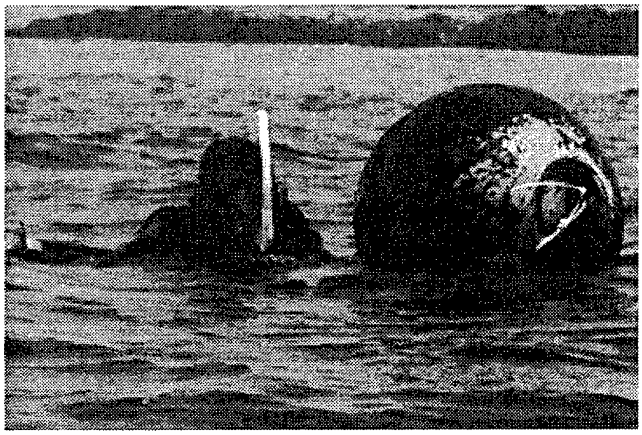
Table B-10 *(continued):*

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

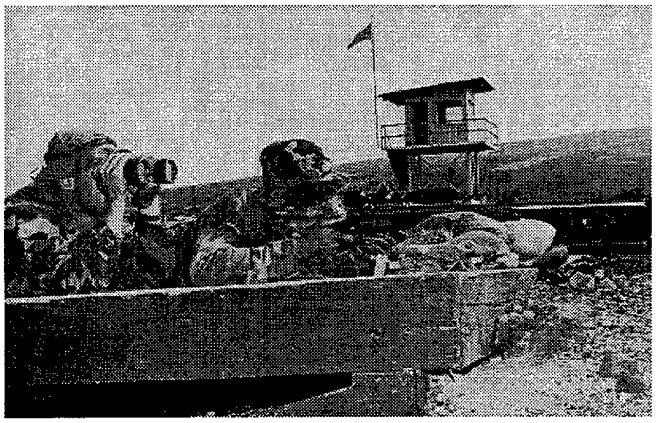
Notes:
1. Craft and Vehicle Data Sheets use English measurements.
2. AAV weight, on-vehicle equipment, and weaponry vary with the Communications and Recovery vehicle variants.
3. Vehicle is undergoing development. Dimensions and characteristics will vary for the Communications vehicle variant.



EOD mine countermeasures



EOD mine countermeasures



SEAL sniper team at rifle range

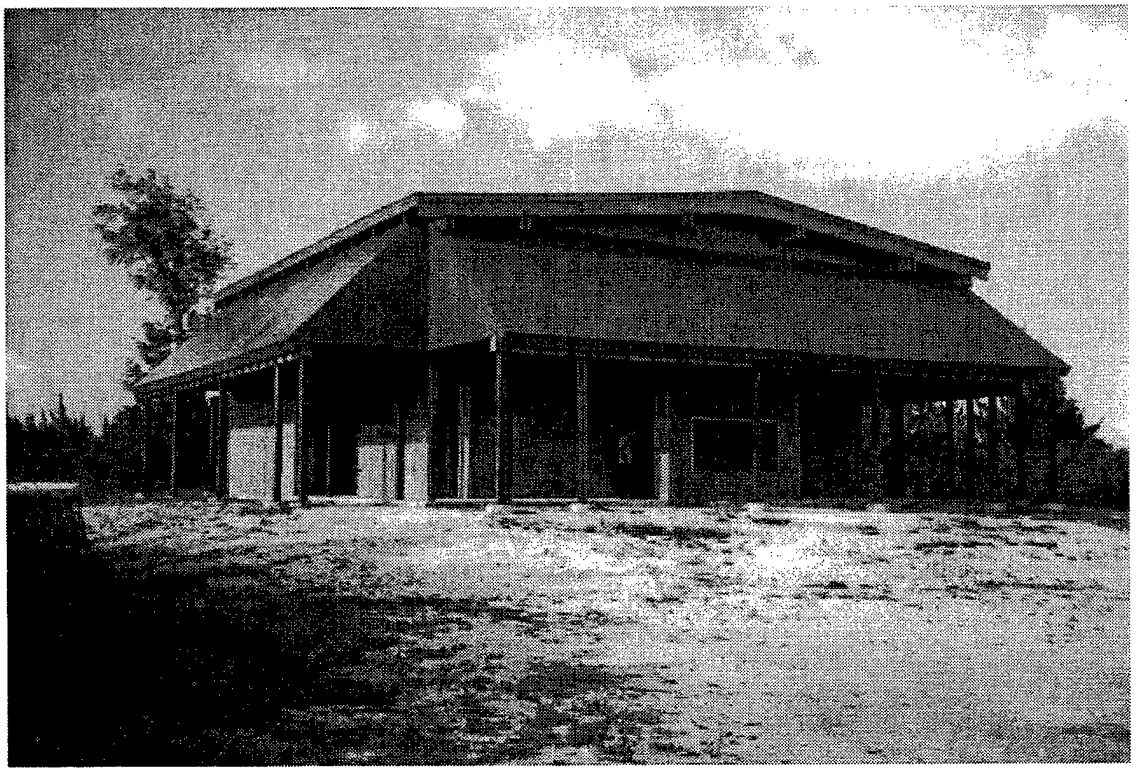
Pistol range

Marine with 60mm mortar

Source: University of Texas website; U.S. Navy file photos

B-11: LIVE FIRE AND UNDERWATER DEMOLITION PHOTOS

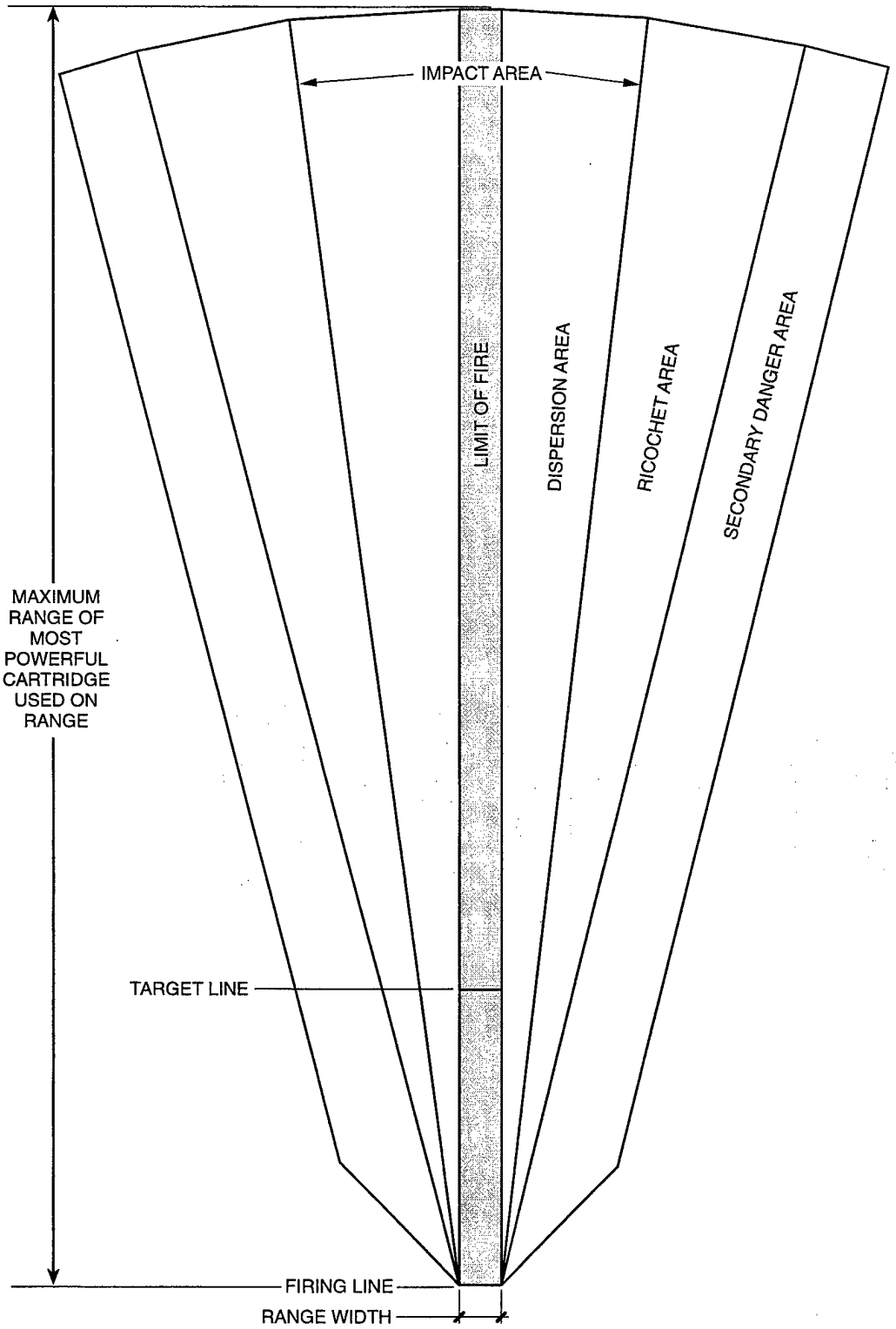
FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999



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: SMALL ARMS RANGE SURFACE DANGER ZONE

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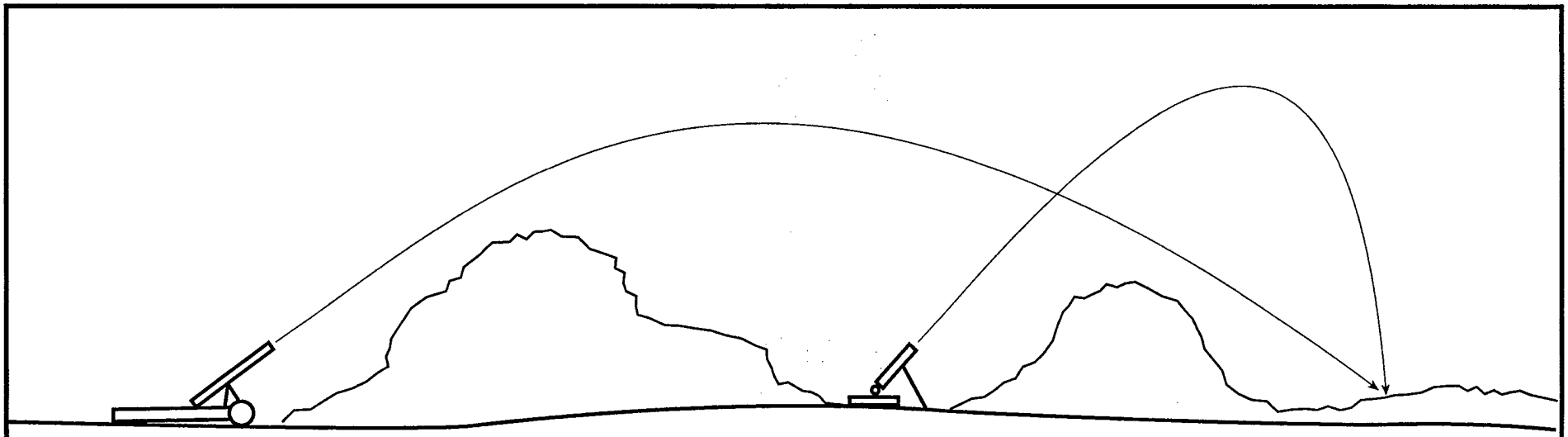
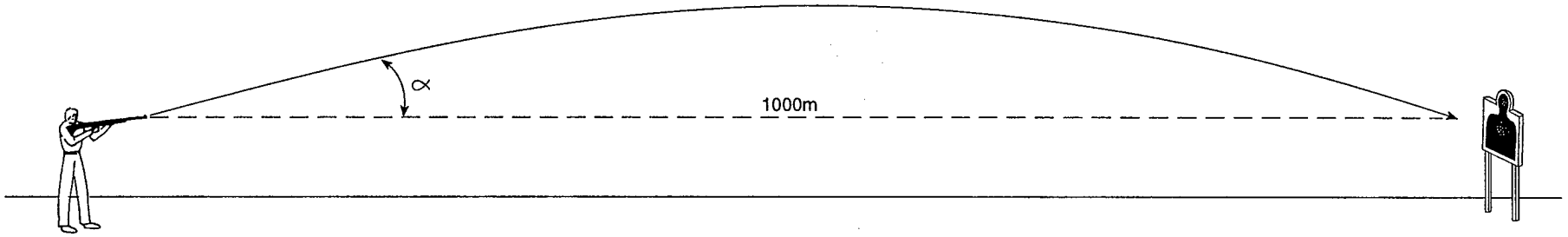


INDIRECT FIRE



∝ = Angle of fire

DIRECT FIRE

NOT TO SCALE

B-15: BALLISTIC TRAJECTORY

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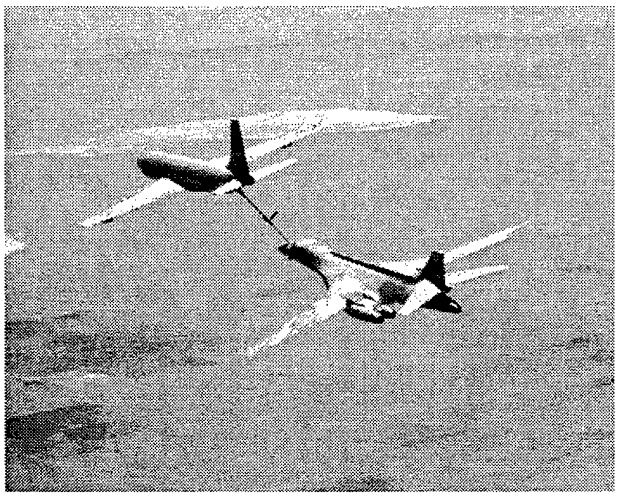
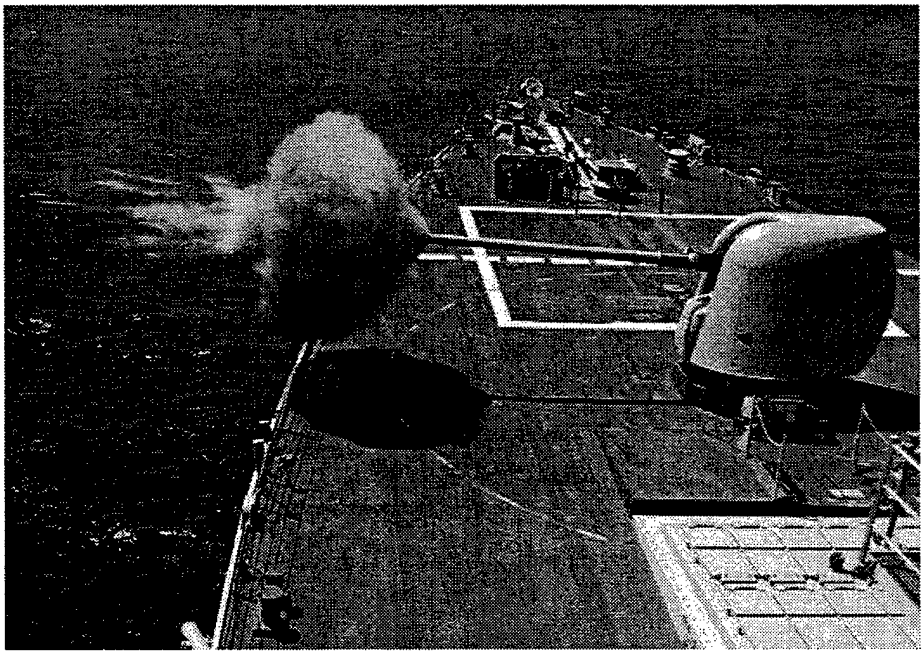
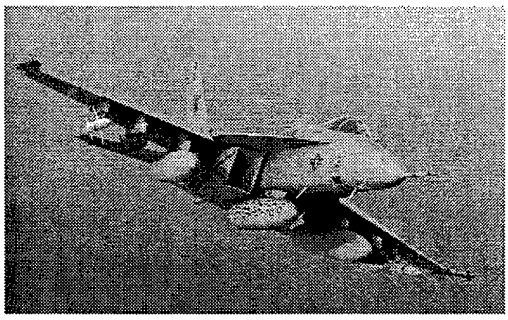
Navy ordnancemen load AIM-9 missile



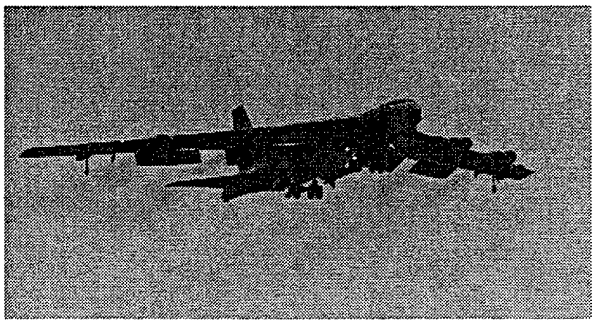
KC-10 refueling a B-1 bomber



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

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

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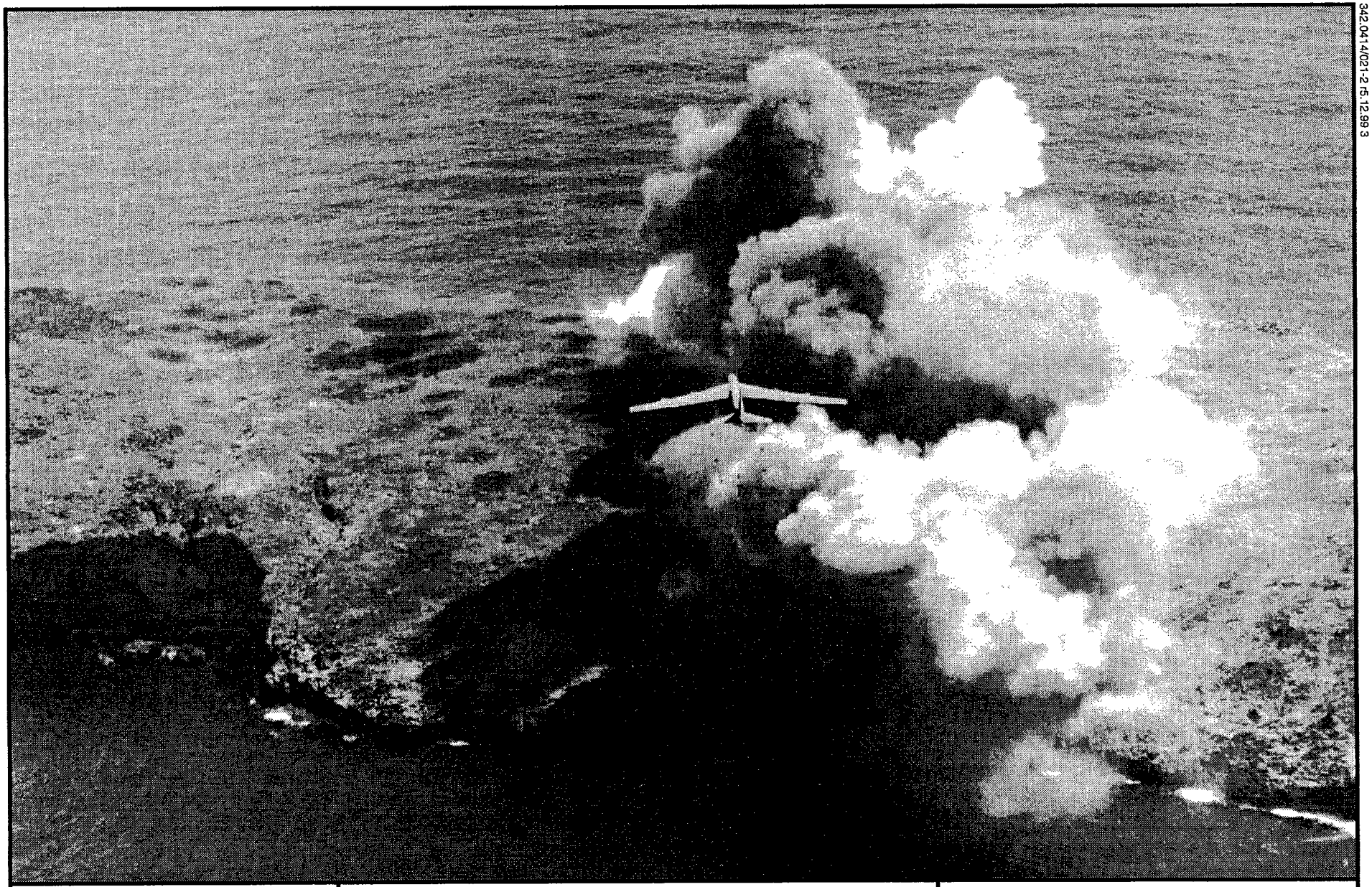

Source: 36 OSS, AAFB

B-17: FDM BOMBING PHOTO

FEIS: Military Training in the Marianas
Belt Collins Hawaii, June 1999

Appendix C
Marine Assessments of Guam and Tinian Training Beaches

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)

C-4: Navy Hydrographic Surveys of Tinian Landing Beaches (March 1994)

C-5: Marianas Training Effects of LCAC Landings on Coral Reefs (17 April 1999)

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

Prepared for:

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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 (*Pitilinopus 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.

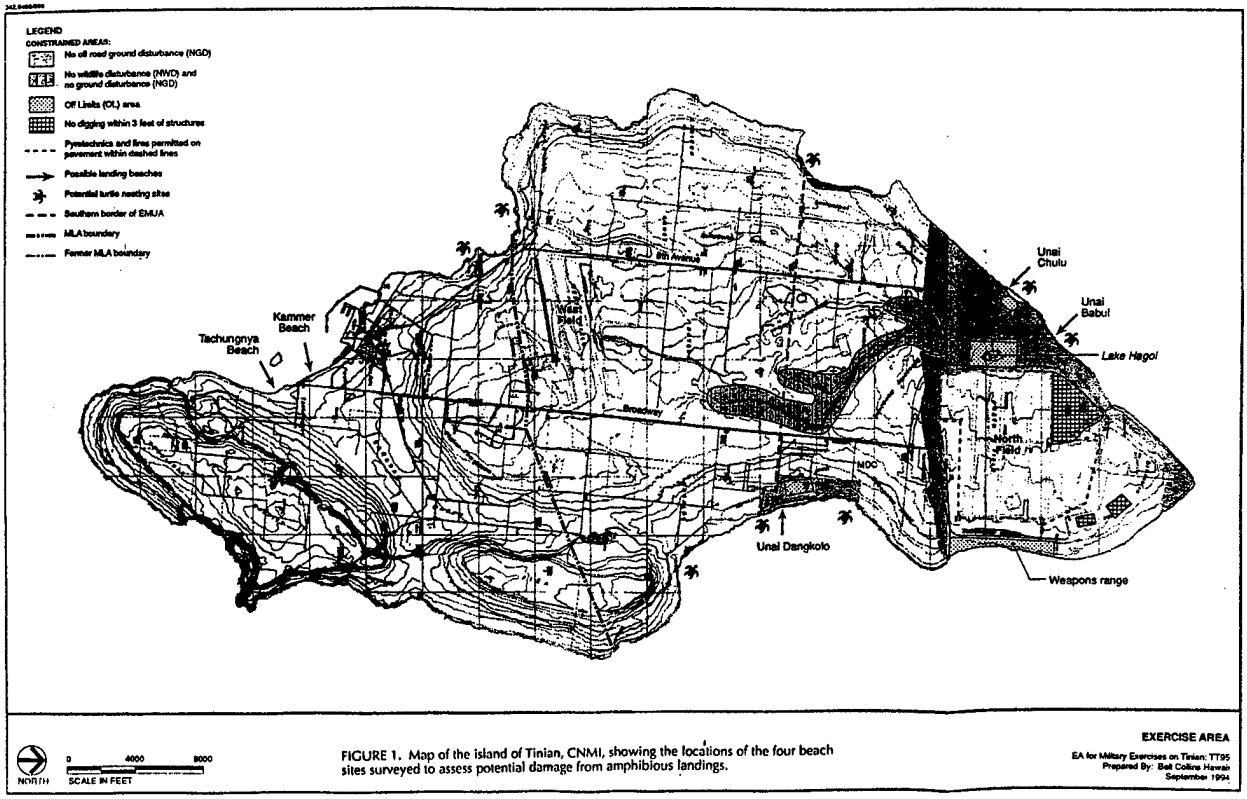

FIGURE 1. Map of the island of Tinian, CNMI, showing the locations of the four beach sites surveyed to assess potential damage from amphibious landings.

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.

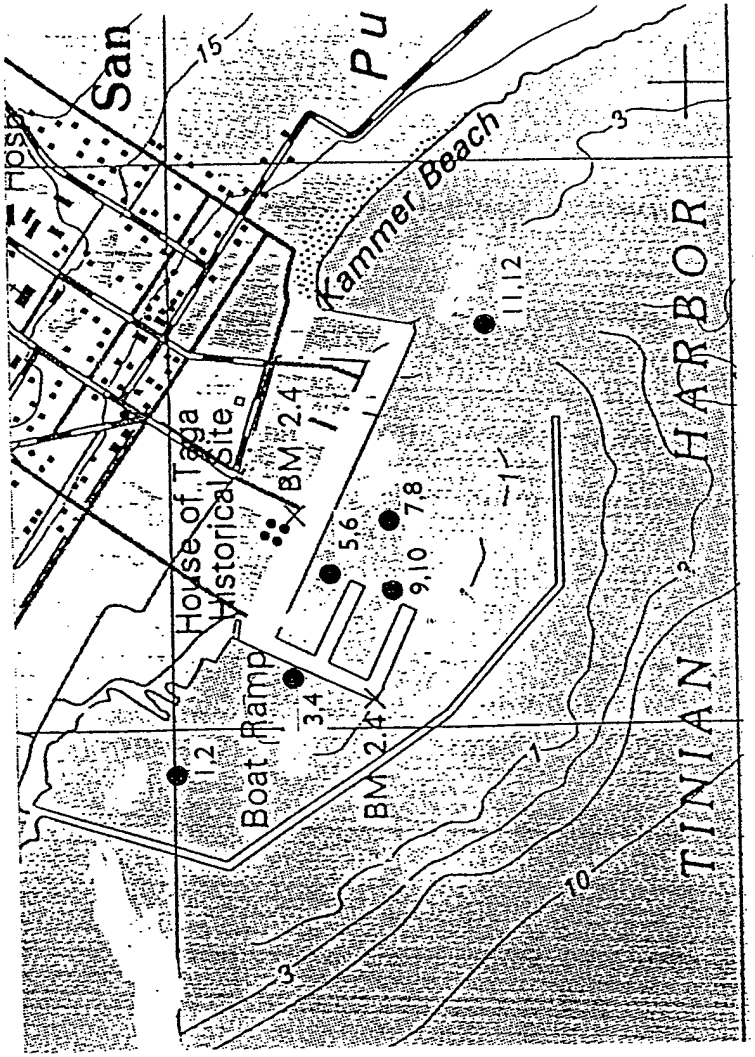

Figure 1. Map of Tinian Harbor showing locations of water sampling stations.

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

Prepared by:

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for:

Belt Collins Hawaii
680 Ala Moana Blvd.
Honolulu, HI 96813

September 1997

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 C-4
Navy Hydrographic Surveys of Tinian Landing Beaches
(March 1994)

14 April 94

From: LTJG Smith, AOIC, SEAL Team ONE BRAVO Platoon
To: Commander, Naval Special Warfare Unit ONE
Via: Operations Officer
Executive Officer

Subj: POST-OPERATIONS REPORT FOR TINIAN ISLAND TRAINING CONDUCTED FROM 20-25 MAR 94

Encl: (1) Kammer Beach Report
(2) Leprosarium Beach Report
(3) Unai Asiga Beach Report
(4) Unai Masalok Beach Report
(5) Aguiguan Island Beach Report
(6) Unai Chulu Beach Survey Report
(7) Unai Babui Beach Survey Report
(8) Unai Chiget Beach Survey Report
(9) Sabanettan Unai Lamlam Beach Report
(10) Map of Tinian with Beach Landing Sites noted

1. From 20-25 Mar 94, SEAL Team ONE BRAVO Platoon conducted hydrographic reconnaissance/beach survey training on Tinian Island. Four beaches surveyed one and a half years ago by SEAL Team FIVE were reconfirmed. In addition, BRAVO platoon found and performed hydro recons and/or Beach Survey Reports on five additional beaches. These nine beaches represent the only possible Beach Landing Sites (BLS) for SEAL operations. The island is completely surrounded by a coral reef thus limiting the areas in which a squad or platoon can land. Of these nine beaches, only three appear suitable for an LCAC landing (Unai Chulu, Unai Asiga and Kammer Beach). One of the landing sites is located on the northwest side of Aguiguan Island (known as "Goat Island" to locals). This site is suitable only to drop swimmers off. Aguiguan Island is a small uninhabited island located 6 NM south of Tinian.

2. SITUATION

Fifteen members of BRAVO Platoon departed Andersen AFB at 0800 20 March in one VRC-50 C-130 aircraft. Upon landing at Tinian West Airfield, we were met by customs officials and Mr. Mike Fitzgerald, a representative from the Mayor's Office and the main point of contact for all military operations on island. The two and a half ton truck was driven off and the platoon checked into the Konton Tasi apartment Complex located in the town of San Jose. Training was conducted from 20-24 Mar. Chartwork was completed during the week in the apartments. The platoon departed Tinian West Airfield on 25 Mar at 1100. The platoon arrived at Andersen AFB at 1145 and then drove back to NAVSTA Guam.

3. EXECUTION

20 MARCH

0500	PLT DEPARTS NSWU-1 EN ROUTE TO ANDERSEN AFB
0600	PLT ARRIVES AT ANDERSEN AFB, VRC-50
0800	PLT DEPARTS FOR TINIAN
0845	PLT ARRIVES TINIAN ISLAND
1000	PLT ARRIVES AT BERTHING FACILITY
1100-1300	CHOW
1300-1700	DESIG PERSONNEL RECONFIRM FOUR PREVIOUSLY SURVEYED BEACHES/DESIG PERSONNEL LOOK FOR NEW BLS

21 MARCH

0900-1200	ADMIN PARALLEL HYDRO CONDUCTED ON KAMMER BEACH
1200-1300	CHOW
1330-1600	NSW BEACH REPORT CONDUCTED ON UNAI MASALOK
1700	CHOW

22 MARCH

0900-1200	ADMIN PARALLEL HYDRO CONDUCTED ON UNAI ASIGA
1200-1300	CHOW
1330-1600	NSW BEACH REPORT CONDUCTED ON LEPROSARIUM BEACH

23 MARCH

0900-1200	ZODIAC TRANSIT OF TINIAN ISLAND IN SEARCH OF FURTHER BLS PICTURES TAKEN OF UNAI CHIGET, UNAI CHULU, UNAI BABUI, AND SABANETTAN UNAI LAMLAM
1200-1400	CHOW
1400-1600	CHARTWORK

24 MARCH

0900-1300	TRANSIT TO AGUIGUAN ISLAND IN SEARCH OF BLS
1300-1400	CHOW
1400-1700	CHARTWORK

25 MARCH

0800	CHECK OUT OF BERTHING FACILITY

0900	TRANSIT TO TINIAN WEST AIRFIELD
1100	DEPART TINIAN ISLAND
1145	ARRIVE ANDERSEN AFB
1300	ARRIVE NSWU-1

4. OBJECTIVES

a. The objective of this trip was to reconfirm the four previously surveyed beaches and to find and survey any further BLS's on Tinian Island. Tinian Island now contains approximately eight beach landing sites. Only three of the eight BLS sites can be used for LCAC landings (Unai Chulu, Unai Asiga and Kammer Beach). In summary, the following Beach Landing Sites are available on Tinian Island with their suitability for LCAC, CRRC and/or swimmer landings noted:

	LCAC	CRRC	SWIMMER
Unai Chulu:	YES	YES	YES
Unai Masalok:	NO	YES	YES
Unai Asiga:	YES	YES	YES
Unai Chiget:	NO	NO	NO
Unai Lamlam:	NO	NO	YES
Unai Babui:	NO	YES	YES
Leprosarium Beach:	NO	YES	YES
Kammer Beach:	YES	YES	YES
Aguiguan (Goat Is.):	NO	YES	YES

5. LOGISTICS

a. Transportation via C-130 allowed the platoon to bring a two and a half ton truck to Tinian. This is obviously the easiest way to travel. It also eliminated the need to rent vehicles while on the island. Ultimately, having the vehicle staged on Tinian Island permanently would greatly benefit platoons and as well as save money.

b. Entry requirements for Tinian Island include a manifest of all gear brought onto the island and a general declaration. Since we travelled by aircraft, the squadron (VRC-50) provided this declaration. It should be noted that if you travel by PB or other boat, it is the responsibility of the platoon to acquire this declaration from COMNAVMAR Customs Office (POC: ABEC Hugh M. O'Neale PRIPHN:349-5218/5238).

c. The platoon utilized the Konton Tasi Apartment Complex for berthing. The complex is owned by Mr. Bill Nabors, Chief Executive Officer to the Mayor of Tinian. The cost is $15.00/night per

person. The rooms can hold up to 5 people and include a kitchen with refrigerator and stove. This seems to be a good idea if a small group of people were to be on Tinian for an extended period of time (e.g. EX TANDEM THRUST).

6. PLATOON COMMANDER'S ASSESSMENT

All aspects of this training exercise went exceptionally well and all participants did an outstanding job. The island affords excellent opportunities for training in several areas of Naval Special Warfare. Tinian Island should be utilized more often in the future, possibly for smaller scale "fly-away" operations. A SEAL squad or element could duck in (provided boat support could get out to sea) and then come ashore on any of the BLS's now surveyed. If the BLS chosen is in the northern part of the island, the squad could patrol to the North Field Military Training Area (NFMTA) and conduct a direct action mission. If the BLS chosen is in the southern part of the island, the squad could rendezvous with an agent and infil via indigenous vehicle to a location near the NFMTA. This would eliminate the need to patrol through private property all the way from the south to the NFMTA which is located in the north near the abandoned runways. This is just one possibility. SR's could also be conducted. For example, there is a radio tower/station just up from Kammer Beach that would provide a suitable reconnaissance sight.

Tinian Island offers numerous possibilities for platoon training. Mr. Mike Fitzgerald of the Mayor's Office is more than willing to accomodate Naval Special Warfare and is anxious to support any type of operation that we request.

Very Respectfully,

N.M. SMITH
LTJG, USN

NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Kammer Beach

   c. Date of Survey: 21 Mar 94 Time: 1030

   d. Beach Location:

	LAT	LONG
Beach Center	14 deg 57' 46.9" N	145 deg 37' 30.8" E
Right Flank	14 deg 57' 44.6" N	145 deg 37' 44.8" E
Left Flank	14 deg 57' 53.1" N	145 deg 37' 31.3" E

   e. Reference Chart: Topographic Map Island of Tinian 1983
   Scale: 1:25000
   Edition Number: N/A
   Date Revised: 1983
   Sheet Number: N/A

   f. Source: NSWU-1 Platoon ONE BRAVO

   g. Type recon Conducted: Admin Parallel

   h. SEAL Team Evaluation:

Kammer Beach is a suitable landing site for LCAC's, AAV's and CRRC's. Due to its partially protected area, the nearshore sea state is mild and surf is limited to small shore break (up to 1 foot in height). The extreme left and right flanks should be avoided. At the LF, steel pilings are protruding out of the water near the one fathom mark. Just right of the right flank, lava rock breaks the surface at the 1/2 fathom mark and extends to the backshore.

All approaches to shore right of beach center are not recommended due to the existence of a coral reef/shelf. The reef begins in shallow water near BC and extends diagonally to the three fathom mark.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

   a. Total Length: 300 yds

   Surveyed Length: 300 yds

   Useable Length: 150 yds

   Shape/Type: Concave

   Coastal Terrain: Lava rock on right flank, pier and steel pilings on left flank.

   Vegetation: Palm trees (30' tall), broad leaf bushes ten feet high on right flank.

   Beach Exits: One paved road runs parallel to beach at the beginning of the hinterland. At both left and right flank, the road connects with a main roadway which also runs parallel to the beach.

   b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	GOOD	GOOD
Tracked:	VERY GOOD	VERY GOOD
Personnel:	EXCELLENT	EXCELLENT

   Matting: Thirty yards required to extend from the HWL to the backshore for 2-wheel drive vehicles.

   General Firmness: Firm

   c. SUROB:

   Significant breaker Height: 1 foot
   Maximum Breaker Height: 2 foot
   Breaker Period: 6 seconds
   Breaker Type: Spilling: 2 %
   Plunging: 98 %
   Surging: N/A

   Breaker Angle: 0 Degrees toward R/L Flank

   Littoral Current:
   Inside Surf Zone: .3 knots from L to R Flank
   Outside Surf Zone: .8 knots from L to R Flank

   Lines of Surf: 2 lines of surf in 20 ft surf zone

Water Temperature: 82 deg F
Air Temperature: 89 deg F
Visibility: 17 NM

d. Obstructions:

Nearshore obstructions: Three underwater obstructions, all left of BC. Only significant obstacle is submerged rock in center lane. Coral reefs begin right of beach center.

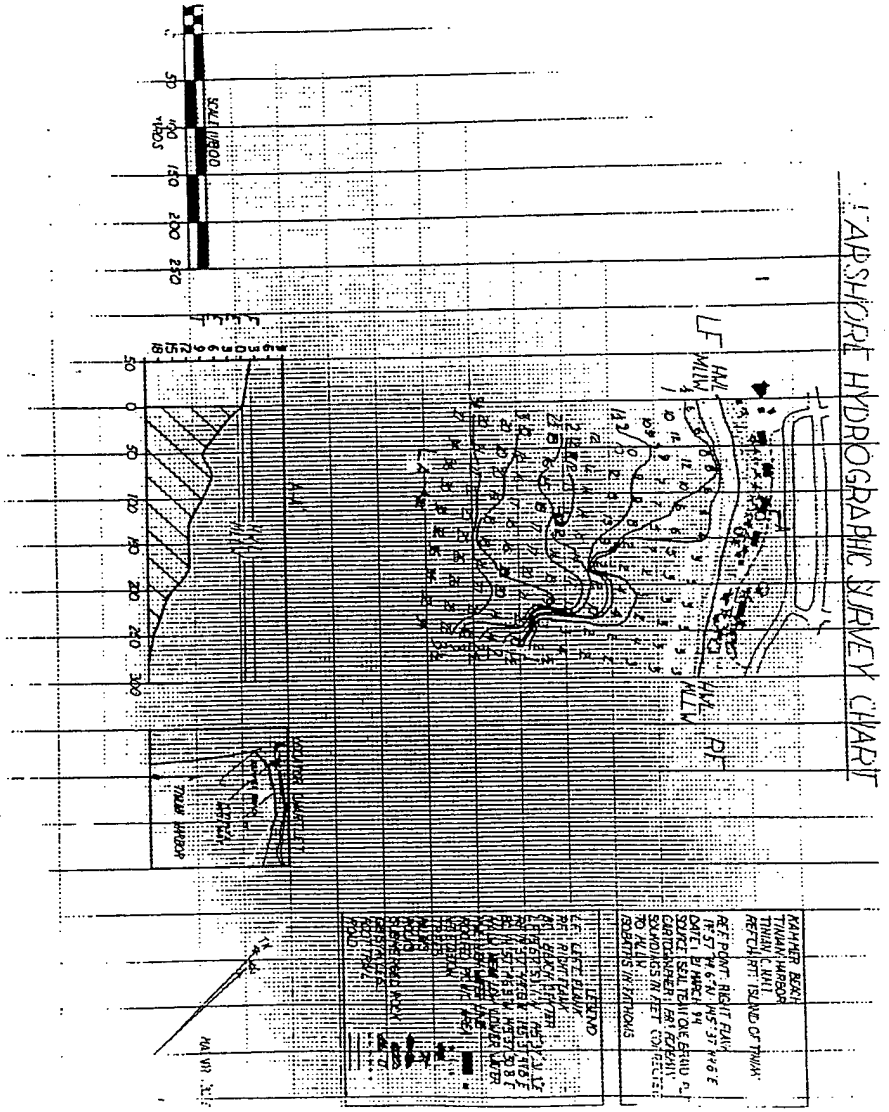
Foreshore obstructions: Small tree (5 ft tall) just right of BC between foreshore and backshore.

Backshore obstructions: Picnic area shelters, palm trees. Thick vegetation/lava rock on the right flank.

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	300 yds	5-15 yds	35 yds
Composition:	Sand/reef	Sand	Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.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TAIWAN HARBOR
MAHMER BEACH
TINIAN, CNMI
REF CHART ISLAND OF TINIAN
REF POINT: RIGHT FLANK
15°57'14.6"N 145°37'49.8"E
DATE: 19 MARCH '14
SOURCE: SEAL TEAM ONE, ERUD
CARTOGRAPHER: JAY ROPPOLI
SOUNDINGS IN FEET CORRECTED
TO MLLW USING NOAA
OBSERVATIONS
LEGEND
REF: RIGHT FLANK
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ALL DISTANCES IN FEET
ROCKS
CORAL HEAD
REEF
SAND
DEEP WATER
SHALLOW WATER
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SHALLOW WATER

KAMMER BEACH

NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Leprosarium Beach

   c. Date of Survey: 22 Mar 94 Time: 1030

   d. Beach Location:

	LAT	LONG
Beach Center	14 deg 58' 58.8" N	145 deg 36' 43.2" E
Right Flank	14 deg 58' 57.8" N	145 deg 36' 46.6" E
Left Flank	14 deg 58' 59.8" N	145 deg 36' 42.0" E

   e. Reference Chart: Topographic Map Island of Tinian 1983
   Scale: 1:25000
   Edition Number: N/A
   Date Revised: 1983
   Sheet Number: N/A

   f. Source: NSWU-1 Platoon ONE BRAVO

   g. Type recon Conducted: Beach Intelligence Survey Report

   h. SEAL Team Evaluation:

Leprosarium Beach is suitable for CRRC or swimmer landings. It is located on the leeward side of the island and the surf zone is negligible. CRRC over-the-beach landings would have to be conducted by pulling the motor up approximately 100 yds offshore (due to the reef) and paddling the rest of the way into the shore. Swimmers should wear protective clothing. The hinterland offers excellent areas in which to cache a boat.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 75 yds

Surveyed Length: 75 yds

Useable Length: 60 yds

Shape/Type: Straight

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush (10-15 ft tall) with scattered trees 10-25 ft tall..

Beach Exits: Drivable trail leads off the LF and winds up to an unimproved dirt road which winds around for 200m and joins a paved road running north-south.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

Matting: Fifty yards required to extend from the HWL to the hinterland for 2-wheel drive vehicles.

General Firmness: Firm

c. SUROB:

Significant breaker Height: 1 foot
Maximum Breaker Height: 2 foot
Breaker Period: 6-8 seconds
Breaker Type: Spilling: 100 %
Plunging: N/A
Surging: N/A

Breaker Angle: 0 Degrees toward R/L Flank

Littoral Current:
Inside Surf Zone: .2 kts
Outside Surf Zone: .5 kts

Lines of Surf: 2 lines of surf in a 20 yd surf zone

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. Obstructions: SEE PHOTOS

Nearshore obstructions: Coral Reef

Foreshore obstructions: Coral and large rocks

Backshore obstructions: Dense brush and trees

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	60 yds	10 yds	25 yds
Composition:	Coral/rock bottom	Rocks/sand	Packed dirt

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Unai Asiga

c. Date of Survey: 22 Mar 94 Time: 1330

d. Beach Location:

	LAT	LONG
Beach Center	15 deg 02' 07.3" N	145 deg 38' 55.7" E
Right Flank	15 deg 02' 07.3" N	145 deg 38' 55.5" E
Left Flank	14 deg 57' 46.9" N	145 deg 37' 30.8" E

e. Reference Chart: Topographic Map Island of Tinian 1983
Scale: 1:25000
Edition Number: N/A
Date Revised: 1983
Sheet Number: N/A

f. Source: NSWU-1 Platoon ONE BRAVO

g. Type recon Conducted: Admin Parallel

h. SEAL Team Evaluation:

Unai Asiga is suitable for either SEAL CRRC landings or SEAL swimmer landings. There is a prominent reef 175 yds out which has average sized waves spilling onto it. From the reef to the shoreline (approx. 50 yds), water depth is only waist deep.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 175 yds

Surveyed Length: 175 yds

Useable Length: 175 yds

Shape/Type: Straight/coastline

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush 10-15 ft tall with scattered trees 10-25 ft tall.

Beach Exits: Drivable road leads directly off the beach.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

Matting: Fifty yards required to extend from the HWL to the hinterland for 2-wheel drive vehicles.

General Firmness: Firm

c. SUROB:

Significant breaker Height: 1-2 feet
Maximum Breaker Height: 4 feet
Breaker Period: 6 seconds
Breaker Type: Spilling: 85 %
Plunging: 15 %
Surging: N/A

Breaker Angle: 0 Degrees toward R/L Flank

Littoral Current:
Inside Surf Zone: .5 kts towards LF
Outside Surf Zone: .5 kts towards LF

Lines of Surf: 3 in 30 yd surf zone

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. Obstructions: SEE PHOTOS

Nearshore obstructions: Coral Reef

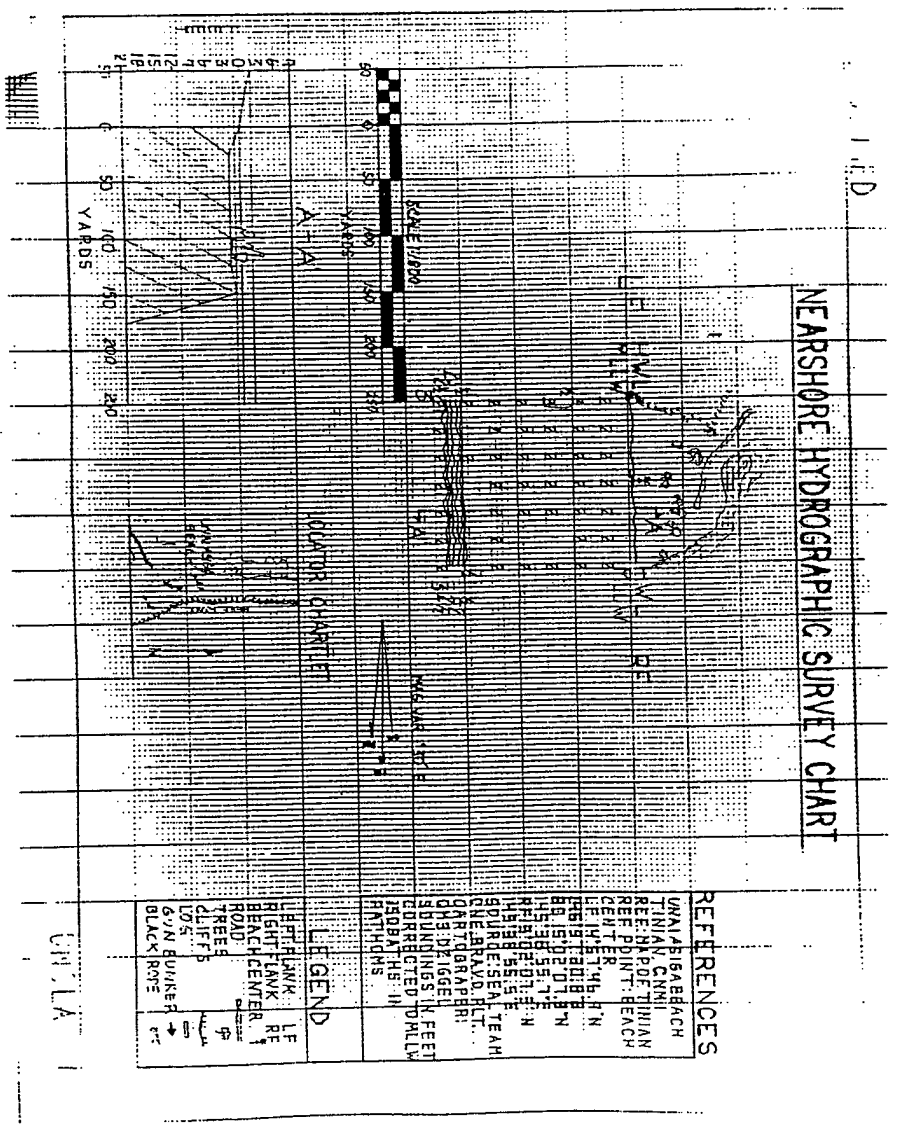
Foreshore obstructions: Coral Reef with exposed rocks/logs at beach center.

Backshore obstructions: Soft sand/brush/trees

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	175 yds	5 yds	N/A
Composition:	Coral/rock bottom	Rocks/sand/ exposed coral/ logs	—

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.



NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Unai Masalok

c. Date of Survey: 22 Mar 94 Time: 0945

d. Beach Location:

	LAT	LONG
Beach Center	15 deg 01' 11.7" N	145 deg 39' 21.6" E
Right Flank	15 deg 01' 11.7" N	145 deg 39' 22.3" E
Left Flank	15 deg 01' 10.6" N	145 deg 39' 21.9" E

e. Reference Chart: Topographic Map Island of Tinian 1983

Scale: 1:25,000

Edition Number: N/A

Date Revised: 1983

Sheet Number: N/A

f. Source: NSWU-1 Platoon ONE BRAVO

g. Type recon Conducted: Beach Intelligence Survey Report

h. SEAL Team Evaluation:

Unai Masalok Beach is suitable for both CRRC and swimmer landings. Extreme caution should be used when conducting either landing due to shallow reef and a strong surf zone. The nearshore is very shallow with heavy wave sets breaking right on the reef. Either of the landings should be conducted with protective gear (Gloves, coral booties, boots, head protection).

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 75 yds

Surveyed Length: 75 yds

Useable Length: 65 yds

Shape/Type: Straight/coastal plain

Coastal Terrain: Lava rock with dense brush.

Vegetation: Moderate to dense brush 8-10 ft tall with scattered trees 10-50 ft tall.

Beach Exits: Drivable trail at the right flank. Matting needed for 2-wheel drive vehicles, possibly for 4x4 vehicles. Trail winds around to the east and joins a dirt road.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

Matting: Fifty yards needed for the only vehicle exiton the right flank. The narrow beach exit is approximately 35 yds in width.
General Firmness: Firm

c. SUROB:
Significant breaker Height: 3-4 feet
Maximum Breaker Height: 6-7 feet
Breaker Period: 8-10 seconds
Breaker Type: Spilling: 73 %
Plunging: 27 %
Surging: N/A
Breaker Angle: 0 Degrees toward R/L Flank
Littoral Current:
Inside Surf Zone: .5 kts toward LF
Outside Surf Zone: .5 kts toward LF
Lines of Surf: 3 Lines of surf in 30 yd surf zone
Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. Obstructions: SEE PHOTOS

Nearshore obstructions: 2-3 exposed rocks/coral off LF approximately 25 yds off beach

Foreshore obstructions: Coral Reef

Backshore obstructions: Several large rocks/Coral Reef/Cliffs

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width	30 yds	10 yds	N/A
Composition:	Coral	Coral/Sand/ Rock/Shells	Sand/Shoal/ Lava Rock/ PackedDirt

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Aguiguan Island (Goat Island)

c. Date of Survey: 21 Mar 94 Time: 1030

d. Beach Location:

	LAT	LONG
Beach Center	14 deg 50' 47" N	145 deg 32' 07" E
Right Flank	N/A	N/A
Left Flank	N/A	N/A

e. Reference Chart: Topographic Map Island of Tinian 1983
Scale: 1:25,000
Edition Number: N/A
Date Revised: 1983
Sheet Number: N/A

f. Source: NSWU-1 Platoon ONE BRAVO

g. Type recon Conducted: Beach Survey Report

h. SEAL Team Evaluation:

The only site possible to come ashore on Aguiguan Island is not a beach. It is a series of steps that lead up the side of the mountain. It is located on the west side of the island and is on the bottom of a rocky cliff. A draw leads from the steps up to the top of the cliff. There are 3-5 steps and waves often break over the steps. The water is very choppy at the site (3-4').

Landing craft recommended are CRRC's or RIBs, the latter being a better platform. The boats would have to either drop the swimmers off a few yards from the steps (if the chop is too rough) or take the boats directly to the steps where personnel can jump to the steps.

Personnel going ashore should wear full body cover for protection against the rocks.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 2 yds

Surveyed Length: 2 yds

Useable Length: 2 yds

Shape/Type: N/A

Coastal Terrain: Rocky cliffs

Vegetation: None

Beach Exits: Draw

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	UNUSABLE	UNUSABLE
4-Wheel Drive:	UNUSABLE	UNUSABLE
Tracked:	UNUSABLE	UNUSABLE
Personnel:	FAIR	FAIR

Matting: N/A

General Firmness: Lava Rock

c. SUROB:

Significant breaker Height: 3-4 feet
Maximum Breaker Height: 5 feet
Breaker Period: 4 seconds
Breaker Type: Spilling: N/A
Plunging: 1 %
Surging: 99 %

Breaker Angle: 0 Degrees toward R/L Flank

Littoral Current: N/A
Inside Surf Zone:
Outside Surf Zone:

Lines of Surf: Chop

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

2. Survey and Reconnaissance Data:

a. Total length: 20 yards

Surveyed length: N/A

Useable length: 20 yards

Shape/Type: Concave/ "V" shaped cove

Coastal Terrain: Vertical lava cliffs on each flank which protrude seaward to form a "V" shaped cove and the backshore has dense vegetation growing over rugged lava.

Vegetation: Palm trees, bushes 5-8 feet tall, and trees 10-20 feet tall.

Beach Exits: The only beach exit is straight back from center beach and is suitable only for a foot patrol.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Poor	Poor
Tracked:	Poor	Poor
Personnel:	Good	Good

Matting: Unusable, not suitable for vehicle traffic.

General firmness: Firm at all times.

c. SUROBS:

Significant Breaker Height: 4 ft
Maximum Breaker Height: 6 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 10%
Plunging: 90%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1.5 kts Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 1 to 2 Lines in 20 ft Surf Zone

Water Temperature: 84° F
Air Temperature: 90° F
Visibility: 20 miles

2

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Unai Chulu

c. Date of Survey: 9 Dec 92 Time: 0800 K

d. Beach Location:

	LAT	LONG
Left Flank:	15° 04' 23.9" N	145° 36' 51.7" E
Beach Center:	15° 04' 23.3" N	145° 36' 51.1" E
Right Flank:	15° 04' 21.6" N	145° 36' 49.5" E

e. Reference Point: LAT: 15° 04' 23.3" N
LONG: 145° 36' 51.1" E

Description: Beach Center

f. Reference Chart: Babanettan Tahgong

Scale: 1:25,000
Edition No.: 3-AMS(AFFE)
Date Revised: 1956
Series: W843
Sheet No.: 3367 11 NW

g. Source: NSWU-1 Platoon FIVE BRAVO

h. Type Recon Conducted: Admin Parallel

i. Normal Axis of Beach: 135° T

k. SEAL Team Evaluation: Unai Chulu is a suitable beach landing site for LCAC and AAV's. A CRRC landing is not recommended due to the existence of a coral reef that runs the length of the shoreline 100m off shore. The surf breaks violently directly on the coral reef (95% plunging), which would make for very hazardous CRRC ops. A swimmer landing is recommended, but only for the most experienced swimmers; and protective clothing is a must to avoid abrasions from the coral.

2. Survey and Reconnaissance Data:

a. Total length: 112.5 yards

Surveyed length: 112.5 yards

Useable length: 50 yards

Shape/Type: Straight/ Coastal Plain

Coastal Terrain: Extremely sharp lava rock on each flank.

Vegetation: Pine trees 30-50 ft tall, dense brush 8-10 ft tall.

Beach Exits: An unimproved dirt road runs parallel to the beach at the start of the hinterland and exits from the left flank, connecting to an improved paved road.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Fair	Fair
4-Wheel Drive:	Good	Good
Tracked:	Good	Good
Personnel:	Excellent	Excellent

Matting: 25 yards required to extend from the HWL to the Hinterland for 2WD vehicles.

General firmness: Firm

c. SUROBS:
Significant Breaker Height: 4-6 ft
Maximum Breaker Height: 8 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 5%
Plunging: 95%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1.5 kts Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 3 Lines in 75 ft Surf Zone

Water Temperature: 82° F
Air Temperature: 90° F
Visibility: 14 miles

NSW BEACH REPORT

d. Obstructions: See Hydrographic Chart

Nearshore obstructions: Coral reef

Foreshore obstructions: Lava Rock/Reef

Backshore obstructions: Pine trees, Dense brush

e. Physical Characteristics:

A-A'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 30 yds	Width:	15 yards	15 yards	15 yards
	Gradient:	1:50	1:6	1:50
	Composition:	Reef	Reef/Sand Rock	Sand

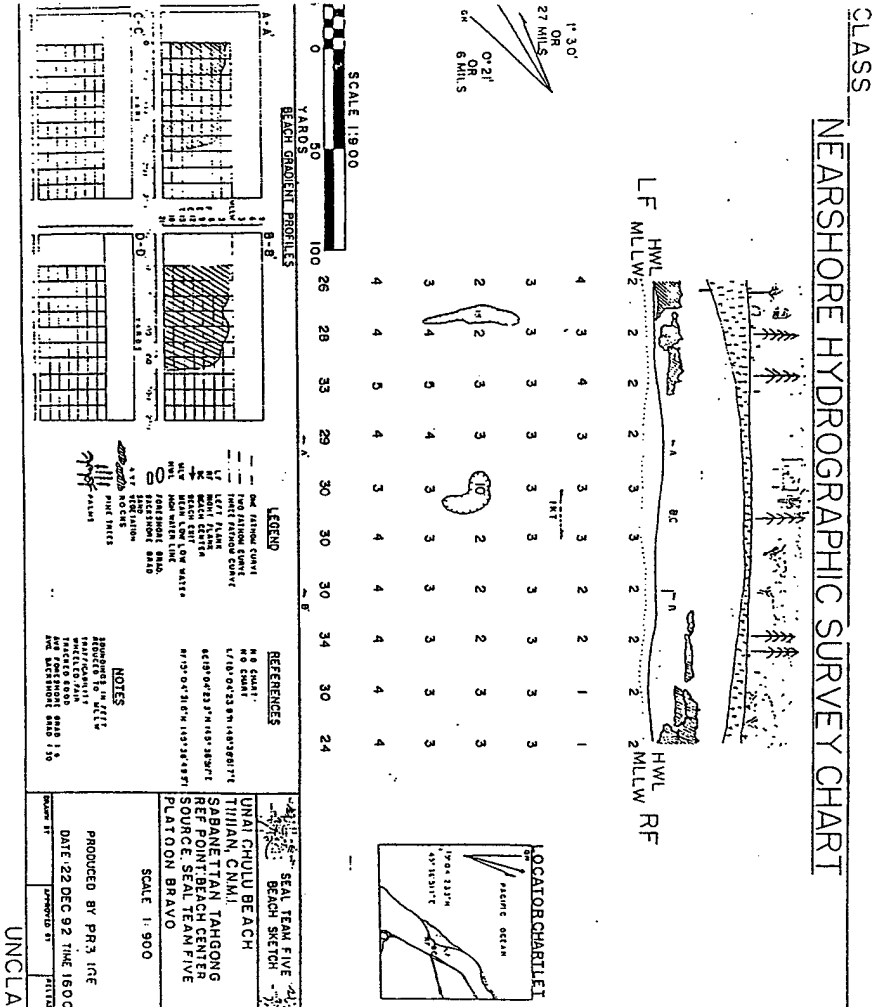
B-B'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 45 yds	Width:	15 yards	15 yards	15 yards
	Gradient:	1:50	1:6	1:50
	Composition:	Reef	Reef/Rock Sand	Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A

CLASS

NEARSHORE HYDROGRAPHIC SURVEY CHART



UNCLASS

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Unai Babui

c. Date of Survey: 9 Dec 92 Time: 0830 K

d. Beach Location:

	LAT	LONG
Left Flank:	15° 04' 50.6" N	145° 37' 17.1" E
Beach Center:	15° 04' 50.1" N	145° 37' 17.1" E
Right Flank:	15° 04' 49.3" N	145° 37' 14.6" E

e. Reference Point: LAT: 15° 04' 50.1" N
LONG: 145° 37' 17.1" E

Description: Beach Center

f. Reference Chart: Sabanettan Tahong

Scale: 1:25,000
Edition No.: 3-AMS(AFFE)
Date Revised: 1956
Series: W843
Sheet No.: 3367 11 NW

g. Source: NSWU-1 Platoon FIVE BRAVO

h. Type Recon Conducted: Admin Parallel

i. Normal Axis of Beach: 135° T

j. SEAL Team Evaluation: Unai Babui is suitable for amphibious landings using LCAC or AAV landing craft. The beach could be used for CRRC and swimmer landings, but extreme caution must be used because of shallow reef and heavy surf. Swimmers conducting a landing should wear protective clothing (Gloves, coral booties, etc.) to protect against the coral reef.

2: Survey and Reconnaissance Data:

a. Total length: 75 yards

Surveyed length: 75 yards

Useable length: 25 yards

Shape/Type: Straight/ Coastal plain

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush 8-10 feet tall with scattered trees 10-20 feet tall.

Beach Exits: A driveable trail at center beach leads to an unimproved dirt road which runs north and south.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Fair	Fair
Tracked:	Fair	Fair
Personnel:	Excellent	Excellent

Matting: 25 yards needed to extend from the HWL to the Hinterland for 2WD vehicles

General firmness: Firm

c. SUROBS:
Significant Breaker Height: 4-6 ft
Maximum Breaker Height: 8 ft
Breaker Period: 8-10 sec
Breaker Type: Spilling: 5%
Plunging: 95%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1 kt Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 3 in a 100 ft Surf Zone

Water Temperature: 82° F
Air Temperature: 90° F
Visibility: 14 miles

NSW BEACH REPORT

d. Obstructions: See Hydrographic Chart

Nearshore obstructions: Coral reef

Foreshore obstructions: Coral and large rocks

Backshore obstructions: Dense brush and trees

e. Physical Characteristics:

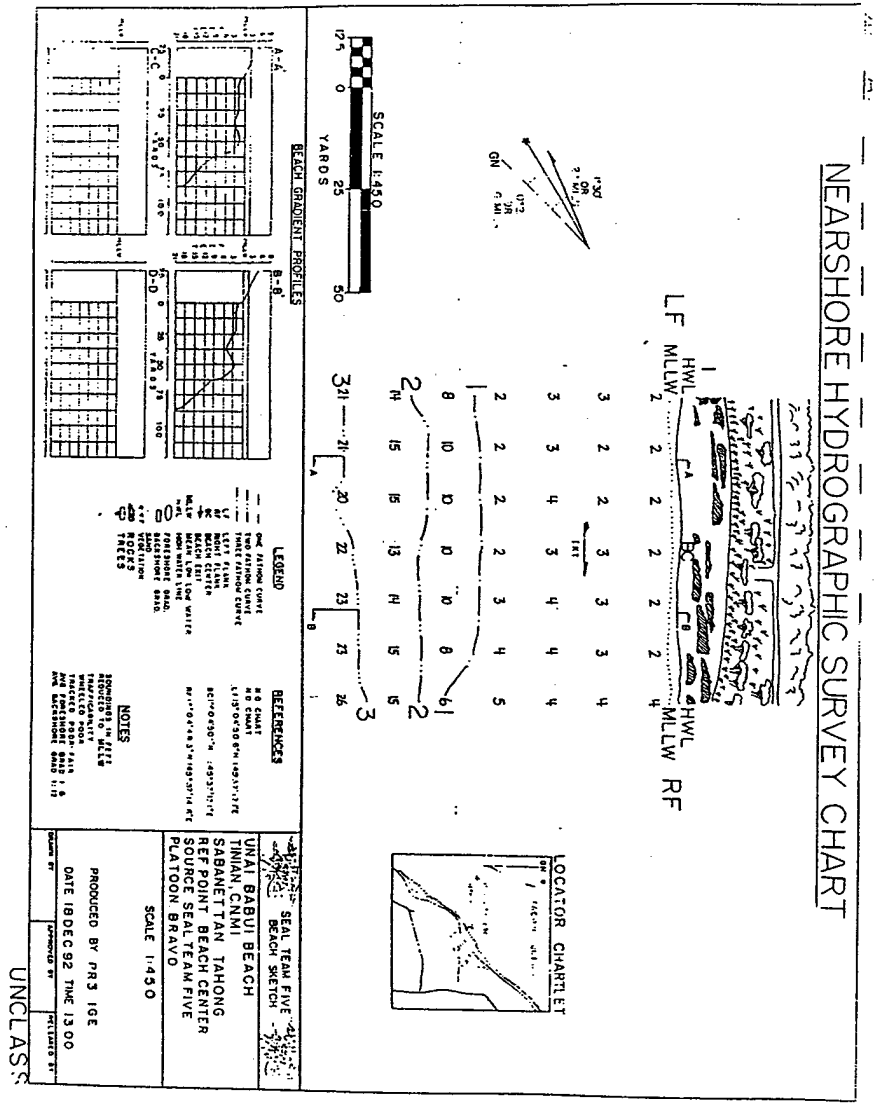
A-A'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 15 yds	Width:	10 yards	10 yards	5 yards
	Gradient:	1:6	1:12	1:50
	Composition:	Coral	Sand/Rocks	Packed dirt

B-B'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 55 yds	Width:	10 yards	10 yards	5 yards
	Gradient:	1:6	1:12	1:50
	Composition:	Coral	Sand/Rocks	Packed dirt

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A



UNCLASS

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Unai Chiget

c. Date of Survey: 9 Dec 92 Time: 1430 K

d. Beach Location:

	LAT	LONG
Beach Center:	15° 3' 44.2" N	145° 39' 13.1" E

e. Reference Point: LAT: 15° 03' 44.2" N
LONG: 145° 39' 13.1" E

Description: The reference point is a 20 ft by 20 ft square shaped rock at center beach. The beach is 30 yards in length.

f. Reference Chart: Saipan and Tinian

Scale: 1:75,000
Edition No.: 5th
Date Revised: 20 Jan 1990
Sheet No.: 81067

g. Source: NSWU-1 Platoon FIVE BRAVO

h. Type Recon Conducted: Beach Survey

i. Normal Axis of Beach: 270° T

j. SEAL Team Evaluation: Amphibious landings are not recommended due to a very powerful surf zone that breaks on top of exposed rock and reef. Unai Chiget is not suitable for CRRC or Swimmer landings.

Survey and Reconnaissance Data:

a. Total length: 30 yards

Surveyed length: 30 yards

Useable length: None

Shape/Type: Concave/Lagoon

Coastal Terrain: Sheer cliff on the left flank, a 10 foot rock ledge on the right flank and a 100 yard lagoon separates center beach from the surf zone.

Vegetation: Thick brush on the right flank growing on top of a lava ledge.

Beach Exits: The beach exit is only suitable for a foot patrol, located straight back from center beach and leads to a small dirt road running East to West.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Poor	Poor
Tracked:	Poor	Poor
Personnel:	Good	Good

Matting: Unusable, the only beach exit is by foot patrol.
General firmness: Firm at all times

c. SUROBS:
Significant Breaker Height: 4 ft
Maximum Breaker Height: 6 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 10%
Plunging: 90%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: .2 kts Toward Beach Center
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 1 to 2 Lines in 15 ft Surf Zone

Water Temperature: 84° F
Air Temperature: 90° F
Visibility: 14 miles

NSW BEACH REPORT

d. Obstructions:

Nearshore obstructions: Rocks and reef

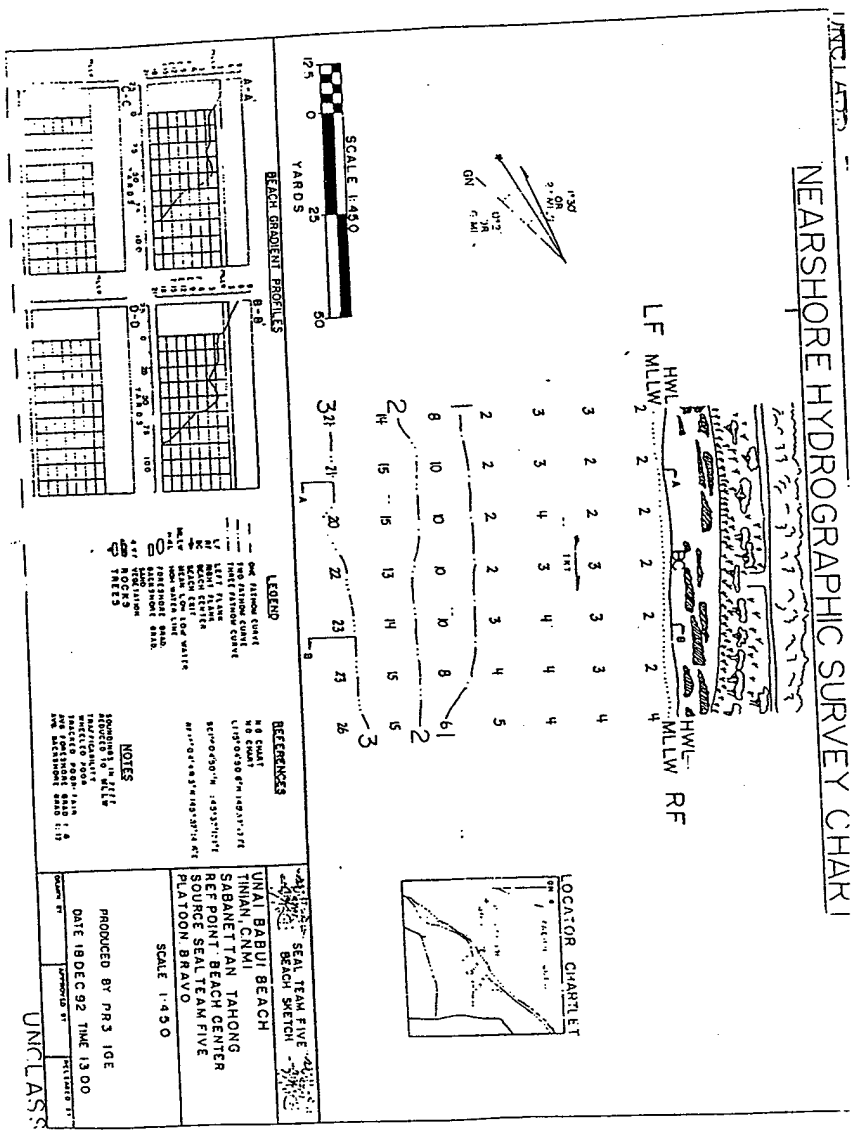
Foreshore obstructions: Large rock at center beach

Backshore obstructions: Dense vegetation

e. Physical Characteristics:

	NEAR SHORE	FORESHORE	BACKSHORE
Width:	N/A	N/A	N/A
Composition:	Reef	Reef/Rock	Rock/Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A



NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Sabanettan Unai Lamlam

c. Date of Survey: 9 Dec 92 Time: 1400 K

d. Beach Location:

	LAT	LONG
Beach Center:	15° 05' 19.6" N	145° 37' 53.6" E

e. Reference Point: LAT: 15° 05' 19.6" N
LONG: 145° 37' 53.6" E

Description: The only sand beach in the immediate vicinity identified by sand and rocks within a "V" shaped cove 20 yards in width.

f. Reference Chart: Sabanettan Tahong Marianas Islands

Scale: 1:25,000
Edition No.: 3-AMS(AFFE)
Date Revised: 1956
Series: W843
Sheet No.: 3367 11 NW

g. Source: NSWU-1 Platoon FIVE BRAVO

h. Type Recon Conducted: Beach Survey

i. Normal Axis of Beach: 135° T

j. SEAL Team Evaluation: Unai Lamlam is not suitable for CRRC landings because of a very shallow coral reef which is exposed during low tides, but just under the water-line during high tides. Any type of swimmer landing could be conducted during the summer months, but extreme caution and protective clothing (Gloves, coral booties, etc.) should be used to protect the swimmers from the coral. Due to the heavy surf conditions during the winter months conducting a swimmer landing is not recommended.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total length: 20 yards

Surveyed length: N/A

Useable length: 20 yards

Shape/Type: Concave/ "V" shaped cove

Coastal Terrain: Vertical lava cliffs on each flank which protrude seaward to form a "V" shaped cove and the backshore has dense vegetation growing over rugged lava.

Vegetation: Palm trees, bushes 5-8 feet tall, and trees 10-20 feet tall.

Beach Exits: The only beach exit is straight back from center beach and is suitable only for a foot patrol.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Poor	Poor
Tracked:	Poor	Poor
Personnel:	Good	Good

Matting: Unusable, not suitable for vehicle traffic.

General firmness: Firm at all times.

c. SUROBS:

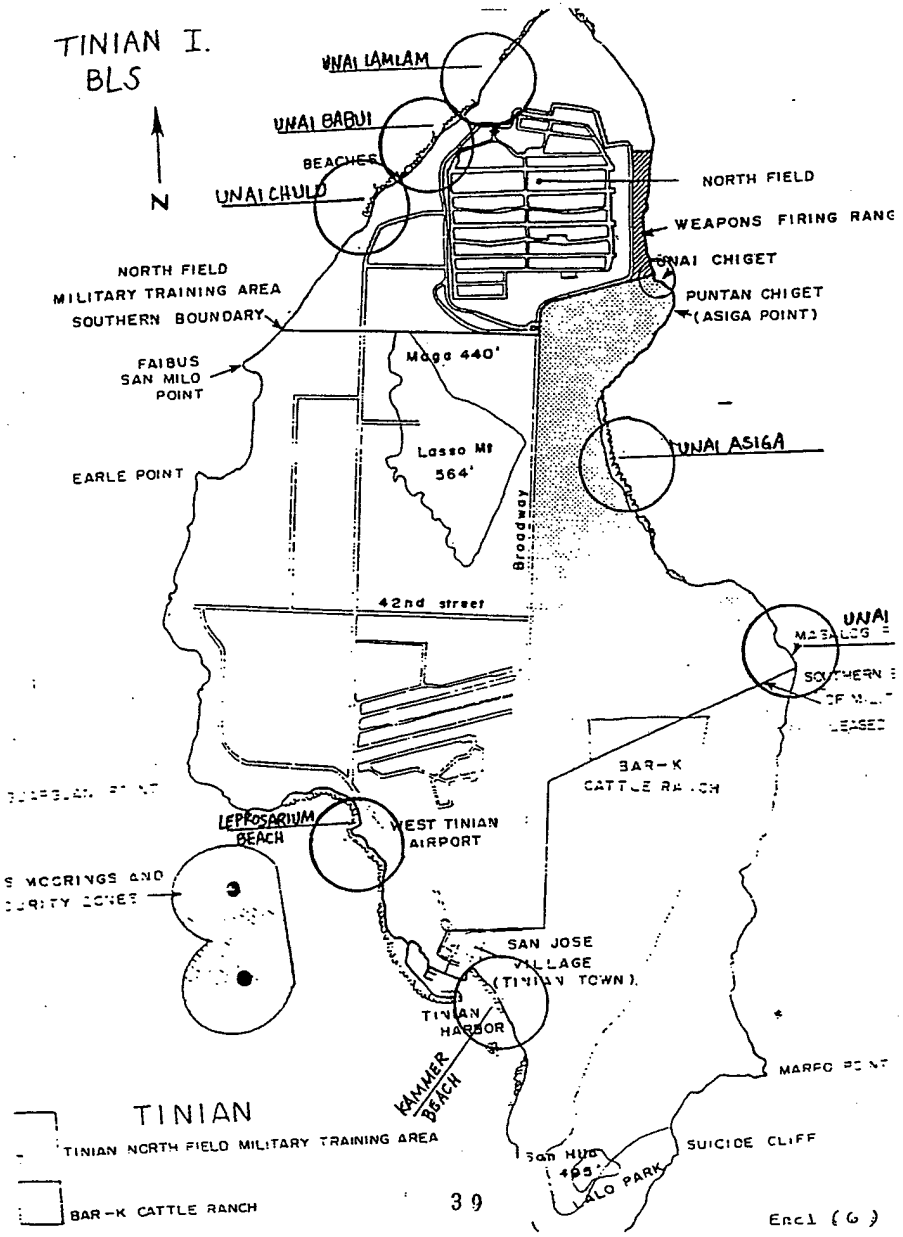
Significant Breaker Height: 4 ft
Maximum Breaker Height: 6 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 10%
Plunging: 90%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1.5 kts Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 1 to 2 Lines in 20 ft Surf Zone

Water Temperature: 84° F
Air Temperature: 90° F
Visibility: 20 miles



Encl (6)

14 April 94

From: LTJG Smith, AOIC, SEAL Team ONE BRAVO Platoon
To: Commander, Naval Special Warfare Unit ONE
Via: Operations Officer
Executive Officer

Subj: POST-OPERATIONS REPORT FOR TINIAN ISLAND TRAINING CONDUCTED FROM 20-25 MAR 94

Encl: (1) Kammer Beach Report
(2) Leprosarium Beach Report
(3) Unai Asiga Beach Report
(4) Unai Masalok Beach Report
(5) Aguiguan Island Beach Report
(6) Unai Chulu Beach Survey Report
(7) Unai Babui Beach Survey Report
(8) Unai Chiget Beach Survey Report
(9) Sabanettan Unai Lamlam Beach Report
(10) Map of Tinian with Beach Landing Sites noted

1. From 20-25 Mar 94, SEAL Team ONE BRAVO Platoon conducted hydrographic reconnaissance/beach survey training on Tinian Island. Four beaches surveyed one and a half years ago by SEAL Team FIVE were reconfirmed. In addition, BRAVO platoon found and performed hydro recons and/or Beach Survey Reports on five additional beaches. These nine beaches represent the only possible Beach Landing Sites (BLS) for SEAL operations. The island is completely surrounded by a coral reef thus limiting the areas in which a squad or platoon can land. Of these nine beaches, only three appear suitable for an LCAC landing (Unai Chulu, Unai Asiga and Kammer Beach). One of the landing sites is located on the northwest side of Aguiguan Island (known as "Goat Island" to locals). This site is suitable only to drop swimmers off. Aguiguan Island is a small uninhabited island located 6 NM south of Tinian.

2. **SITUATION**

Fifteen members of BRAVO Platoon departed Andersen AFB at 0800 20 March in one VRC-50 C-130 aircraft. Upon landing at Tinian West Airfield, we were met by customs officials and Mr. Mike Fitzgerald, a representative from the Mayor's Office and the main point of contact for all military operations on island. The two and a half ton truck was driven off and the platoon checked into the Konton Tasi apartment Complex located in the town of San Jose. Training was conducted from 20-24 Mar. Chartwork was completed during the week in the apartments. The platoon departed Tinian West Airfield on 25 Mar at 1100. The platoon arrived at Andersen AFB at 1145 and then drove back to NAVSTA Guam.

3. **EXECUTION**

20 MARCH

0500	PLT DEPARTS NSWU-1 EN ROUTE TO ANDERSEN AFB
0600	PLT ARRIVES AT ANDERSEN AFB, VRC-50
0800	PLT DEPARTS FOR TINIAN
0845	PLT ARRIVES TINIAN ISLAND
1000	PLT ARRIVES AT BERTHING FACILITY
1100-1300	CHOW
1300-1700	DESIG PERSONNEL RECONFIRM FOUR PREVIOUSLY SURVEYED BEACHES/DESIG PERSONNEL LOOK FOR NEW BLS

21 MARCH

0900-1200	ADMIN PARALLEL HYDRO CONDUCTED ON KAMMER BEACH
1200-1300	CHOW
1330-1600	NSW BEACH REPORT CONDUCTED ON UNAI MASALOK
1700	CHOW

22 MARCH

0900-1200	ADMIN PARALLEL HYDRO CONDUCTED ON UNAI ASIGA
1200-1300	CHOW
1330-1600	NSW BEACH REPORT CONDUCTED ON LEPROSARIUM BEACH

23 MARCH

0900-1200	ZODIAC TRANSIT OF TINIAN ISLAND IN SEARCH OF FURTHER BLS PICTURES TAKEN OF UNAI CHIGET, UNAI CHULU, UNAI BABUI, AND SABANETTAN UNAI LAMLAM
1200-1400	CHOW
1400-1600	CHARTWORK

24 MARCH

0900-1300	TRANSIT TO AGUIGUAN ISLAND IN SEARCH OF BLS
1300-1400	CHOW
1400-1700	CHARTWORK

25 MARCH

0800	CHECK OUT OF BERTHING FACILITY
0900	TRANSIT TO TINIAN WEST AIRFIELD
1100	DEPART TINIAN ISLAND
1145	ARRIVE ANDERSEN AFB
1300	ARRIVE NSWU-1

4. **OBJECTIVES**

a. The objective of this trip was to reconfirm the four previously surveyed beaches and to find and survey any further BLS's on Tinian Island. Tinian Island now contains approximately eight beach landing sites. Only three of the eight BLS sites can be used for LCAC landings (Unai Chulu, Unai Asiga and Kammer Beach). In summary, the following Beach Landing Sites are available on Tinian Island with their suitability for LCAC, CRRC and/or swimmer landings noted:

	LCAC	CRRC	SWIMMER
Unai Chulu:	YES	YES	YES
Unai Masalok:	NO	YES	YES
Unai Asiga:	YES	YES	YES
Unai Chiget:	NO	NO	NO
Unai Lamlam:	NO	NO	YES
Unai Babui:	NO	YES	YES
Leprosarium Beach:	NO	YES	YES
Kammer Beach:	YES	YES	YES
Aguiguan (Goat Is.):	NO	YES	YES

5. **LOGISTICS**

a. Transportation via C-130 allowed the platoon to bring a two and a half ton truck to Tinian. This is obviously the easiest way to travel. It also eliminated the need to rent vehicles while on the island. Ultimately, having the vehicle staged on Tinian Island permanently would greatly benefit platoons and as well as save money.

b. Entry requirements for Tinian Island include a manifest of all gear brought onto the island and a general declaration. Since we travelled by aircraft, the squadron (VRC-50) provided this declaration. It should be noted that if you travel by PB or other boat, it is the responsibility of the platoon to acquire this declaration from COMNAVMAR Customs Office (POC: ABEC Hugh M. O'Neale PRIPHN:349-5218/5238).

c. The platoon utilized the Konton Tasi Apartment Complex for berthing. The complex is owned by Mr. Bill Nabors, Chief Executive Officer to the Mayor of Tinian. The cost is $15.00/night per

person. The rooms can hold up to 5 people and include a kitchen with refrigerator and stove. This seems to be a good idea if a small group of people were to be on Tinian for an extended period of time (e.g. EX TANDEM THRUST).

6. **PLATOON COMMANDER'S ASSESSMENT**

All aspects of this training exercise went exceptionally well and all participants did an outstanding job. The island affords excellent opportunities for training in several areas of Naval Special Warfare. Tinian Island should be utilized more often in the future, possibly for smaller scale "fly-away" operations. A SEAL squad or element could duck in (provided boat support could get out to sea) and then come ashore on any of the BLS's now surveyed. If the BLS chosen is in the northern part of the island, the squad could patrol to the North Field Military Training Area (NFMTA) and conduct a direct action mission. If the BLS chosen is in the southern part of the island, the squad could rendezvous with an agent and infil via indigenous vehicle to a location near the NFMTA. This would eliminate the need to patrol through private property all the way from the south to the NFMTA which is located in the north near the abandoned runways. This is just one possibility. SR's could also be conducted. For example, there is a radio tower/station just up from Kammer Beach that would provide a suitable reconnaissance sight.

Tinian Island offers numerous possibilities for platoon training. Mr. Mike Fitzgerald of the Mayor's Office is more than willing to accomodate Naval Special Warfare and is anxious to support any type of operation that we request.

Very Respectfully,

N.M. SMITH
LTJG, USN

NSW BEACH REPORT

1. **General Information:**

a. **Country:** Tinian, C.N.M.I.

b. **Beach Name:** Unai Asiga

c. **Date of Survey:** 22 Mar 94 **Time:** 1330

d. **Beach Location:**

	LAT	LONG
Beach Center	15 deg 02' 07.3" N	145 deg 38' 55.7" E
Right Flank	15 deg 02' 07.3" N	145 deg 38' 55.5" E
Left Flank	14 deg 57' 46.9" N	145 deg 37' 30.8" E

e. **Reference Chart:** Topographic Map Island of Tinian 1983
Scale: 1:25000
Edition Number: N/A
Date Revised: 1983
Sheet Number: N/A

f. **Source:** NSWU-1 Platoon ONE BRAVO

g. **Type recon Conducted:** Admin Parallel

h. **SEAL Team Evaluation:**

Unai Asiga is suitable for either SEAL CRRC landings or SEAL swimmer landings. There is a prominent reef 175 yds out which has average sized waves spilling onto it. From the reef to the shoreline (approx. 50 yds), water depth is only waist deep.

NSW BEACH REPORT

2. **Survey and Reconnaissance Data:**

a. **Total Length:** 175 yds

Surveyed Length: 175 yds

Useable Length: 175 yds

Shape/Type: Straight/coastline

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush 10-15 ft tall with scattered trees 10-25 ft tall.

Beach Exits: Drivable road leads directly off the beach.

b. **Beach Trafficability:**

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

Matting: Fifty yards required to extend from the HWL to the hinterland for 2-wheel drive vehicles.

General Firmness: Firm

c. **SUROB:**

Significant breaker Height: 1-2 feet
Maximum Breaker Height: 4 feet
Breaker Period: 6 seconds
Breaker Type: **Spilling:** 85 %
Plunging: 15 %
Surging: N/A

Breaker Angle: 0 **Degrees toward** R/L **Flank**

Littoral Current:
Inside Surf Zone: .5 kts towards LF
Outside Surf Zone: .5 kts towards LF

Lines of Surf: 3 in 30 yd surf zone

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. **Obstructions:** SEE PHOTOS

Nearshore obstructions: Coral Reef

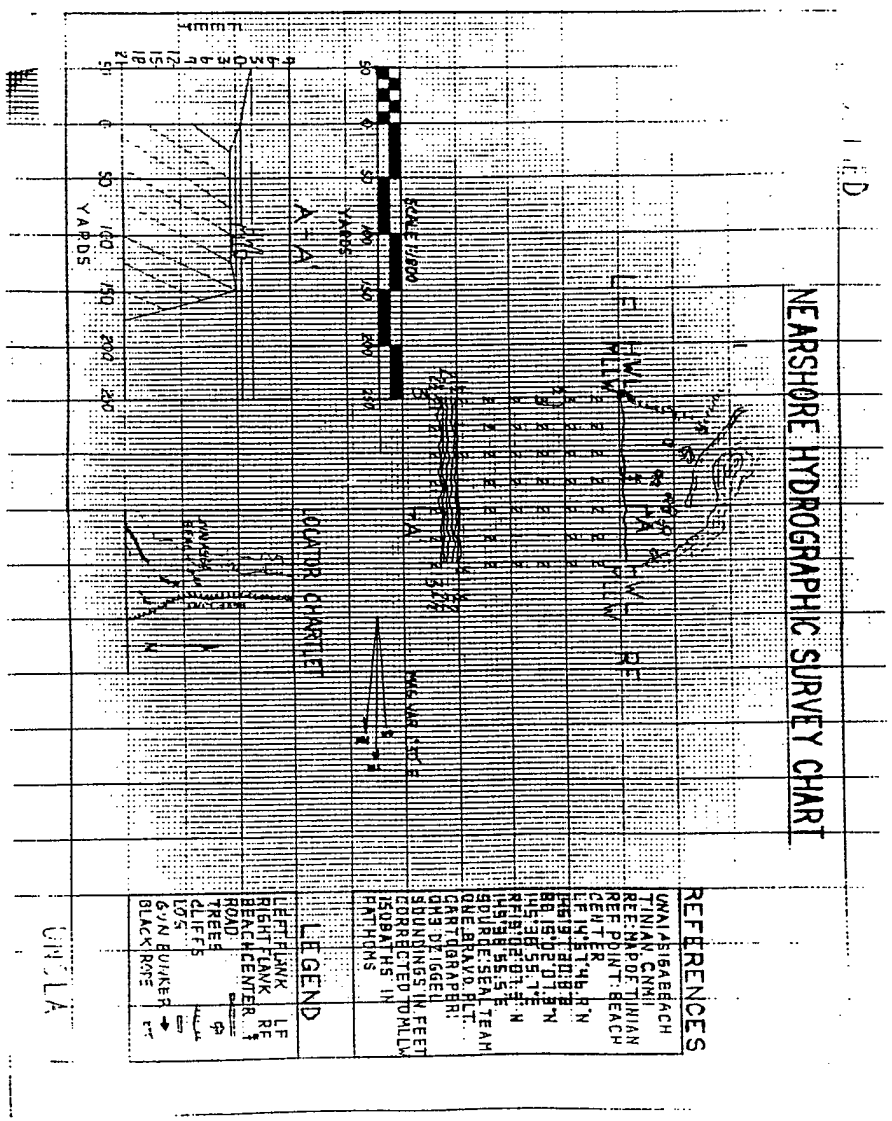
Foreshore obstructions: Coral Reef with exposed rocks/logs at beach center.

Backshore obstructions: Soft sand/brush/trees

e. **Physical Characteristics:**

	Nearshore	Foreshore	Backshore
Width:	175 yds	5 yds	N/A
Composition:	Coral/rock bottom	Rocks/sand/ exposed coral/ logs	—

3. **Remarks:** This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.



NSW BEACH REPORT

1. **General Information:**

   a. **Country:** Tinian, C.N.M.I.

   b. **Beach Name:** Unai Chulu

   c. **Date of Survey:** 9 Dec 92 **Time:** 0800 K

   d. **Beach Location:**

	LAT	LONG
Left Flank:	15° 04' 23.9" N	145° 36' 51.7" E
Beach Center:	15° 04' 23.3" N	145° 36' 51.1" E
Right Flank:	15° 04' 21.6" N	145° 36' 49.5" E

   e. **Reference Point:** LAT: 15° 04' 23.3" N
   LONG: 145° 36' 51.1" E

   Description: Beach Center

   f. **Reference Chart:** Babanettan Tahgong

   Scale: 1:25,000
   Edition No.: 3-AMS(AFFE)
   Date Revised: 1956
   Series: W843
   Sheet No.: 3367 11 NW

   g. **Source:** NSWU-1 Platoon FIVE BRAVO

   h. **Type Recon Conducted:** Admin Parallel

   i. **Normal Axis of Beach:** 135° T

   k. **SEAL Team Evaluation:** Unai Chulu is a suitable beach landing site for LCAC and AAV's. A CRRC landing is not recommended due to the existence of a coral reef that runs the length of the shoreline 100m off shore. The surf breaks violently directly on the coral reef (95% plunging), which would make for very hazardous CRRC ops. A swimmer landing is recommended, but only for the most experienced swimmers; and protective clothing is a must to avoid abrasions from the coral.

2. Survey and Reconnaissance Data:

a. Total length: 112.5 yards

Surveyed length: 112.5 yards

Useable length: 50 yards

Shape/Type: Straight/ Coastal Plain

Coastal Terrain: Extremely sharp lava rock on each flank.

Vegetation: Pine trees 30-50 ft tall, dense brush 8-10 ft tall.

Beach Exits: An unimproved dirt road runs parallel to the beach at the start of the hinterland and exits from the left flank, connecting to an improved paved road.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Fair	Fair
4-Wheel Drive:	Good	Good
Tracked:	Good	Good
Personnel:	Excellent	Excellent

Matting: 25 yards required tc extend from the HWL to the Hinterland for 2WD vehicles.

General firmness: Firm

c. SUROBS:
Significant Breaker Height: 4-6 ft
Maximum Breaker Height: 8 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 5%
Plunging: 95%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1.5 kts Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 3 Lines in 75 ft Surf Zone

Water Temperature: 82· F
Air Temperature: 90· F
Visibility: 14 miles

d. Obstructions: See Hydrographic Chart

Nearshore obstructions: Coral reef

Foreshore obstructions: Lava Rock/Reef

Backshore obstructions: Pine trees, Dense brush

e. Physical Characteristics:

A-A'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 30 yds	Width:	15 yards	15 yards	15 yards
	Gradient:	1:50	1:6	1:50
	Composition:	Reef	Reef/Sand Rock	Sand

B-B'

		NEAR SHORE	FORESHORE	BACKSHORE
Distance from LF 45 yds	Width:	15 yards	15 yards	15 yards
	Gradient:	1:50	1:6	1:50
	Composition:	Reef	Reef/Rock Sand	Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A

NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Leprosarium Beach

   c. Date of Survey: 22 Mar 94 Time: 1030

   d. Beach Location:

	LAT	LONG
Beach Center	14 deg 58' 58.8" N	145 deg 36' 43.2" E
Right Flank	14 deg 58' 57.8" N	145 deg 36' 46.6" E
Left Flank	14 deg 58' 59.8" N	145 deg 36' 42.0" E

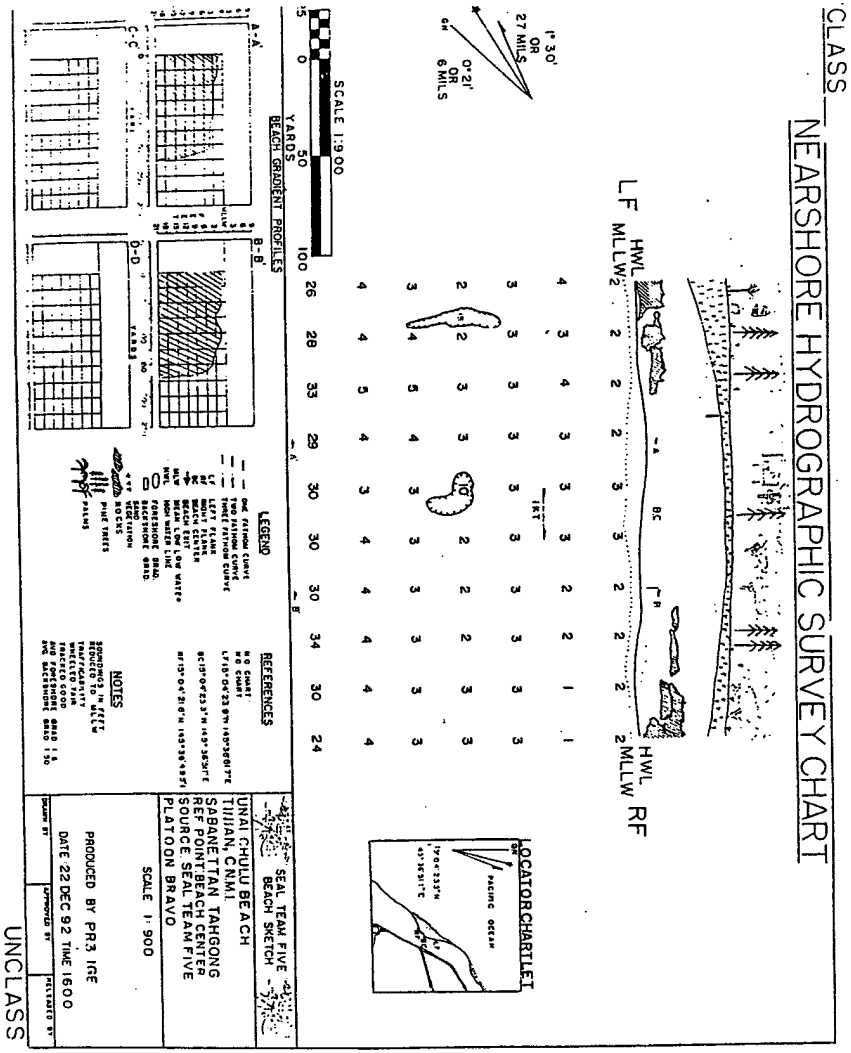
   e. Reference Chart: Topographic Map Island of Tinian 1983
      Scale: 1:25000
      Edition Number: N/A
      Date Revised: 1983
      Sheet Number: N/A

   f. Source: NSWU-1 Platoon ONE BRAVO

   g. Type recon Conducted: Beach Intelligence Survey Report

   h. SEAL Team Evaluation:

Leprosarium Beach is suitable for CRRC or swimmer landings. It is located on the leeward side of the island and the surf zone is negligible. CRRC over-the-beach landings would have to be conducted by pulling the motor up approximately 100 yds offshore (due to the reef) and paddling the rest of the way into the shore. Swimmers should wear protective clothing. The hinterland offers excellent areas in which to cache a boat.



NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 75 yds

Surveyed Length: 75 yds

Useable Length: 60 yds

Shape/Type: Straight

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush (10-15 ft tall) with scattered trees 10-25 ft tall..

Beach Exits: Drivable trail leads off the LF and winds up to an unimproved dirt road which winds around for 200m and joins a paved road running north-south.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

Matting: Fifty yards required to extend from the HWL to the hinterland for 2-wheel drive vehicles.

General Firmness: Firm

c. SUROB:

Significant breaker Height: 1 foot
Maximum Breaker Height: 2 foot
Breaker Period: 6-8 seconds
Breaker Type: Spilling: 100 %
Plunging: N/A
Surging: N/A

Breaker Angle: 0 Degrees toward R/L Flank

Littoral Current:
Inside Surf Zone: .2 kts
Outside Surf Zone: .5 kts

Lines of Surf: 2 lines of surf in a 20 yd surf zone

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. Obstructions: SEE PHOTOS

Nearshore obstructions: Coral Reef

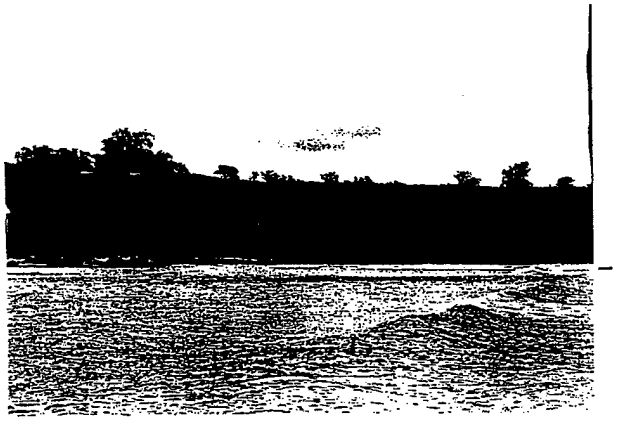
Foreshore obstructions: Coral and large rocks

Backshore obstructions: Dense brush and trees

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	60 yds	10 yds	25 yds
Composition:	Coral/rock bottom	Rocks/sand	Packed dirt

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.



NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Unai Masalok

c. Date of Survey: 22 Mar 94 Time: 0945

d. Beach Location:

	LAT	LONG
Beach Center	15 deg 01' 11.7" N	145 deg 39' 21.6" E
Right Flank	15 deg 01' 11.7" N	145 deg 39' 22.3" E
Left Flank	15 deg 01' 10.6" N	145 deg 39' 21.9" E

   e. Reference Chart: Topographic Map Island of Tinian 1983

   Scale: 1:25,000

   Edition Number: N/A

   Date Revised: 1983

   Sheet Number: N/A

   f. Source: NSWU-1 Platoon ONE BRAVO

   g. Type recon Conducted: Beach Intelligence Survey Report

   h. SEAL Team Evaluation:

Unai Masalok Beach is suitable for both CRRC and swimmer landings. Extreme caution should be used when conducting either landing due to shallow reef and a strong surf zone. The nearshore is very shallow with heavy wave sets breaking right on the reef. Either of the landings should be conducted with protective gear (Gloves, coral booties, boots, head protection).

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

   a. Total Length: 75 yds

   Surveyed Length: 75 yds

   Useable Length: 65 yds

   Shape/Type: Straight/coastal plain

   Coastal Terrain: Lava rock with dense brush.

   Vegetation: Moderate to dense brush 8-10 ft tall with scattered trees 10-50 ft tall.

   Beach Exits: Drivable trail at the right flank. Matting needed for 2-wheel drive vehicles, possibly for 4x4 vehicles. Trail winds around to the east and joins a dirt road.

   b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	FAIR	FAIR
Tracked:	GOOD	GOOD
Personnel:	EXCELLENT	EXCELLENT

   Matting: Fifty yards needed for the only vehicle exiton the right flank. The narrow beach exit is approximately 35 yds in width.
   General Firmness: Firm

c. SUROB:
   Significant breaker Height: 3-4 feet
   Maximum Breaker Height: 6-7 feet
   Breaker Period: 8-10 seconds
   Breaker Type: Spilling: 73 %
   Plunging: 27 %
   Surging: N/A
   Breaker Angle: 0 Degrees toward R/L Flank
   Littoral Current:
   Inside Surf Zone: .5 kts toward LF
   Outside Surf Zone: .5 kts toward LF
   Lines of Surf: 3 Lines of surf in 30 yd surf zone
   Water Temperature: 84 deg F
   Air Temperature: 88 deg F
   Visibility: 14 NM

d. **Obstructions:** SEE PHOTOS

Nearshore obstructions: 2-3 exposed rocks/coral off LF approximately 25 yds off beach

Foreshore obstructions: Coral Reef

Backshore obstructions: Several large rocks/Coral Reef/Cliffs

e. **Physical Characteristics:**

	Nearshore	Foreshore	Backshore
Width	30 yds	10 yds	N/A
Composition:	Coral	Coral/Sand/ Rock/Shells	Sand/Shoal/ Lava Rock/ PackedDirt

3. **Remarks:** This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.

NSW BEACH REPORT

1. **General Information:**

a. **Country:** Tinian, C.N.M.I.

b. **Beach Name:** Aguiguan Island (Goat Island)

c. **Date of Survey:** 21 Mar 94 **Time:** 1030

d. **Beach Location:**

	LAT	LONG
Beach Center	14 deg 50' 47" N	145 deg 32' 07" E
Right Flank	N/A	N/A
Left Flank	N/A	N/A

e. **Reference Chart:** Topographic Map Island of Tinian 1983
Scale: 1:25,000
Edition Number: N/A
Date Revised: 1983
Sheet Number: N/A

f. **Source:** NSWU-1 Platoon ONE BRAVO

g. **Type recon Conducted:** Beach Survey Report

h. **SEAL Team Evaluation:**

The only site possible to come ashore on Aguiguan Island is not a beach. It is a series of steps that lead up the side of the mountain. It is located on the west side of the island and is on the bottom of a rocky cliff. A draw leads from the steps up to the top of the cliff. There are 3-5 steps and waves often break over the steps. The water is very choppy at the site (3-4').

Landing craft recommended are CRRC's or RIBs, the latter being a better platform. The boats would have to either drop the swimmers eff a few yards from the steps (if the chop is too rough) or take the boats directly to the steps where personnel can jump to the steps.

Personnel going ashore should wear full body cover for protection against the rocks.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total Length: 2 yds

Surveyed Length: 2 yds

Useable Length: 2 yds

Shape/Type: N/A

Coastal Terrain: Rocky cliffs

Vegetation: None

Beach Exits: Draw

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	UNUSABLE	UNUSABLE
4-Wheel Drive:	UNUSABLE	UNUSABLE
Tracked:	UNUSABLE	UNUSABLE
Personnel:	FAIR	FAIR

Matting: N/A

General Firmness: Lava Rock

c. SUROB:

Significant breaker Height: 3-4 feet
Maximum Breaker Height: 5 feet
Breaker Period: 4 seconds
Breaker Type: Spilling: N/A
Plunging: 1 %
Surging: 99 %

Breaker Angle: 0 Degrees toward R/L Flank

Littoral Current: N/A
Inside Surf Zone:
Outside Surf Zone:

Lines of Surf: Chop

Water Temperature: 84 deg F
Air Temperature: 88 deg F
Visibility: 14 NM

d. Obstructions:

Nearshore obstructions: Lava Rock

Foreshore obstructions: Lava Rock

Backshore obstructions: Rocks/Cliff

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	N/A	N/A	N/A
Composition:	N/A	N/A	N/A

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.

NSW BEACH REPORT

1. General Information:

a. Country: Tinian, C.N.M.I.

b. Beach Name: Sabanettan Unai Lamlam

c. Date of Survey: 9 Dec 92 Time: 1400 K

d. Beach Location:

	LAT	LONG
Beach Center:	15° 05' 19.6" N	145° 37' 53.6" E

e. Reference Point: LAT: 15° 05' 19.6" N
LONG: 145° 37' 53.6" E

Description: The only sand beach in the immediate vicinity identified by sand and rocks within a "V" shaped cove 20 yards in width.

f. Reference Chart: Sabanettan Tahong Marianas Islands

Scale: 1:25,000
Edition No.: 3-AMS(AFFE)
Date Revised: 1956
Series: W843
Sheet No.: 3367 11 NW

g. Source: NSWU-1 Platoon FIVE BRAVO

h. Type Recon Conducted: Beach Survey

i. Normal Axis of Beach: 135° T

j. SEAL Team Evaluation: Unai Lamlam is not suitable for CRRC landings because of a very shallow coral reef which is exposed during low tides, but just under the water-line during high tides. Any type of swimmer landing could be conducted during the summer months, but extreme caution and protective clothing (Gloves, coral booties, etc.) should be used to protect the swimmers from the coral. Due to the heavy surf conditions during the winter months conducting a swimmer landing is not recommended.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

a. Total length: 20 yards

Surveyed length: N/A

Useable length: 20 yards

Shape/Type: Concave/ "V" shaped cove

Coastal Terrain: Vertical lava cliffs on each flank which protrude seaward to form a "V" shaped cove and the backshore has dense vegetation growing over rugged lava.

Vegetation: Palm trees, bushes 5-8 feet tall, and trees 10-20 feet tall.

Beach Exits: The only beach exit is straight back from center beach and is suitable only for a foot patrol.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Poor	Poor
Tracked:	Poor	Poor
Personnel:	Good	Good

Matting: Unusable, not suitable for vehicle traffic.

General firmness: Firm at all times.

c. SUROBS:

Significant Breaker Height: 4 ft
Maximum Breaker Height: 6 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 10%
Plunging: 90%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1.5 kts Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 1 to 2 Lines in 20 ft Surf Zone

Water Temperature: 84° F
Air Temperature: 90° F
Visibility: 20 miles

NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Kammer Beach

   c. Date of Survey: 21 Mar 94 Time: 1030

   d. Beach Location:

	LAT	LONG
Beach Center	14 deg 57' 46.9" N	145 deg 37' 30.8" E
Right Flank	14 deg 57' 44.6" N	145 deg 37' 44.8" E
Left Flank	14 deg 57' 53.1" N	145 deg 37' 31.3" E

   e. Reference Chart: Topographic Map Island of Tinian 1983
   Scale: 1:25000
   Edition Number: N/A
   Date Revised: 1983
   Sheet Number: N/A

   f. Source: NSWU-1 Platoon ONE BRAVO

   g. Type recon Conducted: Admin Parallel

   h. SEAL Team Evaluation:

Kammer Beach is a suitable landing site for LCAC's, AAV's and CRRC's. Due to its partially protected area, the nearshore sea state is mild and surf is limited to small shore break (up to 1 foot in height). The extreme left and right flanks should be avoided. At the LF, steel pilings are protruding out of the water near the one fathom mark. Just right of the right flank, lava rock breaks the surface at the 1/2 fathom mark and extends to the backshore.

All approaches to shore right of beach center are not recommended due to the existence of a coral reef/shelf. The reef begins in shallow water near BC and extends diagonally to the three fathom mark.

NSW BEACH REPORT

2. Survey and Reconnaissance Data:

   a. Total Length: 300 yds

   Surveyed Length: 300 yds

   Useable Length: 150 yds

   Shape/Type: Concave

   Coastal Terrain: Lava rock on right flank, pier and steel pilings on left flank.

   Vegetation: Palm trees (30' tall), broad leaf bushes ten feet high on right flank.

   Beach Exits: One paved road runs parallel to beach at the beginning of the hinterland. At both left and right flank, the road connects with a main roadway which also runs parallel to the beach.

   b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	POOR	POOR
4-Wheel Drive:	GOOD	GOOD
Tracked:	VERY GOOD	VERY GOOD
Personnel:	EXCELLENT	EXCELLENT

   Matting: Thirty yards required to extend from the HWL to the backshore for 2-wheel drive vehicles.

   General Firmness: Firm

   c. SUROB:

   Significant breaker Height: 1 foot
   Maximum Breaker Height: 2 foot
   Breaker Period: 6 seconds
   Breaker Type: Spilling: 2 %
   Plunging: 98 %
   Surging: N/A

   Breaker Angle: 0 Degrees toward R/L Flank

   Littoral Current:
   Inside Surf Zone: .3 knots from L to R Flank
   Outside Surf Zone: .8 knots from L to R Flank

   Lines of Surf: 2 lines of surf in 20 ft surf zone

Water Temperature: 82 deg F
Air Temperature: 89 deg F
Visibility: 17 NM

d. Obstructions:

Nearshore obstructions: Three underwater obstructions, all left of BC. Only significant obstacle is submerged rock in center lane. Coral reefs begin right of beach center.

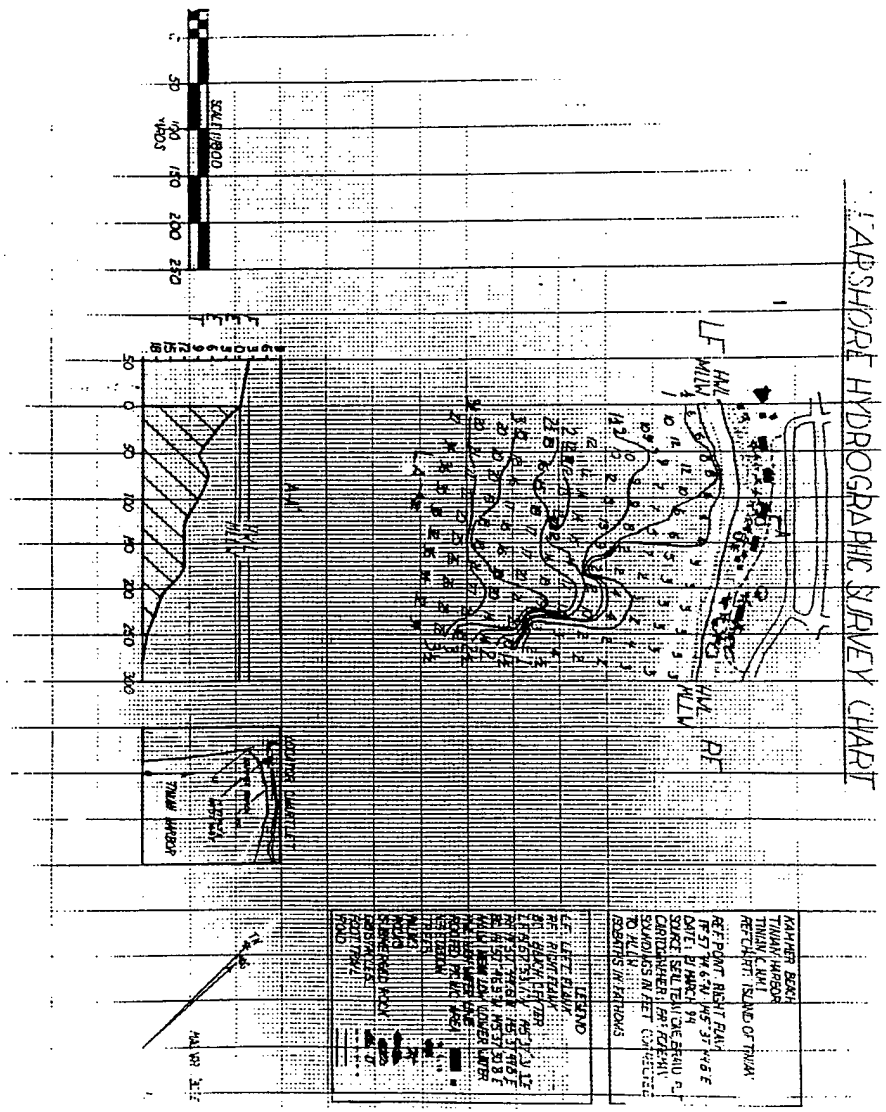
Foreshore obstructions: Small tree (5 ft tall) just right of BC between foreshore and backshore.

Backshore obstructions: Picnic area shelters, palm trees. Thick vegetation/lava rock on the right flank.

e. Physical Characteristics:

	Nearshore	Foreshore	Backshore
Width:	300 yds	5-15 yds	35 yds
Composition:	Sand/reef	Sand	Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST 3820.1A.



KAMMER BEACH

NSW BEACH REPORT

1. General Information:

   a. Country: Tinian, C.N.M.I.

   b. Beach Name: Unai Babui

   c. Date of Survey: 9 Dec 92 Time: 0830 K

   d. Beach Location:

	LAT	LONG
Left Flank:	15° 04' 50.6" N	145° 37' 17.1" E
Beach Center:	15° 04' 50.1" N	145° 37' 17.1" E
Right Flank:	15° 04' 49.3" N	145° 37' 14.6" E

   e. Reference Point: LAT: 15° 04' 50.1" N
   LONG: 145° 37' 17.1" E

   Description: Beach Center

   f. Reference Chart: Sabanettan Tahong

   Scale: 1:25,000
   Edition No.: 3-AMS(AFFE)
   Date Revised: 1956
   Series: W843
   Sheet No.: 3367 11 NW

   g. Source: NSWU-1 Platoon FIVE BRAVO

   h. Type Recon Conducted: Admin Parallel

   i. Normal Axis of Beach: 135° T

   j. SEAL Team Evaluation: Unai Babui is suitable for amphibious landings using LCAC or AAV landing craft. The beach could be used for CRRC and swimmer landings, but extreme caution must be used because of shallow reef and heavy surf. Swimmers conducting a landing should wear protective clothing (Gloves, coral booties, etc.) to protect against the coral reef.

2: Survey and Reconnaissance Data:

a. Total length: 75 yards

Surveyed length: 75 yards

Useable length: 25 yards

Shape/Type: Straight/ Coastal plain

Coastal Terrain: Lava rock with dense brush.

Vegetation: Dense brush 8-10 feet tall with scattered trees 10-20 feet tall.

Beach Exits: A driveable trail at center beach leads to an unimproved dirt road which runs north and south.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Fair	Fair
Tracked:	Fair	Fair
Personnel:	Excellent	Excellent

Matting: 25 yards needed to extend from the HWL to the Hinterland for 2WD vehicles

General firmness: Firm

c. SUROBS:
Significant Breaker Height: 4-6 ft
Maximum Breaker Height: 8 ft
Breaker Period: 8-10 sec
Breaker Type: Spilling: 5%
Plunging: 95%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: 1 kt Toward Right Flank
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 3 in a 100 ft Surf Zone

Water Temperature: 82° F
Air Temperature: 90° F
Visibility: 14 miles

d. Obstructions: See Hydrographic Chart

Nearshore obstructions: Coral reef

Foreshore obstructions: Coral and large rocks

Backshore obstructions: Dense brush and trees

e. Physical Characteristics:

A-A'

Distance from LF 15 yds		NEAR SHORE	FORESHORE	BACKSHORE
	Width:	10 yards	10 yards	5 yards
	Gradient:	1:6	1:12	1:50
	Composition:	Coral	Sand/Rocks	Packed dirt

B-B'

Distance from LF 55 yds		NEAR SHORE	FORESHORE	BACKSHORE
	Width:	10 yards	10 yards	5 yards
	Gradient:	1:6	1:12	1:50
	Composition:	Coral	Sand/Rocks	Packed dirt

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A

NSW BEACH REPORT

1. **General Information:**

   a. **Country:** Tinian, C.N.M.I.

   b. **Beach Name:** Unai Chiget

   c. **Date of Survey:** 9 Dec 92 **Time:** 1430 K

   d. **Beach Location:**

	LAT	LONG
Beach Center:	15° 3' 44.2" N	145° 39' 13.1" E

   e. **Reference Point:** LAT: 15° 03' 44.2" N
   LONG: 145° 39' 13.1" E

   Description: The reference point is a 20 ft by 20 ft square shaped rock at center beach. The beach is 30 yards in length.

   f. **Reference Chart:** Saipan and Tinian

   Scale: 1:75,000
   Edition No.: 5th
   Date Revised: 20 Jan 1990
   Sheet No.: 81067

   g. **Source:** NSWU-1 Platoon FIVE BRAVO

   h. **Type Recon Conducted:** Beach Survey

   i. **Normal Axis of Beach:** 270° T

   j. **SEAL Team Evaluation:** Amphibious landings are not recommended due to a very powerful surf zone that breaks on top of exposed rock and reef. Unai Chiget is not suitable for CRRC or Swimmer landings.

UNCLASS

NEARSHORE HYDROGRAPHIC SURVEY CHART

SCALE 1:450
YARDS 25 0 25 50

BEACH GRADIENT PROFILES

LOCATOR CHARTLET

LEGEND

REFERENCES

NOTES

UNAI BABUI BEACH
TINIAN, CNMI
SABANETTAN TAHONG
REF POINT BEACH CENTER
SOURCE SEAL TEAM FIVE
PLATOON BRAVO
SCALE 1:450

SEAL TEAM FIVE BEACH SKETCH

PRODUCED BY FR3 IGE
DATE 18DEC92 TIME 1300

UNCLASS

Survey and Reconnaissance Data:

a. Total length: 30 yards

Surveyed length: 30 yards

Useable length: None

Shape/Type: Concave/Lagoon

Coastal Terrain: Sheer cliff on the left flank, a 10 foot rock ledge on the right flank and a 100 yard lagoon separates center beach from the surf zone.

Vegetation: Thick brush on the right flank growing on top of a lava ledge.

Beach Exits: The beach exit is only suitable for a foot patrol, located straight back from center beach and leads to a small dirt road running East to West.

b. Beach Trafficability:

	Wet	Dry
2-Wheel Drive:	Poor	Poor
4-Wheel Drive:	Poor	Poor
Tracked:	Poor	Poor
Personnel:	Good	Good

Matting: Unusable, the only beach exit is by foot patrol.
General firmness: Firm at all times

c. SUROBS:
Significant Breaker Height: 4 ft
Maximum Breaker Height: 6 ft
Breaker Period: 10 sec
Breaker Type: Spilling: 10%
Plunging: 90%
Surging: N/A

Breaker Angle: 0 Degrees toward Right/Left Flank

Littoral Current:
Inside Surf Zone: .2 kts Toward Beach Center
Outside Surf Zone: 1 kt Toward Right Flank

Lines of Surf: 1 to 2 Lines in 15 ft Surf Zone

Water Temperature: 84° F
Air Temperature: 90° F
Visibility: 14 miles

d. Obstructions:

Nearshore obstructions: Rocks and reef

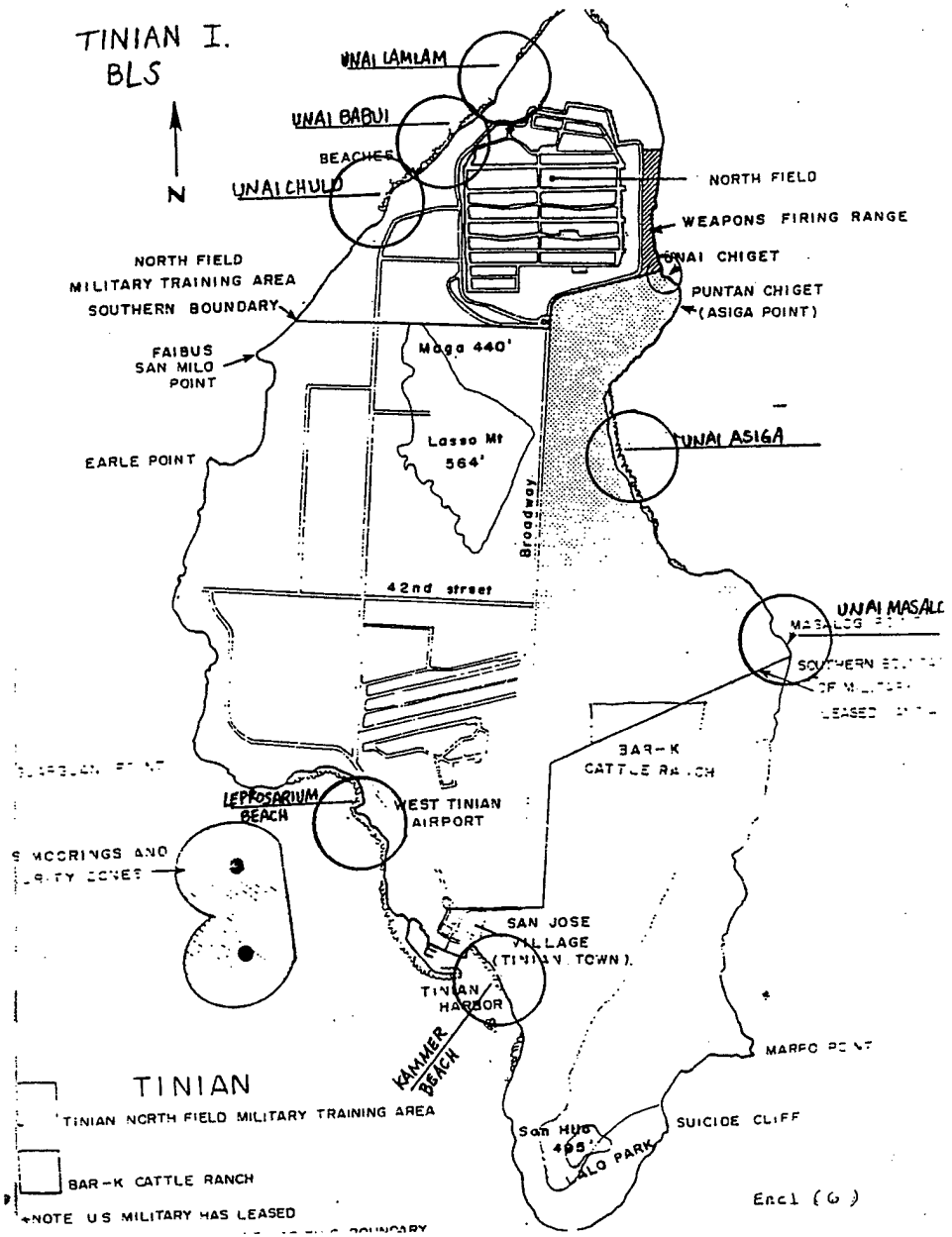
Foreshore obstructions: Large rock at center beach

Backshore obstructions: Dense vegetation

e. Physical Characteristics:

	NEAR SHORE	FORESHORE	BACKSHORE
Width:	N/A	N/A	N/A
Composition:	Reef	Reef/Rock	Rock/Sand

3. Remarks: This beach report was prepared in accordance with COMNAVSPECWARGRUONEINST. 3820.1A


TINIAN I.
BLS
N
UNAI LAMLAM
UNAI BABUI
BEACHES
UNAI CHULO
NORTH FIELD
WEAPONS FIRING RANGE
UNAI CHIGET
PUNTAN CHIGET
(ASIGA POINT)
NORTH FIELD
MILITARY TRAINING AREA
SOUTHERN BOUNDARY
FAIBUS
SAN MILO
POINT
Magga 440'
Lasso Mt
564'
UNAI ASIGA
EARLE POINT
Broadway
42nd street
UNAI MASALOG
BAR-K
CATTLE RANCH
LEPROSARIUM
BEACH
WEST TINIAN
AIRPORT
MOORINGS AND
SAFETY ZONES
SAN JOSE
VILLAGE
(TINIAN TOWN)
TINIAN
HARBOR
KAMMER
BEACH
MARPO POINT
TINIAN
TINIAN NORTH FIELD MILITARY TRAINING AREA
BAR-K CATTLE RANCH
*NOTE US MILITARY HAS LEASED
San Hugo
495'
SUICIDE CLIFF
LALO PARK

Encl (6)

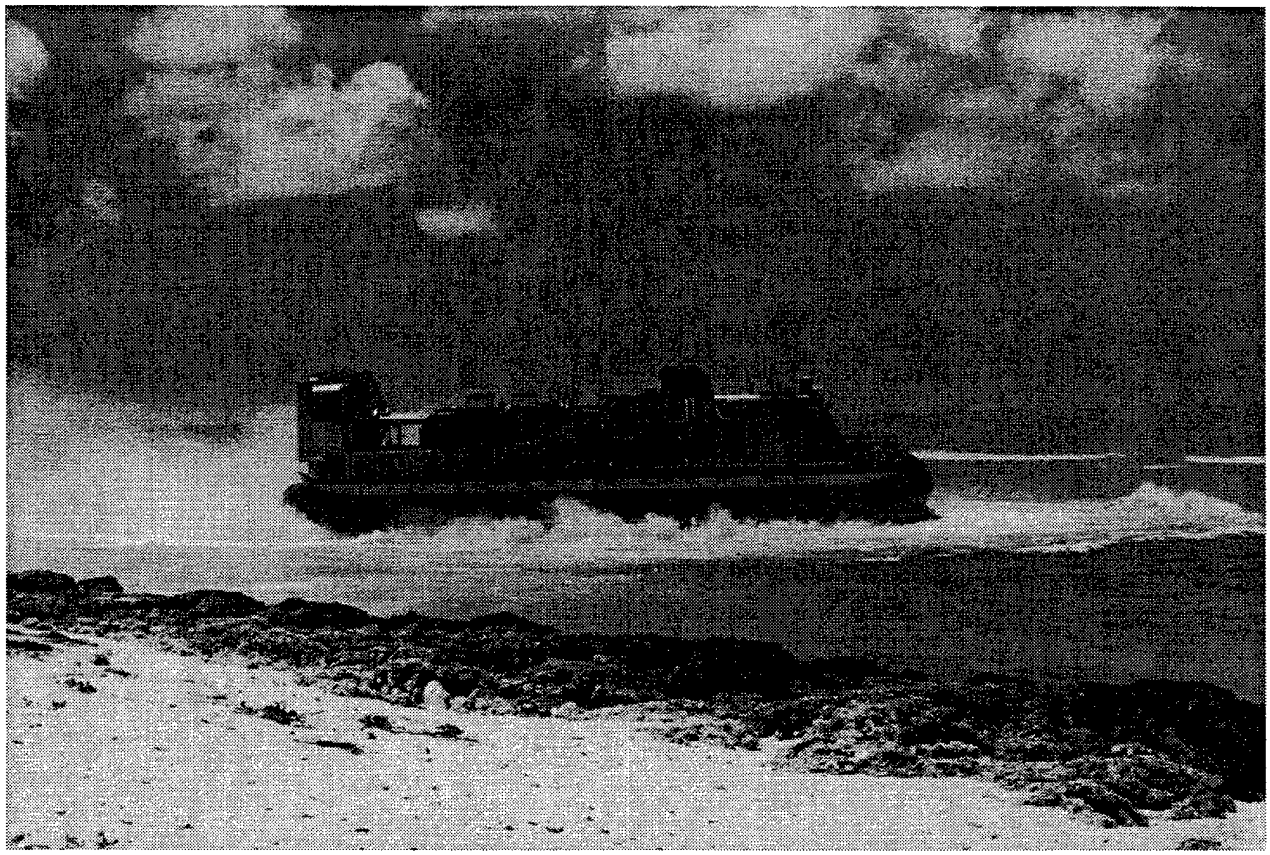
Appendix C-5
Marianas Training Effects of LCAC Landings on Coral Reefs
(17 April 1999)

MARIANAS TRAINING
EFFECTS of LCAC LANDING ON CORAL REEFS

Prepared for:
Belt Collins Hawaii

Prepared by:
Marine Research Consultants

17 April 1999



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MARIANAS ISLANDS AMPHIBIOUS TRAINING
EFFECTS of LCAC LANDINGS ON CORAL REEFS

INTRODUCTION

This report primarily deals with the results of a marine survey conducted during military exercise Tandem Thrust 99 at Unai Chulu, Tinian, Commonwealth of the Northern Mariana Islands, involving use of the Navy's Landing Craft, Air Cushion (LCAC). In addition, this report updates previous survey information that has been provided for Unai Babui and Unai Dankulo. The three beaches comprise those that are being evaluated for amphibious training landing exercises by the Navy and Marine Corps.

Concerns have been expressed by various regulatory agencies on the impacts to nearshore coral reef habitats from beach landing exercises using the LCAC. This craft is designed to operate in either an on-cushion or off-cushion /hullborne fashion. When the craft is on-cushion, which is the normal operating mode, the vehicle rides on a cushion of air with a small gap between the tips of the rubber cushion skirt fingers and the operating surface (e.g., ocean surface). The craft is hullborne when the hull is in the water and the craft is in the displacement mode. The draft of an empty LCAC operating in the off-cushion or hullborne mode is 2 ft 2 inches; the craft has no draft when operating in the on-cushion mode. The pressure generated by the craft during on-cushion operation is 104 lb/ft^2 (0.72 lb/in^2) dispersed over an area or 3,160 ft^2.

To date, the effects to the ocean floor and associated benthic (bottom dwelling) communities from the transit of LCACs have not been documented. As such, little information exists on the effects of LCAC landings over shallow coral reefs. To address the question of impact from LCAC landings, a survey was conducted at Unai Chulu, on the Island of Tinian in the Commonwealth of the Northern Mariana Islands (CNMI) during exercise Tandem Thrust 99. The primary goal of this report is to present the methods, results, and conclusions regarding the effects of LCAC landings at Unai Chulu, while, a secondary objective of the study is to utilize the information to present insights into the effects of the landings in other areas.

Description of Unai Chulu

Unai Chulu consists of a crescent shaped carbonate sand beach approximately 100 meters (m) long, bounded by rocky headlands (weathered reefal limestone). The sand beach face in the intertidal zone slopes rather steeply into a flatter back beach area that contains beach strand vegetation.

Figures 1 and 2 show a cross-sectional representation, and aerial view, respectively, of the reef zonation pattern at Unai Chulu. The two main reef zones are the reef flat and the reef front. The reef flat extends from the highest wash of waves to the reef crest, and is characterized by water depth no greater than 0.5 m at a low tide. The inner reef flat subzone consists primarily of lithified limestone seafloor with a veneer of sand and rubble. The inner reef flat within approximately 20 m of the shoreline is dominated by sand, rubble, and outcrops of a fossil reef, Corals in the nearshore part of the inner reef flat subzone consist primarily of circular, flat-topped lobate corals primarily of the genus *Porites*. Upward growth of these corals is truncated owing to the shallow depth of the inner

reef flat, and living tissue only on the vertical sides of the colonies (Figure 3). Short algal turf occupies much of the sand and rubble surfaces of the inner flat.

In the middle reef flat subzone the bottom composition consists primarily of an exposed lithophyte reef platform that is pitted by the boring action of sea urchins, primarily of the genus *Echinothrix.* Small deposits of sand are found in the shallow burrow pits on the reef platform. Corals are more abundant in the middle reef flat zone, consisting of small colonies of a variety of branching and encrusting forms.

Water depth of the outer reef flat zone is shallower than the mid reef flat zones. The outer reef flat zone absorbs substantial hydrodynamic force from waves breaking on the reef crest. As a result of the shallow depth and concussive force, corals are rare in this subzone and consist primarily of encrusting species. The reef crest is a narrow margin of very shallow limestone that is nearly exposed at low tide. The seaward side of the reef crest grades into a sloping submarine terrace that forms the reef front zone. The crest and upper reef front are composed of ridges and channels cut into the reef platform that are oriented perpendicular to the reef margin. The ridge and channel topography is termed a "spur and groove" system, and is a common feature on windward reef fronts in many locales. Because of the high relief of the reef crest and reef front, water depth varies from less than a meter on the top of the spurs to up to 5-6 meters within the narrow grooves. Coral cover is abundant on the walls of the spurs, extending virtually to the reef crest. The spur and groove zone grades into a deep reef front terrace.

METHODS

The overall approach of the investigation was to establish a series of semi-permanent quantitative benthic transect stations in the path of LCAC landings. Comparison of the stations before and after landings provided information on the extent of impact to the physical structure of the coral reef, as well as the associated communities. Semi-permanent is defined as physically marking the transects so that the exact areas could be relocated for the duration of the monitoring program.

Because the draft of the LCAC, even when in the displacement mode, is less than one meter, the focal areas of the reef were the inner and mid reef flats and shallow inner portions of the reef front. A "landing corridor," approximately two vehicle widths wide (~30 meters) was demarcated off the approximate center of Unai Chulu, in coordination with on-site Navy personnel responsible for conducting the LCAC activities. Within the corridor, three transect "stations" were established. Station 1 was located near the boundary of the inner and mid reef flat zones; station 2 was located in the mid reef flat zone; and station 3 was located in the reef front zone just seaward of the reef crest. Water depth at Stations 1 and 2 was approximately 0.25 to 0.5 m, while the depth at Station 3 was 0.75 to 2 m.

A transect 30 meters (m) in length was established at each station and oriented parallel to the shoreline. Pounding stakes into the limestone substratum to mark the locations of the transect stations proved futile owing to the hardness of the carbonate platform. Instead, transect positions were marked by tying plastic coated copper wire to features on the bottom (generally notches in the

limestone cut by burrowing urchins). This method proved satisfactory for finding the transects repeatedly, and was less invasive to the reef than driving stakes.

The transects were constructed using 100-foot long steel measuring tapes that were secured to the bottom using plastic coated copper wire. The tapes were placed on the reef on the afternoon of March 29, 1999 in anticipation of LCAC landings the following day. Quantitative assessments of benthic community structure were conducted using a photo-transect methods which produced a permanent photographic record of the transect composition. Because of the very shallow water depth and substantial wave action, however, it was not possible to employ a traditional quadrat method. Rather oblique photographs of 10 selected sites were taken on each transect. Attempts were made to include the numbers on the measuring tape within each photographic frame during the pre-landing survey, so that the same locales could be observed during the post-landing surveys. Photographs were taken using a Nikonos camera with a super wide-angle lens (15 mm, 94° field of view) using color film.

Because the purpose of the study was to characterize the impacts to benthic communities, the 10 photo locations were selected as areas with the highest coral cover along the transect. Hence, the resulting assessment of coral cover was not intended to provide a statistically representative view of the reef as a whole, but rather as a selected sub-set that depicted the upper bounds of coral abundance. Such skewing of the site selection process assured that evaluation of impacts to the reef would be optimized. No attempt was made to disturb substrata to observe organisms, and no attempt was made to observe cryptic species dwelling within the reef framework.

Transects were surveyed twice; once on the day prior to LCAC landings (March 29, 1999), and once immediately after the completion of the LCAC operations (March 30, 1999). On the day of the landings, preliminary examination of the reef was made prior to landings to verify that the transect tapes remained in place.

At the time of the surveys, the following meteorological/physical conditions at the landing site were estimated:

Surface seawater temperature
Significant Wave Height
Maximum Wave Height
Wave Interval and Type Breakers (percent Spilling/ percent Plunging)
Wave direction/littoral current direction and speed
Number of breakers/waves in surf zone/width of surf zone
Sea state (calm, moderate, rough)
Beach sand loss as it may affect the reef

RESULTS

Sea conditions during the entire pre-, during and post-landing periods consisted of plunging waves of up to 1 m in height breaking on the reef crest in an area approximately 10 m wide. Seas were calm outside of the reef crest. On the reef flat, water was calm in the inner regions and became increasingly surgy moving toward the reef crest. Littoral currents ran toward the north on the reef flat, and were not detectable outside on the reef front. Water temperature was 28-29°C. No sand loss was apparent on the beach.

LCAC operations consisted of seven landings by two craft, for a total of 14 passes (7 approaches, 7 departures) over the survey reef. Most of the approaches and all of the departures appeared to pass over the transect area (Figure 4). According to the LCAC Craftmasters, the ideal operating procedure during landings it to drive the vehicle on a full cushion completely onto the sub-aerial portion of the beach before deflating the cushions. Similarly, the ideal departure from the beach consists of inflating the cushion on the sand before entry into the water. Under such an operating procedure, impacts to the underwater area are minimized because all maneuvers are conducted on-cushion with no vehicle draft.

At Unai Chulu, initial LCAC approaches to the beach were made at increasingly oblique angles in an attempt to land the vehicle completely on the sand oriented with the bow-stern axis parallel to the beach face. However, such an operating procedure proved to be impossible owing the steep slope angle and narrow width of the beach. As a result, it was deemed most prudent to conduct the remaining landings by driving the vehicles straight onto the sand on a track perpendicular (90°) to the beach face and reef crest. Because of the narrow width of the beach, this landing procedure did not result in beaching of the entire LCAC, with the stern remaining submerged in the inner reef flat in the off-cushion mode (Figure 5). On departures from the beach, the vehicles went on-cushion from the partially submerged beached position, swivelled around the stern to face offshore, and departed over the reef flat on a track perpendicular to the beach face. As a result, there was an area of the submerged inner reef flat that experienced direct contact with the vehicles prior to achieving the on-cushion mode of transit.

During landing and departures, sediment plumes were generated in the track of the vehicles. These plumes remained localized in the track area and dissipated within minutes.

Following the LCAC operations, inspections of the reef flat revealed several effects. In the intertidal zone, several dozen sea cucumbers, predominantly *Stichopus chloronatus*, were washing in the wavelets at the shoreline. Broken thalli of algae were also noted in this area. Observations of several of the flat-topped circular coral heads within a distance of approximately 10 m of the sand-water interface revealed smeared areas of black rubber on the skeletal surface (Figure 6). These corals remained attached to the reef platform. In addition, two hemispherical coral heads in the nearshore zone were broken from their base of attachment (Figure 7). The observations of rubber deposition and broken corals were limited to only the inner area of the reef flat; no such deposition was observed at any other location. Apparently, during the period when the LCACs were beached, or during the pivot to depart the beach, the rubber skirts scraped the upper surfaces of the coral heads, resulting in deposition of some of the rubber on the protruding coral surfaces.

Post-landing surveys of the inner and mid reef flat and reef front revealed virtually no effects to the biotic community from the numerous transits of the LCACs. However, all of the transect tapes that were placed on the reef were broken during the landing activity. Figures 8 and 9 show photographs of the inner and mid reef flat zones (Transects 1 and 2) taken shortly after (<1hour) the multiple LCAC landings. It can be seen that there is no evidence of damage to corals, including finely branched *Acroporas* that appear in all photos. In addition, there is no evidence of deposition of sediment on any of the corals, and no indication of displacement of sea cucumbers or other unattached benthos.

Figures 10 and 11 show several views of the reef front in the spur and groove zone (Transect 3). As described above, there was no indication of breakage or stress to corals, including branched colonies on the reef front or in the spur and groove zone.

UNAI CHULU: DISCUSSION and CONCLUSIONS

There are several useful estimates that can be made to put the potential impacts of LCACs into perspective. The actual weight of the machine is supported by a cushion of air trapped under the skirt. Thus the air pressure exerts an extra force on the water. The question is how much is this force: The weight of the vehicle divided by the surface area of air under the skirt is 340,000 lb /3160 ft^2 or 108 lb/ft^2 ,which is the air pressure reported in the operations manual. That amount of pressure is equivalent to 0.74 $lb/inch^2$. Atmospheric pressure is approximately 15 $lb /inch^2$, so the force exerted by the LCAC is equivalent to 0.74/15 or 5% of atmospheric pressure. It is also equivalent to a water depth of 20 inches. So the extra force from the LCAC is similar to a 20 inch high wave propagating over the reef at the speed of the LCAC, which is about 25 mph (11 m s^2). The speed of a shallow water wave is the square root of g (acceleration of gravity) * h (water depth) or (9.8 m s^2 times 0.5 m)½ (for a 20 inch wave) giving 2.2 m s^2. Thus, the LCAC is actually moving approximately five times faster than the displacement of water by waves over reefs.

When the LCAC remains stationary, water is displaced but the slurry of air and water is very similar to a very small breaking wave over coral. Coral communities can easily withstand air injected into water at pressures of 5% atmospheric. One should also realize that the average energy dissipated by coral reefs from breaking trade wind waves, that occur routinely, is substantially greater than the forces applied from the LCAC. Thus, the extra pressure and energy dissipation from the LCAC is very minor compared to natural forces. In comparison, a 160 lb person with 40 square inches of foot surface area imparts a pressure of 4 lb/sq inch walking on the reef, five times that of the LCAC.

These calculations corroborate the before-and-after observations of the effect of multiple LCAC landings and departures over a shallow reef flat inhabited by highly breakable corals. When operated in an on-cushion mode, regardless of speed, LCACs do not appear to exert any damaging effects to

reef biota. The damage that was noted in the study all occurred in the nearshore zone where the stern of the vehicles rested on the reef surface. Had the beach profile at Unai Chulu been such that the landing-departure procedure included a complete beach exit and entry by the craft to and from the water while on-cushion, it is likely that the observed effects of broken and rubber-scoured corals would have been avoided. It is also likely that the suspension and relocation of sea cucumbers resulted from craft pivoting movements in the nearshore zone while exiting the beach. Such an effect can easily be mitigated by moving sea cucumbers out of the wave-wash zone to the submerged part of the reef. The sediment plumes generated by the vehicles were limited in extent, and short term in duration. Such plumes are likely not qualitatively different from episodes of sediment resuspension that occurs naturally during periods of storm-generated waves that routinely occur in Tinian.

OBSERVATIONS OF OTHER BEACHES ON TINIAN

UNAI BABUI

While on Tinian, investigators conducted qualitative surveys of two other beaches for the purpose of potential consideration as sites for future amphibious landings. Unai Babui is located approximately 1 km north of Unai Chulu, and consists of a narrow beach (~50 m wide) composed of exposed fossil limestone and white sand. The offshore structure is similar to that described above for Unai Chulu, with a shallow reef flat grading from the beach to a shallow reef crest and seaward reef front. As at Unai Chulu, the shallow reef crest zone at Unai Babui absorbs most of the energy of breaking waves. However, while the reef front at Unai Babui consists of a spur and groove system similar to Unai Chulu, there are important distinctions between the two areas. At Chulu the spur and groove zone is relatively narrow (~5 m wide) and the grooves between the spurs are relatively thin in width, generally on the order of 1-2 m. Off the central region of Babui, the spur and groove system is attenuated into a larger area (10-15 m wide), and the grooves are substantially wider (~5-6 m) taking the form of channels rather than narrow grooves. The walls of these channels are nearly vertical, and terminate in flat pavements covered with a layer of large rubble chunks. In addition the landward "heads" of these channels, which extend from the shallow reef crest, form an area of vertical topographical relief parallel to the beach face (Figure 12). The accumulation of rubble at the base of the spur and groove cliffs appears to be a result of breakage of corals growing on the reef surface by the action of storm waves. Seaward of the spur and groove zone, bottom topography slopes gently downward in the reef front zone.

Previous reports discussing the bathymetry of Unai Babui reported a vertical reef face directly seaward of the reef crest. This description was apparently rendered by evaluation of vertical "slices" from the beach to the outer reef. It appears that the representative slice used in the description bisected an area of one of the spur and groove channels, resulting in a profile containing an area of vertical relief. If another slice that bisected the top of a spur had been evaluated, no vertical surface would have been evident. As a result and in order to attain a complete picture of the reef topography, the entire reef and not just a single section needs to be considered.

The "advanced" spur and groove development at Unai Babui appears to make this site unsuitable for landing of Amphibious Landing Vehicles (AAVs). Unlike the LCACs, AAVs are tracked vehicles that contact the sea floor at a depth of approximately 2 m. Hence, with the high variability in topography of the reef crest area at Unai Babui (shallow spurs dropping vertically to rubble-covered channels), it is possible that incoming AAVs could contact the reef on only one track resulting in potential to bottom out, broach or to possibly capsize in heavy surf. In addition, impact of an incoming vehicle with the sheer topography of a channel head may damage the vehicle and the reef face.

UNAI DANKULO

Unai Dankulo (Long Beach) is the largest beach on Tinian, extending approximately 150 meters between limestone cliffs that extend to the water line. 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. The main beach is up to 100 m wide and is relatively flat landward of the intertidal zone. The Dankulo beaches are composed of white calcareous sands that gently slope 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. 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 somewhat sheltered from high wave action, resulting relatively calm conditions on the reef flat. 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 sandy-bottomed channel. In aerial photographs, the channel is visible as a light-colored swath extending from the shoreline across the reef flat. Inspection of the channel suggests 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.

In 1994, surveys were conducted at Unai Dankulo to assess the potential as a site for amphibious training exercises. During this survey, the inner reef flat was observed to be colonized by extensive reef communities, including diverse assemblages of stony corals. Twenty-five species of coral were observed on the reef flat. Growth forms of corals were generally encrusting, lobate or corymbose. Coral cover was estimated at approximately 50-70 percent of bottom cover in the central region of the reef flat (Figure 13). 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. 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.

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. 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. 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 Dankulo 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. 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. 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.

During the 1994 survey, it appeared that the high coral cover on the reef flat was a result of protection from the damaging waves by the continuous, exposed reef crest. However, the re-survey of the area in 1999 revealed substantial changes to the reef flat communities. In 1999 living corals comprised an estimated 2 percent of bottom cover compared to 50-70 percent in 1994. Most of the living corals consisted of lobate forms on the walls of the channel, or on the shoreward side of large micro-atolls (Figure 14). Virtually no living branching or corymbose colonies were observed anywhere on the reef flat. Rather, large accumulations of rubble fragments were present in depressions on the reef surface. A linear depression just seaward of the sand-water interface contained a large accumulation of rubble. Many of the rubble fragments contained remnants of calical structure, suggesting that breakage from the reef was relatively recent.

The dramatic alteration in community structure at Unai Dankulo appears to be the result of a recent typhoon, tentatively identified as Paka that occurred in December 1997. A plausible sequence of events is that meteorological and oceanographic conditions during this typhoon appeared to combine to produce surf with concussive force sufficient to break corals from the outer reef face, and to carry the broken fragments landward over the reef crest to the reef flat. Hydrodynamic forces appear to have been sufficient on the reef flat to also incur breakage by concussive wave forces, and also by the impacts of moving rubble chunks (e.g., "bowling"). Such impacts likely resulted in increased amounts of rubble in motion, which sequentially increased the magnitude of breakage. The final result, as observed in 1999, was near elimination of living corals, with little evidence of new recruitment. Evidence of the magnitude of wave action in the inner reef is the loss of a tree in the center of the beach strand that was evident in pictures of Dankulo taken in the 1940's.

SUMMARY

Unai Chulu: The results of the studies conducted at Unai Chulu on the Island of Tinian, CNMI, indicated that the effects of Landing Craft Air Cushion (LCAC) vehicles are minimal or nonexistent to coral reef habitats when the machines are operated in an "on-cushion" mode. When on-cushion, there is no penetration of the vehicle below the sea surface to impact reef structures, and the hydrodynamic force generated by air cushion lift is small compared to natural wave forces that typically occur on reefs.

The impacts that were observed in the nearshore area appear to be an artifact of the incomplete beaching of the LCACs on landing owing to the narrow, sloping topography of Unai Chulu. At beaches with a more favorable profile and width that allow complete landing of the vehicle while on-cushion, it appears that there will be no detectable impacts to the marine community.

The experimental setup at Unai Chulu appears to have been sufficient to provide a high degree of certainty to these conclusions as multiple passes of LCACs occurred over the same area of very shallow reef that contained delicate branching corals that are the most susceptible to breakage from impact. As a result, it appears that these results can be applied to other reef sites.

Unai Babui: The revisit indicates that this area is not suitable for amphibious landings owing to the narrow width of the rocky beach, and the well-developed spur and groove system of the reef front. The high degree of vertical relief on the reef front appears to provide a very unsafe region for Amphibious Assault Vehicles (AAVs) to make the transition from water to land.

Unai Dankulo: The surveys of this area indicate that a recent typhoon (s) has severely impacted coral community structure. Present estimates of coral cover of 2 percent contrast sharply with estimates of 50-70 percent made in 1994. Results of these studies indicate that LCACs essentially present no danger to shallow coral communities, and the wide aspect of the beach at Dankulo indicates that this location may provide an ideal site for future LCAC landing exercises.

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4: LCAC approaching and departing the beach.
5: LCAC crossing sand-water interface.
6: Two colonies of *Porities* in the nearshore zone showing rubber scuff marks.
7: Two colonies of lobate corals broken from the substratum on the inner reef flat.
8: Two views of the reef flat at transect site 1.
9: Two views of the reef flat at transect site 2.
10: Two views of same area at transect 3 before and after repetitive landings.
11: Two views of branching coral on the top of the spur and groove system on the reef front.

Unai Babui
12: Two views of rubble-filled channels and vertical ridges on the reef front.

Unai Dankulo
13: Extensive growth of branching coral shoreward of the reef flat in 1994.
14: Expanse of coral rubble fragments on the reef flat in 1999.

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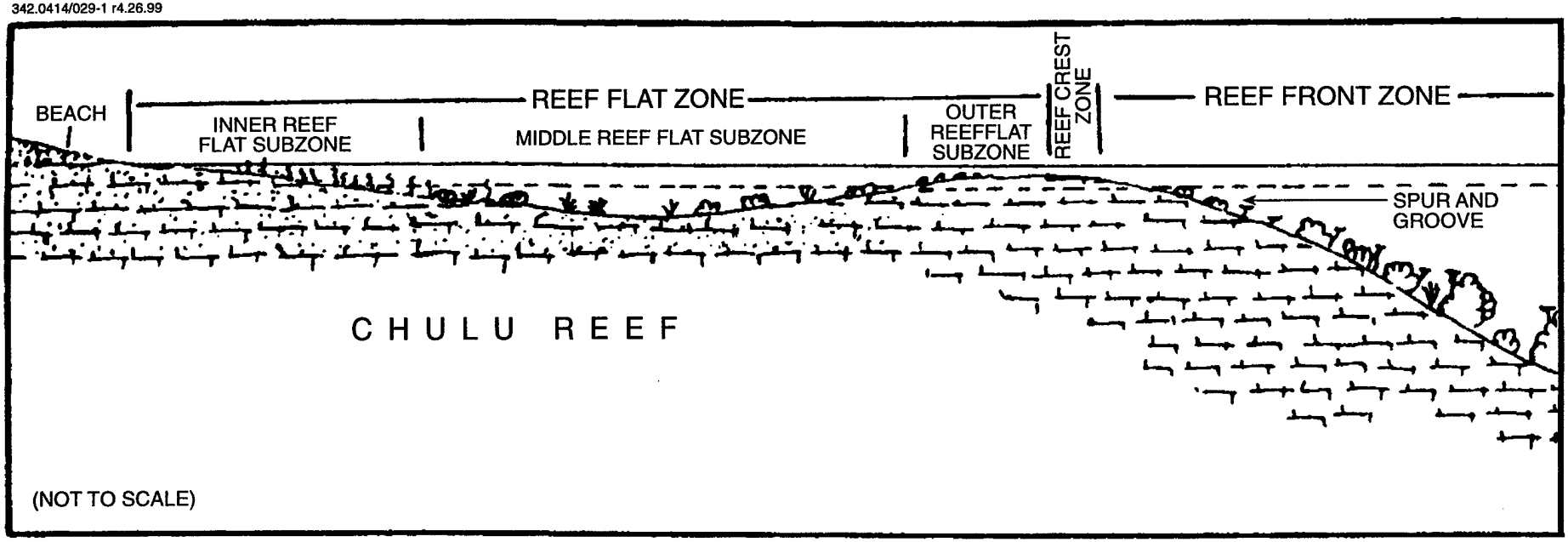

FIGURE 1: Cross-section of the reef at Unai Chulu, Tinian, CNMI showing pattern of reef zones.

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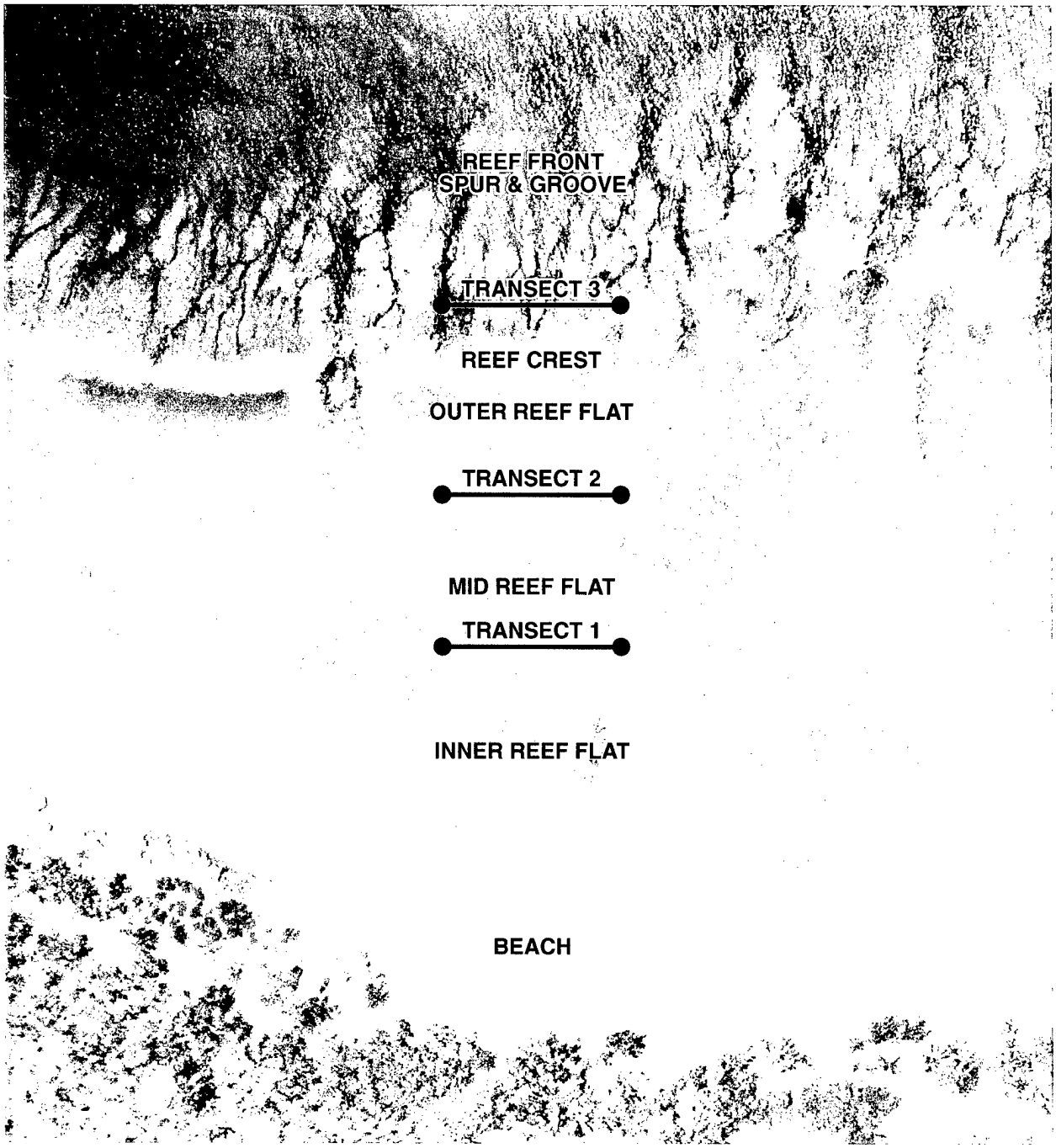

FIGURE 2: Aerial photograph of Unai Chulu, Tinian, CNMI showing reef zonation pattern and locations of survey transects used during assessment of effects to the reef from LCAC's.

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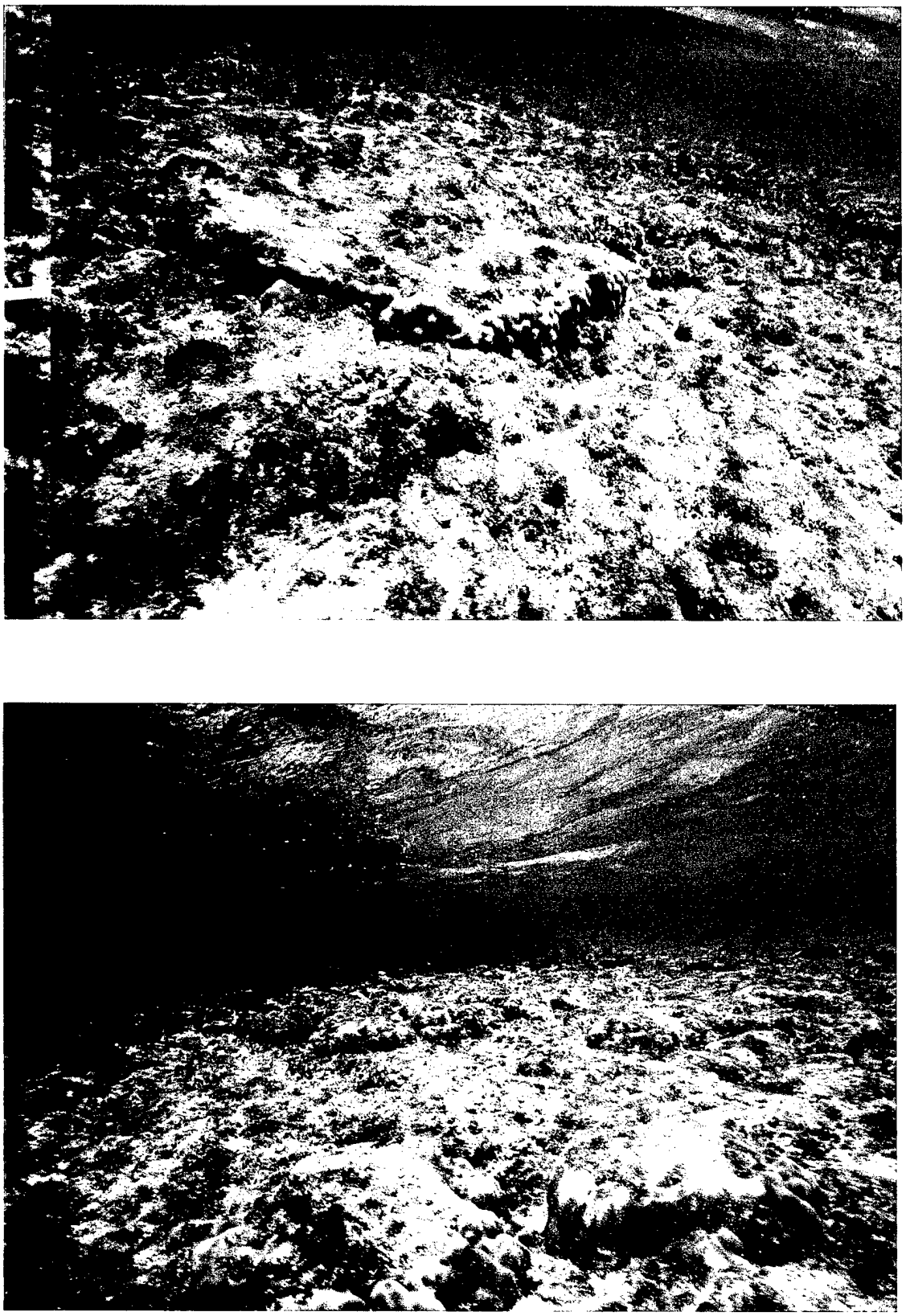

FIGURE 3: Limestone platform of the nearshore region of the inner reef flat at Unai Chulu showing flat-topped colonies of *Porites*. Upward growth of these corals appears to be limited by shallow depth of water.

342.0414/030-2 r4.26.99 1

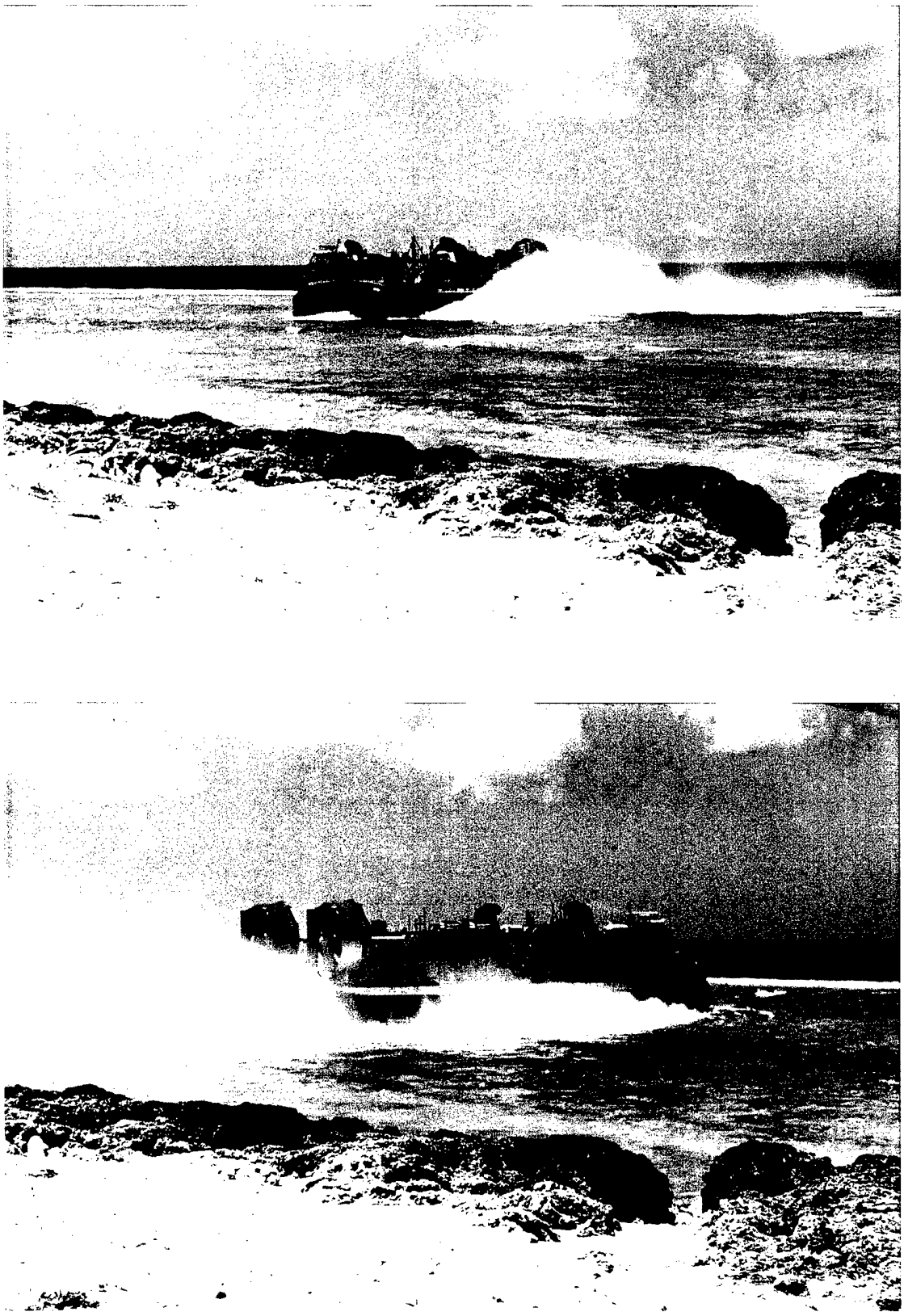

FIGURE 4: Landing Craft Air Cushion (LCAC) approaching (top) and departing (bottom) Unai Chulu in on-cushion mode of travel. In top photo, LCAC has just crossed the reef crest and is over the out reef flat.

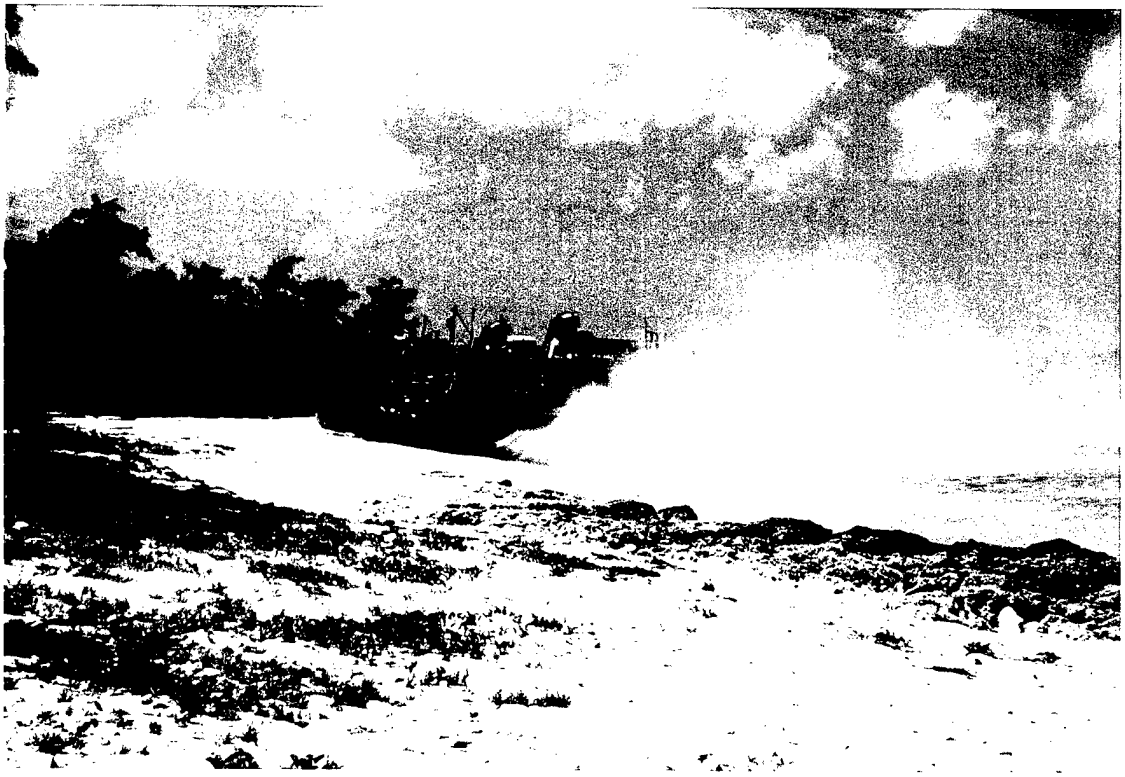

FIGURE 5: LCAC crossing the sand-water interface at Unai Chulu in on-cushion mode (top). LCAC in off-cushion mode while unloading vehicles at Unai Chulu. Stern of vehicle remained submerged during off-loading.

342.0414/030-4 r4.26.99 1

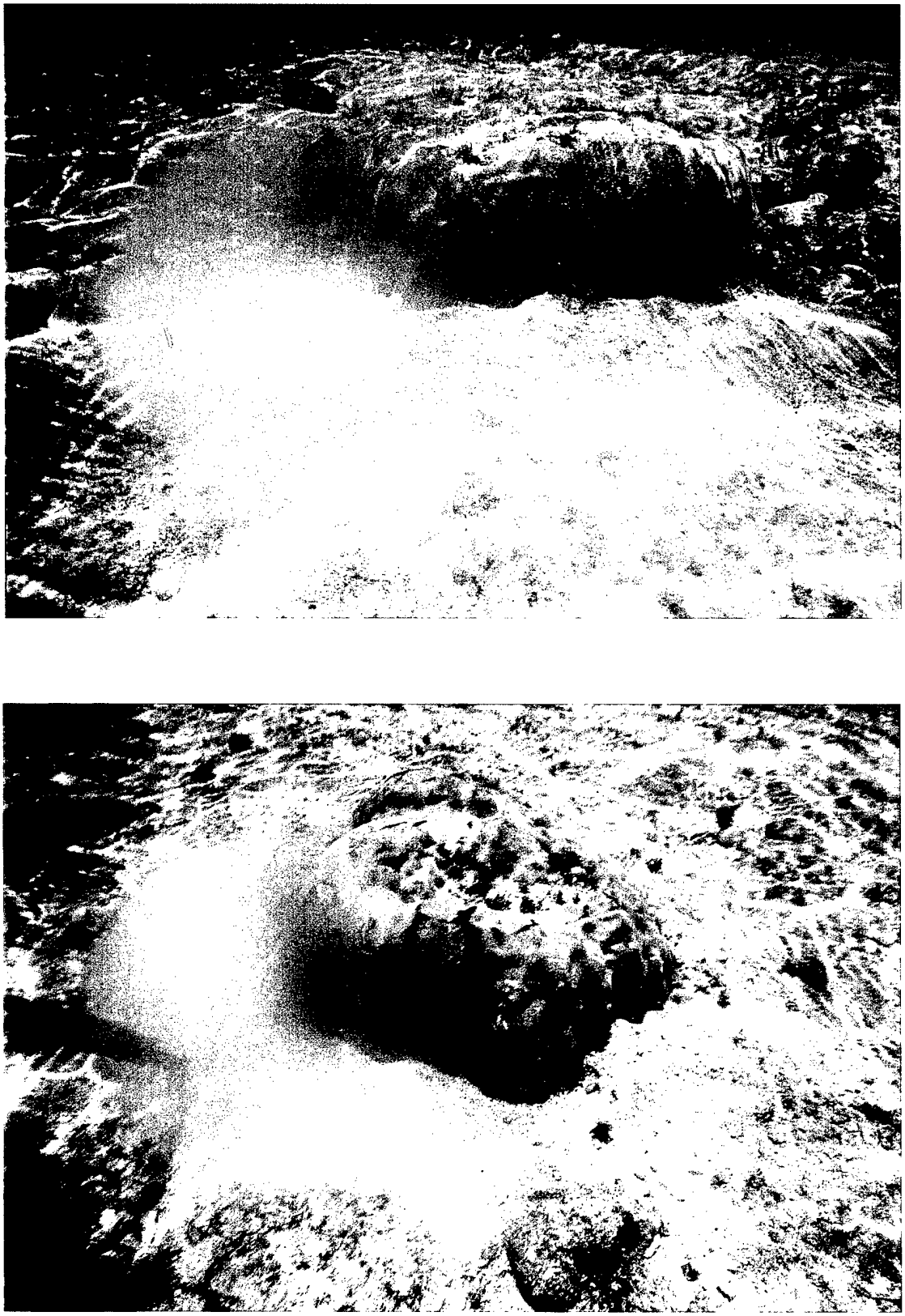

FIGURE 6: Two colonies of *Porities* in the nearshore zone of Unai Chulu showing rubber scuff marks (black areas) caused by contact with rubber skirts of LCACs during landings.

342.0414/030-5 r4.26.99 1

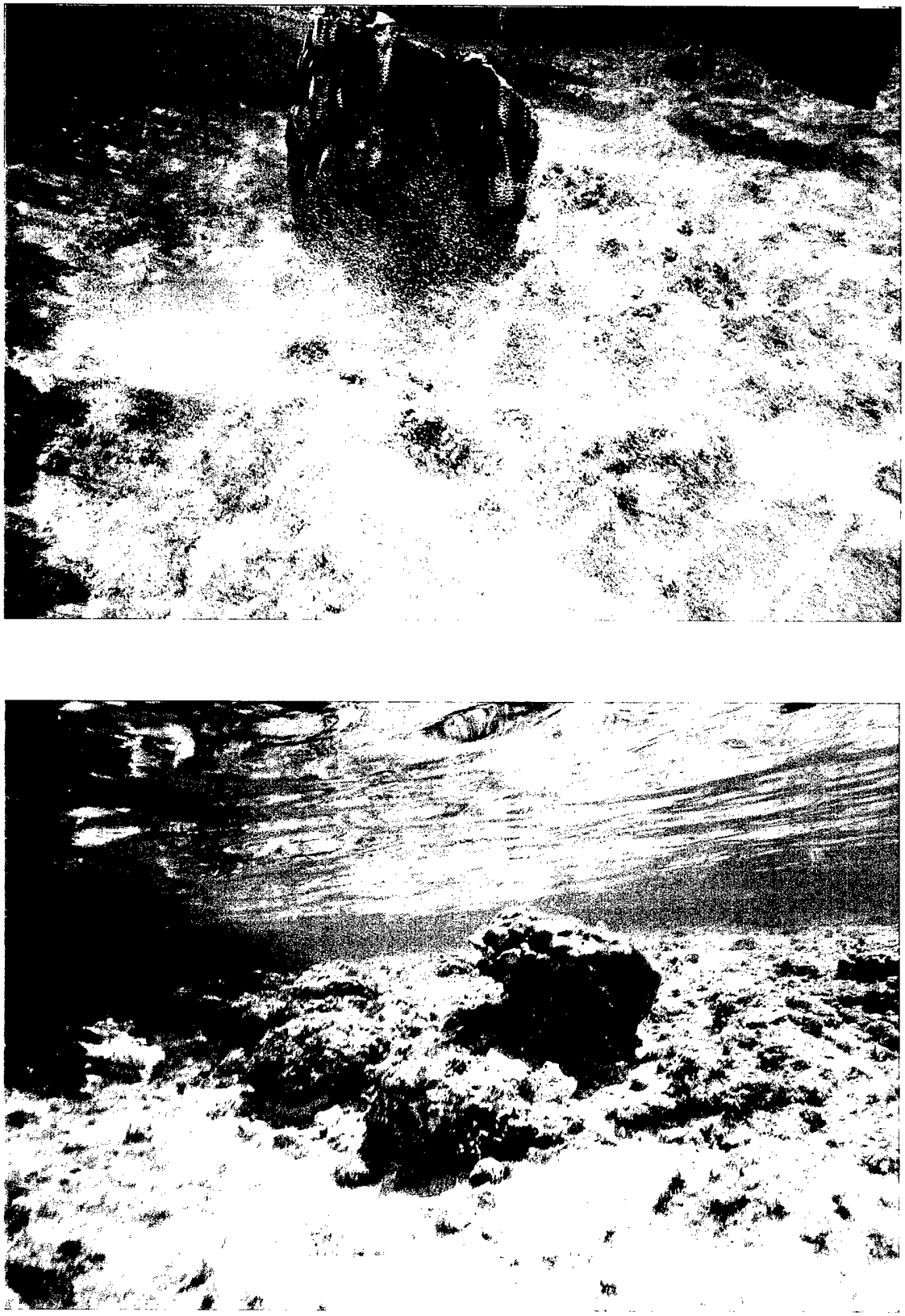

FIGURE 7: Two colonies of lobate corals broken from the substratum on the inner reef flat at Unai Chulu, as a result of impact from LCAC landings.

342.0414/030-6 r4.26.99 1

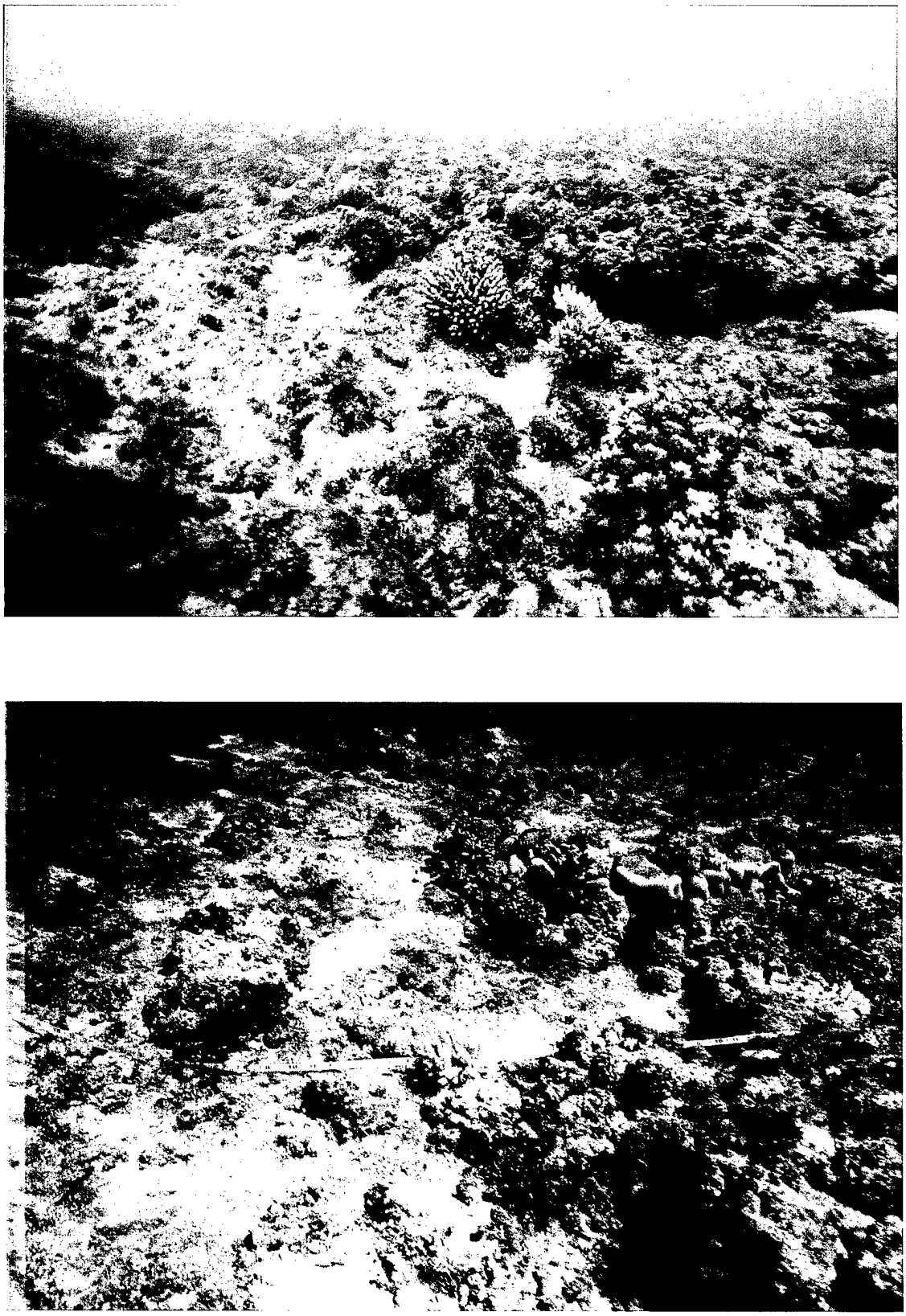

FIGURE 8: Two views of the reef flat at Transect site I following repetitive transits of LCACs. Note lack of broken branch tips of branching corals.

342.0414/030-7 r4.26.99 1

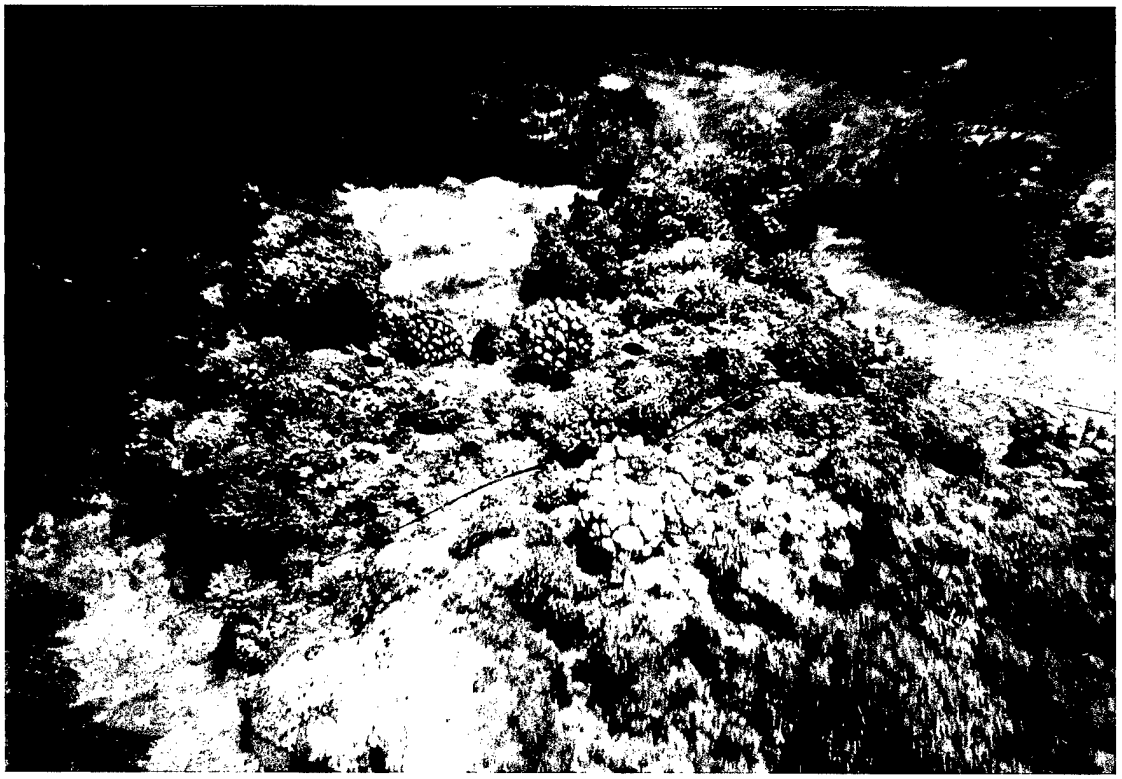

FIGURE 9: Two views of the reef flat at Transect site 2 following repetitive transits of LCACs. Note lack of broken branch tips of branching corals.

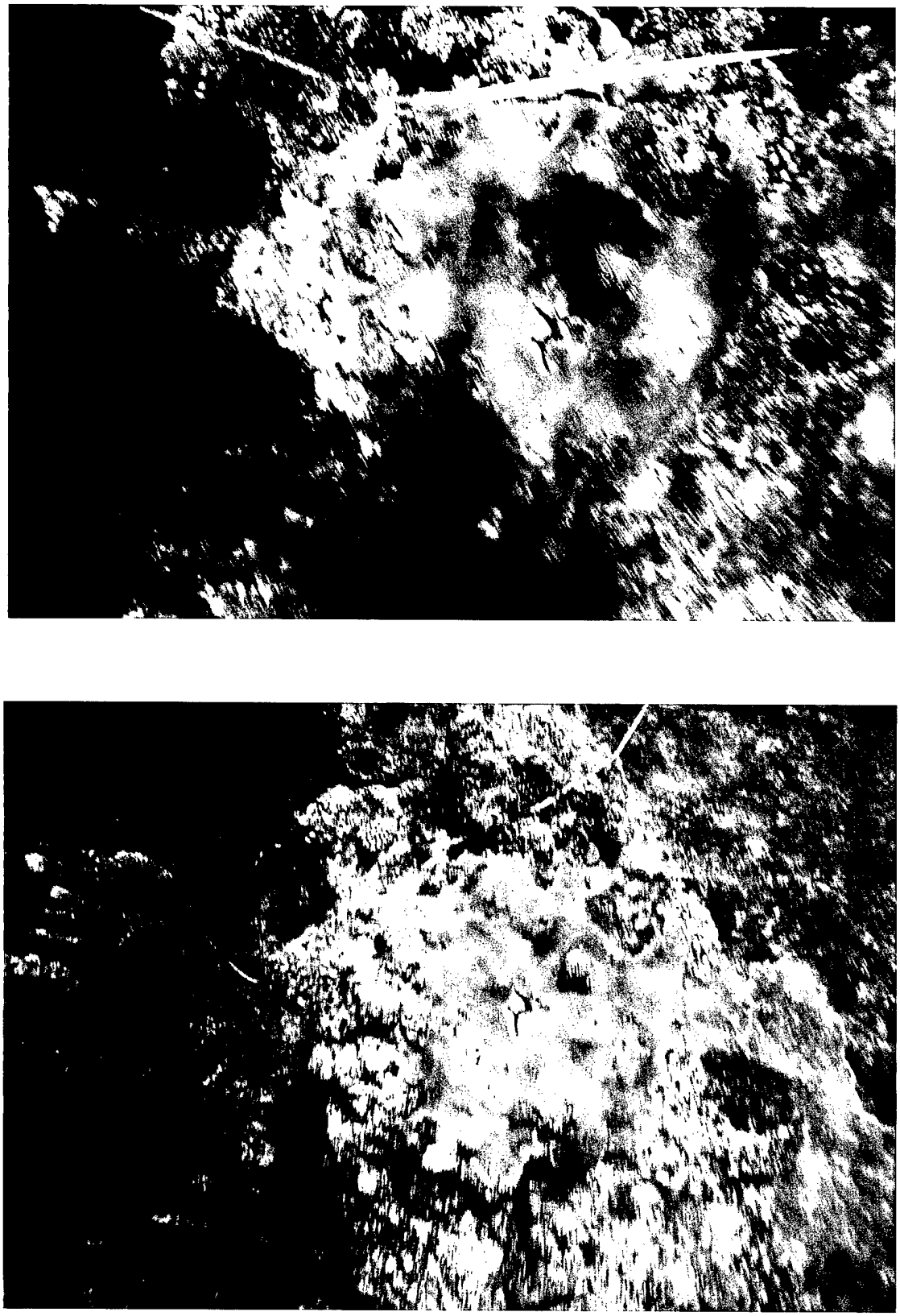

FIGURE 10: Two views of the same area on Transect 3 before (top) and after (bottom) repetitive landings of LCACs at Unai Chulu.

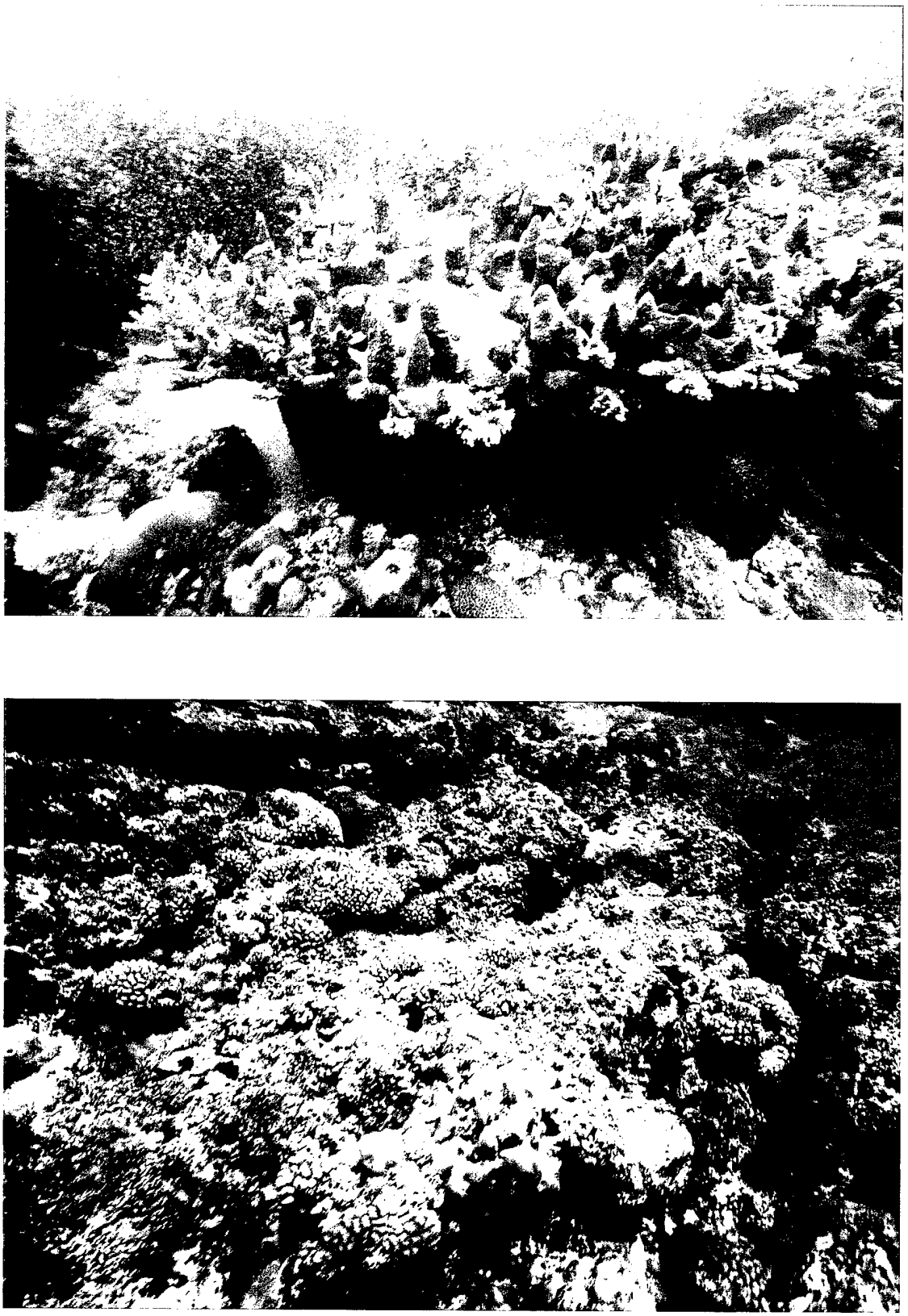

FIGURE 11: Two views of branching corals on the top of the spur and groove system on the reef front of Unai Chulu following repetitive landings of LCACs.

342.0414/030-10 r4.26.99 1

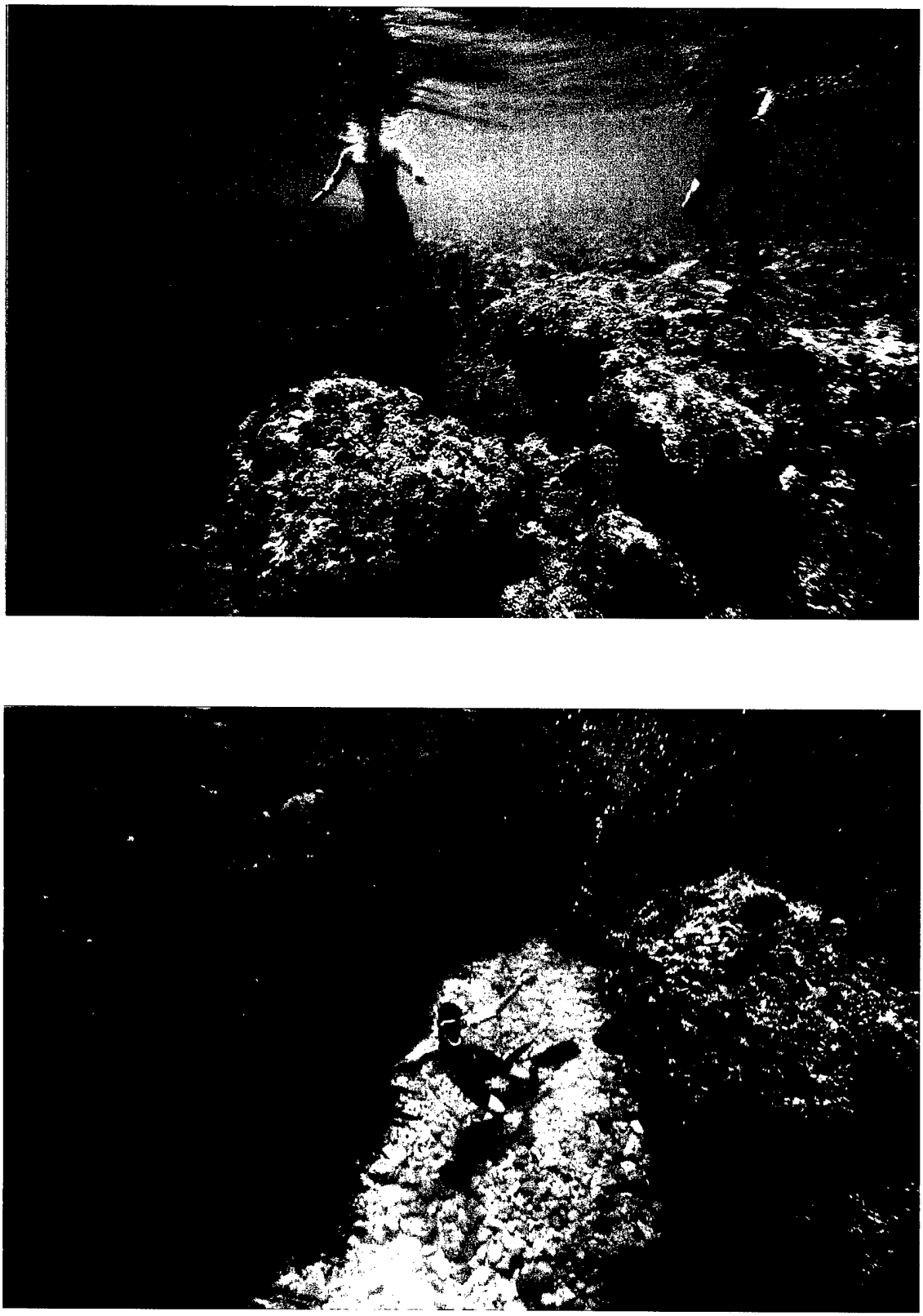

FIGURE 12: Two views of rubble-filled channels and vertical ridges on the reef front of Unai Babui.

342.0414/030-13 r4.29.99 1

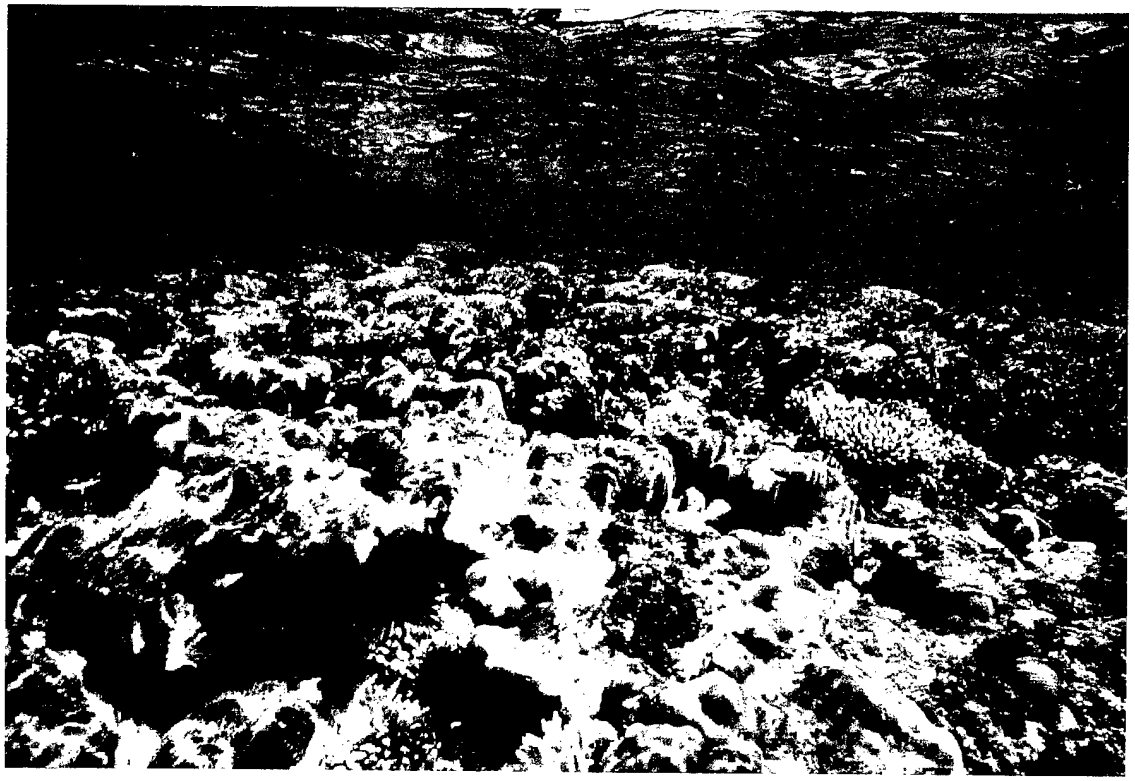

FIGURE 13: Two views of the reef flat shoreward of the reef crest at Unai Dankulo in 1994. Note extensive growth of branching corals throughout the reef.

342.0414/030-11 r4.29.99 2

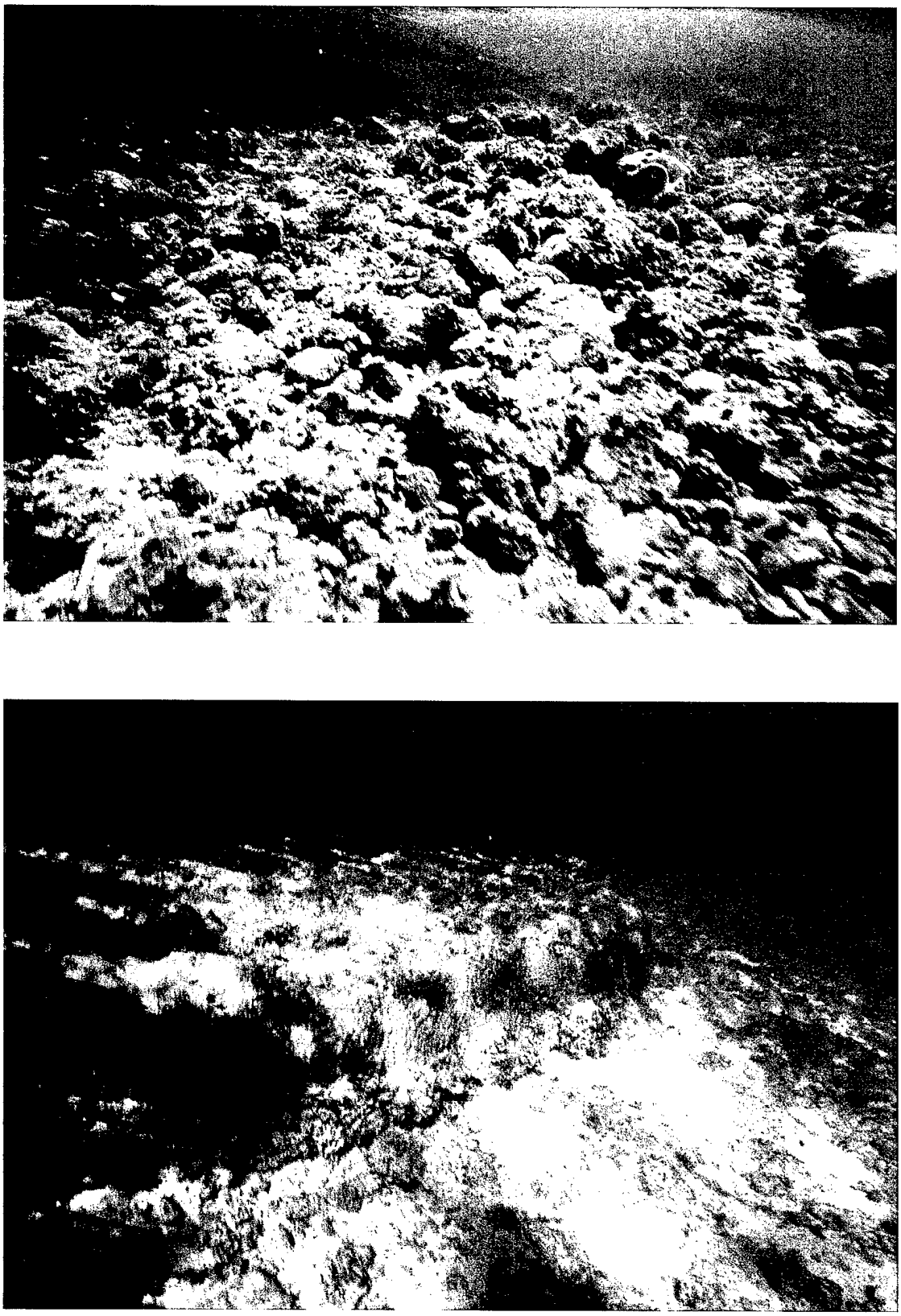

FIGURE 14: Expanse of coral rubble fragments on the reef flat at Unai Dankulo (top). Band of living coral tissue along the shoreward facing side of masive coral on the reef flat at Unai Dankulo (bottom). Living coral decreased from approximately 50-70% in 1994 to ~2% in 1999 at Unai Dankulo as a result of typhoon damage.

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 the 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 of 19 and 23 February 1998
D-23: Biological Opinion of the U.S. Fish and Wildlife Service for Programmatic Aerial Bombardment, Naval Gunfire, and Small Arms Gunfire at Farallon de Medinilla , Commonwealth of the Northern Mariana Islands (April 6, 1998)
D-24: Biological Opinion and Conference Report (Log 1-2-98-F-07), Military Training in the Marianas (January 4, 1999)

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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680 Ala Moana Blvd.
Honolulu, Hawaii 96813

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, 1895, 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.

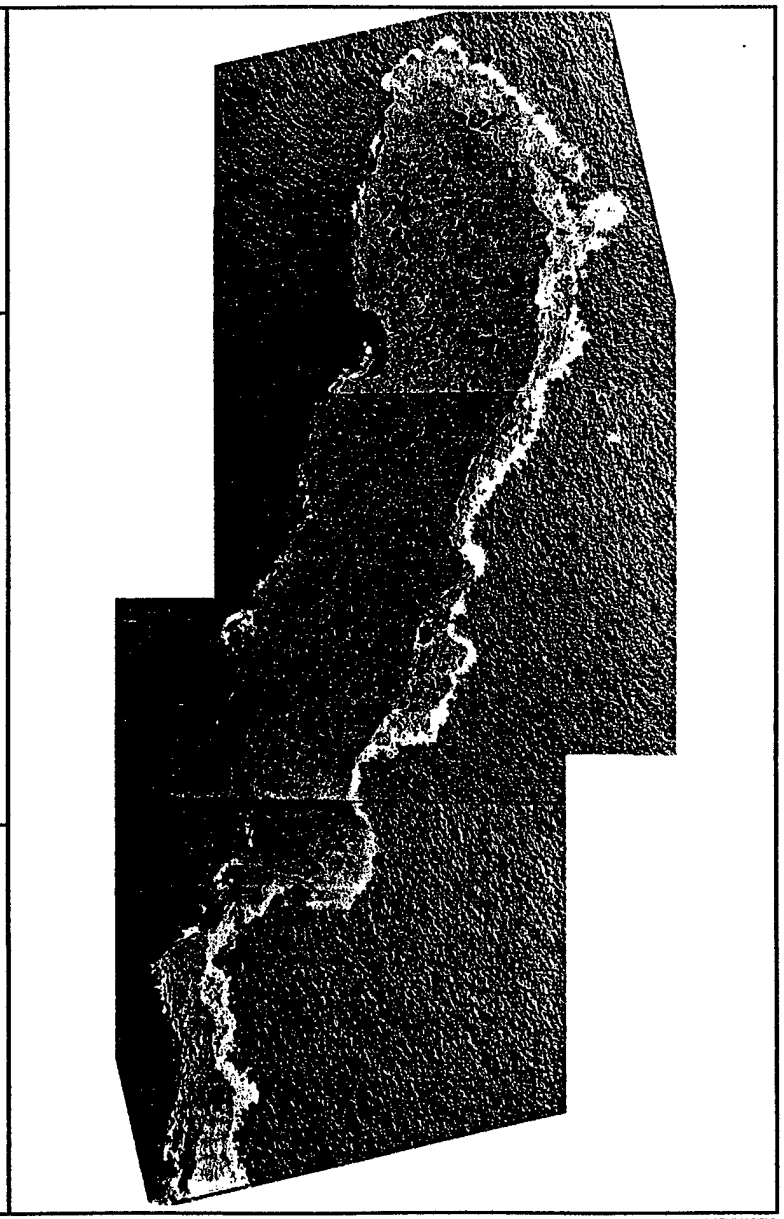
1914-1944: Japanese ornithologists published several editions of checklists of the birds of the Japanese-mandated islands, including the Marianas, during the Japanese era from 1914-1944 (Takatsukasa and Kuroda 1915a, 1915b; Kuroda 1922; Takatsukasa 1932-1938; Hachisuka et al. 1932, 1942). These lists 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.



Source: U.S. Department of the Navy (1944) Aerial photos

NORTH

Figure 1
1944 PHOTO OF FDM
Belt Collins Hawaii, 1997

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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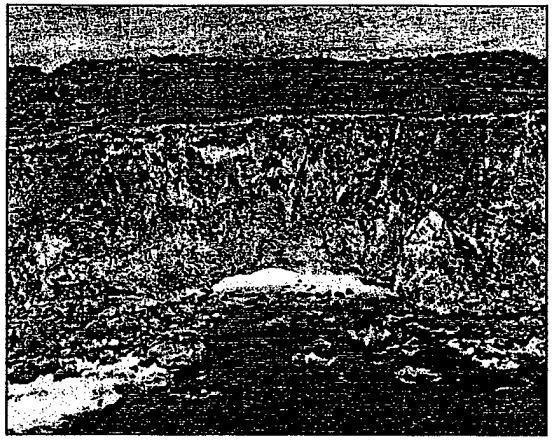

1952 Aerial photo

NORTH

1996 Aerial photo

NORTH

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).

342.0414/009-9 r11.13.97 4

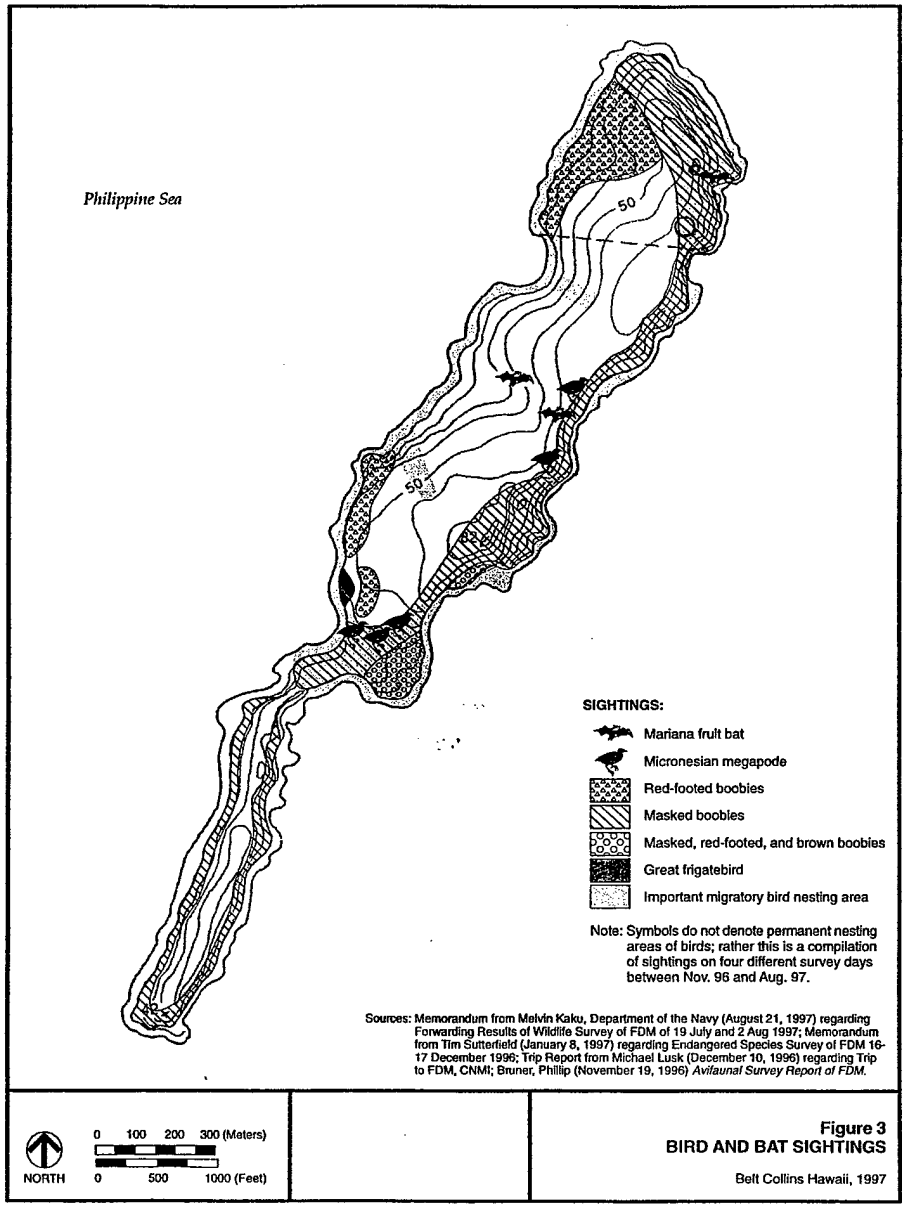

Figure 3
BIRD AND BAT SIGHTINGS
Belt Collins Hawaii, 1997

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 clifflines 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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[16] Marine Research Consultants (August 1997) *Preliminary Report: Assessment of the Marine Environment, Farallon de Medinilla, CNMI, Military Training in th Marianas EIS.* Prepared for Belt Collins Hawaii.

[17] Personal communication with Tim Sutterfield, PACNAVFACENGCOM Fish and Wildlife Biologist, August 15, 1997.

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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 dactylata	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

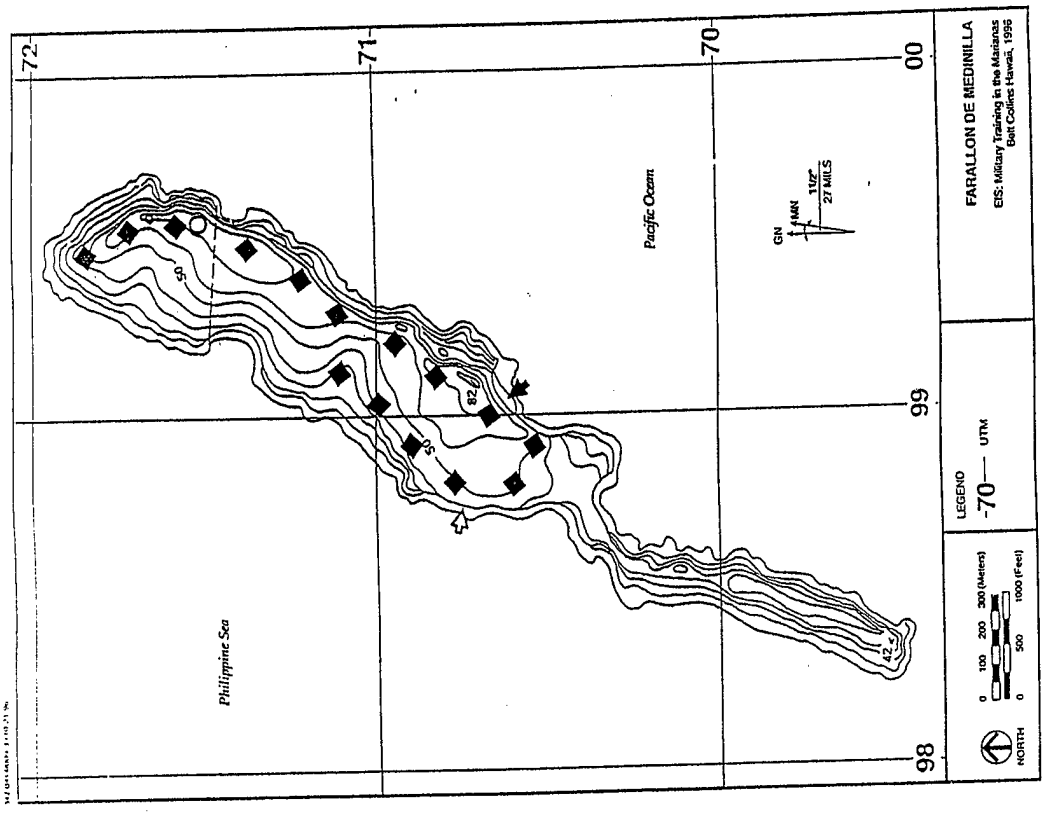

Fig. 1. Location of avifaunal survey. Solid diamonds indicate path of walking survey. Open arrow points to Great Frigatebird colony. Solid arrow indicates the area where Brown Boobies were nesting.

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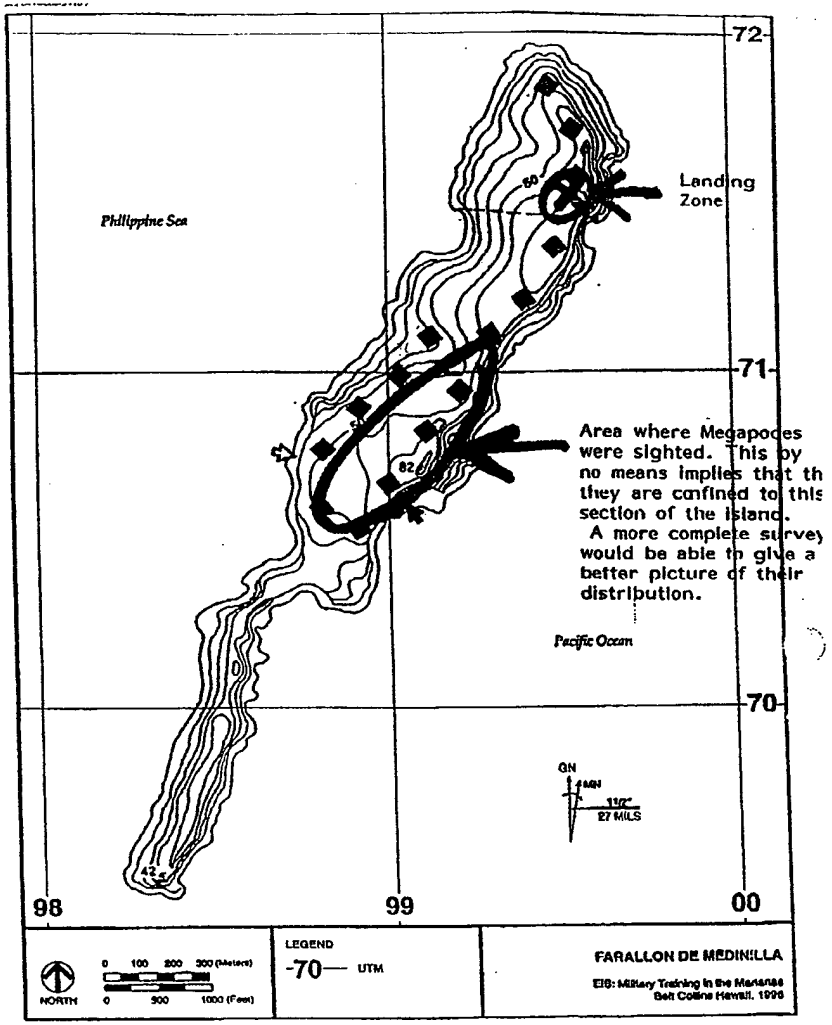
Pratt, H. D., P. L. Bruner, and D. G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton Univ. Press. 409 pp.

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
Pacific Ocean
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.
GN
1 MIN
1/2"
27 MILS
NORTH
0 100 200 300 (Meters)
0 500 1000 (Feet)
LEGEND
-70— UTM
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Bell Collins Hawaii, 1998

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

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December 1996

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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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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.

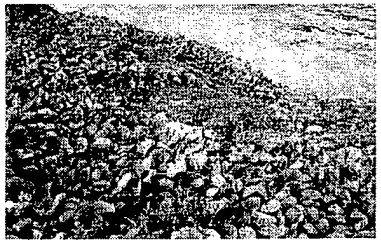


Figure 1: Littoral strand

Figure 2: Ipomoea pes-caprae

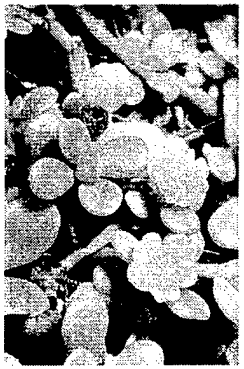


Figure 3: Portulaca lutea

Figure 4: Sesuvium portulacastrum

Figure 5: Fimbristylis cymosa

Figure 6: Wollastonia biflora

Figure 7: Boerhavia repens

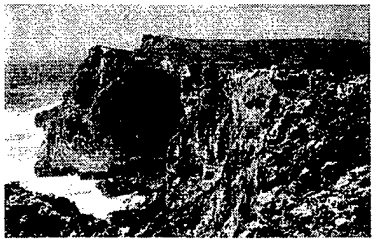


Figure 8: East cliff of F.D.M.

Figure 9: Excoecaria agallocha

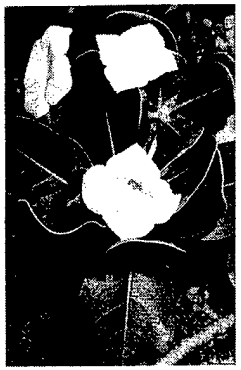


Figure 10: Bikkia tentrandra

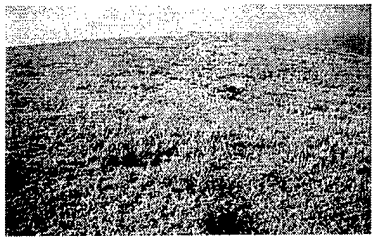


Figure 11: Looking south from north end, F.D.M.

Figure 12: Capparis spinosa

Figure 13: Operculina ventricosa

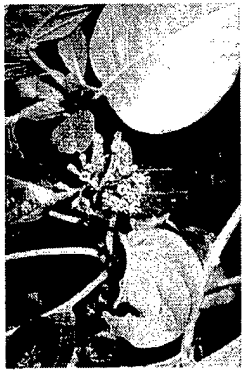


Figure 14: Pisonia grandis

Figure 15: F.D.M. central, east coast

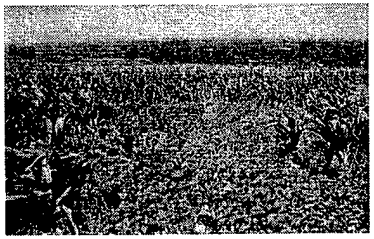


Figure 16: Crinum patch, F.D.M.

Figure 17: Crinum asiaticum

Figure 18: East cliffs of F.D.M.

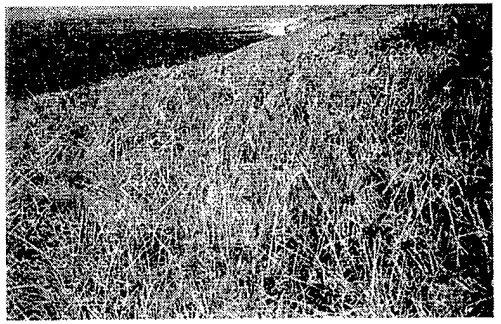


Figure 19: Central F.D.M. – looking north

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.

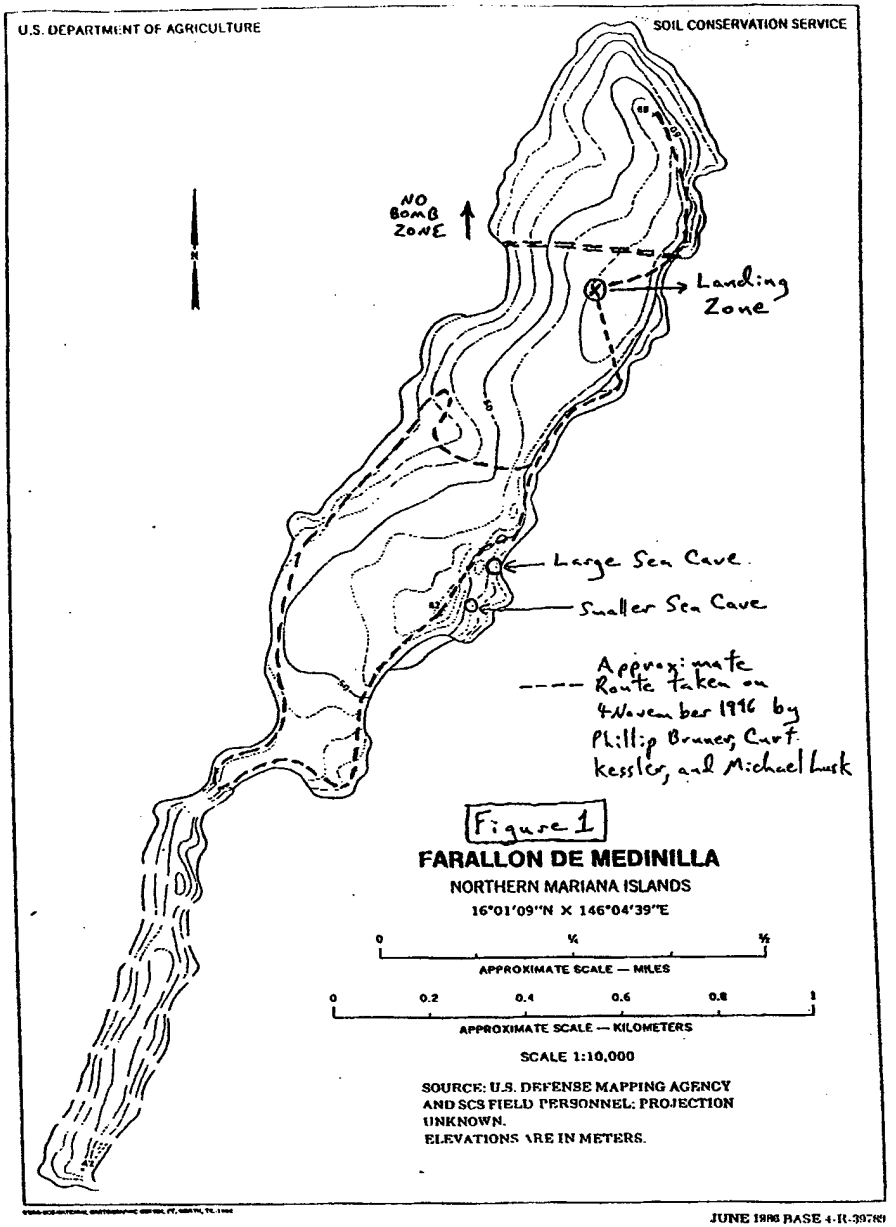
Historically, it is very difficult to determine how many birds were using the island. An Environmental Impact Statement prepared by the Navy in 1975 states that boobies are evenly distributed over the island and estimates a population of 50,000 boobies and 1,000 white terns. If this estimate is accurate, 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.

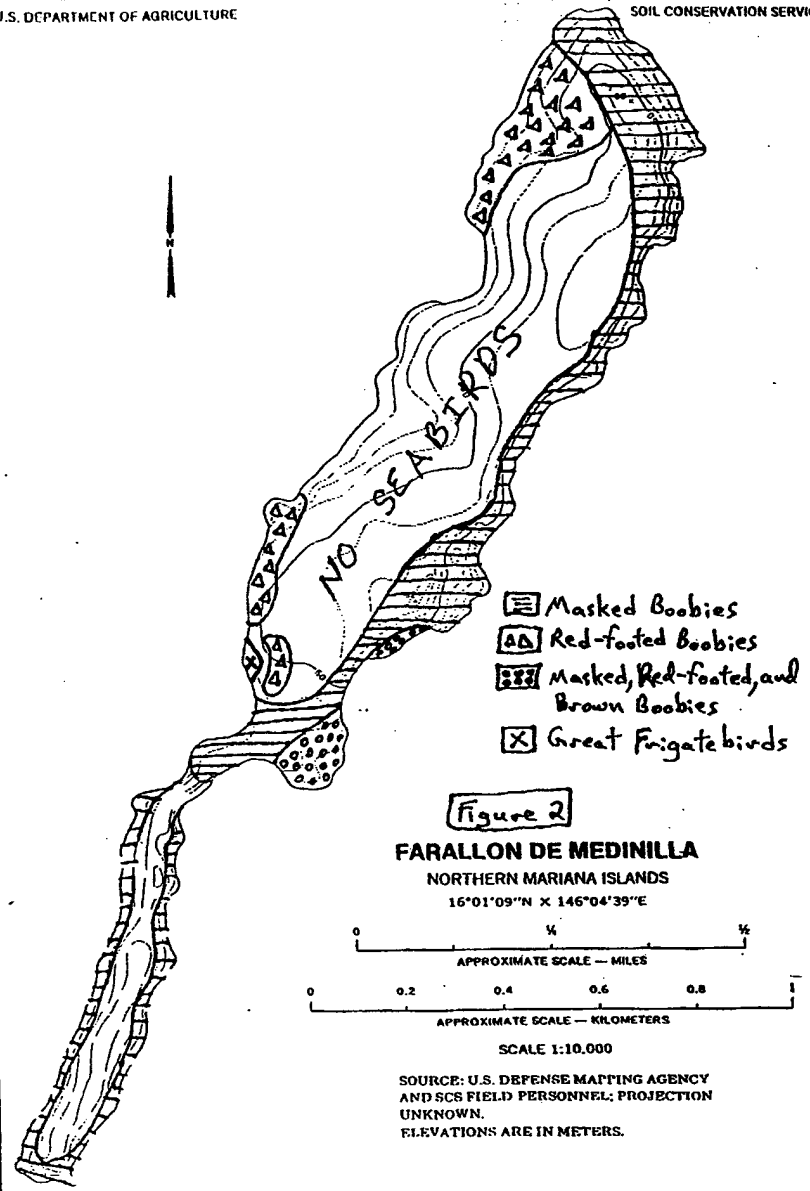
Table 1. Bird species recorded on 4 November 1996 from Farallon de Medinilla, their approximate populations, and indication if breeding was observed.

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



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 1

APPROXIMATE SCALE — MILES

0 0.2 0.4 0.6 0.8 1

APPROXIMATE SCALE — KILOMETERS

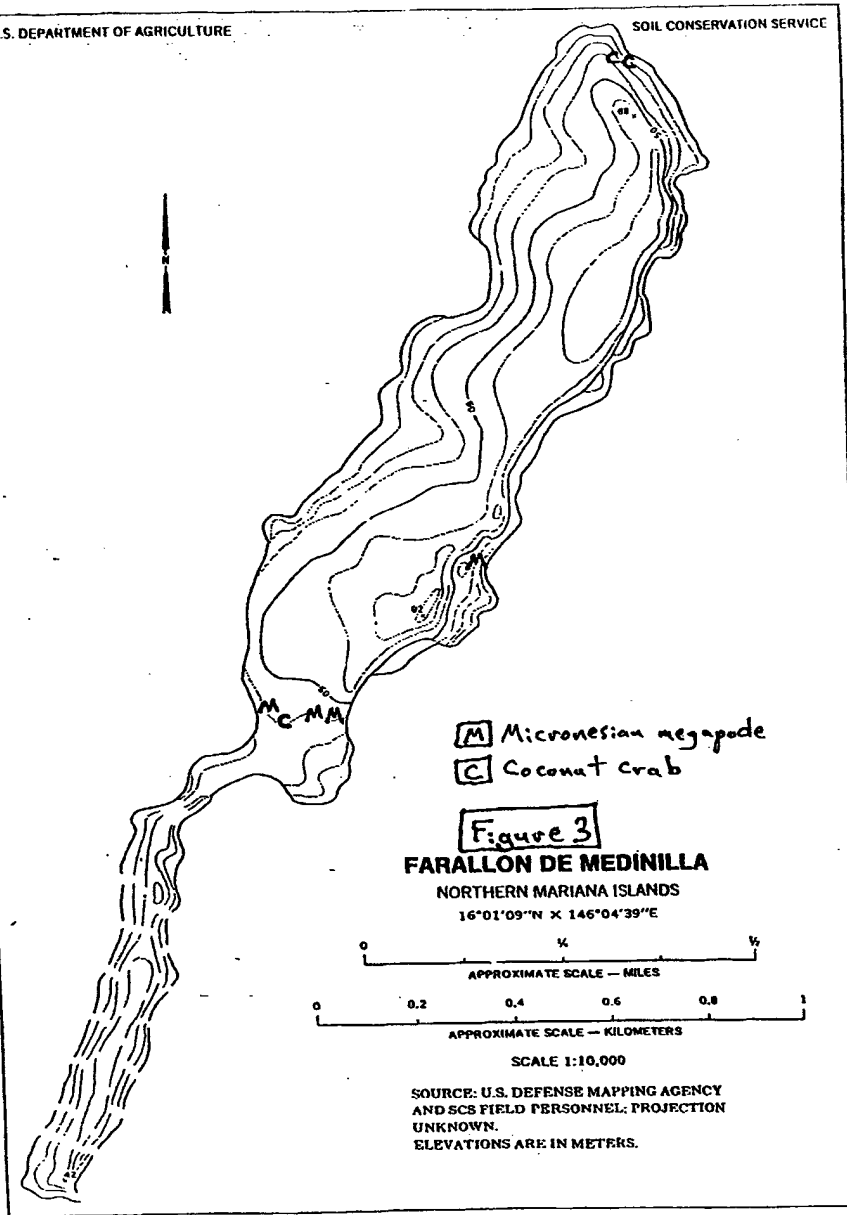
SCALE 1:10,000

SOURCE: U.S. DEFENSE MAPPING AGENCY AND SCS FIELD PERSONNEL; PROJECTION UNKNOWN.
ELEVATIONS ARE IN METERS.

JUNE 1986 BASE 4-R-39789

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



M Micronesian megapode

C Coconut crab

Figure 3

FARALLON DE MEDINILLA

NORTHERN MARIANA ISLANDS

16°01'09"N × 146°04'39"E

0 ½ 1

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-39789

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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COMNAVMARIANAS N45
CINCPACFLT N465
09P

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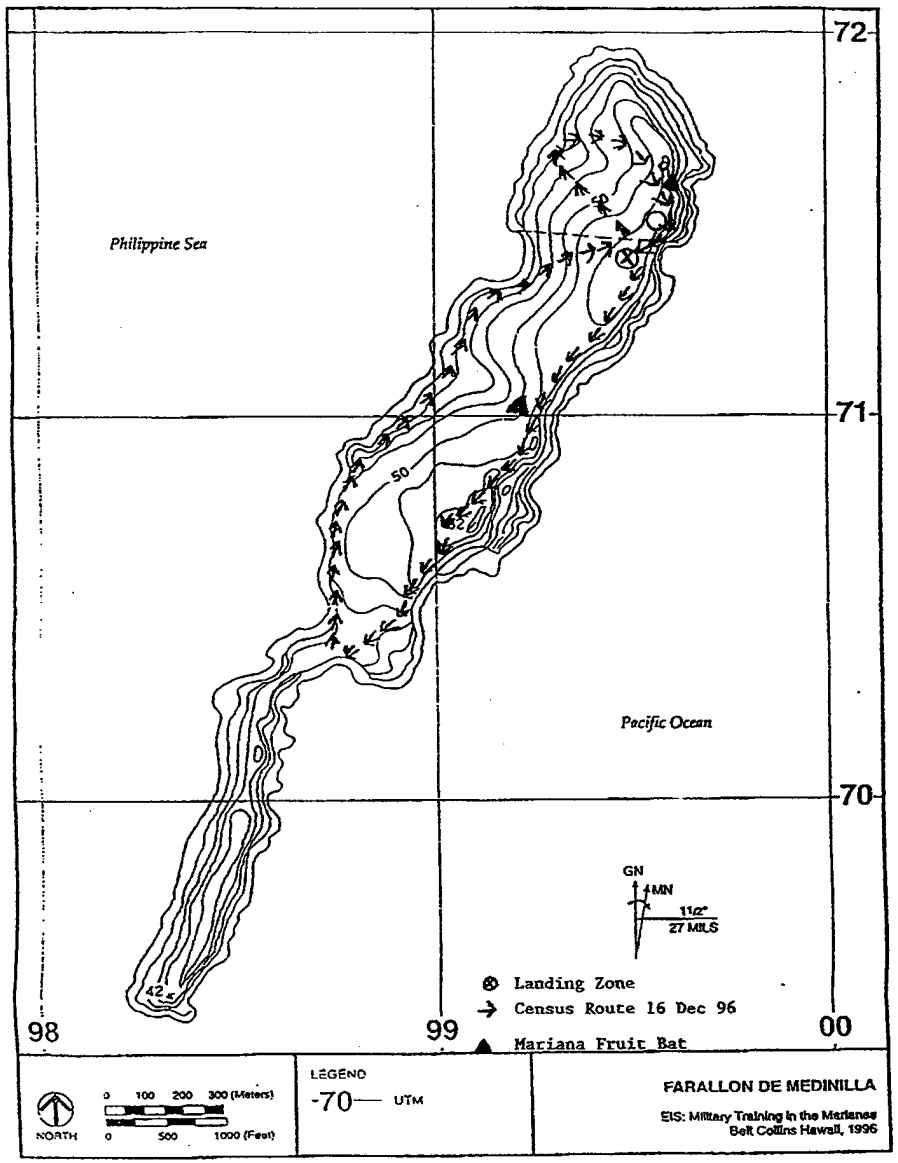

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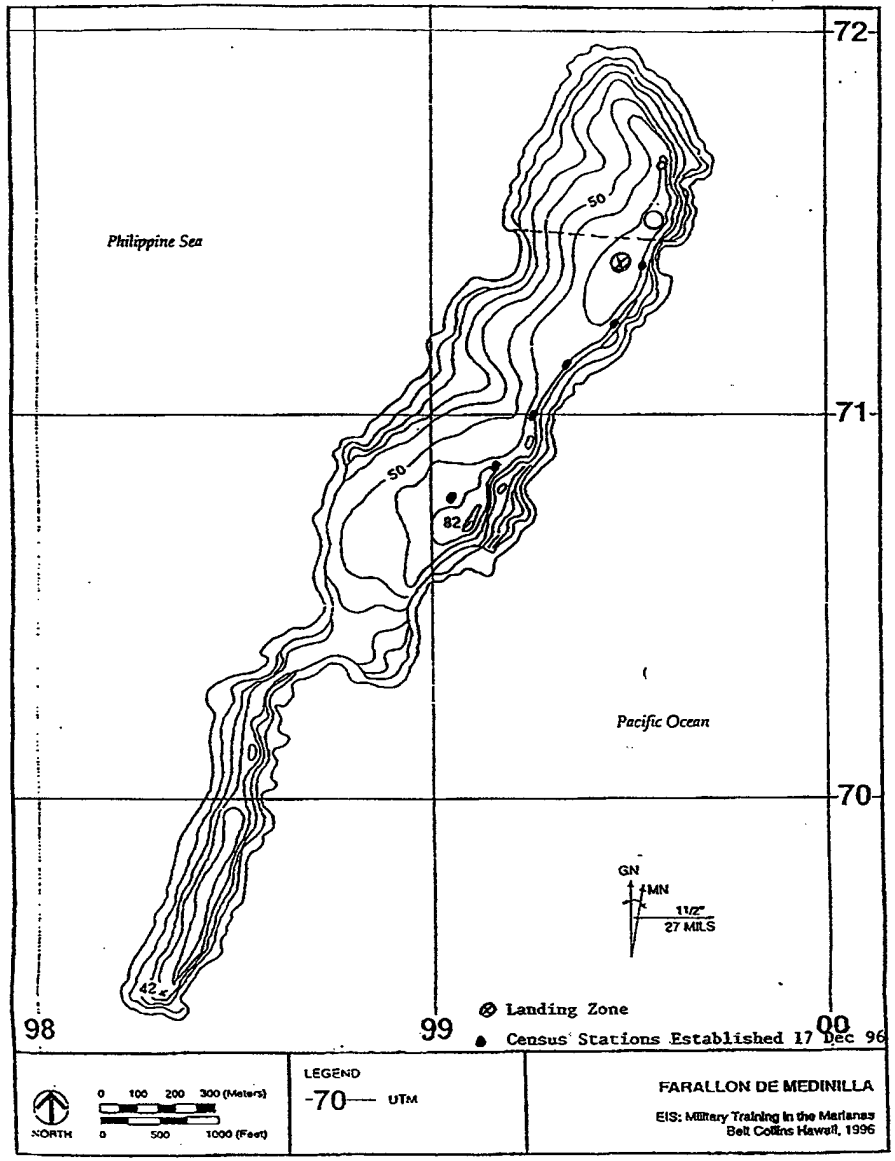

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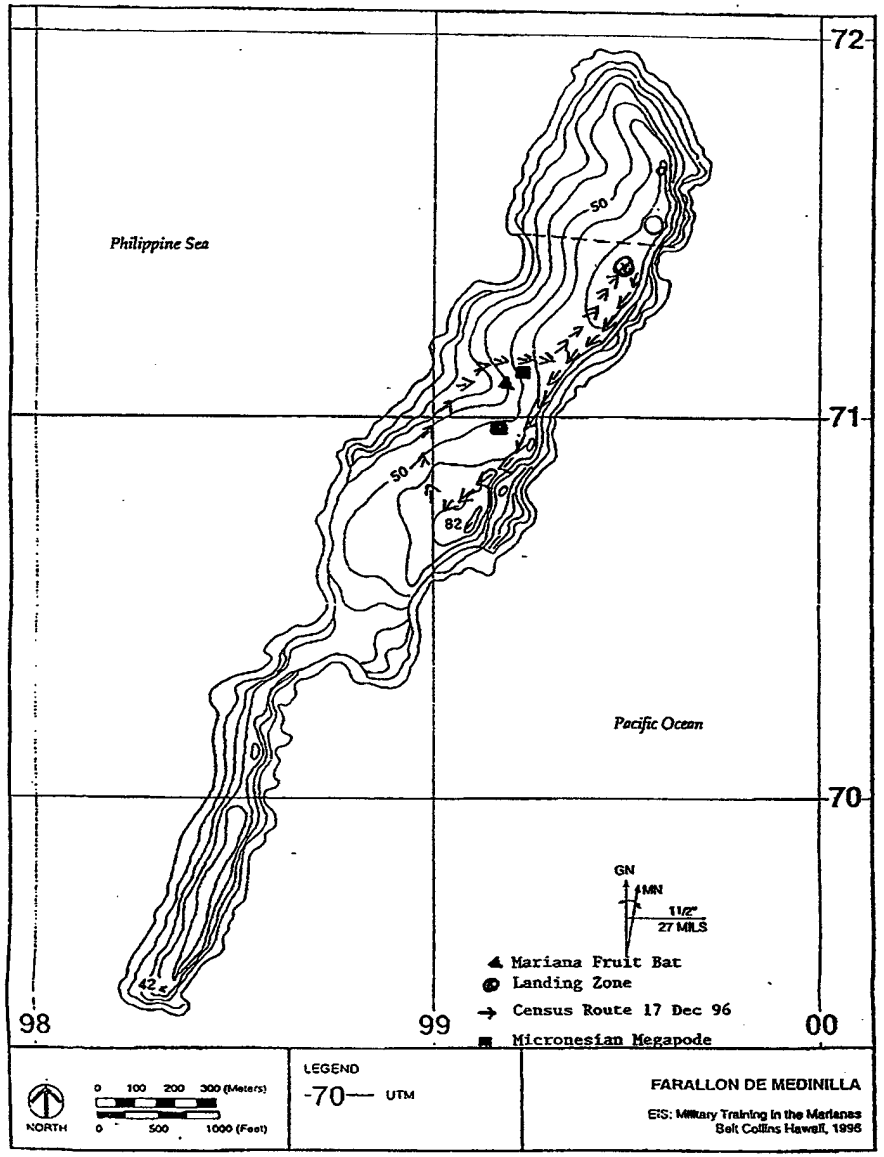

Encl(3)

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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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 Guimard from a specimen collected on Tinian in 1820 (Quoy and Guimard, 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. laperouse* 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 (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
192 Dairy Road
Mangilao, Guam 96923

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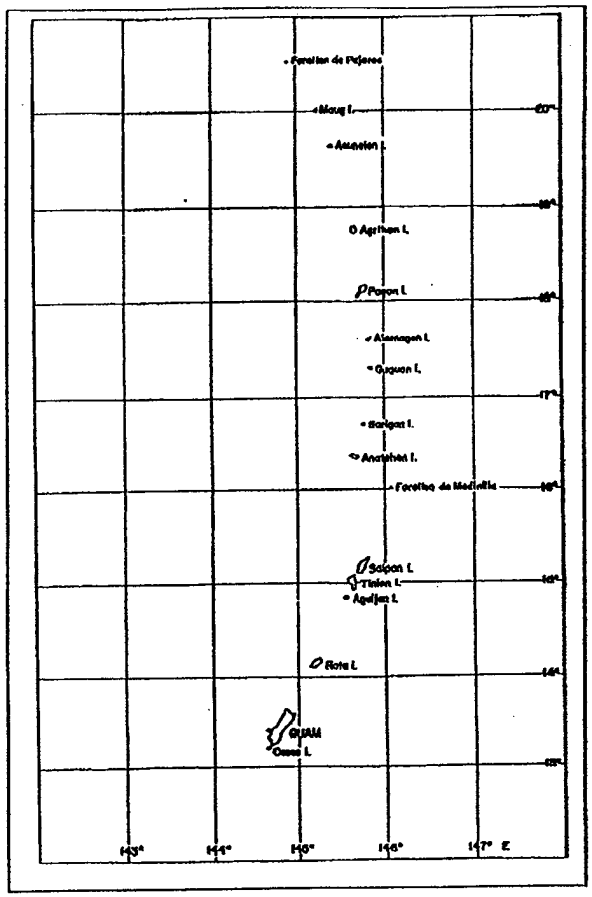

Figure 1. The Commonwealth of the Northern Mariana Islands and Guam.

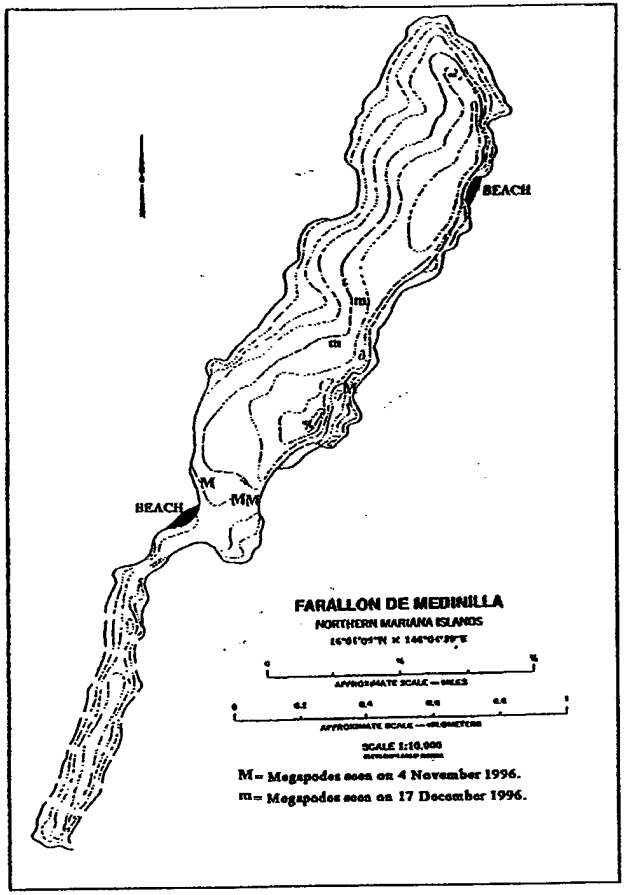

Figure 2. Locations of megapode sightings and beaches on Farallon de Medinilla.

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 latter 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.

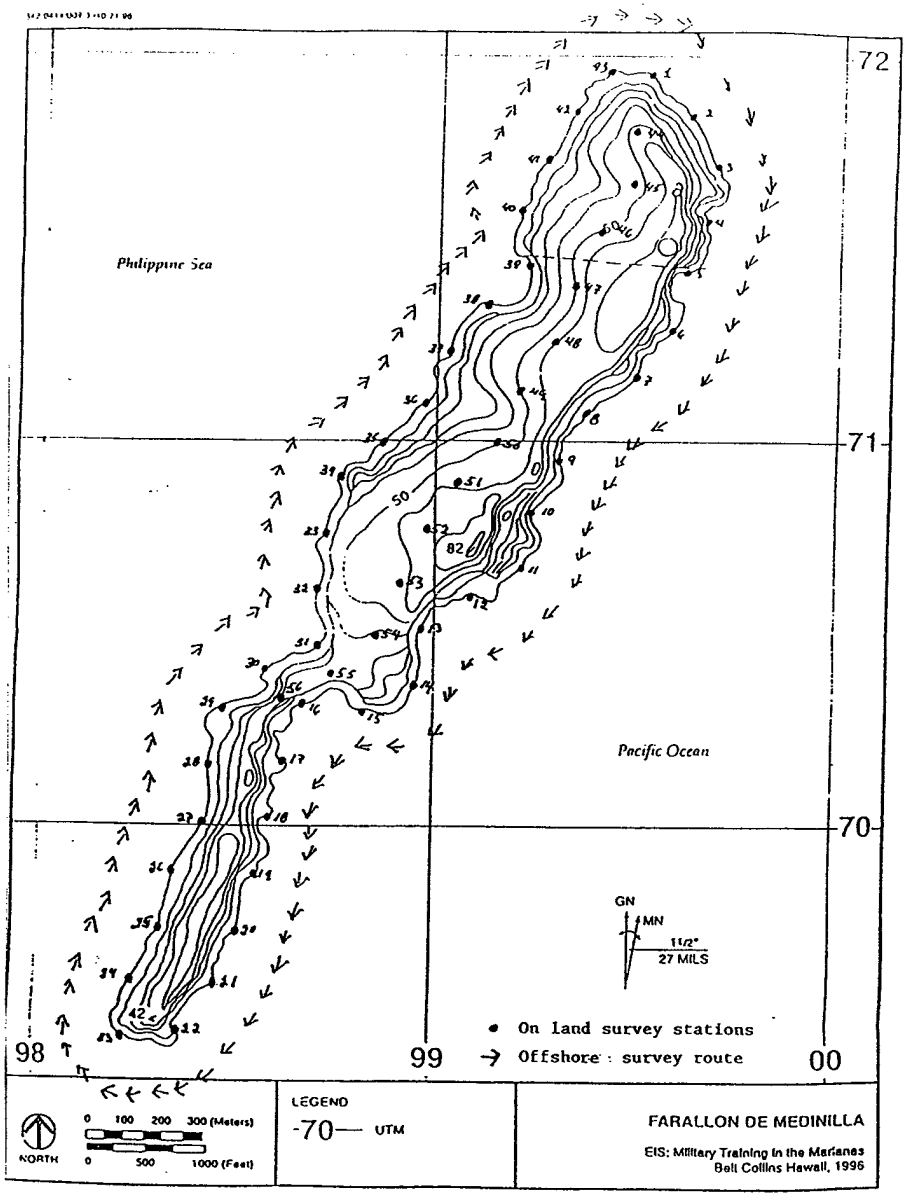
6. The survey methodology will consist of establishing two transect. the first with forty three stations (Enclosure (1) map) 150 meters apart will circle the island and a second transect with 13 additional stations will bisects the island in a north south direction. The helicopter will follow the transacts 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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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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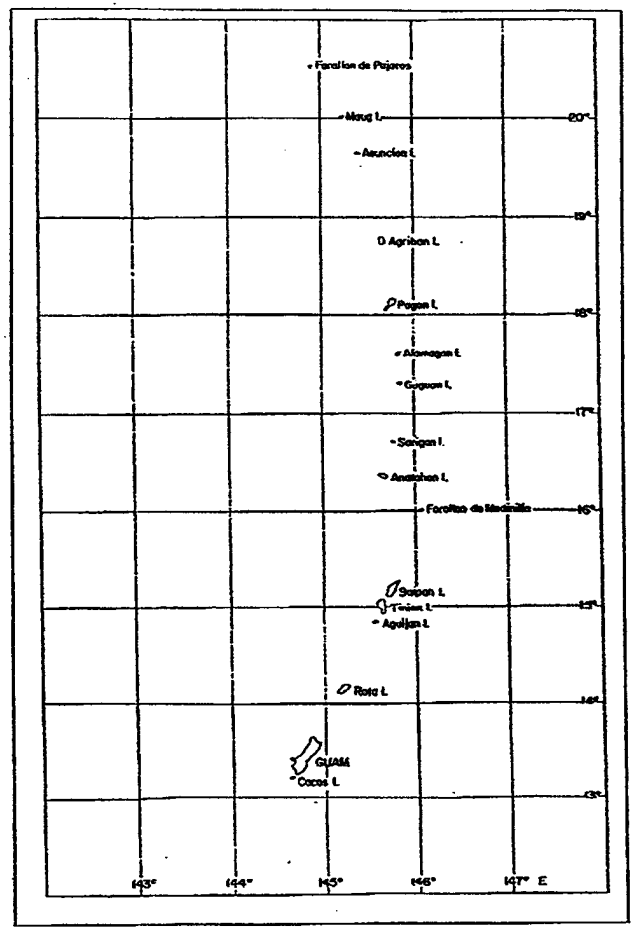

Figure 1. The Commonwealth of the Northern Mariana Islands and Guam.

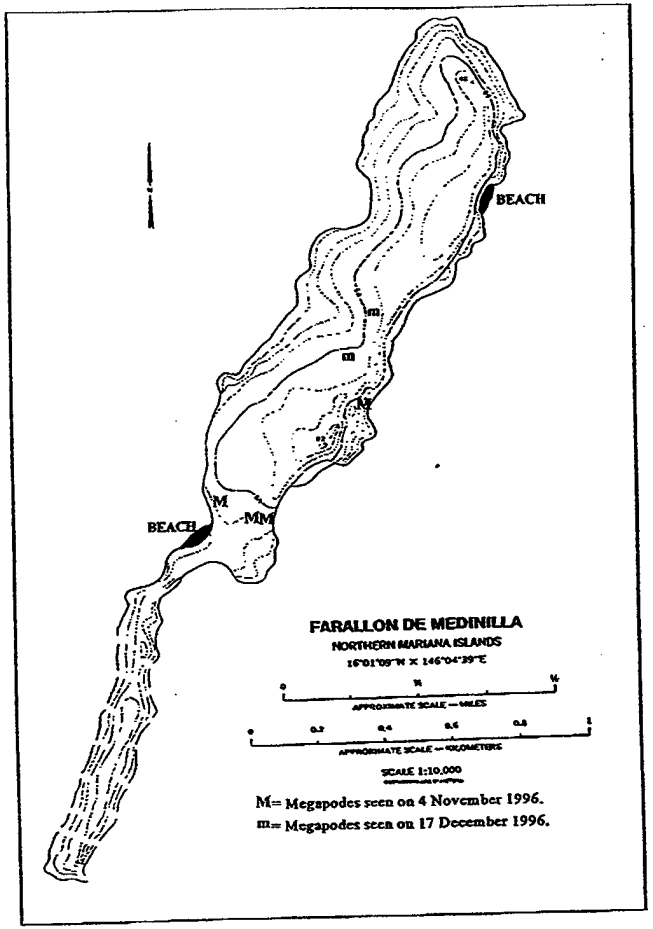

Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla.

Appendix D-10
Wildlife Surveys of Farallon de Medinilla of May 17 and 27, 1997
(June 11, 1997)

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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 300 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

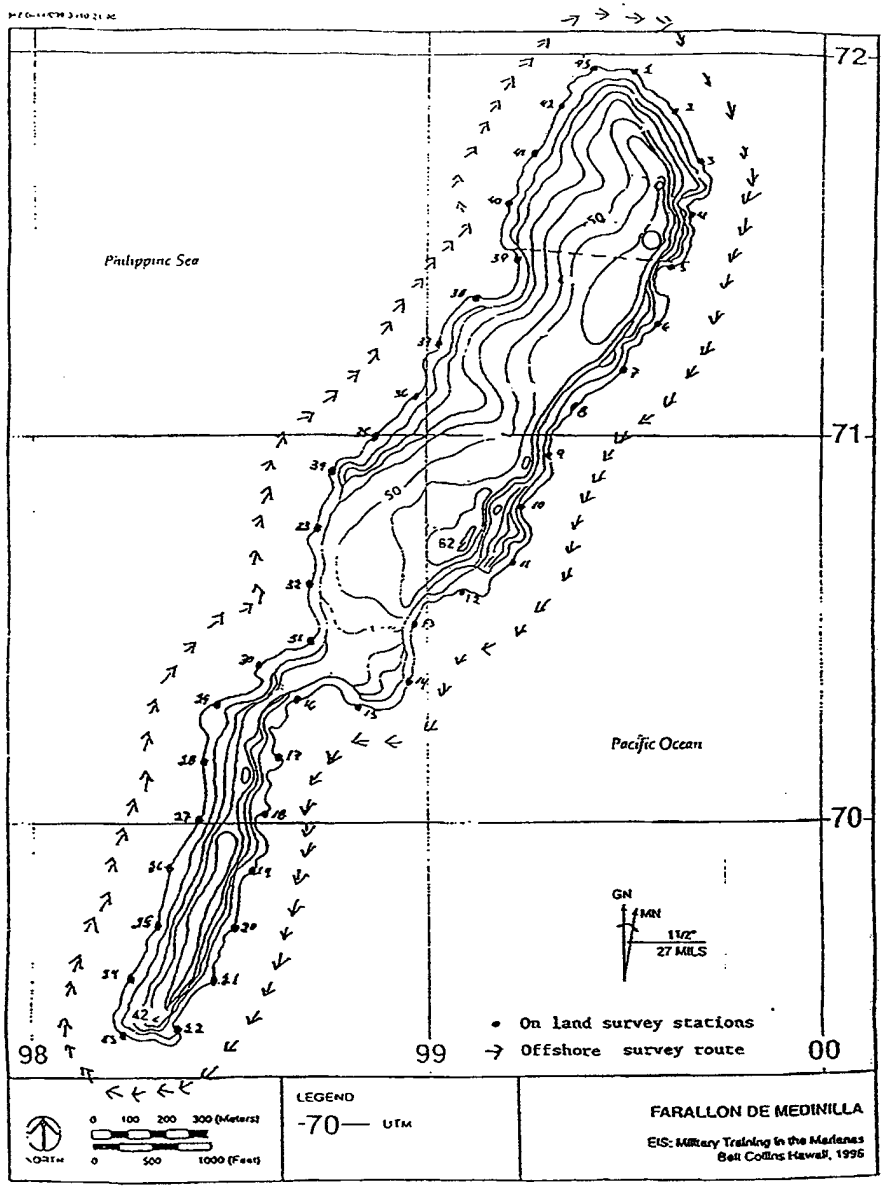

EXHIBIT OSURE(1)

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

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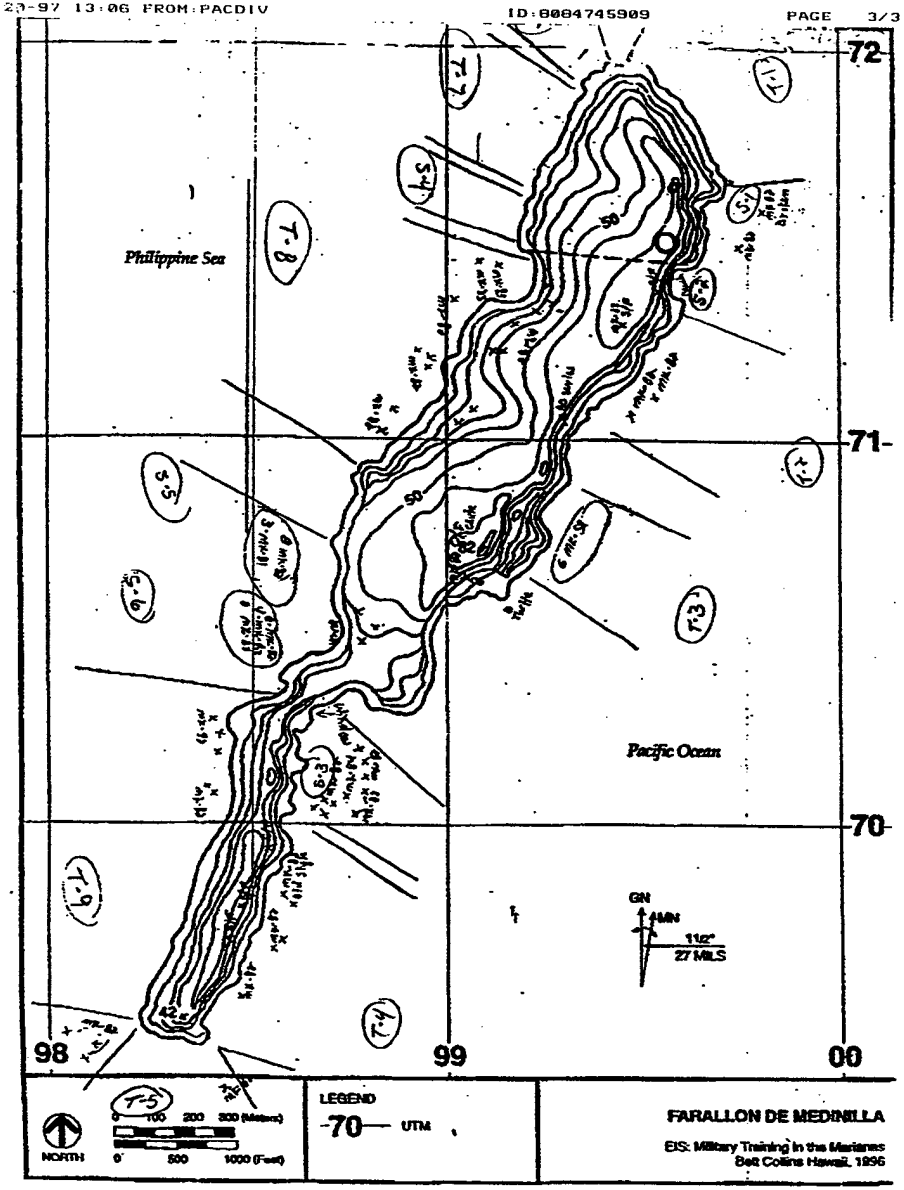
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LEGEND
70 UTM
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

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.

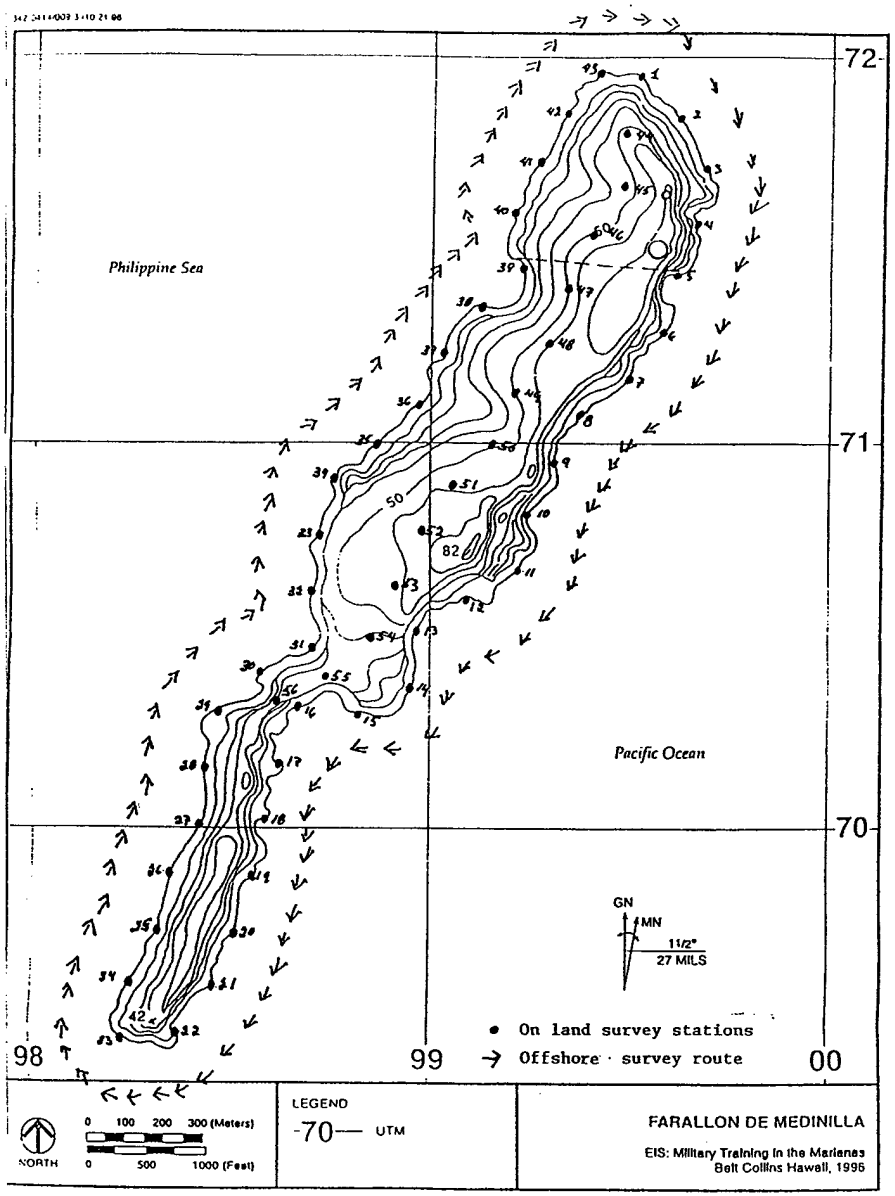
Melvin N. Kaku
MELVIN N. KAKU
By direction

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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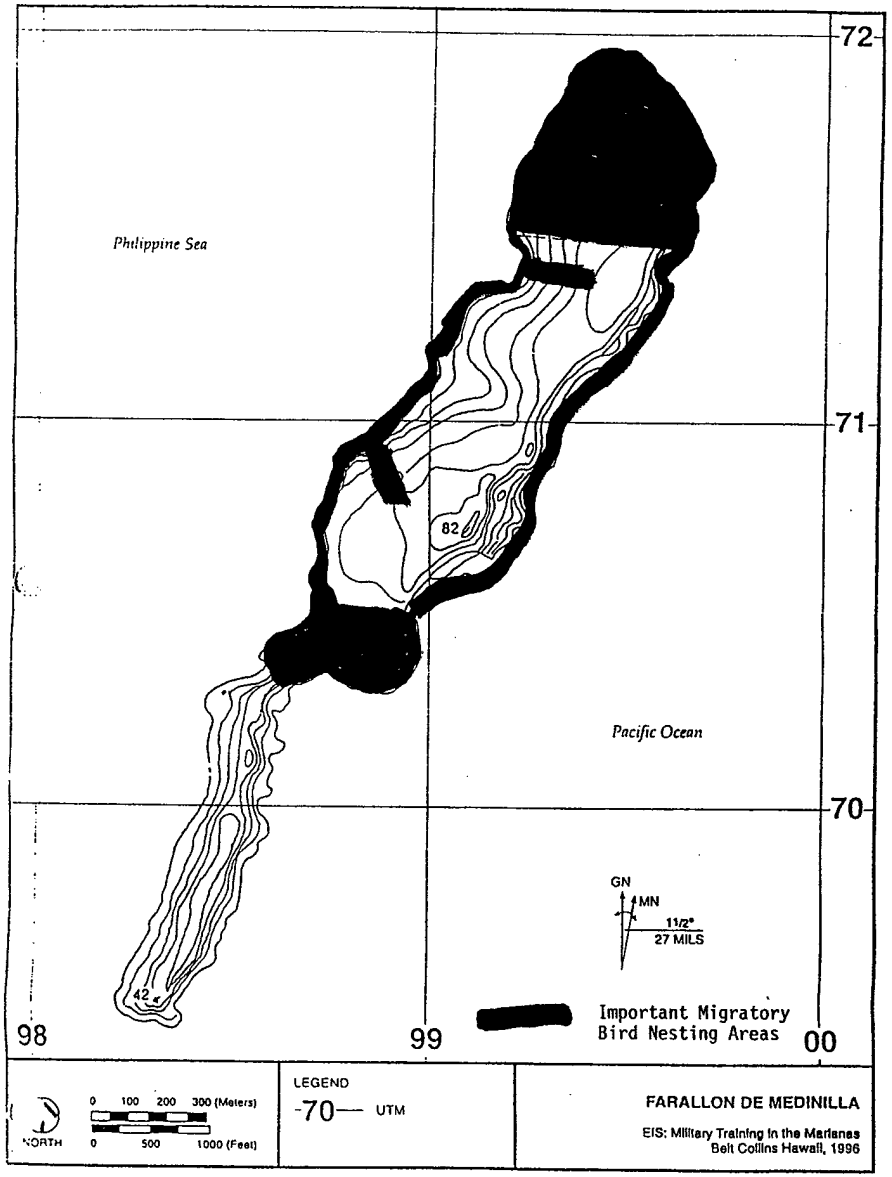
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Important Migratory
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FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

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.

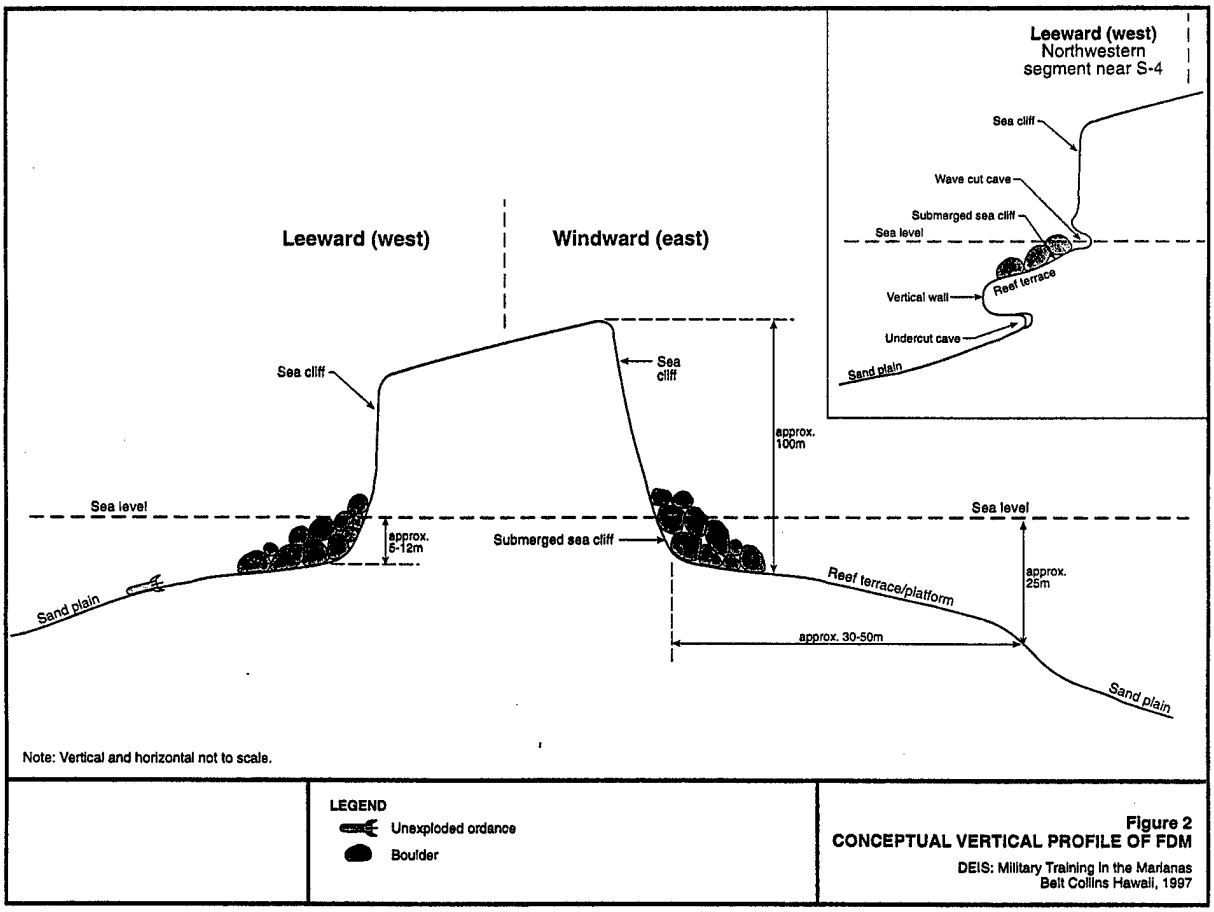

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Figure 2
CONCEPTUAL VERTICAL PROFILE OF FDM
DEIS: Military Training In the Marianas
Belt Collins Hawaii, 1997

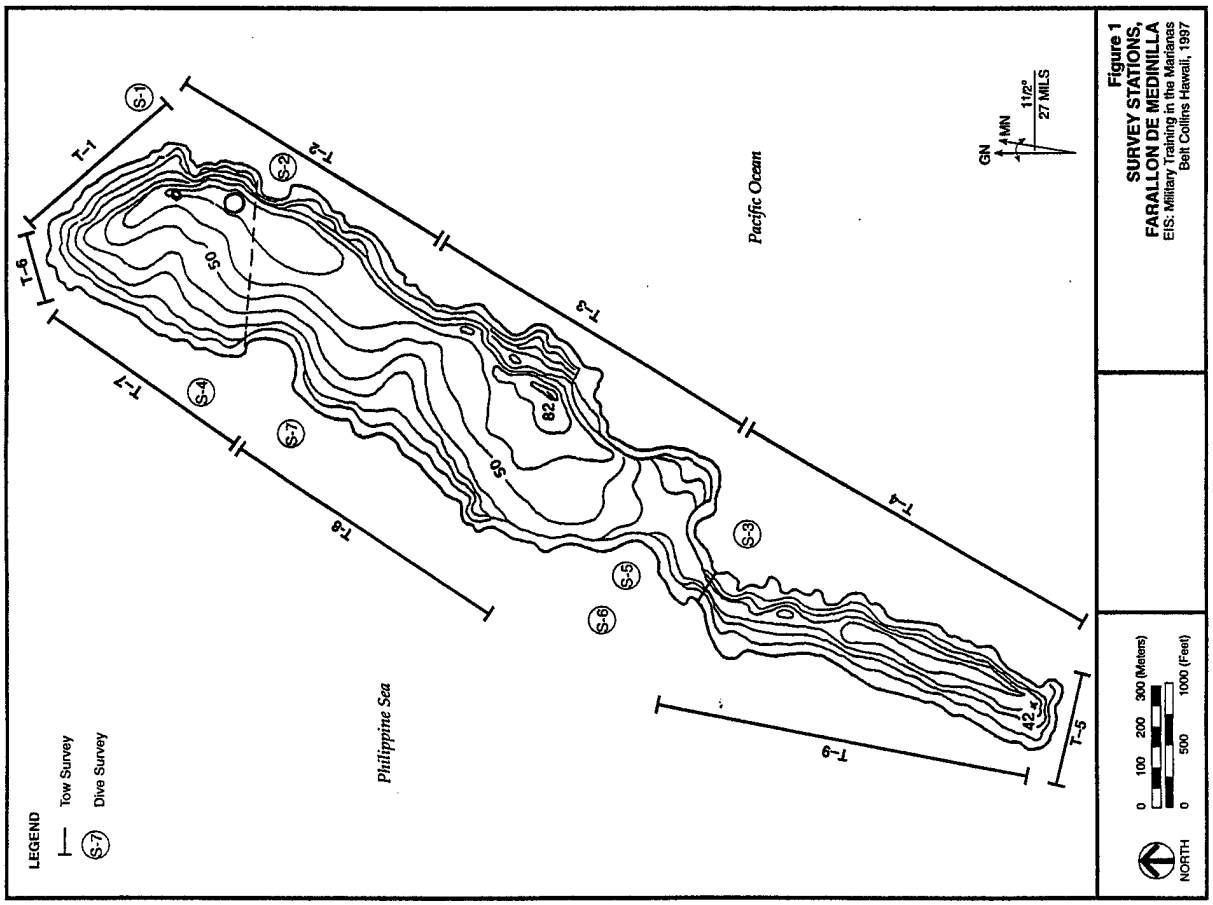

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Figure 1
SURVEY STATIONS,
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1997

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.

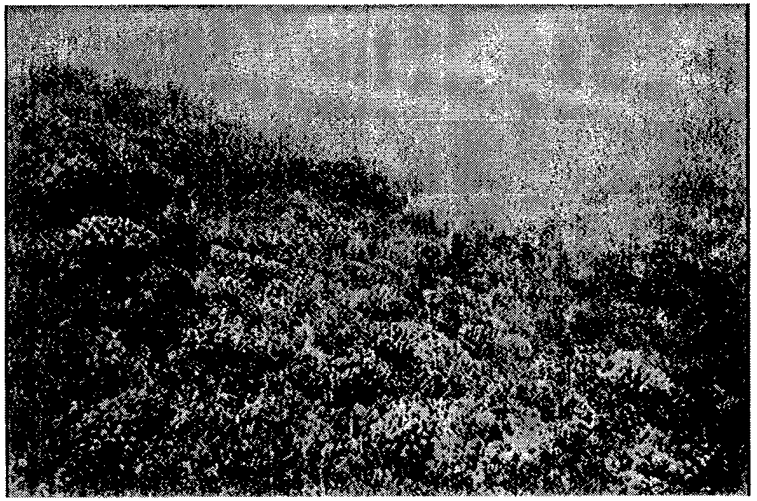


Figure 4. Juncture of reef terrace and sand flat at Dive site S-1.

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).

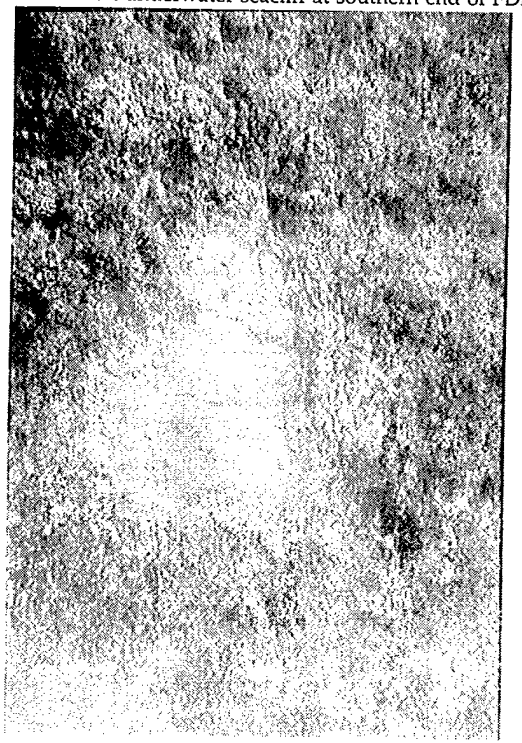


Figure 8. Abundant colonies of *Pocillopora* on upper reef terrace at dive site S-4.

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.

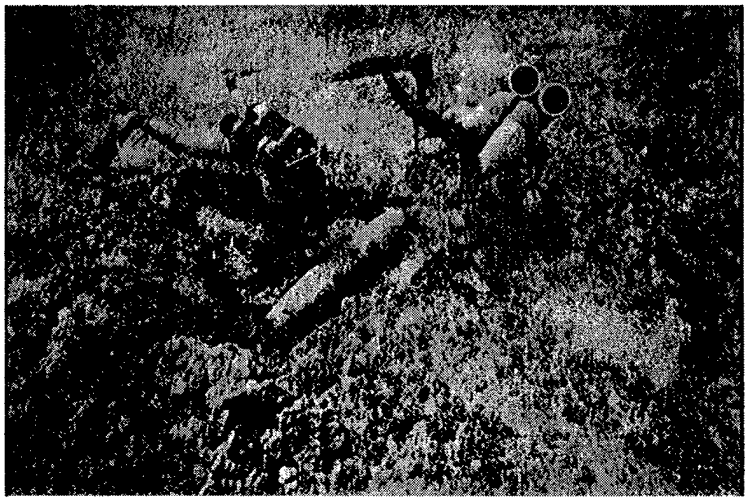


Figure 11. Unexploded bomb with growing coral colonies at Dive site S-7.

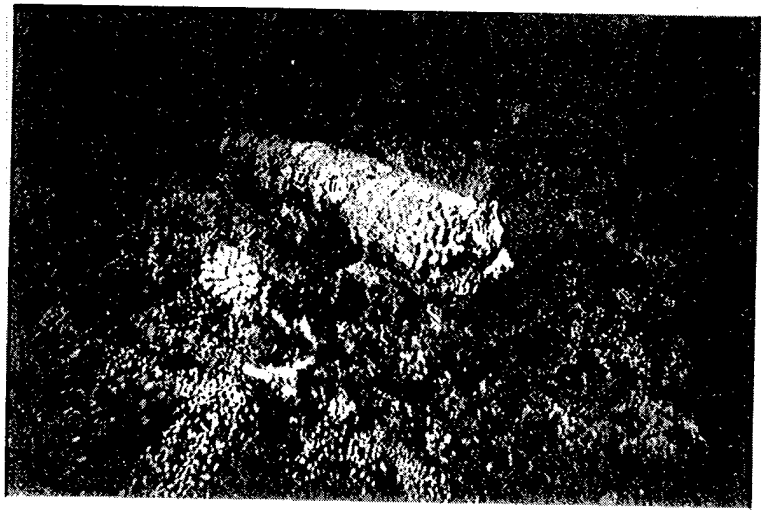


Figure 12. Unexploded bomb with growing coral colonies at Dive site S-6.

Figure 13. Unexploded "snake-eyes" bomb at Dive site S-6.

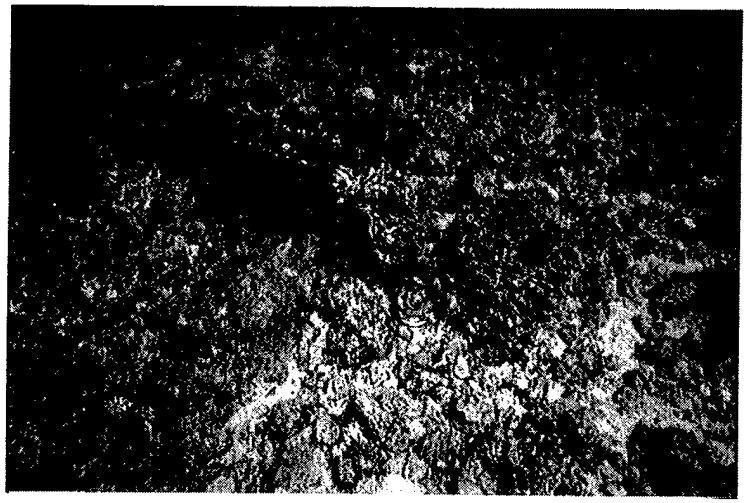
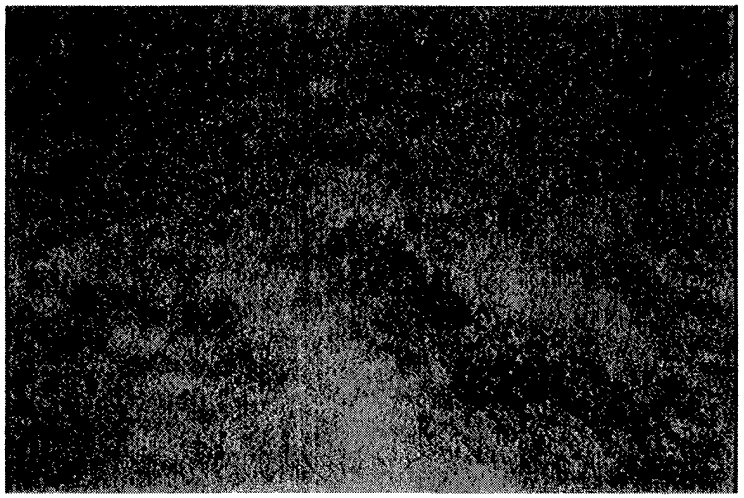


Figure 14. Scoured bottom of inner reef terrace in southwestern quadrat (T-9).



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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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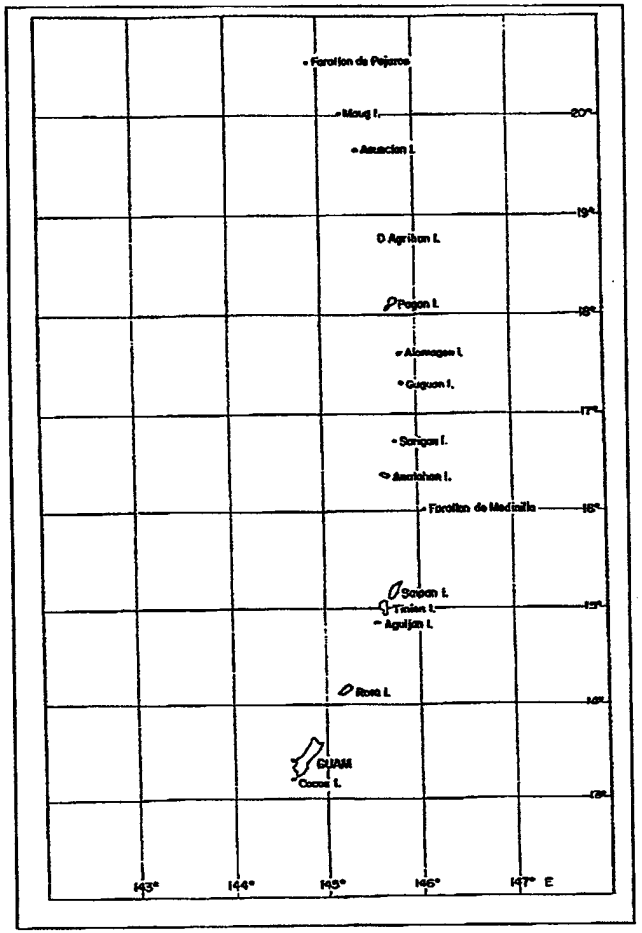

Figure 1. Mariana Islands archipelago.

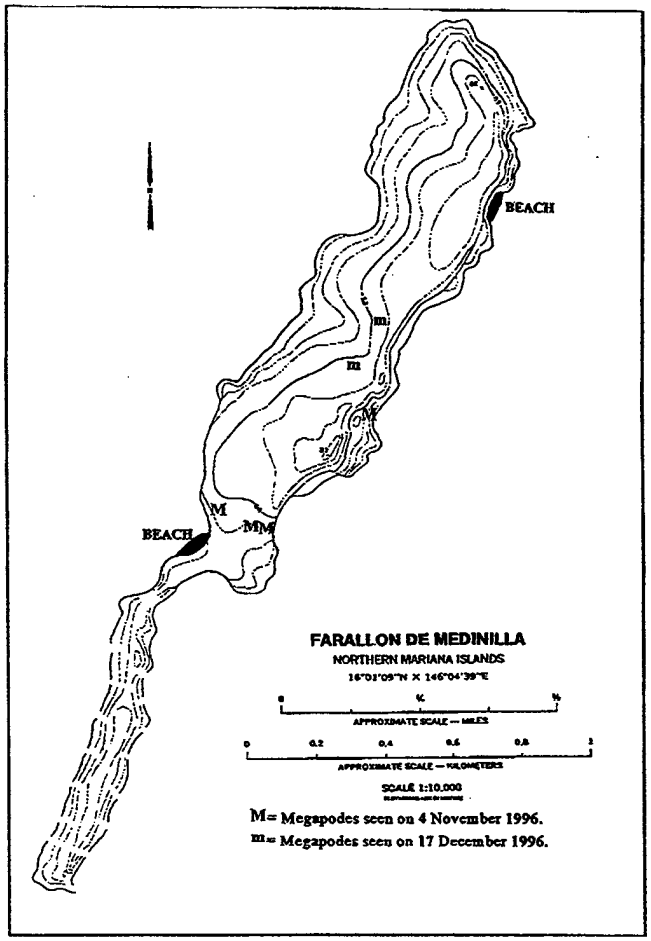

Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla (beaches are not to scale).

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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-8, 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.

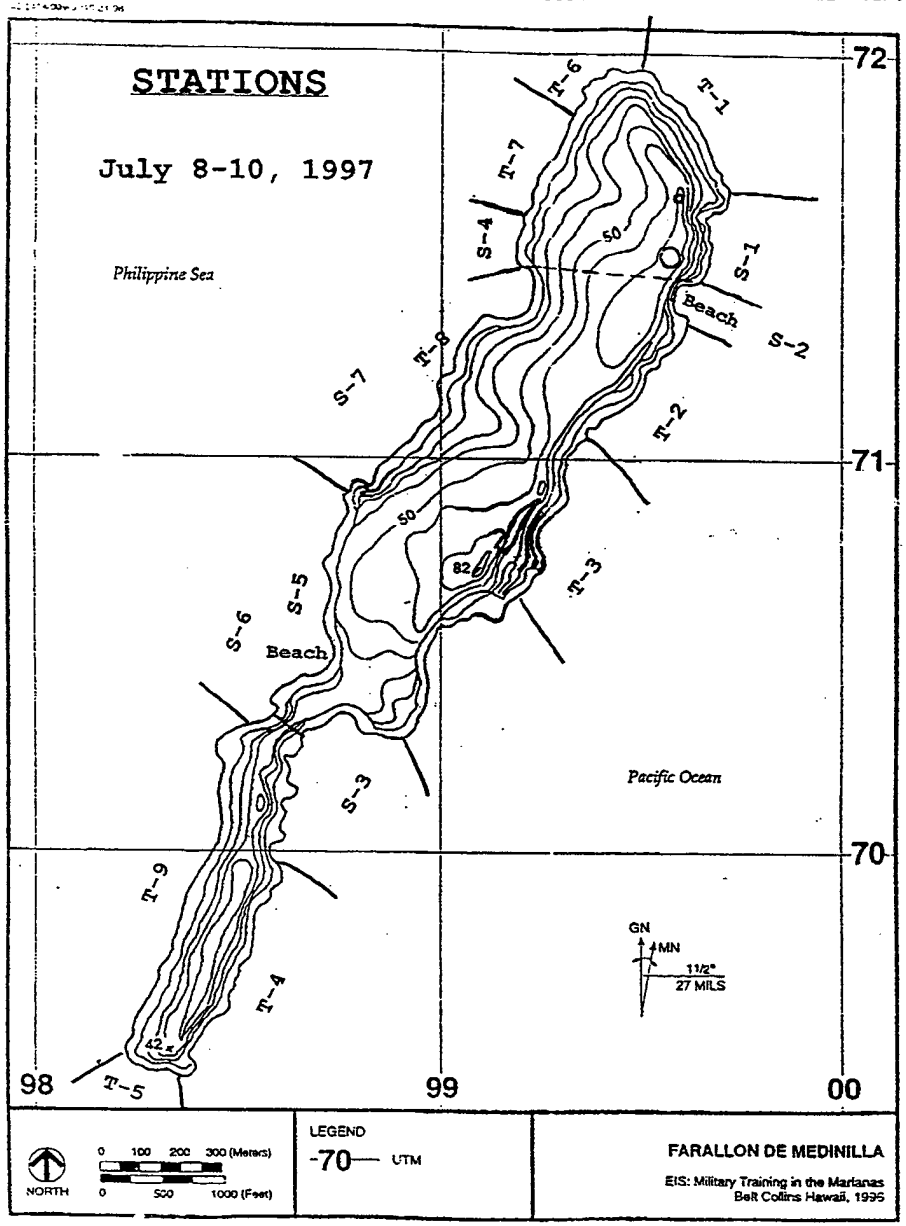
Fishery Resources and Habitat:

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
Bell 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 Karen W Rosa

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

Nearshore Reef Survey
Farallon de Medinilla, CNMI

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.

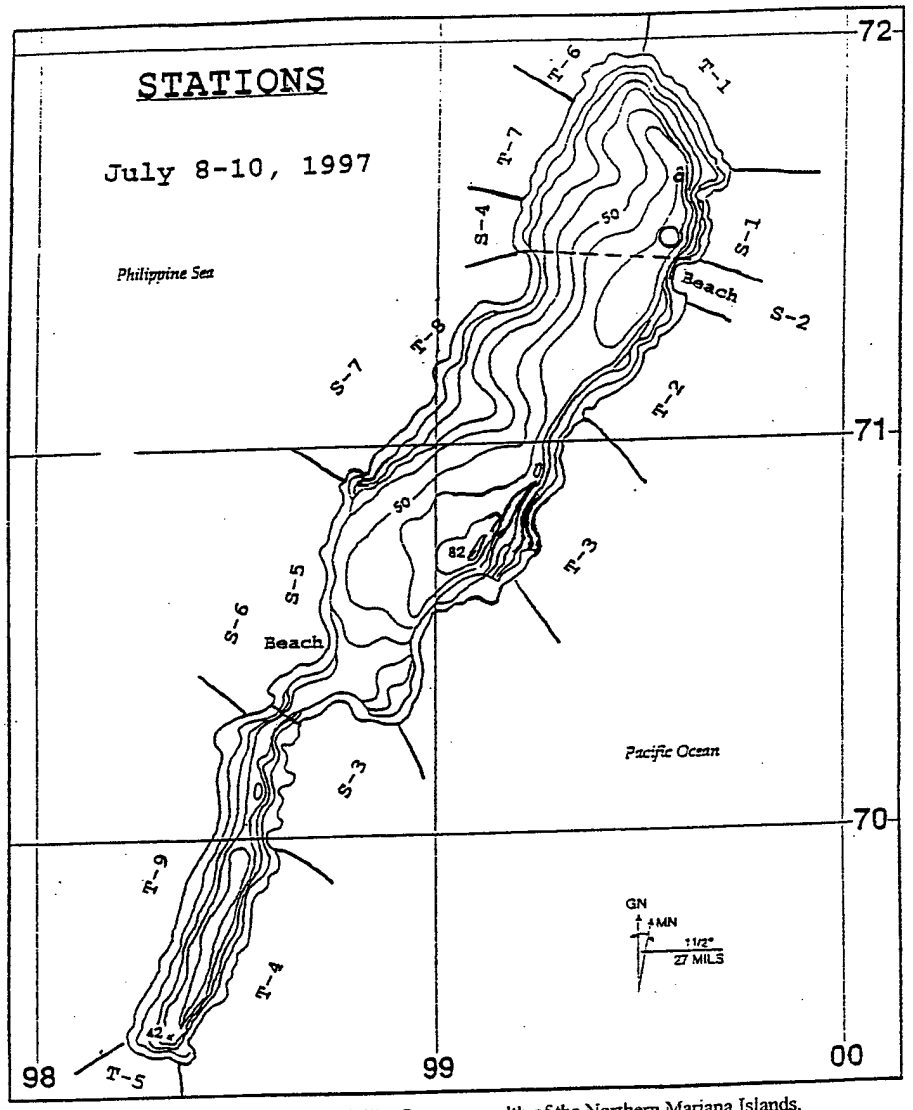


Figure 1. The island of Farallon de Medinilla, Commonwealth of the Northern Mariana Islands.

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 (Stringrays)							
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	G		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.

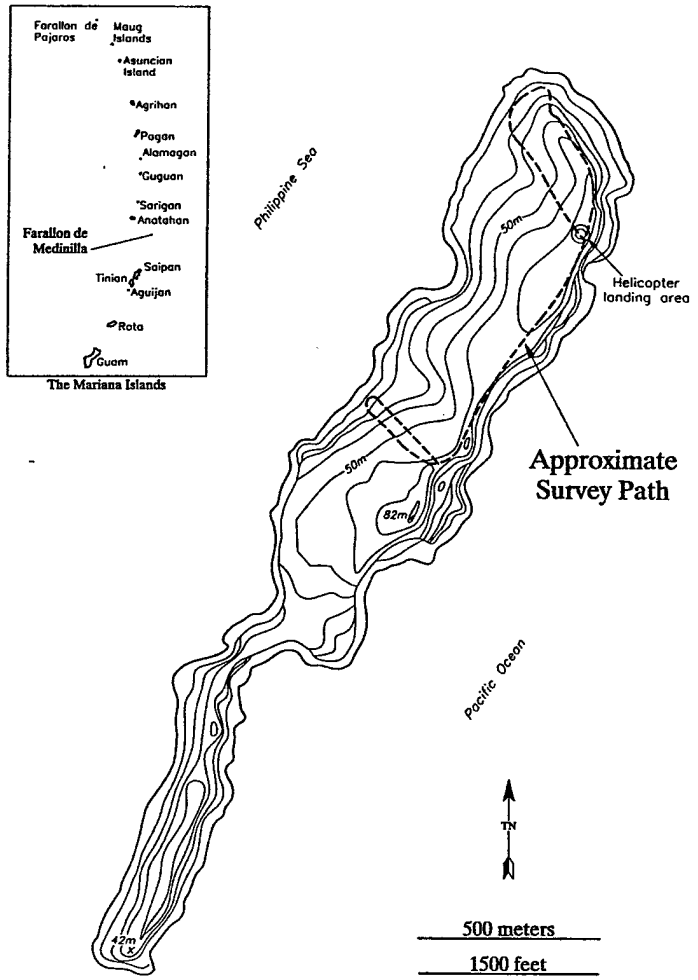

Figure 1. Map of Farallon de Medinilla showing location of reconnaissance survey path.

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 bailloni(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-3

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 crater 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 bailloni*(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 rubrioviolaceous*, 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, Caesiondiae, Balistidae, Pomacentridae, Pomacanthidae, Chaetodontidae, Lethrinidae, Labridae, Scombridae, Kyphosidae, Pempheridiidae, 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. mauriantiana(6?)*, *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 general, 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.

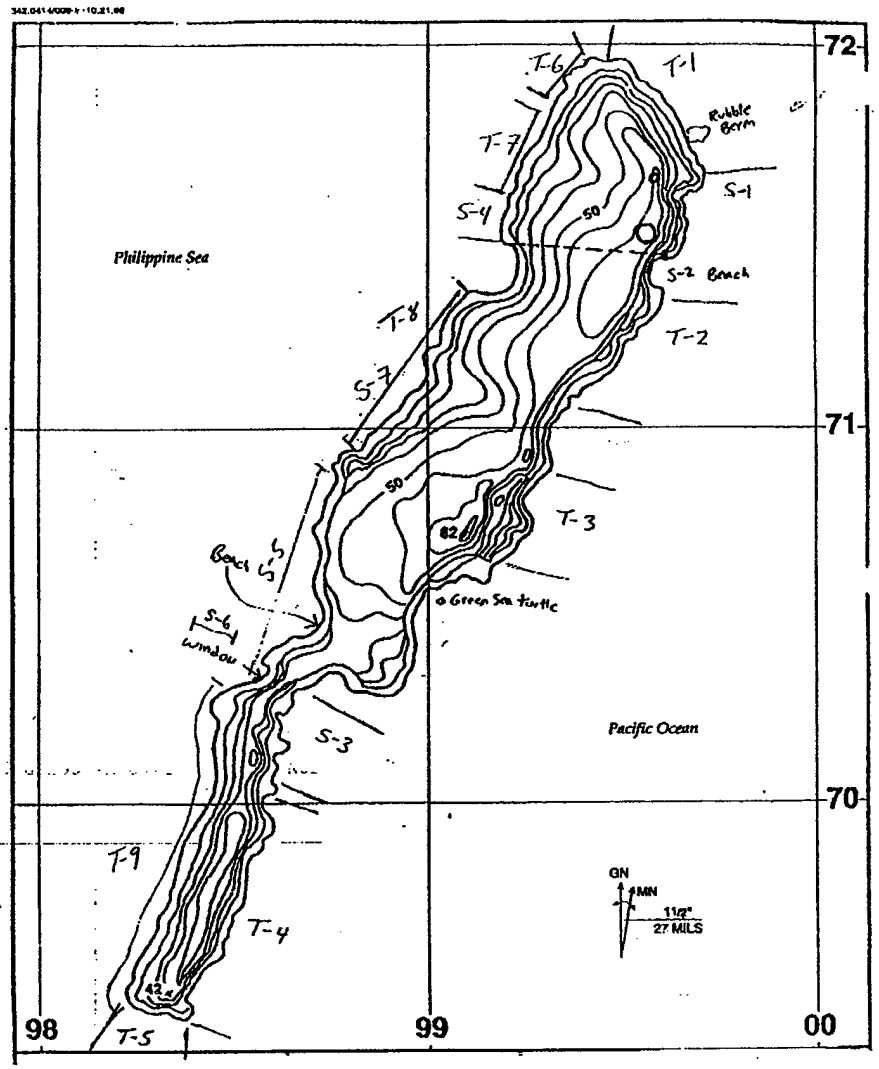

Figure 1. Farallon de Medinilla, with surveyed areas identified.

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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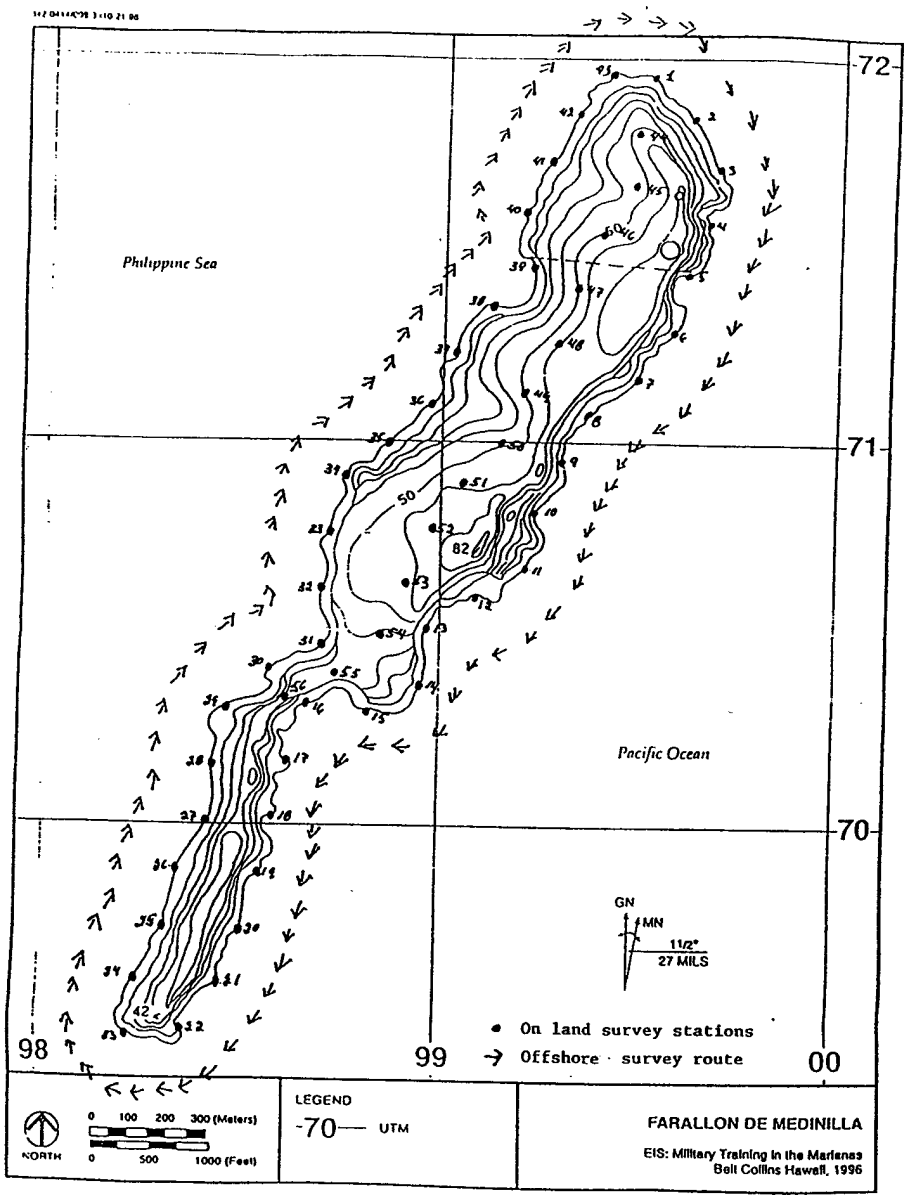

ENCLOSURE(1)

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 Sutterfield 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
PACIFIC ISLANDS ECOREGION
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BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

In Reply Refer To: mri 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

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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:

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(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

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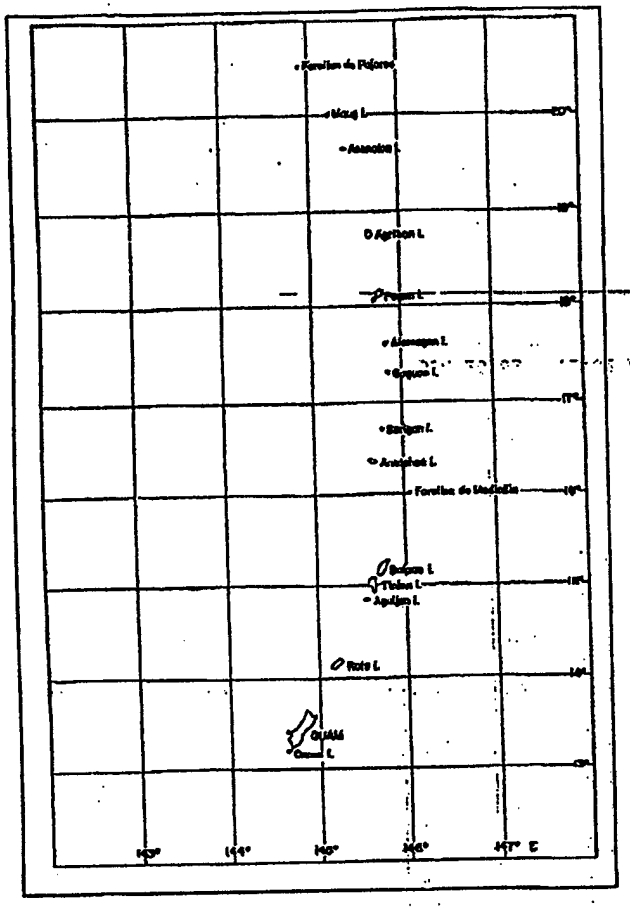

Figure 1. Mariana Islands archipelago.

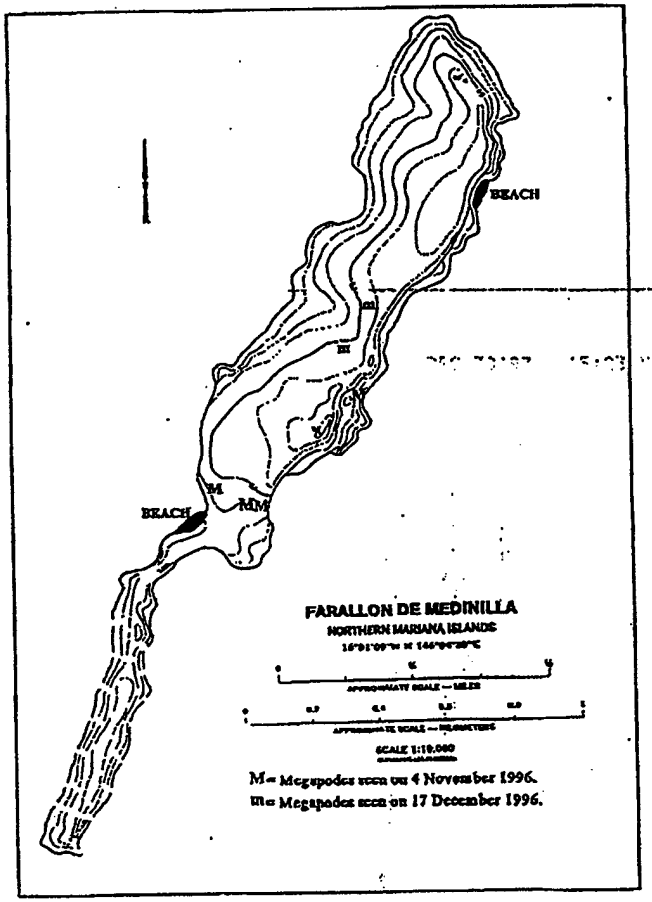

Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla (beaches not to scale).

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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
26 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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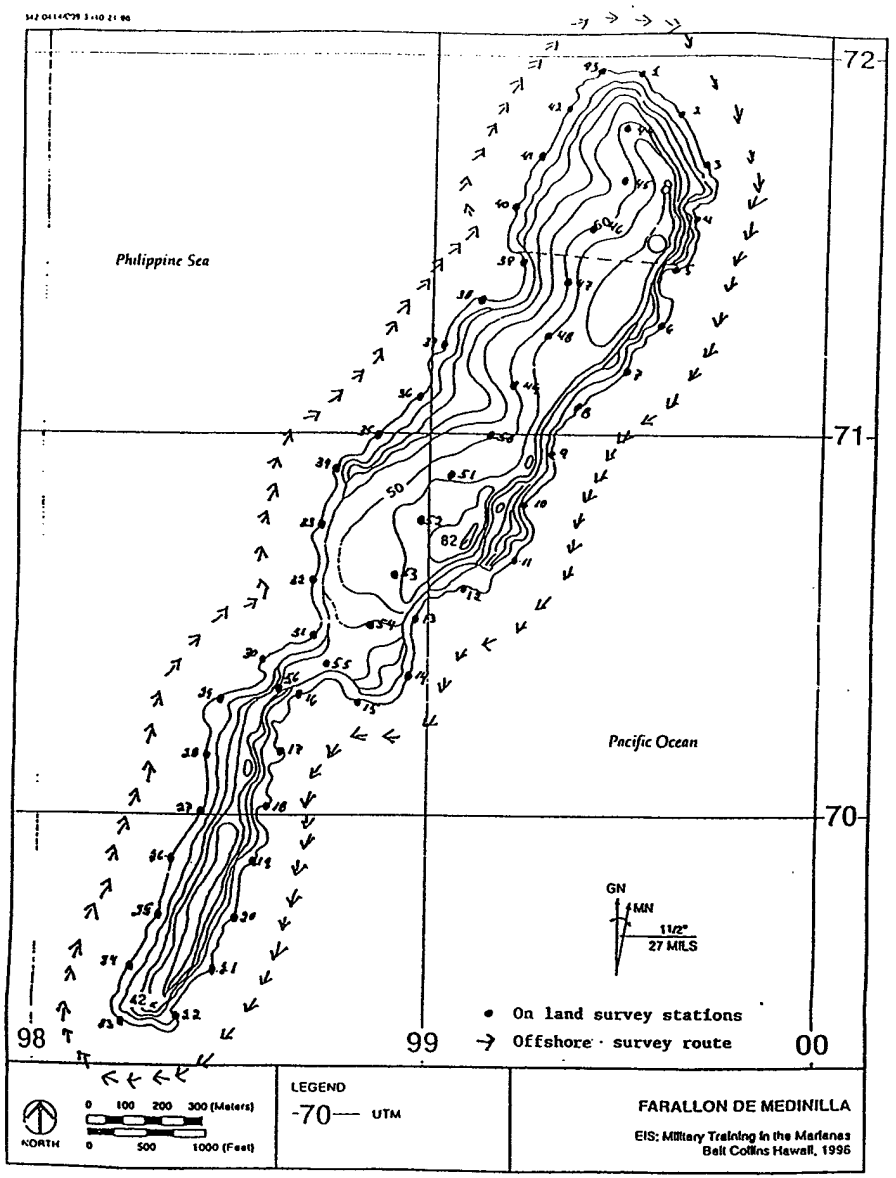
Philippine Sea
Pacific Ocean
72
71
70
98
99
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GN
MN
11/2°
27 MILS
• On land survey stations
→ Offshore survey route
LEGEND
-70— UTM
NORTH
0 100 200 300 (Meters)
0 500 1000 (Feet)
FARALLON DE MEDINILLA
EIS: Military Training in the Marianas
Belt Collins Hawaii, 1996

ENCLOSURE(1)

Appendix D-23
Biological Opinion/Conference Report of the U.S. Fish and Wildlife Service for Programmatic Aerial Bombardment, Naval Gunfire, and Small Arms Gunfire at Farallon de Medinilla, Commonweath of the Northern Mariana Islands

BIOLOGICAL OPINION/CONFERENCE REPORT
of the
U.S. FISH AND WILDLIFE SERVICE
for
PROGRAMMATIC AERIAL BOMBARDMENT, NAVAL GUNFIRE, AND SMALL ARMS GUNFIRE AT FARALLON DE MEDINILLA, COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

April 6, 1998

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United States Department of the Interior

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In Reply Refer To: mrl 1-2-98-F-03 APR 6 1998

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 and Conference Report (Log Number 1-2-98-F-03), Farallon de Medinilla (FDM), Commonwealth of the Northern Mariana Islands (CNMI).

Dear Mr. Kaku:

This represents the biological opinion and conference report 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*, and the proposed threatened Mariana fruit bat, *Pteropus mariannus mariannus*, from proposed programmatic aerial bombardment, naval gunfire, and small arms gunfire. The Department of the Navy (Navy), as the range manager, proposes to use FDM for aerial bombardment, naval gunfire, and small arms gunfire for the next three years (May 1, 1998 to May 1, 2001). In the event that the Mariana fruit bat is listed, the Navy may request that the Service adopt this conference report as a biological opinion under section 7 of the Act, provided that the reinitiation criteria at 50 CFR 402.16 do not apply.

This biological opinion and conference report is based upon 1) the Navy's December 12, 1997, letter requesting formal consultation, 2) information provided in the Service's *Draft Recovery Plan for the Micronesian Megapode* (USFWS 1997), 3) *Endangered and Threatened Wildlife and Plants; Proposed Reclassification From Endangered to Threatened Status for the Mariana Fruit Bat From Guam, and Proposed Threatened Status for the Mariana Fruit Bat From the Commonwealth of the Northern Mariana Islands* (63 FR 14641), 4) 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) 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, fruit bats, green sea turtles, and hawksbill sea turtles, 7) a site visit to FDM on November, 4, 1996, 8) a January 8, 1997, memorandum from Tim Sutterfield (Navy) summarizing the results of a site visit on December 16-17, 1996, 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, 10) a July 8-10, 1997, marine resources survey of FDM, 11) 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, 12) 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, 13) personal communication with Tim Sutterfield assessing impacts to megapodes as a result of training activities on FDM outlined in a January 12, 1998, letter to the Service, and 14) a March 20, 1998, memorandum from Melvin Kaku assessing impacts to the fauna of FDM as a result of the training activities carried out at FDM on February 23, 1998.

The log number for this consultation and conference is 1-2-98-F-03. 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, for ship to shore gunnery practice on August 27, 1997, and aerial bombardment and small arms gunfire on December 12, 1997. The Service completed biological opinions for these actions on January 29, 1997, May 16, 1997, September 11, 1997, and December 30, 1997, respectively. In the January 29, 1997, 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, 1997, 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. Both the September 11, 1997, and December 30, 1997 biological opinions concluded that the authorized take in the May 16, 1997, biological opinion had been met and anticipated the loss of any remaining or newly arrived adult and juvenile megapodes and their nests. Neither the September 11, 1997, nor the December 30, 1997, biological opinions authorized take for sea turtles because it was determined during a July 8-10, 1997, marine resources survey conducted by the Navy, the Service, and the National Marine Fisheries Service (NMFS), that the beaches on FDM were unsuitable for sea turtle nesting (Naughton 1997). In all four biological opinions the Service determined that the level of take was not likely to jeopardize the continued existence of the Micronesian megapode and in the January 29, 1997, and May 16, 1997, biological opinions the Service determined that the level of take was not likely to jeopardize the continued existence of the green sea turtle or hawksbill sea turtle. This conference report represents the first consultation of the Navy with the Service in regards to the proposed threatened Mariana fruit bat. The Mariana fruit bat was proposed as threatened within the CNMI on March 26, 1998 (63 CFR 14641).

Beginning with the first FDM training consultation initiated by the Navy on December 6, 1996, the Service has requested that the Navy initiate a programmatic consultation to cover all routine and continuing training activities on FDM. The Service believed that completion of a

programmatic consultation would alleviate the burden of addressing individual training exercises that are similar in nature. This consultation represents the fulfillment of the Service's request. The Navy initiated programmatic section 7 consultation in a letter received on December 12, 1997.

BIOLOGICAL OPINION/CONFERENCE REPORT

Description of the Proposed Action

The Navy proposes to engage in periodic strategic and tactical bombing, naval gunfire, and small boat gunfire over the next three years on FDM, CNMI. Approximate training tempo and ordnance delivered would consist of:

a. Strategic bombing: U.S. Air Force bombers may fly to FDM up to 160 days per year, with up to 2 range sorties per day (320 range sorties). A total of 5 to 612 live and/or inert ordnance may be dropped per month, with lower numbers being more typical.

b. Close air support bombing: Fighter/attack aircraft may drop a maximum of 80 air-to-surface missiles, 840 air-to-surface rockets (400 2.75-inch, 400 5-inch, and 40 AT-4s), and 4,020 conventional high explosive and inert bombs, of which 1,400 would be small (250 to 500 pounds), and 1,240 would be large (1,000 to 2,000 pounds). This ordnance would be delivered over the course of three, three-week U.S. Marine Corps exercises per year, four, five-day exercises in support of aircraft carriers per year, and five annual seven to fourteen day combined forces exercises.

c. Naval gunfire: Naval guns may fire approximately 1,040 5-inch shells and 400 76-millimeter (mm) shells per year. The exercises would probably occur monthly, with each lasting several days.

d. Small arms fire from raider boats: small groups may fire 7.62-mm and .50 caliber sniper rifles (about 50,000 and 600 rounds per year, respectively) as well as 40-mm grenade launchers (2,600 rounds per year) at the cliffs and, indirectly, to the top surface of the island. These exercises would occur approximately four times per year and last one day each.

It is possible that aerial bombardment, naval gunfire, and small arms gunfire will occur at night. Exercises described above will use small caliber arms and will deploy bomb tonnage similar to those exercises covered under the four previous consultations.

As part of the *Conservation Recommendations* in the January 29, 1997, biological opinion, the Service recommended that the Navy consider funding megapode conservation and recovery projects in the Mariana islands. The Navy has agreed to program funding for this project, up to $100,000 per year for three years. Their participation in this program is now included as part of the project description for the programmatic consultation.

Biology and Population Status of the Species

Although the Micronesian megapode and Mariana fruit bat are the only known listed and proposed species to occur on FDM, there are several other rare or sensitive species that have been recorded on FDM. FDM 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). FDM also provides habitat for migratory shorebirds, including bristle-thighed curlews (*Numenius tahitiensis*), whimbrels (*Numenius phaeopus*), ruddy turnstones (*Arenaria interpres*), and lesser golden-plovers (*Pluvialis dominica*) (Lusk and Kessler 1996). All of these seabirds and migratory shorebirds are protected under the Migratory Bird Treaty Act of 1918 [16 U.S.C. 703-712; 40 Stat. 755], as amended.

FDM is not known to have any endangered or threatened plants, and only two plant species that might be considered rare or uncommon have been recorded there. Seaside cotton (*Gossypium hirsutum* var. *taitense*) has a patchy distribution throughout the Pacific and bunch grass (*Digitaria gaudichaudii*) has only been recorded approximately twice before in the Marianas (Whistler 1996). No true wetlands are known to occur on the island (Whistler 1996).

Although the beaches on FDM are too small and overwashed to provide sea turtle nesting habitat, sea turtles are known to occur in the waters surrounding FDM (Naughton 1997). Marine mammals are also likely to occur in the waters surrounding FDM (Michael Molina, U.S. Fish and Wildlife Service, personal communication 1998). Both of these species will be covered by the National Marine Fisheries Service in a separate programmatic consultation with the Navy.

a) Micronesian Megapode

The Micronesian megapode is the only species addressed in this biological opinion that is currently listed. The Micronesian megapode was listed as endangered on June 2, 1970 (35 FR 8491). This species formerly occurred on all of the islands in the Marianas archipelago (Figure 1) but was extirpated from Guam, Rota, and Saipan in the 19th and early 20th centuries. Currently, it is found on 12 islands with population estimates as follow: 10-15 megapodes on the island of Aguiguan, less than 10 on Tinian, 10-25 on Saipan, less than 10 on FDM, 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 1997) 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

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 extirpations 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.

b) Mariana Fruit Bat

The Mariana fruit bat was proposed as threatened throughout the Marianas archipelago on March 26, 1998 (63 FR 14641). Should this listing action go final, the fruit bats on Guam, which are currently listed as endangered (49 FR 33881) will be downlisted to threatened and all other fruit bats in the Marianas archipelago will be protected as threatened species. Although the status of the Mariana fruit bat prior to the 20th century is unknown, it likely occurred throughout the Mariana Islands and was probably common on the larger southern islands in the archipelago. Currently, there are estimated to be between 200 and 750 animals on Guam (Wiles 1996, Wiles et al. 1995), 25 to 125 animals on each of the islands of Aguijan, Saipan, and Tinian (Lemke 1984, Wiles 1996, Worthington and Taisacan 1996, Marshall et al. 1995), 1,000 on Rota (Worthington and Taisacan 1996), and a minimum of 7,450 bats on the smaller islands north of Saipan (Anonymous 1984, Wiles et al. 1989). Bats may be uncommon on some of the smaller islands such as Maug, Uracus, and FDM, but are known to occur on all of them (USFWS 1998). Based on these figures, the total population for the Mariana Islands is estimated to be at least 8,725 animals, although this figure is based on very rough estimates from the northern Mariana Islands. Evidence indicates that bats move regularly between the larger southern islands and at least annually between the more remote northern islands (Wiles and Glass 1990, Worthington and Taisacan 1996, Wiles et al. 1989, G. Wiles, pers. comm. 1997). For the purposes of conservation, individual island subpopulations of fruit bats in the Mariana islands should be considered and managed as one contiguous population (Lemke 1986, USFWS 1990, Wiles and Glass 1990, Worthington and Taisacan 1996).

The Mariana fruit bat is a medium-sized fruit bat in the family Pteropididae weighing 0.66 to 1.15 pounds (330 to 577 grams) and has a forearm length ranging from 5.3 to 6.1 in (13.4 to 15.6 cm); males are slightly larger than females (USFWS 1998). The rounded ears and large eyes give a canine-like appearance, giving rise to the nickname "flying foxes." The Mariana fruit bat is highly colonial, forming colonies of a few to over 800 animals (Pierson and Raincy 1992, Wiles 1987a, Worthington and Taisacan 1995). The bats group themselves into harems (one male and

two to 15 females) or bachelor groups (predominately males); or reside as single males on the edge of the colony (Wiles 1987a). Reproduction is believed to occur throughout the year on Guam, with no apparent peak in births (Wiles 1987a). Female bats of this family generally have one young per year, resulting in a slow recovery rate when populations are reduced in numbers (Pierson and Raincy 1992). Mariana fruit bats forage and roost primarily in native forest, and occasionally in coconut groves and strand vegetation (Wiles 1987b, Worthington and Taisacan 1996). At least 22 plant species are used as food sources by the Mariana fruit bat, including fruits of 17 species of plants, the flowers of seven, and leaf stems and twig tips of Artocarpus spp. (USFWS 1990, Wiles 1987a).

Fruit bat populations on Guam have been reduced possibly due to the introduction of firearms (Coultas 1931) and the brown tree snake (Wiles 1996, Wiles et al. 1995). Loss of habitat through the effects of typhoons, development projects, and the introduction of feral rats, pigs, and goats has also contributed to the decline of this species throughout the Marianas (Kessler 1997, Marshall et al. 1995, USFWS 1998). Throughout both the inhabited southern and uninhabited northern islands, poaching continues to be one of the most important factors in the decline of the Mariana fruit bat (Glass and Taisacan 1988, Lemke 1992b, Marshall et al 1995, USFWS 1990, Worthington and Taisacan 1996, UFWS 1998).

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 Megapode

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. Megapodes may have emigrated to FDM since 1996, or reproduction on the island may have occurred since then, but recruitment levels through either of these avenues has not been determined. In regards to immigration, the nearest island to FDM with a substantial megapode population, Anatahan, is approximately 50 miles away. No nesting has been recorded on FDM, but the possibility does exist.

b) Mariana Fruit Bat

Two fruit bats were observed roosting in low shrubs on FDM by Tim Sutterfield, Fish and Wildlife Biologist for the Navy, during a site visit in December 1996 (Sutterfield *in lit.* 1997). These two bats probably do not represent a permanent roosting or breeding colony. Although some of the vegetation on the island may provide forage for bats, the low, shrubby nature of the vegetation makes it unlikely that bats utilize FDM for more than a temporary roosting site during travel between larger islands. No roosting or flying bats have been reported from FDM during other site visits or during pre- or post-training helicopter surveys, as would be expected if large numbers of bats were utilizing FDM on a regular basis. The two bats observed on FDM represent a minute fraction of the total population for the Mariana islands.

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 (SOCEX exercises scheduled for January/February 1998 were canceled). Before and after the January 1997, and May 1997, exercises, Tim Sutterfield conducted helicopter surveys in accordance with the Terms and Conditions of the January 29, 1997, and May 16, 1997, biological opinions. A helicopter survey was conducted by a Navy Fish and Wildlife Biologist before the September exercise in accordance with the September 11, 1997, biological opinion, and a fixed-wing aircraft survey was conducted by a Navy biologist after the exercise. None of the surveys revealed any direct evidence of death or injury to megapodes or fruit bats. 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. Death or injury to fruit bats would be equally difficult to ascertain from aerial surveys for similar reasons. On-the-ground surveys are not permitted by the Navy due to the high incidence of unexploded ordnance distributed over the island.

Effects of the Action

The primary concerns of the Service with regard to the effects of aerial bombardment and small arms gunfire practice on the Micronesian megapode and Mariana fruit bat are (1) direct death of megapodes and fruit bats, (2) destruction or abandonment of active megapode nests, (3) abandonment of juvenile fruit bats by mothers, and (4) destruction of required foraging, roosting, and/or 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). The Service believes the August 2, 1997, survey to be representative of the type of damage that can occur during aerial bombardment, naval gunfire, and/or from small arms fire such as grenade launchers or anti-tank rockets. Although fruit bats are strong fliers and likely to abandon the island once bombardment begins, there still exists the strong possibility of death or injury to roosting bats from training activities.

The impact areas for aerial bombardment, naval gunfire, and small arms gunfire cover the entire

area of FDM. Therefore the Service anticipates the possible direct death of any remaining megapodes and destruction of their nests, and the death of any fruit bats occurring on the island during the next three years of 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 or Mariana fruit bats.

Conclusion

After reviewing the current status of the Micronesian megapode and Mariana fruit bat, the environmental baseline of these 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, 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. 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 believes that the last two military 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. The military exercise covered under the December 30, 1997, biological opinion (#1-2-98-F-02) was not conducted. We anticipate that any megapodes still present on FDM, or that may colonize the island prior to the onset of any of the military exercises covered under this biological opinion over the next three years, may also be incidentally taken. We also anticipate that any bats present on the island at the time of commencement of military activities covered under this conference report over the next three years may also be incidentally taken. However, because the inability to conduct on-the-ground surveys precludes exact analysis, the Service authorizes take for both megapodes and bats 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 or Mariana fruit bat because, even if all of the megapodes and/or bats are extirpated from FDM, such losses do not represent a threat to the stability of the overall populations of the species 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 and Mariana fruit bats will be minimized.

The Navy will minimize take of adult and juvenile megapodes and fruit bats, and minimize disruption to breeding activities (including destruction of any active megapode 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 term and condition, which implements 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 western cliff faces, to the extent possible.

(2) The Navy shall prohibit the use of cluster bombs in training on FDM.

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 or fruit bats slows the recovery of these species and represents an adverse effect. Further, destruction of nesting, foraging, and/or roosting habitat for megapodes and fruit bats by shell impacts or by resulting fires 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 these losses of individuals and habitat, the Service recommends that the Navy fund conservation and recovery projects for the megapode and fruit bats in the Marianas. Examples of conservation and recovery projects that should be considered for funding by the Navy include: (1) efforts to eradicate feral ungulates on uninhabited northern islands, (2) surveys to assess status, distribution, and nesting/roosting areas of megapodes and fruit bats, (3) basic research into the life history and demography of the megapode and/or fruit bat, and (4) rat (*Rattus* spp.) eradication on uninhabited northern islands.

In addition, the Service recommends that the Navy monitor the effects of their training activities on megapode and fruit bat habitat and the direct take of megapodes and fruit bats whenever possible. To monitor changes in megapode and fruit bat habitat, the Navy should monitor the extent of vegetation change on FDM by conducting helicopter overflight surveys of FDM with two qualified biologists at least twice a year during each of the three years covered by this biological opinion. One of the biologists on the flight should be a biologist familiar with megapode and/or fruit bat foraging, breeding, and roosting habitat. To assess the direct take of megapodes and fruit bats, if the Navy can ever safely conduct an on the ground reconnaissance mission of any type on FDM, the Navy should allow at least one biologist familiar with megapode and/or fruit bat biology to accompany the Navy reconnaissance team on the ground.

In order to minimize and avoid impacts to nesting and roosting seabirds colonies on FDM, the Service recommends that the Navy concentrate impacts on the southern portion, or within the central interior portion of the island. The Navy should also consider establishing 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) 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, (2) 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 (3) a new species is listed or critical habitat designated that may be affected by this action.

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
USFWS, Region I, Larry Salata

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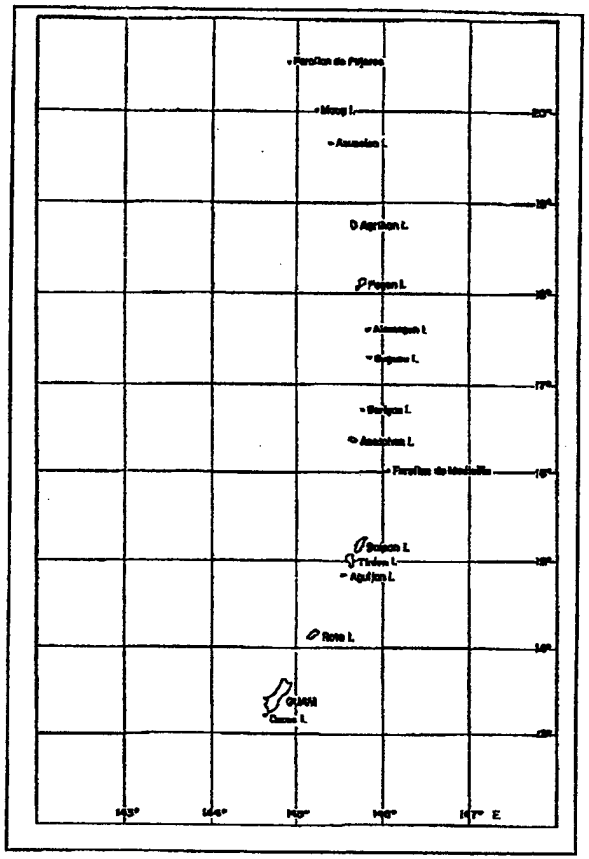

Figure 1. Mariana Islands archipelago.

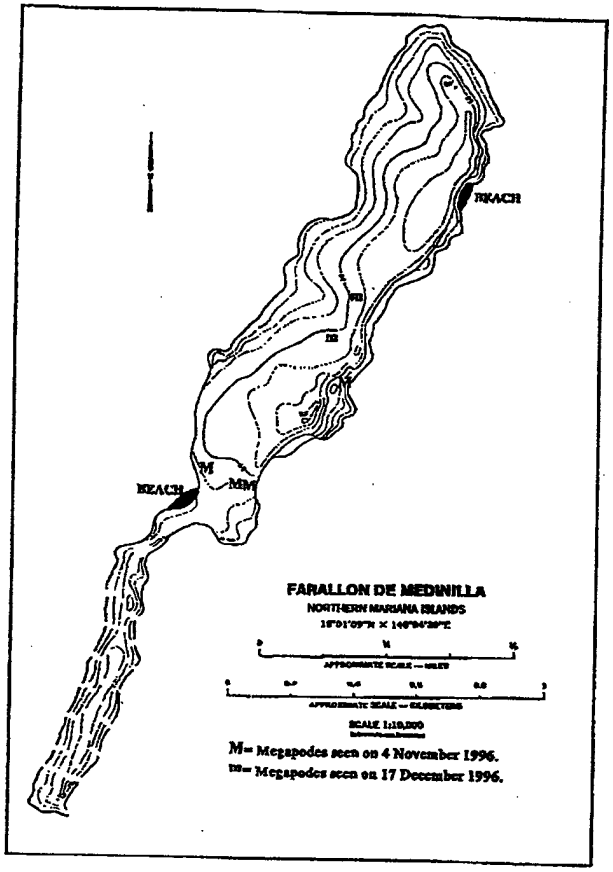

Figure 2. Location of megapode sightings and beaches on Farallon de Medinilla (beaches not to scale).

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Appendix D-24
Biological Opinion and Conference Report (Log Number 1-2-98-F-07), Military Training in the Marianas

United States Department of the Interior
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Pacific Islands Ecoregion
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In Reply Refer To: 1-2-98-F-07 (LTG)

JAN - 4 1999

Mr. Fred Minato
Environmental Planning Division
Pacific Division, Naval Facilities Engineering Command
Building 258 Makalapa
Pearl Harbor, Hawaii 96860-7300

RE: Biological Opinion and Conference Report (Log Number 1-2-98-F-07), Military Training in the Marianas

Dear Mr. Minato:

This responds to your August 19, 1998, request for formal consultation under section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, Stat. 884), as amended (Act), relative to military (*i.e.*, Air Force, Navy, Guam National Guard, Army Reserve, and Marine Corps) training activities on the islands of Guam, Rota, Tinian, and Farallon de Medinilla in the Mariana Islands. The Department of Defense (DOD) is the action agency for this project. This document represents the Service's biological opinion (BO) on the effects of the proposed project on the endangered hawksbill sea turtle (*Eretmochelys imbricata*), Micronesian megapode (*Megapodius laperouse*), the threatened Tinian monarch (*Monarcha takatsukasae*) and green sea turtle (*Chelonia mydas*), and conference report on the effects of the proposed project on the proposed Mariana fruit bat (*Pteropus mariannus mariannus*) within the Commonwealth of the Northern Mariana Islands (CNMI) in accordance with section 7(a)(2) of the Act. Potential effects to the federally endangered Guam rail (*Rallus owstoni*), Mariana crow (*Corvus kubaryi*), Guam swiftlet (*Collocalia bartschi*), Mariana common moorhen (*Gallinula chloropus guami*), and Hayun lagu tree (*Serianthes nelsonii*) were also identified. However, the Service has concurred that the proposed military training activities are not likely to adversely affect these species.

Your August 19, 1998, request for formal consultation was received on August 21, 1998. This biological opinion and conference report is based on the following information: 1) the June 1998 draft environmental impact statement (DEIS) for Military Training in the Marianas; 2) previous biological opinions; 3) the biological literature (see References Cited section at the end of the document); and 4) other information sources. Our log number for this consultation is 1-2-98-F-07. Copies of pertinent materials and documentation are maintained in an administrative record in the Service's office in Honolulu, Hawaii.

Consultation History

The following are summaries of previous section 7 consultations regarding military training activities in the Mariana Islands applicable to the proposed action and a description of correspondence for the proposed action.

On May 2, 1984, the Service issued a BO (1-2-84-F-26) to the Navy addressing the potential impacts of "Kennel Bear" exercises on Tinian on federally listed species, including the Tinian monarch. These activities included unloading and loading of personnel, supplies, and equipment from C-130 aircraft, clearing of vegetation for establishing bivouac camps, setting up a perimeter defense around camps, and firing of weapons at the firing range. These activities were to occur twice each year for one to two weeks each time.

On July 17, 1984, the Service issued a BO (1-2-84-F-44) to the Navy addressing the potential impacts of Marine Corps exercises on Tinian on federally listed species, including the Tinian monarch. These activities included unloading and loading of personnel, supplies, and equipment from and on C-130 aircraft, establishing bivouac camps, firing of weapons at firing ranges, and tactical airdrops. The training involved approximately 400 persons and was to occurr approximately three times per year for four weeks each.

On July 25, 1989, the Service issued a BO (1-2-89-F-47) to the Navy addressing the potential impacts of helicopter training on Anderson Air Force Base, Guam. The federally listed species at issue was the Mariana crow.

On May 4, 1990, the Service issued a BO (1-2-90-F-003) to the Navy addressing the potential impacts of engineering field survey work needed prior to the construction and operation of the Relocatable Over-the-Horizon Radar Project P-225 on Guam (WESTPAC Finegayan) and in the northern portion of Tinian. The federally listed species at issue were the Tinian monarch, Mariana crow, and the Mariana fruit bat.

On August 15, 1990, the Service issued a BO (1-2-90-F-024) to the Navy for reinitiation of consultation for the construction of the P-223 radar transmitter facility on Tinian due to an increase in the number of acres of forest to be cleared. The federally listed species at issue was the Tinian monarch.

On June 22, 1992, the Service issued a BO (1-2-92-F-07) to the Navy addressing the potential impacts of VRC-50 flight squadron field carrier landing practice (FCLP) at Anderson Air Force Base, Guam. The federally listed species at issue were the Mariana crow and the Mariana fruit bat.

On July 30, 1993, the Service issued a BO (1-2-93-F-14) to the Navy addressing the potential impacts from the Navy's permanent relocation of the VRC-50 Squadron to Andersen and the need to conduct VRC-50 flight squadron field carrier land practice (FCLP) training missions. The federally listed species at issue were the Mariana crow and Mariana fruit bat.

On June 27, 1994, the Service issued a BO (1-2-94-F-05) to the Navy addressing the potential impacts of including aircraft training operations by carrier air wing CVW-5, at Anderson Air Force Base, Guam. The federally listed species at issue were the Mariana crow and the Mariana fruit bat.

On September 3, 1994, the Service issued a BO (1-2-94-F-06) to the Navy addressing the potential impacts of performing air operations, including field carrier landing practices (FCLPs) with aircraft from a transiting carrier air wing (CVW) at Andersen Air Force Base, Guam. The federally listed species at issue were the Mariana crow and the Mariana fruit bat.

On February 28, 1996, the Service responded to the DOD's Notice of Intent to prepare the Draft Environmental Impact Statement (DEIS) for Marianas Military Training Plan for the Territory of Guam and the Commonwealth of the Northern Marianas Islands (CNMI). In our response, we stated that the DEIS should describe endangered and threatened species, migratory fishes and birds, and rare, and native species to be affected by the proposed project, and assess the impacts to these species and identify appropriate mitigation measures, as well as address the possible introduction of the brown treesnake (*Boiga irregularis*) into the CNMI. We also recommended that section 7 consultation be initiated prior to issuance of the DEIS. The U.S. Pacific Command was identified as the lead agency for the proposed project and the Pacific Division, Naval Facilities Engineering Command as the coordinating agency.

On January 29, 1997, the Service issued a BO (1-2-97-F-01) to the Navy addressing the potential impacts of aerial bombardment and gunnery training over a four week period in February and/or March 1997 on Farallon de Medinilla (FDM). The federally listed species at issue were the Micronesian megapode, the green sea turtle, and the hawksbill sea turtle.

On April 16, 1997, the Service provided comments on the DEIS for Military Training in the Mariana Islands (January 1997 version) to the Department of the Interior (DOI). The Service recommended that a revised DEIS be prepared due to numerous deficiencies. In August 1998, the Service received the Revised DEIS for Military Training in the Marianas (June 1998 version) and provided comments to the DOI on September 21, 1998.

In an informal consultation dated May 2, 1997 with the U.S. Air Force, overflight conditions for activities at AAFB were negotiated in order to establish a not likely to adversely affect determination for the Mariana crow and Mariana fruit bat.

On May 16, 1997, the Service issued a BO (1-2-97-F-05) to the Navy addressing the potential impacts of gunnery training and aerial bombardment from July 21, 1997 to August 1, 1997, on FDM. The federally listed species at issue were the Micronesian megapode, green sea turtles, and hawksbill sea turtles.

On September 11, 1997, the Service issued a BO (1-2-97-F-08) to the Navy addressing the potential impacts of ship to shore gunnery practice during September 1997, on FDM. The federally listed species at issue were the Micronesian megapode, green sea turtle, and the hawksbill turtle.

On December 30, 1997, the Service issued a BO (1-2-98-02) to the Navy addressing aerial bombardment and small arms gunfire during January and February 1998 on FDM. The federally listed species at issue were the Micronesian megapode and the Mariana fruit bat.

On April 6, 1998, the Service issued a BO (1-2-98-03) to the Navy addressing aerial bombardment, naval gunfire, and small arms gunfire for the next three years on FDM. The federally listed species at issue were the Micronesian megapode and the proposed Mariana fruit bat.

On August 21, 1998, we received a request from the Department of the Navy on behalf of the Department of Defense to initiate section 7 consultation regarding Military Training in the Marianas. On October 2, 1998, the Service wrote a letter stating that the BO would be delivered on or before January 13, 1999 (should have stated January 2, 1999) and that all information required for the consultation was available.

BIOLOGICAL OPINION/ CONFERENCE REPORT

I. Description of the Proposed Action

A. Proposed Action

The following descriptions of the proposed military training actions are taken from the June 1998 Draft Environmental Impact Statement for Military Training in the Marianas and proposed action modifications and clarifications identified in Navy biologist Tim Sutterfield's October 1 and October 19, 1998 electronic mail messages to Assistant Field Supervisor Karen Rosa.

Guam

a) Waterfront Annex

The Waterfront Annex includes Orote Point and most of the shoreline of the Inner and Outer Harbors of Apra Harbor.

Ongoing or continuing activities at the Waterfront Annex include general field maneuvers, logistics support, aviation training, amphibious landing training, live fire

ranges, and underwater demolitions. Field maneuvers are defined as all general military training that occur on land, with the exception of live weapons fire and aviation-related activities. This includes tactical maneuvers on foot, travel in wheeled and tracked vehicles, use of signals and flares, clandestine raiders, rappelling, bivouacs, nuclear biological and chemical (NBC) training, and other miscellaneous activities. A training group for a field maneuver activity may consist of one to 2,000 individuals. Ongoing aviation training includes helicopter insertion and extraction, paradrops, firefighting bucket off loading, search and rescue, and cast and recovery training. Other ongoing training activities include amphibious landings of Landing Craft Air Cushions (LCAC), Landing Craft Utility (LCU), and Amphibian Assault Vehicles (AAV), riverine training, live fire ranges (*i.g.*, small arms known range, distance range, pistol range), and underwater demolitions.

Proposed or new training includes field maneuvers (stress course and rapid runway repair), aviation training, amphibious landing training, underwater demolition training, and live fire ranges. Proposed new aviation training includes forward area refueling near the small arms range and helicopter insertions and extractions in the North Tipalao rappelling area. Proposed new amphibious training includes LCAC landings at Tipalao, Dadi, and Toyland beaches; AAV landing sites at Sumay Cove Marina, the former WWII refueling pier, Tipalao, Toyland, Polaris Point, and Drydock Island beaches; and LCU landing sites at Sumay Cove Marina, the former WWII refueling pier, and Polaris Point and Toyland beaches. A new fire and maneuver range, skeet range, and shooting house is proposed for the southern section of Orote Point. One new deep-water underwater demolition training area is proposed offshore from Dadi Beach and three new shallow-water underwater demolition training sites are proposed (Tipalao, Spanish Steps, west tip of Outer Apra Harbor breakwater).

b) Ordnance Annex
The Ordnance Annex is located in the southern half of Guam and covers 36 square kilometers (sq km). Fena Reservoir, Guam's major surface water body, is located within Ordnance Annex.

Ongoing or continuing activities include field maneuvers, logistics support, and aviation training. Field maneuvers and logistics support training involve water purification, land navigation, small unit reconnaissance patrolling, command post exercises, and bivouac (small to medium). Ongoing aviation training involves using existing helicopter landing zones to land and recover embarked personnel and equipment, personnel insertions and extractions, simulated Tactical Recovery of Aircraft and Personnel (TRAP) and Close Air Support (CAS) in areas north of the ammunition storage area, and using Fena Reservoir to train helicopter crews to load an external fire bucket.

New proposed training activities include paradrops and live firing ranges. Proposed paradrops will use an existing drop zone for small groups of troops delivered from helicopters. A new range area that contains a sniper range, breaching house, jungle trail range, and one SDZ is proposed for the entire southern portion of the Ordination Annex.

c) Andersen Air Force Base and Communication Annexes
Andersen Air Force Base (AAFB), Andersen South, and the two Communication Annexes (*i.e.*, Barrigada and Finegayan) comprise 92 sq km. A National Wildlife Refuge Overlay has been established over much of northwest AAFB and an Ecological Reserve Area has been established at the Communications-Annex Finegayan, including Haputo Beach.

Ongoing training activities include the continued use of the area for field maneuvers, aviation training, Explosive Ordnance Disposal (EOD) demolition, and live fire training.

The proposed new training activities involve the rapid runway repair to be conducted on a former taxiway of Northwest Field, fire bucket off loads in the Main Base area, and the use of mortars (training rounds) at the small arms range at AAFB's Tarague Beach.

Non-DOD Lands

a) Guam
The continuing activity involves the Army National Guard conducting parachute jumps at the Casper and Ghost Drop Zones, near NASA Road in Talofofo on private land in Dandan. This training is conducted bimonthly in small units (typical training unit of 24 personnel).

b) Rota
Continuing activities on Rota include the use of a small island in Songsong Harbor for a small forward staging base for approximately 7 days per month.

Tinian

The action area for military training activities (proposed and ongoing) on Tinian occurs within the Military Lease Area (MLA) and a portion of the southern one-third of Tinian. The MLA consists of the northern two-thirds of the island of Tinian. On the southern one-third of the island troops are brought into the MLA via West Tinian Airport or San Jose Harbor. Troops brought in at the airport and harbor will conduct a "movement to contact" by tactically moving north to the MLA by vehicle or by foot.

Ongoing or continuing training activities considered on Tinian include large-scale maneuvers (airfield seizure/defense and bivouacs), a variety of aviation training, and LCAC training. Ongoing aviation training includes airmobile training (airmobile landings, C-130 cargo drops), airborne training (paradrops), helicopter insertion and extraction, night vision goggle training, fighter and attack aircraft training, firefighting and forward area refueling. Ongoing amphibious landing training on Tinian includes LCAC training at Unai Chulu and Unai Dankulo beaches and LCU landings at Kammer Beach.

Proposed new activities include constructing a small logistics support base camp and new amphibious training. The new camp will be located on the eastern edge of the VOA. New amphibious landings proposed are AAV landings at Kammer and Unai Babui beaches.

After the receipt of the DEIS, several changes and clarifications concerning the training activities on Tinian were made by biologist Tim Sutterfield in his October 1 and October 19, 1998, electronic mail messages to the Service, including:

1) The fire and maneuver range was deleted from the preferred alternative;

2) The only beaches to be used for LCAC landings are Unai Chulu and Unai Dankulo beaches; Tachagna Beach will not be used;

3) No clearing of vegetation is proposed for training areas and bivouac areas; and

4) The only vegetation to be cleared is for the logistic support facility that will be located in the boundary of the VOA site and will require the clearing of 0.75 acres of grassland.

Farallon de Medinilla (FDM)
All of the military training activities on FDM were reviewed in the Service's April 6, 1998, BO (1-2-98-F-03). No new military activities for FDM are proposed in the DEIS that were not covered in this previous BO (Tim Sutterfield, personal communication 1998).

B. Actions to minimize threats to endangered and listed species

1. Brown Treesnake Control/Interdiction Plan (BTS Plan) for Military Training Exercises

Included within the DEIS is a description of the measures to be implemented by DOD to minimize the threat of further dispersal of the brown treesnake (BTS) in the Pacific due to military activities. These measures are described in the BTS Plan in Appendix E of the DEIS.

Specific measures identified in the BTS Plan are as follows:

a) The USDA Wildlife Services (WS) office on Guam is the primary agent for BTS control for the military and is responsible for the following:

1) Inspection of military cargo staged at AAFB and in Apra Harbor on Guam for BTS;
2) Maintenance of trapping and night searches at high-risk areas, airfields, and ports whether training occurs or not;
3) Providing personnel, traps, lights, bait, and guidance for military training exercises on Tinian;
4) Establishing quarantine procedures on Tinian in coordination with local wildlife and/or customs officials and performing inspections of all arriving cargo, in coordination with the CNMI Department of Fish and Wildlife. Quarantine activities required at all ports of entry include erecting temporary barriers, establishing sterile areas, and activating snake traps.
5) Delegation of manpower and dogs construct cargo containment areas (snake proof enclosures or exclosures); and
6) Providing additional information and assistance as needed.

b) Military aircraft will not be able to take off from Guam without having been properly inspected by WS;

c) All training personnel arriving on Guam for an military training exercise will be provided with an BTS information packet and briefed on the BTS hazard prior to leaving Guam for Tinian or Rota;

d) Any person sighting a BTS should attempt to kill or trap the snake and report the incident immediately to WS officials;

e) For all exercises involving interisland transport, COMNAVMARIANAS or AAFB environmental personnel will advise WS in as many days in advance as possible;

f) COMNAVMARIANAS will monitor compliance with the BTS Plan 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.

2. Mitigation for amphibious vehicle landings on turtle nesting beaches:
a) Prior to beach landings by amphibious vehicles, known turtle nesting

beaches will be surveyed by a Navy biologist for the presence of sea turtle nests no more than six hours prior to a landing;

b) Areas free of nests will be flagged, and vehicles will be directed to remain within these areas;

c) A Navy biologist will monitor beaches during any nocturnal landings.

d) If any sea 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;

e) LCAC landings on Tinian will occur during high tide, LCAC's must maintain a full cushion until they reach the top of the beach (off of the sand), and complete the initial 180 degree turn prior to coming off full cushion;

f) On Tinian surveys will be conducted before and after each LCAC landing and AAV landing at least two times per year at Unai Chulu and Unai Babui with Unai Lamlam surveyed as a control site. Navy contracted surveyors will record percent coral cover, turbidity, fish assemblage, sedimentation rates, and the topography of the site;

g) AAV landings at Unai Babui will be restricted to an established approach lane and allowed to land only during high tide and in single file.

3. Overflight conditions over AAFB to minimize impacts to the Mariana crow and Mariana fruit bat.

a) No overflights below 1,600 feet Above Mean Sea Level (MSL) are allowed over Munitions Storage Area 1.

b) For the rest of Andersen AFB, overflights would be allowed below the 1,600 foot MSL during the three- month crow non-breeding season (June through August).

c) No overflights are allowed below 1,600 foot MSL directly above crow territories during the nine-month crow breeding season (September through May). Crow territories will be determined by consultation with the Guam Division of Aquatic and Wildlife Resources.

d) Helicopters are to remain ½ nautical mile from the perimeter of the bat colony at Pati Point, with the exception of flights originating from the end of runways (similar to fixed wing aircraft operations).

4. Areas designated as "No wildlife disturbance"
Within a "no wildlife disturbance" area, the following activities are prohibited:

a) Off-road vehicular traffic;
b) Pyrotechnics or open fires;
c) Firing blanks;

d) Live ammunition or training demolition;
e) Digging;
f) Mechanical vegetation clearing;
g) Flights below 305 meters (m) (1,000 feet) AGL: and
h) Helicopter landing zones.

5. Areas designated as "No training"
Within a "no training" area, no training is allowed, except troop and vehicle movement along established roads to protect wetlands and other rare habitats.

II. Biology and Population Status of the Species

A. Species Not Likely to Be Adversely Affected

The following are summaries of the species considered by the Service during the consultation period for which no adverse effects are anticipated:

Guam rail (*Rallus owstoni*)

Guam rails have been reintroduced to Area 50, AAFB, Guam. Area 50 has been fenced and is in the process of having brown treesnakes removed from the site. The Service does not anticipate that military training activities within AAFB are likely to adversely affect the Guam rail.

Mariana fruit bat (*Pteropus mariannus mariannus*)

Fruit bats are known to forage within the Ordnance Annex on Guam. Military training activities within the sniper range could cause fruit bats foraging in the area to disperse to other areas of Guam. The Service does not anticipate that these activities are likely to adversely affect the Mariana fruit bat on Guam.

Mariana Crow (*Corvus kubaryi*)

In a July 1996 report issued by the Service to the Navy entitled *The Effects of Aircraft Overflights on Endangered Mariana Crows and Mariana Fruit Bats at Andersen Air Force Base, Guam*, the Service documented that low altitude aircraft flights (< 183 meters (m) [600 foot (ft)] Above Ground Level (AGL)) can elicit distress, cause crows to flush, and disrupt nest building, incubation, and nest attendance at least temporarily. Mariana crows also maintain year-round territories and are very susceptible to disturbance during the nest tree selection process immediately prior to the breeding season. The pre-nest building phase of the breeding season is critical for successful breeding and is generally categorized by behaviors such as increased vocalizations, allopreening, and carrying and offering sticks. Disturbance during this critical phase could preclude breeding altogether.

In an informal consultation (May 2, 1997) with the U.S. Air Force, overflight conditions for activities at AAFB were negotiated in order to establish a not likely to adversely affect determination for the Mariana crow. Overflight conditions over Andersen AFB are as follows: (1) no overflights below 487 m (1,600 ft) Above Mean Sea Level (MSL) are allowed over Munitions Storage Area 1, (2) for the rest of Andersen AFB, overflights would be allowed below the 487 m (1,600 ft) MSL during the three- month crow non-breeding season (June through August), and (3) no overflights are allowed below 487 m (1,600 ft) MSL directly above crow territories during the nine-month crow breeding season (September through May). Crow territories will be determined by consultation with the Guam Division of Aquatic and Wildlife Resources.

Guam Swiftlet (*Collocalia bartschi*)

The Guam swiftlet is endemic to the Mariana Islands of Guam, Aguiguan, and Saipan and is the only resident swift in the Mariana Islands. Guam swiftlets seem to prefer to forage above forested ridges and open grassy areas, but they forage over a wide variety of terrain and vegetation and they roost and nest in caves (Pratt *et al.* 1987, USFWS 1991). Caves are occupied throughout the year (USFWS 1991).

Guam swiftlets are found in Mahlac and Fachi Caves, and have been observed foraging along Fena Valley Reservoir and Sadog Gago River (J. Morton, USFWS, personal communication 1998), all of which are located within the Ordnance Annex on Guam. Mahlac Cave harbors what is estimated to be 90% of all swiftlets on Guam, housing between 280-300 birds (USFWS 1991). It is the only significant breeding colony that remains on Guam. Fachi Cave, located within an ammunition bunker, harbors an estimated 15-25 swiftlets (J. Morton, USFWS, personal communication 1998). Military training is not allowed within the area of these two caves. The only public access being considered for Mahlac Cave by the Navy is a recreational fishing program initiated on August 3, 1996, at Fena Lake. It is not likely that this fishing program will lead to more visitors to Mahlac Cave, due to the close supervision of the public and the distance of the lake from Mahlac Cave (L. Morton, Natural Resources Manager, Naval Activities, Guam, personal communication 1996). It is also important that the name of the cave be omitted from any published reports, as the name may serve as a locational guide to persons familiar with the location of Mahlac Stream, which flows through the east side of the Navy base near the cave. The Navy has previously agreed to omit locational information (Biological Opinion 1-2-96-F-06).

Military training activities within the sniper range (Ordnance Annex) would likely cause swiftlets foraging within the lower portion of Fena Valley Reservoir or along Sadog Gago River to disperse to other foraging grounds. Therefore, the Service has determined that the proposed project is not likely to adversely affect the Guam swiftlet.

Mariana Common Moorhen (*Gallinula chloropus guami*)

Moorhens in the Mariana Islands are found primarily at freshwater human-made and natural wetlands that are both seasonal and permanent. Occasionally, they are recorded in brackish water wetlands. The current total estimated population of Mariana common moorhens in the Mariana Islands is approximately 300 to 400 birds (USFWS 1996a). Within the action area, Lake Hagoi, Mahalang, and Bateha Wetlands on Tinian and four wetlands each within the Ordnance Annex and the Waterfront Annex on Guam support moorhens. Lake Hagoi supports approximately 40 birds (USFWS 1996a) and is designated as a "no training" area by the military. The only military training activities allowed within a "no training" area are troop and vehicle movements along established roads. It is anticipated that military training will not affect moorhens using Lake Hagoi. Mahalang and Bateha Wetlands are estimated to support no more than 10 moorhens (USFWS 1996a). Military training activities near these wetlands would likely cause moorhen to temporarily disperse to other wetlands.

Riverine training in Atantano River (Waterfront Annex) is expected to occur seven days a month and involve 16-20 people. The area surrounding the proposed training area is a mangrove swamp and is known to occasionally support moorhen (M. Ritter, USFWS, personal communication 1998). The mangrove swamp is designated as a "no training" area; however, it is anticipated that military training activities in the Atantano River could cause moorhen using the mangrove swamp to disperse to another wetland. There is no military training proposed or ongoing that will affect the other three wetlands known to support moorhen within the Waterfront Annex.

There are four wetlands within the Ordnance Annex that provide habitat for the moorhen. Two seasonal wetlands are located within a "no training" area and the majority of Fena Reservoir is within a "no wildlife disturbance area." A "no wildlife disturbance" designation is described as an area in which the following are prohibited: off-road vehicular travel, pyrotechnics, demolition, digging, mechanical vegetation clearing, flights below 305 m (1,000 ft) AGL, and helicopter landing zones. Heliborne firebucket (onload) and combat swimmer training occur within the northern portion of Fena Valley Reservoir, which is not known to support moorhen. There are no proposed or ongoing military training exercises affecting the fourth wetland within the Ordnance Annex. It is anticipated that no moorhens within the Ordnance Annex will be affected by ongoing or proposed military training activities. However, it is anticipated that military activities in Atantano River on Guam and near Mahalang and Batcha Wetlands on Tinian could cause moorhens using the wetlands to temporarily disperse to another part of the wetland or another wetland. It has been determined that the proposed training exercises are not likely to adversely affect the Mariana moorhen:

Serianthes nelsonii

Two populations of *Serianthes nelsonii* are known from Rota and Guam. All remaining individuals of *Serianthes nelsonii* occur in native limestone forest on soils derived from limestone substrates, with most trees growing on or near steep hillsides or cliffs. However, the species formerly inhabited sites with volcanic soils in southern Guam (USFWS 1993). There were 122 individual plants known in 1993 (USFWS 1993). Currently, there is one mature tree remaining on Guam on Anderson Air Force Base on top of the sea cliffs at Ritidian Point and three seedlings persist on Northwest Field in the vicinity of the tree that was destroyed in 1992 during Typhoon Omar (G. Hughes, USFWS, personal communication 1998; Wiles *et al.* 1995). The mature tree is enclosed within a 3,048 square m (10,000 square ft) fence and the three seedlings are contained within a protective cage to prevent browsing by ungulates. Another 121 individuals are scattered along the Sabana cliffs on Rota, primarily above the town of Songsong. However, this population does not occur within an area of ongoing or proposed military activities. The Service has determined that the proposed project is not likely to adversely affect populations of *Serianthes nelsonii* due to the fencing that protects the mature plant on Guam from training activities and the fact that the plants on Rota do not occur within the action area.

B. Species Likely to be Adversely Affected

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle was listed as a threatened species on July 28, 1978. Green sea turtles are distributed globally throughout tropical and subtropical seas with temperatures above 20 degrees Centigrade (National Marine Fisheries Service [NMFS] 1998a), and are known to occur in the waters of the CNMI (USFWS 1996b).

Green sea turtle hatchlings average 4.7 to 5.4 centimeters (cm) (1.9 to 2.2 inches [in]) in carapace length and weigh between 22 to 31 grams (gm) (0.8 to 1.1 ounces [oz]) and can grow to more than one meter in carapace length and weigh over 100 kilograms (kg) (220 pounds [lbs]) (NMFS 1998a). The color of the green sea turtle's carapace changes as it grows from a hatchling to an adult. The dorsal side of hatchlings is black and the ventral side is pure white (NMFS 1998a). Juveniles are between 35-65 cm (14-26 in) in length have a streaked or radiating sunburst of patterns of yellowish-gold, olive, light and dark brown, reddish-brown, and black (NMFS 1998a). The color of an adult carapace varies from light to dark brown, sometimes shaded with olive, with radiating wavy or mottled markings of a darker color or with large blotches of dark brown (NMFS 1998a).

Green sea turtles greater than 30-35 cm (12-14 in) feed exclusively on macroalgae and seagrasses, while post-hatchlings and juveniles feed carnivorously (*e.g.*, invertebrates and fish eggs) (NMFS 1998a).

Wild green sea turtles have exhibited slow growth and delayed sexual maturity (NMFS 1998a). Studies have estimated that the average age for sexual maturity is at least 25 years (NMFS 1998a). Green sea turtles have been documented to migrate long distances, over 1,000 kilometers (km) (600 miles), between foraging grounds and nesting beaches (NMFS 1998a). For example, a turtle tagged on Tinian was recently sighted in the Philippines (George Balazs, NMFS, personal communication 1997). After completing migration to nesting beaches, green sea turtles lay several successive clutches of eggs during the nesting season before returning to the foraging grounds. On average the green sea turtle lays 1.8 clutches of eggs per season or up to 6 clutches. Each clutch is laid at 10 to 15 day intervals and contains approximately 100 eggs per clutch. Eggs incubate in the sand for 54 to 88 days (mean of 64.5 days). Green sea turtles are known to nest in the CNMI from January through August, which means hatching may continue into October (USFWS 1996b). Female green sea turtles migrate to breed only once every two or possibly more years.

There are no population estimates for the CNMI populations of green sea turtles, but there are some records available. 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). Fewer than ten green turtles nest on the islands of Saipan, Tinian, and Rota each year (NMFS 1998a). Turtles are also known to nest on FDM and Guam (G. Davis, Guam Department of Wildlife Resources, personal communication 1998).

The green sea turtle was listed due to its declining numbers associated with overexploitation for commercial and other purposes, habitat loss and degradation. Populations of the green sea turtle in the Pacific region have continued to decline due to directed harvest (both illegal and legal) and negative impacts to essential habitats (NMFS 1998a). Spread of fibropapilloma has also slowed the recovery of green sea turtle populations (NMFS 1998a).

Green sea turtles are known to nest on the beaches of Tinian and FDM. Amphibious landing training on several beaches of Tinian and bombing activities on FDM are likely to adversely affect the green sea turtle.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Hawksbills are usually less than 95 cm (38 in) in carapace length, which is considered relatively small. They have a narrow head with a tapering beak, thick, overlapping shell scutes, and strongly serrated posterior margin of the carapace (NMFS 1998b). Hatchlings of the hawksbills average 13.2 gm (0.5 oz) and have a tan-colored carapace, top of the head and neck, while the sides and bottom of the head and neck (including the beak) are dark grey; the dorsal and ventral sides of the fore flippers are grey with a whitish fringe around the posterior edge; the dorsal and ventral sides of the hind flippers and plastron are dark grey with two whitish ridges posteriorly on the plastron (NMFS 1998b). Juvenile hawksbill

turtles vary in color; the carapace ranges from light brown to black with varying amounts of distinct yellow streaks and blotches (NMFS 1998b). The adult has a carapace that is dark brown with faint yellow streaks and blotches; the scales on the dorsal side of the flippers and head are dark brown to black with yellow margins; the ventral side of the flippers and the plastron are pale yellow, with scattered dark scales on the flippers (NMFS 1998b).

The hawksbill sea turtle was listed as an endangered species on June 2, 1970. Hawksbill sea turtles occur globally, generally occurring between 30 degrees north and 30 degrees south latitudes in the Atlantic, Pacific, and Indian oceans and associated bodies of water (NMFS 1998b), and are known to occur in the waters of the CNMI (USFWS 1996). Hawksbill sea turtles appear to feed exclusively on sponges (NMFS 1998b).

Hawksbill sea turtles have been documented to migrate long distances, over 1,000 km (600 miles), between foraging grounds and nesting beaches (NMFS 1998b). Hawksbill turtles lay several successive clutches of eggs during the nesting season before returning to the foraging grounds. The hawksbill turtle lays between three to six clutches per season. There is a 13- to 19-day interval between consecutive clutches with approximately 100 eggs per clutch. Eggs incubate for approximately 60 days. The size of a clutch and the days of incubation vary from nest to nest, and site to site. There is no information available regarding the exact month(s) hawksbills nest in the CNMI or Guam. In other areas of the world, hawksbill sea turtles have been recorded nesting year-round (NMFS 1998b).

There are no population estimates for hawksbill sea turtles in the CNMI and Guam, and there is little evidence that hawksbill turtles nest within the CNMI and Guam. However, this does not rule out that they are nesting at low levels at unknown locations (NMFS 1998b). Although no hawksbill turtles were observed nesting on Tinian in 1995, there have been a few reports of hawksbills nesting on Rota and Saipan within the CNMI and on Guam (USFWS 1996).

Hawksbill turtles in the Pacific Islands have dramatically declined. The most serious threat is the harvesting of turtles on nesting beaches and in coastal waters by humans (NMFS 1998b). Other threats to hawksbills in the Pacific include habitat loss due to expansion of resident human populations and/or increased tourism development, and the incidental take of turtles in distant-water fisheries (NMFS 1998b).

Hawksbill sea turtles are known to nest within the action area on Guam. Amphibious landing exercises on Guam are likely to adversely affect the hawksbill sea turtle.

Mariana fruit bat (*Pteropus mariannus mariannus*)

The Mariana fruit bat, locally known as *fanihi*, is a medium-sized fruit bat in the family Pteropididae. This subspecies is restricted to the Mariana archipelago, comprised of the

Territory of Guam and the CNMI. These bats weigh between 330 to 577 gm (0.66 to 1.15 lbs) and have a forearm length ranging from 13.4 to 15.6 cm (5.3 to 6.1 in); males are slightly larger than females (USFWS 1998a). The underside (abdomen) is colored black to brown, with gray hair interspersed, creating a grizzled appearance. The shoulders (mantel) and sides of the neck are usually bright golden brown, but may be paler in some individuals. The head varies from brown to dark brown. The well-formed and rounded ears and large eyes give a canine-like appearance giving rise to the nickname "flying foxes."

The Mariana fruit bat on Guam was listed as endangered on August 27, 1984, without critical habitat (49 FR 33881). On March 26, 1998, the Service proposed to downlist the Mariana fruit bat on Guam to threatened status, and designate all Mariana fruit bats in the Mariana archipelago as threatened (63 FR 14641). Should the proposed rule go final, the fruit bats on Guam, which are currently listed as endangered, will be downlisted to threatened and all of the fruit bats in the Marianas archipelago will be protected as a threatened species.

The Mariana fruit bat is highly colonial, forming colonies of a few to over 800 animals (Pierson and Rainey 1992, Wiles 1987a, Worthington and Taisacan 1995). The bats group themselves into harems (one male and two to 15 females) or bachelor groups (predominately males), or reside as single males on the edge of the colony (Wiles 1987a). Reproduction is believed to occur throughout the year on Guam, with no apparent peak in births (Wiles 1987a). Female bats of this family generally have one young per year, resulting in a slow recovery rate when populations are reduced in numbers (Pierson and Rainey 1992). Length of gestation and age of sexual maturity are unknown for the Mariana fruit bat, but other related bats have a gestation period of approximately 4.6 to 6.3 months (Pierson and Rainey 1992). Female Mariana fruit bats on Guam may be able to breed as soon as at 6 to 18 months of age (USFWS 1990b), but sexual maturity in Pteropodid bats usually does not occur until the bats are 18 to 24 months old (Pierson and Rainey 1992).

Native forest is the primary habitat required by the Mariana fruit bat, although some introduced plant species can provide roosting and feeding resources. Fruit bats are important in tropical forests because they naturally disperse plant seeds and thereby help maintain forest diversity and contribute to plant recovery after typhoons and other catastrophic events (Cox *et al.* 1992). Mariana fruit bats forage and roost primarily in native forest, and occasionally in coconut groves and strand vegetation (Wiles 1987b, Worthington and Taisacan 1996). At least 22 plant species are used as food sources by the Mariana fruit bat, including fruits of 17 species of plants, the flowers of seven, and leaf stems and twig tips of *Artocarpus* spp. (USFWS 1990b, Wiles 1987a).

Although the status of the Mariana fruit bat prior to the 20th century is unknown, it likely occurred throughout the Mariana Islands and was probably common on the larger southern islands in the archipelago. Currently, there are estimated to be between 200 and 750 animals on Guam (Wiles 1996, Wiles *et al.* 1995), 25 to 125 animals on each of the islands of

Aguiguan, Saipan, and Tinian (Lemke 1984, Marshall *et al.* 1995b, Wiles 1996, Worthington and Taisacan 1996), 1,000 on Rota (Worthington and Taisacan 1996), and a minimum of 7,450 bats on the smaller islands north of Saipan (Anonymous 1984, Wiles *et al.* 1989). Bats may be uncommon on some of the smaller islands such as Maug, Uracas, and FDM, but are known to occur on all of them (USFWS 1998a). Based on these figures, the total population for the Mariana Islands is estimated to be at least 8,725 animals, although this figure is based on rough estimates from the northern Mariana Islands. Evidence indicates that bats move regularly between the larger southern islands and at least annually between the more remote northern islands (Wiles and Glass 1990, Wiles *et al.* 1989, Worthington and Taisacan 1996).

Fruit bat populations on Guam have been reduced possibly due to poaching, particularly since the introduction of firearms (Coultas 1931), and predation by the brown tree snake (Wiles 1996, Wiles *et al.* 1995). Loss of habitat through the effects of typhoons, development projects, and the introduction of feral rats, pigs, and goats has also contributed to the decline of this species throughout the Marianas (Kessler 1997, Marshall *et al.* 1995, USFWS 1998). Throughout both the inhabited southern and uninhabited northern islands, poaching continues to be one of the most important factors in the decline of the Mariana fruit bat (Glass and Taisacan 1988, Lemke 1992, Marshall *et al.* 1995b, USFWS 1990b, USFWS 1998a, Worthington and Taisacan 1996).

Fruit bats are known to occur within the action area. Aerial bombardment, gunnery training, naval gunfire, and small arms gunfire exercises conducted on FDM are likely to adversely affect the Mariana fruit bat.

Micronesian megapode (*Megapodius laperouse*)

The Micronesian megapode (known locally as *sasangat* or *sasangal*) is a pigeon-sized bird with dark gray-brown to black body plumage, an ash-gray head with a slightly darker, short, rough crest, a yellow bill, very sparse or absent feathers around the eye, ear, and throat revealing red skin and a red throat patch, and heavily built yellow legs and feet (Baker 1951, Pratt *et al.* 1987, USFWS 1998b). The U.S. Fish and Wildlife Service (Service) listed the Micronesian megapode as endangered in 1970 (35 FR 8491-8498). Two subspecies of the Micronesian megapode are found in Micronesia, *M. l. laperouse* in the Mariana Archipelago, and *M. l. senex* in Palau (USFWS 1998b). Critical habitat has not been designated for this species.

The Megapodiidae are part of a family within the order Galliformes (chicken-like birds) found only in the Australasian region. The family comprises seven genera found in Australasia, Australia, New Guinea and surrounding islands, eastern Indonesia, the Nicobar Islands, the Philippines, Micronesia, Vanuatu, and Niuafo'ou of the Tonga Islands (USFWS 1998b). Megapodes are ground-dwelling birds, but, in spite of their terrestrial habits, megapodes fly well and apparently cross large bodies of water easily (Olson 1980, Pratt *et*

al. 1980).

The Micronesian megapode is generally a bird of the forest. On the southern Mariana Islands they are primarily restricted to native limestone forest (USFWS 1998b). On Sarigan, megapodes are often seen in coconut forest as well as native vegetation, and on Guguan and Maug megapodes seem to prefer forest but are also seen in scrubby and even barren areas (USFWS 1998b). Megapodes encountered in fields of grass and vines are mostly juveniles rather than territorial pairs, suggesting that this is less preferred habitat (Glass and Aldan 1988, Rice and Stinson 1992). The Micronesian megapode seems to be an omnivore taking a variety of plant and animal foods available on the forest floor, including seeds, beetles, ants, other insects, and plant matter (Baker 1951, Glass and Aldan 1988, Stinson 1993a).

Megapodes are sometimes called "incubator birds" because they rely on solar energy, volcanic activity, or microbial decomposition as a heat source for incubation (Clark 1964). They are also characterized by laying large eggs without an air chamber and chicks that lack an egg tooth at hatching and kick their way out of the egg (Clark 1964, Dekker and Brom 1992). Megapode chicks are precocial (feathered, able to walk, and able to regulate their body temperature) at hatching and the adults do not care for the young (Jones *et al.* 1995). There is no information on the number of eggs laid per season by the Micronesian megapode (USFWS 1998b). Apparently one egg is laid at a time but the interval between egg laying is unknown (USFWS 1998). Nicobar megapodes (*M. nicobariensis abbotti*) have an interval of nine days between each egg that is layed (Dekker 1992) while the laying interval is 9 to 20 days (average 13 $\pm$ 4 days) for the orange-footed megapode (*M. reinwardt*) (Crome and Brown 1979). The Polynesian megapode (*M. pritchardii*) may lay 10 to 12 eggs per year (Todd 1983) and one orange-footed megapode laid 12 or 13 eggs over a 4.5-month breeding season (Crome and Brown 1979).

Micronesian megapodes are known to give at least three types of calls, including two calls that are different for males and females and that may be given in a duet. Duetting in birds is correlated with year-round territorial behavior and life-long pair bonds. The existence of duetting in the Micronesian megapode supports the report of Glass and Aldan (1988) that on Saipan megapodes seem to remain together throughout the year in territories that are advertised and defended at least part of the year. It is not known how, or if, territoriality functions at or near heavily used communal nesting areas like the one on Guguan (USFWS 1998b). Seasonality in vocalizations, particularly duetting, is believed to be indicative of seasonal changes in breeding activity, but no clear pattern has thus far emerged for the Micronesian megapode (USFWS 1998b). Chicks were reported to leave nests from January or February to June (Oustalet 1896). Chicks of all sizes have been seen in May and June on Guguan (Glass and Aldan 1988, Rice and Stinson 1992; R.B. Clapp *in litt.* 1983) and in September on Sarigan (Rice *et al.* 1990). Megapodes have been observed digging nest burrows on Maug in late March and early June and on Guguan in May, August, and September (Glass and Villagomez 1986, Reichel *et al.* 1988, Rice and Stinson 1992).

Nesting on some islands may occur year-round and breeding seasonality may differ between islands depending on the source of heat for incubation (USFWS 1998b). There is no information on the nesting success or the age of sexual maturity for the Micronesian megapode.

The Micronesian megapode was historically widespread throughout the Mariana Island chain and has been recorded on all the islands, with the possible exception of Uracus (USFWS 1998b). But numbers declined on all of the southern Mariana Islands (Guam, Rota, Aguiguan, Tinian, and Saipan) in the 19th and early 20th centuries. It is doubtful if the species has ever been abundant during the last century. Definitive population surveys have not been undertaken, but observations indicate that the bird exists in small, but relatively stable, numbers, particularly on the northern islands. The megapode was extirpated on Guam and Rota, and small, remnant populations persist on Aguiguan and Tinian (fewer than 10), along with a very small (possibly reintroduced) population on Saipan (10-25 birds). Megapodes have been consistently found in small numbers (10-15) on Aguiguan during this century (Craig *et al.* 1992, Engbring *et al.* 1986, Lusk 1993, Owen 1974, Stinson 1993a, Takatsukasa 1932-1938, USFWS 1998b). A total of four megapodes were observed on Farallon de Medinilla in November 1996 (Lusk and Kessler 1996). The total island population is estimated to be less than ten birds (USFWS 1998b). The megapode remains in relatively large numbers only on the smaller, mostly uninhabited northern islands. Megapodes were not recorded on Anatahan until 1971 (Falanruw 1975) but current estimates are 200-300 birds (Reichel and Glass 1988a, USFWS 1998b). A recent forest bird survey on Sarigan estimated the population at 545-810 birds (Fancy *et al.* In review). Guguan probably supports the largest megapode population in the Marianas of around 500 birds (Rice and Stinson 1992). Megapode numbers on Guguan are believed to have declined for unknown reasons since estimates were made in 1986 of 1,200 to 2,200 birds (Glass and Villagomez 1986, USFWS 1998b). Fewer than 30 birds are reported on Alamagan, 50 to 100 on Pagan, an unknown number on Agrihan, fewer than 25 on Asuncion, 50 to 100 on Maug (on three islands), and none on Uracus (USFWS 1998b).

Current population estimates of the megapode total about 1,440 to 1,975 birds in the island chain (USFWS 1998b). The megapode was listed as endangered due to historical extirpations on Guam, Rota, Tinian, and possibly Saipan. The decline in numbers is thought to have resulted from intense exploitation by humans (hunting of adults and collection of eggs) and habitat loss (USFWS 1998b). Agriculture and overgrazing by feral goats, cattle and pigs have had a profound effect on the vegetation of the islands and are of concern for megapode (and other native forest species) populations in the northern islands (USFWS 1998b). Loss of habitat through volcanism is also known to have caused serious declines (USFWS 1998b). In addition to possible direct human predation, megapodes are known to be preyed upon by introduced monitor lizards and may also be preyed upon by feral dogs, cats, and pigs (Dekker 1989, Ludwig 1979).

A serious potential threat to megapode populations is the establishment of the brown treesnake from Guam to other islands in the Marianas archipelago (USFWS 1998b). The brown treesnake was accidentally introduced to Guam shortly after World War II and has systematically spread throughout the island, causing the loss of nearly all of the avifauna (birds) and many of the other native vertebrate and invertebrate species of Guam (USFWS 1996c). It is of great concern that there have been recent (1991) sightings of brown treesnakes in cargo from Guam on Rota, Tinian, and Saipan. Should this predatory snake become established on any island where megapodes remain, the bird's populations on these islands would be expected to decrease rapidly within a relatively short period of time.

Megapodes are known to occur within the action area. Proposed military training activities on Tinian and FDM are likely to adversely affect Micronesian megapodes.

Tinian monarch (*Monarcha takatsukasae*)

The Tinian monarch, locally known as *Chichirikan Tinian*, is a small (15 cm [6 in]) flycatcher (Dicuridae: Monarchinae) with light rufous underparts, olive-brown upper parts, dark brown wings and tail, and white rump and undertail coverts (Baker 1951). The monarch is endemic to the island of Tinian, CNMI.

The Tinian monarch was originally listed as endangered in 1970 (35 FR 8491) under the authority of the Endangered Species Conservation Act of 1969 (16 U.S.C. 668cc). Critical habitat was not designated for the Tinian monarch. The endangered status of the monarch was continued under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended. The decision to list the monarch as endangered was based upon an estimate by Gleize (1945) of 40-50 monarchs on Tinian after WW II (52 FR 10890), although it is not clear if his report was an estimate of the number of birds he saw, or an estimate of the entire population. About the same time as Gleize, Downs (1946) reported that monarchs were restricted in distribution to distinct locations on the island, while Marshall (1949) considered the monarch to be abundant.

In the late 1970s, Pratt *et al.* (1979) estimated monarchs to number in the tens of thousands. In 1982, the U.S. Fish and Wildlife Service (Service) conducted forest bird surveys of the southern islands in the Mariana archipelago. They found the monarch to be the second most abundant species on Tinian with a population estimate of 40,000, ubiquitously distributed throughout the island and across all forested habitat types (Engbring *et al.* 1986). Engbring *et al.* (1986) recommended the reassessment of the monarch's endangered status. This reassessment led to the reclassification of the Tinian monarch from endangered to threatened in 1987 (52 FR 10890).

Between 1994 and 1995 the Service conducted a life history study of the Tinian monarch and reported a population estimate of 52,904 monarchs. The Service found that the monarch was

successfully foraging and breeding in secondary and tangantangan forests throughout the island and recommended that the threatened status of the monarch be reassessed (USFWS 1996c).

Subsequently, a survey of the avifauna of Tinian was conducted in 1996 by the Service following the methodology of the 1982 surveys for comparative purposes. The 1996 survey estimated the monarch population at 55,721 birds, significantly higher than the 1982 estimates (Lusk *et al.* 1997). The 1996 survey also found that vegetation density had significantly increased from 1982 levels. This may be related to a marked decrease in grazing pressure in recent years (Lusk *et al.* 1997). It is hypothesized that the increase in the Tinian monarch population is related to the increase in density of both native and introduced forest habitat types, which may represent an increase in monarch habitat quality (Lusk *et al.* 1997). Currently, the Service is considering removal of the Tinian monarch from the list of endangered and threatened species.

Tinian monarchs inhabit a variety of forest types on Tinian, including native limestone forest (dominated by such species as *Ficus* spp., *Elaeocarpus joga, Mammea odorata, Guamia mariannae, Cynometra ramiflora, Aglaia mariannensis, Premna obtusifolia, Pisonia grandis, Ochrosia mariannensis, Neisosperma oppositifolia, Intsia bijuga, Melanolepis multiglandulosa, Eugenia* spp., *Pandanus* spp., *Artocarpus* spp., and *Hernandia* spp.), secondary vegetation (consisting primarily of *Acacia confusa, Albizia lebbeck, Casuarina equisetifolia, Cocos nucifera,* and *Delonix regia* mixed with native species), and almost pure stands of introduced *Leucaena leucocephala* (tangantangan) (Engbring *et al.* 1986, USFWS 1996c).

Currently, the vegetation on Tinian is highly disturbed, with the single most predominant habitat type on Tinian being tangantangan thickets (Engbring *et al.* 1986, Falanruw *et al.* 1989, Fosberg 1960). According to Engbring *et al.* (1986), 38 percent of Tinian is dominated by tangantangan, while Falanruw *et al.* (1989) estimated 54 percent of the island to be covered in secondary vegetation, which in her definition included tangantangan thickets. Only five to seven percent of the island is estimated to remain in native forest (Engbring *et al.* 1986, Falanruw *et al.* 1989), which is restricted to steep limestone escarpments (Falanruw *et al.* 1989).

During the study conducted by the Service between 1994 and 1995, information was obtained on the abundance, distribution, and breeding ecology of several species found on Tinian such as the Tinian monarch (USFWS 1996c). It was found that the native limestone forest may be preferred by monarchs over secondary and tangantangan forest types, based on the following: 1) monarch home range sizes were found to be four to five times smaller in native limestone forest than in secondary and tangantangan forests (home range sizes in limestone forest averaged 1,221 square m [1,334 square yards(yds)]), while home range sizes in secondary and tangantangan forest types averaged 5,196 and 6,385 square m (5,679 and

6,979 square yds), respectively, indicating that native forest is higher quality monarch habitat because smaller areas are able to support a monarch home range; 2) 64 percent of all monarch nests were constructed in native tree species; 3) of 114 monarch nests, 62 were found in native forest while only 52 were found in the secondary and tangantangan forest types combined, indicating that monarchs have higher nest densities in native forest; 4) nesting success in native limestone forest was greater than in secondary and tangantangan forest types (of 19 nests that produced nestlings, 13 were in native limestone forest and only 6 were in secondary forest and tangantangan forests combined); and 5) based on resightings of banded birds, monarch densities were found to be four to five times higher in limestone forest than in either secondary or tangantangan forest (30.7 birds/hectare (ha)(76.7 acre), 7.7 birds/ha (19.3 acre), and 6.0 birds/ha (15.0 acre), respectively).

Other information provided by the previously mentioned study has described the Tinian monarch as a forager of the mid-level forest. It perches on relatively slender branches beneath the forest canopy and gleans invertebrates (*e.g.*, moths, butterflies, ants, caterpillars, and several species of long-legged insect(s) from leaf and bark surfaces. Foraging habits of the Tinian monarch are similar in all three different forest habitats (*i.e.*, limestone forest, secondary forest, and tangantangan).

The Tinian monarch likely breeds year-round. However, peak nesting periods for the Tinian monarch appear to be associated with periods of increased rainfall, which, during the time of the Service's 1994-95 study (USFWS 1996c), occurred during the months of January, May, and September. Tinian monarchs have been observed nesting in three different forest habitats (*i.e.*, native limestone, secondary, and tangantangan). Mean clutch size for the Tinian monarch is two eggs, with an occasional occurrence of one or three eggs (USFWS 1996c).

Likely predators on monarchs and their eggs and nestlings are collared kingfishers (*Halcyon chloris*), Micronesian starlings (*Aplonis opaca*), feral cats (*Felis domesticus*), and the roof rat (*Rattus rattus*) (USFWS 1996c). There is one observation of a monitor lizard (*Varanus indicus*) crawling in a tree with an egg inside its mouth that matched the size and color of a monarch or rufous fantail egg. Another cause of mortality is inclement weather, which has been known to cause a nestling and its nest to fall to the ground when the nest was hit by a large falling branch.

Tinian monarchs are known to occur throughout the action area on Tinian. Therefore, it is likely that the proposed project will adversely affect the Tinian monarch.

III. 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 usually 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. Status of the species within the action area

Green sea turtle

Guam: There is some regular low-level nesting of green turtles on Guam (NMFS 1998a). Green sea turtles have been known to nest at Tarague Beach (Wiles *et al.* 1995).

Tinian: Green sea turtles have been observed nesting at Unai Babui, Unai Dankulo, and Unai Chulu (USFWS 1996). There are also records of sea turtles nesting at Kammer Beach in the past (USFWS 1996).

FDM: The action area is the entire island of FDM, which includes two small beaches (both approximately 50 m long by 10 m wide), one on the southwestern corner and one on the northeastern corner of the main body of the island. Following a visit to FDM in 1997, Service biologist Michael Molina determined that the two beaches on FDM likely 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 (BO 1-2-97-F-08). However, according to Gerald Davis of Guam DAWR, two green sea turtle nests were found during surveys of FDM in 1982. Based on this information, the Service has determined that green sea turtles may, in fact, presently nest on FDM.

Hawksbill sea turtle

Guam: Gerald Davis (Guam Department of Wildlife Resources) discovered a hawksbill nesting on Guam in November 1991 (NMFS 1998b) at Sumay Cove Marina. Hawksbill nesting on Guam is rare, although nesting hawksbills leave minimal crawl traces and not all beaches on the island are properly surveyed for nesting sea turtles (NMFS 1998b).

There are no records of hawksbills nesting in the CNMI (NMFS 1998b). This is due to: 1) beaches being scarce on the remote islands in the north of the Mariana Archipelago, 2) the long history of occupation on the more southern islands, and 3) almost no hawksbill nesting surveys of small pocket beaches have been conducted in remote areas of the CNMI. However, the lack of evidence doesn't rule out the possibility of hawksbills nesting at low levels at unknown locations (NMFS 1998b).

Mariana Fruit Bat

Guam: Almost all of the Mariana fruit bats that remain on Guam occur on Andersen AFB at Pati Point and between Ritidian Point to the northern rim of Tarague Basin (Wiles *et al.*

1995) In March 1997, between 300 to 350 bats were observed on Guam (G. Wiles, personal communication 1997). Bats are also known to occur in the limestone forest areas between Mount Almagasa and East Tower and in the western portion of the Ordnance Annex (Belt Collins 1998).

Rota: There are a total of 1,000 bats on Rota (Worthington and Taisacan 1996). Probably no bats are found in the proposed action area.

Tinian: Between 25 to 125 Mariana fruit bats have been observed on Tinian (Lemke 1984; Wiles 1996, Worthington and Taisacan 1996), but its residence status on Tinian is uncertain (Marshall *et al.* 1995b). The Mariana fruit bat has been observed roosting in large trees surrounding Lake Hagoi and along the cliffiines and forest plateau south of Lake Hagoi, near Mount Lasso (Belt Collins 1998). Bats have also been seen near the West Tinian Airport and the Carolinas Ridge (Belt Collins 1998).

FDM: Two fruit bats were observed roosting in low shrubs on FDM by Tim Sutterfield, Fish and Wildlife Biologist for the Navy, during a site visit in December 1996 (Sutterfield *in lit.* 1997). These two bats probably do not represent a permanent roosting or breeding colony. Although some of the vegetation on the island may provide forage for bats, the low, shrubby nature of the vegetation makes it unlikely that bats utilize FDM for more than a temporary roosting site during travel between larger islands. No roosting or flying bats have been reported from FDM during other site visits or during pre- or post-training helicopter surveys, as would be expected if large numbers of bats were utilizing FDM on a regular basis. The two bats observed on FDM represent a small fraction of the total population for the Mariana islands. Exact take of any fruit bats on the island as the result of aerial and naval bombardment have been indeterminate due to an inability to visit the island.

Micronesian Megapode

Tinian: It is estimated that the remnant population of megapodes on Tinian consists of 10 or fewer individuals (USFWS 1998b). Three confirmed sightings of megapodes were recorded during surveys conducted in 1995, all of which occurred within the Military Leaseback Area (MLA) of Tinian (USFWS 1996c). It is estimated that approximately one-half (5 individuals) to one-third (8 individuals) of the known individuals of megapodes are located within the MLA, which represents less than 1% of the total estimated population within the Marianas archipelago.

FDM: 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% 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 an inability to visit the island. Megapodes may have emigrated to FDM since 1996, or reproduction on the island may have occurred since then, but recruitment levels through either of these avenues has not been determined. With regard to immigration, the island nearest FDM with a substantial megapode population, Anatahan, is approximately 50 miles away. No nesting has been recorded on FDM, but the possibility does exist.

Tinian Monarch
As previously mentioned, the current estimate of the Tinian monarch population is 55,721 birds. Within the action area on Tinian, there are approximately 45,600 monarchs, which represents approximately 82% of the total population.

The northern third of Tinian is used exclusively by the military for training purposes. The central third of Tinian is classified as the Military Lease Area which may be used for military training, but has been leased back to the CNMI government for compatible economic agriculture use and the expansion of the West Tinian Airport. These areas contain three habitat types, native limestone, secondary forest and tangantangan, that support Tinian monarchs.

B. Factors affecting species environment within the action area

Guam
Within the action area on the island of Guam, past and present Federal, State, private, and other human activities that may affect the hawksbill sea turtle, and green sea turtle include military training activities and surveys and habitat improvement projects for the above mentioned species as well as other species. Military activities within the action area on the island of Guam are ongoing. The Service has prepared five previous BOs (1-2-90-F-003, 1-2-92-F-07, 1-2-93-F-14, 1-2-94-F-05, and 1-2-94-F-06) regarding these military activities and their potential to adversely effect the green sea turtle, hawksbill sea turtle, and other listed species. The consultations covered military activities, such as helicopter training, VRC-50 flight squadron field carrier landing practice (FCLP), and the permanent relocation of the VRC-50 Squadron, aircraft training.

No incidental take was anticipated or authorized for the green sea turtle and hawksbill sea turtle for activities on Guam.

A 24-hectare wild game exclosure surrounded by a chain-link fence was constructed by Andersen Air Force Base at Area 50 of Northwest Field to exclude deer and pigs. A bulge barrier has been retrofitted to the fence to prevent brown treesnakes from entering the enclosed area. The intent at this location is to remove all, or nearly all, brown treesnakes from within the plot, and to introduce rare species (*e.g.*, the federally endangered Guam rail)

into the area.

In 1990, Guam Department of Aquatic and Wildlife Resources (GDAWR) began annual crow surveys in northern Guam (*e.g.*, AAFB) to monitor their status (Aguon 1997). Also, efforts to reverse the decline of the Mariana crow began in 1986 with attempts to protect active crow nests from brown treesnake predation. Steel sleeves and an adhesive resin were placed around trunks of active nest trees to act as a snake barrier and snake trapping was begun. Increased nest protection was achieved with the development of electrical barriers and effective snake trapping during the early 1990's. GDAWR also conducts annual monitoring of the Mariana fruit bat colony at Pati Point.

Rota
There have been no activities on Rota that have undergone section 7 consultation that anticipated the incidental take of federally listed species.

Tinian
Within the action area on the island of Tinian, past and present Federal, State, private, and other human activities that may affect the Tinian monarch include military training activities, agricultural and grazing activities, and the expansion of the West Tinian Airport. The Navy has consulted four times (BO's 1-2-84-F-26, 1-2-84-F-44, 1-2-90-F-003, and 1-2-90-F-024) regarding its training activities (*e.g.*, loading and unloading of personnel, supplies, and equipment from C-130 aircraft, clearing of vegetation for establishing bivouac camps, setting up a perimeter defense around camps, firing of weapons at the firing range, and tactical airdrops) within the action area. The consultations resulted in the anticipated incidental take (harassment) of 79 monarchs and loss (harm) of 19 nests (including eggs and young). Also, incidental take was permitted for the harassment of monarchs for ongoing activities such as the Navy's "Kennel Bear" exercises, which occurs twice a year for one to two weeks each time and Marine Corps training, which occurs three times a year for four weeks at a time.

Three other consultations have been conducted with the U.S. Army Corps of Engineers and the U.S. Information Agency for the Tinian Voice of America (VOA) project and the Federal Aviation Administration (FAA) for the expansion of the West Tinian Airport. These consultations anticipated the incidental take for the harm and harassment of 812 Tinian monarchs and the loss (harm) of 681 nests (with young and eggs). The FAA and the CNMI Commonwealth Ports Authority are working with the Tinian Legislature, CNMI DFW, the U.S. Navy, and the Service to set-aside approximately 379 hectares (ha) (937 acres (ac)) of land located to the north of West Tinian Airport to preserve into perpetuity habitat for the Tinian monarch as well as other wildlife and plant species.

FDM
The Navy has consulted five times for aerial bombardment, gunnery training, naval gunfire, and small arms gunfire exercises conducted on FDM (BO's 1-2-97-F-01, 1-2-97-F-05, 1-2-

97-F-08, 1-2-98-F-02, and 1-2-98-F-03). The consultations resulted in the anticipated incidental take of all Micronesian megapodes on the island, three adult green sea turtles and three adult hawksbill sea turtles, 12 active turtle nests, and an indeterminable number of Mariana fruit bats.

The Navy has funded the removal of feral ungulates from the island of Sarigan for the purpose of improving habitat for the Micronesian megapode and Mariana fruit bat.

IV. Effects of the Action

Green Sea Turtle & Hawksbill Sea Turtle
The primary concerns of the Service with regard to the effects of military activities on green sea turtles are (1) direct death of sea turtles on nesting beaches, (2) the destruction of active turtle nests, (3) harassment of sea turtles on nesting beaches, and (4) destruction of nesting habitat.

Mariana Fruit Bat
FDM: The primary concerns of the Service with regard to the effects of ongoing aerial bombardment and small arms gunfire practice on the Mariana fruit bat on FDM are (1) direct death of fruit bats, (2) abandonment of juvenile fruit bats by mothers, and (3) destruction of required foraging and roosting habitat. Although fruit bats are strong fliers and likely to abandon the island once bombardment begins, there remains the probability of death or injury to roosting bats from training activities.

The impact areas for aerial bombardment, naval gunfire, and small arms gunfire cover the entire area of FDM. Therefore, the Service anticipates the possible direct death or injury of fruit bats occurring on the island during the future years of training as proposed.

Micronesian Megapode
Tinian: If megapodes nest on Tinian and either build mounds or burrow between the roots of trees as incubation strategies, there is a potential that troop movements (of up to 2,000 personnel) through limestone forest or adjacent non-native secondary forests could directly affect the megapode by trampling nests that are not seen by personnel.

FDM: The primary concerns of the Service with regard to the effects of ongoing aerial bombardment and small arms gunfire practice on the Micronesian megapode on FDM are (1) direct death of megapodes, (2) destruction or abandonment of active megapode nests, and (3) destruction of required foraging, roosting, and/or 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). The Service believes the August 2, 1997, survey to be representative of the type of damage that can occur during aerial bombardment, naval gunfire, and/or from small arms fire such as grenade launchers or anti-tank rockets.

The impact areas for aerial bombardment, naval gunfire, and small arms gunfire cover the entire area of FDM. Therefore the Service anticipates the possible direct death of any remaining megapodes and destruction of their nests occurring on the island during the future years of training on FDM.

Tinian Monarch
Ongoing and proposed field maneuver training on Tinian 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. Large-scale activities will occur a maximum of three times per year, for up to three weeks each time, whereas training for individuals may occur daily, weekly, or on a monthly basis. These activities can occur in areas that contain limestone forest, secondary forest, and tangantangan forest, all of which support Tinian monarchs.

Tinian monarchs are known to nest throughout the action area. Due to the number of people that will be traveling though the area during the day or night and the fact that Tinian monarch nests are found mid-level in trees, there is potential for soldiers moving through the area to directly affect monarchs by knocking nests out of trees.

V. 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. There are no known future State, local, or private actions that are reasonably certain to occur in the action area.

VI. Conclusion

After reviewing the current status of the green sea turtle, hawksbill sea turtle, Micronesian megapode, and the Tinian monarch, the environmental baseline of these species in the action area, and the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that the proposed military training activities are not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species; therefore, none will be affected.

After reviewing the current status of the Mariana fruit bat (within the CNMI), the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's conference opinion that these military training activities, as proposed, is not likely to jeopardize the continued existence of the proposed Mariana fruit bat. No critical habitat has been proposed, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent 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. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. 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 to be prohibited taking under the Act 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 undertaken by the Department of Defense so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Department of Defense has a continuing duty to regulate the activity covered by this incidental take statement. If the Department of Defense (1) fails to assume and implement the terms and conditions or (2) fails to require adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to a permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Department of Defense or (applicant) must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR 402.14(I)(3)).

Amount or extent of take anticipated for listed species

Guam

Hawksbill sea turtle: The Service has determined that hawksbill sea turtles may be incidentally taken during amphibious landing training (*e.g*, AAV and LCU) near Sumay Cove, if such training is conducted during the nesting period, which could occur year round (NMFS 1998b). Specifically, incubating eggs may be inundated with water from wind and wave action from amphibious vehicles landing on the boat ramp at the Sumay Cove Mariana. The incidental take is expected to be in the

form of the loss of one turtle nest (eggs and associated hatchlings) per year.

Tinian

Green sea turtle: The Service has determined that green sea turtles may be incidentally taken during the amphibious landing training (*e.g.*, LCAC, AAV, and LCU) proposed at Unai Chulu, Unai Dankulo, and Unai Babui if such training occurs during the nesting season. Specifically, incubating eggs may be crushed by the landing craft or by off-loaded vehicles; vehicle tracks in the sand may prevent hatchlings from reaching the ocean; and activities on or near the beach may prevent turtles from nesting on the beach. The incidental take is expected to be in the form of the loss of one turtle nest (eggs and associated hatchlings) per nesting season.

The Service is concerned that if a nest is not found prior to a landing that it could be crushed and any eggs or hatchlings within or near the nest could be affected.

Tinian monarch: The Service has determined that Tinian monarchs may be incidentally taken during troop movements of 10 or more personnel occurring within monarch habitat during peak nesting periods, which is during the months of January, May, and September as associated with periods of increased rainfall (USFWS 1996a). The Service estimates that 1% of the troops moving through the forest, especially at night, could inadvertently knock a monarch nest out of the nest tree and result in the take of a egg or a chick. The incidental take is expected to be in the form of the loss of a combination of 60 eggs or chicks per year.

Micronesian megapode: The Service's primary concern is that troops moving through the forest, especially at night, may inadvertently step on and crush a megapode nest. The incidental take is expected to be in the form of the loss of one megapode nest, and any associated eggs per year.

FDM

Green sea turtle: Military training activities on FDM from the year 2001 and into the future are anticipated to result in the take of green sea turtles. The incidental take is expected to be in form of the loss of one nest per year from bombing and gunnery practice on FDM.

Micronesian megapode: The Service believes that the two military 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 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 levels of incidental take authorized in biological opinion #1-2-97-F-05 and biological opinion #1-2-97-F-08 have likely been met. The military exercise covered under the December 30, 1997, biological opinion (#1-2-98-F-02) was not conducted. We anticipate that any megapodes still present on FDM, or that may colonize the island prior to the onset of any of the military exercises covered under biological opinion #1-2-98-F-03, which covers the time period of May 1, 1998 to May

1, 2001, may also be incidentally taken.

Under this consultation, military training activities on FDM from the year 2001 and into the future are anticipated to result in the take of Micronesian megapodes. The incidental take is expected to be in form of the death of one megapode per year from bombing and gunnery practice on FDM.

Amount or extent of take anticipated for proposed species

FDM

Mariana fruit bat: For previous consultations for military training activities on FDM, it was anticipated that any bats present on the island at the time of commencement of military activities covered under the above timeline would also be incidentally taken. Under this consultation, military training activities on FDM from the year 2001 and into the future are anticipated to result in the take of Mariana fruit bats. The Service is concerned that if fruit bats are present on FDM, they will be hit by the ammunition used for training. The incidental take is expected to be in form of the death or injury of one adult or juvenile Mariana fruit bat per year from bombing and gunnery practice on FDM.

Effect of the take

In the accompanying biological opinion/conference report, the Service determined that this level of anticipated take is not likely to result in jeopardy to the green sea turtle, hawksbill sea turtle, Micronesian megapode, Mariana fruit bat, and Tinian monarch or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures for Listed Species

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of green sea turtles, hawksbill sea turtles, Micronesian megapodes, and Tinian monarchs.

1. Minimize the loss of nests, eggs, and hatchlings of green sea turtles on the islands of Tinian and FDM.

2. Minimize the loss of nests, eggs, and hatchlings of hawksbill sea turtles at Sumay Cove, Guam.

3. Minimize the loss of eggs of megapodes on Tinian and adult and juvenile megapodes and any nests on FDM.

5. Minimize the loss of eggs and chicks of Tinian monarchs on Tinian.

Terms and Conditions for Listed Species

In order to be exempt from the prohibitions of section 9 of the Act, the Department of Defense must comply with the following terms and conditions, which implement the reasonable and prudent

measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

In order to address reasonable and prudent measure #1, the following terms and conditions apply:

1a) Minimize amphibious landing exercises on Tinian and aerial bombardment, gunnery training, naval gunfire, and small arms gunfire exercises conducted on FDM during the green sea turtle nesting period (January to October);

1b) Report to the Service within one month of the completion of amphibious vehicle landings on known turtle nesting beaches on Tinian the amount or extent of take of green sea turtles that has occurred as a result of implementation of the proposed action; and

1c) Report to the Service within one month of the completion of aerial bombardment, gunnery training, naval gunfire, and small arms gunfire exercises on FDM the amount or extent of take of green sea turtles or their nests that has occurred as a result of implementation of the proposed action.

In order to address reasonable and prudent measure #2, the following terms and conditions apply:

2a) For AAV and LCU landings at Sumay Cove, Guam, conduct the mitigation/minimization measures as stated in the project description section of the BO for amphibious landing exercises.

2b) Temporarily cease amphibious landing exercises will be temporarily ceased at any given time that there is a sea turtle or nest present within Sumay Cove, Guam until the turtle or nest is not in harm's way;

2c) Minimize amphibious landing exercises at Sumay Cove, Guam, during the hawksbill sea turtle nesting period; and

2d) Report to the Service within one month of the completion of amphibious vehicle landings at Sumay Cove, Guam, the amount or extent of take of hawksbill sea turtles that has occurred as a result of implementation of the proposed action.

In order to address reasonable and prudent measure #3 the following terms and conditions apply:

3a) On FDM, the military shall restrict its impact zone to the central interior portion and/or southern tip of the island and western cliff faces, to the extent possible;

3b) The use of cluster bombs shall be prohibited in training on FDM; and

3c) The Department of Defense shall report within one month of completion each time military training activities have taken place on FDM on the amount or extent of take of megapodes and fruit bats that has occurred as a result of implementation of the proposed action.

In order to address reasonable and prudent measure #4 the following terms and conditions apply:

4a) On Tinian, limit the amount of troop movements occurring at night through Tinian monarch habitat during peak breeding season, which is during the months of January, May, and September as associated with periods of increased rainfall (USFWS 1996a), and through limestone forest and adjacent secondary forest during the Micronesian megapode nesting season;

4b) Avoid conducting troop movements within monarch nesting habitat during the peak nesting season for monarchs; and

4c) Report to the Service on an annual basis (by December 31) regarding troop movements on Tinian and the amount or extent of take of Tinian monarchs or Micronesian megapodes that has occurred as a result of implementation of the proposed action. The reports should be sent to the Pacific Islands Manager, U.S. Fish and Wildlife Service, 300 Ala Moana Boulevard, Room 3-122, Box 50088, Honolulu, Hawaii, 96850.

The following term and condition applies to each species in which incidental take has been permitted:

5) Any injured or dead listed birds, mammals or reptiles found during any of the proposed and ongoing military training activities in the Mariana Archipelago should be reported to the Service's Law Enforcement Office in Guam, Guam Department of Aquatic and Wildlife Resources (GDAWR), and the CNMI DFW. Care instructions will be provided regarding any sick or injured listed species. If dead individuals are found, the Service's Law Enforcement Office in Guam should be notified within one working day. Dead listed species should be wrapped in aluminum foil and refrigerated (dead birds should not be wrapped in plastic or placed in a freezer) and then given to the Service's staff for disposition. The Service's Law Enforcement Office will provide further instructions on the proper disposal of the animals, including shipping requirements to facilities to determine cause of death, if the cause is not known. The Service's Law Enforcement Office in Guam (U.S. Fish and Wildlife Service, P.O. Box 23774, GMF, Barrigada, Guam, 96921; telephone: 671/472-7151), the Pacific Islands Ecological Services Office in Honolulu (U.S. Fish and Wildlife Service, 300 Ala Moana Boulevard, Room 3-122, Box 50088, Honolulu, Hawaii, 96850; telephone: 808/541-3441), GDAWR (192 Dairy Road, Mangilao, GU 96923, 671/735-3957),and the CNMI DFW (P.O. Box 10007, Saipan, MP, 96950; telephone: 670/322-9628) should be provided with a written report describing the events surrounding the demise or

injury of the species, if known, and measures must be taken to prevent further injuries or deaths.

Reasonable and Prudent Measures for Proposed Species
The prohibitions against taking the species found in section 9 of the Act do not apply until the species is listed. However, the Service advises the Department of Defense to consider implementing the following reasonable and prudent measures. If this conference report is adopted as a biological opinion following a listing or designation, these measures, with their implementing terms and conditions, will not be discretionary.

1. Minimize the loss of adult and juvenile Mariana fruit bats on FDM.

Terms and Conditions for Proposed Species
In order to be exempt from the prohibitions of section 9 of the Act, the Department of Defense must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

In order to address reasonable and prudent measure #1 the following terms and conditions apply:

1a) On FDM, the military shall restrict its impact zone to the central interior portion and/or southern tip of the island and western cliff faces, to the extent possible;

1b) The use of cluster bombs shall be prohibited in training on FDM; and

1c) The Department of Defense shall report within one month of completion each time military training activities have taken place on FDM on the amount or extent of take of megapodes and fruit bats that has occurred as a result of implementation of the proposed action.

In summary, the Service anticipates that no more than two nests of green sea turtles per nesting season (one nest on Tinian and one nest on FDM), one hawksbill sea turtle nest per year on Guam, 60 eggs or chicks per year of Tinian monarchs, one Micronesian megapode egg per year on Tinian, one megapode per year on FDM, and one Marina fruit bat per year on FDM will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency 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 measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize 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.

The Brown Treesnake Control/Interdiction Plan for Military Training Exercises (BTS Plan) and the U.S. Department of Agriculture, Wildlife Services (WS), Brown Treesnake Control Procedures In Support of Scheduled Military Training Exercises, are located in Appendices E-1 and E-2 respectively of the DEIS. These documents describe various proposed measures to prevent the export of the brown treesnake from Guam to other Mariana and Pacific islands and the U.S. Mainland. However, the plans are several years old and some of the protocols in them have become outdated. The Service recommends that the BTS Plan be updated by consolidating the most effective protocols regarding prevention and control of the brown treesnake in order to avoid any confusion by those carrying out the measures. Comments regarding the design and implementation of the revised BTS Plan should be solicited from WS, DFW, the Biological Resources Division of the U.S. Geological Survey (BRD), and the Service. Also, the effectiveness of the BTS Plan should be assessed periodically by involving external expertise on snake control techniques and strategies. As new information and techniques become available, the BTS Plan should be updated.

The Service recommends that the DOD consider funding the following conservation and recovery projects for threatened and endangered species found within the Mariana Islands: (1) efforts to eradicate feral ungulates on uninhabited northern islands, (2) surveys to assess status, distribution, and nesting/roosting areas of threatened or endangered species, (3) basic research into the life history and demography of threatened or endangered species, and (4) rat (*Rattus* spp.) eradication on uninhabited northern islands.

In addition to FDM providing habitat for the green sea turtle, Micronesian megapode, and Mariana fruit bat, 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 under the Act, 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 bombing activities be limited to low periods in the seabird breeding season. Also, the Navy should 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 minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Conclusion

The Service has determined the military activities carried out by the Department of Defense on Guam, Rota, FDM, and Tinian, as described in the DEIS are not likely to jeopardize the continued existence of the green sea turtle, hawksbill sea turtle, Mariana fruit bat, Micronesian megapode, and the Tinian monarch.

This concludes formal consultation and conference on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and 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 effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

You may ask the Service to confirm the conference report as a biological opinion issued through formal consultation if the Marianas fruit bat is listed within the CNMI. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference report as the biological opinion of the project and no further section 7 consultation will be necessary.

After listing of the Mariana fruit bat in the CNMI as endangered/threatened and/or designation of critical habitat for the Mariana fruit bat and any subsequent adoption of this conference report, the Federal agency shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect the species or critical habitat in a manner or to an extent not considered in this conference report; (3) the agency action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this conference report; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference report does not become effective until the species is listed and the conference report is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the Mariana fruit bat within the CNMI has occurred. Modifications of the report and incidental take statement

may be appropriate to reelect that take. No take of the Mariana fruit bat in the CNMI may occur between the listing of the species and the adoption of the conference report through formal consultation, or the completion of a subsequent formal consultation.

This BO and formal conference report satisfies section 7 requirements of the Act. However, it does not cover requirements pertaining to wildlife and plant species under local territorial or commonwealth laws and regulations.

If you have any questions concerning this biological opinion or conference report, please contact Assistant Field Supervisor Karen Rosa or Fish and Wildlife Biologists Leila Gibson (telephone: 808/541-3441; facsimile: 808/541-3470).

Sincerely,

Robert P. Smith

Robert P. Smith
Pacific Islands Manager

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Appendix E
The Brown Tree Snake (BTS) Reports

E-1: The Brown Tree Snake (BTS) Control/Interdiction Plan for Military Training Exercises (1 October 1996)

E-2: USDA Wildlife Services Brown Tree Snake Control Procedures in Support of Scheduled Military Training Exercises

E-3: Brown Tree Snake Control and Interdiction Plan (TT99 Appendix C - December 1998)

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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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 tranship 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. Provide available detector dogs and handlers to assist military inspections 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

27 AUG 1993

Honorable Allen Stayman
Deputy Assistant Secretary
Territorial and International Affairs
10th and C Streets, NW
Washington, DC 20240

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

TAKE PRIDE IN AMERICA

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 including 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: Ast. Sec. NRCS
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 E-3
Brown Tree Snake Control and Interdiction Plan
(TT99 EA Appendix C - December 1998)

Appendix B to ANNEX T, "Environmental Protection
Tandem Thrust 99 Exercise Plan 99-1
Brown Tree Snake Control/Interdiction Plan.

References:
(a) COMNAVMARIANAS letter Serial N45/1906 of 31 OCT 1996
(b) U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services "Brown Tree Snake Control Procedures in Support of Scheduled Military Training Exercise"

1. Purpose The purpose of this plan is to prevent the spread by inadvertent transportation of the Brown Tree Snake (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) specifically Tinian, Hawaii, and other snake-free Pacific Islands.

2. Background.
a. Deployment 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 adversely affect future training activities emanating from or transiting through Guam.

b. The Department of Defense (DOD), U.S. Department of Agriculture (USDA), and other federal and state agencies have entered into a Memorandum of Agreement (MOA). In a joint effort to control the spread of BTS, all parties of the MOA have specific responsibilities. The USDA APHIS Wildlife Services (WS) is identified as the agency which provides BTS control support to DOD during military training exercises conducted in the CNMI area.

3. Responsibilities

a. Combined Exercise Control Group (CECG). When lower echelon commands need upgraded manpower/equipment resources for control requirements, the CECG should be consulted for support. Ensure that WS support is provided in a reliable and timely manner.

b. Combined Exercise Support Group (CESG). Coordinate all cargo handling procedures for cargo departing Guam with WS personnel. Work with WS personnel to identify and establish snake sterile zones for staging of equipment, vehicles, aircraft, and cargo. Schedule BTS control briefings by WS for military training participants. Ensure an effective BTS control and inspection process. Provide military monitors as necessary.

c. Unit Commanders. Coordinate with on-site contacts to obtain wash down facilities

and inspections. Develop unit plans for and perform wash down operations of equipment and vehicles. Aircraft Unit Commanders must ensure that all aircraft that depart from Guam and scheduled to land elsewhere must be inspected by WS personnel. Aircraft that depart from Australia must also be inspected if the aircraft are scheduled to offload cargo directly to Tinian. Certify equipment and vehicles have been properly cleaned prior to submitting to WS personnel for inspection. Cooperate with WS personnel to expedite inspection process.

d. USDA WS. Provide BTS qualified personnel in appropriate numbers to support military exercises of varying magnitude. Provide all pre- and post- training operations BTS trappings, fence line/jungle BTS spotlight searches, an appropriate number of detector dogs, and an establishment of a barrier/cargo containment area. Provide all tools, materials, and equipment necessary to construct containment areas.

4. Control, Cleaning and Inspection Procedures.

a. Risk: There is always a risk of inadvertent transportation of BTS whenever military units emanate or transit through Guam. BTS is a heat sensitive nocturnal reptile that seeks shelter during the heat of the day. Typical areas that attract BTS include CONEX boxes, undercarriages of vehicles, personal gear, and aboard aircraft. The snake's ability to go without food for extended periods of time allows them to survive long voyages or flights undetected. There are varying levels of risk in terms of containing or housing a BTS:

i. Low Risk: Material originating off island and on Guam only during daylight hours or within sterile areas during nighttime hours.

ii. 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.

iii. High Risk: Material originating from Guam, stored for extended periods, or in regular use.

b. Control Measures on Guam. Throughout the training exercise, WS will provide BTS control support to the military. This support will include those arrangements associated with the identification and purchase of BTS control tools, materials, and equipment needs. WS will provide available personnel and trained detector dogs on Guam to conduct 100% of all cargo, equipment, and vehicles inspection. All unit commanders are to coordinate and cooperate with WS personnel in expediting and assuring the BTS control process.

i. Prior to the exercise, WS will intensify BTS trapping activities at or near identified cargo, landing craft, and aircraft staging areas on Guam. These areas shall include up to 500 meters from identified staging areas. Traps will be spaced at approximately 20-meter intervals. WS will be responsible for care and maintenance of all traps. To augment traps, WS will conduct nightly spotlight searches with high-intensity floodlights in and around the identified staging areas.

ii. WS will install temporary snake barrier systems to prevent BTS from entering cargo containment areas. In consultation with the command post, training unit commanders will specify the barrier entrance and exit points. BTS traps will be activated and monitored in the vicinity of the cargo containment areas.

iii. WS should be consulted to determine the most favorable locations for tent facilities based on low risk areas.

iv. Surrounding the immediate vicinity of temporary lodging quarters, WS will activate and monitor BTS traps. Traps will be placed at strategic locations suspected of attracting snakes. WS detector dogs will be used throughout the area while troops are being staged prior to deployment from Guam. Exercise caution during breakdown and re-packing of temporary facilities.

c. Control Measures on Tinian.

i. Prior to the arrival of the first military cargo form Guam, WS will have coordinated with local wildlife and quarantine officers. WS will purchase and transport BTS control tools, materials, and equipment prior to troops or cargo arriving on island. If local wildlife or quarantine personnel assistance is needed, WS will provide the training and oversight.

ii. WS will erect temporary barriers to prevent BTS from entering the cargo containment areas on island. WS will take augment measures, which include setting traps one week prior to inbound cargo from Guam and conducting night searches throughout the duration of the exercise. Traps will be set near port or entry, drop zones, and take-off zones. Additional BTS traps will be used for contingency and where BTS is specifically sighted.

d. Cleaning Procedures.

i. The training unit is responsible for cleaning vehicles and heavy equipment prior to staging in a cargo containment area. High pressure or steam cleaning may facilitate the removal of BTS from vehicles and equipment. Prior to entering the cargo containment areas, all heavy equipment and vehicles must be thoroughly cleaned by DOD personnel. The WS Detector Dog Teams will not inspect heavy equipment and/or vehicles that have not been cleaned, which would delay the process.

ii. Wash down areas should be expeditiously identified and established. Command Post and WS should be consulted for support.

e. Inspection Procedures on Guam.

i. 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 all cargo using snake detector dogs. Any containerized cargo suspected of housing a BTS will be immediately flagged with florescent ribbon and subsequently opened by the military. Interior contents will be further inspected to verify

and remove any discovered BTS. WS detector dogs will inspect transport craft 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. Transport craft left stationary for more than two hours will also be inspected a second time prior to departure.

ii. WS may identify inspected items within 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 cargo reaches its destination, the tag must be removed from the cargo. WS will maintain a log of all cargo, vehicle, equipment, or craft inspected. WS will monitor the time lapsed from each inspection and notify the military the need of any re-inspection prior to the cargo or craft departing from Guam.

iii. DOD personnel will inspect own personal gear and other hand-carried equipment and supplies for BTS. Command posts will provide necessary briefs to inform training participants of concerns regarding the BTS. WS will provide support to command posts on BTS orientation.

iv. The military will provide WS points-of-contacts (POCs) in an effort to maintain clear and open communication lines. WS will keep the POCs abreast of BTS related activities. To assist with the scheduling of inspections, WS is to request within reason, that some form of notification be provided when unscheduled changes or delays occur.

e. Inspection Procedures on Tinian.

i. Floodlights will be provided by the military to assist WS and local wildlife officers with night inspections while personnel/cargo off-loading is taking place.

ii. During nights when inbound traffic is arriving, WS and military will coordinate spotlight search of areas in close proximity to designated off-load and breakdown locations. Visual checks of these areas will be conducted on regular intervals with special emphasis during cargo off-load and breakdowns.

5. **Guidelines for BTS Sighting.** It is critically important to interdict (kill) any BTS when sighted, especially on Tinian or Hawaii. The cost and difficulty of trying locate an escaped BTS coupled with the significant ecological impact resulting from the BTS importation into snake-free lands justifies the capturing or killing sighted BTS action taking precedence over the exercise. However, any means to capture or kill any sighted BTS should be taken with caution, safety, and discretion.

a. BTS Sighting on Guam.

i. If military personnel deem a sighted BTS or a suspected BTS not interdictable, then immediately contact the local area WS office:

- Andersen AFB Office: 366-3261
- Guam District Office: 635-4400

- COMNAVMARIANAS Office: 472-7101

ii. Whether a BTS is interdicted or a WS office is called for assistance, any sighting of or suspected BTS must be reported to the CESG via the command post. The CESG will notify the appropriate personnel in charge of WS operations during the exercise of any BTS sighting. The CESG will inform USCINCPAC REP Guam (COMNAVMARIANAS) Command Center at 339-7133.

iii. DOD will assist WS and local officials in the interdiction of snakes upon request as practical.

iv. Once requested, WS will dispatch either personnel or BTS detector dog team to the vicinity of the BTS sighting. WS will ensure there are sufficient personnel and detector dog teams to adequately cover the expanse of the training areas.

v. Care must be taken when killing or capturing a snake. The BTS is only mildly toxic; however, snakes of other species may be more venomous. If a person is bitten, the snake should be killed and, if possible, kept refrigerated, or frozen, or placed in alcohol, until it can be turned over to WS for positive identification.

b. BTS Sighting on Tinian.

i. Items ii through v of "BTS Sighting on Guam" applies to any BTS or any snake sighting on Tinian.

ii. If military personnel deem a sighted BTS or a suspected BTS cannot be killed or captured, immediately contact the local natural resource agency:

- Tinian, CNMI: Division of Fish and Wildlife
  CNMI Government
  Saipan, MP 96950
  Telephone: (670) 322-3927/8
  FAX: (670) 322-9629

iii. If deemed necessary, WS may make special arrangements to airlift a detector dog team on island in response a BTS sighting or a suspected BTS during the training exercise.

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.*

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[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
Military Exercises and Historic Sites in Military Training Areas on the Island of Tinian: An Archaeological Assessment (December 1998)

Military Exercises and Historic Sites in the Military Lease Area of the Island of Tinian, CNMI: An Archaeological Assessment

by
David J. Welch
H. David Tuggle

International Archaeological Research Institute, Inc.
December 1998

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.
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December 1998

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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).

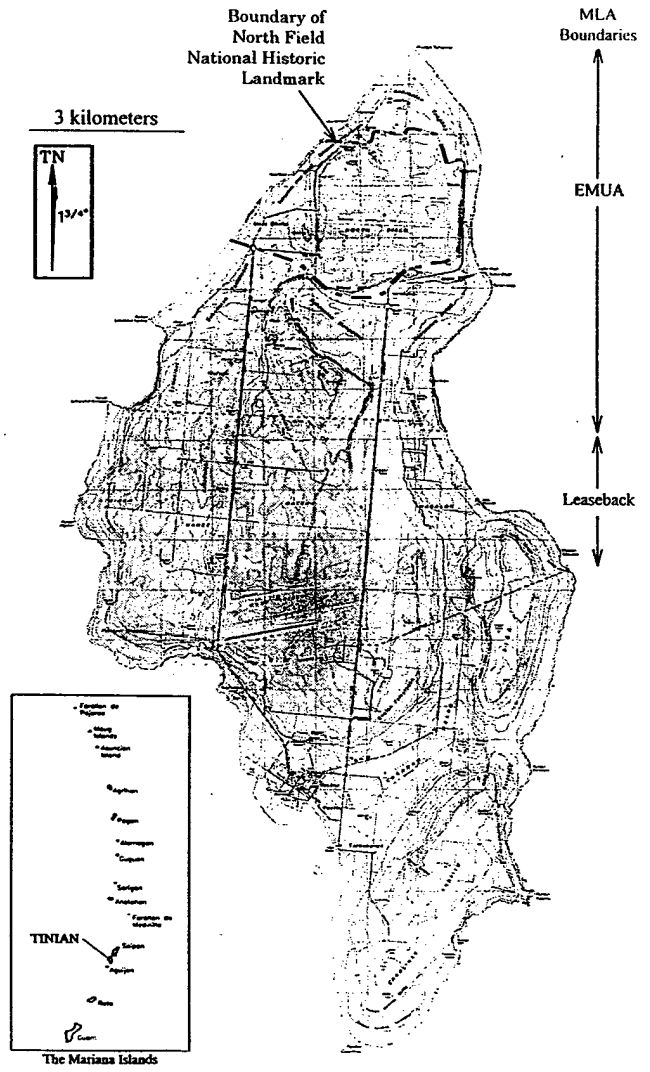

Figure 1. The Mariana Islands, showing Tinian and the project area.

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;

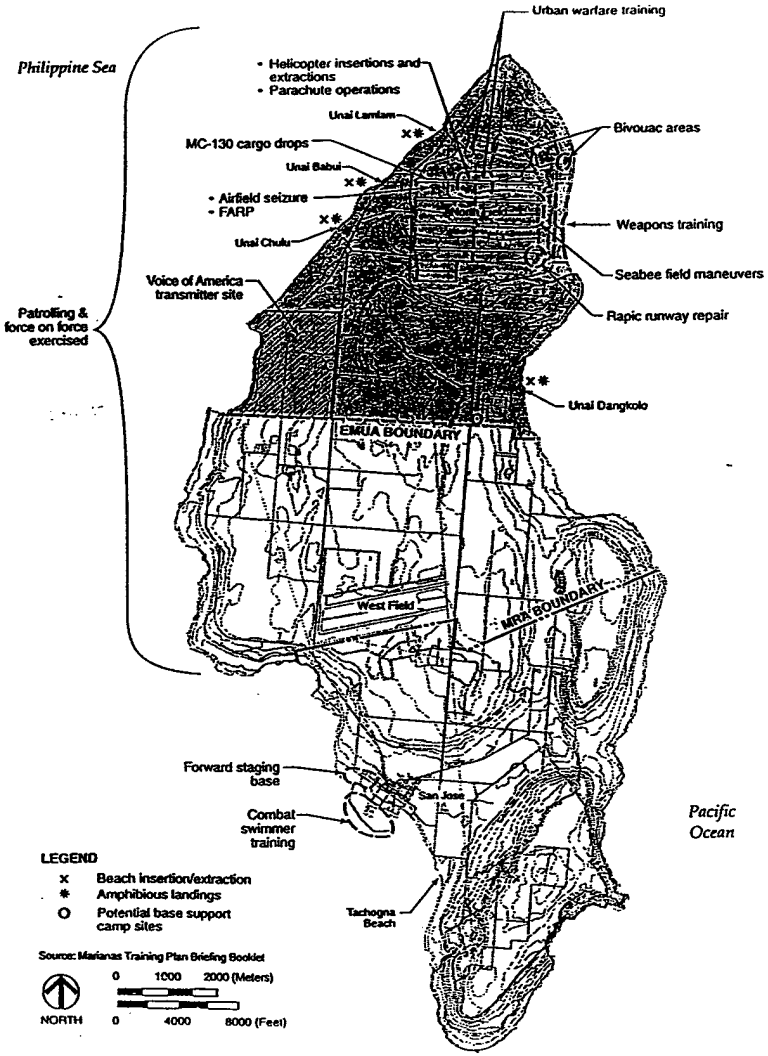

Figure 2. Proposed training areas, Tinian. (From Belt Collins Hawaii 1996a)

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.

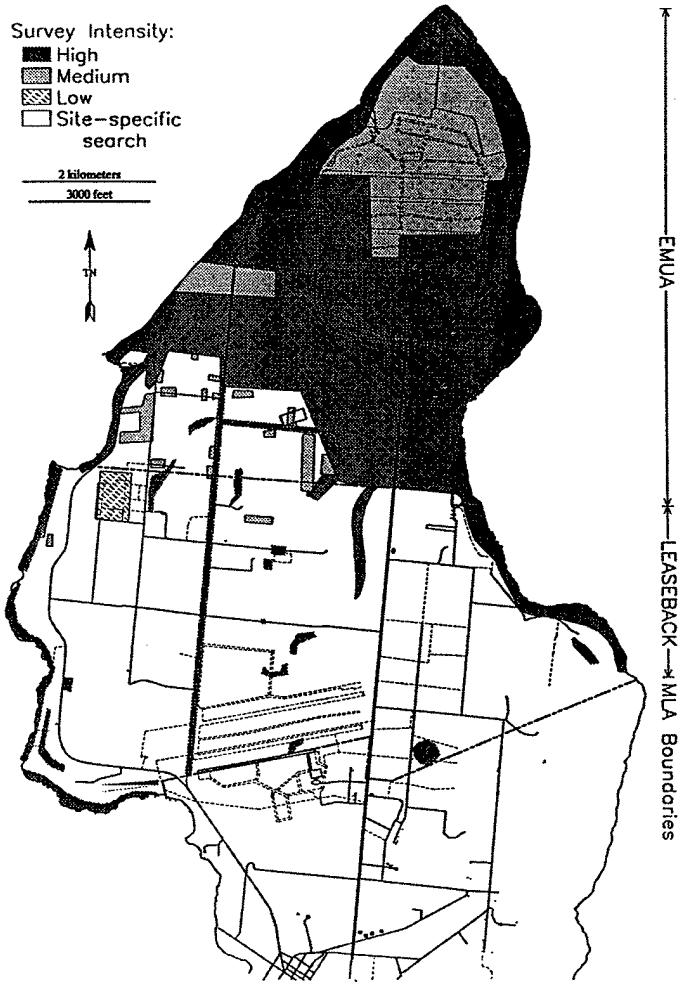

Figure 5. Survey intensity in the MLA.

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

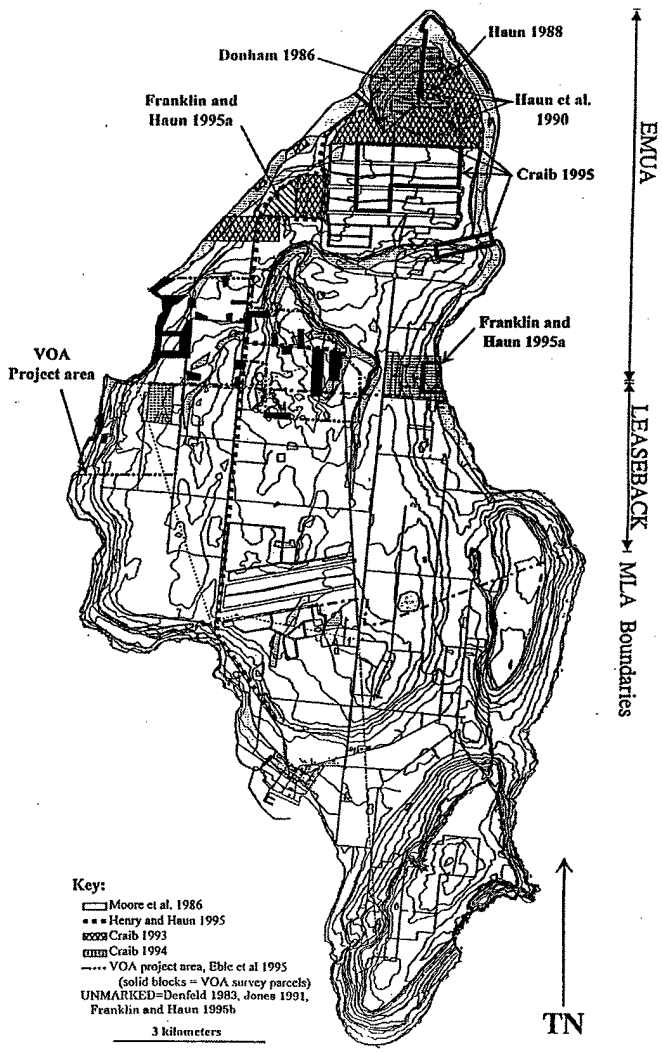

Figure 3. Map of Tinian showing the Military Lease Area and locales of archaeological surveys (pre-Henry et al. 1996).

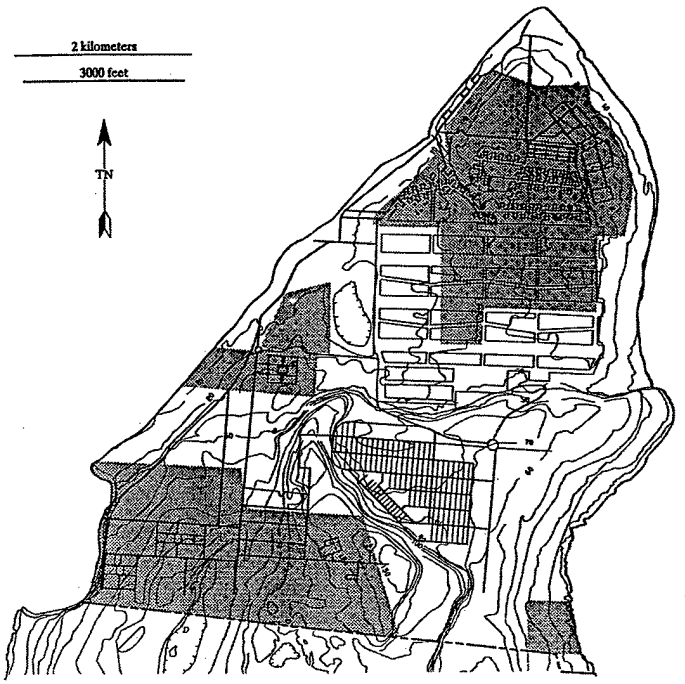

Figure 4. Survey area of Henry et al. (1996), shown in unscreened area (from Henry et al. 1996). Screened areas are other surveys, as shown in Figure 3.

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.

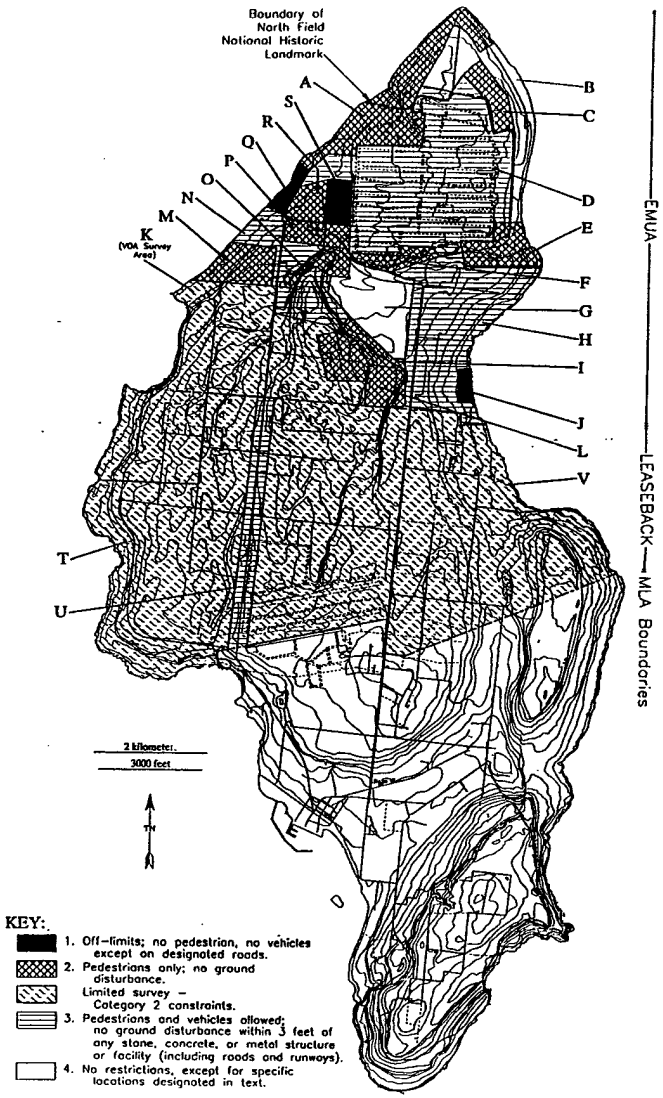

Figure 6. Site Protection Areas with National Landmark boundary.

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

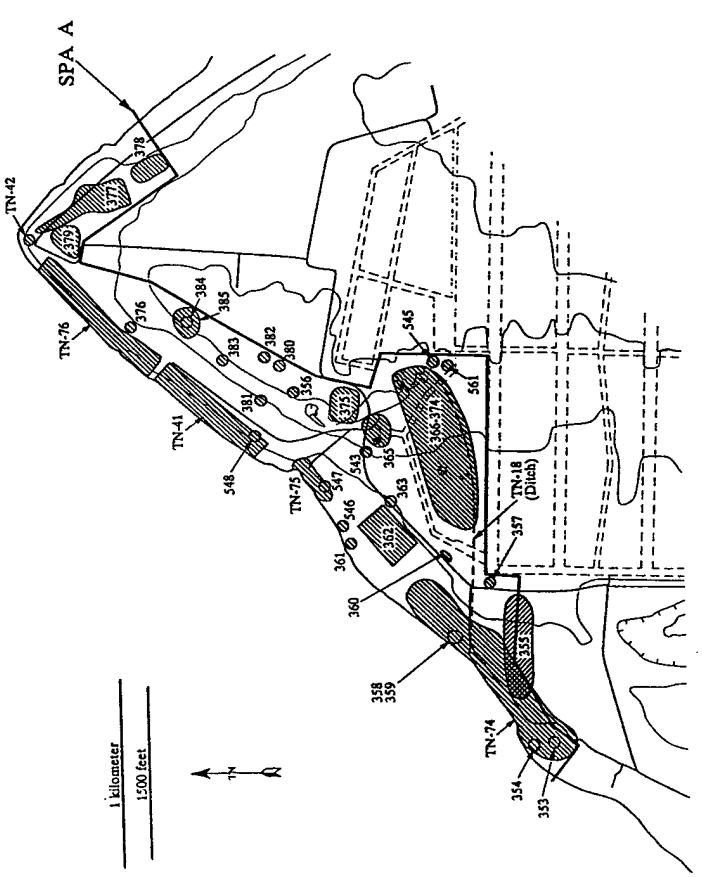

Figure 7. Significant archaeological sites, Site Protection Area A. (All site numbers without TN- prefix have Z- prefix.)

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).

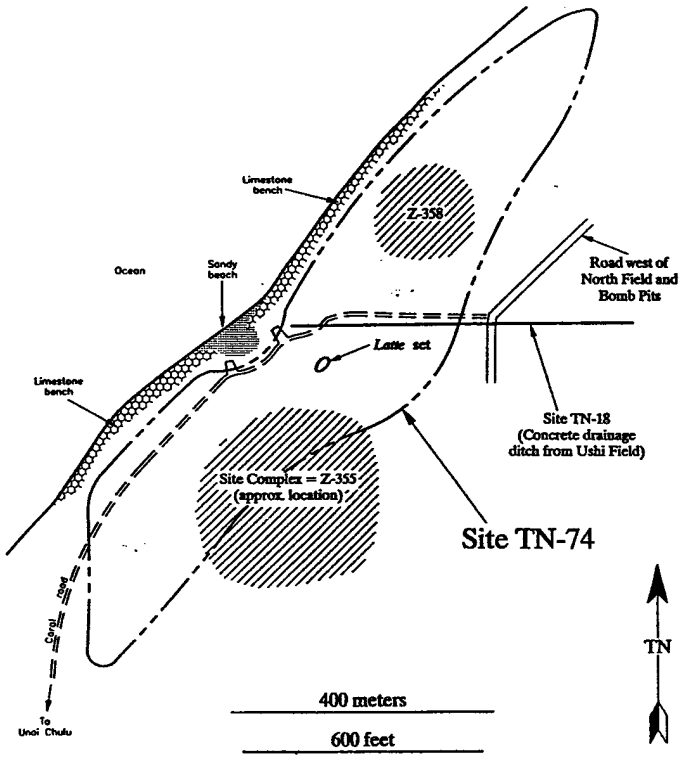

Figure 8. Detail of Unai Babui, in Site Protection Area A.

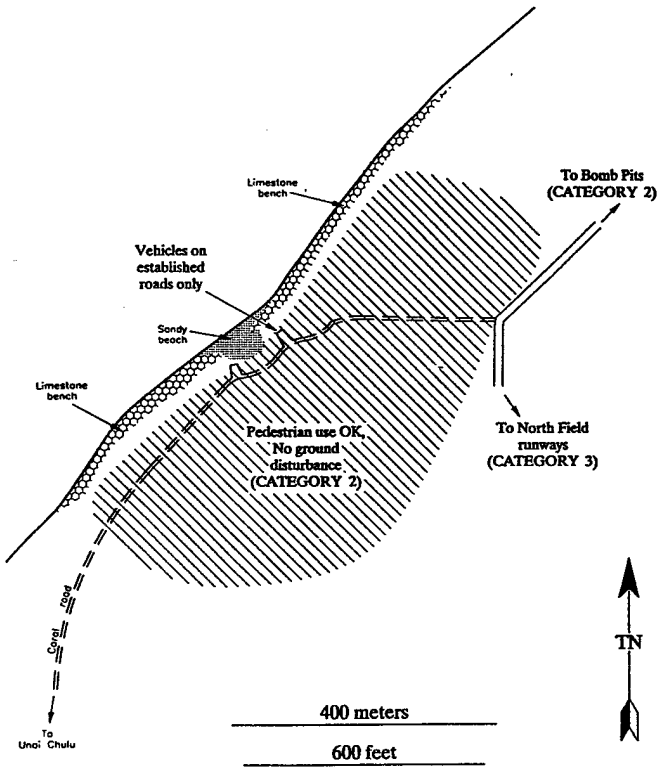

Figure 9. Constraints at Unai Babui, in Site Protection Area A.

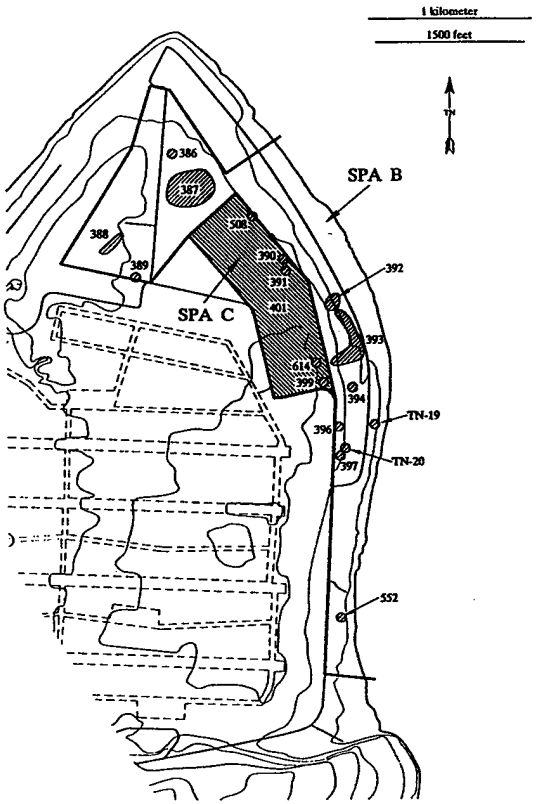

Figure 10. Archaeological sites, Site Protection Areas B and C. (All site numbers without TN- prefix have Z- prefix.)

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.

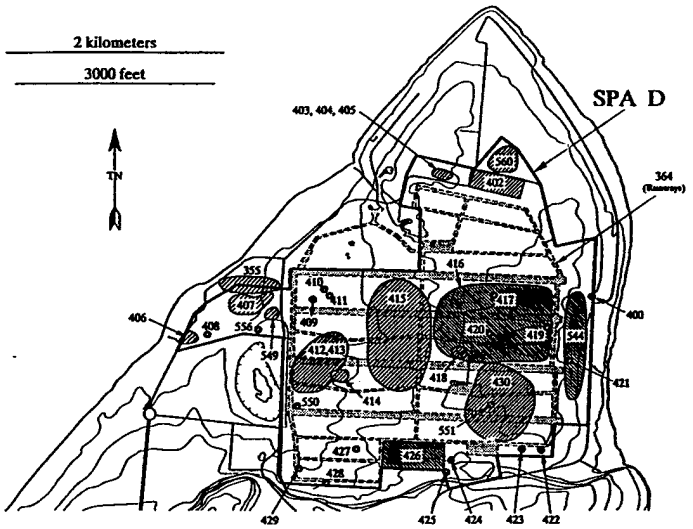

Figure 11. Significant archaeological sites, Site Protection Area D. (All site numbers without TN- prefix have Z- prefix.)

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	Amtrak	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.

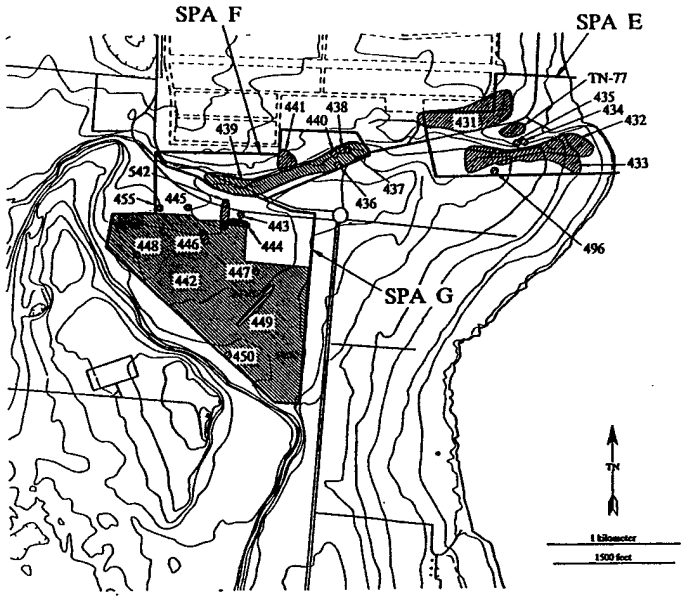

Figure 12. Significant archaeological sites, Site Protection Areas E, F, and G. (All site numbers without TN- prefix have Z- prefix.)

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.

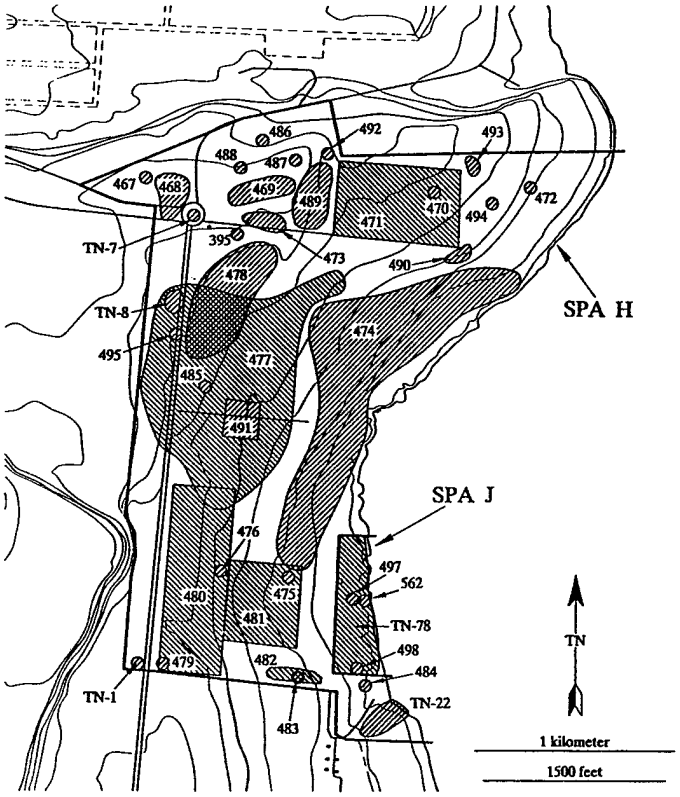

Figure 13. Significant archaeological sites, Site Protection Areas H and J. (All site numbers without TN- prefix have Z- prefix.)

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 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	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.

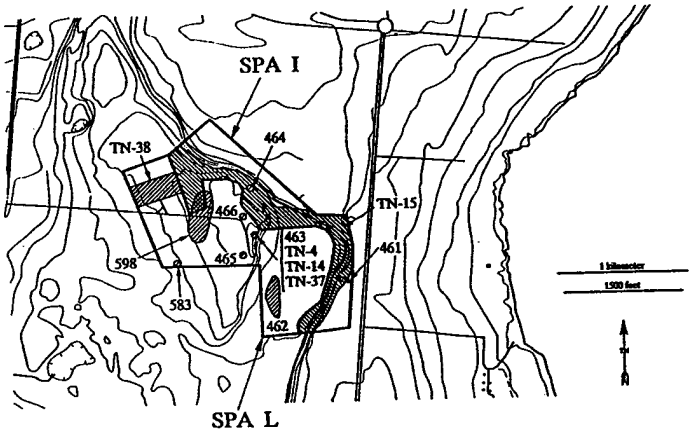

Figure 14. Significant archaeological sites, Site Protection Areas I and L. (All site numbers without TN- prefix have Z- prefix.)

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.

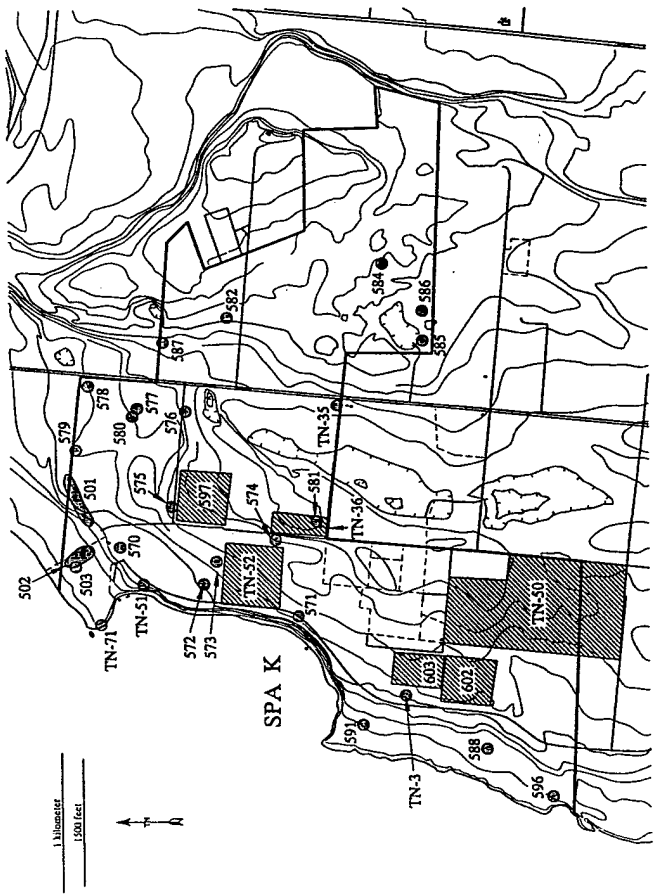

Figure 15. Significant archaeological sites, Site Protection Area K. (All site numbers without TN- prefix have Z- prefix.). The hatched site areas indicate site identification from aerial photos, without ground verification.

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).

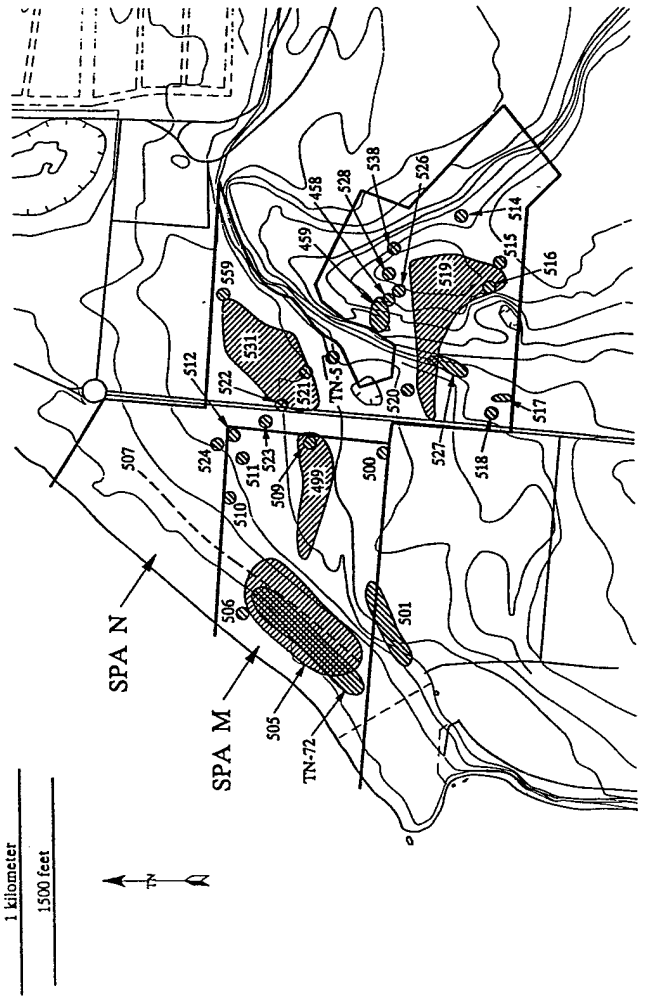

Figure 16. Significant archaeological sites, Site Protection Areas M and N. (All site numbers without TN- prefix have Z- prefix.)

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. Fam, 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.

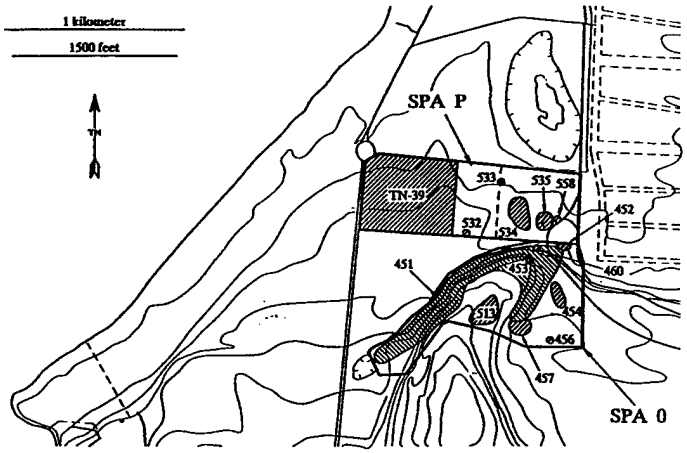

Figure 17. Significant archaeological sites, Site Protection Areas O and P. (All site numbers without TN- prefix have Z- prefix.)

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.

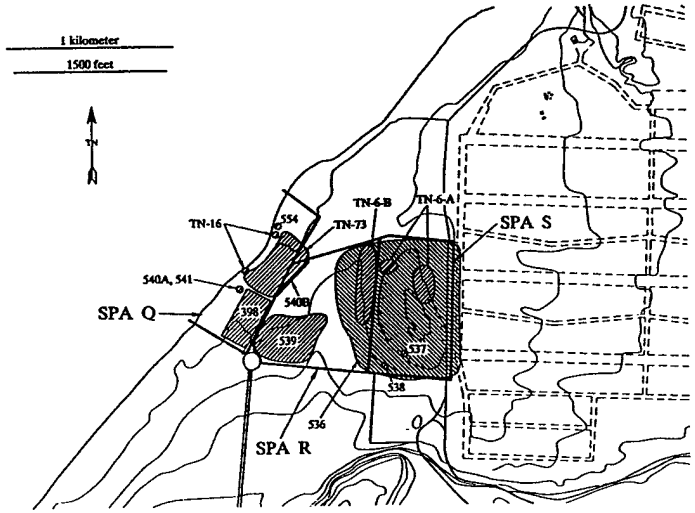

Figure 18. Significant archaeological sites, Site Protection Areas Q, R, and S. (All site numbers without TN- prefix have Z- prefix.)

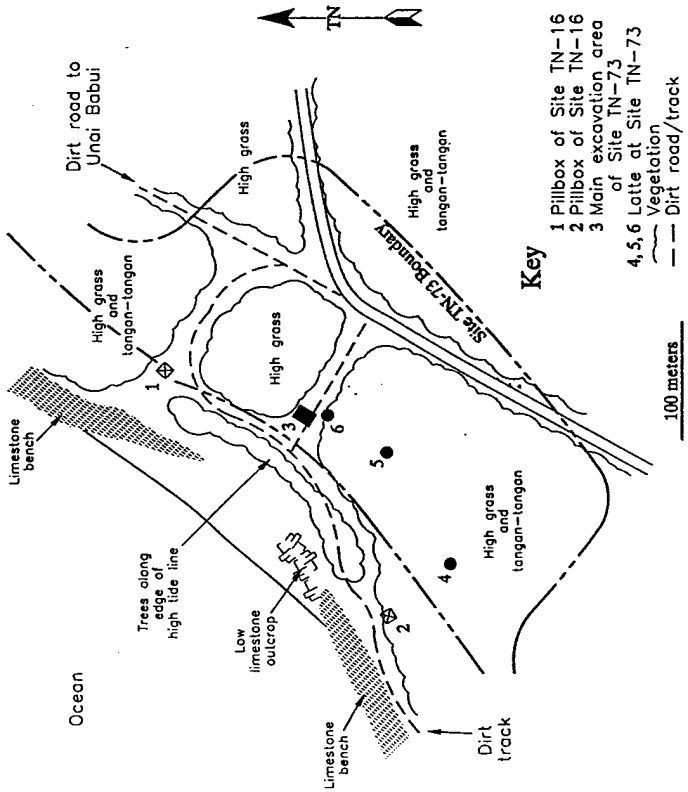

Figure 19. Detail of Unai Chulu, Site Protection Area Q.

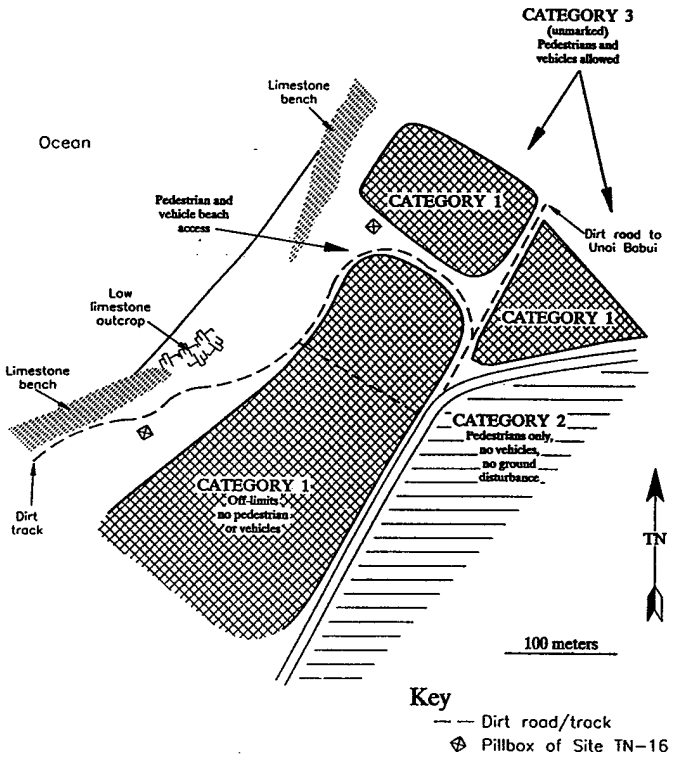

Figure 20. Constraints at Unai Chulu.

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.

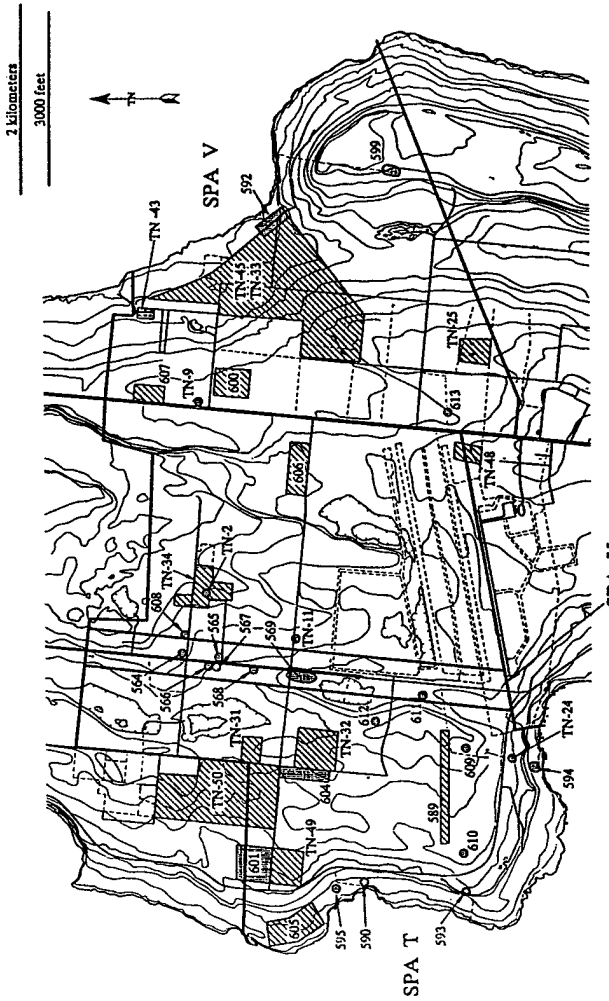

Figure 21. Significant archaeological sites, Site Protection Areas T, U, and V. (All site numbers without TN- prefix have Z- prefix.) The hatched site areas indicate site identification from aerial photos, without ground verification.

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.

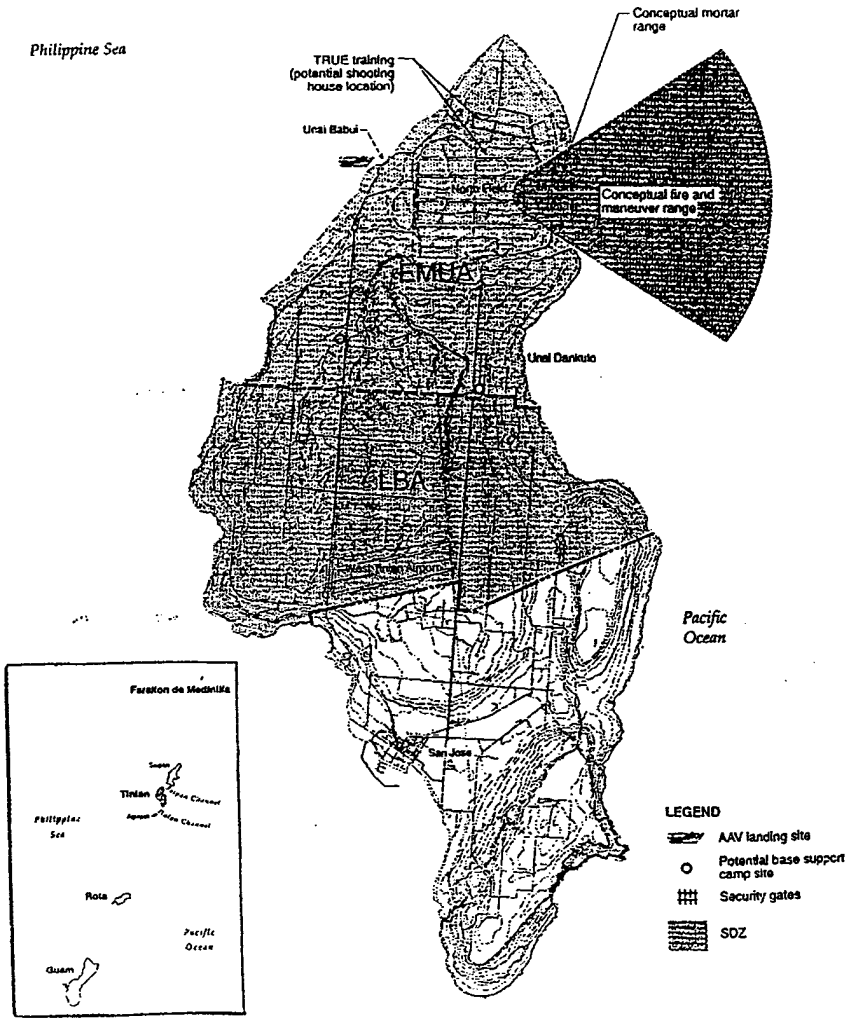

Figure 22. Proposed Tinian Training. (From Belt Collins Hawaii 1996b:Figure 2-10.)

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	Gatoi; 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	Homestend 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	Famalaoan 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 ?	Homestend, 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

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

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.

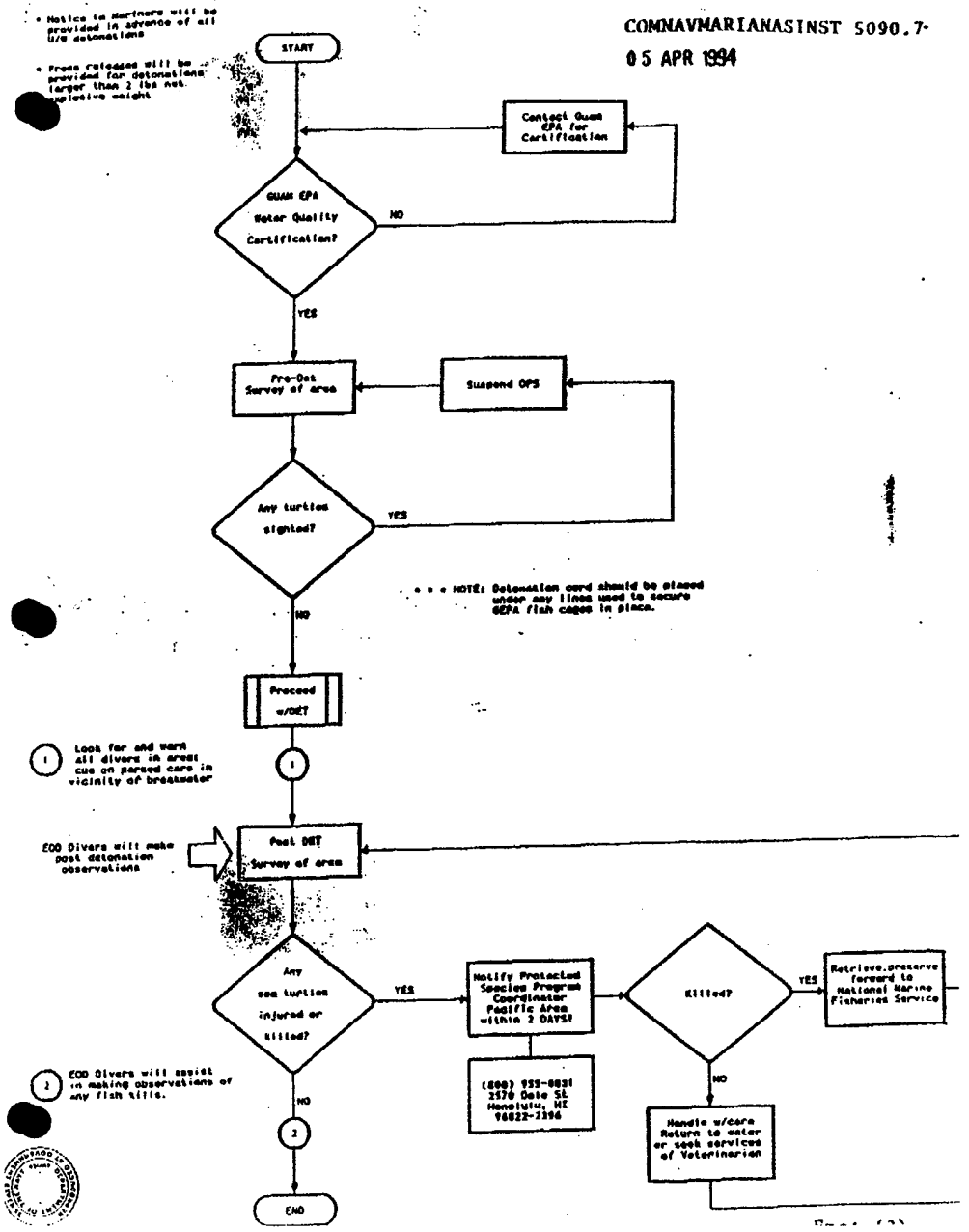
e. While preparing for the verification dive, and as part of the 30 minute waiting period, the boat will transit the area and look for signs of injured or dead turtles/marine life. If any are found, they will be turned over to DAWR for forwarding to the National Marine Fisheries Service.

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
Leiognathus 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")

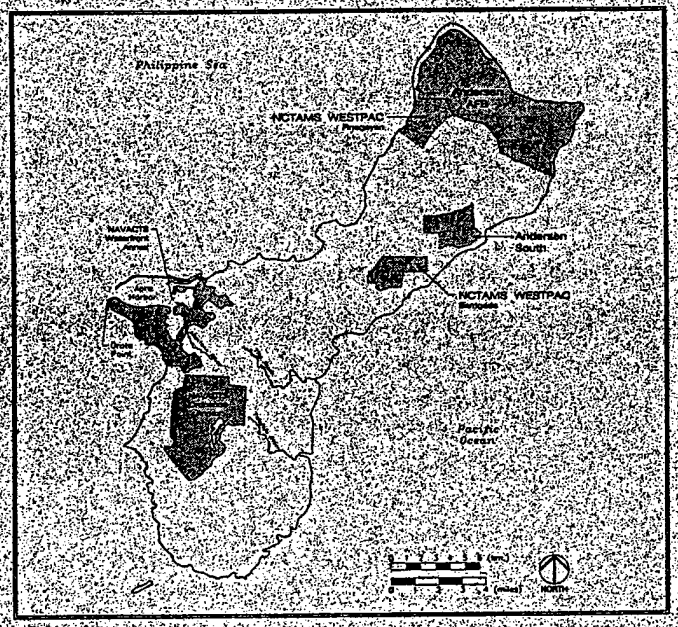
SPECIES	QUANTITY	SIZE (cm)
Lutjanus bohar	1	51.5
L. gibbus	13	18, 15, 20, 17, 19, 19, 18, 11, 20, 18, 20, 15, 15
Chaetodon auriga	2	14, 15
C. ulietensis	1	9
C. ephippium	1	11
Psuedobalistes flavimarginatus	1	23
Suflamen chrysoptera	2	15, 13
Gerres argyreus	4	19, 20, 21, 22
Parupeneus heptacanthus	1	31
Cheilinus fasciatus	4	22, 13, 13, 12, 28
Epibulus insidiator	1	28
Pomacentrus ambotnensis	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
Ptereleotris (sp?)	1	19.5
Total species: 20	**Total: 76**	

GEPA FILE

**Photos taken of collected fishes **Down-time restricts the complete collection of fishes

Appendix J
Military Exercises and Historic Sites in Military Training Areas on the Island of Guam: An Archaeological Assessment (December 1998)

Military Exercises and Historic Sites in Military Training Areas on the Island of Guam: An Archaeological Assessment



by

Judith R. McNeill
David J. Welch

International Archaeological Research Institute, Inc.
December 1998

MILITARY EXERCISES AND HISTORIC SITES IN MILITARY TRAINING AREAS ON THE ISLAND OF GUAM: AN ARCHAEOLOGICAL ASSESSMENT

by

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December 1998

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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).

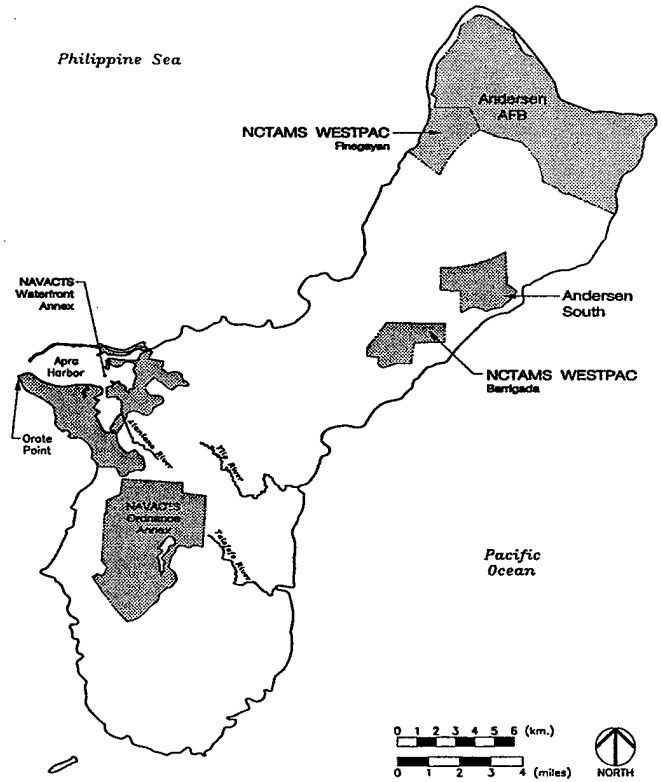

Figure 1. Map of Military Base Areas Included in this Study.

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

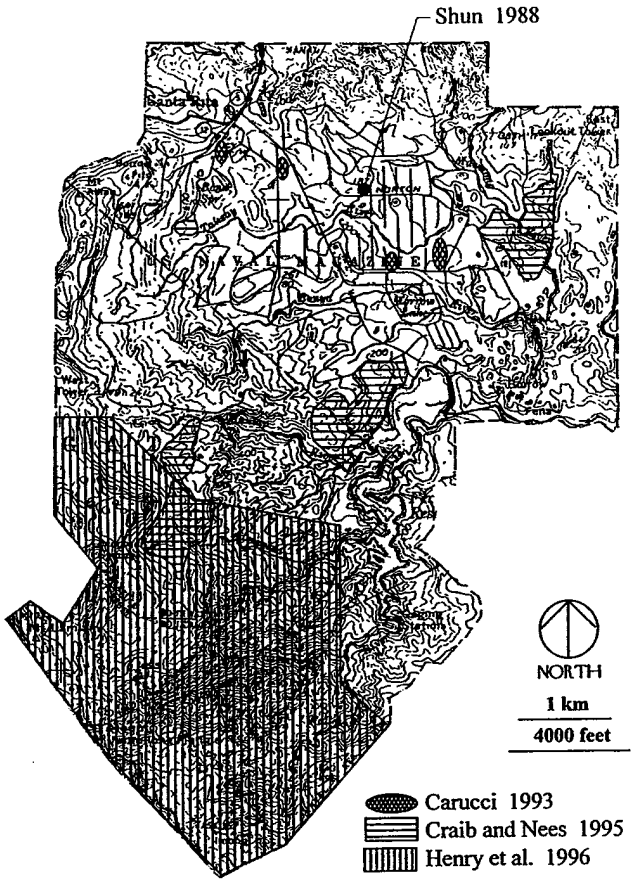

Figure 2. Location of Archaeological Surveys at NAVACTS Ordnance Annex.

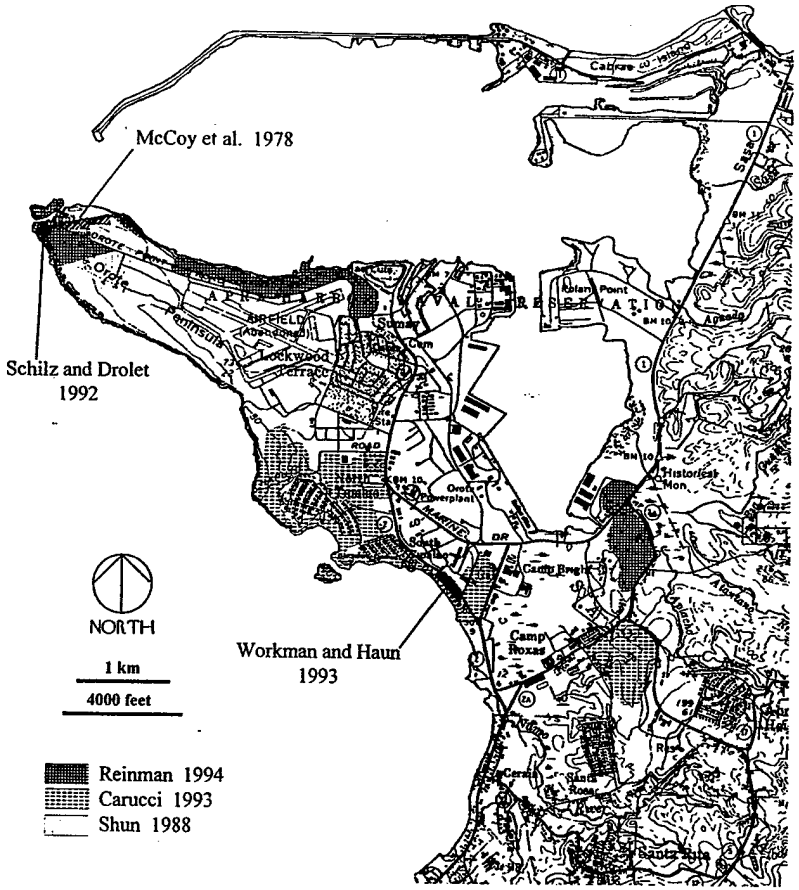

Figure 3. Location of Archaeological Surveys at NAVACTS Waterfront Annex.

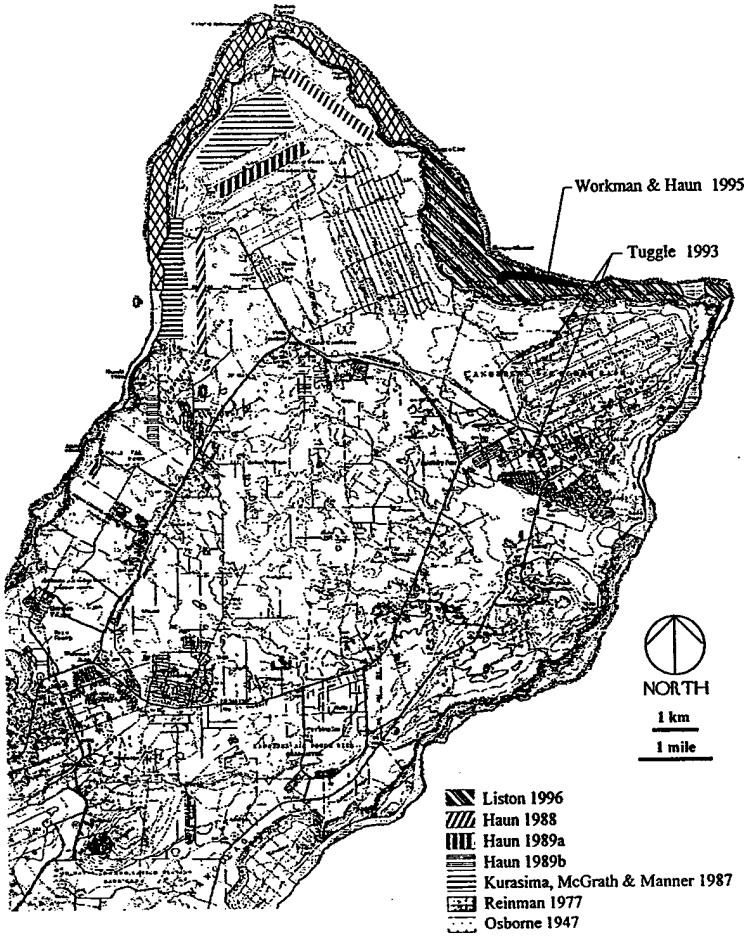

Figure 4. Location of Archaeological Surveys at Andersen AFB and NCTAMS.

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

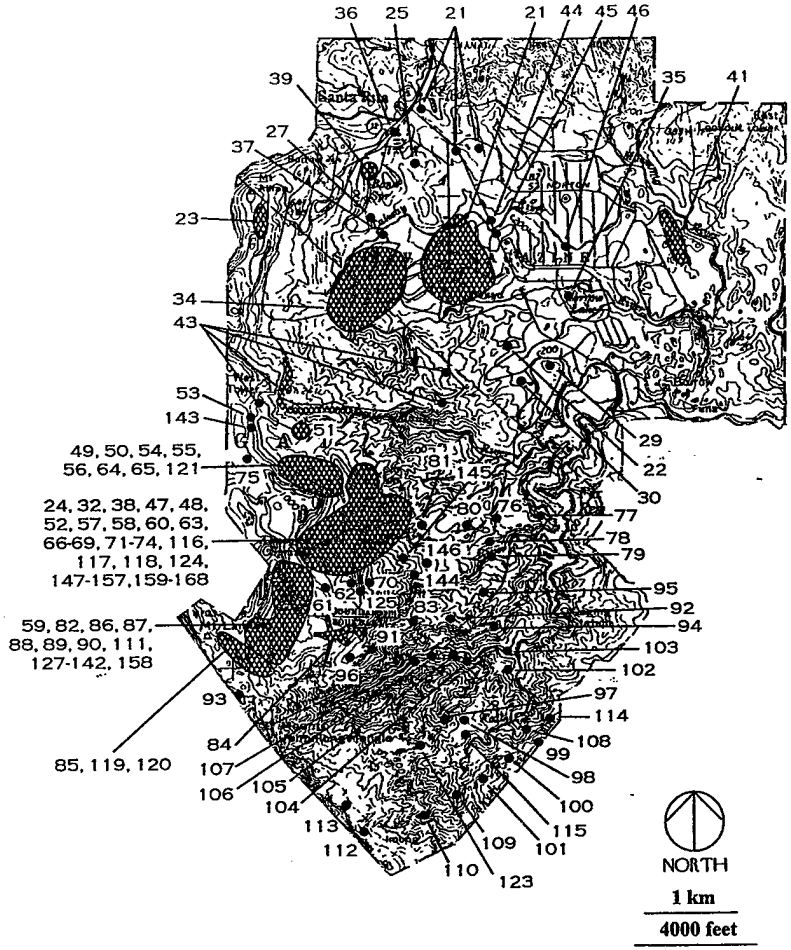

Figure 5. Archaeological Sites at NAVACTS Ordnance Annex.

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.

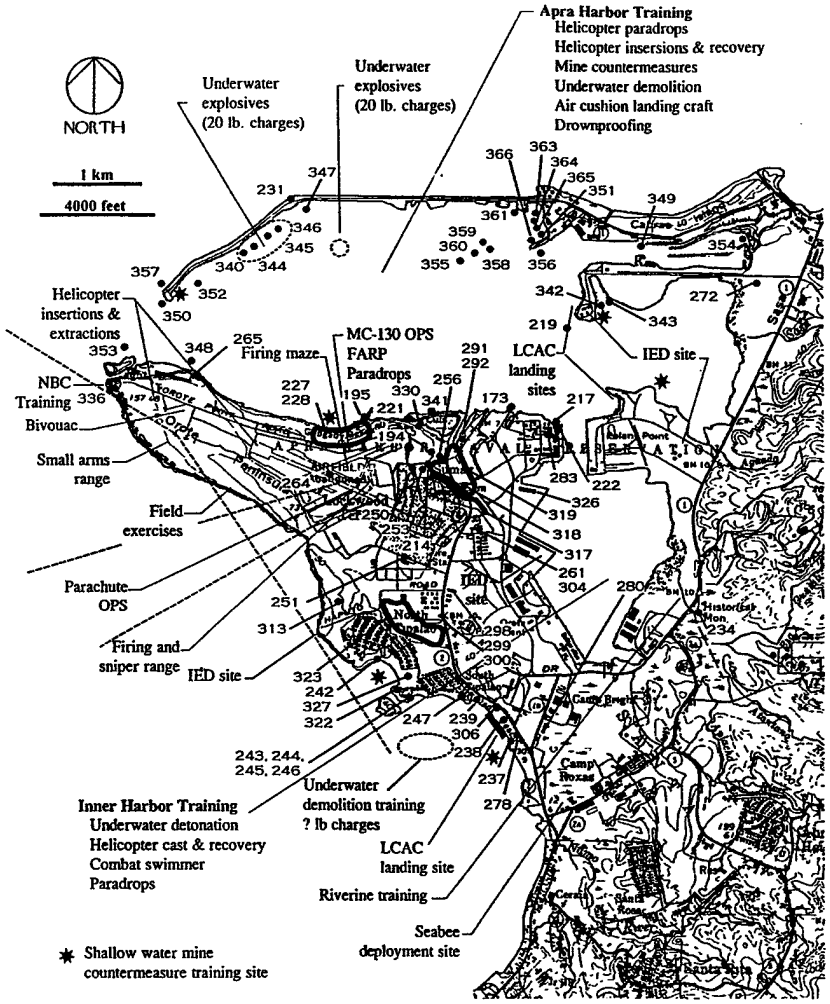

Figure 6. Selected Archaeological Sites at NAVACTS Waterfront Annex.

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 m² 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 m². 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.

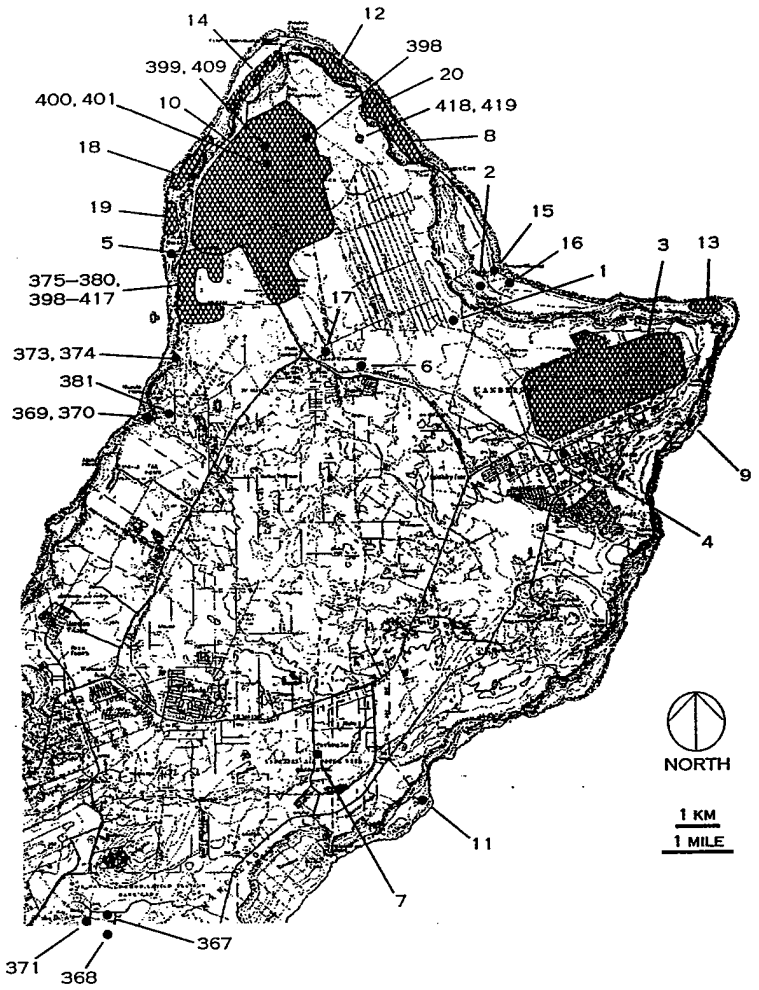

Figure 7. Archaeological Sites at Andersen AFB and NCTAMS.

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.

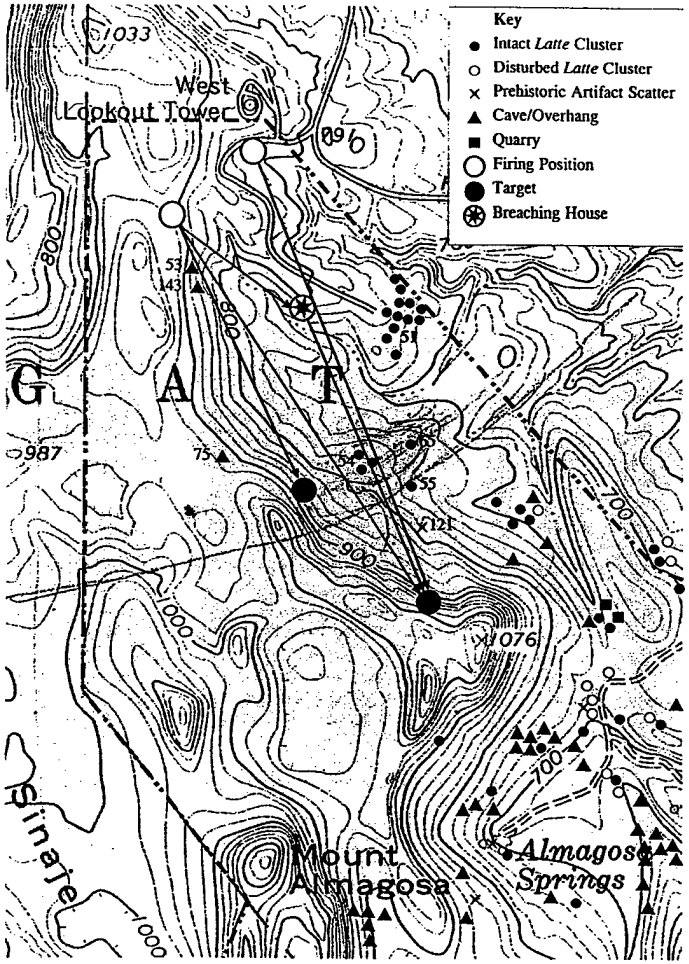

Figure 8. Archaeological Sites Potentially Impacted by the ORDANX Firing Range.

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.

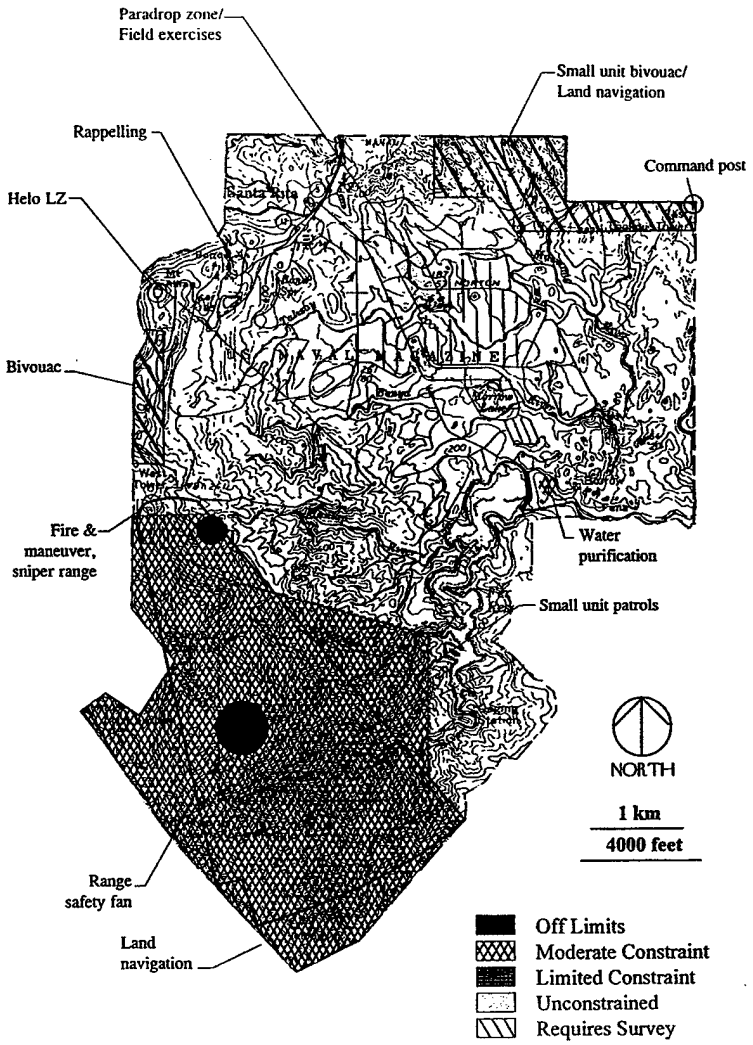

Figure 9. Site Protection Areas for NAVACTS Ordnance Annex Training.

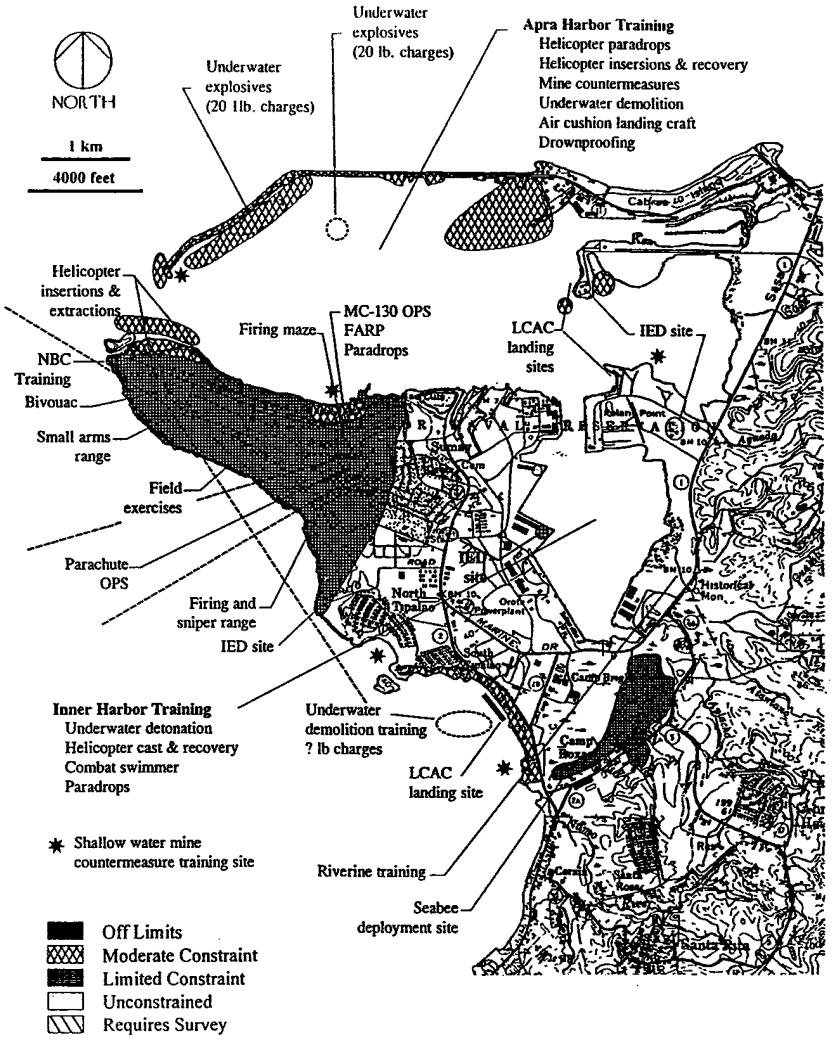

Figure 10. Site Protection Areas for NAVACTS Waterfront Annex Training.

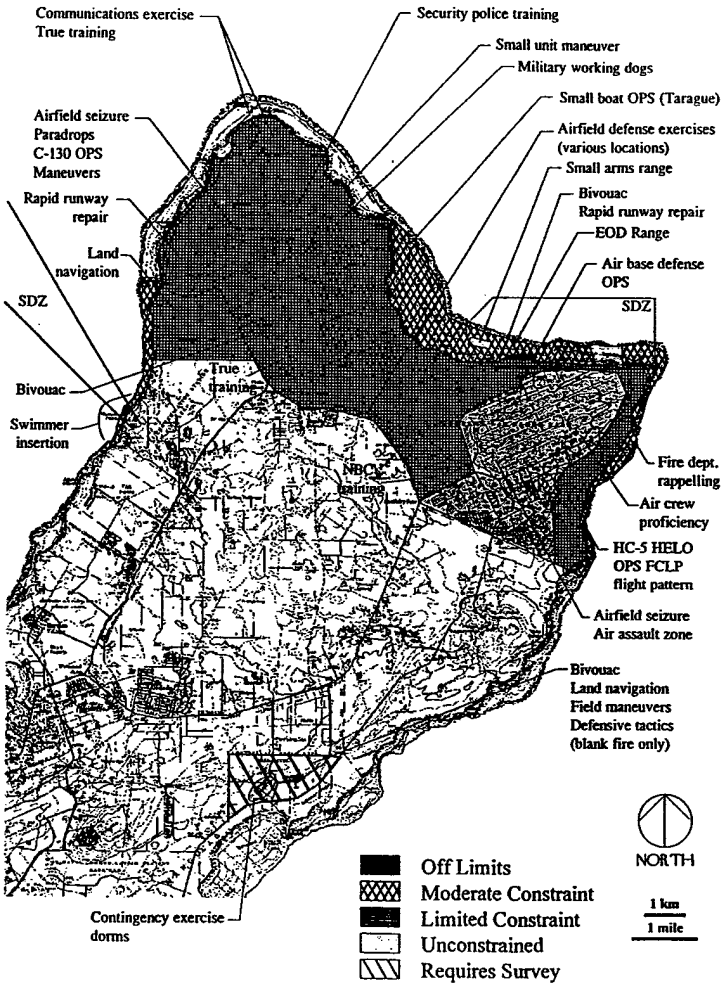

Figure 11. Site Protection Areas for Andersen AFB and NCTAMS Training.

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	Uruno Beach Complex	66-08-0011	*latte* structures and surface materials	prehistoric	Schilz 1996	39	yes		Dec 74	June 74	
19.	AAFB	Uruno 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 5 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						no systematic survey or mapping
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			
26.	ORDANX	Bona Spring		latte remains	prehistoric	Craib and Nees 1995		D				} may be the same site
27.	ORDANX	Bona Spring Complex	66-02-0152	no visible surface remains; *latte* structure(s)	prehistoric	Craib and Yoklavich 1992b		II				
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						} may be the same site
33.	ORDANX	Dobo Spring Complex		multiple latte features; 30 acres	prehistoric	Craib and Nees 1995	DS1-10	D				

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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				} may be the same site
41.	ORDANX	Maemong River Complex		rockshelters with prehistoric and historic surface materials; "needs survey"	?	Craib and Yoklavich 1992b Lauter-Reinman 1994	69	II unev				
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				location not mapped in report
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			
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		15.4 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)		1028.5 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	inq	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						
						Lauter-Reinman 1995	6	unev				
176.	WFANX	Apuntua Point Remains		submerged discarded historic materials	WWII?	Lauter-Reinman 1994						
177.	WFANX	Baseball Field - 95		surface feature	1946	Lauter-Reinman 1995	7	no				
178.	WFANX	Baseball Field -1962		surface feature	1946	Lauter-Reinman 1995	8	no				
179.	WFANX	Basketball Court - 1978		surface feature	1949	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	9	no	WWII and permanent base construction			
180.	WFANX	Battery Recharge Shop - Bldg. 779		surface structure	1947	Craib and Yoklavich 1992c		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	10	unev	permanent base construction			
181.	WFANX	Bldg. 5506 - A4-1		surface structure	?	Lauter-Reinman 1995	11	no				
182.	WFANX	Building 93-1		metal surface structure	1945	Lauter-Reinman 1994	84	no	modified			
183.	WFANX	Bulldozed Debris & Pad TN-5		disturbed surface materials	?	Carucci 1993	TN-5	NE				
						Lauter-Reinman 1994	9	no				
						Lauter-Reinman 1995	12	no				
184.	WFANX	Bulldozed Debris TN-3		disturbed surface materials	?	Carucci 1993	TN-3	NE				
						Lauter-Reinman 1994	10	no				
						Lauter-Reinman 1995	13	no				
185.	WFANX	Bulldozed Debris TN-4		disturbed surface materials	?	Carucci 1993	TN-4	NE				
						Lauter-Reinman 1994	11	no				
						Lauter-Reinman 1995	14	no				
186.	WFANX	Bunker and Gun Emplacement A4-8 & 9			?	Lauter-Reinman 1995	15	no				
187.	WFANX	Butler 2016		metal surface structure	?	Lauter-Reinman 1994	12	no				
						Lauter-Reinman 1995	16	mq	unusual construction type			
188.	WFANX	Butler 2028		metal surface structure	?	Lauter-Reinman 1994	13	mq	unusual construction type			
						Lauter-Reinman 1995	17	no				
189.	WFANX	Butler 2055		metal surface structure	?	Lauter-Reinman 1994	14	no	modified			
						Lauter-Reinman 1995	18	unev				
190.	WFANX	Butler 2060		metal and concrete surface structure	?	Lauter-Reinman 1994	15	no	modified			
						Lauter-Reinman 1995	19	unev				
191.	WFANX	Butler 2060A		metal and concrete surface structure	?	Lauter-Reinman 1994	16	no	modified			
						Lauter-Reinman 1995	20	unev				
192.	WFANX	Butler 2068		metal surface structure	?	Lauter-Reinman 1994	17	no	modified			
						Lauter-Reinman 1995	21	unev				
193.	WFANX	Butler 2070		metal surface structure	?	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	158	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			
						Lauter-Reinman 1994	30	no	WWII base construction			
						Lauter-Reinman 1995	41	no				
216.	WFANX	Fallout Shelter - Bldg. 5507			1946	Craib and Yoklavich 1992d		II	assoc. with the broad patterns of Navy			
						Lauter-Reinman 1995	43	unev	permanent base construction			

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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			
						Lauter-Reinman 1995	49	no	WWII and permanent base construction			
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						on map, but not listed among resources
						Lauter-Reinman 1995	51	no				
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			
						Lauter-Reinman 1994	44	unev	battles			
						Lauter-Reinman 1995	60	no				
234.	WFANX	Historical Monument and Spanish Shrine	66-03-1012	no description	?	Craib and Yoklavich 1992d						on map, but not discussed in text
235.	WFANX	Housing Area 8 Remains A7-1&2			1950s	Lauter-Reinman 1995	63	no				
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	Japanese 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				
						Lauter-Reinman 1995	87	no-st				
257.	WFANX	Marine Barracks Site	66-03-1036	no surface features remaining	1921-1941	Craib and Yoklavich 1992d		III	assoc. with broad patterns of Navy WWII			not mapped
						Lauter-Reinman 1995	88	no	base construction			
258.	WFANX	Military Dump A5-5			?	Lauter-Reinman 1995	89	no				
259.	WFANX	Miramar Road Remains - A8-2			?	Lauter-Reinman 1995	90	no				
260.	WFANX	Modified Karst Pits A5-6 & 7			?	Lauter-Reinman 1995	91	no				
261.	WFANX	NOB Hill Bowl Theater		masonry surface structure, remnant	1945	Yoklavich and Craib 1992		I	Criterion C; assoc. with broad patterns of			
						Lauter-Reinman 1994	72	yes	pre-WWII Navy construction; only extant			
						Lauter-Reinman 1995	92	yes	example			
262.	WFANX	Office Bldg. for Shop Area - 1770		wooden surface structure	1947	Yoklavich and Craib 1992		I	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1995	93	unev	Navy permanent base construction; "unique structure due to its materials"			
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				
						Lauter-Reinman 1995	94	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	prehistoric/ historic	Craib and Yoklavich 1992d		I	research potential; assoc. with important	Oct 79	Oct 79	
						Lauter-Reinman 1995	95	yes	events in history			
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				
						Lauter-Reinman 1995	96	no				
267.	WFANX	Orote Village			1676	Craib and Yoklavich 1992c		II	potential cultural deposits			
						Craib and Yoklavich 1992d Carucci 1993		II				
						Lauter-Reinman 1995	97	unev				
268.	WFANX	Pad Complex A4-6			?	Lauter-Reinman 1995	100	no				
269.	WFANX	Pan American Airways Hotel Remains	66-03-0142	concrete foundation only, location in question; destroyed during recapture of Guam	1936-1944	Craib and Yoklavich 1992d		III	presence of existing remains questionable		Oct 74	
						Lauter-Reinman 1994	78	mq				
						Lauter-Reinman 1995	98	no				
270.	WFANX	Pan American Airways Seaplane Ramp		concrete quay	1935-1944	Lauter-Reinman 1994	79	mq				
						Lauter-Reinman 1995	99	unev				
271.	WFANX	Picnic Structure Pads TN-24		concrete surface features	?	Carucci 1993	TN-24	NE				
						Lauter-Reinman 1994	80	no				
						Lauter-Reinman 1995	101	no				
272.	WFANX	Piti *Latte* Site	66-03-0137	single 10 pillar *latte*; probably destroyed	prehistoric	Craib and Yoklavich 1992d		II				
273.	WFANX	Potable Water Tank - 532			1945	Lauter-Reinman 1994	81	no				
274.	WFANX	Potable Water Well - C534			1945	Lauter-Reinman 1994	82	no				
275.	WFANX	Pottery and Lithic Scatter			prehistoric	Lauter-Reinman 1995	104	unev				
276.	WFANX	Pottery Scatters A8-3			prehistoric	Lauter-Reinman 1995	105	unev				
277.	WFANX	Pottery Sherds TN-17			prehistoric	Carucci 1993	TN-17	NE				
						Lauter-Reinman 1995	103	no				
278.	WFANX	Prehistoric Rockshelter TN-13	66-02-1302		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			
						Lauter-Reinman 1994	83	nce	WWII base construction; modified			
						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			
						Lauter-Reinman 1994	85	mq	base construction; unique design			
						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			
						Lauter-Reinman 1994	96	no	base construction			
						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			
						Lauter-Reinman 1994	107	yes	base construction; good example of type			
						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			
						Lauter-Reinman 1994	108	yes	base construction; good example of type			
						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			
						Lauter-Reinman 1994	109	no	base construction			
294.	WFANX	Quonset 609		metal surface structure	1945	Craib and Yoklavich 1992c		II	common; assoc. with the broad patterns of			
						Lauter-Reinman 1994	87	no	Navy WWII base construction; distinctive			
						Lauter-Reinman 1995	110	no	construction type			
295.	WFANX	Quonset 611		metal surface structure	1945	Craib and Yoklavich 1992c		II	common; assoc. with the broad patterns of			
						Lauter-Reinman 1994	88	no	Navy WWII base construction; distinctive			
						Lauter-Reinman 1995	111	no	construction type			
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			
						Lauter-Reinman 1994	89	no	WWII base construction; distinctive construction type			
298.	WFANX	Quonset 634A		metal surface structure	1944-1945?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	90	mq	base construction; unremarkable example			
						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			
						Lauter-Reinman 1995	113	mq				
300.	WFANX	Quonset 634C		metal surface structure	1944-1945?	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	92	mq	base construction; unremarkable example			
						Lauter-Reinman 1995	114	mq				
301.	WFANX	Quonset 730			1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	93	no	base construction			
						Lauter-Reinman 1995	115	no				
302.	WFANX	Quonset 731			1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	94	no	base construction			
						Lauter-Reinman 1995	116	no				
303.	WFANX	Quonset 732			1944-1945	Craib and Yoklavich 1992d		II	assoc. with broad patterns of Navy WWII			
						Lauter-Reinman 1994	95	no	base construction			
						Lauter-Reinman 1995	117	no				
304.	WFANX	Quonset Hut in Shop Area - Site 1686		metal surface structure	1945	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1994	97	nce	Navy permanent base construction; common			
						Lauter-Reinman 1995	119	nce				
305.	WFANX	Refueling Structure T-3		concrete surface features; unknown function	WWII	Craib and Yoklavich 1992d		II	assoc. with WWII battles			
						Lauter-Reinman 1994	112	no				
						Lauter-Reinman 1995	132	unev				
306.	WFANX	Remains at Camp Bright TN-11	66-02-1300	concrete features and foundations	WWII	Carucci 1993	TN-11	A				
						Lauter-Reinman 1994	113	no-st				
						Lauter-Reinman 1995	133	no-st				
307.	WFANX	Remains of Aircraft Eng. A4-12			?	Lauter-Reinman 1995	134	no				
308.	WFANX	Remains of Comm. Cond.			?	Lauter-Reinman 1995	135	no				
309.	WFANX	Sewer Features TN-23		concrete and metal surface features	?	Carucci 1993	TN-23	NE				
						Lauter-Reinman 1994	115	no				
						Lauter-Reinman 1995	136	no				
310.	WFANX	Sewer Features TN-25		metal surface features	?	Carucci 1993	TN-25	NE				
						Lauter-Reinman 1994	116	no				
						Lauter-Reinman 1995	137	no				
311.	WFANX	Shipboard Guns - Objects		metal objects	?	Craib and Yoklavich 1992d		II	distinctive object type; removed from			
						Lauter-Reinman 1994	117	no	original locations			
312.	WFANX	Shop Bldgs. 1714, 1771-1774, 3000-3004, 1767, 1768		metal surface structures	1947 & 1949	Yoklavich and Craib 1992		II	assoc. with broad patterns of pre-WWII			
						Lauter-Reinman 1995	138	unev	Navy permanent base construction			
313.	WFANX	Sinkhole Caverns - PS-1 & 2	66-03-1304	subsurface features	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				
						Lauter-Reinman 1995	140	no				
315.	WFANX	Storm Drain & Bridge TN-15		surface features	?	Carucci 1993	TN-15	NE				
						Lauter-Reinman 1994	119	no				
						Lauter-Reinman 1995	141	no				
316.	WFANX	Structure Foundations A4-4&5			?	Lauter-Reinman 1995	142	no				
317.	WFANX	Sumay Caves Fortifications		modified rockshelters; surface artifacts	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	1936?	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					
						Lauter-Reinman 1995	SR-29					
350.	WFANX	Caribia - Harbor mouth		submerged remains		Lauter-Reinman 1995	SR-21					
351.	WFANX	Fishing Boat - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-9					
352.	WFANX	LCU - Glass Breakwater		submerged remains		Lauter-Reinman 1994	SR-19					
						Lauter-Reinman 1995	SR-19					
353.	WFANX	LCU - north of Orote		submerged remains		Lauter-Reinman 1994	SR-24					
						Lauter-Reinman 1995	SR-24					
354.	WFANX	LCU - Piti back bay		submerged remains		Lauter-Reinman 1994	SR-4					
						Lauter-Reinman 1995	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						
						Lauter-Reinman 1995	SR-18					
356.	WFANX	Nichiyu Maru	66-03-1155	submerged Japanese Navy freighter	1933	Craib and Yoklavich 1992d						
						Lauter-Reinman 1994						
						Lauter-Reinman 1995	SR-5					
357.	WFANX	RMS Scotia		submerged ship	1904	Lauter-Reinman 1995	SR-22					
358.	WFANX	SMS Cormoran	66-03-1037	submerged ship	1917	Lauter-Reinman 1994					July 74	no discussion in report
						Lauter-Reinman 1995	SR-15					
359.	WFANX	Tokai Maru	66-03-1089	submerged Japanese Navy transport ship	1930	Lauter-Reinman 1994				July 88	July 88	
						Lauter-Reinman 1995	SR-16					
360.	WFANX	Japanese Naval Tug		submerged remains		Lauter-Reinman 1995	SR-17					
361.	WFANX	Tug - Seaplane Ramp		submerged remains		Lauter-Reinman 1995	SR-11					
362.	WFANX	Tug - Dry Dock Island		submerged remains		Lauter-Reinman 1995	SR-12					
363.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-6					
364.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-7					
365.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-8					
366.	WFANX	Yacht - Marianas Yacht Club		submerged remains		Lauter-Reinman 1995	SR-10					
367.	NCTAMS	Barrigada Battlefield	66-04-1059	no surface remains	1944	Craib and Yoklavich 1992a		II	associated with significant event in Guam			
						Lauter-Reinman 1994	7	no-st	history			
						Craib and Yoklavich 1996		II	warrants plaque only			
368.	NCTAMS	Barrigada Golf Course - Facility No. 95		surface feature	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)

BOTANICAL SURVEY OF THE MARIANA ISLANDS MILITARY TRAINING AREAS

by

Dr. Art Whistler
Isle Botanica

Prepared for

Belt Collins, Inc.
Honolulu, Hawaii

March 1996

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INTRODUCTION

The U.S. Navy maintains a number of training facilities in Guam and the Commonwealth of the Northern Marianas that have been used for many years. In addition, the Navy wants to add new sites and activities to those currently in use on lands under their jurisdiction. In order to comply with the National Environmental Policy Act (NEPA), The Navy has contracted Belt Collins Hawaii to prepare an Environmental Impact Statement (EIS) to evaluate the impact of the training activities upon the environment. As part of the EIS, a botanical survey was required for those sites with significant vegetation and flora that may be adversely affected by the training activities.

The following report is a botanical survey of the Navy training sites sites selected by Belt Collins Hawai'i because of the presence of possibly significant vegetation and flora. The field work was carried out by Isle Botanica at eight sites on Guam and Tinian. Six of the sites are on Guam, and five of these are located in the Naval Magazine: Land Navigation Site, Bivouac Area, Sniper Range, Helicopter Landing Site, and Rappelling Site. The sixth, the Riverine Training Site, is located within Apra Harbor, but was only briefly investigated since the proposed activities on the stream are not likely to impact the streamside vegetation. The remaining two sites are located on Tinian--Live Fire Weapons Range and a Parachute Drop Zone.

The field work carried out by the principal investigator (Dr. Art Whistler) and a botanical assistant during a visit to the islands from 30 January to 9 February 1996. The field team visited each site at least twice, during which time a checklist of the flora was compiled during the "walk-through" surveys, and notes were compiled about the plant communities present. In the following report, the sites are listed in the order noted above. For each of these sites, the vegetation is discussed, followed by a brief discussion of any sensitive vegetation or plant species present. That is followed by a summary discussion, and by checklists of the flora of three of the areas--Naval Magazine (all five sites), Live Weapons Firing Range, and Parachute Drop Zone.

NAVAL MAGAZINE, GUAM

Land Navigation Site

This area is an irregularly shaped parcel located at the northeast corner of the Naval Magazine, west and south of the "East Lookout Tower" and south of the cross-island road (Highway 17). The topography comprises rolling hills with scattered gullies leading downslope into the main area of the magazine. The herbaceous vegetation that covers the hills and slopes is probably maintained by periodic, accidental or intentional burning. In some places the surface is highly eroded, leaving barren areas of the red lateritic soil. There is increased erosion in the drainage areas, where barren, steep-sided gullies cut through the unprotected soil. Along the stream channel,

especially where the topography flattens out, wetlands are formed.

Four types of vegetation can be distinguished at the site: (1) Mission-grass Savanna; (2) Fernland; (3) Phragmites Marsh; and (4) Ravine forest, but the boundaries between these are not always distinct, especially between the grassland and fernland.

1. Mission-grass Savanna

The vast majority of the rolling hills and much of the flat areas are covered with grassland (Fig. 1) dominated mostly by Pennisetum polystachyon (mission grass). Other grass species, such as Dimeria chloridiformis, Chrysopogon aciculatus, Bothriochloa bladhii, and Saccharum spontaneum, and sedges, such as Fimbristylis cymosa, Fimbristylis tristachya, and Rhynchospora rubra, are also present, but except for Dimeria, are rarely dominant. Relatively little Miscanthus floridulus (sword grass) is present, but where it does occur it forms dense patches. Other herbaceous species, such as Waltheria indica, Hyptis capitata, Crotalaria retusa, Mimosa pudica (sensitive plant), Chromolaena odorata, and Bidens alba (beggar's-tick), are also common among the grasses. There are also a few scattered trees, mostly Casuarina equisetifolia (ironwood), and shrubs, such as Morinda citrifolia (Indian mulberry) and Scaevola taccada, but the overall vegetation is predominantly herbaceous.

In the central portion of this grassland habitat there is an area where saplings of timber trees, mostly Calophyllum inophyllum (Alexandrian laurel) and Acacia sp., have been planted. This area is otherwise quite barren, since it appears to have been recently weeded or sprayed with herbicide. It is adjacent to the boundary of the magazine, where there is a mature plantation forest dominated by the same Acacia species and another of the same genus.

2. Fernland

The boundary between the grasslands and fernlands is indistinct, but the fernlands tend to occupy the flatter, more highly degraded areas of lateritic soil (Fig. 2). The dominant species here is Dicranopteris linearis (false staghorn fern), along with mission grass and the endemic grass species Dimeria chloriformis. There also some savanna-like areas with clusters of trees, principally ironwood and Pandanus tectorius (screwpine), but with lesser amounts of native woody species, such as Pouteria obovata, Wikstroemia elliptica, Myrtella bennigseniana, the native subshrub Phyllanthus saffordii, and the native sedge Machaerina mariscoides. The introduced trees Melaleuca quinquenervia (paperbark) and Acacia sp. are also found here, but these are mostly restricted to the northern boundary of the magazine, where their seeds have apparently blown in from the adjacent plantation forest area.

3. Phragmites Wetland

This vegetation type is dominated by the tall, cane-like

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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LIST OF FIGURES

1. Land Navigation Site with grassland vegetation covering the hills and ravine forest in the distant ravines.
2. Land Navigation Site with eroded soil and fernland vegetation.
3. Land Navigation Site ravine forest.
4. Land Navigation Site with waterfall in ravine forest.
5. Sniper Range Site with grassland vegetation covering the hills and ravine forest in the gullies.
6. Helicopter Landing Site with managed land vegetation on an old road.
7. Helicopter Landing Site with a mosaic of vegetation.
8. Rappelling Site with sparse vegetation on the cliff.

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).

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Figure 1. Land navigation site, NAVACTS Ordnance Annex

Figure 2. Land navigation site, NAVACTS Ordnance Annex

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).

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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)

REPORT OF A FAUNAL (BIRD AND MAMMAL) SURVEY OF THE NAVACTS GUAM ORDINANCE ANNEX PROPOSED TRAINING SITE AND PORTIONS OF THE ATANTANO RIVER.

Prepared for

Belt Collins and Associates

by

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17 May 1996

INTRODUCTION

The purpose of this report is to summarize the findings of a three day (1-3 April 1996) bird and mammal field survey of a proposed training sites on NAVACTS Guam Ordinance Annex and the Atantano River, Guam (Fig. 1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or could utilize the range of available habitats.

2- Where necessary supplement these findings with published and/or unpublished data.

3- Evaluate the possible impacts to wildlife that might occur as a consequence of the proposed project.

GENERAL SITE DESCRIPTIONS

The NAVACTS site presently contains dense second growth forest and grasslands with some native vegetation, predominantly along the western boundary (Fig. 1). A small wetland adjoins portions of the

road leading to Almagosa Spring. Small streams meander through the property impacted by the proposed project. The understory vegetation in some areas showed signs of feral mammal activity. The vegetation along the Atantano River is dense, making access to the river's edge virtually impenetrable. The portions of the river examined in this brief visit were too deep for wading birds.

Weather during the field survey was variable with occasional passing showers and some clear periods.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. Attention was also paid to the presence of tracks and scats as indicators of wildlife activity.

On 1 April the NAVACTS Site and surrounding areas were surveyed by driving along existing roads with brief stops at a few locations. The 2 April survey focused on the proposed training area. Walking surveys traversed the property north of Almagosa Springs road and around the West Tower and bivouac site. In addition, a portion of the Almagosa River was also surveyed on foot.

The Atantano River was studied at the section which crosses Route 1 and at the river's mouth at Apra Harbor.

All birds and mammals seen or heard on each survey day were tallied and are reported on Table 1. Tracks and scats also provided information about wildlife activity in this region.

Scientific names used herein follow those given in the most recent American Ornithologists' Union Checklist A.O.U 1983), Field guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Non-endangered Birds:

The only species seen on or near the NAVACTS site were Cattle Egret (Bubulcus ibis), Yellow Bittern (Ixobrychus sinensis), Black Francolin (Francolinus francolinus), Pacific Golden-Plover (Pluvialis fulva) and Siberian Tattler (Heteroscelus brevipes). The identification of the Tattler was made when the bird gave the two noted whistle which diagnostically separates it from the similar Wandering Tattler (Heteroscelus incanus). Only One Siberian Tattler was seen and heard near Almagosa Spring. Table One gives the total number of birds seen at and near this site over the course of two survey days.

The three species seen at the Atantano River between Highway One and Apra Harbor were: Yellow Bittern; Eurasian Tree Sparrow (Passer

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 Swifflet (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 Swifflet 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.

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.

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

Appendix N
Rota NVG Training Noise

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_{nx} = 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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& ASSOCIATES
ACOUSTICAL CONSULTANTS

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
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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.

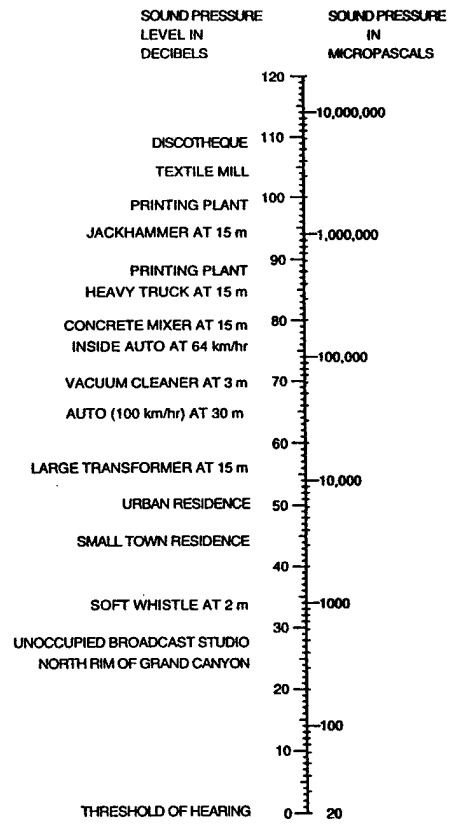

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FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

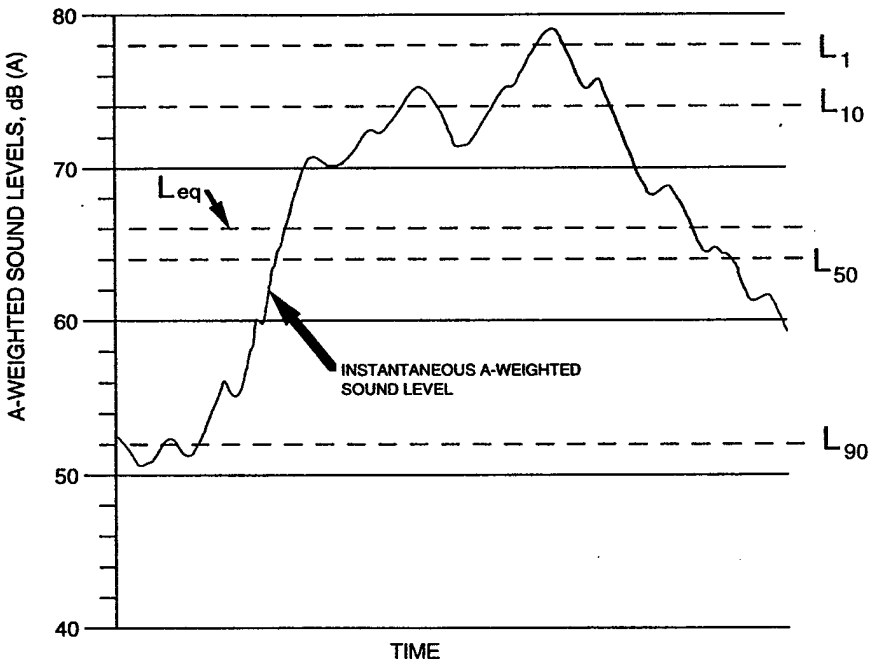

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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

Flight Tracks

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Figure No. 1

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PALI PALMS PLAZA
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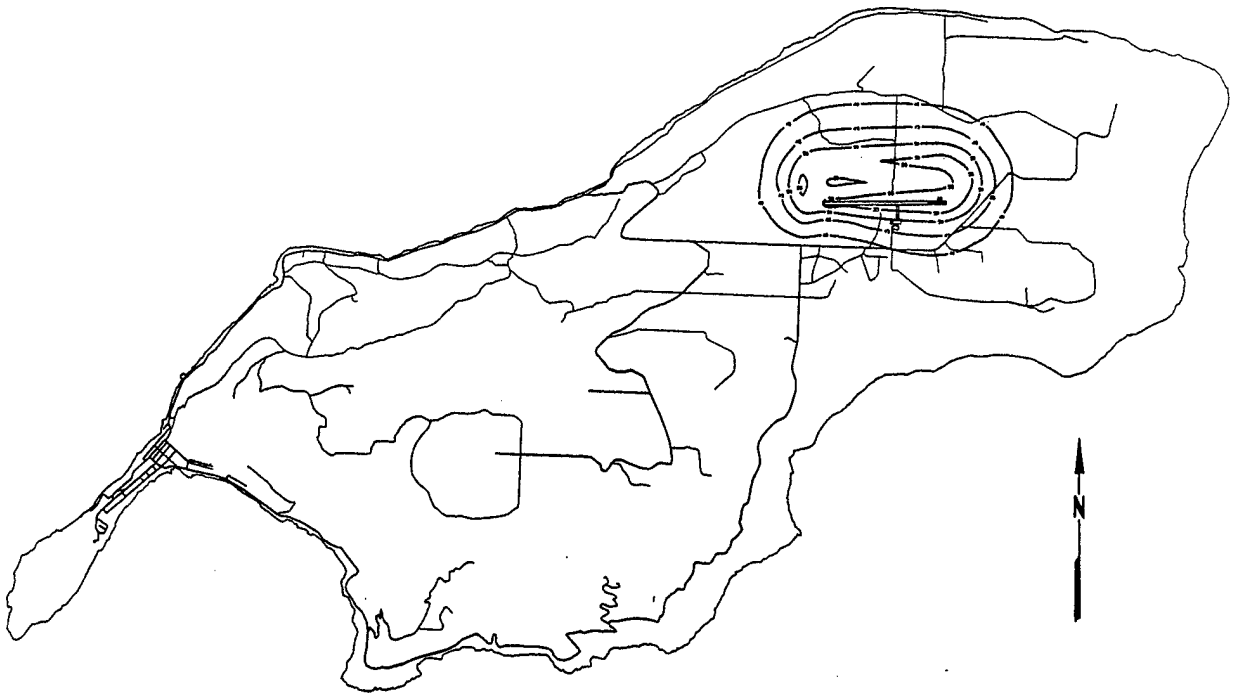
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN



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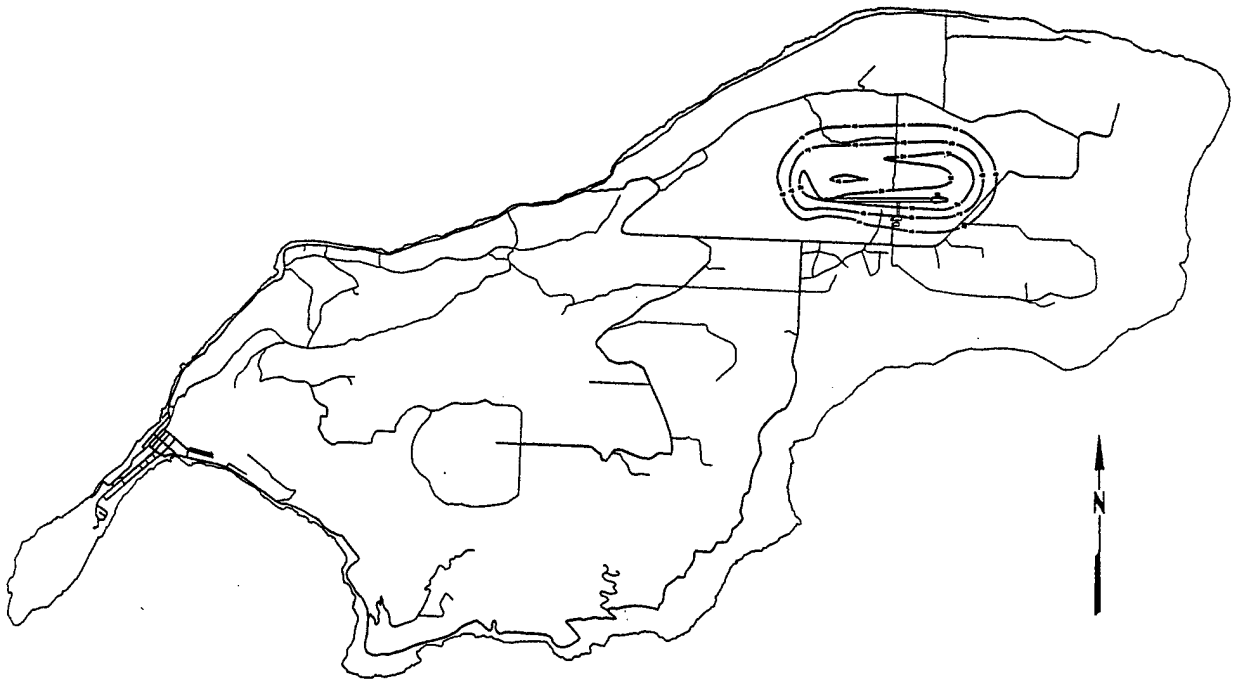
Ldn Contours for A Typical Training Exercise Day

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN

Figure No. 2



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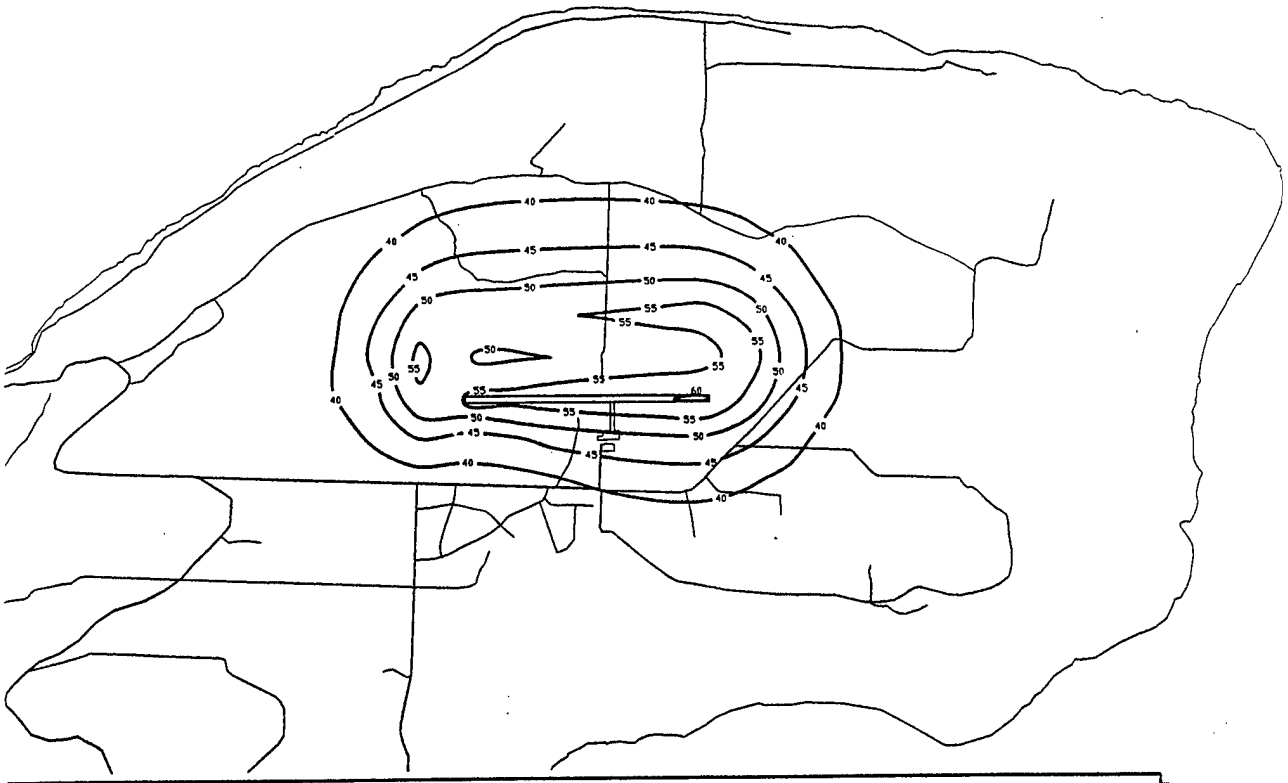
Daily Average Ldn Contours Based on One Year

HC-5 Training Exercises at Rota Airport

Scale: 1" = 6,000'

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN

Figure No. 3



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Enlargement of Figure No. 2

HC-5 Training Exercises at Rota Airport

Scale: 1" = 3,000'

Date	Project No.	Drawn By
May 9, 1996	96-05	PTN

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
May 9, 1996	96-05	PTN

Figure No. 5

Appendix O
Lease Agreements

O-1: Technical Agreement Regarding the Use of Land to Be Leased by the United States in the Northern Mariana Islands dated 15 February 1975

O-2: Interim Permit by and between the Marianas Public Land Corporation of the Commonwealth of the Northern Mariana Islands and the United States of America dated 4 November 1981

O-3: USCINCPAC Instruction 11011.3 dated 15 May 1985 with Lease Agreement dated 6 January 1983

O-4: Commander-in-Chief, U.S. Pacific Command Representative Guam/Commonwealth of the Northern Mariana Islands/Federated States of Micronesia/Republic of Palau Letter 11011-MAR over Serial N4/0058 dated 25 July 1994, "Tinian Leaseback" with Tinian Leaseback and Disposal Agreement between the CNMI and the U.S. Government.

Appendix O-1
Technical Agreement Regarding the Use of Land to Be Leased by the United States in the Northern Mariana Islands dated 15 February 1975

TECHNICAL AGREEMENT REGARDING USE OF LAND TO BE LEASED BY THE UNITED STATES IN THE NORTHERN MARIANA ISLANDS

The duly authorized representatives of the United States and the people of the Northern Mariana Islands,

Considering that they have today entered into a formal Covenant to establish a Commonwealth of the Northern Mariana Islands in political union with the United States;

Recognizing that Sections 802 and 803 of that Covenant contain provisions relating to the use of land to be leased by the United States in the Northern Mariana Islands for defense purposes;

Noting that the extent of land required for use by the United States has been determined and the precise boundaries agreed upon by both parties hereto; and

Desiring that all basic arrangements relative to land be reduced to a formal land agreement;

Have now entered into the following Technical Agreement which will be deemed to have been approved when the District Legislature of the Mariana Islands District of the Trust Territory of the Pacific Islands approves the Covenant, and which will become effective on the date that Sections 802 and 803 of the Covenant come into force.

ENCLOSURE( )

PART I. MATTERS TO BE INCLUDED IN LAND LEASES WITH THE UNITED STATES

1. Description. Lands to be leased by the United States for defense purposes are set forth in Section 802 of the Covenant and are further described and depicted on the maps attached as Exhibits A, B, and C.

2. Acquisition. The Government of the Northern Mariana Islands or the legal land entity established by the Marianas District Legislature to receive and administer public lands in the Northern Mariana Islands, immediately upon request, will execute the lease for the lands being conveyed to the United States Government as described in paragraph 1, above, with the duly authorized representatives of the United States under the terms set forth in Section 803 of the Covenant.

Payment under the lease will be made as soon as practicable after the appropriation of funds by the Congress of the United States. The United States may enjoy full and unrestricted use of the land immediately upon making the above payment. The amount to be paid will be adjusted at the time of payment by a percentage which is the same as the percentage change, up or down, in the United States Department of Commerce composite price index from the date of signing of the Covenant.

Should payment not be made within five years from the date that Sections 802 and 803 of the Covenant

come into force, then this Agreement will automatically terminate and both parties will be released from all liability or obligations created by this Agreement and Sections 802 and 803 of the Covenant.

3. Settlement of Claims and Encumbrances. Lands leased by the United States Government defined in paragraph 1, above, are subject to the lease of the Micronesian Development Corporation, which will be allowed to continue in accordance with its terms. All other encumbrances on or any adverse possession of lands described in paragraph 1, above, will be removed and all existing claims will be settled by the Government of the Northern Mariana Islands or by the legal entity at no additional cost to the United States Government. The United States Government will, however, pay all Title II benefits due under the Uniform Relocation and Real Property Acquisition Policies Act of 1970.

The United States Government and the Government of the Northern Mariana Islands will consult and coordinate on specific actions by either party that may affect or involve possible adjustments or termination of the Micronesian Development Corporation lease. Both parties will render full assistance to the other towards achieving specific needs with respect to the Micronesian Development Corporation lease, to include either compliance with the terms of the lease, amendments to the lease, or action to terminate

the lease. In no event will either party impede the action of the other with respect to the Micronesian Development Corporation lease. The United States Government will be responsible for damages resulting from a breach or early termination of the Micronesian Development Corporation lease resulting solely from United States initiatives. The Government of the Northern Mariana Islands will be responsible for damages resulting from a breach or early termination resulting solely from its initiatives. Both the United States Government and the Government of the Northern Mariana Islands or its legal entity will hold the other harmless from all claims arising by reason of such breaches or termination.

4. Disposal. Should the property leased to the United States on Tinian not be required for the needs or the discharge of the responsibilities of the United States Government, or otherwise become surplus property under United States law, the Government of the Northern Mariana Islands or the legal entity will be given first opportunity to acquire the interest of the Government of the United States in such property in accordance with United States law.

5. Leasebacks.

A. Tinian.

(1) General. A total of approximately 6,458 acres (2,614 hectares) out of a total of approximately

17,799 acres (7,203 hectares) on Tinian will be leased back from the land on Tinian described in paragraph 1, above, at such time as the lease to the United States Government for the land on Tinian becomes effective. All leasebacks on Tinian made pursuant to this Agreement will be subject to the following restrictions which will be contained in the leases and will be incorporated in any subleases executed by the Government of the Northern Mariana Islands or by the legal entity:

a. Uses of land must be compatible with planned military activities;

b. There will be no permanent construction without prior consent;

c. Federal Aviation Administration safety zone areas apply with respect to land use;

d. Uses that damage or have a detrimental effect on subsequent use of the land will not be permitted;

e. All leasebacks will be subject to cancellation upon one year's notice, or sooner in the event of urgent military requirement or national emergency; and

f. Provisions for fair compensation in the event of cancellation or early termination will be included.

(2) Area South of Present West Field. Approximately 1,335 acres (540 hectares) lying south of West Field including

the harbor area, as indicated in Exhibit A, will be made available to the Government of the Northern Mariana Islands or the legal entity under leaseback. This leaseback will be for a term of ten years with renewal rights for an additional ten years upon the approval of the United States Government, except for the harbor area which will be on a five year basis renewable with United States Government approval. These leasebacks will be for the sum of one dollar per acre per year. The Government of the Northern Mariana Islands or the legal entity may in turn sub-lease these lands on terms compatible with the leaseback, with such sub-leases subject to immediate revocation in the event of violation of their terms. Permissible uses are grazing, agriculture that does not interfere with flight safety, and other possible uses that may be approved from time to time by the United States Government.

(3) Area North of Present West Field and East of Broadway. The lands north of West Field and east of Broadway, indicated in Exhibit A, will continue to be used in accordance with the terms and conditions of the current lease with the Micronesian Development Corporation. This includes approximately 4,010 acres (1,623 hectares).

(4) Military Maneuver Area on Tinian--Grazing Leases. The United States will lease back the land within all but two of the existing grazing leases in the proposed maneuver area north of West Field shown in Exhibit A.

Substitute grazing leases will be made available within areas set aside for maneuvers north of West Field for the two leases indicated in Exhibit A which are presently located in areas with a high probability of their being used by United States forces, which renders them unsuitable for leaseback. This agreement is limited to accommodation of persons actually using this leased land for grazing purposes as of December 19, 1974. All such leases will be for five years at one dollar per acre per year, renewable with United States Government approval for additional periods of up to five years and subject to immediate revocation in the event of violation of their terms. Grazing will be the only use permitted unless authorized by the United States Government. Approximately 610 acres (247 hectares) will be leased back in this category.

(5) Military Maneuver Area on Tinian--Present Private Owners. There are 38 deeded homestead parcels and six pending homesteads in the maneuver area as indicated in Exhibit A. The Government of the Northern Mariana Islands or the legal entity will acquire the land at no additional cost to the United States Government and will provide an opportunity for the owners of these homesteads who may be eligible for new homesteads as a result of their displacement to exchange their land with comparable lands outside the military area. The homestead owners will be fully compensated by the Government of the Northern Mariana Islands or by

the legal entity if they do not choose this exchange and will, in addition, receive from the United States Government whatever relocation compensation and assistance to which they would be entitled under United States law. After this land now held as homesteads is acquired by the United States Government by lease from the Government of the Northern Mariana Islands or from the legal entity the United States Government will, on a case-by-case basis and on request, lease it back to those former owners who wish to continue to farm the land for periods of five years at one dollar per acre per year, renewable with United States approval for additional periods of up to five years. Approximately 503 acres (204 hectares) are involved in this category.

(6) Civilian Aviation Terminal Facilities, West Field. The present existing civilian air terminal may remain until its relocation is determined to be necessary by the United States Government. Sufficient land will be made available at nominal cost adjacent to the present or a future runway for civilian terminal facilities, including aprons, aircraft parking, terminal building(s), automobile parking and roadways. If a future relocation becomes necessary, the United States will reimburse the Government of the Northern Mariana Islands for fair value of the then-existing terminal building and make alternate land available at nominal cost as near to the runways and related taxiways

as practicable for construction by the Government of the Northern Mariana Islands of new terminal facilities. The costs of again relocating the terminal facilities, along with construction costs for necessary replacement of apron and parking areas, will be borne by the United States Government. Ample land provision will be made, also at nominal cost, for necessary growth and expansion of the civilian facility.

B. Saipan--Tanapag Harbor.

The United States Government will make available to the Government of the Northern Mariana Islands without cost 133 acres (53.8 hectares) out of the 177 acres (71.6 hectares) leased to the United States Government at Tanapag Harbor, as indicated in Exhibit B. This area will be set aside for public use as an American memorial park to honor the American and Marianas dead in the World War II Marianas campaign. Two million dollars ($2,000,000) of the total funds paid by the United States Government will be placed in a trust fund by the Government of the Northern Mariana Islands, or by the legal entity, with income from the fund used to develop and maintain the memorial park. Income from this trust fund may be utilized for other purposes only with the concurrence of the United States Government. The United States will assist in this development by providing assistance in planning and technical advice. Adequate space will be provided the United States Government to

construct at its expense a memorial to the Americans who died in the Marianas campaign. In addition, the Government of the Northern Mariana Islands may erect its own memorial to Marianas war dead at its expense. The remaining 44 acres (17.8 hectares) will be made available to the Government of the Northern Mariana Islands or to the legal entity by leaseback on the same terms and conditions named in paragraph 5A(1), above, as appropriate. Uses of the 44 acres must be harbor-related as determined by the United States. The definition of harbor-related activities will be made available to the Government of the Northern Mariana Islands on request and incorporated in subleases in the area. Leases will be for ten years and will be automatically renewable.

C. Other Leasebacks. The Government of the United States may from time to time lease back other land temporarily in excess within the land described in paragraph 1, above, to the Government of the Northern Mariana Islands or to the legal entity in accordance with applicable laws and regulations.

PART II. JOINT USE

The Government of the United States or its duly authorized representative will enter into joint use agreements with a duly authorized agency or agencies of the Government

of the Northern Mariana Islands, when such agency or agencies have been established by the Government of the Northern Mariana Islands, which will cover among other things the following:

1. San Jose Harbor, Tinian. San Jose Harbor will initially be under Government of the Northern Mariana Islands control under specific terms of the leaseback. If a decision is made by the Department of Defense to implement plans for an operational joint service base on Tinian, appropriate joint control arrangements will be agreed upon for the construction and subsequent periods to accommodate the needs of the civilian community along with military needs. At such time as joint control arrangements become necessary, the feasibility of adopting standards which will permit uninterrupted commercial shipping operations during fuel transfer operations will be investigated so as to minimize the possible interference with civilian activity. When the United States upgrades the existing harbor the Government of the Northern Mariana Islands will upgrade its approximately 600 feet of wharf space or reimburse the United States for having such services performed as part of the United States construction project.

With respect to the two plots totalling approximately nine acres (3.6 hectares) immediately adjacent to the 600 foot civilian wharf shown in Exhibit A, the Government

of the Northern Mariana Islands will place appropriate restrictions on their use for harbor-related activities only.

2. West Field, Tinian

A. General Use. For aviation purposes the Government of the Northern Mariana Islands and the civilian community of Tinian will have continuous joint use of West Field with exceptions for safety of flight and priority military operations. The Government of the Northern Mariana Islands will have operational responsibility for West Field, except during periods of military use, until the United States assumes permanent operational responsibility. During such periods the Department of Defense will assume operational responsibility and control.

B. Development Costs. The cost of improving and maintaining present civilian terminal facilities and future civilian terminal facilities will be borne by the Government of the Northern Mariana Islands.

C. Fuel Supplies. After the United States military takes over control and management of the field standard military aviation fuels and oils will be supplied as soon as they become available, subject to Federal Energy Administration allocation, on a cost basis by the Government of the United States to the Government of the Northern Mariana Islands for civil and compatible commercial aviation needs on Tinian. It is understood that provision of such

fuels and oils will not be permitted to compete with private commercial enterprises performing this service.

D. Terminal Utilities. The Government of the United States during its planning of future base facilities will take into consideration the needs of the future civilian terminal area for water, power, telephone and other utilities applicable to a terminal facility so as to make available to the civilian terminal appropriate utility hookups at the closest practicable locations to allow for civilian development of these utilities and joint use thereafter on a reimbursable basis.

E. Use of Present Facilities. The use of facilities presently in existence at the West Field location and the use of the present air strip will continue on an uninterrupted basis prior to, during and subsequent to initial construction upgrade and during any future improvement program to the greatest extent possible. There will be close coordination with the Government of the Northern Mariana Islands to insure as little hardship as possible should interruptions of the use of the present West Field and its terminal facilities be necessary for military operations such as maneuvers. The use of a runway and taxiways may be curtailed from time to time to allow appropriate and adequate construction and repair work to be accomplished. This construction and repair work will at all times be

coordinated with the civilian community so as to minimize any hardships involved.

F. United States Facilities. When an operational military airfield is established at West Field, Tinian, the United States Government will provide such aircraft and structural fire protection services and aircraft crash rescue services as are available. The cost of such services shall be borne by the United States Government, subject to charging appropriate fees for users of these services.

G. Landing Fees. At such time as the military forces permanently take over operation of West Field, commercial aircraft will be charged the minimum allowable landing fees according to the standard policy of the apppropriate military department, and collection will be in accordance with the terms of the formal joint use agreement. In the interim the Government of the Northern Mariana Islands may establish and collect landing fees from all non-United States Government aircraft.

H. Access, Security and Customs.

(1) Access to the present and future civilian air terminal area will be unrestricted.

(2) Security in and around the present and future civilian air terminal and operation and maintenance of the civilian facilities will be the responsibility of the Government of the Northern Mariana Islands or its representative.

(3) Customs inspections of all persons, baggage and freight will be in accord with all applicable laws and implementing regulations with the general principle established that whenever and wherever possible this customs inspection shall be performed in the military area by customs inspectors arranged for by the military and in the civilian area by customs inspectors arranged for by the Government of the Northern Mariana Islands.

PART III. SOCIAL AND CIVIL INFRASTRUCTURE ARRANGEMENTS

The following provisions, unless modified in writing by mutual agreement of the duly authorized representatives of the United States Government and the Government of the Northern Mariana Islands, will govern the future relations between the United States military forces in the Northern Mariana Islands and the civil authorities thereof. Coordination on these arrangements will be accomplished through a Civil-Military Advisory Council organized as soon as required after implementation of this Agreement.

1. Civilian Responsibilities. It is understood that the Government of the Northern Mariana Islands has full responsibility for planning, as well as developing, all facilities and services for the Tinian civilian community.

2. Fishing and Shoreline Activities, Tinian. All shoreline areas in and around the northern two-thirds

of Tinian will remain open to fishermen at all possible times except for those limited areas that must be closed to comply with safety, security and hazardous risk requirements as may develop from either military activities or commercial activities.

3. Beaches, Tinian. Marianas citizens will have the same access to beach areas in the military areas of Tinian for recreational purposes as military personnel and their dependents. During times of military maneuvers, operations or related activity the use of certain beaches or areas of the beach will be restricted. Closure for such purposes, however, will be kept to a minimum consistent with military requirements in the interest of safety and security. Conduct of all personnel within the beach areas and use of these areas will be subject to applicable military regulations.

4. Utilities

A. Utilities planning will be undertaken for Tinian on an island-wide basis, taking into account reasonable projections of civilian population at the time development by the military becomes necessary. Planning accomplished by the United States will be closely coordinated with planning by the Government of the Northern Mariana Islands. The Government of the Northern Mariana Islands will bear the cost of civilian planning by either undertaking

the planning work or reimbursing the United States for planning services.

B. The Government of the Northern Mariana Islands will take necessary action to obtain such federal funds as are available for planning pursuant to the Housing and Community Development Act of 1974 and other relevant laws.

C. When utilities are constructed for military purposes the United States Government will make excess capacity of utilities available to the civilian community on Tinian on an appropriate fee basis if desired. Use of this excess capacity by the civilian community is to be without contribution into the development costs of the capacity, and the United States Government will not be expected to create or to insure any such excess capacity for the civilian community on Tinian.

D. When utilities are constructed for military purposes, additional capacity can be added subject to full payment for the incremental costs by the Government of the Northern Mariana Islands.

5. Water. Potable water will be made available to the United States military base by the Government of the Northern Mariana Islands at a mutually agreed cost.

6. Medical Care. In accordance with applicable guidelines and regulations, emergency care in military facilities established on Tinian will be provided by the

military to all residents of Tinian when available on the island. In addition medical care in military health facilities on Tinian on a non-emergency basis will be provided residents of Tinian where civilian capacity is non-existent, subject to the capacity and capability of the military and professional staff and availability of such Tinian military health facilities. Costs for all medical care will be at the prevailing reimbursement rates.

7. Fire Protection. When military firefighting facilities become necessary a mutual fire protection aid agreement similar to that type of agreement presently provided voluntarily by the military services in other locations will be entered into between the military facility on Tinian and the local community.

8. Base Exchange, Commissary and Movies. At such time as an operating base is established purchasing of commodities by the civilian community from the base exchange and commissary will be prohibited, but use of base movies by the civilian community as guests in accordance with existing regulations will be permitted.

9. Schools. Prior to the arrival of significant numbers of school age dependents of military personnel, appropriate local and federal officials will initiate such advance consultation and school development programs as necessary to secure federal assistance as may be required

for an integrated local school system adequate to provide for all stages of Tinian's development. The Department of Defense will consult with and advise the appropriate officials of the Northern Mariana Islands as soon as possible regarding such programmed arrivals.

10. Assistance to the Community. The United States Government will consider sympathetically all bona fide requests from the community or its residents for materials or technical assistance, from resources on the base, in the event local resources are insufficient to meet the community needs.

11. Economic Opportunity. To the extent practicable appropriate United States military and civilian authorities or contractors executing United States Government contracts will attempt to utilize the resources and services of people of the Northern Mariana Islands in construction, development, supply and maintenance activities in the Marianas. Further, United States military and civilian authorities will, whenever practicable, provide technical and training assistance to the people of the Northern Mariana Islands in accordance with applicable United States law to assist in their achievement of necessary skills.

PART IV. IMPLEMENTATION

This Technical Agreement will become effective when Sections 802 and 803 of the Covenant come into force. Subordinate formal implementing agreements are to be executed as soon as possible.

Signed at Saipan, Mariana Islands on the fifteenth day of February, 1975.

FOR THE PEOPLE OF THE NORTHERN MARIANA ISLANDS

Edward DLG. Pangelinan
Chairman, Marianas
Political Status Commission

Vicente N. Santos
Vice Chairman, Marianas
Political Status Commission

FOR THE UNITED STATES OF AMERICA

Ambassador F. Haydn Williams
Personal Representative of the
President of the United States

Members of the Marianas Political Status Commission:

Juan LG. Cabrera

Joaquin I. Pangelinan

Vicente T. Camacho

Manuel M. Sablan

Jose R. Cruz

Joannes B. Taimanao

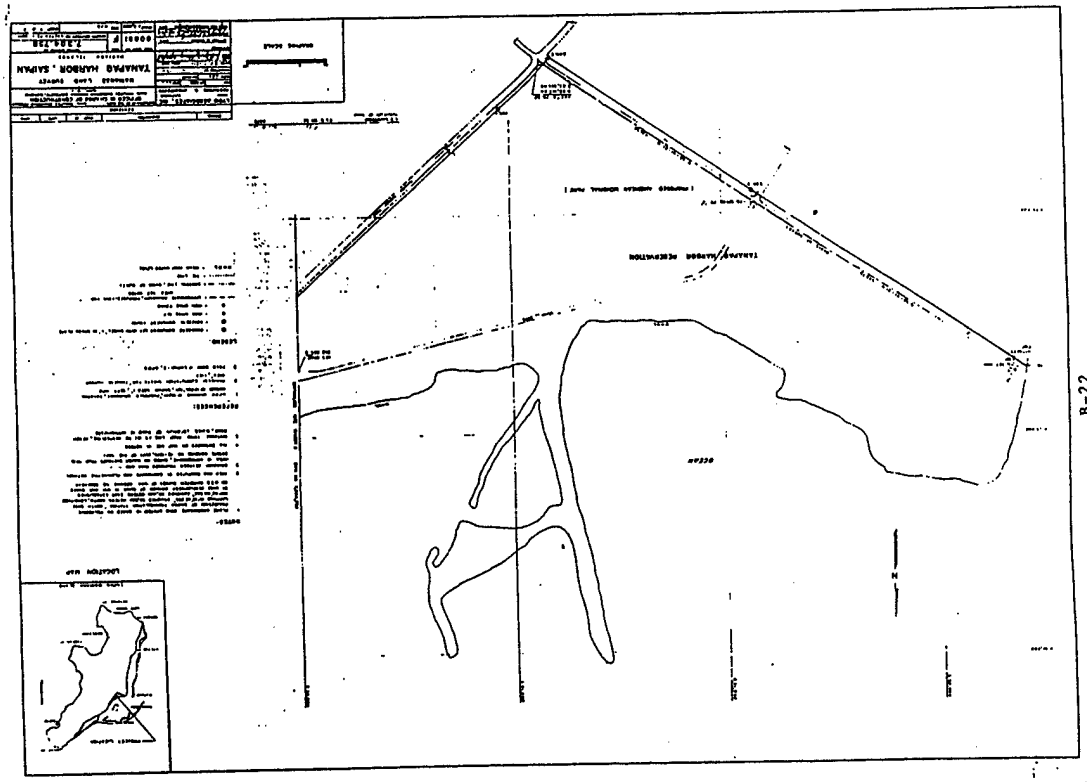
Bernard M. Hofschneider

Benjamin T. Manglona

Pedro A. Tenorio

Daniel T. Muna

Dr. Francisco T. Palacios



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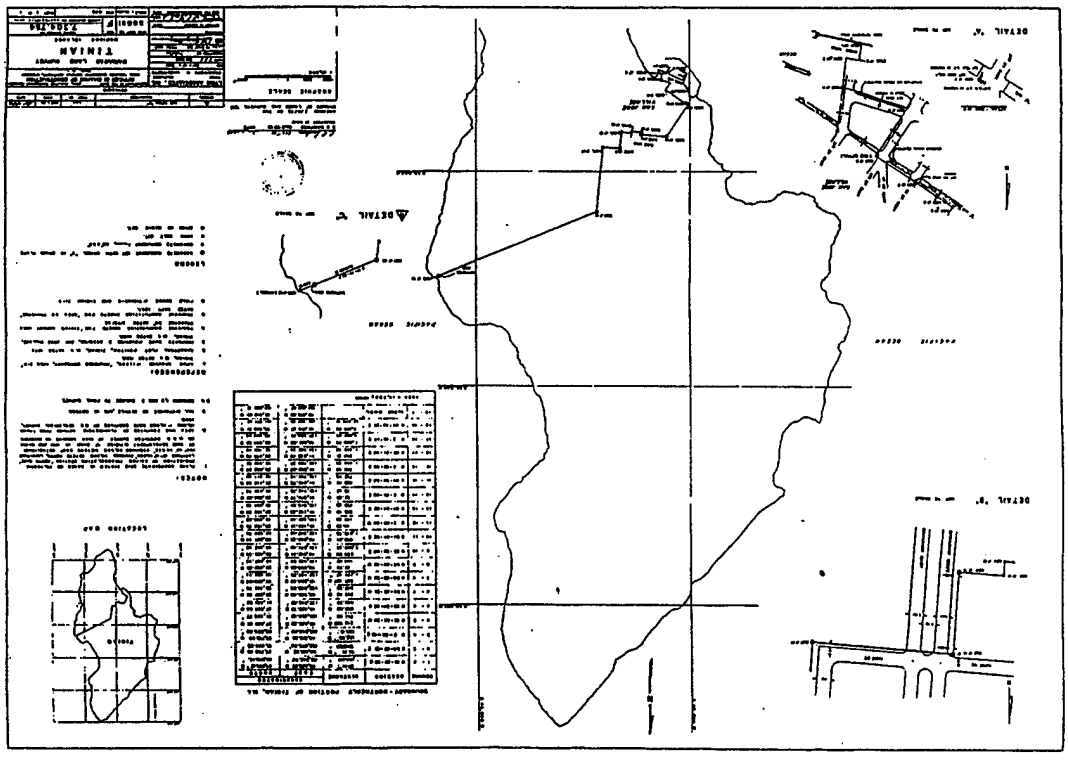

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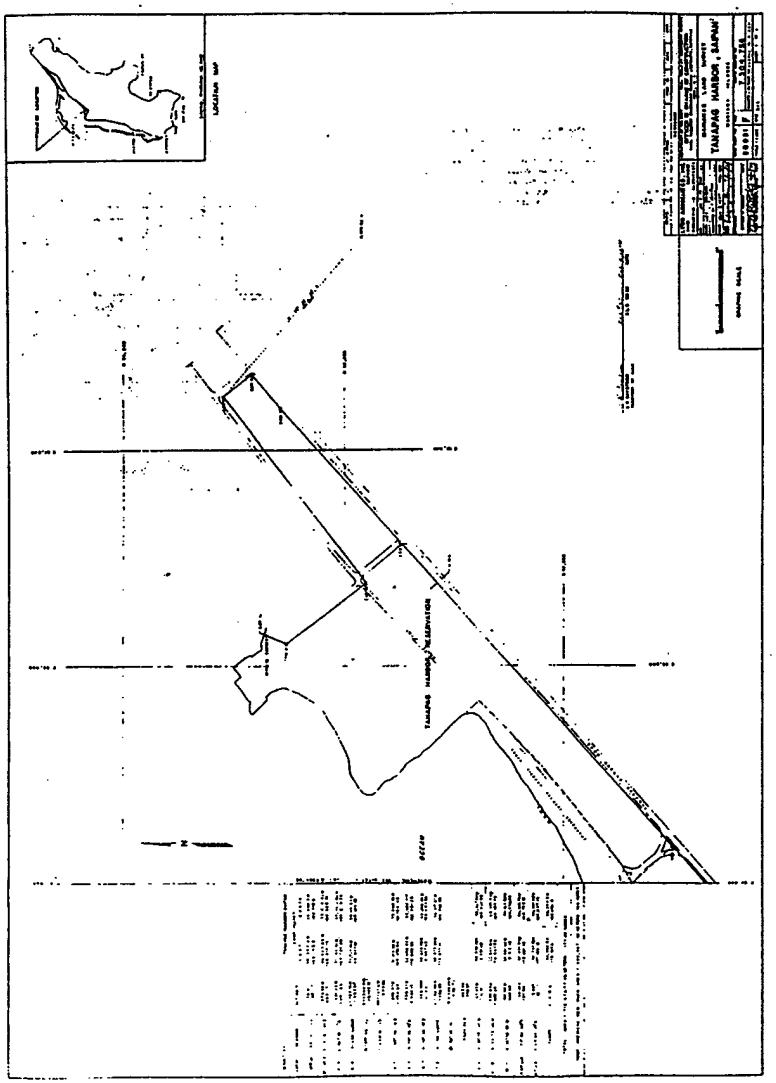
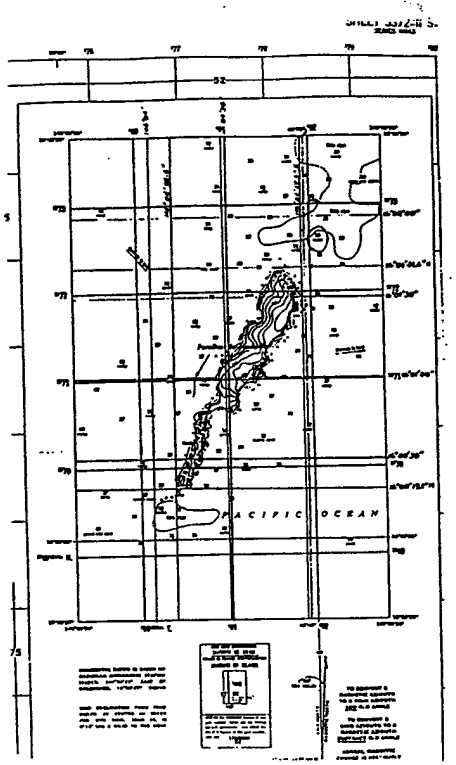


FARALLON DE MEDINILLA

MARIANA ISLANDS

Description as follows:

That certain land mass known as Farallon de Medinilla, located in the Mariana Islands group approximately 43 miles Northeasterly of Saipan Island, lying between Latitudes 16 degrees 00 minutes 19.1 seconds and 16 degrees 01 minutes 41.4 seconds North and between Longitudes 146 degrees 04 minutes 08.6 seconds and 146 degrees 04 minutes 38.9 seconds East, said land mass being approximately 9,200 feet (2,800 meters) long and 1,700 feet (500 meters) wide at its widest point and containing an area of approximately 206 acres (83.4 hectares).



MEMORANDUM FOR:

The Chairman, Marianas Political Status Commission

The President's Personal Representative for Micronesian Status Negotiations

SUBJECT:

Report of the Joint Drafting Committee on the Negotiating History

Pursuant to decisions taken in December during the fifth series of negotiations in Saipan on the future political status of the Marianas, the joint Marianas-United States Drafting Committee has met and has undertaken to record the intention of the parties regarding certain provisions of the Covenant. We submit our report herewith.

The results of our discussions are reflected in the attached draft negotiating history which is recommended by the Joint Drafting Committee for your consideration. The draft serves to set out our tentative agreement on a number of substantive matters. We recommend that it be approved by both delegations and incorporated into the official record.

Howard P. Willens
Howard P. Willens
Counsel
Marianas Political
Status Commission

James M. Wilson, Jr.
United States
Deputy Representative

Approved by the delegations of the Northern Mariana Islands and the United States on February fifteenth, 1975.

Edward DLG. Pangelinan
Edward DLG. Pangelinan
Chairman
Marianas Political
Status Commission

F. Haydn Williams
Ambassador F. Haydn Williams
The President's Personal
Representative for
Micronesian Status Negotiations

REPORT OF THE DRAFTING COMMITTEE

Section 101. Inasmuch as the definition of the term "Northern Mariana Islands" in Subsection 1005(b) is incorporated in Article I, it is understood that the geographic integrity of the Northern Mariana Islands is subject to the mutual consent requirement of Section 105.

Section 103. The Government of the Northern Mariana Islands will not be considered an agency or instrumentality of the United States Government.

Section 104. Reference to the federal powers mentioned in this Section is not intended to derogate from the sovereignty vested in the United States by Section 101 or the legislative powers vested in the United States by Section 105.

Section 105. It is intended that prior to the termination of the Trusteeship Agreement the consent of the Northern Mariana Islands envisaged by this Section may not be given without the consent of the popularly elected legislature. It is understood that the authority of the United States under this Section will be exercised through, among other provisions of the United States Constitution, Article IV, Section 3, Clause 2.

Section 202. The authority of the federal courts to determine whether or not the Constitution of the Northern Mariana Islands and subsequent amendments thereto are consistent with the provisions of the Constitution, treaties and laws of the United States applicable to the Northern Mariana Islands is not intended to be exclusive so as to preempt the power of the courts of the Northern Mariana Islands to make such determinations in appropriate cases.

Section 203(c). It is the intention of the parties that the provision stating that the legislative powers of the Northern Mariana Islands will extend "to all rightful subjects of legislation" be broadly interpreted, consistent with Section 102, to mean that the power of the legislature will be limited only by the terms of the Covenant, the provisions of the Constitution, treaties and laws of the United States applicable to the Northern Mariana Islands, and the Constitution of the Northern Mariana Islands.

It is also the intention of the parties, as reflected in the unanimous view of the members of the Marianas Political Status Commission, that the Northern Mariana Islands Constitution provide for a distribution of the membership of one house of the legislature on the basis of appropriate considerations in addition to population and in particular that the phrase "chartered municipalities of the Northern Mariana Islands" be interpreted to mean the present chartered municipalities of Rota, Saipan and Tinian as constituted at the time of signature of this Covenant and any additional future chartered municipalities that may be added pursuant to the terms of the Constitution of the Northern Mariana Islands.

Section 401. The establishment of a district court for the Northern Mariana Islands does not preclude the appointment of the District Judge, United States Attorney and United States Marshal for Guam to hold the corresponding offices in the Northern Mariana Islands at the same time. The United States Congress, in its discretion, may also provide that the United States Attorney and the United States Marshal for the Northern Mariana Islands are authorized or required to perform, at the request of the Government of the Northern Mariana Islands, certain functions related to the execution of the local laws.

Subsection 402(c). It is the intention of the parties with respect to this Subsection that the Legislature of the Northern Mariana Islands be under no obligation to grant any appellate jurisdiction to the District Court for the Northern Mariana Islands. The Legislature may choose at any time and from time to time to establish appellate courts of the Northern Mariana Islands and to eliminate or reinstate the appellate jurisdiction of the District Court.

Subsection 501(a). This Subsection is intended, among other things, to extend to the people of the Northern Mariana Islands the basic rights of United States citizenship and to make applicable to them certain of the constitutional provisions governing the relationship between the federal government and the States, as if the Northern Mariana Islands were a State. As reflected in this Subsection the parties recognize that certain provisions of the Constitution of the United States will apply to the Northern Mariana Islands of their own force by virtue of Article I of this Covenant.

The inclusion or omission of the power to legislate in the specific reference to certain provisions of the Constitution of the United States is not designed to affect the authority of the United States to legislate with respect to the Northern Mariana Islands. That power is governed by Article I.

Subsection 501(b). The provisions of the Covenant referred to in this Subsection constitute integral parts of the mutual compromises and concessions without which the accession of the Northern Mariana Islands to the United States would not have been possible. The inclusion of any of those provisions in this Subsection should not imply that these provisions are in conflict with the Constitution of the United States.

Section 502. The interim formula stated in this Section is not intended to be the exclusive method by which laws of the United States are or can be made applicable to the Northern Mariana Islands. The Congress of the United States will have power subject to Section 105 to alter the manner and extent to which laws covered by the formula apply to the Northern Mariana Islands, to make laws not covered by the formula applicable or to make laws covered by the formula inapplicable. The formula does not make the Northern Mariana Islands into a territory or possession of the United States prior to termination. In many instances, however, the Northern Mariana Islands will be treated as if it were a territory or possession of the United States prior to termination, for many laws applicable to Guam because it is a territory or possession will become applicable to the Northern Mariana Islands.

The phrase "applicable to Guam" or "applicable to the Trust Territory of the Pacific Islands" in this Section is to mean "applicable within" as well as "with respect to" the geographic areas mentioned or the people who reside in or who are citizens of those geographic areas.

The term "the federal banking laws" in Subsection (a) has particular reference to Sections 13, 25 and 25(a) of the Federal Reserve Act, as amended (12 U.S.C. 466, and 601-632, respectively) and Section 5191 of the Revised Statutes (12 U.S.C. 143). The reference to the Micronesian Claims Act in Subsection (a) is not intended to preclude the Northern Mariana Islands from seeking such amendments to the Act, or increased appropriations for its implementation, as appear appropriate or desirable.

Subsection 503(a). It is understood that the laws of the Trust Territory of the Pacific Islands, as modified by the Government of the Northern Mariana Islands pursuant to its authority, which relate to the subjects addressed in this Subsection, will continue to be effective after termination of the Trusteeship Agreement, except to the extent that they are modified by federal law after termination or by the Government of the Northern Mariana Islands.

Section 504. The provision that the United States will bear the cost for the work of the Commission does not mean that the United States will pay the salary of the four Commissioners who are domiciled in the Northern Mariana Islands.

Section 506. To the extent that the United States law does not apply, the Northern Mariana Islands has the power over immigration into its territory. An immediate relative of a United States citizen residing in the Northern Mariana Islands may gain admission to the Northern Mariana Islands in accordance with local law without claiming at that time entitlement to immediate relative status under the United States Immigration and Nationality Act.

Section 601. The revenue provisions of the Covenant are not designed to render the Federal Unemployment Tax and the benefits derived therefrom applicable to the Northern Mariana Islands.

Subsection 603(b). The parties believe that the treatment provided for in this Subsection is consistent with the obligations of the United States under the General Agreement on Tariffs and Trade. However, this Subsection is not intended to conflict with United States international obligations and does not require that the United States take any action which would be inconsistent with such obligations. Should such a conflict arise, the United States will seek appropriate waivers or modifications of its international obligations.

Subsection 603(d). The term "a developing territory" as used in this Subsection is intended to refer to the June 25, 1971 General Agreement on Tariffs and Trade waiver regarding preferential tariff treatment of goods from developing countries and territories and to other similar benefits which may be available to the Northern Mariana Islands.

Section 702. It was not considered necessary to include this Section among the provisions listed in Section 105 which may be modified only by mutual consent. The reason for this omission is that, while Section 702 constitutes a commitment on the part of the United States Government, it is of a transitional nature extending for seven years following the establishment of the new Government. In addition, a failure to appropriate funds as required by that Section would constitute a dispute under Article IX which could be submitted to the courts pursuant to the provisions of that Article.

Subsection 704(c). The reference in this Subsection and in Subsection 803(b) to a United States Department of Commerce composite price index is intended to refer to the United States Gross National Product Implicit Price Deflator.

Section 803. It is understood that the Government of the Northern Mariana Islands may exercise its obligations and rights under this Article through a legal entity established to receive and hold public lands in trust for the people of the Northern Mariana Islands.

Section 805. The parties intend that it will be the responsibility of the Government of the Northern Mariana Islands to implement the provisions of this Section. In particular, the parties understand that the Constitution or laws of the Northern Mariana Islands will define the operative terms in this Section, including such terms as "long-term interest in real property", "acquisition" and "persons of Northern Mariana Islands descent".

Subsection 806(a). The use of any property or interest acquired by the United States pursuant to this Subsection will not be limited to the public purposes for which it was originally obtained.

Section 901. This Section is not intended to preclude the Government of the Northern Mariana Islands from requesting the Congress of the United States to confer non-voting delegate status on the Resident Representative provided for in this Section.

Subsection 904(c). The parties note that this Subsection is not intended to preclude the Government of the Northern Mariana Islands from discussing matters of mutual concern with other Pacific island communities.

Section 1001. In accordance with the request of the Marianas District Legislature, the United States intends to administer the Mariana Islands District separately from the remainder of the Trust Territory following approval of the Covenant by the people of the Northern Mariana Islands. In establishing other qualifications for voting in the plebiscite the United States will consult with representatives of the Marianas District Legislature and other local leaders.

Section 1002. The parties note that the United States has stated that it is now planning on a provisional basis to terminate the Trusteeship for all the districts by 1981.

PRESS RELEASE February 15, 1975

A Covenant establishing a Commonwealth of the Northern Mariana Islands in political union with the United States of America was signed on Saipan February 15. The signing clears the way for submission of the document to the Marianas Legislature for its consideration. After approval by the legislature, the Covenant will be voted on by the people of the Northern Marianas. Both houses of the United States Congress will be asked to approve the Covenant following completion of the Marianas' portion of the ratification process. The signing took place in the filled auditorium of the Mount Carmel School where the first round of Marianas political status negotiations began in December 1972.

In his remarks during the public signing ceremony, the Personal Representative of the President of the United States, Ambassador F. Haydn Williams read messages from the President and the Secretary of Interior. President Ford's message extended his "warmest congratulations to the people of the Northern Mariana Islands as their representatives sign a Covenant of Political Union with the United States." The President continued, stating that "over the past quarter century you have consistently sought to form a closer union with the United States. We have welcomed that desire which is embodied in the Covenant which we sign today. This Covenant, the product of almost three years of cooperative discussions, recognizes both of our interests in this new relationship. The United States looks forward to an enduring and mutually beneficial union. With warm good wishes, Gerald R. Ford."

Ambassador Williams drew attention to the fact that the signing ends another chapter in the long history of the desire of the people of the Northern Marianas for political union with the United States, a story which began more than twenty five years ago. The opening of formal negotiations leading to the Covenant signed today, Ambassador Williams stated, began following creation of the Marianas Political Status Commission by the District Legislature in 1972. The status commission is a broadly representative body consisting of representatives of the political parties, the District Legislature, and such important elements of the private sector as the Carolinian Community and the Chamber of Commerce.

Looking to the future, the Ambassador stated that installation of a new government of the Northern Marianas under their own Constitution could take place as early as the summer or fall of 1976. The timing will depend on the speed with which the Covenant moves through the ratification process and the District Legislature calls a convention to draft a Constitution. The date for the plebiscite, which will be observed by the United Nations, has not been set, but it is hoped that it will take place in the last two weeks of June 1975.

Marianas Political Status Commission Chairman Edward DLG. Pangelinan expressed his pleasure that the negotiations had been successfully concluded and stated that the people of the Marianas are prepared for self-government. He continued, saying that the people of the Marianas are prepared to "embrace the United States Constitution and its Bill of Rights". Both the Ambassador and Chairman Pangelinan spoke of the need to fully inform the people of the meaning of the Covenant so that they can express their collective will in an act of self determination during the plebiscite.

In addition to those signing, dignitaries in attendance included Lieutenant Governor of Guam Rudy Sablan, Guam Senator Vicente (Ben) Ada, the High Commissioner and Deputy High Commissioner, Edward E. Johnston and Peter Coleman, Marianas District Administrator Francisco T. Ada. The invocation was given by His Excellency Felixberto Flores, Bishop of the Diocese of Agana; the Benediction by Reverend Mack Williams, Pastor of the Saipan Community Church.

MARIANAS POLITICAL STATUS COMMISSION

Mr. Edward DLG. Pangelinan, Chairman, representing the Northern Mariana Islands.
Mr. Vicente N. Santos, Vice-Chairman, representing the Mariana Islands District Legislature
Mr. Juan LG. Cabrera, representing the Mariana Islands District Legislature
Mr. Vicente T. Camacho, representing the Saipan Municipal Council
Mr. Jose R. Cruz, representing the Tinian Municipal Council
Mr. Bernard V. Hofschneider, representing the Tinian Municipal Council
Mr. Benjamin T. Manglona, representing the Rota Municipal Council
Mr. Daniel T. Muna, representing the Saipan Municipal Council
Dr. Francisco T. Palacios, representing the Marianas Territorial Party
Mr. Joaquin I. Pangelinan, representing the Marianas Popular Party
Mr. Felix F. Rabauliman, representing the United Carolinian Association
Mr. Oscar C. Rasa, representing the Joint Committee on Future Status, Congress of Micronesia
Mr. Manuel A. Sablan, representing the Business Community
Mr. Joannes R. Taimanao, representing the Rota Municipal Council
Mr. Pedro A. Tenorio, representing the Joint Committee on Future Status, Congress of Micronesia

FORMER MEMBERS OF THE MARIANAS POLITICAL STATUS COMMISSION WHO PARTICIPATED IN THE NEGOTIATIONS

Mr. Jose C. Tenorio
Congressman Herman M. Manglona
Mr. Francisco A. Hocog
Judge Felipe A. Salas
Former Congressman Herman Q. Guerrero
Senator Olympio T. Borja

CONSULTANTS AND STAFF

Howard P. Willens, Esquire, Wilmer, Cutler and Pickering Law Firm, Washington, D.C.
Jay F. Lapin, Esquire, Wilmer, Cutler and Pickering Law Firm, Washington, D.C.
Michael S. Helfer, Esquire, Wilmer, Cutler and Pickering Law Firm, Washington, D.C.
Mr. James R. Leonard, James R. Leonard Associates, Inc., Consulting Economists and Development Planners
Mr. Joseph F. Screen, former Financial Consultant
Mr. James E. White, Esquire, Executive Director
Mrs. Patricia A. Brennan, Secretary

UNITED STATES DELEGATION

Ambassador F. Haydn Williams, The President's Personal Representative for Micronesian Status Negotiations
Mr. James M. Wilson, Jr., U.S. Deputy Representative for Micronesian Status Negotiations
Captain Richard Y. Scott, U.S. Navy, Director, Office for Micronesian Status Negotiations

ADVISERS

Mr. Edward E. Archer, State Adviser, Office for Micronesian Status Negotiations
Mr. James Berg, Special Adviser, Office of Territorial Affairs, Department of the Interior
Mr. Alf Bergesen, Status Liaison Officer, Office of the High Commissioner, Trust Territory of the Pacific Islands
Mr. Adrian de Graffenried, Legal Adviser, Office for Micronesian Status Negotiations
Mr. Herman Marcuse, Office of the Legal Counsel, Department of Justice
Mr. Emmett Rice, Acting Director, Office of Territorial Affairs, Department of the Interior
Mr. David Schiele, Assistant Status Liaison Officer, Office of the High Commissioner, Trust Territory of the Pacific Islands
Colonel Athol M. Smith, U.S. Army, Department of Defense Adviser, Office for Micronesian Status Negotiations
Captain Edward C. Whelan, U.S. Navy, Office of the Secretary of Defense

ADMINISTRATION

YNC Keith K. Caplinger, U.S. Navy, Special Assistant to the Director, Office for Micronesian Status Negotiations
Ms. Doris Treakle, Secretary to Ambassador Williams
Ms. Lois Valk, Secretary, Office of the Status Liaison Officer

FORMER MEMBERS OF THE UNITED STATES DELEGATION WHO PARTICIPATED IN THE NEGOTIATIONS

RADM William J. Crowe, Jr., U.S. Navy
Mr. Stanley S. Carpenter

FORMER ADVISERS TO THE UNITED STATES DELEGATION WHO PARTICIPATED IN THE NEGOTIATIONS

Lieutenant Colonel Walter Appelle, U.S. Air Force
Mr. Barry Ballow
Lieutenant Commander James H. Bateman, U.S. Navy
Mr. John Dorrance
Mr. O. Thomas Johnson
Colonel William Kenty, U.S. Air Force
Mr. Harmon E. Kirby
Mr. Jack Knowles
Mr. Roy Markon
Colonel James P. McCarthy, U.S. Air Force
Lieutenant Commander Alan R. Pendleton, U.S. Navy
Mr. Joseph P. Samaritano
Captain Gordon J. Schuller, U.S. Navy
Mr. Solomon Silver
Lieutenant Colonel Dale Strait, U.S. Air Force
Mr. Andre Surena
Ms. Mary Vance Trent
Commander W. R. Westlake, U.S. Navy
Mr. Thomas Whittington

GPO 887-494

Appendix O-2
Interim Permit by and between the Marianas Public Land Corporation of the Commonwealth of the Northern Mariana Islands and the United States of America dated 4 November 1981

N62766-82RP-00053

INTERIM PERMIT

AGREEMENT FOR ISSUANCE OF AN INTERIM PERMIT, made this 4th day of November, 1981, by and between the Marianas Public Land Corporation of the Commonwealth of the Northern Mariana Islands, Saipan, Northern Mariana Islands (hereinafter referred to as "Permittor") and the duly authorized representative of the United States of America (hereinafter referred to as "Permittee");

WHEREAS, in accordance with Sections 802 and 803 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 (hereinafter referred to as "Covenant") and with Part I of the Technical Agreement of the Covenant, upon payment by the United States to the NMI Government the total sum of $19,520,600.00 adjusted at the time of payment by the percentage change of the United States Department of Commerce composite price index from the date of signing the Covenant, February 15, 1975; the NMI Government will lease to the United States for military use, for a term of fifty (50) years with an option in the United States to renew for an additional fifty (50) years at no additional cost to the United States, the following areas:

(1) On Tinian Island, approximately 17,799 acres (7,203 hectares) and the waters immediately adjacent thereto;

(2) On Saipan Island, approximately 177 acres (72 hectares) at Tanapag Harbor; and

(3) On Farallon de Medinilla Island, approximately 206 acres (83 hectares) encompassing the entire Island, and the waters immediately adjacent thereto; and

WHEREAS, Part I of the Technical Agreement of the Covenant provides that the lease payment must be made within five (5) years from the date Covenant Sections 802 and 803 come into force, January 9, 1978, or both parties to the lease, the NMI Government and the United States, will be released from all liability or obligations created by the Technical Agreement and Sections 802 and 803; and

WHEREAS, under that Use and Occupancy Agreement, dated, October 19, 1971, between the Government of the Trust Territory of the Pacific Islands and the United States has been using the entire island of Farallon de Medinilla as an impact target area; and

WHEREAS, under certain Use and Occupancy Agreements between the Government of the Trust Territory of the Pacific Islands and the United States and through other informal arrangements between representatives of the aforesaid governments, all of which terminated on January 9, 1978, the United States has been using a portion of northern Tinian Island, on an intermittent basis, for amphibious military training exercises; and

WHEREAS, these areas on Tinian and Farallon de Medinilla in use by the United States for military purposes are included within the area to be leased by the NMI Government to the United States, described hereinabove and in Section 802 of the Covenant; and

WHEREAS, during the period from January 9, 1978, until such time as the Covenant lease agreement is executed and the lease payment is made, the United States has a requirement to continue to use Farallon de Medinilla as an impact target area and a portion of northern Tinian for amphibious military training exercises, to the same extent and for the same purpose that it has been using the property prior to the date of this Interim Permit; and

WHEREAS, revocable Permit NF(R)-28906 was executed on

MARIANAS PUBLIC LAND CORPORATION
P.O. Box 380
Saipan, Northern Mariana Islands 96950

MARIANAS PUBLIC LAND CORPORAT
P.O. Box 380
Saipan, Northern Mariana Islands 96950

January 9, 1978, by and between the Governor of the Commonwealth of the Northern Mariana Islands and Permittee for the use by Permittee of Farallon de Medinilla Island and a portion of Tinian Island which has been revoked by Permit N62766-79-RP-0005; and

WHEREAS, the parties desire to increase the interim compensation under Permit N62766-79-RP-0005; and

WHEREAS, Article XI, Sections 4 and 5 established and granted jurisdiction, authority and responsibility for the use and disposition of all public lands in the Commonwealth to the Permittor; and

WHEREAS, the Permittor is willing to convey to the Permittee a revocable right to use said areas; and

WHEREAS, at this time the Permittor and the Permittee do not desire to exercise any of the rights or obligations under the above referenced optional lease agreement pursuant to Sections 802 and 803 of the Covenant and Part I of the Technical Agreement of the Covenant;

NOW THEREFORE, in consideration of the mutual promises hereinafter set forth and the mutual benefits to be derived therefrom:

1. Permittor does hereby grant unto the Permittee a revocable Interim Permit to enter and occupy:

(a) Farallon de Medinilla Island in its entirety, and the waters immediately adjacent thereto, consisting of approximately 206 acres for an aircraft and ship ordnance impact target area; and

(b) That portion of northern Tinian Island, shown shaded in red on Exhibit "A", and attached hereto and made a part hereof, for amphibious military training exercises.

The Permittee may restrict access to the waters immediately adjacent to the permitted areas up to three (3) miles from the areas upon giving adequate public notice of 48 hours for Farallon de Medinilla and 7 days for Tinian.

2. The Permittee is not to be considered as acquiring hereunder any estate or permanent interest whatsoever in the property of the NMI Government.

3. The Permittor may revoke this Interim Permit, in whole or in part, upon written notice to the Permittee at least thirty (30) days prior to such revocation.

4. The Permittee shall at all times with respect to the areas covered by this Permit use due care for the public safety.

5. As provided by Section 5(e) of Article XI of the Constitution of the Northern Mariana Islands, no interest is granted Permittee within one hundred fifty feet of the high water mark of any sandy beach. Permittee shall be allowed reasonable ingress and use of the beach areas for bivouac and other temporary purposes in these areas.

6. From the effective date of this Interim Permit, the Permittee shall be liable and responsible to repair and restore improved properties and structures within and without the permitted areas damaged by the Permittee. The Permittee shall be responsible to the extent permitted by United States law for any damage or injury to the NMI Government or to others arising from its use of the areas covered by this Permit; provided that nothing herein shall be construed as requiring the Permittee to restore the areas to the condition existing prior to the time the United States began its use of the property for military purposes. The Permittee shall further hold the NMI Government harmless from any and all claims and damages or liability, to the extent permitted by United States law, resulting from the use and occupancy of these areas by the United States.

MARIANAS PUBLIC LAND CORPORAT
P.O. Box 380
Saipan, Northern Mariana Islands 96950

7. As Interim compensation, Permittee shall provide all humanitarian and civic action services presently being supplied to the Commonwealth of the Northern Mariana Islands and the amount of Thirty Thousand Dollars ($30,000.00) per year. If this Interim Permit is revoked, the monetary payment per year shall be refunded pro rata.

8. Nothing in the terms and conditions of this revocable Interim Permit shall be construed to be an exercise of any of the rights or obligations of that above referenced option to lease for military purposes pursuant to Sections 802 and 803 of the Covenant and Part I of the Technical Agreement of the Covenant.

9. Permittee warrants that it knows and is aware of which parcels of land in the permitted areas presently are public land and those which are owned, homesteaded, leased or actively farmed by private parties as of January 9, 1978. Permittor shall notify Permittee of any changes of public land, relative to the use areas, to private, commercial or homestead use. In the event that any homestead, grazing lease, or actively farmed area as of January 9, 1978, has been omitted from Exhibit "A" or the aforesaid notification of changes in public land use has been provided by the Permittor, the Permittee will also avoid the use of these lands in the conduct of amphibious military exercises. The Permittee shall further hold the NMI Government harmless from any and all claims and damages or liability, to the extent permitted by United States law, resulting from any improper use or trespass upon any said private areas.

10. The effective date of this Interim Permit shall be November 17, 1981 which shall supersede Permit N62766-79-RP-00005.

IN WITNESS WHEREOF, the parties hereto have caused

MARIANAS PUBLIC LAND CORPORATION
P.O. Box 380
Saipan, Northern Mariana Islands 96950

this agreement to be executed on the day and year first above written.

PERMITTOR:	PERMITTEE:
MARIANAS PUBLIC LAND CORPORATION	UNITED STATES OF AMERICA
By: _____	By: _____
Antonio R. Sablan Chairman Board of Directors	Henry J. Rinnert Captain, C.E.C., U.S.N. by direction of the Commander, Naval Facilities Engineering Command, Acting under the direction of the Secretary of the Navy

N6766-82RP-00053A

ADDENDUM TO INTERIM PERMIT

AGREEMENT ON ADDENUM TO INTERIM PERMIT, N62766-82RP-00053, dated 4 November 1981, between the Marianas Public Land Corporation of the Commonwealth of the Northern Mariana Islands, Saipan, Northern Mariana Islands (hereinafter referred to as "Permittor") and the duly authorized representative of the United States of America (hereinafter referred to as "Permittee");

WHEREAS, Permittor and Permittee desire to fix the interim monetary compensation the Permittee shall provide under the provisions of paragraph 7 of Interim Permit N62766-82RP-00053 for the period 17 November 1982 to 9 January 1983;

NOW THEREFORE, the Permittor and Permittee agree that the monetary compensation to be provided under the provisions of Interim Permit N62766-82RP-00053 for the period from 17 November 1982 to 9 January 1983 shall be the sum of Four Thousand Five Hundred Dollars ($4,500.00).

Except as modified by this Addendum, all provisions of Interim Permit N62766-82RP-00053, dated 4 November 1981, remain in full force and effect.

This Addendum is effective upon its execution by both parties.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed this 20TH day of August 1982.

PERMITTOR:
MARIANAS PUBLIC LAND CORPORATION

By: _____
Antonio R. Sablan
Chairman
Board of Directors

PERMITTEE:
UNITED STATES OF AMERICA

By: Henry J. Rinnert
Henry J. Rinnert
Captain, C.E.C., U.S.N.
by direction of the
Commander Naval Facilities Engineering Command
Acting under the
direction of the
Secretary of the Navy

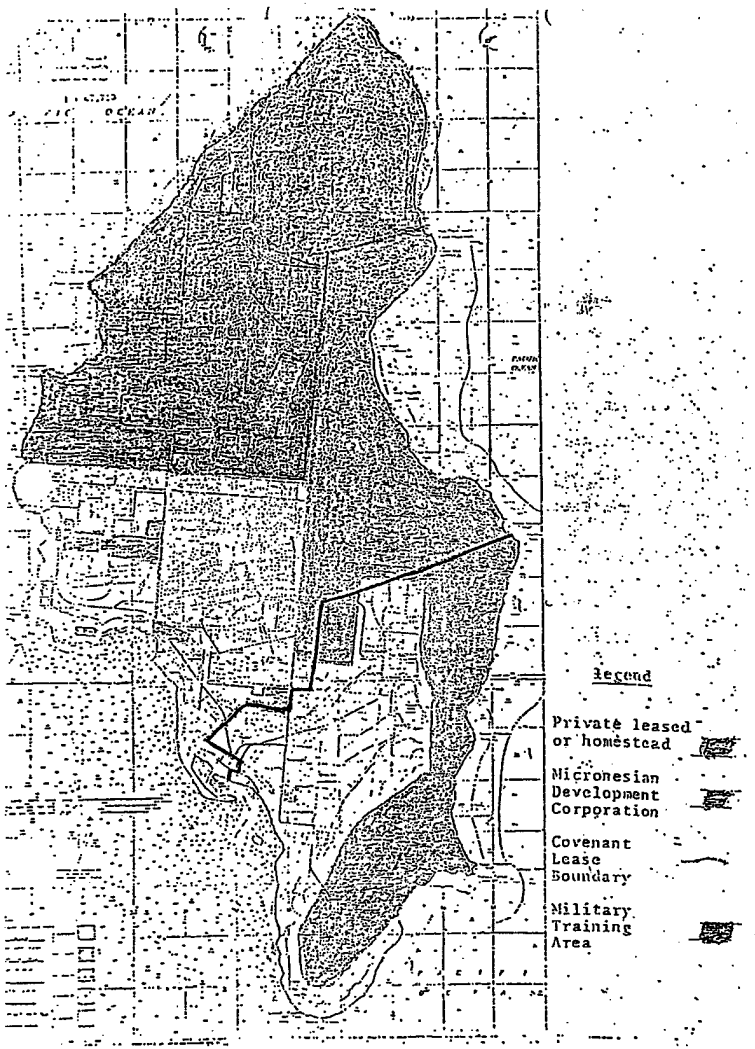


EXHIBIT "A"

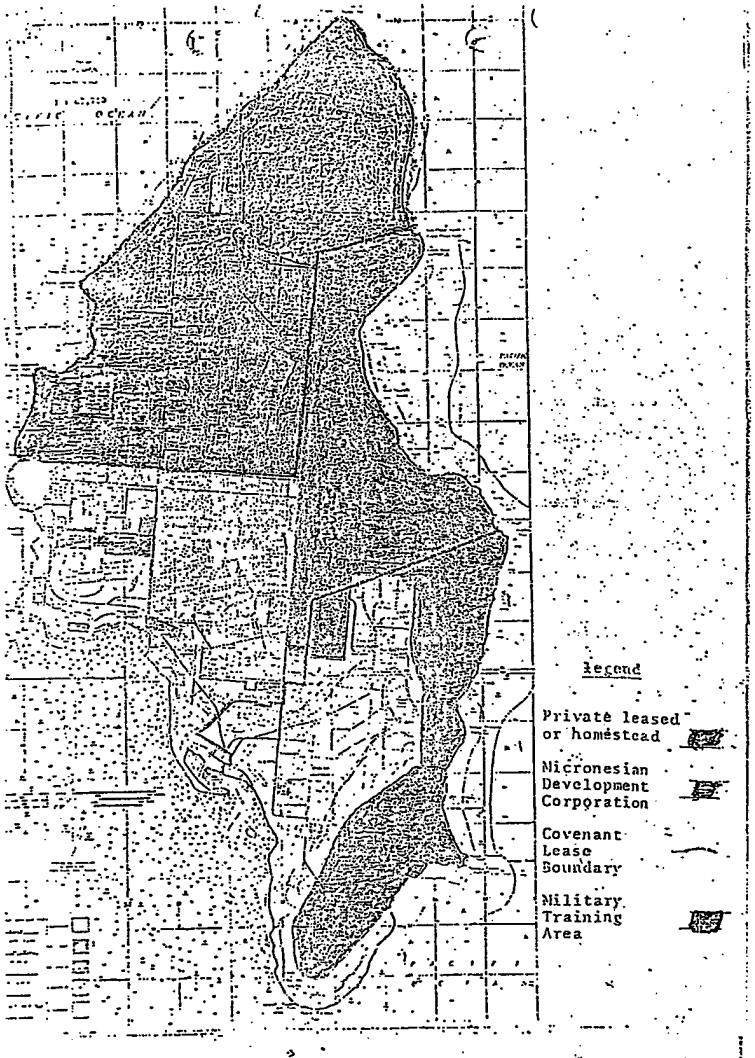


EXHIBIT "A"

Appendix O-3
USCINCPAC Instruction 11011.3 dated 15 May 1985 with Lease Agreement dated 6 January 1983

COMMANDER IN CHIEF, U.S. PACIFIC COMMAND
(USCINCPAC)
CAMP H.M. SMITH, HAWAII 96861-5025

USCINCPACINST 11011.3
5614
15 May 1985

USCINCPAC INSTRUCTION 11011.3

Subj: Use of Military Lease Lands on Tinian, Commonwealth of the Northern Mariana Islands (CNMI)

1. Purpose. To establish policy pertaining to the use of military lease lands on Tinian, CNMI.

2. Background

a. An agreement was signed with the Government of the Commonwealth of the Northern Mariana Islands (CNMI) in January 1983 which provided for the lease to the U.S. of certain lands within the CNMI for military use. The long-term and overriding purpose in acquiring the CNMI lease is to ensure there is a capable forward basing option location in the Pacific, exceeding the capability of Guam alone, in the event of major hostilities in the Pacific or loss of access to existing forward basing facilities.

b. Since acquisition of the lease, several additional proposals for use of the leased land on Tinian, CNMI have been submitted. Identification of other uses for the Tinian land necessitates establishment of a policy which allows consideration of current use requirements while maintaining the integrity of contingency use availability.

3. Policy

a. The primary purpose of the CNMI lease is to provide training areas for USPACOM forces and to preserve options for USPACOM forward military basing should circumstances require.

b. USCINCPAC will be the approving authority for all use of CNMI lease lands which fall outside of the purpose stated in paragraph 3a.

c. Approval of requests for use of the CNMI lease lands will be considered on a case-by-case basis based on relative priorities and in the light of training/contingency land requirements.

4. Responsibilities

a. USCINCPAC: J4 will staff requests for use of CNMI lease lands falling outside the purposes stated in paragraph 3a and make appropriate recommendations as necessary to USCINCPAC.

b. USPACOM Component Commands: Will keep USCINCPAC apprised of current use of CNMI lease lands and of any long term and/or contingency plans which include use of these lands.

5. Action. Commands desiring use of CNMI lease lands for purposes other than stated in paragraph 3a will submit requests to USCINCPAC (J4) to include the following:

a. Purpose of land requirement.

b. Amount and location of land required.

c. Description of any proposed permanent/semipermanent construction to include infrastructure placement.

d. Justification for use of CNMI lease land vice other sites.

WALTER C. SCHRUPP
Major General, USAF
Deputy Chief of Staff

Distribution: (USCINCPACINST 5605.1F)
List I
A
List II
A
B
D
List III
A

Copy to: (USCINCPACINST 5605.1F)
List II
F (1, 5)
List III
B (12)

LEASE AGREEMENT
MADE PURSUANT TO
THE COVENANT TO ESTABLISH A COMMONWEALTH OF THE
NORTHERN MARIANA ISLANDS
IN POLITICAL UNION WITH THE UNITED STATES OF AMERICA

THIS LEASE AGREEMENT is made this 6th day of January 1983, by and between the MARIANAS PUBLIC LAND CORPORATION, a corporation created under and existing pursuant to the Constitution of the Northern Mariana Islands, the COMMONWEALTH PORTS AUTHORITY, a public body organized and existing under and pursuant to Public Law No. 2-48, and the COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS, hereinafter referred to respectively as the "Corporation", the "Authority", and the "Commonwealth", and collectively as the "Lessors", and the UNITED STATES OF AMERICA, as lessee, hereinafter referred to as the "United States".

WITNESSETH: that

WHEREAS, the Marianas Political Status Commission, being the duly appointed representative of the people of the Northern Mariana Islands, and the Personal Representative of the President of the United States for Micronesian Status Negotiations entered into a Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America (Public Law 94-241; 90 STAT 263) on the 15th day of February 1975, in order to establish a self-governing commonwealth for the Northern Mariana Islands within the United States political system and to define the future relationship between the Northern Mariana Islands and the United States; and

WHEREAS, said Covenant became mutually binding when it was respectively approved by the United States of America, the Mariana Islands District Legislature, and the people of the Northern Mariana Islands; and

WHEREAS, Sections 802 and 803 of said Covenant provide that certain property in the Northern Mariana Islands, as hereinafter described, will be made available to the United States by lease to enable it to carry out its defense responsibilities; and

WHEREAS, noting that the extent of land required by the United States had been determined and the precise boundaries thereof agreed upon, and desiring that all basic arrangements relative to land be reduced to a formal land agreement, the parties to said Covenant also entered into a Technical Agreement setting forth additional terms and conditions of the lease to the United States; and

WHEREAS, said Sections 802 and 803 and said Technical Agreement became effective on the 9th day of January 1978, in accordance with Presidential Proclamation No. 4534 signed on the 24th day of October 1977; and

WHEREAS, the Corporation is the legal land entity established by the Constitution of the Northern Mariana Islands to manage and dispose of surface public lands in the Northern Mariana Islands, including those lands on Saipan, Tinian and Farallon de Medinilla Islands as described in said Section 802; and

WHEREAS, subject to the provisions of said Section 802 and said Technical Agreement, the Authority is the fee title holder of certain additional surface lands on Tinian Island, hereinafter described; and

WHEREAS, the Commonwealth has been authorized by Public Law No. 3-40, to execute this Lease Agreement as it applies to the waters immediately adjacent to the surface lands located on Tinian and Farallon de Medinilla Islands described in said Section 802; and

WHEREAS, the United States has requested that said surface lands and adjacent waters be made available at this time;

NOW, THEREFORE, for and in consideration of the Premises, and the rent hereinafter reserved and of the covenants herein contained on the part of the United States to be observed and performed, it is hereby agreed as follows:

ARTICLE 1. GRANT OF PREMISES

a. Grant by Corporation. The Corporation does hereby grant, demise, and let unto the United States, subject to all the terms, covenants and conditions hereinafter set forth, and the United States does hereby accept and rent from the Corporation the following real property located in the Commonwealth of the Northern Mariana Islands:

(1) On Tinian Island, approximately 17,089 acres (6,916 hectares) of land, described as that land shown in Exhibit A, attached hereto and made a part hereof, less the land described below in Article 1.b.;

(2) On Saipan Island, approximately 177 acres (72 hectares) of land at Tanapag Harbor, as further described in Exhibit B, attached hereto and made a part hereof; and

(3) On Farallon de Medinilla Island, approximately 206 acres (83 hectares) of land encompassing the entire island, as further described in Exhibit C, attached hereto and made a part hereof.

b. Grant by Authority. The Authority does hereby grant, demise, and let unto the United States, subject to all the terms, covenants, and conditions hereinafter set forth, and the United States does hereby accept and rent from the Authority approximately 709 acres (287 hectares) of land located on Tinian Island, Commonwealth of the Northern Mariana Islands, comprised of all that parcel of land described in Exhibit D, attached hereto and made a part hereof, less that certain portion of Lot 221 T 01 (44,409 square meters) as shown on

Cadastral Plat No. 221 T 00, approximately 2 acres (1 hectare) in size, located within the lands described in said Exhibit D.

c. Grant by Commonwealth. The Commonwealth does hereby grant, demise, and let unto the United States, subject to all the terms, covenants and conditions hereinafter set forth, and the United States does hereby accept and rent from the Commonwealth pursuant to Section 802 of the Covenant waters of the Commonwealth immediately adjacent to the leased surface lands on Tinian and Farallon de Medinilla Islands, Commonwealth of the Northern Mariana Islands, hereinabove leased to the United States by the Corporation. The United States shall have the right within the waters to facilitate access and egress to the leased surface lands and to construct reasonable port facilities; PROVIDED, that the United States shall disturb to the minimum extent possible the seabed and subsoil in exercising its right of construction. The Commonwealth retains the right, without undue interference to the rights of the United States under this Lease Agreement to exploit the living and non-living resources of the waters immediately adjacent to the leased surface lands.

d. Definition of Premises. As used hereinafter, the term "Premises" shall be construed to refer collectively to all of the lands and waters hereinabove described in this Article.

ARTICLE 2. TERM

To have and to hold the above described Premises unto the United States, its successors and assigns, for a term of fifty (50) years, commencing on the first day of January 1983, SUBJECT, however, to: (1) the terms and conditions of the "Land Acquisition and Deferred Payment Agreement" executed simultaneously with this Lease Agreement; and (2) the terms and conditions of a lease covering a portion of the Premises, made as of the 11th day of June 1965, between the Government of the Trust Territory of the Pacific Islands, as lessor, and the Micronesian Development Company, Inc., as lessee, which lease shall be allowed to continue in

accordance with the provisions of Article 6 of this Lease Agreement.

ARTICLE 3. OPTION TO EXTEND

The United States shall have the option of renewing this Lease Agreement in whole or in part for an additional term of fifty (50) years if it so desires at the end of the first term hereof. If the United States elects to exercise its option to renew this Lease Agreement, the United States must provide notice of its intent to renew during the period 1 January to 30 September 2032.

ARTICLE 4. PURPOSE AND SCOPE

The Premises are leased and may be used for any purpose required to carry out the defense responsibilities of the United States. Nothing herein shall derogate from the rights of the parties provided under the Covenant.

ARTICLE 5. RENT

a. Rent Amounts. The United States shall pay to the Lessors in full settlement of this Lease Agreement, including the second fifty (50) year term if exercised under the provisions of Article 3 hereof, the total sum of $19,520,600, determined as follows:

(1) for the property on Tinian Island, $17,500,000;

(2) for the property at Tanapag Harbor, Saipan Island, $2,000,000; and

(3) for Farallon de Medinilla Island, $20,600;

all of which above sums shall, in accordance with the terms of said Covenant and Technical Agreement, be adjusted by a percentage which is the same as the percentage change in the United States Department of Commerce composite price index from the date of signing of said Covenant to the effective date of this Lease Agreement. It is hereby agreed that the total adjusted sum to be paid to the Lessors by the United States is $33,000,000.

b. Manner of Payment. It is agreed by the parties hereto that the United States shall discharge its responsibilities under this Article by paying to the Corporation all monies due hereunder in accordance with the terms and conditions of the "Land Acquisition and Deferred Payment Agreement" executed by the United States, the Commonwealth, and the Corporation simultaneously with this Lease Agreement.

ARTICLE 6. LEASE TO MICRONESIAN DEVELOPMENT COMPANY, INC.

As noted in Article 2 of this Lease Agreement, a portion of the Premises is encumbered by a lease dated the 11th day of June 1965, to the Micronesian Development Company, Inc., hereinafter referred to as "MDC", which lease shall be allowed to continue in accordance with its terms. The United States and the Corporation will consult and cooperate on specific actions by either party that may affect or involve possible adjustments or termination of the MDC lease. Each party will render full assistance to the other in order to achieve specific needs with respect to the MDC lease, to include either compliance with the terms of the lease, amendments to the lease, or actions to terminate the lease. In no event will either party impede the action of the other with respect to the MDC lease. The United States will be responsible for damages resulting from a breach or early termination of the MDC lease resulting solely from United States initiatives. The Corporation will be responsible for damages resulting from a breach or early termination resulting solely from Corporation initiatives. Both the United States and the Corporation will hold the other harmless from all claims arising by reason of any such breach or termination.

ARTICLE 7. COVENANT OF SUFFICIENT INTERESTS; REMOVAL OF ENCUMBRANCES; AND INDEMNIFICATION BY LESSORS

Subject to fulfillment of the provisions of said "Land Acquisition and Deferred Payment Agreement", the Lessors hereby

covenant with the United States that they have the right to make this Lease Agreement for the aforesaid term. If the United States shall perform all of the covenants and provisions of this Lease Agreement to be performed by the United States, the United States shall, during the term hereof, freely, peacefully, and quietly occupy and enjoy the full possession of the Premises without molestation or hindrance, lawful or unlawful, of any person whomsoever with the exception of said MDC; and that if, at any time during the term hereby granted, the title of the Lessors shall fail or be discovered not to enable the Lessors to grant the term hereby demised, the Lessors shall take whatever actions are necessary to expeditiously restore possession of the affected portions of the Premises to the United States. The Lessors shall indemnify and save and hold harmless the United States, its officers, agents and employees for and from any and all liability or claims for loss or damage which may arise from the failure of the Lessors title to the Premises or its ability to grant the term hereby demised.

ARTICLE 8. LIABILITY OF UNITED STATES

The United States shall hold the Lessors harmless from any and all claims for damage or injury caused by or resulting from any act or omission of the United States in connection with the United States' use of the Premises to the extent permitted under the Federal Tort Claims Act (62 STAT 869-982, 28 U.S.C. 2671-2680).

ARTICLE 9. IMPROVEMENTS; RESTORATION

a. Improvements. The United States shall during the term of this Lease Agreement have the right, at its own expense, to construct, place, erect, or install such buildings, structures, equipment and facilities as may be necessary for the United States' use of the Premises pursuant to this Lease Agreement;

provided that at the expiration of this Lease Agreement, or its prior termination in whole or in part, the United States shall have the option of either removing such buildings, structures, equipment and facilities as it may elect, or abandoning the same in place. At least ninety (90) days prior to the expiration or earlier termination of this Lease Agreement, the United States shall give notice to the Lessors of those buildings and structures or other improvements the United States intends to remove from the Premises. Upon the expiration or earlier termination of this Lease Agreement, all buildings and structures or other improvements not included in said listing shall be deemed to have been abandoned by the United States and shall become the property of the appropriate lessor. Unless otherwise agreed to in writing by the parties hereto, the buildings and structures or other improvements included in said listing shall be removed by the United States within six (6) months of the expiration or earlier termination of this Lease Agreement.

b. Restoration. It is understood that the activities of the United States in connection with carrying out its defense responsibilities may result in damage to the Premises. In that event, upon the expiration or earlier termination of this Lease Agreement in whole or in part, the parties shall consult in good faith to determine and agree upon the extent of the damage, taking into account conditions at the time, including potential uses of the Premises. With respect to the islands of Saipan and Tinian, the United States will correct the damage, including removal of unexploded ordnance and exploded ordnance fragments introduced or uncovered by the United States during the term of this Lease Agreement. With respect to the island of Farallon de Medinilla, upon identification by the Lessors of a project for use of a specific area and notification to the

United States of such intended use, the United States shall, to the extent practicable, remove all unexploded ordnance and exploded ordnance fragments from that area.

ARTICLE 10. LEASEBACKS; SUBLEASES AND ASSIGNMENTS; REASSIGNMENTS; AND DISPOSALS

a. Required Leasebacks. In accordance with Sections 803(d) and (e) of said Covenant and Part I.5. of said Technical Agreement, the United States shall, by separate agreements, lease back to the appropriate lessor certain portions of the Premises located on Saipan and Tinian Islands. Until such time as said required leaseback agreements are consummated, all leases, licenses or permits issued by the Lessors authorizing use of any portion of the Premises covered by the required leaseback agreements may continue in force and effect. At such time as said required leaseback agreements are effective, new agreements permitting continued use may be issued to the using party by the appropriate lessor recognizing the restrictions imposed by the leaseback agreement.

b. Other Leasebacks. Pursuant to Part I.5.C. of said Technical Agreement, the United States shall lease back to the Corporation, in accordance with the provisions of Part I.5.A.(1) and (4) of said Technical Agreement, the area shown in Exhibit E, attached hereto and made a part hereof, excluding the areas referred to in paragraph a. of this Article. Until such time as the leaseback agreement is consummated, all leases, licenses or permits issued by the Lessors authorizing use of any portion of the Premises covered by this leaseback may continue in force and effect. At such time as the leaseback agreement becomes effective, new agreements permitting continued use may be issued to the using party by the Corporation recognizing the restrictions imposed by the leaseback agreement.

c. Additional Leasebacks. The United States may from time to time lease back to the appropriate lessor, in accordance with applicable laws and regulations, additional portions of the Premises which are temporarily in excess of the needs of the United States. All requests made for use of the Premises which are unrelated to the needs or the discharge of the responsibilities of the United States shall be processed in accordance with the leaseback procedures of this paragraph.

d. Subleases and Assignments by United States. The United States may sublease the Premises or any portion thereof as required for the needs or the discharge of the responsibilities of the United States. The United States may also assign the Premises or any portion thereof as required for the needs or the discharge of the responsibilities of the United States, with the prior written consent of the appropriate lessor.

e. Reassignments. It is understood that the United States agency having control over the Premises is the Department of Defense. The United States may, however, consistent with the purpose of this Lease Agreement, reassign use of all or portions of the Premises to other United States Federal agencies in accordance with applicable United States law.

f. Disposals. Should any portion of the Premises not be required for the needs or the discharge of the responsibilities of the United States, or otherwise become surplus property under United States law, the Lessors will be given the first opportunity to acquire the interest of the United States in such property in accordance with United States law.

ARTICLE 11. JOINT USE

Should the United States exercise joint control of San Jose Harbor pursuant to Part II.1. of said Technical Agreement requiring the Commonwealth to upgrade wharf space or reimburse the United States for having such service performed, the United

States will offset the value of any improvements to San Jose Harbor made by the Commonwealth subsequent to the signing of said Covenant.

ARTICLE 12. NON-UNITED STATES ACCESS TO PREMISES

a. Authorized Access. It is hereby agreed that execution of the joint use agreements and implementation of the other arrangements contemplated by said Technical Agreement shall be held in abeyance until such time as a need therefor is established. In the interim and consistent with the provisions of said Technical Agreement, the Lessors shall have unrestricted use of the West Field area and San Jose Harbor on Tinian Island for civilian aviation and port related activities, respectively; provided, however, that any expansion of existing facilities or construction of additional facilities shall be subject to prior written approval of the United States. In addition to the access rights provided for hereinabove and Articles 6 and 10 of this Lease Agreement, the general public shall have access to the remaining portions of the Premises on Saipan and Tinian Islands consistent with the laws of the Commonwealth of the Northern Mariana Islands for recreational, hunting, and fishing purposes until such time as said remaining portions of the Premises are required for the needs or the discharge of the responsibilities of the United States.

b. Restriction of Public Access. Notwithstanding the provisions of paragraph a. of this Article, during times of military maneuvers, operations, or related activity, the granted right of public access may be restricted by the United States. Closure for such purposes, however, will be kept to a minimum consistent with military requirements and in the interest of safety and security. Additionally, all shoreline areas in and around the portions of the Premises located on or

immediately adjacent to Tinian Island, shall remain open to fishermen at all possible times except for those limited areas that must be closed to comply with United States safety and security requirements. The United States shall provide adequate public notice of seven (7) days prior to restricting public access, except in times of emergency.

c. Farallon de Medinilla. Public access to Farallon de Medinilla Island and the waters of the Commonwealth immediately adjacent thereto shall be permanently restricted for safety reasons.

ARTICLE 13. OFFICIALS NOT TO BENEFIT

No member of or Delegate to Congress, or elected or appointed official of the Commonwealth, or Resident Commissioner shall be admitted to any share or part of this Lease Agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this Lease Agreement if made with a corporation for its general benefit.

ARTICLE 14. GRATUITIES

The United States may, by written notice to the Lessors, terminate the rights of the Lessors under this Lease Agreement if it is found, after notice and hearing by the Secretary of the Navy or his duly authorized representative, that gratuities (in the form of entertainment, gifts, or otherwise) were offered or given by the Lessors, or any agent or representative of the Lessors, to any officer or employee of the United States with a view toward securing a lease or securing favorable treatment with respect to the awarding or amendment, or the making of any determination with respect to the performing of such lease; provided, that the existence of the facts upon which the Secretary or his duly authorized representative makes such findings shall be in issue and may be reviewed in any

competent court. In the event this Lease Agreement is so terminated, the United States shall be entitled (1) to pursue the same remedies against the Lessors as it could pursue in the event of a breach of the contract by the Lessors, and (2) as a penalty in addition to any other damages to which it may be entitled by law, to exemplary damages in an amount (as determined by the Secretary or his duly authorized representative) which shall be not less than three nor more than ten times the cost incurred by the Lessors in providing such gratuities to any such officer or employee. The rights and remedies of the United States provided in this clause shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Lease Agreement.

ARTICLE 15. COVENANT AGAINST CONTINGENT FEES

The Lessors warrant that no person or selling agency has been employed or retained to solicit or secure this Lease Agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Lessors for the purpose of securing business. For breach or violation of this warranty the United States shall have the right to annul this Lease Agreement without liability or, in its discretion, to deduct from the rental price or consideration or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee. (Licensed real estate agents or brokers having listings on property for rent, in accordance with general business practice, and who have not obtained such licenses for the sole purpose of effecting this Lease Agreement may be considered as bona fida employees or agencies within the exception contained in this Article.)

ARTICLE 16. SUCCESSORS AND ASSIGNS

The terms "Corporation", "Authority", "Commonwealth", and "Unite States" wherever used herein shall be held to mean and include, respectively, the Corporation, the Authority, the Commonwealth, and the United States, their successors and assigns. This instrument shall be binding upon and inure to the benefit of the parties hereto and their said respective successors and assigns.

ARTICLE 17. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this Lease Agreement shall be of any effect unless in writing. All notices required under this Lease Agreement shall be addressed to the Corporation or to the United States, as may be appropriate, at the following addresses or at such other addresses as may from time to time be agreed upon by the parties hereto:

FOR THE LESSORS:

Chairman, Board of Directors
Marianas Public Land Corporation
P. O. Box 380
Saipan, CM 96950

DUPLICATE COPY TO:

Governor
Commonwealth of the Northern
Mariana Islands
Saipan, CM 96950

FOR THE UNITED STATES:

Commander, Pacific Division
Naval Facilities Engineering
Command (Code 24)
Pearl Harbor, Hawaii 96860

DUPLICATE COPY TO:

Commander, U. S. Naval Forces
Marianas (Code N4)
Box 6A
FPO San Francisco 96630

ARTICLE 18. DISPUTES

The parties will use their best efforts to resolve between themselves any question or dispute relating to the interpretation or operation of this Lease Agreement and the Land Acquisition and Deferred Payment Agreement.

ARTICLE 19. ADMINISTRATION

a. The Lessors' representative specified in Article 17 hereof shall have complete charge of the administration of this Lease Agreement, and shall exercise full supervision and general direction insofar as the interests of the Lessors are affected.

b. The United States' representative specified in Article 17 hereof shall, under the direction of the Commander, Naval Facilities Engineering Command, have complete charge of the administration of this Lease Agreement, and shall exercise full supervision and general direction thereof insofar as the interests of the United States are affected.

IN WITNESS WHEREOF, the parties hereto have caused this Lease Agreement to be executed as of the date first above written.

FOR THE UNITED STATES OF AMERICA

By: _____
Assistant Secretary of the Interior, Territorial and International Affairs

By: _____
Assistant Secretary of Defense, International Security Affairs

By: _____
Commander, U. S. Naval Forces Marianas

FOR THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

By: _____
President of the Senate

By: _____
Governor

By: _____
Speaker of the House

FOR THE MARIANAS PUBLIC LAND CORPORATION

By: _____
Chairman, Board of Directors

FOR THE COMMONWEALTH PORTS AUTHORITY

By: _____
Chairman, Board of Directors

APPROVED AS TO FORM: _____
Legal Counsel
Commonwealth Ports Authority

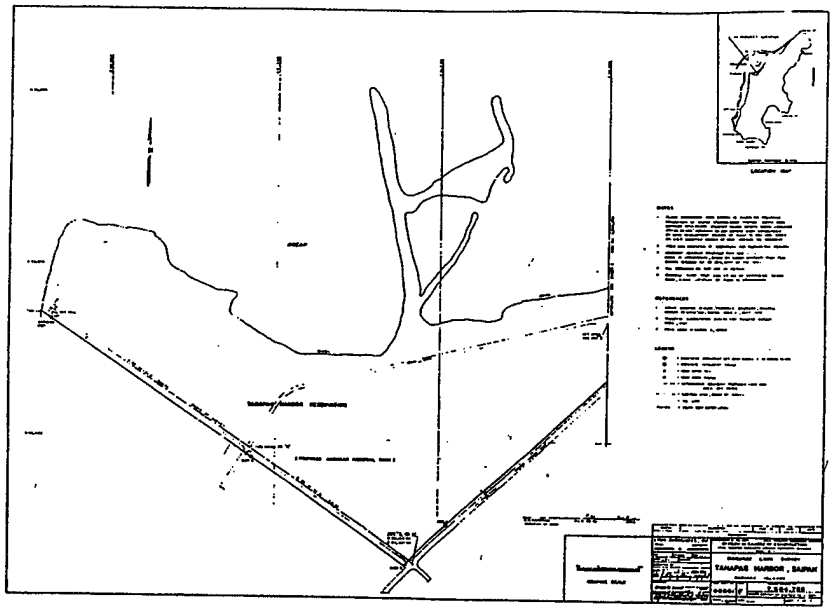


Exhibit B
(Sheet 1 of 2)

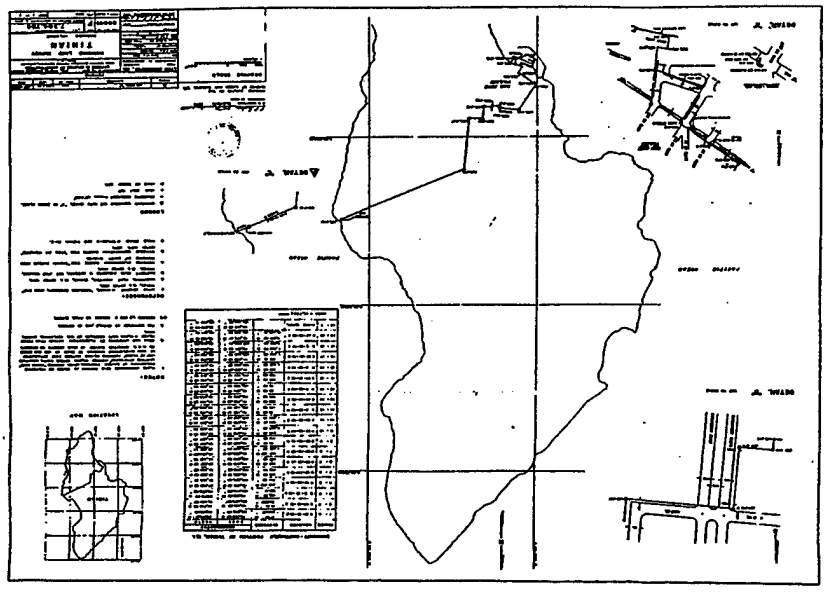


Exhibit A

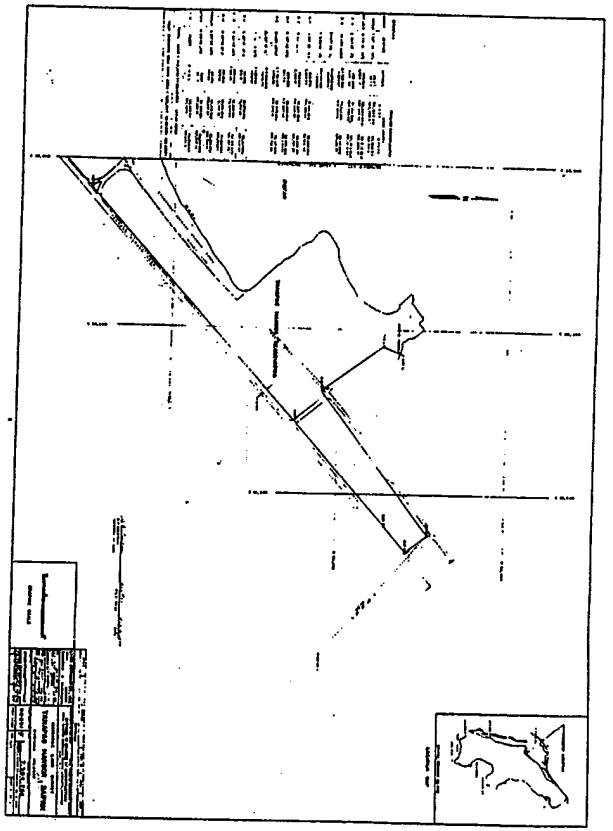


Exhibit B
(Sheet 2 of 2)

PARCELLE DE MOTUTELA

PALMYRA ISLANDS

Description as follows:

That certain land once known as Parcelle de Motutella, located in the Palmyra Islands group approximately 43 miles Northwestwest of Saipan Island, lying between latitudes 16 degrees 00 minutes 19.1 seconds and 16 degrees 01 minutes 41.6 seconds North and between longitudes 162 degrees 04 minutes 46.5 seconds and 162 degrees 05 minutes 38.7 seconds East, said land once being approximately 7,100 feet (2,600 meters) long and 1,700 feet (500 meters) wide at its widest point and containing an area of approximately 198 acres (83.4 hectares).

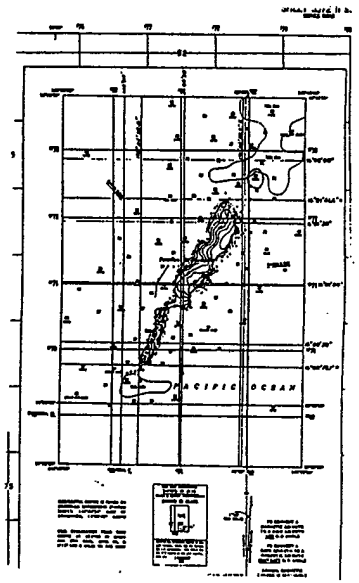


Exhibit C

EXHIBIT D

All that certain tract or parcel of real property located on the island of Tinian, Commonwealth of the Northern Mariana Islands, more particularly bounded and described as follows:

Beginning at a point, designated as Corner 1, which is North 101,101.06 meters by East 126,861.57 meters on the Mariana Islands Plane Coordinate System;

Thence S 69° 26' 06" E, a distance of 1,523.82 feet to Corner 2;

Thence S 82° 58' 41" E, a distance of 3,415.41 feet to Corner 3;

Thence N 79° 07' 03" E, a distance of 3,700.00 feet to Corner 4;

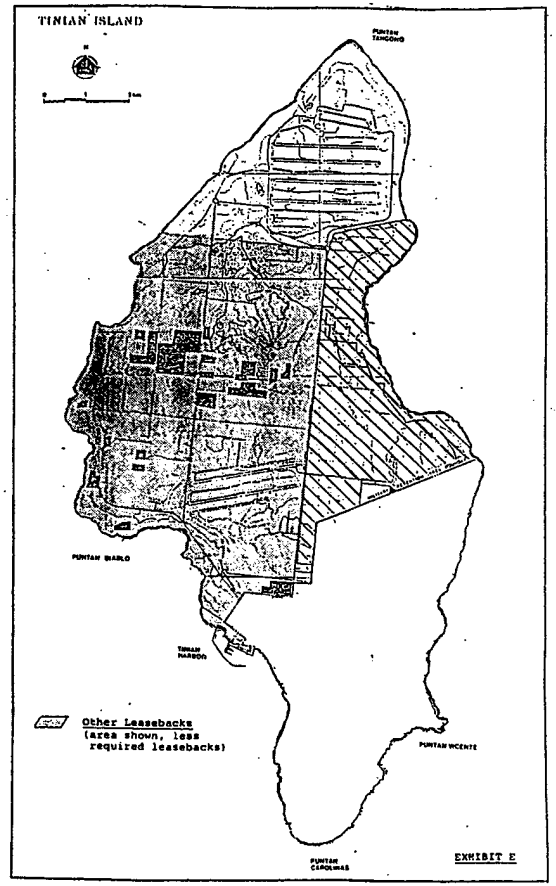
Thence S 76° 22' 57" E, a distance of 1,680.13 feet to Corner 5;

Thence N 05° 12' 00" E, a distance of 4,107.49 feet to Corner 6;

Thence S 79° 07' 03" W, a distance of 10,916.72 feet to Corner 7;

Thence S 10° 52' 57" E, a distance of 1,405.00 feet to the place of beginning;

containing an area of 30,971,295.00 square feet (2,877,327.40 square meters), more or less.



Appendix O-4

Commander-in-Chief, U.S. Pacific Command Representative Guam/Commonwealth of the Northern Mariana Islands/Federated States of Micronesia/Republic of Palau Letter 11011-MAR over Serial N4/0058 dated 25 July 1994, "Tinian Leaseback" with Tinian Leaseback and Disposal Agreement between the CNMI and the U.S. Government.

24

241

DEPARTMENT OF THE NAVY

COMMANDER IN CHIEF U.S. PACIFIC COMMAND REPRESENTATIVE
GUAM/COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS/
FEDERATED STATES OF MICRONESIA/REPUBLIC OF PALAU
PSC 489
FPO AP 96536-0051

IN REPLY REFER TO:
11011-MAR
Ser N4/0058
25 JUL 1994

From: Commander in Chief U.S. Pacific Command Representative Guam/Commonwealth of the Northern Mariana Islands/Federated States of Micronesia/Republic of Palau
To: Foreign Military Rights Affairs, Office of the Assistant Secretary of Defense, The Pentagon, Washington, D.C., 20301-2400
Via: Commander in Chief U.S. Pacific Command (J4)

Subj: TINIAN LEASEBACK

Encl: (1) Draft Leaseback and Disposal Agreement between the Commonwealth of the Northern Mariana Islands and the United States of America
(2) Refund calculation

1. Enclosure (1) is the product of many years of cooperative negotiations between this headquarters and the elected government of the Commonwealth of the Northern Mariana Islands (CNMI). The proposed agreement is enthusiastically supported by each of the parties because it successfully meets the legitimate land use needs of both.

2. The major expansion of the Exclusive Military Use Area will provide valuable ground maneuver terrain for the various training exercises which have been conducted with dramatically increased frequency in the past two years. It will also gain control of the surface danger zones urgently needed for the reauthorization of live fire weapons training on Tinian and should accommodate construction of a Voice of America transmitter station if that project is ultimately funded.

3. The deletion of 1,245 acres from the lease will allow the people of Tinian to proceed with the much needed economic development of their island, while relieving us of the burden of oversight of most of the projects envisioned. Finally, the leaseback of the remaining, central portion of the island will allow that land to be put to more productive use while adequately protecting our continued ability to maneuver in that area.

4. The terms of the buyout of our leasehold interest in the 1,245 acres are completely equitable. The CNMI shall refund to the U.S. Government exactly what we paid eleven years ago for those rights in the property, adjusted by an appropriate economic escalator to reflect the current value of that payment.

5. I am very grateful for the outstanding, on-site assistance provided by Mr. Michael Kilian of the Pacific Division, Naval

Facilities Engineering Command. He was able to take the ideas and intentions of the negotiators and craft the final version of this agreement into a clear and orderly format.

6. In the interest of the U.S. Military forces operating in the Pacific theater, and on behalf of the people of Tinian, we request your earliest possible approval of this agreement. We further request that authority to sign the agreement for the United States of America be delegated to the USCINCPAC REP Guam/CNMI/FSM/Palau. If approval is granted, we intend to arrange with the Governor of the CNMI for a signing ceremony to be held on the island of Tinian on 8 August 1994.

E. R. KRISTENSEN

Copy to:
COMPACNAVFACENGCOM

LEASEBACK AND DISPOSAL AGREEMENT

BETWEEN

THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

AND

THE UNITED STATES OF AMERICA

MADE PURSUANT TO

THE COVENANT TO ESTABLISH A COMMONWEALTH OF THE

NORTHERN MARIANA ISLANDS

IN POLITICAL UNION WITH THE UNITED STATES OF AMERICA

THIS LEASEBACK AND DISPOSAL AGREEMENT is made this 8th day of August, 1994, by and between the UNITED STATES OF AMERICA, hereinafter referred to as the "United States," and the COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS, hereinafter referred to as the "Commonwealth."

WITNESSETH: that

WHEREAS, acting in accordance with Article VIII of the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America (Public Law 94-241; 90 Stat. 263), the Commonwealth and the United States on the 6th day of January 1983 entered into a Lease Agreement whereunder the Commonwealth leased to the United States effective as of the 1st day of January 1983 certain lands located in the Commonwealth of the Northern Mariana Islands; and

WHEREAS, pursuant to said Covenant, Lease Agreement, and a separate Technical Agreement Regarding Use of Land To Be Leased by the United States in the Northern Mariana Islands executed simultaneously with said Covenant, until such time as required for military purposes the United States shall lease back to the Commonwealth the following lands located on Tinian Island; approximately 1,335 acres south of West Field including the harbor area, approximately 4,010 acres north of West Field and east of Broadway, and approximately 610 acres included in all but two of the grazing leases in effect at the time the Covenant was executed and in the proposed maneuver area north of West Field; and

WHEREAS, the Commonwealth confirms that all privately owned homestead parcels located within the leased premises have been acquired by the Commonwealth or the Marianas Public Land Corporation as required by ARTICLE 2. of that LAND ACQUISITION AND DEFERRED PAYMENT AGREEMENT, executed simultaneously with the Lease Agreement, and accordingly the Lease Agreement is hereby effective as to all lands leased to the United States under said Lease Agreement, and the United States and the Commonwealth have subsequently met and agreed to proceed with the leaseback of certain lands on Tinian; and

WHEREAS, pursuant to ARTICLE I.5.A.(5) of the Technical Agreement, after the Commonwealth acquires certain privately owned homestead parcels within the leased area by fully

compensating such owners for their property interests, the Lease Agreement becomes effective as to these parcels and the United States will, on a case-by-case basis and on request, lease such parcels back to those former owners who wish to continue to farm the land upon certain leaseback terms and conditions set forth in the Technical Agreement; and the Commonwealth has agreed to administer this leaseback program on behalf of the United States on certain agreed conditions; and

WHEREAS, certain lands leased by the United States under said Lease Agreement are subject to a pre-existing lease to Micronesian Development Corporation which expires on June 10, 1995, and the United States and the Commonwealth have agreed that thereafter approximately 2606 acres of these lands will be available for leaseback to the Commonwealth until such time as required for military purposes; and

WHEREAS, the availability for the Commonwealth to leaseback certain areas north of West Field has been affected by a requirement of the United States to expand its exclusive use area in north Tinian, and the United States and the Commonwealth have agreed to adjust the boundaries for these areas; and

WHEREAS, the Commonwealth has indicated a strong desire to acquire approximately 1245 acres of the leased premises for economic development purposes, consisting of the San Jose harbor area and all of the land between the harbor and West Field, and the United States has determined that this real property is no

longer required for defense purposes and therefore may be declared surplus to the United States except for the reservation of certain rights; and, in accordance with ARTICLE 10.f. of the Lease Agreement, the United States has given the Commonwealth an opportunity to acquire the interest of the United States in this property; and

NOW, THEREFORE, for and in consideration of the Premises, the rent hereinafter reserved, the administration of leases to former homestead parcel owners, the expansion of leasehold uses from "grazing" to "agriculture, grazing, and other uses permitted by the United States," the relinquishment of leaseback rights within the expanded exclusive military use area, the commitment to release certain surplus property within the leased premises, and of the terms and conditions contained herein on the part of the Commonwealth to be observed and performed, it is hereby agreed as follows:

ARTICLE 1. LEASEBACK OF PREMISES.

A. PREMISES. The United States does hereby grant, remise and lease back unto the Commonwealth, subject to all of the terms and conditions hereinafter set forth, and the Commonwealth does hereby accept and rent from the United States that certain real property located on the island of Tinian, Commonwealth of the Northern Mariana Islands, hereinafter referred to as the "Premises", and comprised of Area 1 (the area north of West Field

and west of Broadway minus the approximately 503 acres described in the Technical Agreement as homestead parcels and further described below) containing approximately 5306 acres (2122 hectares), more or less; the "Homestead parcels" (former homestead parcels comprising approximately 503 acres and located within the boundary of Area 1); and Area 2 (the area east of Broadway and south of the expanded "Exclusive Military Use Area," leased to Micronesia Development Corporation until June 10, 1995), containing approximately 2606 acres (1042 hectares), more or less, all as depicted on Exhibit "A", which is attached hereto and made a part hereof by reference, together with all roadways, utilities, and other improvements existing on said real property.

B. TERM AND OPTION TO EXTEND. Upon payment of rent by the Commonwealth for a particular area included in the Premises, this Leaseback shall begin as to that area and be for a term of ten years. With the prior written approval of the United States, the Commonwealth shall have the right and option to lease back the Premises for successive additional periods of ten years, each pursuant to all of the terms and conditions set forth herein.

C. RENT. The Commonwealth, in consideration of the foregoing, covenants and agrees to pay to the United States, in lawful money of the United States of America, rent calculated at the rate of one dollar for each acre comprising the Premises, less the approximately 503 acres of former homestead parcels, for each year this Leaseback remains in force and effect. Payments

shall be made annually in advance on or before the anniversary date of this agreement and shall be by check made payable to "USCINCPACREP GUAM" and be forwarded to the following address:

Commander in Chief U.S. Pacific Command Representative
Guam/Commonwealth of the Northern Mariana Islands/
Federated States of Micronesia/Republic of Palau
PSC 489 Box 7
FPO AP 96536-0051

All rent payable pursuant to the terms of this Leaseback shall be paid without prior notice or demand.

D. AUTHORIZED USES. The Premises may be used by the Commonwealth, and its leaseback sublessees, only for agriculture, grazing and other uses permitted by the United States. For purposes of this Leaseback, the term "agriculture" shall mean only the planting, cultivating, and harvesting of crops or fruit or nut bearing trees. Any use of the Premises by the Commonwealth, and its leaseback sublessees, shall be compatible with Federal Aviation Administration safety zone area requirements for the West Field airport.

E. SUBLEASES; ASSIGNMENT PROHIBITED. The Commonwealth may sublease all or any part of its interest in this Leaseback or in or to the Premises or any part thereof on terms compatible with the Leaseback, provided:

(1) each leaseback sublease shall contain the restrictive terms, covenants and conditions of the Leaseback, including the provisions concerning termination and surrender set forth in Articles 1.K, L, M, N and O hereof;

(2) such subletting shall not release the Commonwealth from any of its obligations under this Leaseback; and

(3) the Commonwealth shall promptly provide to the United States a copy of each sublease agreement.

The Commonwealth shall not assign all or any part of its interests in the Leaseback Agreement or in or to the Premises or any part thereof.

F. USE COMMITMENTS WITHIN LEASEBACK PREMISES.

(1) Within the Homestead parcels area of the Premises, the Commonwealth agrees to process requests by former homestead parcel owners, who were farming such property at the time it was acquired by the Commonwealth, to continue to use their former lands for agricultural or grazing purposes and to grant sublease agreements to them for a period of five years at one dollar per acre per year, renewable with United States approval for additional periods of up to five years. In consideration for undertaking the administration of such sublease program, the United States agrees to permit the Commonwealth to retain such rental payments which pursuant to Article 1.A.5.(5) of the Technical Agreement would otherwise be paid to the United States.

(2) Pursuant to said Technical Agreement and Lease Agreement, the Micronesian Development Company, Inc., may through June 10, 1995, continue to use Area 2 of the Premises subject to a lease dated June 11, 1965, in accordance with the terms and conditions of said lease.

G. IMPROVEMENTS. On a case-by-case basis, permanent improvements may be permitted on the Premises with the prior written consent of the United States. A permanent improvement is defined as any facility or structure which cannot be removed from the Premises without rendering it useless for its original intended purpose. The Commonwealth shall submit to the United States detailed plans and specifications of any proposed permanent improvements, including the total estimated cost of the proposed improvements, together with an explanation of how this improvement is required to further the purpose for which the land is to be used.

Temporary improvements may be installed by the Commonwealth or its leaseback sublessees upon review and approval by the United States, but they shall be removed in the event this land area is affected by early termination of all or any part of this Leaseback pursuant to Article 1.L. or Article 1.O. hereof. The United States shall not be responsible for compensating the Commonwealth or its leaseback sublessees for the value of such temporary improvements except to the extent of loss of or damage to such temporary improvements where less than ninety (90) days notice is provided by the United States for such removal.

No improvements will receive final approval until environmental documentation has been completed by the Commonwealth and approved by the United States in accordance with the National Environmental Policy Act.

H. COMPENSATION FOR TERMINATION. In the event of termination by the United States, fair compensation as specified in Article 5.A.(1).f. of the Technical Agreement for grazing and agriculture use, shall be limited to the value of any unharvested annual crop or fruit already planted at the time of notice of termination by the United States to the Commonwealth and which cannot be harvested. For perennial crops or fruit or nut bearing trees, already planted at the time of notice of termination by the United States to the Commonwealth, fair compensation shall be computed as if they were permanent improvements. No compensation shall be paid for crops or trees planted after such notice of termination.

With regard to compensation for permanent improvements in the event of termination by the United States due to a military requirement, every proposed sublease agreement by the Commonwealth shall provide for fair compensation in the event of early termination under Article 1.L.(1) or (2). The United States and the Commonwealth shall establish a compensation formula for each sublease based upon the type of improvements involved, a straight-line depreciation of the improvement's capital value at the time of notice of termination, and other equitable considerations. The obligation of the United States to pay compensation under this Agreement is subject to the availability of appropriated funds.

The United States shall not compensate the Commonwealth or its leaseback sublessees for the value of any permanent improvements upon early termination of this Leaseback under Article 1.L.(3) hereof due to a breach of leaseback provisions, or due to early termination by the Commonwealth under Article 1.M. hereof for voluntary reasons.

I. MAINTENANCE OF EXISTING ROADWAYS. While this Leaseback continues in force and effect, the Commonwealth shall have the right to maintain the roadways, utilities, and other improvements owned by the Commonwealth and comprising a part of the Premises of this Leaseback so that the same remain usable by the general public and the leaseback sublessees of the Commonwealth. The United States shall have no responsibility for ensuring that such facilities owned by the Commonwealth remain usable for the purposes of this Leaseback.

J. RIGHT TO INSTALL UTILITIES. The United States reserves the right to construct, install, reconstruct, operate, maintain, and remove: water, gas, oil, fuel and other pipelines, drainage and sewer systems, overhead and underground power, telephone and other utility transmission lines, in, on, under, and over the Premises together with all necessary rights and privileges for the full enjoyment of the foregoing, including but without limitation on the foregoing, the right to ingress and egress; provided however, the United States shall not exercise its rights under this provision until first consulting in writing with the

Commonwealth. Nothing in this provision shall be construed so as to affect any utilities located within the leased premises on the effective date of this agreement.

K. COMPLIANCE WITH EXISTING STATUTES. The United States and the Commonwealth shall comply with the requirements of all applicable laws and regulations.

L. TERMINATION BY THE UNITED STATES. The United States shall have the right to terminate this Leaseback, in whole or in part, as follows:

(1) immediately upon notice to the Commonwealth during a national emergency declared by the President or the Congress of the United States or in the event of urgent military requirement as determined by the Secretary of Defense; or

(2) upon a minimum of one (1) year's written notice to the Commonwealth from the Secretary of Defense if the purpose for termination is to carry out the defense responsibilities of the United States; or

(3) in the event that the Commonwealth or any of its sublessees shall default or fail in the performance of a material covenant or agreement to be performed in the Leaseback, including the non-payment of rent by the Commonwealth, and

(a) such default shall not have been cured for a period of thirty (30) days after receipt by the Commonwealth of written notice of said default from the United States, or

(b) if such default cannot, with due diligence, be cured within thirty (30) days, and the Commonwealth shall not have commenced the remedying thereof within such period or shall not be proceeding with due diligence to remedy it (it being intended in connection with a default not susceptible of being cured by the Commonwealth with due diligence within thirty (30) days that the time within which to remedy same shall by mutual agreement be extended for such period as may be necessary to complete same with due diligence).

If after delivery of notice of termination under Article 1.L.(b) above, the use plans of the United States are delayed or abandoned, the United States will continue to make the affected property available to the Commonwealth on a license basis or under a new leaseback until such time as the property is required by the United States.

M. TERMINATION BY THE UNITED STATES DUE TO MILITARY REQUIREMENT; CONSEQUENCES. In the event of termination under Article 1.L.(1) or (2) hereof, the United States shall:

(1) make an equitable adjustment of any advance rent paid by the Commonwealth; and

(2) compensate the Commonwealth in accordance with Article 1.H. hereof for any United States approved permanent improvements.

N. TERMINATION BY UNITED STATES DUE TO BREACH BY COMMONWEALTH, CONSEQUENCES. In the event of termination under Article 1.L.(3) hereof;

(1) there shall be no adjustment in advance rentals paid by the Commonwealth;

(2) the United States shall be entitled to recover and the Commonwealth shall pay to the United States;

(a) costs incurred in resuming possession of the Premises; and

(b) costs incurred in performing any obligation on the part of the Commonwealth to be performed hereunder; and

(3) the United States shall not be responsible for compensating the Commonwealth or its leaseback sublessees for any resulting losses or damages of any nature whatsoever.

O. TERMINATION BY COMMONWEALTH. The Commonwealth shall have the right to terminate this Leaseback in whole or in part at each annual anniversary of the effective date hereof by providing at least ninety (90) days advance written notice to the United States.

P. SURRENDER. Upon the expiration of this Leaseback Agreement or its earlier termination in whole or in part, the Commonwealth and its sublessees shall quietly and peacefully remove themselves and their property from the affected portion of the Premises. Upon failure or neglect or the leaseback sublessees to so remove, the Commonwealth shall diligently pursue

the removal of its sublessees. The Commonwealth hereby expressly waives any provision of law requiring notice to quit possessions of the Premises.

Q. UNITED STATES NON-LIABILITY; INDEMNIFICATION BY COMMONWEALTH. The United States will not be responsible for any claim for damage, property loss, personal injury or death resulting from any act or omission of the Commonwealth in connection with the Commonwealth's leaseback of the premises. The Commonwealth agrees that it will indemnify and hold harmless the United States (and its officers, agents, and employees) for any and all liability arising from any such claim or claims.

R. ACCESS. The United States shall have access to the Premises at all reasonable times and for all reasonable purposes not inconsistent with the quiet use and enjoyment thereof by the Commonwealth, including, but not limited to, the purpose of inspection.

ARTICLE 2. RELEASE OF LEASEBACK RIGHT.

A. ADDITIONAL EXCLUSIVE MILITARY USE AREA. At the time the Lease Agreement was executed, the United States only required exclusive control over the area shown as "U.S. Exclusive Military Use Area" on Exhibit "A" to enable it to carry out its defense responsibilities. Since that time, additional land requirements for military training and other national defense purposes have developed and it is now necessary to decrease the size of the

Lease Agreement's required leaseback area north of West Field by approximately 3312 acres (1325 hectares), more or less, in order to increase the size of the area under exclusive United States' control.

B. RELEASE OF LEASEBACK RIGHTS.

(1) The Commonwealth does hereby release its rights under Part I.5.A.(5) of the Technical Agreement and ARTICLE 10.a of the Lease Agreement to enter into a leaseback agreement for grazing purposes to that area containing approximately 3312 acres (1325 hectares) and shown as "Expanded U.S. Exclusive Military Use Area" on Exhibit "A." The United States agrees that if in the future requirements should change and exclusive use is no longer required, for all or parts of this area, the United States will make the affected property available to the Commonwealth on a license basis or under a new leaseback agreement until such time as the property is again required by the United States.

(2) Pursuant to the Technical Agreement, the Micronesian Development Corporation, Inc., may until June 10, 1995 continue to use that portion of the expanded "Exclusive Military Use Area" which is east of Broadway and subject to a lease dated June 11, 1965, in accordance with the terms and conditions of that lease.

ARTICLE 3. DISPOSAL OF LEASEHOLD INTEREST.

A. COMMONWEALTH USE REQUIREMENTS. Leaseback of the area south of West Field, including the harbor area, for economic development purposes has become very important to the Commonwealth and the people of Tinian; however, such development would not be compatible with the military purpose of the Lease Agreement. Accordingly, the Commonwealth has requested that it be permitted to purchase from the United States the United States' remaining period of use under the Lease Agreement for this area and that this area, containing approximately 1245 acres (498 hectares), more or less, and shown as "Surplus Area" on Exhibit "A," then be withdrawn from the Lease Agreement.

B. UNITED STATES' DETERMINATION OF SURPLUS. The United States has reviewed its requirements for future use of this area and has determined that it no longer needs to be retained in the Lease Agreement in order for the United States to discharge its defense responsibilities, and therefore may be declared surplus to the United States; provided that the United States retains the following rights in support for its use of the remaining leased premises:

(1) The right, in common with others, to moor vessels, handle cargo, stage equipment and materiel, and conduct other port-related activities at San Jose Harbor;

(2) The right to temporarily secure and use portions of the surplus area, on a not-to-interfere basis as approved by

the Commonwealth or its designee, to conduct, or perform activities in support of, military training exercises; and

(3) The right to install, operate, and maintain fuel and utility lines from San Jose Harbor over lands owned by the Commonwealth to serve the remaining areas included in the leased premises.

C. PAYMENT FORMULA. The Commonwealth and United States agree that the purchase price for this interest shall be based on the concept of the Commonwealth returning lease payments previously received pursuant to the Lease Agreement based on current conditions and calculated in accordance with a formula which takes into account: (1) the number of years of use remaining to the United States in the 100-year lease term; (2) the proportionate amount paid by the United States for the surplus area in relation to the total lease payment amount; and (3) an annual adjustment using the Gross National Product Implicit Price Deflator from the time of lease payment to the time payment is made for this acquisition.

D. EXECUTION. An initial payment of one hundred thousand dollars ($100,000.00) shall be paid at the signing of this document, with the balance of two million, five hundred and fifteen thousand dollars ($2,515,000.00) to be paid no later than one year from this date, together with interest on any unpaid balance which shall accrue monthly at the established Treasury Bill rate. Upon receipt of full payment, the United States shall

execute and record a "Release of Leasehold Interest", attached hereto as Exhibit "B".

ARTICLE 4. COVENANT AGAINST CONTINGENT FEES.

The Commonwealth warrants that no person or agency has been employed or retained to solicit or secure this Leaseback and Disposal Agreement upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, except bona fide employees or bona fide established agencies maintained by the Commonwealth for the purpose of securing business. For breach or violation of this warranty, the United States shall have the right to annul this Leaseback and Disposal Agreement without liability or in its discretion to require the Commonwealth to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage or contingent fee.

ARTICLE 5. OFFICIALS NOT TO BENEFIT.

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this Leaseback and Disposal Agreement, or to any benefit to arise therefrom, but this provision shall not be construed to extend to this Leaseback and Disposal Agreement if made with a corporation for its general benefit.

ARTICLE 6. NOTICES.

No notice, order, direction, determination, requirement, consent, or approval under this Leaseback and Disposal Agreement shall be of any effect unless in writing. All notices required under this Leaseback and Disposal Agreement shall be addressed to the Commonwealth, or to the United States, as may be appropriate, at the following addresses or at such other address as may from time to time be agreed upon by the parties hereto in writing:

FOR THE COMMONWEALTH:

Governor
Commonwealth of the Northern
Mariana Islands
Saipan, MP 96950
and duplicate copies to:
Chairman, Board of Directors
Marianas Public Land Corporation
P.O. Box 380
Saipan, MP 96950

and
Chairman of the Board
Commonwealth Ports Authority
P.O. Box 1055
Saipan, MP 96950

FOR THE UNITED STATES:

Commander in Chief, U.S. Pacific
Command Representative Guam/
Commonwealth of the Northern.
Mariana Islands/Federated States of
Micronesia/Republic of Palau
PSC 489 Box 34
FPO AP 96536-0051

ARTICLE 7. ADMINISTRATION.

(a). The United States representative specified in Article 6. of this Leaseback and Disposal Agreement shall, under the direction of the Commander, Naval Facilities Engineering Command, have complete charge of the administration of this

Leaseback and Disposal Agreement, and shall exercise full supervision and general direction thereof insofar as the interests of the United States are affected.

(b). The Governor of the Commonwealth, or an appropriate Commonwealth Government Agency designated by the Governor, shall have complete charge of the administration of this Leaseback and Disposal Agreement, and shall exercise full supervision and general direction thereof insofar as the interests of the Commonwealth are affected.

IN WITNESS WHEREOF, the parties hereto have caused this Leaseback and Disposal Agreement to be executed as of the date first written above.

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

By: _____

JESUS C. BORJA
ACTING GOVERNOR OF THE
COMMONWEALTH OF THE
NORTHERN MARIANA ISLANDS

UNITED STATES OF AMERICA

By: _____

CHAS. W. FREEMAN, JR.
ASSISTANT SECRETARY OF DEFENSE
(INTERNATIONAL SECURITY AFFAIRS)

APPROVED AS TO FORM:

By: _____

LOREN A. SUTTON
ASSISTANT ATTORNEY GENERAL
COMMONWEALTH OF THE
NORTHERN MARIANA ISLANDS

By: _____

E. K. KRISTENSEN
REAR ADMIRAL, U.S. NAVY
COMMANDER IN CHIEF
UNITED STATES PACIFIC
COMMAND REPRESENTATIVE
GUAM/CNMI/FSM/PALAU

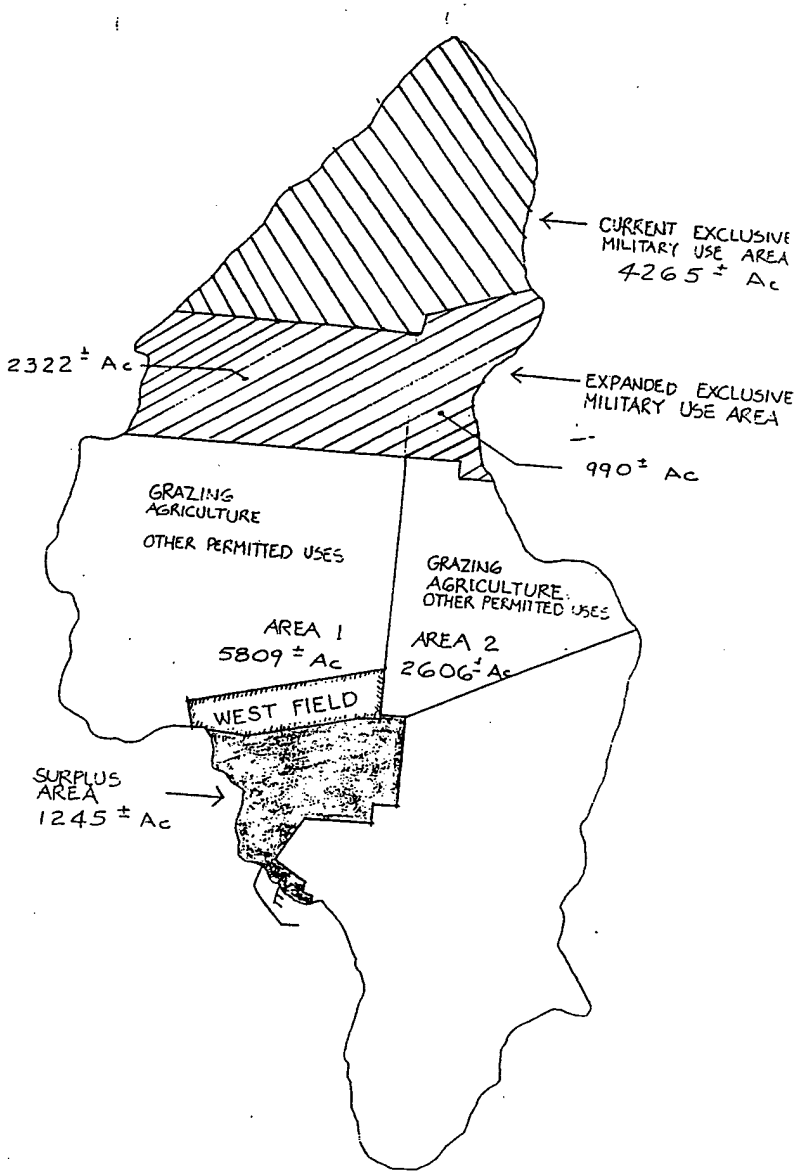


EXHIBIT 'A'

RELEASE OF LEASEHOLD INTEREST

THIS RELEASE OF LEASEHOLD INTEREST is made this ____ day of _____, 199__, by the **UNITED STATES OF AMERICA** referred to as the "United States.

WITNESSETH: that

WHEREAS, on the 8h day of August, 1994, the Commonwealth of the Northern Mariana Islands, hereinafter referred to as the "Commonwealth", and the United States entered into that **LEASEBACK AND DISPOSAL AGREEMENT** involving certain lands on Tinian Island which are leased to the United States by the Commonwealth under a Lease Agreement dated January 6, 1983; said lease Agreement having been entered into pursuant to Article VIII of the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America (Public Law 94-241; 90 Stat. 263) and a separate Technical Agreement Regarding Use of Land To Be Leased by the United States in the northern Mariana Islands executed simultaneously with said Covenant; and

WHEREAS, in **ARTICLE** of said **LEASEBACK AND DISPOSAL AGREEMENT** the United States agreed to release to the Commonwealth its leasehold interest in approximately 1,245 acres of the leased premises upon condition that the Commonwealth purchase this interest from the United States in accordance with an agreed payment formula; and

EXHIBIT "B"

WHEREAS, pursuant to ARTICLE 3.D. of this **LEASEBACK AND DISPOSAL AGREEMENT**, the United States is obliged to execute this Release of Leasehold Interest upon receiving full payment of the agreed purchase price from the Commonwealth.

NOW, THEREFORE, for and in consideration of the payment of _____ million _____ thousand dollars and _____ cents ($_,___,___) to the United States, the receipt of which is hereby acknowledged, the United States does remise, quitclaim, convey and release unto the Commonwealth, all of its leasehold interest to that certain real property described as follows:

> **The area south of West Field, including the harbor area, containing approximately 1245 acres (498 hectares), more or less, and shown as "Surplus Area" on Exhibit "A".**

RESERVING, HOWEVER, to the United States:

1. The right, in common with others, to moor vessels, handle cargo, stage equipment and materiel, and conduct other port-related activities at San Jose Harbor.

2. The right to temporarily secure and use portions of the described area, on a not-to-interfere basis as approved by the Commonwealth or its designee, to conduct, or perform activities in support of, military training exercises..

3. The right to install, operate, and maintain fuel and utility lines from San Jose Harbor over lands owned by the Commonwealth to serve remaining areas included in the leased premises.

TO HAVE AND TO HOLD unto the aforesaid Commonwealth, its successors and assigns forever.

IN WITNESS WHEREOF, the United States has caused these presents to be executed as of the day and year first above written.

UNITED STATES OF AMERICA

By: _____