DOCUMENT OF ENVIRONMENTAL PROTECTION

ACTIVITY: DREDGING AND FILLING

CONTROL NUMBER DEP-16-001.0

May 2017

EFFECTIVE DATE: 22 December 2017

UNITED STATES ARMY GARRISON - KWAJALEIN ATOLL/
RONALD REAGAN BALLISTIC MISSILE DEFENSE TEST SITE
IN THE
REPUBLIC OF THE MARSHALL ISLANDS

PREPARED BY KWAJALEIN RANGE SERVICES, LLC.

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FINAL DOCUMENT OF ENVIRONMENTAL PROTECTION
FOR
DREDGING AND FILLING
DEP-16-001.0
May 2017

SHALL TAKE EFFECT UPON SIGNATURE

FOR THE U.S. ARMY KWAJALEIN ATOLL

JAMES A. DEORE
COL, IN
Commanding

22 Dec 2017
DATE

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REPUBLIC OF THE MARSHALL ISLANDS
ENVIRONMENTAL PROTECTION AUTHORITY
P.O. Box 1322
Majuro, Marshall Islands 96960
Phone: (692) 625-3035/5203 * Fax: (692) 625-5202 * Email: rmiepa@ntamar.net

September 4, 2017

Mr. Derek Miller
US Army Garrison
Kwajlein Atoll Environmental Engineer, Energy Manager, Utilities Lead Directorate of Public Works

Mr. Miller,

RMIEPA has no comment or objection to proceeding with the dredging and filling final DEP.

Thank you for the opportunity to provide comments.

Sincerely,

Ms. Moriana Phillip
General Manager
Marshall Islands Environmental Protection Authority
Majuro, Republic of the Marshall Islands

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2017-CPA-0058

JUN 13 2017

Mr. Derek Miller
U.S. Army Garrison – Kwajalein Atoll
PSC 701, Building 730
APO AP 96555-9998

Dear Mr. Miller:

The U.S. Fish and Wildlife Service (Service) has received your letters dated May 11, 2017 for the Final Document of Environmental Protection (DEP) concerning the Dredging and Filling Operations at U.S. Garrison - Kwajalein Atoll (USAG-KA). This DEP covers processes, requirements, and limitations for dredging and filling operations around U.S. Army Kwajalein Atoll (USAKA). Our response is pursuant to the U.S. Army Kwajalein Atoll (USAKA) Environmental Standards (UES), the Fish and Wildlife Coordination Act (FWCA) of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401] as amended (FWCA), Clean Water Act of 1977 [33 U.S.C. 1251 et seq.; 62 stat. 1155], as amended (CWA), the Endangered Species Act (ESA) of 1973 [16 USC 1531 *et seq.*; 87 Stat. 884], as amended, the Migratory Bird Treaty Act of 1918 (MBTA) [16 USC 703-712 *et seq.*; 40 Stat. 755], as amended, and other authorities mandating Service review for impacts on trust resources.

We acknowledge that most of our comments were addressed for the Draft DEP. However, we note there is one outstanding issue regarding the turbidity threshold stated in section 7.1(c). The Final DEP maintains that a 10 NTU limit (above background) at 50 meters (150 feet) from the construction site is a suitable threshold for monitoring. We had previously recommended using a lower threshold based on concerns of sediment impacts to nearby marine resources. We acknowledge that the Final DEP also allows for more consideration of special conditions under specific proposals that are known to be in proximity to sensitive marine resources, and hence this limit may be more restrictive in some situations. We further recognize that one simple threshold number may not be applicable to all situations, and the concept of measuring turbidity with the NTU metric does not fully account for all the potential secondary impacts with the movement of sediment on coral reefs. Many other variables play into the realized effects of sedimentation, but simple turbidity measurements are an easy metric to use to monitor potential impacts. Overall, this is a complex issue that is not easy to resolve with only a few best management practices. However, we still maintain that a 10 NTU limit (above baseline) at 50 meters (150 feet) from the construction site is in our estimation unduly high.

Your response stated that the U.S. EPA's Water Quality Standards range from 3% above baseline to 50 NTUs. More specific turbidity criteria are available, however, from other U. S.

Pacific jurisdictions. For instance, the State of Hawaii has detailed turbidity thresholds for various types of marine waters. The two that are the most pertinent to USAG-KA are for embayments and open coastal waters. Turbidity criteria for embayments are 0.4-1.5 NTU (mean), 1-3 NTU (not to exceed 10% of the time), and 1.5-5 NTU (not to exceed 2% of the time). The range is contingent upon the amount of freshwater discharged to the embayment. Turbidity criteria for open coastal waters are 0.2-0.5 NTU (mean), 0.5-1.25 NTU (not to exceed 10% of the time), and 1-2 NTU (not to exceed 2% of the time). The range is again subject to the amount of freshwater discharge. The Territory of American Samoa also has detailed turbidity thresholds for various types of marine waters and locations. The two that are the most pertinent to USAG-KA are for embayments and open coastal waters. Turbidity criteria for embayments are 0.35 NTU (mean), 0.45 NTU (not to exceed 10% of the time), and 0.60 NTU (not to exceed 2% of the time). Turbidity criteria for open coastal waters are 0.25 NTU (mean), 0.35 NTU (not to exceed 10% of the time), and 0.45 NTU (not to exceed 2% of the time). The Commonwealth of the Marianas Islands and the Territory of Guam both use a 0.5 NTU for higher-rated water classes and a 1.0 NTU for lower-rated water classes. These numbers represent chronic water quality standards and may not be directly applicable to acute impacts from dredge and fill projects. However, they do provide some basis on which to base a turbidity threshold. A more appropriate source of regulatory guidance may be obtained from specific CWA 401 water quality certifications for the various jurisdictions in which specific turbidity thresholds are used for specific dredge and fill projects. Unfortunately, this information is not readily available, but we note that CNMI's Bureau of Environmental and Coastal Quality does not provide any special allowance for dredge and fill projects that rely on their water quality standards.

When one considers a 10 NTU threshold at 50 meters for a project with sediment containment measures, then the turbidity is likely substantially higher between the action area and the 50 meter monitoring point. The actual zone of mixing that may impact sensitive marine resources will increase based on the turbidity intensity and particle size of the sediment among others, and likely extend beyond 50 meters at a 10 NTU threshold. Since particle size is not measured, we can only make decisions on the intensity of the turbidity. Particle size is an important issue, but also complex and associated with other variables such as the specifics of the dredge action and the composition of the sediment/ substratum being dredged.

Although we retain concern about the 10 NTU threshold, we are currently unable to provide an alternate value that is substantiated in current regulatory frameworks or peer-reviewed literature. We previously recommended a 1-5 NTU threshold, and while we still believe this to be more suitable, we also acknowledge this cannot be resolved in the timeframe of this DEP approval. We are therefore concurring with the 10 NTU threshold for the current DEP, albeit with reservations, and also provide two additional recommendations: 1) that this issue continue to be discussed among the appropriate agencies with the goal of determining appropriate thresholds for small dredge and fill actions. Similar dialogues are currently ongoing in the context of several large-scale projects elsewhere in the country, the outcomes of which may provide insights to USAG-KA. 2) turbidity monitoring plans should include intensive, quantitative turbidity monitoring efforts that can provide appropriate data for future consideration of this issue.

We appreciate the opportunity to provide input on the proposed projects. If you have questions regarding our comments, please contact Marine Biologist Tony Montgomery (Tony_Montgomery@fws.gov or 808-792-9456). In future communications regarding this project, please refer to reference #2017-CPA-0058.

Sincerely,

for Mary M. Abrams, Ph.D.
Field Supervisor

Enclosure: Agency Approval Form

AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION
FOR
DREDGING AND FILLING

DOCUMENT NUMBER DEP-16-001.0

May 2017

U.S. Fish and Wildlife Service
Agency

[signature] Y/C
Name

6/13/17
Date

AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION
FOR
DREDGING AND FILLING

DOCUMENT NUMBER DEP-16-001.0

May 2017

U.S. Army Corps of Engineers, Honolulu District

Agency

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AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION
FOR
DREDGING AND FILLING

DOCUMENT NUMBER DEP-16-001.0

May 2017

USEPA
Agency

Norwood Scott
Name

5/16/2017
Date

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AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION FOR DREDGING AND FILLING

DOCUMENT NUMBER DEP-16-001.0

May 2017

National Marine Fisheries Service

Agency

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DOCUMENT OF ENVIRONMENTAL PROTECTION

ACTIVITY: DREDGING AND FILLING
CONTROL NUMBER DRAFT DEP-16-001.0

DATE SUBMITTED: May 2017
DATE EFFECTIVE: 22 December 2017
DEP EXPIRES: Five years after final signature

SUMMARY

The activities described in this Document of Environmental Protection (DEP) and the companion Notice of Continuing Activity (NCA) are for dredging and filling projects. NCA-10-002.0 was revised and re-numbered as NCA-16-001.0 (DEP Appendix B). This DEP references various documents and reports; it is expected that the most current version of any of the reports available will be used for project planning.

The purpose of this DEP and associated NCA are to establish requirements and limitations for dredging and/or filling projects at the U.S. Army Kwajalein Atoll (USAKA) located in the waters of the Republic of the Marshall Islands (RMI) as well as any dredging and/or filling activities conducted by the U.S. Army Garrison – Kwajalein Atoll (USAG-KA) in the RMI or RMI waters. Routine maintenance dredging and/or filling is required to restore, repair, and maintain existing harbor and channel depths, shorelines, and in-water or near shore structures. Dredging and/or filling work may also be required for new marine construction and restoration projects and protection of eroding shorelines.

REFERENCES:

- Kwajalein Range Services. *Critical Erosion Areas on Roi-Namur.* July 2016.
- Teledyne Solutions, Inc. *United States Army Kwajalein Atoll (USAKA) Shoreline Protection Survey*. February 2007.
- U.S. Army Corps of Engineers. *Shoreline Inventory for the Islands of Roi-Namur, Kwajalein and Meck.* February 2009.
- U.S. Army Kwajalein Atoll. *Document of Environmental Protection: Point-Source Discharges at USAKA*; DEP-12-002.0, July 2014.
- United States Army Kwajalein Atoll. *Document of Environmental Protection: Protection of Cultural Resources*; DEP-10-001. November 2015.
- U.S. Army Kwajalein Atoll. *Historic Preservation Plan for United States Army Kwajalein Atoll*. August 2006.
- U.S. Army Kwajalein Atoll. *Notice of Continuing Activity: Dredging and Filling - USAKA*; NCA-16-001.0, July 2016.
- U.S. Army Kwajalein Atoll. *Water Quality Management Plan (WQMP).* September 2015.
- U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command. *Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands*, 14th Edition. September 2014.
- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). *2010 Inventory of Endangered Species and Other Wildlife Resources, Ronald Reagan Ballistic Missile Defense Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands*. December 2012.
- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). *2012 Marine Biological Inventory, the Mid-Atoll Corridor at Ronald Reagan Ballistic Missile Defense Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands*. December 2013.

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FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

CY	Cubic yard
DEP	Document of Environmental Protection
ECR	Environmental Comments and Recommendations
EOD	Explosive Ordnance Disposal
HPP	Historic Preservation Plan
KEEP	Kwajalein Environmental Emergency Plan
NCA	Notice of Continuing Activity
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPA	Notice of Proposed Activity
NTU	Nephelometric Turbidity Unit
PCB	Polychlorinated Biphenyl
PDS	Project Description Sheet
PDS1	Dredging and/or Filling Project Description Sheet 1
PDS2	Dredging and/or Filling Project Description Sheet 2
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RMIHPO	Republic of the Marshall Islands Historic Preservation Officer
TCLP	Toxicity Characteristic Leaching Procedure
UES	USAKA Environmental Standards
USACE	United States Army Corps of Engineers, Honolulu District
USAKA	United States Army Kwajalein Atoll
USAG-KA	United States Army Garrison – Kwajalein Atoll
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WQMP	Water Quality Management Plan

1.0 TYPE OF ACTIVITY

Section 2-17.3.1(f) of the *Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands*, 14th Edition, herein referred to as the USAKA Environmental Standards (UES), requires a DEP for "Dredging in, quarrying in or from, or discharge of fill or dredged materials to waters of the RMI." The UES lists requirements for a dredging and/or filling DEP in §3-2.7.2(b). This DEP will serve to permit both routine and non-routine dredging and/or filling activities at USAKA, as well as any dredging and/or filling activities conducted by USAG-KA in the RMI or RMI waters, subject to the requirements and procedures documented herein and will obviate the need for a separate DEP for each proposed dredging and/or filling activity. In accordance with UES §3-2.7.2(a), separate *National Environmental Policy Act* (NEPA) documentation is required for both new and maintenance dredging and or filling activities. Quarrying activities are not authorized by this document and will require a separate DEP.

2.0 LOCATION OF ACTIVITY

The harbors, channels, shorelines, marine ramps, piers, and outfall and intake structures at Kwajalein, Roi-Namur, Meck, Illeginni, Ennylabegan, Legan, Gagan, Gellinam, Omelek, Eniwetak, and Ennugarret, as well as any dredging and/or fill activities conducted by USAG-KA in the RMI or RMI waters. NCA Appendix C describes these areas and discusses potential dredge, fill, and shoreline protection projects and known environmental conditions. Locations where dredging and filling are protected are identified in the USAG-KA *Water Quality Management Plan.*

3.0 TECHNICAL DESCRIPTION OF ACTIVITY

As covered by this DEP, dredging includes the deepening of harbors and channels and the clean-out or removal of silts and other natural materials from marine ramps, water intakes and storm water outfalls. Dredging also includes the disturbance of materials associated with the construction of new in-water or shoreline structures (i.e. jetties, piers, outfalls, etc.), shoreline protection projects, or the renovation of existing facilities. The removal of manmade objects or obstructions that have fallen or fall into the water is not considered dredging and, therefore, is not addressed in this DEP.

Dredging may be accomplished using hydraulic dredges and pipelines, or by using cranes with buckets or draglines, from shore or from barges. Clean-out around marine ramps and intake or outfall pipes is a continual requirement and should be done with a frequency that ensures good operation and maintenance practices. Such maintenance dredging activities may be accomplished by the use of heavy equipment (including backhoes and bucket loaders) or hydraulic pumping trucks on the shoreline.

Dredging may involve disposition of dredged material (i.e. spoils) either on land or in the waters adjacent to the dredging site. Proposals to place of dredge spoils in the marine environment will

Be evaluated by the USAG-KA Environmental Engineer and the Appropriate Agencies, as applicable. Any dredged material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts associated with siltation, spillage, and turbidity to marine flora and fauna.

This DEP covers the placement of fill for new and recurring operations, maintenance, repair, and construction activities. Filling involves the placement of earthen materials (rock, sand, or soil), and sometimes concrete or rubble, either on the shoreline or off-shore for construction of new shoreline or in-water structures (i.e. jetty, pier, outfall, etc.), for the protection and maintenance of existing shorelines or facilities to replace material lost to erosion, damage, or accidents, or to reinforce existing foundations and supports. Any fill material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts associated with siltation, spillage, and turbidity to marine flora and fauna. Furthermore, any fill material placed into the marine environment will be oriented in a manner that does not alter coastal hydrology to the extent that deposition may accumulate and degrade marine habitat. Proposals, including construction of new shoreline or in-water structures, may require hydrology studies to assess potential impacts to the marine environment.

Critical erosion, as described in this DEP, is defined as erosion that threatens public safety, infrastructure, or cultural, historical, or natural resources. Critical erosion areas, along with non-critical erosion areas identified in the 2007 Teledyne shoreline survey, the 2009 USACE shoreline inventory and the 2016 Kwajalein Range Services supplemental survey are documented to establish a baseline of the existing conditions for nine of the eleven islets. USAG-KA may choose to periodically inspect these areas to document changing conditions and determine if additional protective actions are necessary.

Pile driving is authorized in this DEP for repair/replacement of existing pilings. The guidelines for such an activity must follow procedures outlined in this DEP as well as UES §3-2.7.2(b) (1) – (6).

Quarrying operations are not authorized by this document.

4.0 ENVIRONMENTAL AREAS POTENTIALLY AFFECTED

Dredging and/or filling activities incidental to construction for the placement of a new structure in the lagoon or ocean (e.g., communication lines, pipelines, power lines, range instrumentation, shore protection devices, etc.), are subject to requirements of this DEP.

Potential effects on dredging, filling, and/or shoreline protection projects from changing climate conditions will be caused by changing weather and ocean current patterns, increasing water temperatures, or rising seas. Direct effects of these changing conditions may include increased shoreline erosion and damage to seawalls as well as changes to siltation in harbors and shipping channels. Indirect effects may include location shifts of vegetation and wildlife habitats, and the concomitant presence of protected species.

Although localized changes may occur to shoreline and near shore hydrology as a result of dredging, filling, and/or shoreline protection projects at USAKA, it is not expected that these activities will have any effect on the global climate.

5.0 TECHNICAL DESCRIPTION AND ANALYSIS OF ENVIRONMENTAL CONTROLS

Project areas for all proposed dredging and/or filling activities (including the small quantity exception) will be visually examined and/or surveyed for potential impacts to marine resources and habitats. Any project including potential impacts to USAKA species and habitats in UES Appendices 3-4A through 3-4D will require coordination with NMFS and USFWS to determine if a Special Condition applies due to presence of listed species. Projects determined to include a Special Condition will require Appropriate Agency notification and approval prior to implementation.

Various biological surveys conducted at and around USAKA, including of the 2014 biological surveys of the United States Coast Guard (USCG) Aids to Navigation (ATON) and their surrounding substrates at USAKA, have confirmed that UES consultation species exist throughout USAKA and within most of the areas of the ATON.

6.0 REQUIREMENTS AND LIMITATIONS

6.1 Project Planning Phase Requirements

(a) The following requirements, 1-19, apply to all dredging and/or filling activities unless otherwise noted.

(1) For each dredging and/or filling project in areas authorized by this DEP involving 25 cubic yards (CY) or less of dredge or fill material and without Special Conditions as described below, a "Dredging and/or Filling Project Description Sheet 1" (PDS1; Figure 1) will be completed and submitted to the USAG-KA Environmental Engineer no later than 14 days prior to beginning work.

(2) Special Conditions qualify as follows:

(i) Creates cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area

(ii) Impacts USAKA species and habitats in the most recent updates to UES Appendices 3-4A through 3-4D; coordination with NMFS and USFWS is required to determine if a Special Condition applies due to presence of listed species.

(iii) Determined to be an "undertaking," in accordance with the current DEP for the *Protection of Cultural Resources,* and the Historic Preservation Plan (HPP).

(iv) Involves the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects

(v) Involves projects of any size on Eniwetak

(vi) Involves a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand)

(vii) Involves use of explosives

(viii) Involves quarrying, which is not authorized by this DEP

(3) The following activities will be completed for each dredging and/or filling event during the project planning phase and submitted for review via the appropriate PDS:

(i) Designation of dredging method and/or explanation of shoreline protection design and materials.

(ii) Schedule. All reasonable efforts will be made to limit dredging and filling activities during the period 15 June through 15 August, except for emergency repairs, in an effort to avoid impacting coral spawning season and turtle nesting season.

(iii) Develop a silt and turbidity strategy which will include

1. Selection of the appropriate type of silt containment devices/equipment. In cases, such as shoreline protection or activities in the reef flat, silt containment devices may not be effective and can possibly result in damage to coral species from the deployment of anchors.

2. Selection of appropriate type of turbidity monitoring device and development of a turbidity monitoring plan in accordance with monitoring requirements described in section 7.1(c) below. In cases where minimal silt condition may occur such as reef flats or where it is unsafe to conduct monitoring, turbidity monitoring may not be required.

3. Corrective Action Plan if the identified turbidity thresholds are exceeded.

(iv) Plan for identifying and/or relocating marine species listed in UES Appendices 3-4A and 3-4C in the area of the activity.

(4) For each dredging and/or filling project in areas authorized by this DEP, involving 25 CY or less of dredge or fill material, and without Special Conditions, USAG-KA may proceed with the action, provided the USAG-KA Environmental Engineer has reviewed and concurred with the PDS1 (Figure 1), NEPA analysis and the required environmental controls are employed.

(5) If NMFS and USFWS consultation indicates a Special Condition, USAG-KA will consult with the Appropriate Agencies regarding mitigation where loss or impact to coral(s) or species or habitats listed in UES Appendices 3-4A through 3-4D by dredging and/or filling operations would occur. USAG-KA may consider mitigation on a regional ecosystem basis within Kwajalein Atoll, and may implement mitigation projects on land or submerged lands that are outside of USAG-KA control in accordance with this DEP (however this does not obviate the need for other agreements or approvals).

(6) For each dredging and/or filling project in areas authorized by this DEP requiring greater than 25 CY of dredge or fill material and/or with Special Conditions, a "Dredging and/or Filling Project Description Sheet 2" (PDS2; Figure 2) will be submitted for a 30-day review, comment, and signature by the Appropriate Agencies. All agency comments will be addressed before final project approval is granted.

(7) Consolidated materials such as formed concrete or wood pilings, metal sheet pile, outfall pipes, or other structures to be placed in the marine environment or on the shoreline do not constitute fill material for the purpose of "small quantity exception" determination. A Project Description Sheet (PDS) for proposals involving the placement of such materials will be submitted to the USAG-KA Environmental Engineer and the Appropriate Agencies, as applicable. To support the assessment process, an in-water visual inspection will be performed, to include digital photo-documentation of habitats and resources, where consolidated materials are to be installed.

(8) During the project planning phase, available NEPA documentation will be reviewed for adequacy and updated, if necessary, to address the proposed project. If available NEPA documentation is determined to be insufficient for the proposed action, new environmental analysis and documentation will be prepared and approved by the USAG-KA Environmental Engineer

prior to initiation of the project. USAG-KA will ensure NEPA analysis addresses any and all effects by the project on coral reefs (UES § 3-2.7.2).

(9) Selection of dredging and/or filling sites will be consistent with protected areas delineated in the WQMP.

(10) The results of the most recently spatially relevant completed biennial USFWS and/or NMFS *Inventory of Endangered Species and Other Wildlife Resources,* and species and habitat listings in UES Appendices 3-4A through 3-4D will be consulted during the planning and implementation of all dredging and/or filling projects. A marine biological resources evaluation will be performed at the project site to identify significant and endangered species and/or habitats in the vicinity of the activity. The evaluation will include digital photo-documentation of habitats and resources (shorelines and submerged lands) in areas to be dredged and/or filled as well as any other documentation necessary to adequately document significant species and/or habitats.

(11) Proposals which include the disposal of dredge spoils in the marine environment will be evaluated via the applicable PDS by the USAG-KA Environmental Engineer and the Appropriate Agencies, as applicable.

(12) Based on available data, *Gambierdiscus toxicus* is known to exist in sediment material around USAKA and the dredging of bottom sediments could intensify the potential for ciguatera contamination. USAG-KA will notify the community that areas where dredging and/or filling activities are upcoming, ongoing, or have recently occurred and should be avoided for fish consumption.

(13) For proposed dredging activities in an area where results of previous analysis indicate contamination may be present in sediment, information on the extent of contamination will be included in the PDS.

(14) In accordance with UES §3-2.7.2, projects will be designed to result in minimal damage to reef areas. Specific controls, such as, selection of shoreline protection method, selecting the appropriate time of year so as to cause the least impact to coral growth and reproductive success, employment of silt curtains, turbidity testing, and planning for identifying and/or relocating endangered marine life in the area of the activity, will be evaluated and selected.

(15) Use of revetments rather than sea walls or retaining walls should be considered for any areas known or suspected to be potential haul out areas for sea turtles. Sea walls will be limited to areas that have steep inclines or vertical drops where sea turtles would not haul out. Revetments with fill behind them are preferred in shallow slope areas so that sea turtles may

continue to haul out. Although seawalls can sometimes be effective, they are not a preferred method of shoreline protection because they can cause new and potentially severe downstream erosion problems.

(16) Any shorelines known or suspected to be nesting or resting areas for migratory seabirds or shorebirds, respectively, will be protected in a manner that does not result in the net loss of such habitat either on-site through an appropriately designed erosion control project or through the creation of new suitable habitat at an appropriate off-site location.

(17) No migratory birds or other wildlife resources and habitats will intentionally be lost by the proposed activities. By strict adherence to the provisions of UES §3-2.7.2 on reef protection, and with careful application of environmental controls, unavoidable impacts on wildlife resources and habitats from shoreline protection activities will be minimized.

(18) A permanent record will be maintained of all projects regardless of size. The record will include at a minimum the date, location, type, and amount of fill for a location. The information will be the basis for all future enhanced protection methods. See section 6.0 below.

(19) During sand replenishment, care will be taken to ensure grain size of replenishment sand is similar to that eroded to minimize shifts in types of impacts incurred from sand transport through the marine system.

(20) The following exceptions may apply to routine dredging and/or filling projects.

(i) Dredging and/or filling projects that may occur routinely can be covered under a single PDS as long as the activity remains within the scope of the approved PDS and associated NEPA documentation. This may apply to projects such as the movement of sand on Emon Beach that occurs approximately every six months with no significant changes to the nature or scope of work.

(ii) A single dredging and/or filling PDS can be used to conduct similar activities at different locations and islets provided the activity remains within the scope of the approved PDS and associated NEPA documentation. This may apply to activities associated with placement and removal of unconsolidated fill on marine ramps for different islets to support the on- and off-loading of supplies/equipment from marine vessels.

Figure 1: Project Description Sheet 1

Dredging and/or Filling Project Description Sheet 1

Less Than or Equal to 25 cubic yards, and without Special Conditions*

Date: _____

1. Project Name:
2. Projected Start Date:
3. Project Description:
4. Projected End Date or Re-Evaluation Date (for Routine Projects):
5. Frequency of Activity for Routine Projects:
6. Location of Project and Project Limits:
   a. Provide maps showing the exact location of the project
   b. Show the exact limits of the project, to include spoils locations
   c. Provide digital photo-documentation of habitats and resources (shorelines and submerged lands) in areas to be dredged and/or filled
   d. State whether or not project affects any protected area as defined in UES Appendices 3-4B and 3-4D
   e. State whether or not project is in a protected area identified in the Water Quality Management Plan
   f. Provide information on the potential for existing contamination within the proposed project area.
7. Date of Last Dredging/Filling at or near the Proposed Location:
   Describe any problems encountered, environmental issues, and the environmental controls used
8. Project is in a sensitive cultural resources area: Yes_____ No _____
   Explain if Yes: _____
9. Method of Accomplishment:
   a. Provide information on equipment to be used
   b. Provide estimated quantities of dredge and/or fill material (cubic yards)
   c. Provide information on the method, equipment, location and limits of spoils disposal (include map or diagram)
   d. Provide project geometry (linear feet of shoreline to be protected, depth/height to be filled, bottom/top widths, side slopes, etc.)
   e. Provide estimated project duration (number of days)
   f. Provide information on quality control methods to be used

g. Provide information on any personnel and/or contractor to be used, including relevant experience

10. Environmental Issues:
    a. Provide information on the environmental setting
    b. Verify all fill material to be used for the specified project is non-hazardous and non-polluting
    c. Provide information on the environmental controls and monitoring procedures to be used
    d. Provide NEPA documentation covering the project
    e. Provide type of marine species present, including coral and any species protected in UES Appendices 3-4A and 3-4C
    f. Provide Public Notification, including notice dates and broadcast media

_____ _____

USAG-KA Environmental Engineer Date

*** Special Conditions qualify as follows:**

i. Creates cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area

ii. Impacts USAKA species and habitats in the most recent updates to UES Appendices 3-4A through 3-4D, coordination with NMFS and USFWS is required to determine if a Special Condition applies due to presence of listed species

iii. Determined to be an "undertaking," in accordance with the current DEP for *Protection of Cultural Resources,* and the HPP

iv. Involves the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects

v. Involves projects of any size on Eniwetak

vi. Involves a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand).

vii. Involves use of explosives

viii. Involves quarrying, which is not authorized by this DEP

Figure 2: Project Description Sheet 2

Dredging and/or Filling Project Description Sheet 2

Greater Than 25 cubic yards, and/or with Special Conditions*

Date: _____

1. Project Name:
2. Projected Start Date:
3. Project Description:
4. Projected End Date or Re-Evaluation Date (for Routine Projects):
5. Frequency of Activity For Routine Projects:
6. Identify applicable Special Conditions (if any):
7. Location of Project and Project Limits:
   a. Provide maps showing the exact location of the project
   b. Show the exact limits of the project, to include spoils locations
   c. Provide digital photo-documentation of habitats and resources (shorelines and submerged lands) in areas to be dredged and/or filled
   d. State whether or not project affects any protected area as defined in UES Appendices 3-4B and 3-4D
   e. State whether or not project is in a protected area identified in the Water Quality Management Plan
   f. Provide information on the potential for existing contamination within the proposed project area.
8. Date of Last Dredging/Filling at or near the Proposed Location:
   Describe any problems encountered, environmental issues, and the environmental controls used
9. Project is in a sensitive cultural resources area: Yes_____ No _____
   Explain if Yes: _____
10. Method of Accomplishment.
    a. Provide information on equipment to be used
    b. Provide estimated quantities of dredge and/or fill materials (cubic yards)
    c. Provide information on the method, location and limits of spoils disposal (include map or diagram)
    d. Provide project geometry (linear feet of shoreline to be protected, depth/height to be filled, bottom/top widths, side slopes, etc.)
    e. Provide estimated project duration (number of days)
    f. Provide information on quality control methods to be used

g. Provide information on any personnel and/or contractor to be used, including relevant experience

11. Environmental Issues.
    a. Provide information on the environmental setting
    b. Verify all fill material to be used for the specified project is non-hazardous and non-polluting
    c. Provide information on the environmental controls and monitoring procedures to be used
    d. Provide NEPA documentation covering the project
    e. Provide type of marine species present, including coral and any species protected in UES Appendices 3-4A and 3-4C
    f. Provide Public Notification, including notice dates and broadcast media

_____ _____

Agency Approval Date

*** Special Conditions qualify as follows:**

i. Creates cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area

ii. Impacts USAKA species and habitats in the most recent updates to UES Appendices 3-4A through 3-4D. Coordination with NMFS and USFWS is required to determine if a Special Condition applies due to presence of listed species

iii. Determined to be an "undertaking," in accordance with the current DEP for *Protection of Cultural Resources*, and the HPP

iv. Involves the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects

v. Involves projects of any size on Eniwetak

vi. Involves a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand)

vii. Involves use of explosives

viii. Involves quarrying, which is not authorized by this DEP

6.2 Requirements Prior to Beginning Project Work

(a) When a PDS for Greater Than 25 cubic yards and/or with Special Conditions is required, the following requirements will be applicable:

(1) The PDS2 will be forwarded to the Appropriate Agencies for review.

(2) Written comments, objections, and/or concurrences should be received from the Appropriate Agencies by the USAG-KA Environmental Engineer within 30 days of report receipt. Unless otherwise agreed to by USAG-KA, no response from an agency within the 30 days will indicate Agency approval with the project as proposed. If, within the 30-day comment period, any Agency requests an extension of time to submit comments, up to an additional 45 days will be added to the comment period.

(3) All agency comments regarding the proposed project will be considered by USAG-KA, which will respond in writing indicating proposed resolution before proceeding with the dredging and/or filling project. Work will not start until all Agency comments are resolved per UES §2-19.

(4) All mitigation measures recommended by the Appropriate Agencies will be evaluated by USAG-KA, which will respond in writing indicating whether the measures will be adopted, and if not, the mitigations that will be adopted to achieve the desired protection (UES §2-17 and §2-19).

(b) Prior to use, all equipment will be inspected and cleaned of any petroleum-based product or other potential polluting material that could be released into the marine environment.

(c) Areas to be dredged and any areas to receive dredge spoils will be evaluated for cultural/historic resources via the PDS and NEPA documentation before operations begin.

(d) The USAG-KA Environmental Engineer will ensure that damage to reef areas and the surrounding environment, including water areas, will be minimized.

(e) Immediately prior to beginning dredging and/or filling activities, a pre-activity marine life reconnaissance survey will be conducted in the area. If any UES protected mobile marine species are observed in the project area, dredging and filling activities will be delayed until they have left the area. If surveys indicate presence of species listed in UES Appendices 3-4A and C, that has not been included on the PDS, the PDS will need to be updated including potential NMFS and USFWS consultation or coordination, as applicable, to determine appropriate protective measures.

(f) Dredging and/or filling in areas showing evidence of active turtle nesting will be avoided to prevent damage to potential habitats and nesting areas (NCA, Appendix C). Dredging and/or filling activities will not be conducted within a 100-meter radius of identified active nesting areas.

(g) Rare seagrasses are found in the lagoons near several of the islands (NCA, Appendix C). Prior to dredging and filling activities in or near these areas, a survey will be conducted to delineate the bed boundaries.

(h) Surveys will be conducted for nesting seabirds and shorebirds prior to dredging and/or filling activities in shoreline areas. Dredging and/or filling activities will not be conducted in areas populated with viable nests.

(i) Baseline turbidity monitoring will be conducted at a distance of 50 meters (150 feet) from the project site prior to the commencement of the activity, as described in section *7.1*(c) below.

6.3 Requirements During Dredging and/or Filling Activities

(a) Dredging and filling will be scheduled to coincide with low tide when possible.

(b) Dredging and filling operations will cease during adverse weather or water conditions.

(c) The work area will be monitored throughout each work day for the presence of marine species.

(d) When feasible, fueling and servicing of dredging or filling equipment which operates in the marine environment will be performed in upland areas designated by USAG-KA for such functions, and will be performed in a controlled manner to prevent releases to the marine or terrestrial environments.

(e) Contamination of the marine environment will not result from project related activities. Disposal of surplus wet concrete, trash, or debris into the marine environment is not covered by this DEP.

(f) Turbidity and siltation from dredging and/or filling activities will be minimized and will be contained within the vicinity of the project site through the use of silt containment devices where appropriate. Silt curtains will be used, to the extent practicable, as a standard procedure to minimize the dispersion of elevated levels of suspended material. In some cases, such as shoreline protection or activities in the reef flat, where silt containment devices may not be effective and can possibly result in damage to coral species from the deployment of anchors, projects may be granted approval to proceed without the use of silt containment devices.

(g) During active dredging and/or filling operations, turbidity monitoring will be conducted as described in section 7.1(c) below. In some cases, where minimal silt condition may occur such as reef flats or where it is unsafe to conduct monitoring, projects may be granted approval to proceed without turbidity monitoring.

(h) Dredge spoils will not be stockpiled on beach areas, reef flats, or in sensitive marine habitats.

(i) Any dredge spoils or fill material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts associated with siltation, spillage, and turbidity to marine flora and fauna.

(j) Appropriate care will be taken to preclude and/or minimize spillage when loading, hauling, and unloading dredge spoils.

(k) Non-hazardous dredge spoils to be saved for use in filling or other projects will be dewatered and stored in an upland area designated by USAG-KA for such usage. Dewatering areas will not be located in the vicinity of freshwater lenses. No return flow from the dewatering of spoils (either hazardous or non-hazardous) will be allowed to enter the marine environment, unless approved by the USAG-KA Environmental Engineer or the Appropriate Agencies, as applicable.

(l) Dredge spoils determined to have hazardous characteristics will be collected and dewatered in an upland area designated by USAG-KA for such usage. The containment area will employ impermeable berms and liners to capture and prevent any runoff from entering the terrestrial or marine environments.

(m) To determine the appropriate method of disposal, dredge spoils will be tested for polychlorinated biphenyls (PCB) and Toxicity Characteristic Leaching Procedure (TCLP) metals. Once dewatered, dredge spoils determined to have hazardous characteristics will be properly containerized and stored until ready for disposal as a hazardous waste in accordance with UES §3-6.

(n) Any liquid collected from the dewatering of spoils which have been determined to have hazardous characteristics will be properly containerized and stored until ready for disposal as a hazardous waste in accordance with UES §3-6.

(o) In the event of an accidental fuel spill, emergency response personnel will respond in accordance with the Kwajalein Environmental Emergency Plan (KEEP). Absorbent pads and containment booms will be stored on-site to facilitate the immediate clean-up of any petroleum spills.

(p) If explosives are discovered during dredging and/or filling activities Explosive Ordnance Disposal (EOD) personnel will be notified. EOD personnel will make a

determination as to whether explosives can be removed from the site of discovery. All explosive materials encountered during the activity will be handled in accordance with the current DEP for Disposal of Munitions and Other Explosive Material, and UES §3-6.5.7(a)(2) and (3).

(q) If prehistoric or historic artifacts, or human remains are discovered in dredged materials, the USAG-KA Environmental Engineer and archeologist will be notified. Any artifacts or remains found would not be in context, so the dredge site would not be considered a potential historic property. The USAG-KA Environmental Engineer, will safeguard the artifact(s) or remains until the significance of the items can be determined.

(r) Injury, disturbance, or death to any listed species, living coral, habitats of special concern, or migratory birds, due to dredging and/or filling operations, that were not previously documented, will be reported to the Appropriate Agencies by USAG-KA within 24 hours by the most expeditious means available (UES §2-7.3.1(e)). Following this emergency notification, USAG-KA will submit written notification to the Appropriate Agencies within 10 days as specified in UES §2-7.2.1. Reports will include the type and number of organisms disturbed, injured or killed; their condition; the locations and conditions of the original and new habitats; and the projected chances of recovery if injured (UES §2-7.2.2).

(s) During sand replenishment, care will be taken to ensure grain size of replenishment sand is similar to that eroded to minimize shifts in types of impacts incurred from sand transport through the marine system.

6.4 Post Dredging and/or Filling Project Requirements

(a) A post-activity marine life reconnaissance survey will be conducted in the project area under the supervision of the USAG-KA Environmental Engineer. An in-water reconnaissance may be necessary dependent on the type of project undertaking, as specified in the PDS.

(b) Any injury, disturbance, or death to any listed species, living coral, habitats of special concern, or migratory birds not previously documented will be reported as stated in section 6.3(r) above.

(c) A Project Completion Report will be provided to the USAG-KA Environmental Engineer including project controls used and their effectiveness. Results of turbidity and marine species monitoring (as described in section 2.0) and any other special monitoring required by the project will be included. The report will include results of the post-activity marine life reconnaissance survey. A copy of the Project Completion Report will be submitted to the USAG-KA Environmental Engineer in accordance with requirements in section 7.3(e).

6.5 Limitations

(a) No dredging and filling operations will occur at USAKA unless documented in an appropriate NEPA document, as described in UES §3-2.7.2(a).

(b) No project involving dredging, quarrying, or discharge of dredged or fill materials will be undertaken in USAKA waters at a depth of less than 30 feet below the mean low water line unless authorized in a final DEP, as described in UES §3-2.7.2(d). Such work will be authorized within the scope of this DEP.

(c) The USAG-KA Environmental Engineer and the Appropriate Agencies, as applicable, will authorize dredging and/or filling work in accordance with this DEP. The USAG-KA Environmental Engineer will stop the work if appropriate environmental controls are not used or if potential harm to the environment exists.

(d) The tidal ponds on the islands of Roi-Namur and Legan will not be subjected to dredging and/or filling activities of any kind in accordance with the Water Quality Management Plan.

(e) The disposal of wet concrete into the water, over the reef edge, or on shore protection structures is not authorized by this DEP.

(f) Project-related materials (fill, revetment rock, pipe etc.) will not be stockpiled in the water (reef flats, inter-tidal zones, etc.).

6.6 Personnel

(a) All personnel who operate, maintain, or manage equipment or processes used in dredging and filling activities will have the level of knowledge required for performing their tasks safely and in a way that preserves the environment.

(b) Before engaging in any dredging and/or filling activities, personnel will receive the required training to ensure that they are proficient in performing their tasks in an environmentally safe manner. Verification of the training will be noted in the training record, and the immediate supervisors will document that adequate training has been provided per UES §2-10 and §3-6.5.1(d)(1).

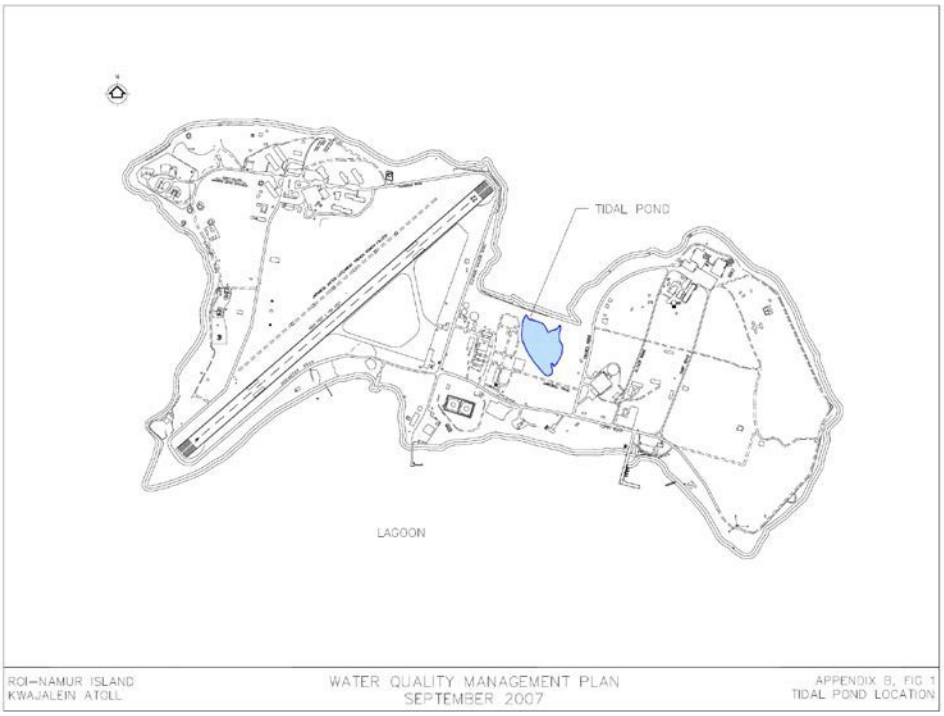

Figure 3: Tidal Pond Location on Roi-Namur

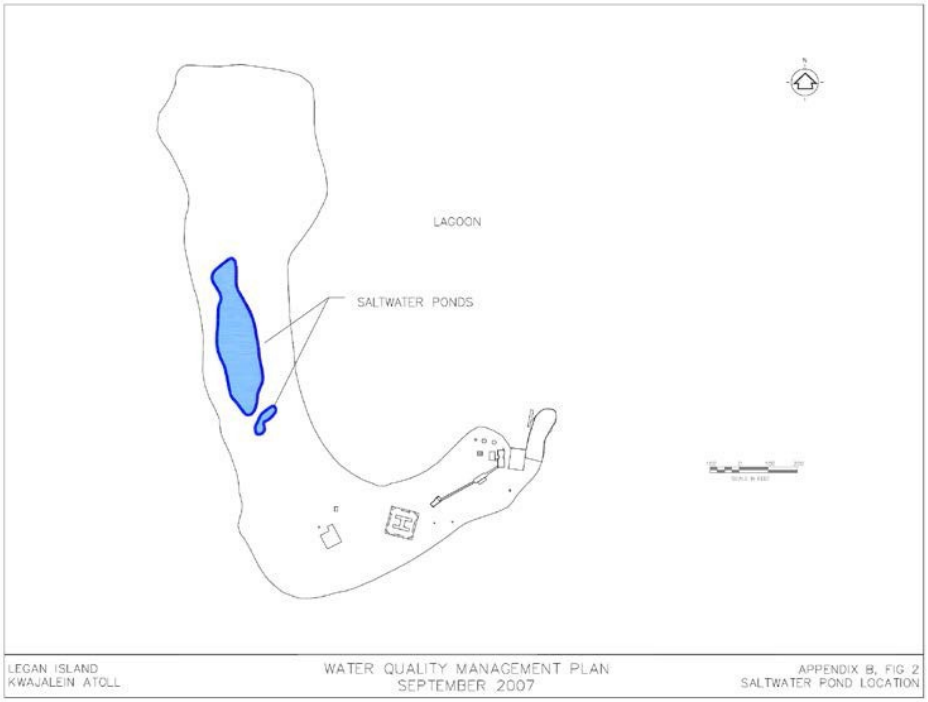

Figure 4: Saltwater Pond Locations on Legan

6.7 Emergency Procedures

There may be need for immediate, emergency repairs to shore protection or other structures as a result of damage from major ocean storms, accidents or erosion. The USAG-KA Environmental Engineer may determine a situation to constitute an emergency condition which are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural or cultural resources. Under such circumstances, the procedures of project authorization typically required for dredging, filling, or shoreline work within the scope of this DEP may be superseded in order to facilitate a more immediate response time. Within 24 hours of discovery of an imminent and substantial endangerment, USAG-KA will notify the Appropriate Agencies of the emergency. Within 10 days following emergency notification, USAG-KA will submit written notification of the circumstances and actions taken to mitigate the threat to human health or the environment to the Appropriate Agencies. The written report will contain, at a minimum, the relevant information described in UES §2-7.2.2.

7.0 MONITORING, RECORD KEEPING, AND REPORTING

7.1 Monitoring Procedures

(a) Personnel involved in dredging operations will monitor collected dredged material (brought onshore) for cultural or historic artifacts or remains unearthed during dredging activities.

(b) The work area will be monitored daily for the presence of species listed in UES Appendices 3-4A and C immediately prior to the beginning of work and throughout each work day. Work will be delayed or stopped until any such species, not previously considered, have left the area.

(c) Turbidity monitoring will be conducted, where applicable. Baseline turbidity monitoring will be conducted 50 meters (150 feet) from the project site prior to the commencement of the activity. During active dredging and/or filling operations, turbidity monitoring will be conducted daily at a distance of 50 meters (150 feet) from the site of the activity. Monitoring times and locations should be representative of regular working conditions. If turbidity measurements exceed 10 nephelometric turbidity units (NTU) from the baseline measurement, work will cease until turbidity returns to less than 10 NTUs above the baseline turbidity value. All daily turbidity measurements will be recorded and submitted as part of the Project Completion Report.

7.2 Reporting Procedures

(a) Any PDS for proposed dredging and/or filling activities of greater than 25 CY and/or with Special Conditions will be forwarded by USAG-KA to the Appropriate Agencies for review and signature. Agency concurrence may be assumed after 30 days of submission of the PDS if a timeline extension has not been requested.

(b) A written report will be provided to the Appropriate Agencies within 10 days of 24 hour notification, described in section 7.3(c) below, of an incident resulting in the disturbance, injury, or death of a listed species, critical habitat or migratory bird. The report will include the type and number of organisms disturbed, injured, or killed; their condition; the locations and conditions of the original and new habitats; and the projected chances of recovery if injured.

(c) A written report will be provided to the Appropriate Agencies if any of the requirements of the DEP or the UES are violated during the activity covered by this DEP within 30 days of the violation.

(d) A written report will be provided to the Appropriate Agencies within 10 days following any emergency notification, as specified in section 7.4(a) below.

(e) A Project Completion Report will be provided to the USAG-KA Environmental Engineer including project controls used and their effectiveness. Results of turbidity and marine species monitoring (as described in section 2.0) and any other special monitoring required by the project will be included. The report will include results of the post-activity marine life reconnaissance survey. A copy of the Project Completion Report will be submitted to the USAG-KA Environmental Engineer within 30 days of project completion.

7.3 Notification Procedures

(a) Emergency Notifications

i. Within 24 hours of discovery of an emergency environmental condition, USAG-KA will notify the public affected or potentially affected by the condition and the Appropriate Agencies by the most expeditious means available.

ii. Within 10 days following emergency notification, USAG-KA will submit written notification of the event to the Appropriate Agencies that contains at a minimum the relevant information described in UES §2-7.2.2.

iii. Emergency notifications will be made for any condition that the USAG-KA Environmental Engineer determines to constitute an emergency condition.

(b) Public Notifications

i. Public notifications will be made by USAG-KA to advise the public of an activity or action that has been taken or is planned as a result of emergency conditions and any precautions to be taken by the public.

ii. Public notification made as a result of emergency conditions will be made in any or all of the following as applicable: *The Kwajalein Hourglass* newspaper, *Marshall Islands Journal* newspaper, posters or bulletins displayed in public places, the Newsline, and the public television "Roller", and will be effective for the locations affected.

iii. Public notification will be made for any other non-emergency projects of the potential for increased risk of Ciguatera from consumption of fish, including the area where dredging and/or filling activities are upcoming, ongoing, or have recently occurred and should be avoided for fish consumption. If possible these notifications should be available to the public a minimum of 7 days prior to the activity through 7 days following project completion.

(c) Agency Notification

In the event that any listed species, critical habitats, or migratory birds are disturbed, injured, or killed due to dredging and/or filling activities, USAG-KA will inform the Appropriate Agencies within 24 hours by the most expeditious means available.

7.4 Record Keeping

(a) Records on dredging and filling activities will be maintained by USAG-KA for demonstrating compliance with the UES, and will be available for examination by outside agencies during external auditing (UES §2-13.1).

(b) All records associated with dredging and/or filling, including PDS and Project Completion Reports, will be maintained for at least five years (UES §2-13.2).

(c) All Notices of Proposed Activity (NPA), NCAs, DEPs, and Environmental Comments and Recommendations (ECR), pertaining to dredging and/or filling activities will be preserved for the duration of the activity plus 10 years or for 10 years after the expiration of the DEP, whichever is less.

(d) Personnel-training records will be preserved for 10 years beyond the period the employee is engaged in activities potentially affecting the environment at USAKA (UES §2-13.2.1).

8.0 COMPLIANCE STATUS

Dredging and/or filling activities in the locations authorized by this DEP will be compliant with the UES provided the requirements and limitations, described here-in, are adhered to and implemented.

8.1 RESOLUTION OF NONCOMPLIANT AREAS

There are no known non-compliant issues associated with this activity. With the implementation of the requirements, limitations, and monitoring protocols described in this DEP, dredging and filling activities at USAKA will be in full compliance with the UES.

9.0 MINOR DEP MODIFICATIONS

Minor modifications to this DEP may be accomplished under the provisions of UES §2- 17.3.6(e).

10.0 CLIMATE CHANGE

Rising global atmospheric Greenhouse Gas (GHG) emissions are affecting the Earth's climate. The effects include, but are not limited to, more heavy downpours and flooding, more intense storms, sea-level rise, ocean acidification, and harm to wildlife and ecosystems. In accordance with UES Section 2-17.3.3(c), the NCA shall include an analysis of climate change and its potential impacts on the activity, and a description of related limitations and requirements. The potential impact of climate change effects on dredging and filling activities include increases in erosion, accretion of sediment, and more pronounced flooding at USAG-KA. As a consequence, an increase in the frequency and the magnitude of dredging and filling activities are expected at USAKA.

Increased Erosion
Due to sea-level rise, elevated intensity of storms and correlated wave actions as well as the loss of coral reef buffer to dissipate wave energy from ocean acidification, increased erosion of the coastal shorelines on the USAKA islets are expected to occur. In order to mitigate increased erosion at USAKA, more frequent and larger dredging and filling activities to repair/replace existing shoreline protection structures as well as support the construction of additional or enhanced shoreline protection activities are anticipated.

Increased Accretion of Sediment
Sea-level rise and more intense storms and associated wave action are expected to increase the accretion of sediment around the USAKA islets. To mitigate the accretion of sediment, more dredging and filling activities are anticipated to restore harbors and channel depths and maintain in-water structures such as intake and outfall discharge pipes.

Increased Flooding
More intense and heavy downpours can result in more frequent and more severe flooding of the USAKA islets. Additionally, the rise in sea level can result in inland flooding from wave action during storms and king tide events. Ocean water flooding on Kwajalein, Roi-Namur, and Meck

islets has the potential to contaminate groundwater lenses and water catchment areas and impact the respective drinking water systems. To mitigate the potential increase in flooding events, an increase in dredging and filling activities are anticipated to enhance shoreline protection structures and to maintain/modify existing stormwater conveyance discharge systems.

11.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS ON THE DEP AND USAG-KA's RESPONSES

U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
COMMENT: No comments received.
USAG-KA RESPONSE: Noted.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY
COMMENT: No comments received.
USAG-KA RESPONSE: Noted.

U.S. ENVIRONMENTAL PROTECTION AGENCY
COMMENT: No comments received.
USAG-KA RESPONSE: Noted.

U.S. FISH AND WILDLIFE SERVICE
COMMENT: No comments received.
USAG-KA RESPONSE: Noted.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION
COMMENT 1: Pg. 6, 6.1(10), Recommend adding "spatially relevant" to 1st sentence to read, "The results of the most recent spatially relevant USFWS and/or NMFS biennial Inventory of …" Suggest adding "and/or" between USFWS and NMFS as the marine and terrestrial inventories have recently and are more than likely in the future to be reported separately.
USAG-KA RESPONSE: : Recommendation accepted and incorporated.

COMMENT 2: Pg. 8 and 9, PDS, No 4, not clear on why specifically asking for project end dates only for routine projects. Wouldn't "routine projects" be more or less never ending?
USAG-KA RESPONSE: The intent of the project end date was to identify an anticipated end date for a single dredging and filling activity or to provide an end date for the routine dredging and filling activity. It is appropriate to include a project end date for routine activities to allow for a re-evaluation of the proposed activity to include another review of the impact to UES protected species in the area of impact.

The following revisions to Figures 1 (Dredging and Filling Project Description Sheet 1) and 2 (Dredging and Filling Project Description Sheet 2) were made in response to the comment:

1. Section 4 was revised to reflect "Projected End Date or Re-Evaluation Date (for Routine projects).
2. Section 5 was revised to reflect "Frequency of Activity for Routine Projects".

COMMENT 3: Pg. 12, 6.3 (e), perhaps change 2nd sentence to, "If any marine species not previously reported and/or considered in the PDS2 are observed in the project area..."
USAG-KA RESPONSE: The intent of this condition was to conduct a survey of the area immediately prior to the beginning of the dredging and filling activity to identify any UES protected mobile marine species (i.e., marine mammals, sea turtles, etc.) in the area of impact. If any are identified, the activity would be delayed until they had left the area. To clarify the intent, the second sentence in the condition was revised to state, "...If any protected mobile marine species are observed in the project area, dredging and filling activities will be delayed until they have left the area..."

COMMENT 4: Pg. 15, 6.4(r), Perhaps change 1st sentence to, "Unplanned (i.e. not reported and/or considered in the project related PDS) injury, disturbance, or death..."
USAG-KA RESPONSE: Based on the comment received, this condition was revised to address the reporting of any injury, disturbance, or death to any listed species, living corals, habitats of special concern, or migratory birds due to the dredging and/or filling activity that was not previously documented in the coordination/consultation process with the Appropriate Agencies. The condition was revised to reflect, "Injury, disturbance, or death to any listed species, living coral, habitats of special concern, or migratory birds due to the dredging and/or filling operations, that were not previously documented, will be reported to the Appropriate Agencies..."

COMMENT 5: Pg. 15, 6.5(1)(a), Clarification needed. Process refers to section 1.3 (r) above, but I can't seem to locate a 1.3 (r). Is 6.4 (r) what is intended here?
USAG-KA RESPONSE: Section 6.5(1)(a) incorrectly referenced Section 1.3(r). The Section was modified to correctly reference Section 6.4(r).

COMMENT 6: Pg. 15, 6.5(1)(b), I might have missed it, but I didn't see the stated requirements noted in the last sentence in section 6.2 (may want to double check or clarify).
USAG-KA RESPONSE: Section 6.5(1)(b) incorrectly reference Section 6.2 regarding the submittal of the Project Completion Report. The Section was modified to correctly reference Section 7.3(e).

COMMENT 7: Pg. 16, 6.6 (a), I was under the impression we covered ATON using the dredge and fill DEP, but it's unclear to me whether such was covered by any NEPA documentation. How would ATON be considered here, and if not through dredge and fill, then what might be a more appropriate avenue?
USAG-KA RESPONSE: In accordance with the Compact of Free Association and the UES, USAKA activities in the RMI are required to undergo a NEPA review. The current ATON maintenance activities are covered under the programmatic agreement and will be conducted under the auspices of the Dredging and Filling DEP. A routine dredging and filling sheet will be prepared for future ATON maintenance activities. A new DEP is planned to address the maintenance of in-water structures in the near future. The ATON maintenance activities will then be addressed via the new DEP once finalized.

COMMENT 8: Pg. 18, 7.1 (b), Suggest modifying 2nd sentence as such. "Work will be delayed or stopped until any such species, not previously reported and/or considered in a project related PDS, have left the area. Approved conservation measures related to PDS species shall be followed."
USAG-KA RESPONSE: Based on the comment received, Section 7.1(b) was revised to reflect, "…Work will be delayed or stopped until any such species, not previously consid, have left the area."

COMMENT 9: Pg. 19, 7.3 (a), 1st sentence, might want to delete "," following Agencies. Also, might be good to add, "if a timeline extension has not been requested" to the end of the 2nd sentence to be consistent with previous DEP section.
USAG-KA RESPONSE: Recommendations accepted and incorporated.

COMMENT 10: Pg. 19. 7.3 (d). Change reference from "7.3(a)" to "7.4(a)".
USAG-KA RESPONSE: Recommendation accepted and incorporated.

COMMENT 11: Pg. 20, 7.4 (b) iii, suggest touching base with Dr. Lisa Ruth to determine if dredge and fill activities in areas with known contaminants may further increase risks for human exposure due to potential for enhanced uptake in food fish. Contaminant risks may be enhanced in at least 2 ways (1) resuspension and spread of contaminants with bottom disturbance (2) movement of contaminated fish out of project area to take residence in neighboring sites. Thinking it might be prudent to enhance in active dredge public notification regarding any potential for enhanced availability of contaminants /fill areas if Dr. Ruth believes such might be the case.
USAG-KA RESPONSE: Dr. Lisa Ruth was consulted on the comment received and identified that current fishing restrictions are already in place at several industrial areas such as the Kwajalein harbor, Kwajalein Landfill reef flat, Meck Harbor, Illeginni Harbor, Roi-Namur Fuel Pier and the Roi-Namur Wendy Point and Landfill Areas. People should always avoid consuming fish from these areas regardless of what permitted dredging/filling activities may be taking place. The concern is more appropriate for dredging and filling activities in areas that do not have fishing restrictions. The requirement to provide public notification for increased risk for Ciguaterra will also serve to notify the public of the fishing restrictions in those areas for 7 days prior to and after the activity.

PUBLIC COMMENT
COMMENT 1: Figure C-1-2, I could not find the Inner Harbor that is listed on Table C-1-2 Kwajalein on Figure C-1-1 of Appendix C of the NCA. Therefore, is the entire area shown on Figure C-1-1 considered the Inner Harbor? All the other areas listed on Table C-1-2 were shown on Figure C-1-1, except, of course, Ebeye Pier. Thanks for your work on this and the opportunity for me to read it.
USAG-KA RESPONSE: The Inner Harbor location listed in Table C-1-2 is referring to the general location of the harbor between the Cargo Pier and the Fuel Pier. Table C-1-2 has been revised to identify the area of the Inner Harbor and will be incorporated into the final Document of Environmental Protection (DEP). The intent of Figure C-1-1 is to identify the classification of coastal-water use and to identify the location of harbor facilities. Figure C-1-1 does not identify all

areas and structures that require minimum bottom depths to support the draft of specific vessels as identified on Table C-1-2; although, as you noted, all of the structures other than the Ebeye Pier are identified on Figure C-1-1.

12.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS ON NCA AND USAG-KA RESPONSES

U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
COMMENT: NCA does not affect resources within the jurisdiction of this agency. No comments are provided.
USAG-KA RESPONSE: Comment noted.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY
COMMENT: No comments received.
USAG-KA RESPONSE: Noted.

U.S. ENVIRONMENTAL PROTECTION AGENCY
COMMENT: NCA may affect resources within the jurisdiction of this agency. Agree with proposed environmental controls. No comments provided.
USAG-KA RESPONSE: Comment noted.

U.S. FISH AND WILDLIFE SERVICE
COMMENT 1: Section 5.1(c) (5) We recommend the following change: The evaluation will include the production of a habitat map of the construction and adjacent areas as well as a quantification of the resources and habitat to be impacted. However, the level of information needed for a marine biological resources evaluation will be proportional to the level of impacts. In some cases, if an existing map exists of the area, then simple photo-documentation of the habitats and its resources may be sufficient.
USAKA RESPONSE: Section 5.1(c) (5) was revised to include the statement, "The level of information needed for a marine biological resources evaluation will be proportional to the level of impacts." The UES is reviewed and updated periodically. The habitat maps of USAKA areas will be part of the next review of the UES. The USFWS may be able to aid in the generation of updated maps at that time.

COMMENT 2: Section5.1(c) (6) (iii) & (iv). We recommend combining these two items into one bullet with the additional requirement of developing a silt and turbidity monitoring strategy that will fully describe the method of turbidity monitoring, the containment devices or system, monitoring strategy for turbidity, and corrective actions to be taken if the turbidity exceeds clearly stated thresholds.
USAKA RESPONSE: Section 5.1(c)(6)(iii) and (iv) were combined and revised to state, "Develop a silt and turbidity control strategy identifying the selection of an appropriate type of turbidity monitoring device, an appropriate type of silt containment devices/equipment, and the corrective actions to be taken if the identified turbidity thresholds are exceeded."

COMMENT 3: Section5.1 (e) (3). We recommend this section be modified to include stricter controls on maximum turbidity based on background conditions, but also add flexibility based on the marine resources around the project area. This section could set a minimum standard, but some projects may require stricter controls based on the amount and type of marine resources

Generally speaking, turbidity monitoring should occur prior to the start of construction and at set periods throughout the construction operation to monitor the changing conditions. Control areas should also be monitored to set the baseline conditions outside the influence of the project. These base line conditions then set a standard in which to make operation decisions based on turbidity changes due to the project activities. In addition, a NTU of 10is high for many reefs and a change of 10 above baseline conditions may be extraordinarily high. Many state water quality standards use a change of1 NTU. We recommend a two-tiered scale on the turbidity threshold. If sensitive resources are known to be in the area or adjacent area, then a change of 1 NTU should be used while in areas where there are no sensitive resources or species of concern, then a 5 NTU threshold may be used. The threshold used for a given project would be documented in the pre-planning turbidity strategy described in Section 5.1(c) (6) (iii) & (iv).

USAG-KA RESPONSE:

Comment noted. Section 5.1 (e) (3) does indicate turbidity monitoring will occur prior to the start of construction as a baseline and that monitoring will be conducted during the dredging and/or filling operation according to the working conditions. Environmental controls and monitoring procedures are to be identified on the required Project Description Sheet (PDS). If it is determined that the proposed dredging and/or fill project could potentially Impacts any USAKA species or habitats listed in UES Appendices 3-4A through 3-4D, a PDS 2 would be required to be reviewed and approved by the Appropriate Agencies. This would give the agencies an opportunity to ensure that the proposed monitoring plan is acceptable. USAKA has managed all dredging and filling operations successfully and without incident in accordance with the best management practice of ceasing work at any point that monitoring indicates that the turbidity is exceeding 10 NTU above baseline. That stipulation has been mandated in the previous Dredging and Filling DEP as well as the previous Shoreline Protection DEP. There is no standard method for developing criteria for turbidity because the effects are site specific based on several factors such as the sediment properties, the site conditions such as depth of water or the current, as well as operational considerations. According to www.epa.gov/wqs-tech, the specific Water Quality Standards in the various states have turbidity thresholds ranging anywhere from 3% above baseline to 50 NTUs, depending on the area of the state and the duration of the elevated turbidity. Many states and territories, such as Guam do not have stipulated thresholds for the "effect zone" or "mixing zone" of dredging and/or filling projects, but require best management practices. Studies have shown that dredging and filling operations generally result in short-term disruption near the USAKA islands due in part to the large sediment particles/sand rapidly resettling after disturbance. On July 19, 2012, during the Roi-Namur Pier Repair Project, turbidity monitoring affirmed that elevated turbidity levels dissipate rather quickly; at one point, at the location the work was being conducted, a 24.5 NTU decreased to 10.5 NTU in 2 minutes.

COMMENT 4: Section 5.1,f,(1) iii. We recommend adding that some basic characterization of the surrounding area will be conducted 10-30 past construction to determine if there were any secondary impacts associated with increased turbidity. This can include a basic visual reconnaissance of the surrounding areas to determine if there is any coral bleaching or notable sediment deposition on corals or the surrounding habitats.

USAG-KA RESPONSE:

Section 5.1 f (1) was revised to include the sentence, "An in-water reconnaissance may be necessary, dependent on the type of project undertaking, as specified in the PDS." Section 5.1 f (2) was revised to include the sentence, "The report will include results of the post activity marine life reconnaissance survey."

COMMENT 5: Section 9.0 (a) (3). The 2016 marine inventory has found additional seagrass areas.
USAG-KA RESPONSE: Assuming the 2016 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2016 Inventory.

COMMENT 6: Section 9.0(b). We recommend that new habitats maps be produced for all USAKA areas, but most importantly the areas that this DEP will cover. The USFWS has a protocol that can aid in the production of these maps and is currently working on a map of Eniwetak. However, this should be expanded to areas that will likely have high projects or other impacts.
USAG-KA RESPONSE: The UES is reviewed and updated periodically. The habitat maps of USAKA areas will be part of the next review of the UES. The USFWS may be able to aid in the generation of updated maps at that time.

COMMENT 7: Section 9.0. This section does not cover the protected fishes that currently have UES protection.
USAG-KA RESPONSE: Section 9(a)(7) was added to address fish species included in UES Appendices 3-4A and 3-4C.

COMMENT 8: Section 12.3. Marine and Terrestrial Habitats and Appendix C. There is reference to Appendix C and marine habitat maps that show marine resources. These maps are not included in the document, so we can comment on them. If they are the same maps as in the UES, they are likely not sufficient for the purposes of this DEP. However, the USFWS has particular expertise in this field and we can provide assistance in collecting data and generating maps for this DEP.
USAG-KA RESPONSE: The UES is reviewed and updated periodically. The habitat maps of USAKA areas will be part of the next review of the UES. The USFWS may be able to aid in the generation of updated maps at that time.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION

COMMENT 1: Page 1, Para 3, 2nd Sent. The UES consultation and coordination requirements should apply to removal of corals from intake pipes; we're not aware that a consultation or coordination on such has yet occurred. I believe there are plans to address such through appropriate field surveys, analysis, and process this FY. The suggestion f o r exclusion in the NCA and DEP appears inappropriate, absent evaluation and appropriate UES process. See also exclusion language on page 6, sect 1.5.1, line 6.
USAG-KA RESPONSE: Page 1, Paragraph 3, 2nd Sentence was revised to remove "except in intake and outfall locations." Page 6, section 1.5.1, line 6 was revised to remove "except from intake and outfall locations." Page ii, paragraph 5, a sentence was added; "Intakes will be assessed to the fullest extent possible by examining the end of the pipe and the immediate area."

COMMENT 2: Page 1, para 4, last sent "does not require approval" is odd language here. Perhaps change to, "is not addressed in this NCA."
USAG-KA RESPONSE: Page 1, paragraph 4, last sentence, was revised as, "therefore, is not addressed in this NCA."

COMMENT 3: Page 1, last para, 2nd sentence. Remove comma after "areas."
USAG-KA RESPONSE: Page 1, last paragraph, 2nd sentence, was revised to remove the comma after the word "areas."

COMMENT 4: Page B-1, Sect 5.1, paras 2-3. Switch between English and metric units, might want to go English in 3rd para.
USAG-KA RESPONSE: This is part of the Water Quality Management Plan (WQMP), November 2015. The document is reviewed every 2 years. The suggested revision will be addressed with the next revision of the WQMP. Appendix B has been removed from the document.

COMMENT 5: Page B-2, Sect 5.2, para 3, line 6. Clarity needed. Are these areas where dredging, quarrying, etc. are protected, or areas protected from dredging, quarrying, etc.?
USAG-KA RESPONSE: This is part of the Water Quality Management Plan (WQMP), November 2015. The document is reviewed every 2 years. The suggested revision will be addressed with the next revision of the WQMP. Appendix B has been removed from the document.

COMMENT 6: Page B-2, Sect 5.2.1, para 1, line 2. Suggested channels are re-dredged typically every 10 years, which contrasts with the statement on Page 2, Section 1.2, para 2, line 2. Clarification needed.
USAG-KA RESPONSE: This is part of the Water Quality Management Plan (WQMP), November 2015. The document is reviewed every 2 years. The suggested revision will be addressed with the next revision of the WQMP. Appendix B has been removed from the document.

COMMENT 7: Page B-3, sect 5.2.2, 2nd para, line 2 "the effects of", or "the effects on"? As for seagrasses, turbidity may similarly effect corals (which were noted to rely on sunlight in previous paragraph), and sedimentation may lead to tissue loss and associated diseases.
USAG-KA RESPONSE: This is part of the Water Quality Management Plan (WQMP), November 2015. The document is reviewed every 2 years. The suggested revision will be addressed with the next revision of the WQMP. Appendix B has been removed from the document.

COMMENT 8: Page B-5, 1st bullet. Add corals, so it reads, "… such as corals and giant clams", as they are much more likely to be encountered and needing to be moved to avoid certain mortality.
USAG-KA RESPONSE: This is part of the Water Quality Management Plan (WQMP), November 2015. The document is reviewed every 2 years. The suggested revision will be addressed with the next revision of the WQMP. Appendix B has been removed from the document.

COMMENT 9: Page C-i, No. 3, line 2. Thinking the "or" should be changed to "and", to read, "Environmental Engineer and Appropriate Agencies (as applicable)…"

USAG-KA RESPONSE: Revised Page C-i, No. 3, line 2 as, "No work shall commence until the appropriate Project Description Sheet, including all required documentation, has been approved by USAG-KA Environmental Engineer and Appropriate Agencies (as applicable) in accordance with the provisions of this NCA and DEP."

COMMENT 10: Page C-1-1, para 3, line 5-6. There are also quarries on the south side of the islet that were made during Japanese times (see Figure c-1-2).
USAG-KA RESPONSE: Page C-1-1, paragraph 3, line 5-6 was revised as, "Former reef quarry pits of varying dimensions and depths are present on the east and south shore of the islet."

COMMENT 11: Page C-1-1, para 4, lines 7-8. The sediments of Kwajalein Harbor have been shown to be contaminated. Please clarify how the spoils from dredging in this region will be reutilized as fill, disposed on land or in adjacent water areas given there is no mention of appropriate contaminants removal. Would such activities be in accordance with the UES? This is a big issue that should be fully addressed in this NCA.
USAG-KA RESPONSE: Page C-1-1, paragraph 4, lines 7-8 has been revised as, "Disposal of dredge spoils in the water adjacent to the dredge site may be permissible, provided the requirements of this NCA (Section 5.1,e,7 through 13) and the associated DEP (Section 6.3,h through n) are satisfied."

COMMENT 12: Page C-1-5. Para 6, line 3-4. Inventories prior to and including 2010 did not survey Kwajalein Harbor. A specific biological survey of the harbor was conducted in 2014 for in support of harbor renovation activities. In addition, the 2014 inventory covered the remaining portion of the harbor. The Echo Pier results have been reported and should be referenced here. Funding for the 2014 Inventory analysis and write-up was just recently received, so a report containing that info is not yet available. Reference to the 2010 and prior inventory surveys should be avoided as the harbor provides specific habitats and biological elements not found in those areas outside that were surveyed.
USAG-KA RESPONSE: Page C-1-5, paragraph 6, lines 3 and 4 have been revised as, "Biennial inventories of endangered species and other wildlife resources at Kwajalein Atoll have been conducted by the USFWS and NMFS since 2004 and provide information on the marine biological resources around Kwajalein Harbor," in order to properly reflect that the harbor itself had not been inventoried prior to 2014. Assuming the 2014 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2014 Inventory.

COMMENT 13: Page c-2-8, Figure c-2-3, box in right hand corner. Suggests dredging, quarrying and filling is protected in shaded areas, as opposed to areas being protected from such activities. See other maps in Appendix C for same issue.
USAG-KA RESPONSE: Comment noted. The maps have been revised to properly identify the colored areas as, "areas protected from dredging and filling."

COMMENT 14: Page C-3-4, 3rd para. The description should note that the Inventory did not include resources within the harbor. The harbor was specifically covered by the 2014 inventory,

however funding for analysis and reporting was just received so that report has yet to be written and released.

USAG-KA RESPONSE: has been revised as, "The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and USNMFS in December 2012 provides information on the marine biological resources around Meck Harbor," in order to properly reflect that the harbor itself had not been inventoried prior to 2014. Assuming the 2014 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2014 Inventory.

COMMENT 15: Page c-4-1, Ennylabegan Islet. Para 3 indicates that continued maintenance of the harbor here is essential to operations at USAKA, yet the power plant was shut down and, if memory serves, water tank maintenance has been discontinued, so the question of "essential" arises. Please clarify.

USAG-KA RESPONSE: The Ennylabegan Islet's harbor is considered essential as it is a support receiver site for future compliance cleanup projects and existing and future energy projects.

COMMENT 16: Page c-4-1, para 5, line 4. Typo: "Dredging is only be…."?

USAG-KA RESPONSE: Page C-4-1, paragraph 5, line 4 was revised as, "Dredging is only required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel."

COMMENT 17: Page c-5-2, para 1, line 3. Typo: change "Illegini would" to "Illegini would"

USAG-KA RESPONSE: Page C-5-2, paragraph 1, line 3 was revised as, "Access to the open ocean from Illeginni would be via South Pass to the south however most vessels arriving at Illeginni originate from Kwajalein."

COMMENT 18: Page c-5-2, para 2, line 6. Reported bottom depths of 2.5 meters seem inaccurate. Much of the harbor appears to be deeper than that.

USAG-KA RESPONSE: The Illeginni Harbor was generally approximately 2.5 meters (8.2 feet) and was dredged to 6.1 meters (20 feet) several years ago. The depth is currently 4.6 meters (15 feet). Page C-5-2, paragraph 2, line 6 was revised as, "Bottom depth at Illeginni Harbor is approximately 4.5 to 5 meters (14.8 to 16.4 feet) currently."

COMMENT 19: Page c-5-4, para 2, line 1. Typo: change "IlleginiHarbor" to "Illegini Harbor."

USAG-KA RESPONSE: Page C-5-4 has been revised as, "Illeginni Harbor, located on the lagoon-facing reef on the northeastern end of the islet is in a windward, high-energy environment."

COMMENT 20: Page c-5-4, marine biological resources. As stated for other harbors, Illegini harbor has not historically been surveyed as part of the inventories. However, the 2014 survey identified numerous coral species including UES consultation and some rare coordination species, as well as substantial seagrass areas. There were also quite a number of large clams that appeared to be Hippopus hippopus.

USAG-KA RESPONSE: Page C-5-4 has been revised as, "The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and NMFS in December 2012 provides information on the marine biological resources around Illeginni Harbor," in order to properly reflect that the harbor itself had not been inventoried prior to 2014. Assuming the 2014 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2014 Inventory.

COMMENT 21: Page c-6-1, para 2, line 2. The pier at Legan is extremely deteriorated to the extent that boats cannot securely tie up there. The currents and winds make Legan harbor a tricky place to anchor. Might want to point this out.
USAG-KA RESPONSE: Comment noted.

COMMENT 22: Page 10, Sect 1.6.2, line 4. Appendix C or D? Also, what percentage of existing shoreline appears to be in the "Critical erosion" category in appendix D?
Might be good to present such a number, either by islet or in total.
USAG-KA RESPONSE: Page 10, Section 1.6.2, line 4 was revised as "Appendix D and Appendix E." Included, "The 2009 Shoreline Inventory (Appendix E) cites 2,462 feet of the inventoried 37,335 feet of shoreline identified as critical."

COMMENT 23: Page 11, No. 5. The BSR was just recently refurbished. Was there an issue with the refurbishment such that it is being undermined by erosion? Please clarify.
USAG-KA RESPONSE: Comment noted. The BSR was refurbished due to the deterioration of the concrete.

COMMENT 24: Page 12, Sect 1.7b2. Recommend including Appendices 3-4B though D along with A in the Appendix too, so folks referring to this NCA and later DEP will be fully (as opposed to partially) informed.
USAG-KA RESPONSE: NCA has been revised to remove the last sentence, "An update to UES Appendix 3-4A (revised as of February 25, 2016) is included as Appendix G to this NCA." Appendix G was removed from the NCA.

COMMENT 25: Page 17, Figure 4, 4d. Recommend replacing reference to 3-4c with 3- 4d, as c refers to species, not area, and d refers to habitats.
USAG-KA RESPONSE: Revised page 17, Figure 4, 4d to, "State whether or not project affects any protected area as defined in UES Appendices 3-4B and 3-4D."

COMMENT 26: Page 13, sect 1.7.3. Project description sheets should be modified to include project end dates and frequency of activities if to be used routinely over time. All sites intended for activities should be listed along with project durations.
USAG-KA RESPONSE: Page 13, section 1.7.3, the Project Description Sheet 1 and 2 were revised to include the projected end date and the frequency of activity for routine dredge and fill projects.

COMMENT 27: Page 14, sect 1.7.4, line 1-3. The sentence contradicts itself (i.e. consolidated fill material does not constitute fill material). Clarification needed.

USAG-KA RESPONSE: Page 14, section 1.7.4, sentence 1 was revised as, "Consolidated material such as formed concrete or wood pilings, metal sheet pile, outfall pipes, or other structures to be place in the marine environment or on the shoreline does not constitute fill material."

COMMENT 28: Page 19, sect 2.3. Softer rock?
USAG-KA RESPONSE: Page 19, section 2.3 was revised as, "Lagoon reef flats are typically narrower than ocean reef flats and are composed of unconsolidated rock."

COMMENT 29: Page 21. Section 4.1. One potential change not being addressed well includes changes in energy transfer of incoming waves with shoreline protection or fill structures, which may affect adjacent biological communities. In addition, energy may be transferred to affect other shorelines.
USAG-KA RESPONSE: Page 21, section 4.1, was revised to add the sentence, "Shoreline protection or fill structures could cause changes in energy transfer of incoming waves which could have an effect on adjacent biological communities or other shorelines."

COMMENT 30: Page 22, Sect 5.0 (c)(3), line 1. Change to results of the most recent spatially relevant completed biennial inventory ….." The inventory has moved to a rotation of such between mid-atoll corridor and islets, etc., so this should allow room to focus on what's actually relevant.
USAG-KA RESPONSE: Page 22, section 5.0(c)(3) was revised as, "The results of the most recent spatially relevant completed biennial USFWS and NMFS Inventory of Endangered Species and Other Wildlife Resources, and species and habitats of concern (UES Appendices 3-4A through 3-4D) will be consulted in the planning and implementation of all dredge and fill projects."

COMMENT 31: Page 22, 5.0 (c)(3), line 5 and Page 23, (5), lines 1-2. Change to, "…identify and, to the extent warranted, quantify significant and"
USAG-KA RESPONSE: Page 22, 5.0(c)(3), line 5 and Page 23,(5), line 1 was revised as "A marine biological resources evaluation will be performed at the project site to identify and, to the extent warranted, quantify significant and endangered species in the vicinity of the activity."

COMMENT 32: Page 23, (4), line 3. Add in "will be" provided to the Appropriate Agencies...
USAG-KA RESPONSE: Pages 23, (4) was revised as, "Proposed dredging activities in an area where previous sediment testing indicates contamination will be coordinated with the USAG-KA Environmental Engineer, and information on the extent of contamination will be provided to the Appropriate Agencies along with the Project Description Sheet before any dredging activities may proceed."

COMMENT 33: Page 25, (9). We also identified large beds of seagrass in Illegini Harbor in the 2014 Inventory. Illegini should be added to the list here.
USAKA RESPONSE: Page 25, (9) was revised as, "Rare seagrasses are found in the lagoons near several of the islets (see NCA, Appendix C). Prior to dredging and filling activities, survey will be conducted to delineate any bed boundaries."

COMMENT 34: Page 26, (7). Add an "or" before "in sensitive marine habitats."

USAG-KA RESPONSE: Page 26, (7), revised as "Dredged spoils will not be stockpiled on the beach areas, reef flats, or in sensitive marine habitats."

COMMENT 35: Page 26, (13), line 1. Typo. Remove comma and change "is" to "are."
USAG-KA RESPONSE: Page 26, (13), line 1 was revised as "Non-hazardous dredge spoils that are to be saved for use in filling or other projects will be dewatered and stored in an upland area designated by USAG-KA for such usage."

COMMENT 36: Page 27, (f)(1)i. Might want to tailor wording as emergency notifications will not be needed for coordinated transplantations or impacts to species.
USAG-KA RESPONSE: Page 27, (f)(1)i was revised as "In the event any listed species, living coral, habitats of special concern, or migratory birds are disturbed, injured, or killed due to dredge and fill activities, the Appropriate Agencies will be informed by USAG-KA within 24 hours by the most expeditious means available (UES §2-7.3,*Emergency Notifications*)."

COMMENT 37: Page 30. (3). Extensive beds of seagrass were also observed in Illegini Harbor in 2014.
USAG-KA RESPONSE: Assuming the 2014 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2014 Inventory.

COMMENT 38: Page 30, (4) line 1. Typo "Mostare."
USAG-KA RESPONSE: Page 30, (4), line 1 revised to "Most are...."

COMMENT 39: Page 31 (6). All corals are coordination species (likely goes well beyond 4 families), and some of the species require consultation. All the corals are 'species of concern" under the UES.
USAG-KA RESPONSE: Page 31 (6) was revised as, "All corals present at Kwajalein Atoll are considered species of concern and may trigger coordination procedures with Appropriate Agencies (UES Appendix 4-4C). Additionally, a number of coral species are included in UES Appendix 3-4A and, as such, require consultation with Appropriate Agencies."

COMMENT 40: Page 31 (7) ii and Page 32(8)ii and Page 32 (9)ii. The 2012 inventory surveyed patch reefs and lagoon slopes, not the USAKA islets, in contrast to what is stated. Think what is being referenced is the summary table which includes information from past recent inventories as well as project related assessments?
USAG-KA RESPONSE: Page 31 (7) ii, sponge information was removed and replaced with protected fish at the patch reefs and lagoon slopes in 2012, Page 32(8)ii was revised to reflect that the species were identified at the patch reefs and lagoon slopes in the 2012 inventory and in the near-shore ocean waters in previous inventories. Page 32 (9)ii was revised to reflect that the evidence of pearl oysters noted was in a previous inventory.

COMMENT 41: Page 32(b). The harbors were surveyed in 2014 and will be reported on within the next 6 months (funding recently received).
USAG-KA RESPONSE: Assuming the 2014 Inventory is published prior to issuance of the Final DEP, this section will be revised to reference the published 2014 Inventory.

Appendix A

Notice of Continuing Activity:
Dredging and Filling,
Control Number NCA-16-001.0, July 2016

NOTICE OF CONTINUING ACTIVITY

ACTIVITY:
DREDGING AND FILLING

CONTROL NUMBER NCA-16-001.0

July 2016

**U.S. ARMY KWAJALEIN ATOLL/RONALD REAGAN BALLISTIC MISSILE DEFENSE TEST SITE
IN THE
REPUBLIC OF THE MARSHALL ISLANDS**

PREPARED BY KWAJALEIN RANGE SERVICES, LLC.

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NOTICE OF CONTINUING ACTIVITY (NCA)

ACTIVITY: DREDGING AND FILLING - USAKA

DATE SUBMITTED: July 2016

REFERENCES:

- Teledyne Solutions, Inc. *United States Army Kwajalein Atoll (USAKA) Shoreline Protection Survey.* February 24, 2007.
- U.S. Army Corps of Engineers. *Shoreline Inventory for the Islands of Roi-Namur, Kwajalein and Meck.* February 2009.
- Kwajalein Range Services. *Critical Erosion Areas on Roi-Namur.* July 2016
- U.S. Army Space and Missile Defense Command/U.S. Army Forces Strategic Command. *Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands,* 14th Edition. September 2016.
- United States Army Kwajalein Atoll. *Historic Preservation Plan.* August 2006.
- United States Army Kwajalein Atoll. *Document of Environmental Protection: Point-Source Discharges*; DEP-12-002.0, July 2014.
- United States Army Kwajalein Atoll. *Document of Environmental Protection: Protection of Cultural Resources*; DEP-04-001. November 2004.
- United States Army Kwajalein Atoll. *Water Quality Management Plan.* September 2015.
- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). *2010 Inventory of Endangered Species and Other Wildlife Resources, Ronald Reagan Ballistic Missile Defense Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands.* December 2012.
- U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). *2012 Marine Biological Inventory, the Mid-Atoll Corridor at Ronald Reagan Ballistic Missile Defense Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands.* December 2013.

TYPE OF ACTIVITY:

The purpose of this Notice of Continuing Activity (NCA) and the companion Document of Environmental Protection (DEP) is to establish requirements and limitations for both routine and non-routine dredging and/or filling projects. Maintenance dredging and/or filling is required to restore existing harbors, channels, shorelines, and structures in or near the shoreline at U.S. Army Kwajalein Atoll (USAKA) in the waters of the Republic of the Marshall Islands (RMI). Dredging and/or filling work is required for new marine construction and restoration projects, maintenance of existing structures, and protection of shorelines. Quarrying activities are not authorized by this NCA and companion DEP and will require a separate NCA and DEP.

The NCA and DEP process proposed herein is similar to the "general" permits (and approval process) authorized by the United States Army Corps of Engineers (USACE) under Section 404 of the U.S. Clean Water Act (33 U.S. Code [USC] 1344) for work in and around the waters of the U.S. Approval of a DEP for dredging and filling does not eliminate the need for separate National Environmental Policy Act (NEPA) documentation for dredge and/or fill activities at USAKA.

This NCA and the associated DEP references various documents and reports; it is expected that the most current version of any of the reports available will be used for project planning.

This NCA identifies dredge and fill locations and specific dredging, filling, and/or shoreline protection projects in advance of actual need, and provides information on the surrounding area, existing environmental conditions, and required environmental controls. The NCA prescribes a shortened, multi-step approval process so that when dredge and/or fill work is needed, details on individual dredge or fill project design, spoils and borrow areas, and required environmental controls can be finalized, and the project can be submitted to the United States Army Garrison – Kwajalein Atoll (USAG-KA) Environmental Engineer or Appropriate Agencies for their concurrence prior to project start.

The DEP will authorize, with the approval of the USAG-KA Environmental Engineer, dredging and/or filling projects of approximately 25 cubic yards (CY) or less, hereinafter referred to as the "small quantity exception." The small quantity exception applies to new projects, maintenance, repair, or clean-out of previously dredged or filled areas, such as build-up in front of water intakes, stormwater discharge outfalls, or marine ramps, and placement of fill for repair to shorelines and/or shoreline protection structures. All environmental controls necessary to protect the environment will be employed (See Section 5.0 of this NCA). All projects requiring greater than 25 CY of material will require review and approval by the Appropriate Agencies prior to implementation.

There may be need for immediate or emergency repairs to shore protection or other structures as a result of damage from major ocean storms or accidents. The USAG-KA Environmental Engineer may determine a situation to constitute an emergency condition which are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural or cultural resources. Under such circumstances, the procedures of project authorization typically required for dredge, fill, or shoreline work within the scope of this NCA and associated DEP may be superseded in order to facilitate a more immediate response time.

Dredging and/or filling activities incidental to construction for the placement of new structure in the lagoon or ocean (e.g., communication lines, pipelines, power lines, range instrumentation, shore protection devices, etc.), are subject to requirements of this NCA and associated DEP. Project areas for all proposed dredge and fill activities (including those ≤ 25 yd3 in volume) will be visually examined and/or surveyed for potential impacts to marine resources and habitats. Intakes will be assessed to the fullest extent possible by examining the end of the pipe and the immediate area. Any project including potential impacts to USAKA species and habitats in UES Appendices 3-4A through 3-4D will require coordination with NMFS and USFWS to determine if a Special Condition applies due to presence of listed species. Projects determined to include a

Special Condition will require Appropriate Agency notification, and approval prior to implementation.

As covered by this NCA and associated DEP, dredging includes the deepening of harbors and channels and the clean-out or removal of silts and other natural materials from marine ramps, water intakes and stormwater outfalls. Dredging also includes the disturbance of materials associated with the construction of new in-water or shoreline structures (i.e. jetties, piers, outfalls, etc.), shoreline protection projects, or the renovation of existing facilities. The removal of manmade objects or obstructions that have fallen or fall into the water is not considered dredging and, therefore, is not regulated by this DEP.

Dredging may be accomplished using hydraulic dredges and pipelines, or by using cranes with buckets or draglines, sometimes from shore and sometimes from barges. As covered by this NCA and associated DEP, dredging includes the deepening of existing harbors and channels and the clean-out/removal of silts and other natural materials from marine ramps, water intakes and stormwater or other type outfalls. Clean-out around marine ramps and intake or outfall pipes is a continual requirement and should be done with a frequency that ensures good operation and maintenance practices. Procedures described in this DEP for small dredging removals (less than or equal to 25 cubic yards of material) do not require specific agency review of the activity.

Dredging may involve disposal of dredged material (i.e. spoils) either on land or in the waters adjacent to the dredging site. Proposals which include the disposal of dredge spoils in the marine environment will be evaluated by the USAG-KA Environmental Engineer or Appropriate Agencies. Any dredged material to be disposed of in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts to marine flora and fauna associated with siltation, spillage, and turbidity.

Pile driving is authorized in this DEP for repair/replacement of existing pilings. The guidelines for such an activity must follow procedures outlined in this DEP as well as the USAKA Environmental Standards (UES) §3-2.7.2(b) (1) – (6).

Quarrying operations are not authorized by this document.

This NCA and associated DEP covers the placement of fill for new and recurring operations, maintenance, and repair and construction activities. Filling involves the placement of earthen materials (rock, sand, or soil), and, sometimes, concrete or rubble, either on the shoreline or off-shore, for construction of new shoreline or in-water structures (i.e. jetty, pier, outfall, etc.), for the protection and maintenance of existing shorelines or facilities to replace material lost to erosion, damage, or accidents, or to reinforce existing foundations and supports. Any fill material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts to marine flora and fauna associated with siltation, spillage, and turbidity. Furthermore, any fill material placed into the marine environment will be oriented in a manner that does not alter coastal hydrology to the extent that deposition may accumulate and degrade marine habitat. Proposals including construction of new shoreline or in- water structures may require hydrology studies to assess potential impacts to the marine environment.

Critical erosion, as described in this NCA and associated DEP, is defined as erosion that threatens public safety, infrastructure, or cultural, historical, or natural resources. Critical erosion areas, along with non-critical erosion areas identified in the 2007 Teledyne shoreline survey, the 2009 USACE shoreline inventory and the 2016 KRS supplemental survey, are documented to establish a baseline of the existing conditions for nine of the eleven islets. USAG-KA may choose to periodically inspect these areas to document changing conditions and determine if additional protective actions are necessary.

LOCATION OF ACTIVITY

Eleven (11) islets throughout USAKA are covered by this NCA. The areas specified are the harbors, channels, shorelines, marine ramps, piers, and outfall and intake structures at Kwajalein, Roi-Namur, Meck, Illeginni, Ennylabegan, Legan, Gagan, Gellinam, Omelek, Eniwetak, and Ennugarret, as well as any dredge and or fill activities conducted by USAG-KA in the RMI or RMI waters. NCA Appendix C describes these areas and discusses potential dredge, fill, and shoreline protection projects and known environmental conditions. Locations where dredging and filling are protected are identified in the USAG-KA *Water Quality Management Plan* (WQMP) and UES §3.2.3. Maps showing areas prohibited from dredging and filling are also provided in NCA Appendix C.

COMPLIANCE STATUS

If dredging and/or filling activities are required at USAKA, the procedures and environmental controls described herein shall be followed in compliance with the UES and the requirements of this NCA and companion DEP.

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ABBREVIATIONS AND ACRONYMS

CY	Cubic yard
DEP	Document of Environmental Protection
ECR	Environmental Comments and Recommendations
HPP	Historic Preservation Plan
IAW	In accordance with
KEEP	Kwajalein Environmental Emergency Plan
KRS	Kwajalein Range Services
µg/L	Micrograms per liter
LCM	Landing Craft Module
LCU	Landing Craft Utility
NCA	Notice of Continuing Activity
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Unit
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RMIHPO	Republic of the Marshall Islands Historic Preservation Officer
UES	USAKA Environmental Standards
USACE	United States Army Corps of Engineers
USAG-KA	United States Army Garrison - Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WQMP	Water Quality Management Plan

1.1 TECHNICAL DESCRIPTION OF ACTIVITY

1.2 General

As covered by this NCA, dredging at USAKA is used for restoring existing harbor and channel depths, construction of new structures, as well as renovation of existing facilities. Filling is used to create new shoreline or in-water structures and repair or restore foundation sediment around piers, ramps, shorelines, and shore protection structures. Dredging and/or filling of reef, lagoon, and ocean areas are important to operations at USAKA, and there are usually few alternatives to dredging or filling except cancellation or relocation of marine transportation activities or relocation of structures away from the water. In view of the potential for damage to the reef and marine habitats and resources, the UES regulations are very specific with regard to dredging and/or filling activities (UES §3-2.7.2 is attached as Appendix A).

Dredging may be accomplished using hydraulic dredges and pipelines, or by using cranes with buckets or draglines, sometimes from shore and sometimes from barges. Dredged material, or spoils, will either be reutilized as fill material or disposed of on land, delivered either by pipeline or by barge. Disposal of dredge spoils in the water adjacent to the dredge site may be permissible, provided the requirements in this NCA and associated DEP are satisfied.

The removal of coral will be identified in the Project Description Sheets submitted to the Appropriate Agencies.

Filling involves the placing of earthen materials (sand, rock, or soil), and sometimes, concrete or rubble (often referred to as "riprap"), either on the shoreline or offshore, for the construction of new in-water or shoreline structures or the protection and maintenance of existing shorelines, infrastructure or facilities. The removal of manmade objects or obstructions that have fallen or fall into the water is not considered dredging, therefore, is not addressed in this NCA.

A February 2007 shoreline survey was conducted by Teledyne of 9 of the 11 USAKA islets: Kwajalein, Roi-Namur, Meck, Ennylabegan, Illeginni, Legan, Gellinam, Gagan, and Omelek. Ennugarret and Eniwetak were not surveyed; however, the steps described in this NCA and the follow on DEP still apply to these two islets. This report is provided as Appendix D to this NCA. In February 2009, a shoreline inventory for the islets of Roi-Namur, Kwajalein and Meck was prepared by the U.S. Army Corps of Engineers (USACE). Although the report was not completely finalized, it did classify shorelines as "Critical", "Potentially Critical" and "Non-Critical", and is provided as Appendix E. Additionally, in 2016 Kwajalein Range Services (KRS) conducted a supplemental survey for the islet of Roi-Namur to assess the current status of previously undocumented areas. A memorandum of this survey is provided as Appendix F.

Critical erosion is defined as erosion that threatens public safety, infrastructure or cultural, historical, or natural resources. Critical and non-critical erosion areas are documented in the 2007 Teledyne shoreline survey and the 2009 USACE shoreline inventory to establish a baseline of the existing conditions. USAG-KA may choose to periodically inspect these areas to document changing conditions and determine if additional protective actions are necessary. One such undertaking is documented in the 2016 KRS supplemental survey.

1.3 Activity Locations

Except where dredging and/or filling activities are protected (as identified in the WQMP), dredging and/or filling could be necessary at any of the 11 islets operated by USAG-KA, and dredging could be necessary in the ocean and lagoon areas that support water traffic (See Figure 1 below). The scope of this NCA and associated DEP is for dredging and/or filling activities at the 11 islets where USAG-KA plans to continue operations and for which information is currently available: Kwajalein, Roi-Namur, Meck, Illeginni, Ennylabegan, Legan, Gagan, Gellinam, Omelek, Eniwetak, and Ennugarret, as well as any dredge and or fill activities conducted by USAG-KA in the RMI or RMI waters.

Figure 1 shows the location of the USAG-KA-operated islets (and the other islets regularly visited by USAKA vessels) and the navigable boat channels and passes. Most of the passes and channels leading into the lagoon from the ocean and the inter-atoll channels are naturally deep and dredging is not commonly necessary.

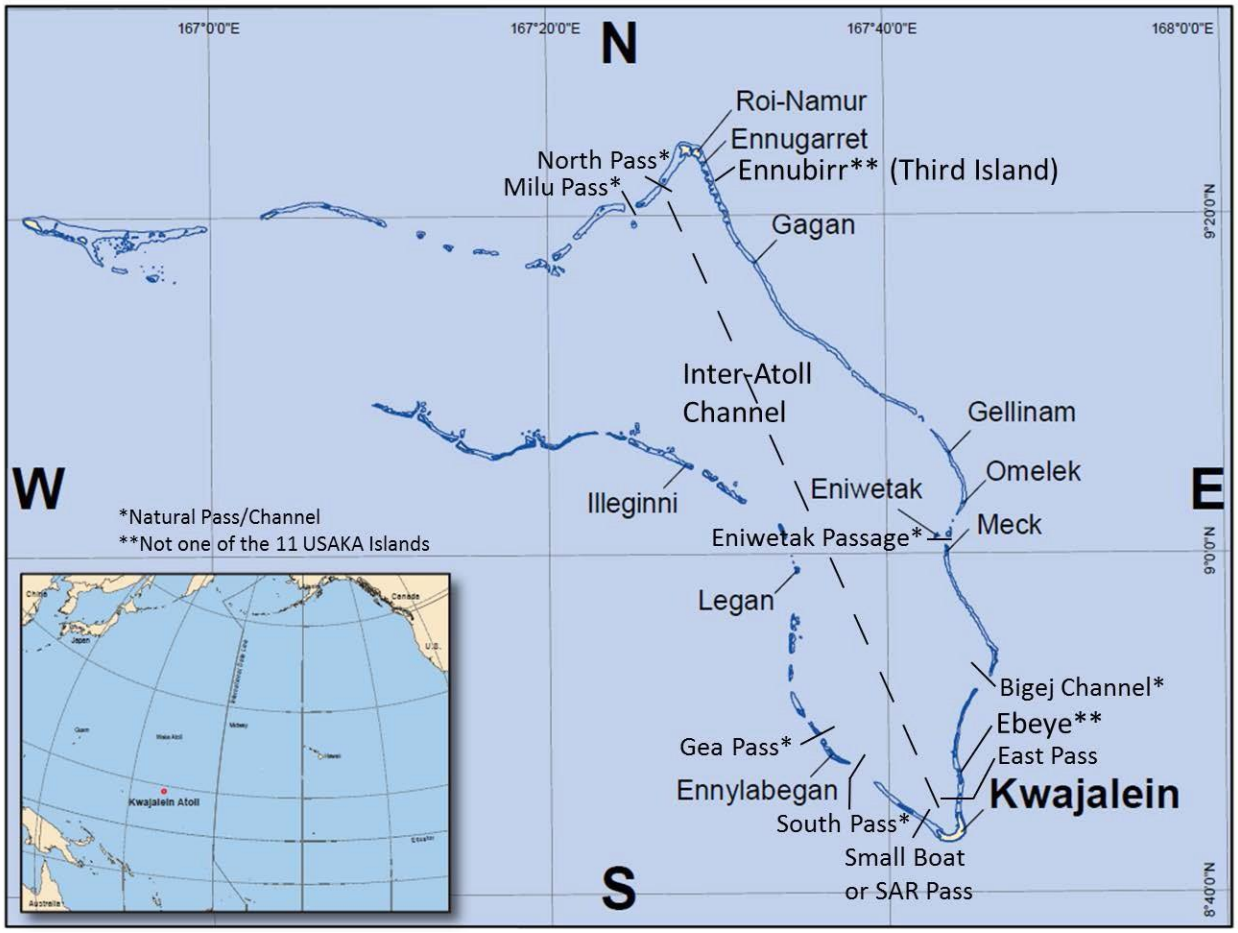

Figure 1 Map of Kwajalein Atoll

1.4 Dredging

As covered by this NCA, dredging includes the deepening of harbors and channels and the clean-out or removal of silts and other natural materials from marine ramps, water intakes and stormwater outfalls. Dredging also includes the disturbance of materials associated with the construction of new in-water or shoreline structures (i.e. jetties, piers, outfalls, etc.), shoreline protection projects, or the renovation of existing facilities. The 1993 USAKA Supplemental Environmental Impact Statement (SEIS) states "on average approximately 10,000 CY of material are dredged annually from USAKA harbors and channels." Dredging involves disposal of dredged materials, or spoils, either on land or in the water in the vicinity of the dredging site. Past dredging at USAKA was accomplished using either hydraulic dredge with spoils disposal on land via pipeline or barge, or by using a crane with clamshell or dragline from a barge or from onshore with onshore spoils disposal. Most dredging activities occurring currently at USAKA are small scale removals as part of regular maintenance of shorelines and outfalls.

1.5 Dredging Requirements

Requirements for harbor and channel dredging vary considerably by islet and are primarily marine traffic, weather, and/or ocean current dependent; i.e., the channel depth and turning radius needed to accommodate the largest expected vessels, and the degree storms, adverse weather, and currents caused silting in or around boat harbors, channels, ramps, and intake and outfall pipes. Harbor and channel dredging requirements usually result from periodic inspections and by reported problems negotiating particular harbors or channels. While USAG-KA maintains no recurring dredging schedule, manmade harbors and channels typically require periodic dredging to maintain operating capacity. Natural passes and channels seldom require dredging as most are already deep enough to pass most vessels.

Clean-out dredging around marine ramps, and intake and outfall pipes is a continual requirement and should be done with a frequency that both ensures good operation and maintenance practices. Regular maintenance dredging may often qualify for the 25 CY or less small quantity exception (See NCA Section 1.5.1).

1.6 Required Depths

Required depths for USAG-KA vessels and for supporting commercial shipping and fuel barges are shown in Table 1. Required depths for USAKA harbors, channels, and passes are shown in Tables 2 and 3. Except as noted, the Landing Craft Utility (LCU), such as the Great Bridge, is the design vessel used most for harbor and inter-atoll traffic.

Table 1 Vessels Using USAKA Harbors and Channels

VESSEL	DRAFT (FT)	DEPTH REQ'D (FT)
Recreational-Use Boats	3-5	7-8
Catamarans	6.5	10-12
Landing Craft Modules (LCM)	5	7-8
LCU (Great Bridge)	9-11	12
Tug Boats w/Barge	13.5-15	15
Kwajalein Mobile Range Safety System (KMRSS, Worthy)	14	15-16
Matson Container Ship	23	25-30
Fuel Tankers (T-5)	34	38-40
Fuel Barges	< 10	12
Patriot	4	6
Blount Design Ferry Boat	6	8

Table 2 Harbor Depth Requirements

HARBOR	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CONDITION (AS OF JULY 2016)	REMARKS
Kwajalein				
Inner Harbor (area between the cargo pier and fuel pier)	Tugs, KMRSS, ferry boats, catamarans, Patriot, recreational-use boats	20	Depth marginal	Needs dredging
Cargo Pier	Matson container ship, KMRSS, ferry boats, catamarans, visiting vessels	30	Depth satisfactory	Need to monitor
Fuel Pier	Fuel tankers	35	Depth satisfactory	Potential project
Syncro-Lift	LCUs, tugs, barges, catamarans, Patriot	28	Depth satisfactory	Potential project
Barge Slip Ramp	Tugs, barges, LCUs/LCMs	18	Depth satisfactory	
Ebeye Pier	Matson container ship, ferry boats, recreational-use boats	30	Depth unknown	Need to monitor Potential project
Roi-Namur				
Cargo/Fuel Pier	LCUs, tugs, barges	16	Depth unsatisfactory	Need to monitor
Yokohama Pier	LCMs, catamarans, ferry boats	12	Depth unsatisfactory	Needs dredging
Ennubirr (Third Island) Pier	Ferry boats, recreational use boats	8	Unknown	Needs to be evaluated and potentially dredged
Meck	LCUs, LCMs, tugs, barges, catamarans	18	Depth unsatisfactory	Needs dredging
Omelek	LCUs, LCMs	12	Depth satisfactory	--
Ennylabegan	LCUs, LCMs	15	Depth unsatisfactory	Enlarge turning basin. Blasting required
Legan	LCUs, LCMs	12	Depth may be unsatisfactory	Very tight turn to enter
Illeginni	LCUs, LCMs, tugs, barges	15	Depth unsatisfactory	--
Gagan	LCUs, LCMs, tTugs, fuel barges	15	Depth unsatisfactory	--
Gellinam	LCUs, LCMs, tugs, fuel barges	15	Depth satisfactory	Breakwater deteriorating
Eniwetak	LCMs, Patriot	8	Depth satisfactory	Current controlling depth is 8 feet

Table 3 Channel Depth Requirements

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CONDITION (AS OF JULY 2016)	REMARKS
Gea Pass	Matson container ship, fuel tankers	100	Depth good	Natural pass
Search & Rescue (SAR) Pass	Recreational-use boats	8-10	Possible silting	Manmade pass
South Pass	LCMs, Recreational-use boats, KMRSS, LCUs	25	Depth satisfactory	Natural pass
South Pass to Kwaj Cargo Pier (north approach)	Matson Containership, Fuel Tankers, Tugs, Barges	45	Depth satisfactory	Inter-atoll channel
South Pass to Kwaj Cargo Pier (south approach)	Matson container ship, fuel tankers	45	Depth satisfactory	Inter-atoll channel
Kwaj Cargo Pier to Ebeye	Matson container ship, KMRSS, catamarans, tankers, Recreational-use boats, ferry boats	45	Possible silting	Inter-atoll channel
Inter-Atoll Channel (also known as Kwaj-Roi Highway)	LCUs, LCMs, catamarans, tugs, visiting vessels, recreational-use boats, barges, KMRSS, Patriot	45	Depth satisfactory. Coral heads often a problem	Inter-atoll channel
Roi-Namur to Ennubirr (Third Island)	LCMs, catamarans, ferry boats	12	Depth satisfactory. Coral heads need removal	Inter-atoll channel
East Channel	--	--	--	Not used
Eniwetak Pass	Tugs	25	Depth satisfactory. Coral heads often a problem	Natural pass
Bigej Pass	Tugs	45	Possible silting	Natural pass
North Pass	Tugs, LCUs, KMRSS	90	Depth good	Natural pass
Mellu Pass	Tugs, LCUs, KMRSS	90	Depth good	Natural pass

1.6.1 Existing Harbor/Channel Conditions

Harbor and channel silting does not occur at USAKA to the same extent it does in U.S. stateside harbors. Channel depths are satisfactory with a few minor exceptions. Some islet harbor depths become unsatisfactory and require dredging. The ocean passes and channels are naturally deep, and dredging would only be required in the event of shoaling from a major ocean storm or a significant change in ocean currents. Most inter-atoll channels are acceptable depths except for occasional coral heads. The removal and method of removal of any coral will be identified in the Project Description Sheets submitted to the USAG-KA Environmental Engineer or UES regulatory agencies identified in this NCA and associated DEP.

1.6.2 Areas to Monitor

(a) Potential dredging needs at USAKA are the following:

(1) Kwajalein inner harbor

(2) Kwajalein barge slip ramp (BSR), fuel pier, Syncro-Lift areas, and Echo Pier

(3) Piers, barge ramps, harbors, and outfalls:

i. Roi-Namur cargo/fuel pier and Yokohama Pier
ii. Meck pier, dolphin pier, and marine ramp
iii. Ennylabegan cargo/personnel pier and marine ramp
iv. Illeginni piers and marine ramp
v. Legan pier, marine ramp, and mooring area
vi. Gagan pier and marine ramp
vii. Eniwetak pier, marine ramp, and mooring area
viii. Ebeye harbor
ix. Ennubirr harbor

(4) Search and Rescue (SAR) Pass (manmade)

(5) Approach channel to Ennubirr (Third Island) from Roi-Namur

(6) Salt water intake at Roi-Namur

(7) Mid-Atoll Corridor

(8) Fiber optic cable (lagoon –wide)

(9) Roi-Namur fuel pier and Yokohama Pier Access Channel

(10) Legan Harbor Access Channel

(11) Gagan Harbor Access Channel

(12) Eniwetak Harbor Access Channel

(13) Kwajalein Echo Pier to Ebeye Channel

(14) Bigej Pass

1.6.3 Potential Dredging Projects

(a) Appendix C lists the potential dredging locations at USAKA covered by this NCA, specifically the harbors, channels and shorelines at the 11 USAG-KA-operated islets and other RMI areas of interest, and identifies individual projects where known. Information in Appendix C includes:

(1) A description of the area to be dredged or filled

(2) A listing of potential dredging or filling projects in each area

(3) Known environmental conditions and documents

(4) Maps of the area showing:

i. Classification of coastal water use
ii. Marine biological resources
iii. Areas where dredge and fill are protected as identified in the WQMP
iv. Location of harbor/port facilities

1.7 Filling

In past years, going back to the Japanese occupation of the islets, considerable amounts of fill material were added to many of the atoll islets to expand land area for use by inhabitants or to dispose of wartime debris and/or discarded equipment. Figure 2 illustrates the extent of past filling at Kwajalein.

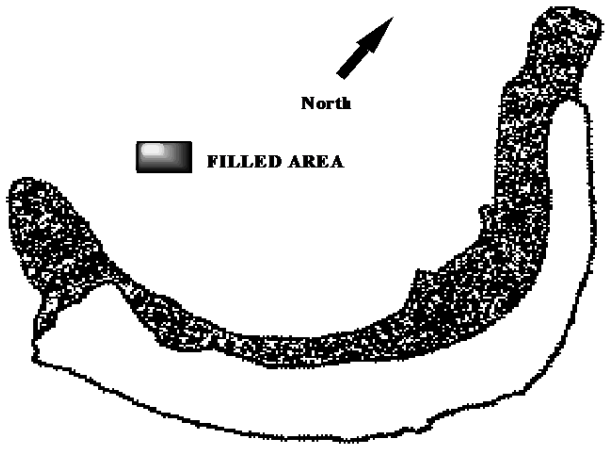

Figure 2 Extent of Filled Area at Kwajalein

1.7.1 Fill Requirements

Virtually any existing facility or structure along the shorelines of the 11 USAKA islets covered by this NCA, to include shore protection, could require filling type work under this NCA. Filling involves the placing of earthen materials (sand, rock, or soil), and sometimes, concrete or rubble (often referred to as "riprap"), either on the shoreline or offshore, for the construction of new in-water or shoreline structures or the protection and maintenance of existing shorelines, infrastructure or facilities. Under this NCA, fill material, to include concrete rubble, would be placed near or adjacent to a structure or facility to replace material lost to erosion, damage, or accidents, or to reinforce existing foundations and supports, which may include the placement of fill below the waterline. Any fill material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts to marine flora and fauna associated with siltation, spillage, and turbidity. Disposal of wet concrete into the water, over the reef edge or on shore protection structures is prohibited. The UES states that no project involving dredging, quarrying, or discharge of dredged or fill materials shall be undertaken in USAKA waters at a depth of less than 30 feet below the mean low water line, unless authorized in a final DEP. The DEP associated with this NCA will authorize dredging and filling in such waters.

1.7.2 Potential Fill Projects

Potential filling projects include repairs or restoration to existing filled areas, and to structure foundations built along the shoreline or in the water (such as piers or docks, the Syncro-Lift facility, the saltwater intakes, and foundations for power lines and range instrumentation). Appendix D and Appendix E lists some of the potential shoreline protection locations at USAKA covered by this NCA. The 2009 Shoreline Inventory (Appendix E) cites 2,462 feet of the inventoried 37,335 feet of shoreline identified as critical.

1.7.3 Shoreline Protection

(a) Severe shoreline erosion exists on Kwajalein, Roi-Namur and other islets. USAG-KA has proposed major projects to restore these shorelines and provide shore protection.

(b) This NCA and the associated DEP will identify areas of critical and non-critical shoreline erosion at USAKA. Areas with critical erosion identified in the 2007 Teledyne shoreline survey, the 2009 USACE shoreline inventory, the 2016 KRS supplemental survey and areas that have had shoreline protection activities in recent years are the following:

(1) Kwajalein 1: MPS 36 – roadway undercut

(2) Kwajalein 2: Between Kwaj Lodge and the Adult Pool – erosion exposing unexploded ordnance

(3) Kwajalein 3: South of Adult Pool – erosion ledge

(4) Kwajalein 4: Emon Beach – sand loss exposing hard coral base

(5) Kwajalein 5: Barge Slip Ramp

(6) Kwajalein 6: Ocean side of Mt. Olympus – unpaved path and community interest area (pet cemetery)

(7) Roi-Namur 1: Yokohama Pier area – erosion impacting building and beach area

(8) Roi-Namur 2: Japanese pillbox – impacted by surf

(9) Roi-Namur 3: Southwest end of runway, lagoon side – erosion; loss of beach

(10) Roi-Namur 4: Across from waste water treatment plant, running southward along Speedball – erosion ledge near roadway with emergency shoreline protection near waste water treatment plant

(11) Roi-Namur 5: Southeastern shore of Roi, near beach shacks – significant erosion

(12) Roi-Namur 6: Northern shore of Roi – erosion and undercutting east of the radars

(13) Roi-Namur 7: Tank trap area, northeast of Dyess Army Airfield – inundation presents hazard to airfield and drinking water source

(14) Roi-Namur 8: East of the historic Japanese air operations building – insufficient rip rap allows seawater to breach the shoreline

(15) Roi-Namur 9: Northwestern shore of Namur – seawater breaching west of TRADEX

(16) Illeginni 1: Building 9061 – erosion ledge threatening structure

(17) Illeginni 2: Detection Tower – erosion ledge threatening structure

(18) Gagan 1: Japanese pillbox – historic structure in surf

(19) Omelek: No critical areas identified

(20) Ennylabegan, Gellinam, Legan, and Meck: No critical areas identified

1.7.4 Emergency Repairs

There may be need for immediate or emergency repairs to shore protection or other structures as a result of damage from major ocean storms or accidents. The USAG-KA Environmental Engineer may determine a situation to constitute an emergency condition which are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural or cultural resources. Under such circumstances, the procedures of project authorization typically required for dredge, fill, or shoreline work within the scope of this NCA and associated DEP may be superseded in order to facilitate a more immediate response time. Within 24 hours of discovery of an imminent and substantial endangerment, USAG-KA will notify the Appropriate Agencies of the emergency condition. Within 10 days following emergency notification, USAG-KA will submit written notification of the circumstances and

actions taken to mitigate the threat to human health or the environment to the Appropriate Agencies. The written report will contain, at a minimum, the relevant information described in UES Section 2-7.2.2.

1.8 Project Procedures

(a) Two procedures are proposed for dredge and fill projects. The first is referred to as the "small quantity exception" for small dredge or fill projects involving approximately 25 CY of material or less and "Without" Special Conditions. These projects may include cleaning out silt and debris in front of a water intakes, outfalls, or marine ramps or performing minor shoreline protection repairs. The second procedure is a dredge or fill project involving more than 25 CY of material, and/or "With" Special Conditions. Both procedures have equivalent environmental protection and control requirements, except that prior Appropriate Agency review is not required for projects involving less than 25 CY of material that are "Without" Special Conditions.

(b) Special Conditions, qualify as follows:

(1) Create cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area,

(2) Impacts USAKA species and habitats in UES Appendices 3-4A through 3-4D, coordination with the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) is required to determine if a Special Condition applies due to presence of listed species.

(3) Determined to be an "undertaking", in accordance with the current DEP for *Protection of Cultural Resources*, and the Historic Preservation Plan (HPP),

(4) Involve the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects,

(5) Involve projects of any size on Eniwetak,

(6) Involve a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand),

(7) Involves use of explosives,

(8) Involves quarrying.

(c) Only projects that have no involvement with protected species or habitats as listed in the most recent updates to UES Appendices 3-4A thru 3-4D may proceed without Appropriate Agency approval. Projects that are determined not to be "undertakings" in accordance with the DEP for Protection of Cultural Resources and the HPP, may be executed without Republic of the Marshall Islands Environmental Protection Authority (RMIEPA) and Historic Preservation Office (RMIHPO) approval.

(d) USAG-KA will consult with the Appropriate Agencies regarding mitigation where loss or impact to coral(s) or protected species or habitats by dredge and/or fill operations would occur. USAG-KA may consider mitigation on a regional ecosystem basis within Kwajalein Atoll, and may implement mitigation projects on land or submerged lands that are outside of USAG-KA's control in accordance with this DEP (however this does not obviate the need for other agreements or approvals).

1.8.1 Small Dredge and Fill Projects for Less than or Equal to 25 CY of Material, and "Without" Special Conditions

For dredge and fill projects involving 25 CY or less of dredge or fill material, and "Without" special conditions, USAG-KA may proceed with the work, provided the work is described in a "Dredge and/or Fill Project Description Sheet 1" (Figure 3). The project sheet will be submitted to the USAG-KA Environmental Engineer no later than 14 days prior to beginning work. The project must be covered by an appropriate NEPA document. The USAG-KA Environmental Engineer has the authority to authorize the work IAW this NCA and associated DEP, and to stop the work if appropriate environmental controls are not used or there is a potential harm to the environment. The USAG-KA Environmental Engineer will maintain records on all such projects for agency review. If species listed in the most recent updates to UES Appendices 3-4A or 3-4C will potentially be affected by the project the NMFS and USFWS will be consulted.

1.8.2 Dredge and Fill Projects Involving More than 25 CY of Material, and/or With Special Conditions

For each dredge and fill project in areas authorized by this DEP, requiring dredge or fill of greater than approximately 25 CY of material, and/or "With" special conditions, a "Dredge and/or Fill Project Description Sheet 2" (Figure 4) will be submitted for review, comment, and signature by the Appropriate Agencies. All agency comments will be addressed before final project approval is granted.

1.8.3 Routine Dredge and Fill Projects

Dredge and/or fill projects that may occur routinely can be covered under a single Project Description Sheet as long as the activity remains within the scope of the approved Project Description Sheet and associated NEPA documentation. This may apply to projects such as the movement of sand on Emon Beach that occurs approximately every six months with no significant changes to the nature or scope of work.

Additionally, a single dredge and/or fill Project Description Sheet can be used to conduct similar activities at different locations and islets provided the activity remains within the scope of the approved Project Description Sheet and associated NEPA documentation. This may apply to activities associated with placement and removal of fill on the marine ramps for different islets to support the on- and off-loading of supplies/equipment from marine vessels.

1.8.4 Consolidated Fill Material

Consolidated material such as formed concrete or wood pilings, metal sheet pile, outfall pipes, or other structures to be placed in the marine environment or on the shoreline does not constitute fill

material. A Project Description Sheet for proposals involving the placement of such materials will be submitted to the USAG-KA Environmental Engineer and Appropriate Agencies as applicable. To support the assessment process, an in-water visual inspection will be performed, to include digital photo-documentation of habitats and resources, where consolidated materials for piles/pilings are to be installed.

Figure 3 Project Description Sheet 1

Dredging and/or Filling Project Description Sheet 1

Less Than or Equal to 25 cubic yards, and without Special Conditions*

Date: _____

1. Project Name:
2. Projected Start Date:
3. Project Description:
4. Projected End Date (Re-Evaluation Date for Routine Projects) :
5. Frequency of Activity (If routine project):
6. Location of Project and Project Limits:
   a. Provide maps showing the exact location of the project
   b. Show the exact limits of the project, to include spoils locations
   c. Provide digital photo-documentation of habitats and resources (shorelines and submerged lands) in areas to be dredged and/or filled
   d. State whether or not project affects any protected area as defined in UES Appendices 3- 4B and 3-4D
   e. State whether or not project is in a protected area identified in the Water Quality Management Plan
   f. Provide information on the potential for existing contamination within the proposed project area.
7. Date of Last Dredging/Filling at or near the Proposed Location:
   Describe any problems encountered, environmental issues, and the environmental controls used
8. Project is in a sensitive cultural resources area: Yes_____ No_____
   Explain if Yes:_____
9. Method of Accomplishment:
   a. Provide information on project methods and equipment to be used
   b. Provide estimated quantities of dredge and/or fill material (cubic yards)
   c. Provide information on the method, equipment, location and limits of spoils disposition (include a map or diagram)
   d. Provide project geometry (linear feet of shoreline to be protected, depth/height to be filled, bottom/top widths, side slopes, etc.)
   e. Provide estimated project duration (number of days)
   f. Provide information on quality control methods to be used
   g. Provide information on any personnel and or contractor to be used, including relevant experience

10. Environmental Issues

h. Provide information on the environmental setting
b Verify all fill material to be used for the specified project is non-hazardous and non-polluting
c. Provide information on the environmental controls to be used
d. Provide NEPA documentation covering the project
e. Provide type of marine species present, including coral and any species protected in UES Appendices 3-4A and 3-4
f. Provide Public Notification, including notice date and broadcast media

_____ _____

USAG-KA Environmental Engineer Date

*** Special Conditions qualify as follows:**

i. Create cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area.

ii. Impacts USAKA species and habitats in the most recent updates to UES Appendices 3-4A through 3-4D, coordination with NMFS and USFWS is required to determine if a Special Condition applies due to presence of listed species,

iii. Determined to be an "undertaking", in accordance with the DEP for *Protection of Cultural Resources,* DEP-04-001 and the Historic Preservation Plan (HPP),

iv. Involve the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects,

v. Involve projects of any size on Eniwetak,

vi. Involve a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand),

vii. Involves use of explosives,

viii. Involves quarrying, which is not authorized by this DEP.

Figure 4 Project Description Sheet 2

Dredging and/or Filling Project Description Sheet 2

Greater Than 25 cubic yards, and/or with Special Conditions*

Date: _____

1. Project Name:
2. Projected Start Date:
3. Project Description:
4. Projected End Date (Re-Evaluation Date for Routine Projects):
5. Frequency of Activity (If routine project):
6. Identify applicable Special Condition
7. Location of Project and Project Limits:
   a. Provide maps showing the exact location of the project
   b. Show the exact limits of the project, to include spoils locations
   c. Provide digital photo-documentation of habitats and resources (shorelines and submerged lands) in areas to be dredged and /or filled
   d. State whether or not project affects any protected area as defined in UES Appendices 3-4B and 3-4D
   e. State whether or not project is in a protected area identified in the Water Quality Management Plan
   f. Provide information on the potential for existing contamination within the proposed project area
8. Date of Last Dredging/Filling at or near the Proposed Location: Describe any problems encountered, environmental issues, and the environmental controls used
9. Project is in a sensitive cultural resources area: Yes_____ No _____

   Explain if Yes: _____
10. Method of Accomplishment:
    a. Provide information on project methods and equipment to be used
    b. Provide estimated quantities of dredge and/or fill material (cubic yards)
    c. Provide information on the method, location and limits of spoils disposition (include a map or diagram)
    d. Provide project geometry (linear feet of shoreline to be protected, depth/height to be filled, bottom/top widths, side slopes, etc.)
    e. Provide estimated project duration (number of days)
    f. Provide information on quality control methods to be used
    g. Provide information on any personnel and/or contractor to be used, including relevant experience

11. Environmental Issues:
    a. Provide information on the environmental setting
    b.. Verify all fill material to be used for the specified project is non-hazardous and non-polluting
    c. Provide information on the environmental controls and monitoring procedures to be used
    d. Provide NEPA documentation covering the project
    e. Provide type of marine species present, including coral and any species protected in UES Appendices 3-4A and 3-4C
    f. Provide Public Notification, including notice date and broadcast media

Agency Approval _____ Date _____

*** Special Conditions qualify as follows:**

i. Create cumulative shoreline protection in excess of 200 linear feet within any 2,000 linear foot area.

ii. Impacts USAKA species and habitats in the most recent updates to UES Appendices 3-4A through 3-4D, coordination with NMFS and USFWS is required to determine if a Special Condition applies due to presence of listed species,

iii. Determined to be an "undertaking", in accordance with the DEP for *Protection of Cultural Resources* and the Historic Preservation Plan (HPP),

iv. Involve the construction of a jetty or shoreline protection structure that will alter the natural ocean/lagoon current or tidal effects,

v. Involve projects of any size on Eniwetak,

vi. Involve a substantial shift of substrate topography or type (i.e., sand to boulders, boulders to sand),

vii. Involves use of explosives,

viii. Involves quarrying, which is not authorized by this DEP.

1.8.5 Projects Not Covered By This NCA

Blasting of corals and/or coral reefs, either to prepare an area for construction or to obtain rock or aggregates (quarrying), is not permitted by this NCA and associated DEP.

1.9 NEPA Documentation

In accordance with the UES, prior NEPA documentation is required before any dredge or fill project may proceed. Existing NEPA documents will be reviewed for adequacy. If necessary, appropriate NEPA analysis and documentation will be prepared before project approval is sought.

2.1 DESCRIPTION OF ACTIVITY ENVIRONMENTAL SETTING

The local environmental setting is described briefly below.

2.2 Land and Reef Area

Kwajalein Atoll is a coral reef, dotted with a string of approximately 100 islets that enclose one of the world's largest lagoons (~1,100 square miles). It is located 2,300 miles west-southwest of Hawaii. The combined land area of the islets totals 5.6 square miles. Lagoon depths are typically 120-180 feet, although numerous coral heads approach or break the surface. Ocean depths outside the lagoon descend rapidly to as much as 13,000 feet within five miles of the atoll.

2.3 Islet Geology

The reefs and islets of the atoll consist of coral rock and sediments lying atop submarine volcanoes formed 70 to 80 million years ago. As the volcanoes subsided, coral reefs grew upward to the ocean surface and formed the islets that create the lagoon. The top of the reef (or reef flat) is intertidal. Approximately 25 natural passages admit small boats to the lagoon. The reef rock from which the atoll is built and the sands and sediments of its beaches and lagoon bottom are formed from the remains of calcium-secreting marine organisms. These organisms, when alive, are sensitive to sedimentation, burial, and changes in circulation caused by human activities. Shorelines are dynamic, constantly eroding or accreting, depending on local wave and current patterns.

2.4 Marine Geology

On the ocean side a shallow reef flat extends to a seaward reef slope. Ocean reef flats on the windward (north and east) side are subjected to stronger wind and wave action and are characterized by a well-defined system of ridges and channels. Oceanside beaches are generally composed of gravel-to-cobble size material, while lagoon-side beaches are mostly sand. Windward ocean reef flats are composed of hard rock extending down two to four feet, with softer unconsolidated rock below. Lagoon reef flats are typically narrower than ocean reef flats and are composed of unconsolidated rock.

2.5 Human Activity

(a) USAG-KA operates 11 islets in the atoll. The largest and the most populated is Kwajalein with about 1,300 residents, and the next most populated is Roi-Namur, with about 100 residents. Movement of personnel and supplies by water is essential for operations, maintenance, and test activities. USAG-KA receives most of its supplies and fuel via ocean barge and freighter from Guam via Hawaii or the U.S. mainland. Maintenance of lagoon passes, inter-atoll channels, and harbors are essential for continued operations.

(b) About 15,000 Marshallese residents live at Kwajalein Atoll. Most live on Ebeye, with smaller Marshallese communities on Ennylabegan and Ennubirr. Many Marshallese work for USAG-KA and commute daily by water to Kwajalein, Roi-Namur, and Meck Islets in support of operations and maintenance activities

2.6 Marine Water Quality

The ocean waters of the RMI are deep and are considered pollution free, pristine, and transparent. Marine water quality in the vicinity of USAKA is excellent. Water quality in near-shore and lagoon waters is generally high, except in the immediate areas of point and non-point source discharges. In these areas water quality is degraded by wastewater, suspended sediments, thermal discharge, stormwater runoff, sandblasting, and landfill leachate.

3.1 ENVIRONMENTAL AREAS POTENTIALLY AFFECTED BY ACTIVITY

3.2 Water Quality and Reef Protection

Reef areas and the ocean or lagoon floor could be altered by dredging and filling operations. Dredging involves the mechanical excavation and removal of material from the lagoon or ocean floor. The in-place materials (sand, silt, plant and marine life) if present, will be affected. In addition to the immediate area where the excavation occurs, ocean or lagoon bottom sediments will be disturbed and silting may occur adjacent to the site. Water quality in the vicinity of any dredge and fill operation could be temporarily degraded. Shoreline protection activities, including placement of fill and armor stone along the shore, could result in the creation of a turbidity plume that would extend down current from the project site. Material placed below mean low water mark would likely bury organisms in or on the sediment surface. Live coral areas and areas where fish and macroinvertebrates are concentrated may be susceptible to increases in turbidity that could result in smothering of corals and other invertebrates, and could impair respiration in fish. Additionally, based on available data, *Gambierdiscus toxicus* is known to exist in sediment material around USAKA, and the dredging of bottom sediments could intensify the potential for ciguatera contamination due to fish consumption.

3.3 Endangered Species and Wildlife Resources

Dredging and/or filling projects could temporarily disturb protected and endangered species or sensitive habitat. The construction of revetments and sandy fill material could eliminate the shoreline area as potential nesting habitat. Construction of sea walls or retaining walls could eliminate sea turtle haul out areas.

3.4 Material and Waste Management

Existing land area could be altered by deposition of spoils. Contaminated material could be dredged in the vicinity of fuel piers, point source discharges, or previous spill areas.

3.5 Cultural Resources

Cultural resources could be found in the vicinity of areas to be dredged or filled.

4.1 ANALYSIS OF EFFECT OF ACTIVITY ON ENVIRONMENTAL AREAS IN ABSENCE OF ENVIRONMENTAL CONTROLS

4.2 Water Quality and Reef Protection

Reef areas and the ocean or lagoon floor could be altered by dredging and/or filling operations. In the absence of any or all of the environmental controls outlined in Section 5.0 below, injury to marine resources and habitats is possible. Marine mammals, sea turtles, giant clams, and other species listed in the most recent updates to UES Appendices 3-4A through 3-4D, could frequent or inhabit the areas to be dredged or filled, and degraded water clarity due to silting could affect growth of corals and seagrasses. Although coral and other marine life damaged by silting can be restored, restoration times are in the tens of years. Plants and animals may be affected where dredge spoils operations cover existing ground.

Since dredging involves the mechanical excavation and removal of material from the lagoon or ocean floor, the in-place materials, including any sand, silt, plant and marine life will be affected. Disturbed sediments will settle on the ocean or lagoon floor, possibly atop coral, plant, and other marine life thus impacting recruitment, growth, or potential survival; and sediments in suspension can carry beyond the immediate area due to currents and wave action. Ocean and lagoon water could become turbid, altering light and visibility in the area. Also, runoff from dredge spoils-piles and spillage at the harbors where spoils are being loaded and unloaded could further degrade water quality. This bottom disturbance, potential spillage, and subsequent silting can be more troublesome if sediments in areas to be dredged contain contaminants from prior spills or years of contaminated runoff from adjacent land area. As identified in the Point Source Discharge NCA, sites having impaired marine water quality may be associated with activities on Kwajalein, Roi-Namur, and Meck Islets. Shoreline protection or fill structures could cause changes in energy transfer of incoming waves which could have an effect on adjacent biological communities or other shorelines.

4.3 Endangered Species and Wildlife Resources

In the absence of environmental controls, dredging and filling activities could result in impacts to UES-protected species or sensitive habitat.

4.4 Cultural Resources

Cultural resources could be damaged or destroyed during dredging and filling activities if the guidelines of the DEP for *Protection of Cultural Resources* are not implemented.

5.1 TECHNICAL DESCRIPTION AND ANALYSIS OF ENVIRONMENTAL CONTROLS USED IN ACTIVITY

5.2 General Controls For Dredging and Filling Projects

(a) Controls generally fall into four categories: the investigations and checks done in the project planning phase well in advance of the project; the checks and coordination done in the weeks and months immediately prior to beginning work; the actions taken during the project itself; and the reports and documentation required following completion. Dredge and fill projects will be identified in advance and project planning and identification of appropriate controls should begin at that time.

(b) No project involving dredging, quarrying or discharge of dredged or fill materials will be undertaken in USAKA waters at a depth of less than 30 feet below the mean low water line, unless authorized in a final DEP. (UES §3-2.7.2(d)). Such work will be authorized within the scope of the Dredging and Filling DEP associated with this NCA.

(c) Project planning phase:

(1) During the project planning phase, available NEPA documentation will be reviewed for adequacy and updated, if necessary, to address the proposed project. If available NEPA documentation is determined to be insufficient for the proposed action, new environmental analysis and documentation will be prepared and completed before project approval is granted by the USAG-KA Environmental Engineer. USAG-KA will ensure NEPA analysis addresses any and all effects by the project on coral reefs (UES § 3-2.7.2); and in coordination with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS).

(2) In selection of dredge and/or fill sites, dredging and filling in areas of valuable marine resources will be consistent with the WQMP.

(3) The results of the most recent spatially relevant completed biennial USFWS and NMFS *Inventory of Endangered Species and Other Wildlife Resources*, and species and habitats of concern (UES Appendices 3-4A through 3-4D) will be consulted in the planning and implementation of all dredge and fill projects. A marine biological resources evaluation will be performed at the project site to identify and, to the extent warranted, quantify significant and endangered species in the vicinity of the activity.

(4) Proposed dredging activities in an area where previous sediment testing indicates contamination may be present, will be coordinated with the USAG-KA Environmental Engineer, and information on the extent of contamination will be provided to the Appropriate Agencies along with the Project Description Sheet before any dredging activities may proceed.

(5) A marine biological resources evaluation will be performed at the project site to identify and to the extent warranted, quantify significant and endangered species in the vicinity of the activity. The evaluation will include digital photo-documentation of habitats and resources in areas to be dredged and/or filled, as well as any other documentation

required to adequately provide the necessary information. The level of information needed for a marine biological resources evaluation will be proportional to the level of impacts.

(6) The following activities will be completed during the project planning phase:

i. Designation of dredging method and/or explanation of shoreline protection design and materials. Specific controls, such as selection of dredging method, selecting the appropriate time of year for dredging to minimize impact to coral reproduction and growth, selection and employment of silt containment devices, turbidity testing, and identifying or relocating species in the area of the activity will be evaluated and selected as appropriate. These measures can significantly reduce potential impact to habitats and animals.

ii. Schedule. All reasonable efforts will be made to limit dredge and/or fill activities during the period of 15 June through 15 August except for emergency repairs, in an effort to avoid impacting coral spawning season and turtle nesting season.

iii. Develop a silt and turbidity control strategy identifying the selection of an appropriate type of turbidity monitoring device, an appropriate type of silt containment devices/equipment, and the corrective actions to be taken if the identified turbidity thresholds are exceeded.

iv. Plan of identifying and/or relocating marine life in the area of the activity including UES-protected species.

(7) Any areas known or suspected to be potential haul out areas for sea turtles should consider use of revetments rather than sea walls or retaining walls. Sea walls would preferably be used in areas that have steep inclines or vertical drops where sea turtles would not be hauling out. Revetments with fill behind them are preferred in shallow slope areas so that sea turtles may continue to haul out. Although seawalls can sometimes be effective, they are not a preferred method of shoreline protection because they can cause new and potentially severe downstream erosion problems.

(8) Any shorelines known or suspected to be nesting or resting areas for migratory seabirds or shorebirds, respectively, will be protected in a manner that does not result in the net loss of such habitat either on-site through an appropriately designed erosion control project or through the creation of new suitable habitat at an appropriate off-site location.

(9) USAG-KA will conduct appropriate environmental analyses and will coordinate early on in the project planning process with USFWS and NMFS in accordance with UES §3-2.7.2, of proposed actions that may affect coral reefs.

(10) Proposals which include the disposal of dredge spoils in the marine environment will be evaluated via the applicable project description sheet by the USAKA Environmental Engineer or Appropriate Agencies (USFWS, NMFS, USACE, USEPA, and RMIEPA).

(d) Prior to beginning any work involving dredging or fill material greater than 25 CY and/or With Special Conditions:

Project Description Sheets for proposals requiring approval from Appropriate Agencies will be forwarded to the following:

i. National Marine Fisheries Service (NMFS), Pacific Islands Regional Office
ii. Republic of the Marshall Islands Environmental Protection Authority (RMIEPA)
iii. U.S. Army Corps of Engineers, Honolulu District (USACE)
iv. U.S. Environmental Protection Agency (USEPA), Region 9
v. U.S. Fish and Wildlife Service (USFWS), Pacific Islands Office

The Republic of the Marshall Islands Historic Preservation Office (RMIHPO) will also be consulted if the project is determined to be an "undertaking" in accordance with the current DEP for the *Protection of Cultural Resources*, and the Historic Preservation Plan (HPP).

(1) Written comments, objections, and/or concurrences will need to be forwarded to the USAG-KA Environmental Engineer within 30 days of receipt. Unless otherwise agreed to by USAG-KA, no response from an agency within the 30 days will indicate Agency approval with the project as proposed. If, within the 30-day comment period, an Agency requests an extension of time to submit comments, up to an additional 45 days will be added to the comment period.

(2) All agency concerns arising from the project action will be considered by USAG-KA, which will respond in writing indicating how the concern will be resolved before proceeding with the dredge and fill project. Work will not start until all Agency comments are resolved per UES §2-19.

(3) All mitigation measures recommended by the Appropriate Agencies will be evaluated by USAG-KA, which will respond in writing indicating whether the measures will be adopted, and if not, the mitigations that will be adopted to achieve the desired protection (See UES §2-17 and §2-19).

(4) Immediately prior to beginning dredge and/or fill activities, a pre-activity marine life reconnaissance survey will be physically conducted in the area. Should any endangered or protected marine species, such as sea turtles or marine mammals, be observed in the project area, dredge or fill activities will be delayed until they have moved out of the area. If surveys indicate presence of species listed in UES Appendices 3-4A and C, the PDS will need to be updated including potential NMFS and USFWS consultation or coordination, as applicable, to determine appropriate protective measures.

(5) Prior to use, all equipment will be inspected and cleaned of any petroleum-based product or other potential polluting material that could be released into the marine environment.

(6) Areas to be dredged and any areas to receive dredge spoils will be evaluated for cultural/historic resources via the PDS and NEPA documentation before operations begin.

(7) The USAG-KA Environmental Engineer will ensure that damage to reef areas and the surrounding environment, including water areas will be minimized.

(8) Dredging and filling in areas showing evidence of sea turtles' nesting will be avoided to prevent damage to potential habitats and nesting areas (see NCA, Appendix C). Dredging and filling activities will not be conducted within a 100- meter radius of identified active nesting areas.

(9) Rare seagrasses are found in the lagoons near several of the islets (see NCA, Appendix C). Prior to dredging and filling activities, a survey will be conducted to delineate any bed boundaries.

(10) Seabirds and shorebirds nest on the islets of USAKA (see NCA, Appendix C). Surveys will be conducted for nesting seabirds and shorebirds prior to dredging, and/or filling activities in shoreline areas. Dredging and/or filling activities will not be conducted in areas populated with viable nests.

(e) During dredge and/or fill operations:

(1) Any injuries or deaths of turtles caused by dredge and/or fill operations will be reported to NMFS and USFWS.

(2) Siltation from dredging and/or fill activities will be minimized and will be contained within the vicinity of the site through use of effective silt containment devices. Silt curtains will be used, to the extent practicable, as a standard procedure to minimize the dispersion of elevated levels of suspended materials. In some cases, such as shoreline protection or activities in the reef flat, silt containment devices may not be effective and can possibly result in damage to coral species from the deployment of anchors.

(3) Turbidity monitoring will be conducted, where applicable. Baseline turbidity monitoring will be conducted daily at a distance of 50 meters (150 feet) from the project site prior to the commencement of the activity. During active dredging and/or filling operations, turbidity monitoring will be conducted daily at a distance of 50 meters (150 feet) from the site of the activity. Monitoring times and locations should be representative of regular working conditions. If turbidity measurements exceed 10 nephelometric turbidity units (NTUs) from the baseline measurement, work will cease until turbidity returns to less than 10 NTUs above the baseline turbidity value. In some cases, where minimal silt condition may occur such as reef flats or where it is unsafe to conduct monitor (adverse ocean conditions), turbidity monitoring may not be required.

(4) When possible, work will not be performed from June 15 through August 15 of any year to avoid coral spawning season and turtle nesting season.

(5) Activities will be scheduled to coincide with low-tides when possible.

(6) Activities will be curtailed during adverse weather conditions.

(7) Dredged spoils will not be stockpiled on the beach areas, reef flats, or in sensitive marine habitats.

(8) Dredged spoils determined to have hazardous characteristics will be collected and dewatered in an upland area designated by USAG-KA for such usage. The containment area will employ impermeable berms and liners to capture and prevent any runoff from entering the terrestrial or marine environments.

(9) To determine the appropriate method of disposal, dredged spoils will be tested for Toxicity Characteristic Leaching Procedure (TCLP) metals and PCBs. Once dewatered, dredge spoils determined to have hazardous characteristics will be properly containerized and stored until ready for disposal as a hazardous waste in accordance with UES §3-6.

(10) Any liquid collected from the dewatering of spoils which has been determined to be hazardous will be properly containerized and stored until ready for disposal as a hazardous waste in accordance with UES §3-6.

(11) Appropriate care will be taken to preclude and/or minimize spillage when loading, hauling, and unloading dredge spoils.

(12) Any dredge spoils to be disposed of in the marine environment or any fill material to be placed in the marine environment will be non-hazardous, non-polluting, and placed in such a manner as to minimize any potential adverse environmental impacts to marine flora and fauna associated with siltation, spillage, and turbidity.

(13) Non-hazardous dredge spoils that are to be saved for use in filling or other projects will be dewatered and stored in an upland area designated by USAG-KA for such usage. Dewatering areas will not be located in the vicinity of freshwater lenses. No return flow from the dewatering of the spoils (either hazardous or non-hazardous) will be allowed to enter the marine environment, unless approved by the Appropriate Agencies.

(14) Settling ponds will be used to capture sediments before water is released to the environment. No return flow from dewatering will be allowed to enter the ocean.

(15) Contamination of the marine environment will not result from project-related activities. Disposal of surplus wet concrete, trash or debris into the marine environment is not covered by this NCA and associated DEP. Such activities require a separate DEP, and no dredge and fill activities will result in direct or intentional contamination of the marine environment.

(16) Equipment will be inspected and cleaned of any petroleum or other pollutants that may be released to the marine environment prior to entering the marine environment.

(17) When feasible, fueling and servicing of dredging or filling equipment which operates in the marine environment will be performed in upland areas designated by USAG-KA for such function, and will be performed in a controlled manner to prevent releases to the marine or terrestrial environments.

(18) In the unlikely event of an accidental fuel spill, emergency response personnel will respond in accordance with the Kwajalein Environmental Emergency Plan (KEEP). Absorbent pads and containment booms will be stored on-site to facilitate the immediate clean-up of any petroleum spills.

(19) If explosives are discovered during dredge and/or fill activities, Explosive Ordnance Disposal (EOD) personnel will be notified. EOD personnel will make a determination as to whether explosives can be removed from the site of discovery. All explosive materials that are encountered during the activity will be handled in accordance with the current DEP for Disposal of Munitions and Other Explosive Material, and UES §3-6.5.7(a)(2) and (3).

(20) If prehistoric or historic artifacts, or human remains are discovered in dredged materials the USAG-KA Environmental Engineer and archeologist will be notified. Any artifacts or remains found would not be in context, so the dredge site would not be considered a potential historic property. The USAG-KA Environmental Engineer, with the assistance of an archeologist, would safeguard the artifact(s) or remains until the significance of the said items can be determined.

(21) During sand replenishment, care will be taken to ensure grain size of replenishment sand is similar to that eroded to minimize shifts in types of impacts incurred from sand transport through the marine system.

(22) Based on available data, *Gambierdiscus toxicus* is known to exist in sediment material around USAKA, and the dredging of bottom sediments could intensify the potential for ciguatera contamination. USAG-KA will notify the surrounding community that areas where dredging and/or filling activities are ongoing or have recently occurred should be avoided for fish consumption.

(f) At the conclusion of dredge or fill activities:

(1) A post-activity marine life reconnaissance survey will be conducted. An in-water reconnaissance, may be necessary dependent on the type of project undertaking, as specified in the PDS.

i. In the event any listed species, living coral, habitats of special concern, or migratory birds are disturbed, injured, or killed due to dredge and fill activities, the Appropriate Agencies will be informed by USAG-KA within 24 hours by the most expeditious means available (UES §2-7.3, *Emergency Notifications*).
ii. Following this emergency notification, USAG-KA will submit within 10 days written notification as specified in UES §§2-7.2.2.
iii. Reports to the agencies will include the type and number of organisms disturbed, transplanted, injured or killed; their condition; the locations and conditions of the original and new habitats; and the projected chances of recovery if injured (UES §2-7.2.2(p)).

(2) A Project Completion Report will be provided to the USAG-KA Environmental Engineer including project controls used and their effectiveness. Results of turbidity and marine

species monitoring (as described in Section 2.0) and any other special monitoring required by the project will be included. The report will include results of the post activity marine life reconnaissance survey. A copy of the Project Completion Report will be submitted to the USAG-KA Environmental Engineer, IAW Section 18 of this NCA, Records Keeping.

5.3 Additional Controls For Unidentified Shoreline Protection Projects

(a) When a new shoreline protection project is identified, the following controls should be implemented:

(1) Review the 2007 Teledyne shoreline survey, the 2009 USACE shoreline inventory, and the 2016 KRS supplemental survey (Appendices D-F) for areas of concern. The reports will identify areas that have had previous shoreline protection, areas where there is critical or non-critical erosion, and areas that have no signs of erosion and no previous shoreline protection.

(2) Check the most recently completed USFWS/NMFS *Inventory of Endangered Species and Other Wildlife Resources,* for impacts on habitat or wildlife in the area of concern. Habitat maps can also be reviewed in UES Appendix 3-4D.

(3) Check the HPP for any impact to cultural resources in the area of concern.

(4) Check the WQMP to see if the project site is located in a protected area. Projects in protected areas require adequate planning and consideration of mitigation measures.

(5) Complete the appropriate Project Description Sheet.

(6) Follow procedures outlined in NCA Section 1.5.

(7) Follow general project controls outlined in NCA Section 5.1.

6.0 DISPERSION MODEL FOR MODELING AIR SOURCES

Dredge and/or fill operations do not have any regulated continuous air emissions, and thus dispersion modeling is not required.

7.0 ANALYSIS OF WASTE DISCHARGE FOR POINT-SOURCE WASTE DISCHARGES TO WATER

There are no known point-source waste discharges associated with dredging and/or filling activities.

8.0 INFORMATION FOR HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES

There are no treatment, storage, or disposal facilities for hazardous wastes associated with dredging and/or filling activities.

9.0 BIOLOGICAL ASSESSMENT IF PROTECTED RESOURCES MAY BE AFFECTED

(a) Biological resources discussed in this section include those terrestrial and marine species found in and around Kwajalein Atoll which are protected by the UES and are most likely to be encountered during dredge and/or fill activities. The UES provides two levels of protection to species found in and around Kwajalein Atoll. UES Appendix 3-4A includes species listed as rare, threatened, or endangered by the U.S. Endangered Species Act, resident and migratory species protected by the Marine Mammal Protection Act, and other species protected by RMI statutes. Projects including potential impact to species listed in Appendix 3-4A will require consultation with Appropriate Agencies as described in UES section 3-4.5. UES Appendix 3-4C and D include species and habitats of significant biological importance as determined by US and RMI statutes. Potential impact to species or habitats listed in Appendix 3-4C and D will require coordination with Appropriate Agencies as described in UES section 3-4.6. All species of sea turtles and marine mammals potentially encountered in and around the RMI are listed as consultation species and are included in Appendix 3-4A. Also discussed in this section are several species of giant clams, migratory birds, corals, seagrasses, sponges, trochus, and pearl oysters, all of which are listed as protected under various RMI statutes and/or acts and the UES (see UES Appendices 3-4A and C).

(1) Sea Turtles. The UES lists the Green Sea Turtle (*Chelonia mydas*), the Loggerhead Sea Turtle (*Caretta caretta*), the Olive Ridley Sea Turtle (*Lapidochelys olivacea*),the Hawksbill Sea Turtle (*Eretmochelys imbricata*) and the Leatherback Sea Turtle (*Dermochelys coriacea*) as threatened or endangered.

i. Sea turtles are commonly sighted at USAKA. In the 2012 Marine Biological Inventory sea turtles were observed at patch and lagoon slope habitats in six of the 35 Mid-Atoll Corridor sites. Species and numbers included five green (*Chelonia mydas*), two hawksbill (*Eretmochelys imbricata*), and one unidentified sea turtle. It is suggested, based on cumulative observations that low level sea turtle residence may occur throughout the atoll. The 2010 biological inventory indicates that turtle nesting habitat was observed on 10 of 11 USAKA-controlled islets. Turtles were once common at the former food disposal ramp area on Kwajalein, and all listed turtle species were reported to be much more abundant off Roi-Namur in the past than at present. In general, sightings of turtles in the water are infrequent and widespread throughout the atoll indicating that Kwajalein Atoll is a residential and/or transitory area for sea turtles.

ii. In surveys and reconnaissance visits to all of the USAKA islets (except Kwajalein and Roi-Namur) in March 1988 and February 1992, no evidence of nesting sea turtles was found. Ennylabegan was found to have the best potential turtle nesting beaches, but the presence of a Marshallese population and domestic animals (sea turtles continue to be a traditional food source for the Marshallese) made it unlikely that successful nesting occurs there. Although no confirmed turtle nest pits were observed as part of the 2010 biological inventory, observed turtle nesting, confirmed pits and potential nesting sites have been documented at 10 of 11 USAKA-controlled islets during previous surveys or through community observations and reporting. No potential nesting

sites have yet been identified on Gellinam Islet. A nest was laid at Emon Beach on Kwajalein in 1997. Confirmed nest pits were observed on Eniwetak during the 2004 biological inventory. A hawksbill nest was also observed on Omelek on July 5, 2009. In September 2010, a green sea turtle nest was discovered on Kwajalein. 50 hatchlings were moved to the ocean and 50 eggs dug up that did not hatch. In May 2011 hatchlings were observed via infrared camera on Eniwetak going towards the ocean. In May 2013 a potential turtle haul-out was observed on the beach area just north of the Legan harbor (facing the lagoon). In 2014 three potential haul-outs were observed on Eniwetak southern beach, one in May and two in December. Two potential haul-outs were observed on the ocean side beach on Kwajalein just south of the Airport Terminal in November 2014. In January 2015, numerous turtle hatchlings were found on the airfield grassy area between the beach and the runway. They were collected and take to the beach/ocean area where the suspected haul-outs occurred. Other potential nesting sites have been described for Omelek, Ennylabegan, Legan, Ennugarret, Gagan, Illeginni, Meck, and Roi-Namur as part of past biological inventories.

iii. Dredging and/or filling activities in areas where there is evidence of sea turtles should be avoided in order not to damage potential habitats and nesting areas. These areas are shown in wildlife habitat maps presented in Appendix C. There are also reports of sea turtles in the lagoon and in the near-shore ocean waters. If sea turtles are present at any time within a project site work must cease until the turtles have left the area.

(2) Giant Clams.

i. There are five species of giant clams found at Kwajalein Atoll. The largest and most vulnerable species (*Tridacna gigas*) has been significantly reduced in numbers throughout the Marshall Islands. Reproductively viable populations of this species are found at several locations at USAKA.

ii. In the 2010 biological inventory, evidence of giant clams was found in the near-shore ocean waters of all 11 USAKA islets (see wildlife habitat maps in Appendix C).

(3) Seagrasses. A single species of rare seagrass (*Halophila minor*) is concentrated in the lagoon near the islet of Roi-Namur. Locations where rare seagrasses are found is discussed in the Roi-Namur Terrestrial Survey Section of the Inventory of Endangered Species and Other Wildlife Resources that was published by USFWS and NMFS. Seagrass was observed for the first time at Ennylabegan and Eniwetak as part of the 2010 biological inventory, suggesting a more widespread distribution than previously known.

(4) Marine Mammals. Marine mammals may occur in the Kwajalein area. Most are open-water, widely-distributed species not likely to be found within the lagoon or in near-shore areas of USAKA. Marine mammals may be found, however, in the broad ocean area north and east of Kwajalein Atoll. If marine mammals are present at any time within a project site work must cease until the animals have left the area.

(5) Migratory Birds.

i. Migratory birds that may occur in the Kwajalein area are listed in UES Appendix 3-4C. Common residents include the Sooty Shearwater, the Pacific Reef Heron, the Lesser Golden Plover, the Wandering Tattler, the Whimbrel, the Black Naped Tern, the White Tern, plus numerous other species which occasionally visit. While the only bird species currently listed as protected by the RMI is the Ratak Micronesian Pigeon (*Ducula oceania ratakensis*; see UES Appendix 3-4A), many are listed as protected under the Migratory Bird Conservation Act (see UES Appendix 3-4C).

ii. In the 2010 inventory of Endangered Species and Other Wildlife Resources, evidence of nesting seabirds was observed on 10 of the 11 USAKA islets. The number of nesting seabirds observed in 2010 was comparable to previous inventory years, but considerably low relative to habitat availability and protected status. The 2010 inventory documented 21 overall species of birds including: eight seabirds, 10 shorebirds/waders, one waterfowl, and two non-native species. Species richness within the USAKA islets fell between 7 and 15 species of birds.

(6) Corals.

i. All corals present at Kwajalein Atoll are considered species of concern and may trigger coordination procedures with Appropriate Agencies (UES Appendix 4-4C). Additionally, a number of coral species are included in UES Appendix 3-4A and, as such, require consultation with Appropriate Agencies.

ii. In the 2012 Marine Biological Inventory, over 216 different species of stony coral were found in the waters surrounding the 11 USAKA islets, including40 species of concern (see wildlife habitat maps in Appendix C). For each of the 35 lagoon slope and patch reef sites, an average of 86 coral species were observed and ranged between 56 and 107 species.

(7) Fish

i. There are several species of fish that may be present at the Kwajalein Atoll area which are listed as consultation species in UES Appendix 3-4A and a few species listed in UES Appendix 3-4C which are coordination species.

ii. In the 2012 Marine Biological Inventory, evidence of six different species of fish listed as consultation species under UES Appendix 3-4C was found at the patch reefs and lagoon slopes.

(8) Trochus.

i. UES Appendix 3-4A lists two species of trochus in the vicinity of USAKA as protected by the UES under the RMI Marine Resources (Trochus) Act of 1983, 33 MIRC, Chapter 3.

ii. In the 2012 Marine Biological Inventory, evidence of trochus was found at the patch reefs and lagoon slopes and in previous years' inventories, trochus were identified in the near-shore ocean waters of all 11 USAKA islets (see wildlife habitat maps in Appendix C).

(9) Pearl Oysters.

i. The only pearl oyster occurring in the Kwajalein area and listed in UES Appendix 3-4A is the Black-Lip Pearl Oyster (*Pinctada margaritifera*). While no pearl oysters are listed as either endangered or threatened in the U.S. Endangered Species Act, the Black-Lip Pearl Oyster is listed a UES-protected species under the RMI Marine Resources Act, 33 MIRC, Chapter 1.

ii. In past Marine Biological Inventories, evidence of pearl oysters was observed in nine of the 103 sites surveyed for the protected macroinvertebrates. *Pinctada margaritifera* was found in six of the 11 USAKA islets and was not observed in the Mid-Atoll Corridor.

(b) The wildlife habitat maps in Appendix C list and show potential habitats for the above species. As depicted in these maps, the species of concern are generally not shown in existing harbor or channel areas where dredging activities are most likely to occur. However, to avoid these species, visual surveys will be conducted from the shoreline of near-shore areas or underwater of deep water locations prior to any dredge or fill activities. If sea turtles, marine mammals, seabirds and/or protected fish species are present, dredge and/or fill activities will be delayed until after these species leave the area.

10.0 INFORMATION ON RECEIVING WATER QUALITY FOR WATER DISCHARGES

There are no water discharges as a result of these activities.

11.0 INFORMATION ON MARINE LIFE, CURRENTS, AND OTHER CHARACTERISTICS OF OCEAN DISPOSAL SITES

There is no ocean disposal associated with these activities.

12.1 INFORMATION ON MARINE LIFE AND ENVIRONMENT IN DREDGING OR FILLING AREAS

12.2 Marine Water Quality

(a) Both ocean and lagoon marine water quality is high in most waters around USAKA. Water quality in near-shore and lagoon waters is generally very high, with high dissolved oxygen and pH levels typical of mid-ocean conditions. Lagoon turbidity levels tend to be higher than ocean waters because of higher plankton populations and increased suspended sediment from wave action and tidal- and wind-generated currents. Water quality may be degraded by suspended sediment, thermal discharge, stormwater runoff, sandblasting, and landfill leachate. Sites having impaired marine water quality may be affected by activities on Kwajalein, Roi-Namur, and Meck Islets.

(b) The prevailing trade winds cause strong currents to enter Kwajalein Lagoon and the passes. These currents are a major source of ocean water exchange with lagoon water and help keep the lagoon relatively well-mixed. Colder ocean surface waters enter the lagoon through passes between the islets. Currents flow toward the west and southwest across the lagoon at surface speeds of 0.1 to 0.25 knots. These currents are not subject to reversal with tidal stage, but appear to accelerate during tidal change reaching maximum velocity at half-tide.

(c) Marine water temperatures are relatively uniform throughout the year. Seasonal surface water temperatures vary from 82-88ºF.

12.3 Marine Biological Resources

While differing species populate the reef habitats of each of the USAKA islets, all of these habitats support populations of fish, shellfish and invertebrates of subsistence and cultural value. A complete listing of marine species can be found in the wildlife habitat survey maps (2010 *Inventory of Endangered Species and Other Wildlife Resources*, published by USFWS and NMFS in December 2012). Maps of the eleven islets covered in this NCA showing locations of the various marine species are included in Appendix C. Characteristic features of species families of the major phyla, or groupings, found during previous studies and surveys are shown in Table 3.7.1 to the 1993 SEIS, and protected species and habitats within USAKA are listed in UES Appendices 3-4 A-D which is subject to updates based on Agency review.

12.4 Marine and Terrestrial Habitats

(a) Habitats of significant biological importance on lands under lease to the United States include:

(1) Marine Habitats

i. Lagoon-facing reef slope and reef flat
   A. Inter-islet reef flat
   B. Lagoon floor
   C. Ocean-facing reef slope and reef flat
   D. Quarry pits
   E. Seagrass beds
   F. Intertidal zone
   G. Reef passes

(2) Terrestrial Habitats

i. Seabird colonies
ii. Shorebird sites
iii. Reef heron breeding sites
iv. Sea turtle nesting habitat
v. Mixed broadleaf, pemphis and pisonia forests
vi. Salt ponds

12.5 Fishing

The structure of the fisheries sector in and around the capital city of Majuro includes commercial fishing, game fishing and sport diving by tourists, cultivation of sponges, pearl oysters and ornamental clams, and aquarium fish collection. Although there are no locally based commercial fisheries operating in and around the Kwajalein Atoll extensive fishing for tuna and billfish species by foreign vessels (mainly U.S. and Japanese) occurs in offshore waters of the RMI Exclusive Economic Zone. Some aquaculture is conducted around the Kwajalein Atoll and programs are underway to increase local aquaculture industries.

Subsistence fishing is traditional and provides the primary source of protein for most RMI nationals. Fishing in the lagoon and ocean side is common. Within Kwajalein Lagoon, subsistence fishing occurs outside the mid-atoll corridor at all times, and within the mid-atoll corridor during authorized periods. Additionally, subsistence fishing occurs in the near-shore ocean waters. Fishing methods include boat and land-based hook-and-line fishing, net fishing (hand cast from shore or drag, gill and surround by boat), and spearfishing.

13.0 SPECIES AND NUMBERS OF MIGRATORY BIRDS AND OTHER WILDLIFE RESOURCES AND HABITATS THAT MAY BE TAKEN

No migratory birds and other wildlife resources and habitats should be taken by the proposed activities. By strict adherence to the provisions of UES §3-2.7.2 on reef protection, and with careful application of the environmental controls discussed in Section 5.0 above, impacts on wildlife resources and habitats from dredging and filling activities will be minimized.

14.0 CLIMATE CHANGE ANALYSIS

Rising global atmospheric Greenhouse Gas (GHG) emissions are affecting the Earth's climate. The effects include, but are not limited to, more heavy downpours and flooding, more intense storms, sea-level rise, ocean acidification, and harm to wildlife and ecosystems. In accordance with UES Section 2-17.3.3(c), the NCA shall include an analysis of climate change and its potential impacts on the activity, and a description of related limitations and requirements. The potential impact of climate change effects on dredging and filling activities include increases in erosion, accretion of sediment, and more pronounced flooding at USAG-KA. As a consequence, an increase in the frequency and the magnitude of dredging and filling activities are expected at USAKA.

Increased Erosion

Due to sea-level rise, elevated intensity of storms and correlated wave actions as well as the loss of coral reef buffer to dissipate wave energy from ocean acidification, increased erosion of the coastal shorelines on the USAKA islets are expected to occur. In order to mitigate increased erosion at USAKA, more frequent and larger dredging and filling activities to repair/replace existing shoreline protection structures as well as support the construction of additional or enhanced shoreline protection activities are anticipated.

Increased Accretion of Sediment

Sea-level rise and more intense storms and associated wave action are expected to increase the accretion of sediment around the USAKA islets. To mitigate the accretion of sediment, more dredging and filling activities are anticipated to restore harbors and channel depths and maintain in-water structures such as intake and outfall discharge pipes.

Increased Flooding

More intense and heavy downpours can result in more frequent and more severe flooding of the USAKA islets. Additionally, the rise in sea level can result in inland flooding from wave action during storms and king tide events. Ocean water flooding on Kwajalein, Roi-Namur, and Meck islets has the potential to contaminate groundwater lenses and water catchment areas and impact the respective drinking water systems. To mitigate the potential increase in flooding events, an increase in dredging and filling activities are anticipated to enhance shoreline protection structures and to maintain/modify existing stormwater conveyance discharge systems.

15.0 NOTIFICATION

In accordance with Section 1.5.2 of this NCA a written notification containing a detailed description of the proposed activity, to include sketches and/or maps delineating the limits of the work, will be forwarded by USAG-KA to the RMIEPA, USEPA Region 9, USACE, USFWS, and the NMFS. Notification will also be forwarded to the RMIHPO, if project requires.

16.0 EMERGENCY NOTIFICATIONS

Within 24 hours of discovery of an emergency environmental condition, USAG-KA will notify the public affected or potentially affected by the condition and the Appropriate Agencies by the most expeditious means available. Emergency environmental conditions are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural and cultural resources. Within 10 days following emergency notification, USAG-KA will submit written notification of the event to the Appropriate Agencies that contains, at a minimum, the relevant information described in UES Section 2-7.2.2. Emergency notifications will be made for any condition that the Commander, USAG-KA, determines to constitute an emergency condition.

17.0 PUBLIC NOTIFICATION

Public notifications will be made by USAG-KA to advise the public of an activity or action that USAG-KA has taken or is planning and any precautions to be taken by the public, including the increased risk of Ciguatera from consumption of fish. Public notification will be made through means that are widely available and consulted by the public at USAKA and the RMI. This normally

includes publication in *The Kwajalein Hourglass* and *The Marshall Islands Journal*, posters or bulletins displayed in public places, announcements on the television "Roller", and radio announcements and will be effective for the locations affected.

18.0 RECORDS KEEPING

(a) USAG-KA environmental records on dredging and/or filling activities will be maintained for demonstrating compliance with the UES and will be available for examination by outside agencies during external auditing (UES §2-13-1).

(b) All records associated with dredging and filling (including Project Description Sheets and Project Completion Reports) will be maintained for at least five years (UES §2-13.2).

(c) NCAs, Environmental Comments and Recommendations (ECRs), and DEPs permitting dredging and/or filling activities will be preserved for the duration of the activity plus ten (10) years or for ten (10) years after expiration of the DEP, whichever is less.

19.0 RESOLUTION OF NONCOMPLIANT AREAS

Currently, there are no known non-compliant dredging or filling activities at USAKA.

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NCA - APPENDIX A

UES SECTION 3-2.7.2: REEF PROTECTION AND DREDGING, QUARRYING, AND DISCHARGE OF DREDGED OR FILL MATERIALS,

AND

UES DREDGE AND FILL DEFINITIONS

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3-2.7.2 Reef Protection and Dredging, Quarrying, and Discharge of Dredged or Fill Materials

To ensure that damage to the reef areas is minimized and to prevent harm to the environment, including water areas, USAKA shall, before taking any action that might adversely affect the reef areas of USAKA, conduct the appropriate environmental analysis of its proposed action consistent with these Standards and the Compact.

(a) No dredge and fill shall occur on USAKA unless documented in an appropriate NEPA document.

(b) No project involving dredging, quarrying, or discharge of dredged or fill materials shall be undertaken unless documented in a final DEP. All NCAs/NPAs shall demonstrate compliance with the criteria listed in Sections 3-2.7.2(b)(1) through (6) below and, at a minimum, include the relevant information described in Sections 2-17.3.2 and 3-2.7.1(e).

(1) The area affected by the proposed activity will be minimized to the greatest extent practicable.

(2) The proposed activity is consistent with the water quality management plan prepared according to Section 3-2.5.1 and will not result in a violation of a water quality standard listed in Appendix 3-2C, except as may be allowed within a mixing zone.

(3) All adverse effects on threatened or endangered species or critical habitats described in Section 3-4 are eliminated or mitigated to the satisfaction of the Appropriate Agencies.

(4) The proposed activity will not result in the loss or destruction of significant cultural resources of the RMI as described in Section 3-7.

(5) All reasonable measures will be taken to mitigate all adverse effects associated with the proposed activity.

(6) There are no practicable alternatives to the proposed discharge that would have a less adverse effect on the environment.

(c) Routine maintenance dredging and filling projects may be authorized in a programmatic NCA/NPA and DEP.

DREDGE AND FILL DEFINITIONS

For technical clarity, the following definitions from the UES apply:

Dredged material: Material that is excavated or dredged from waters of the RMI.

Discharge of dredged material: Addition of dredged material into RMI waters. The term includes, without limit, the addition of dredged material to a specified discharge site in RMI waters and the runoff or overflow from a contained land or water disposal site. Discharges of pollutants into RMI waters resulting from the onshore subsequent processing of dredged material that is extracted for a commercial use (other than fill) are not included in this term. The term does not include incidental soil movement occurring during normal dredging operations.

Fill material: Any material that replaces parts of the territorial waters of the RMI with dry land or that changes the bottom elevation of a water body for any purpose.

Discharge of fill material: Addition of fill material into RMI waters. The term includes, without limit, the following activities: placement of fill that is necessary for constructing a structure; building a structure or impoundment requiring rock, sand, dirt, or other materials for its construction; developing sites for recreational, industrial, commercial, residential, and other uses; protecting or reclaiming property using devices such as riprap, groins, seawalls, breakwaters, revetments; beach nourishment; levees; fill for structures such as sewage treatment facilities, intake and outfall pipes for power plants, and sub-aqueous utility lines; and artificial reefs.

Dredging and Filling (Maintenance): Routine dredging or deepening of an existing, already dredged, channel or area using mechanical means, or the routine maintenance and repairs to existing shore protection structures. This does not include blasting or quarrying activities.

NCA
APPENDIX B
(Reserved)

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APPENDIX C

POTENTIAL AREAS FOR DREDGE AND FILL PROJECTS AT USAKA - HARBORS, PIERS, AND OTHER FACILITIES

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POTENTIAL AREAS FOR DREDGE AND FILL PROJECTS AT USAKA - HARBORS, PIERS, AND OTHER FACILITIES

NOTES

1. Each of the NCA sub-appendices (C-1 through C-11) listed below contains the following:

    a. A description of the area where potential dredge and/or fill projects may occur
    b. A listing of potential dredge and/or fill projects in each area
    c. Known environmental conditions and/or documents
    d. Figures of the area showing:

        (1) Classification of coastal water use and location of harbor facilities
        (2) Marine biological resources
        (3) Areas protected from dredging and filling

2. While a particular harbor or channel area may be required to maintain a specific depth, it is possible that only limited sections of the whole area will need to be deepened. The exact limits of any dredging project will be determined by survey of depths in the project area. Based on survey results, only shoaled or shallow areas may require dredging.

3. No work shall commence until the appropriate Project Description Sheet, including all required documentation, has been approved by USAG-KA Environmental Engineer and Appropriate Agencies (as applicable) in accordance with the provisions of this NCA and DEP.

4. The USAG-KA Water Quality Management Plan (WQMP) includes areas worthy of protection from dredging, quarrying, or filling as well as areas where dredging, quarrying, or filling are given special scrutiny for protection. The most recent version of the WQMP will be referenced during the project planning phase, and all efforts made to avoid dredging or filling in protected areas.

AREAS REQUIRING DREDGE OR FILL COVERED BY THIS NCA (See Figure C-1):

Harbors and Shorelines	See Appendix:
Kwajalein Islet***,1**	C-1
Roi-Namur Islet**1**	C-2
Meck Islet	C-3
Ennylabegan Islet*****	C-4
Illeginni Islet	C-5
Legan Islet*****	C-6
Gagan Islet	C-7
Gellinam Islet*****	C-8
Omelek Islet	C-9
Eniwetak Islet	C-10
Ennugarret Islet	C-11

Any other dredge or fill projects conducted by USAG-KA in the RMI or RMI waters are also covered by this NCA and associated DEP.

*** Addressed in the 1985 Corps of Engineers Dredging EA**
1 Includes information regarding potential projects on Ebeye Islet and Ennubirr Islet, respectively

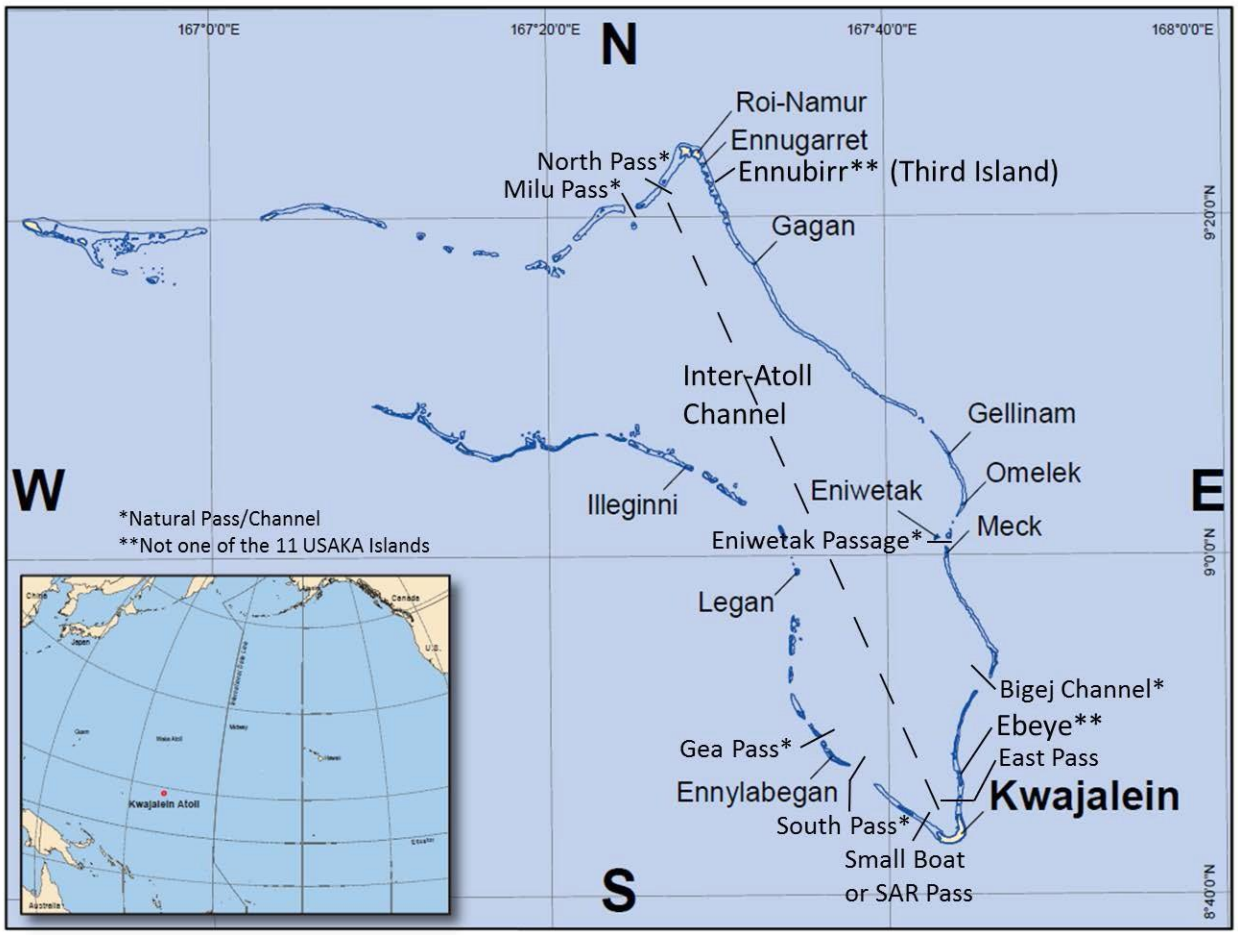


Figure C-1 Map of Kwajalein Atoll

C-1. KWAJALEIN ISLET

General Description:

Kwajalein Islet is the largest of the USAKA operated islets, approximately 748 acres in size with a resident population of about 1,300, and is the primary base of operations for USAG-KA activities within the atoll. Additionally, a large number of Marshallese residents commute daily to Kwajalein by boat from Ebeye Islet. Kwajalein Islet is bounded on the north and west by Kwajalein Lagoon and on the east and south by the Pacific Ocean (Figure C-1-1).

Kwajalein Harbor is located on the west side in the middle of the islet and serves as the primary location for marine operations and as the main berthing area for USAG-KA watercraft, including small recreational-use crafts, tugboats, barges, inter-atoll catamarans, ocean going LCUs (Great Bridge), LCMs, the Patriot, the Kwajalein Mobile Range Safety System (KMRSS), inter-island ferry boats, and marine police boats. Visiting vessels include fuel tankers, the Matson container ship, and occasional military or scientific research vessels. Continued maintenance of the Kwajalein Harbor is essential to operations at USAKA.

The remainder of the Kwajalein Islet shoreline consists of sandy beach, natural earth, rock or coral outcrops, and concrete or riprap seawalls and shoreline protection structures (Figure C-1-2). Much of the shoreline protection is in poor condition and in need of repair. Near-shore ocean and lagoon floor is primarily coral on the north, east, and south and a mixture of sand and coral on the west. Former reef quarry pits of varying dimensions and depths are present on the east and south shore of the islet. Residential and industrial structures are present along the shoreline as well as point source discharges. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms. Rare storm events can result in significant waves from the west with the potential to damage lagoon facing structures and erode shoreline.

Numerous underwater channels, mooring and turning areas, navigation aids, intake and outfall structures, piers, facility foundations, etc. are found throughout Kwajalein Harbor. The entire harbor area has previously been dredged numerous times beginning with pre-World War II construction. The last major dredging effort occurred in the late 1980's. Fill has been placed at locations throughout the harbor area for shoreline protection and for structure foundations or protection. Dredging is only required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Dredged material, or spoils, will either be reutilized as fill material or disposed of on land. Disposal of dredge spoils in the water adjacent to the dredge site may be permissible, provided the requirements of this NCA (Section 5.1,e,7 through 13) and the associated DEP (Section 6.3,h through n) are satisfied. Dredging and filling in the Kwajalein Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structures may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To

the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Kwajalein Harbor and Channels

Kwajalein Harbor is served from the north and west by inter-atoll channels which run the length and breadth of the atoll connecting USAKA and other islets. Gea Pass on the west edge of the atoll leads to the open ocean and is the main entry and exit channel to Kwajalein Atoll. Inter-atoll channels lead west and north to Ebeye Islet, Meck Islet, Roi-Namur, and the other islets of the atoll. Inter-atoll channels passes are for the most part naturally deep and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of channels and passes is essential to USAG-KA operations. The following table shows the major channels, required depths, and current conditions.

Table C-1-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Gea Pass	Matson container ship, fuel tankers	100	Depth good	Natural pass
Search & Rescue (SAR) Pass	Recreational-use boats	8-10	Possible silting	Manmade pass
South Pass	LCMs, recreational-use boats, KMRSS, LCUs (Great Bridge), Patriot, visiting vessels	25	Depth satisfactory	Natural pass
South Pass to Kwaj Cargo Pier (north approach)	Matson container ship, fuel tankers, tugs, barges, visiting vessels	45	Depth satisfactory	Inter-atoll channel
South Pass to Kwaj Cargo Pier (south approach)	Matson container ship, fuel tankers, visiting vessels	45	Depth satisfactory	Inter-atoll channel
Kwaj Cargo Pier to Ebeye & Meck	Matson container ship, catamarans, KMRSS, fuel tankers, recreational-use boats, Patriot, ferry boats	45	Possible silting	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, catamarans, tugs, visiting vessels, recreational-use boats, barges, KMRSS, Patriot	45	Depth satisfactory. (Coral heads always a problem)	Inter-atoll channel

Kwajalein Islet Marine Facilities/Potential Dredging Projects

Kwajalein Harbor encompasses the area between and adjacent to the Cargo Pier (Echo Pier) and the Fuel Pier (Figure C-1-1). Within the harbor area are a small boat marina and ramp, and the Syncro-Lift facility for lifting vessels out of the water for maintenance. Other Kwajalein Harbor facilities include the Barge Slip Ramp (BSR) a barge mooring area to the north of the harbor. Additionally, ferry boats run multiple times daily from Kwajalein Harbor to the pier at Ebeye Islet. The Matson container ship also visits the Ebeye Pier regularly. Each of these facilities requires access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (see Table C-1-2). Bottom depths at Kwajalein Harbor facilities are generally satisfactory but should be monitored. The Ebeye Pier is in need of repair and adjacent bottom depths are unknown but presumed to be unsatisfactory. Dredging will occasionally be required to maintain minimum depths. Each of these facilities is proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-1-2 Kwajalein

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Inner Harbor (area between fuel pier and cargo pier)	Tugs, ferry boats, KRMSS, catamarans, ferry boats, Patriot recreational-use boats	20	Depth marginal	Needs dredging
Cargo Pier	Matson container ship, KRMSS, ferry boats, catamarans, visiting vessels	30	Depth satisfactory	Need to monitor
Fuel Pier	Fuel tankers	35	Depth satisfactory	Potential project
Syncro-Lift	LCUs (Great Bridge), tugs, barges, catamarans, Patriot	28	Depth satisfactory	Potential project
Barge Slip Ramp	Tugs, barges, LCUs (Great Bridge), LCMs	18	Depth satisfactory	--
Barge Mooring Area	Tugs, barges	14	Depth satisfactory	--
Small Boat Marina	Recreational-use boats	6-8	Depth marginal	Potential project
Barge Off-Loading Ramp	Tugs, barges, LCUs (Great Bridge), LCMs	14	Depth satisfactory	--
Ebeye Pier	Matson container ship, ferry boats, recreational-use boats	30	Depth unknown	Need to monitor Potential project

General Environmental Conditions - Kwajalein Harbor

Marine waters within and adjacent to Kwajalein Harbor as well as around the BSR, point source discharge outfalls, and the southwest ocean-facing shoreline are classified as Class B waters and are suitable for commercial and industrial use (Figure C-1-1). All other waters adjacent to the Kwajalein Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding Kwajalein Harbor is residential to the north and generally industrial to the east and south. Most USAG-KA maintenance, supply and fuel storage activities are located

near the harbor. Islet power, water and sewage plants are located just south of the harbor. The lagoon floor in the harbor area is generally sandy, with some buildup of silt on top.

Point source discharges including stormwater, industrial and domestic wastewaters and cooling waters are present within Kwajalein Harbor and other lagoon and ocean facing shoreline areas (see DEP-12-002.0, *Point-Source Discharges*). Potential contamination of bottom sediments exists in the harbor and other lagoon facing areas as a result of industrial activity and stormwater runoff. .

Shorelines along the lagoon in the vicinity of the harbor consist of concrete and sheetpile walls, riprap, and natural sand and earth. Various shoreline protective measures are used to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc., in the areas to be dredged. Echo Pier itself is a potentially eligible for the RMI Register of Historic Places due to its association with World War II.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding Kwajalein Islet.

Marine Biological Resources - Kwajalein Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

Biennial inventories of endangered species and other wildlife resources at Kwajalein Atoll have been conducted by the USFWS and NMFS since 2004 and provide information on the marine biological resources around Kwajalein Harbor. The most recent inventory was performed in 2014, but not yet available at the time this document was finalized. The 2012 inventory is currently available. (Figure C-1-2).

The reef adjacent to the lagoon side of Kwajalein Islet is in a relatively low-energy environment, protected from normal trade winds and swell. In the central portion of the lagoon 65 hard coral species were observed about 400 meters (1,312 feet) from shore where a steep wall has continued to support a diverse coral community, including many juvenile reef fish and sponge species. There were also three species of macro-invertebrates observed and one juvenile and one adult Napoleon wrasse (*Cheilinus undulatus*) in the central portion of the lagoon. On the northeastern side of the lagoon in the area adjacent to Kwajalein Harbor the benthic habitat transitions from a sand/rubble substrate to one covered by communities of dense coral (*Montipora*). The macro-algae observed in thick patches in this area as part of the 2004 inventory was no longer present in 2010. There were 52 species of hard coral, green sea turtles (*Chelonia mydas),* hawksbill sea turtles (*Eretmochelys imbricate),* and giant coral trout (*Plectropomus laevis*) observed in this area during the 2010 inventory, as well as a variety of macro-invertebrates and reef fish. Seagrasses were not observed in the area adjacent to Kwajalein Harbor in 2010 but were present in other near-shore locations to the north and southwest.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging in Kwajalein Harbor, a U.S. Army Corps of Engineers Environmental Assessment (EA), was prepared in 1985. Additionally, dredging and filling in the atoll as a whole, to include shore protection, was addressed in the 1993 Supplemental Environmental Impact Statement (SEIS) in support of the three levels of activity evaluated at USAKA. In 2012 an EA, resulting in a Finding of No Significant Impact (FONSI), was prepared for proposed repair to the BSR including shoreline modification. An EA was prepared for restoration of Echo Pier in 2015. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Kwajalein marine ramp to support vessel activities

Figure C-1-1
KWAJALEIN: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

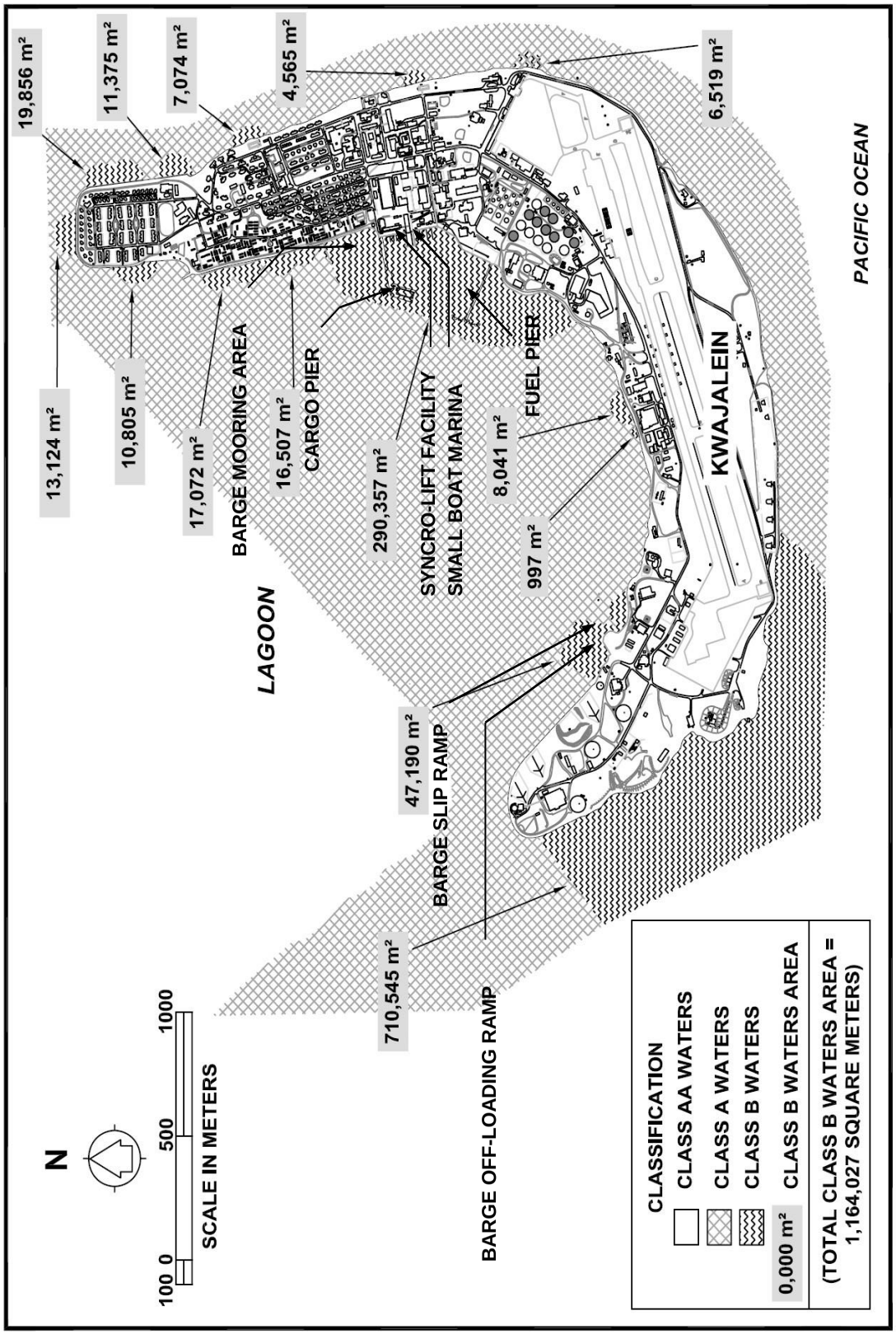


Figure C-1-2
KWAJALEIN: MARINE BIOLOGICAL RESOURCES

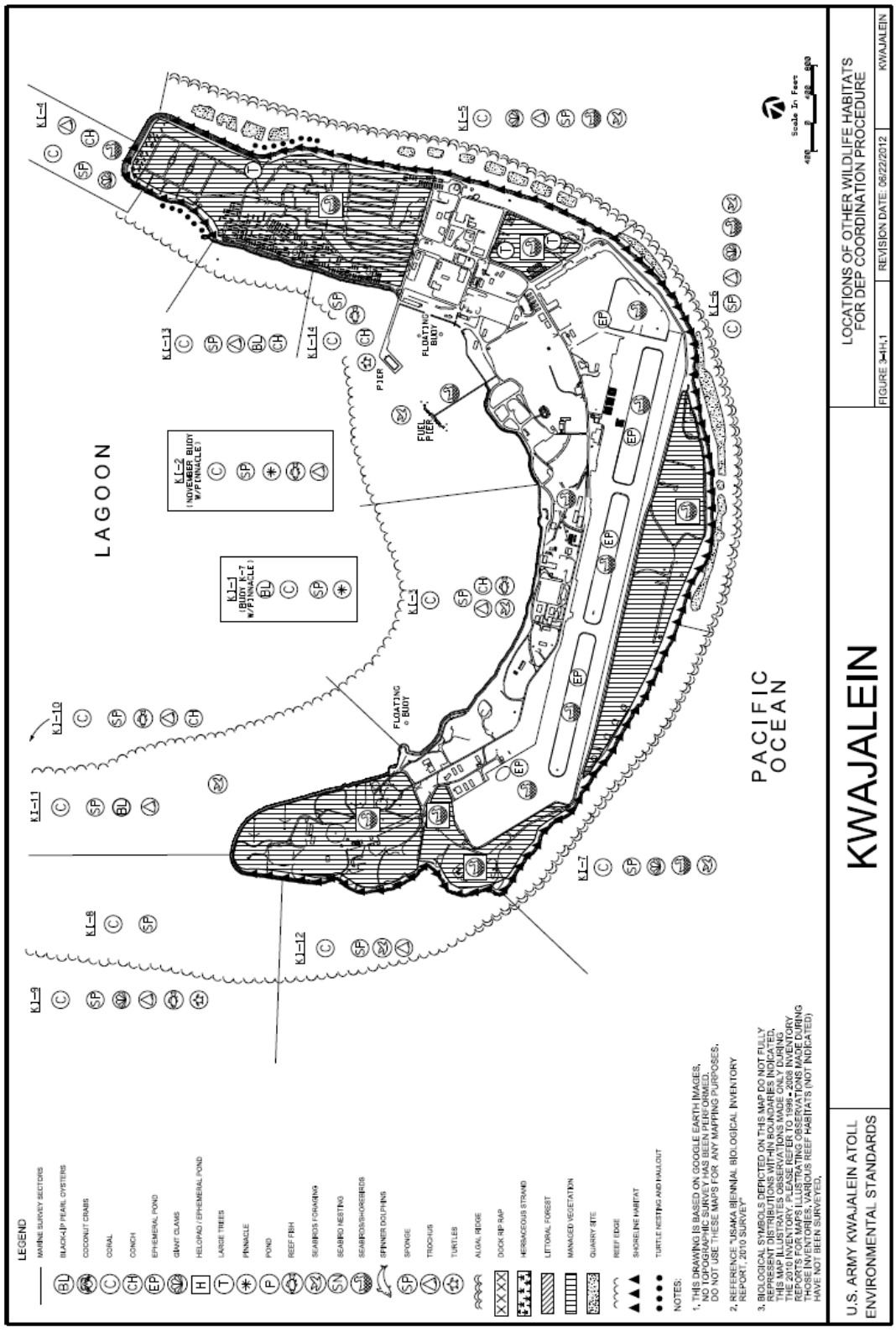
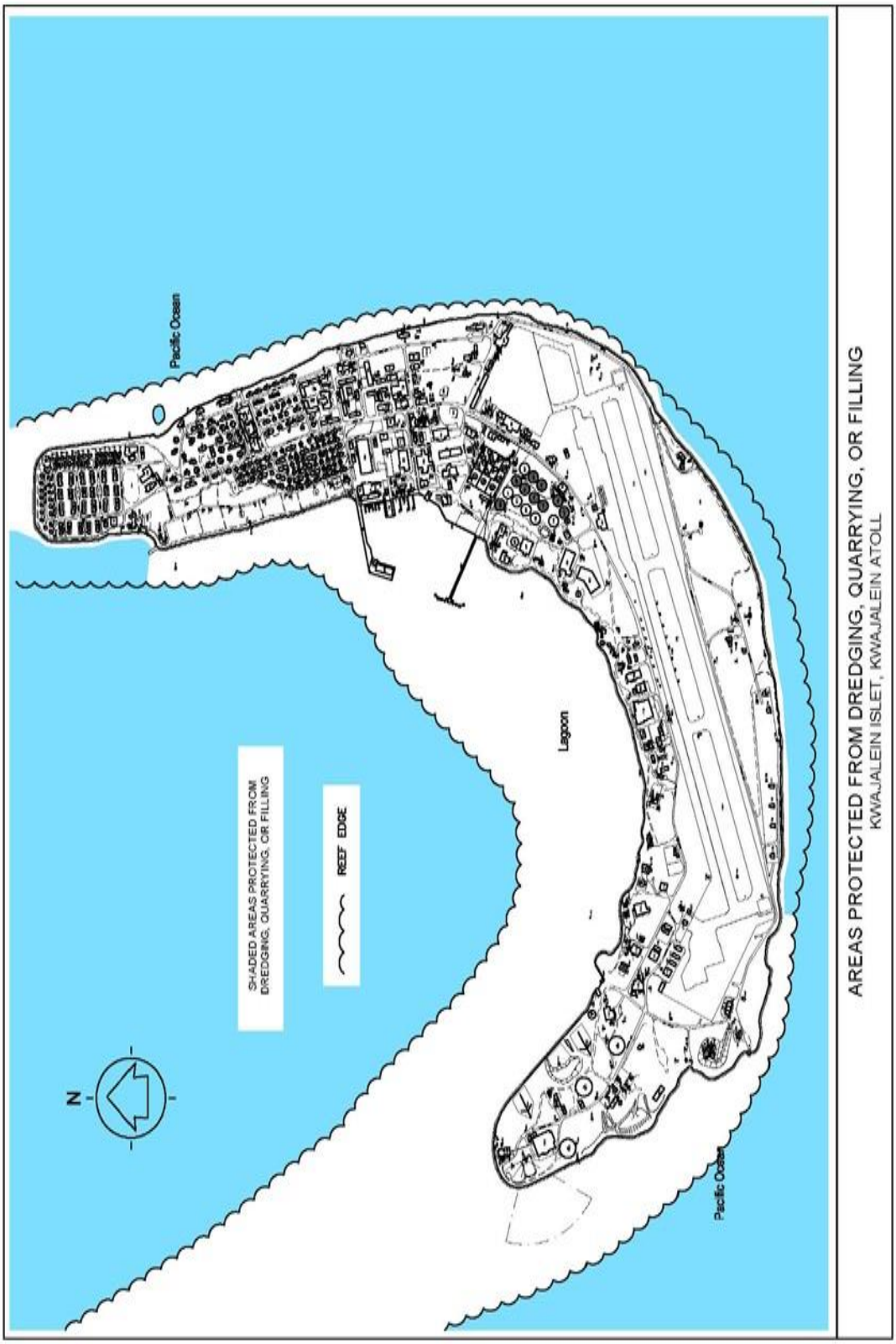


Figure C-1-3
KWAJALEIN: AREAS PROTECTED FROM DREDGING AND FILLING



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C-2. ROI-NAMUR ISLET

General Description:

Roi-Namur Islet is the second largest USAKA islet, approximately 398 acres in size. It is bounded on the south by Kwajalein Lagoon and on the north by the ocean, with ocean reef flats to the east and west. Roi-Namur Islet supports a resident population of about 100 persons, with an additional daytime population of 100 or so who commute daily to Roi-Namur from Kwajalein by air and by boat from Ennubirr Islet. Roi-Namur Islet was originally two islets which were joined by quarried offshore fill materials prior to World War II.

Roi-Namur Harbor is located on the south side of the islet and includes the Cargo (Yokohama) Pier, a small boat marina for recreational-use boats and a ferry terminal servicing Ennubirr (Figure C-2-1). A second fuel/cargo pier is located to the west of the harbor. Most vessels utilizing the harbor or fuel/cargo pier originate from Kwajalein, where supplies are received, off-loaded from ocean going vessels, and reloaded for delivery to Roi-Namur aboard USAG-KA owned and operated vessels. Visiting vessels include the LCUs (Great Bridge), LCMs, catamarans, the KRMSS, The Patriot, marine police boats, and various USAG-KA tugs and barges. Almost all cargo is received via Roi-Namur Harbor as air service is limited to helicopters and small commuter planes. Continued maintenance of the harbor and fuel/cargo pier are essential to operations at Roi-Namur.

The remainder of the Roi-Namur Islet shoreline consists of sandy beach and limestone rock or coral out-crops, with some concrete or riprap seawalls and shoreline protection structures (Figure C-2-2). Near-shore ocean and lagoon floor are primarily hard coral to the north, east, and west, and white calcareous sand on the south. Former quarry pits of varying dimensions and depths are present along the north shore of Roi-Namur in the vicinity of where the two islands were joined. Residential and Industrial structures are present along the shoreline as well as point source discharges. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

Underwater channels, mooring and turning areas, navigation aids, intake and outfall structures, piers, facility foundations, etc. are found throughout Roi-Namur Harbor and fuel/cargo pier. The areas around the two piers have been dredged numerous times beginning with pre-World War II construction. The date of the most recent dredging is unknown. Fill has been placed at numerous locations for shoreline protection and for structure foundations or protection. Dredging is only required in shallow or shoaled area and to the depths necessary to support marine vessels using a particular facility or channel. When dredging is accomplished, dredged spoil is disposed of on-islet away from the ocean or lagoon. Dredged material, or spoils, will either be reutilized as fill material or disposed of on land. Disposal of dredge spoils in the water adjacent to the dredge site may be permissible, provided the requirements in this NCA and associated DEP are satisfied. Dredging and filling in the Roi-Namur Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structures may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Roi-Namur Harbor and Channels

Roi-Namur Harbor is served from the south by the main Inter-Atoll Channel, which runs the length of the atoll between Kwajalein and Roi-Namur. A connecting channel runs east to Ennubirr Islet (or Third Island), which is home to many Marshallese employees. Mellu and North Passes to the west provide deep-water access to the ocean to the north. Inter-atoll channels and passes are for the most part naturally deep and dredging is seldom needed. Coral heads are potential obstacles within these channels, particularly on the way to Third Island, however, they can usually be marked and avoided. Maintenance of inter-atoll channels is essential to USAG-KA and Roi-Namur operations. The following table shows the major channels, required depths, and current conditions.

Table C-2-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges, KMRSS, catamarans, Patriot	45	Depth satisfactory. Coral heads always a problem	Inter-atoll channel
Roi-Namur to Ennubirr (Third Island)	LCMs, catamarans, ferry boats	12	Depth satisfactory. Coral heads need removal	Inter-atoll channel
North Pass	Tugs, LCUs, KMRSS	90	Depth good	Natural pass
Mellu Pass	Tugs, LCUs, KMRSS	90	Depth good	Natural pass

Roi-Namur Islet Marine Facilities/Potential Dredging Projects

Roi-Namur Harbor encompasses the area adjacent to the Cargo (Yokohama) Pier, small boat marina and ferry terminal (Figure C-2-1). Other Roi-Namur Harbor facilities include the fuel/cargo pier to the west. Additionally, ferry boats run multiple times daily from Kwajalein Harbor to the pier at Ennubirr Islet. Each of the pier facilities requires access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-2-2). Bottom depths within the harbor and at the Cargo/Fuel Pier are generally unsatisfactory. The Ennubirr Pier is in need of repair and adjacent bottom depths are unknown but presumed to be unsatisfactory. Dredging will be required to maintain minimum depths. Each of these facilities is proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-2-2 Roi-Namur

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Cargo/Fuel Pier	LCUs (Great Bridge), tugs, barges	16	Depth unsatisfactory	Need to monitor
Cargo Pier (Yokohama Pier)	LCMs, catamarans, ferry boats	12	Depth unsatisfactory,	Need to dredge pier side and approaches
Ennubirr Pier	Ferry boats, recreational-use boats	8	Unknown	Needs to be evaluated and potentially dredged

General Environmental Conditions-Roi-Namur Harbor

Marine waters surrounding and between the fuel/cargo pier and Roi-Namur Harbor as well as along the northwest and northeast ocean-facing shorelines are classified as Class B waters and are suitable for commercial and industrial use (Figure C-2-1). All other waters adjacent to the Roi-Namur Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding the Roi-Namur Harbor is essentially industrial to the north of the cargo/fuel pier and contains mission/operational facilities to the north and west of the Cargo (Yokohama) Pier. Some Roi-Namur supply and fuel storage activities are located between the two piers as are the islet power and water intake plants. The lagoon floor in the harbor area is generally sandy, with some buildup of silt on top.

There are point source discharges in the area between the two piers (See DEP-12-002.0, *Point-Source Discharges*). These discharges include runoff from the fuel farm containment area and cooling water. Potential contamination of bottom sediments exists in the harbor in the area of the outfalls.

Shorelines along the lagoon in the vicinity of the harbor consist of concrete walls and riprap to prevent erosion, and natural sand and earth. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Yokohama Pier itself is potentially eligible for the RMI Register of Historic Places due to its association with World War II.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Roi-Namur Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and NMFS in December 2012 provides information on the marine biological resources in and around Roi-Namur Harbor (Figure C-2-2).

Roi-Namur Harbor is protected from normal trade winds and swell, and is in a low to moderate energy environment. The shoreline along the southeastern corner of the islet has remained a potential nesting and haul-out habitat for sea turtles. The substrate is primarily broad sand flats with patches of hard reef, where 17 species of hard corals and three species of macro-invertebrates were observed. *Acropora* coral colonies largely remained intact and continued to form significant patches that supported a variety of reef fish, including juvenile size classes and larval fish "clouds." There was a high density of anemonefishes observed due to these patches supporting multiple species of sea anemones. The benthic community continues to be dominated by seagrass (*Halophila minor*), with some green algae (*Halimeda* and *Caulerpa*), across the area between the small boat marina and the fuel pier.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document to address dredging at this location is the 1993 USAKA SEIS, which addressed dredging and filling in the atoll as a whole, to include some shore protection. Recent erosion control projects in the in the vicinities of the wastewater treatment plant and two recreational structures included NEPA review. A 2005 EA for repairs to the fuel/cargo pier resulted in a FONSI. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Roi-Namur marine ramp to support vessel activities.

FIGURE C-2-1
ROI NAMUR: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

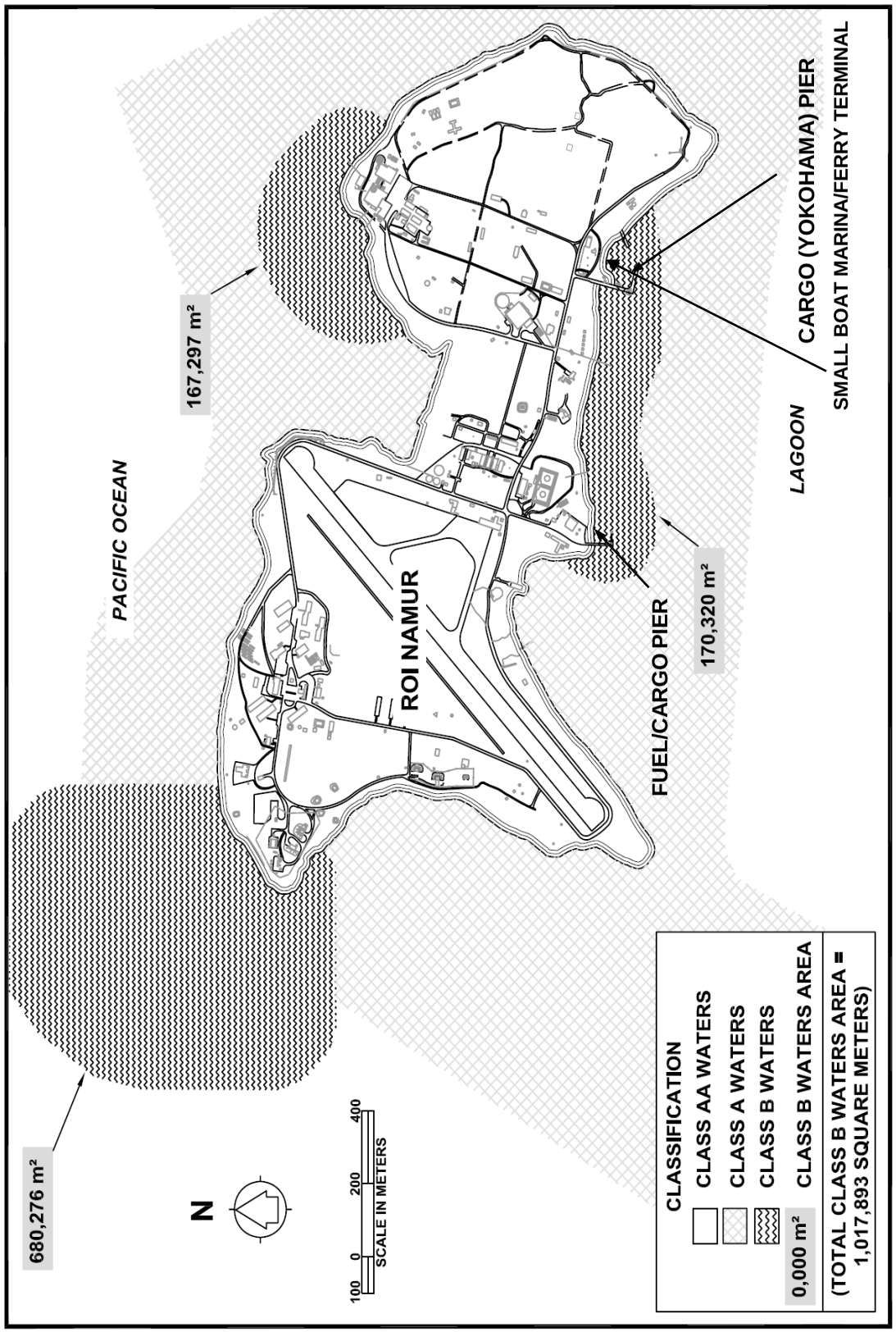


Figure C-2-2
ROI-NAMUR: MARINE BIOLOGICAL RESOURCES

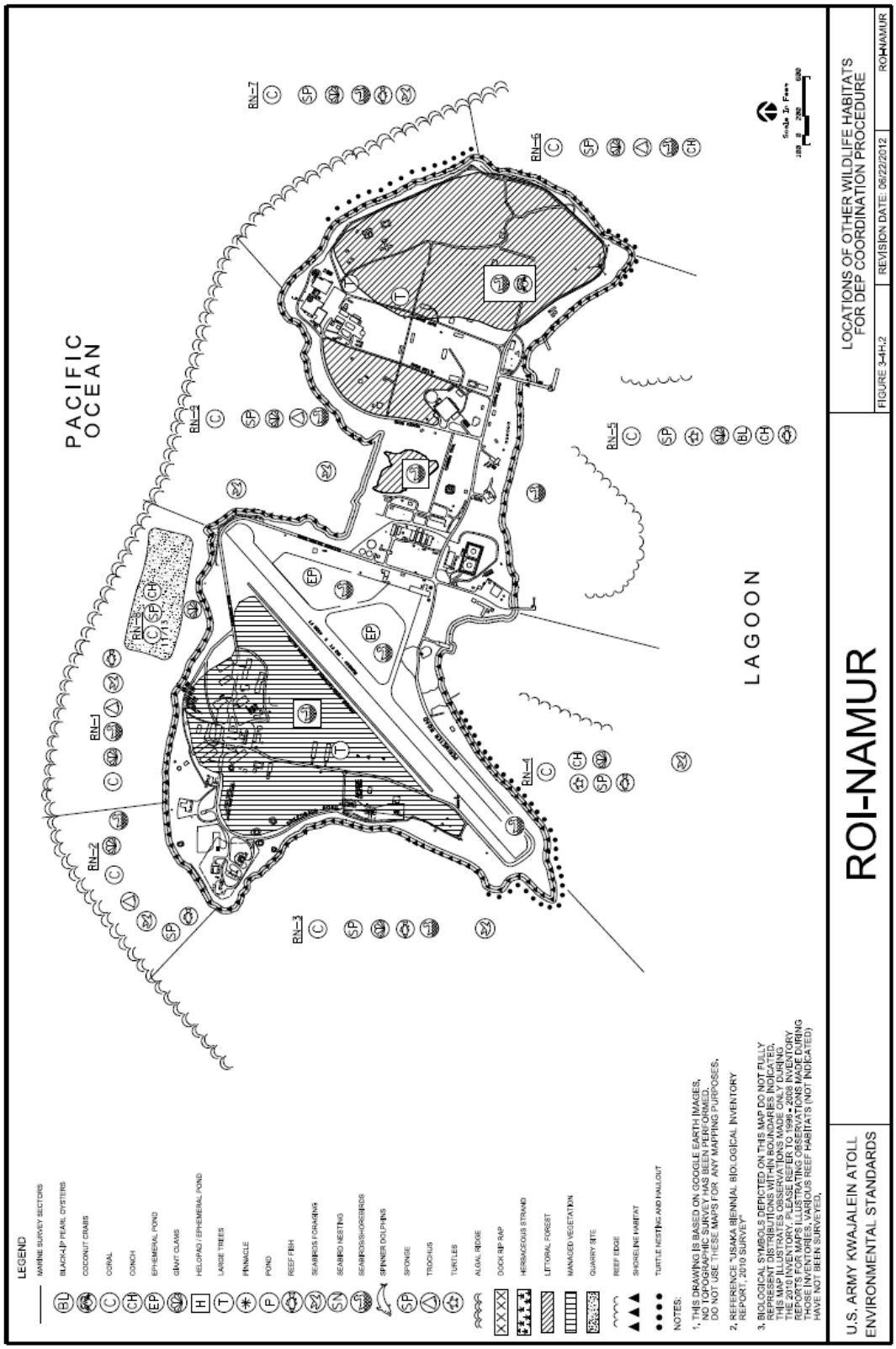


Figure C-2-3
ROI-NAMUR: AREAS PROTECTED FROM DREDGING AND FILLING

C-3. MECK ISLET

General Description:

Meck Islet is the fourth largest of the USAKA islands, approximately 55 acres in size including 18 acres of landfill. It is bounded on the east by the Pacific Ocean, on the west by Kwajalein Lagoon, and on the north and south by reef flats. Operations on Meck have decreased since 2002. There is no permanent population residing on Meck and the transient workforce which once numbered over 100 has dropped to 10 to 20 employees daily. Increased occupancy occurs periodically. In July – October of 2012 and 2013 a man-camp was established as temporary personnel housing. Most transient employees travel to and from Meck via catamaran, which travels from Kwajalein two to three times daily. The only air service to Meck is by helicopter, which travels from Kwajalein on an as-needed basis with visitors and small cargo.

Meck Harbor is located on the southwest lagoon facing side of the islet and consists of a mooring area protected by a jetty, a cargo/personnel pier and a marine ramp (Figure C-3-1). The harbor serves as entry and exit point for personnel commuting to Meck by catamaran and, for cargo and fuels. Vessels utilizing Meck harbor include catamarans from Kwajalein, marine police boats and the LCUs (Great Bridge), LCMs, and tugs and barges. LCUs and LCMs utilize the marine ramp for loading and unloading cargo. Continued maintenance of the harbor is essential to operations at USAKA.

The remainder of the Meck Islet shoreline consists of sandy beach with occasional limestone rock or rocky coral outcrops (Figure C-3-2). The majority of the shoreline has been reinforced by concrete seawall and riprap. Some of the shoreline protection is in poor condition and in need of repair. Near-shore ocean and lagoon floor is primarily sand on the west and limestone rock and hard coral on the north, east, and south. Former quarry pits of varying dimensions and depths are present on the east reef flats. There are industrial structures along the shoreline as well as two industrial stormwater and one industrial wastewater point source discharges. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

An underwater channel leads in from the west to the cargo/personnel pier and marine ramp mooring and turning areas. The harbor area has been previously dredged however the date of the last major dredging effort is unknown. Fill has been placed throughout the harbor area for shoreline and harbor protection and for structure foundations. Dredging is only required in shallow or shoaled areas and to depths necessary to support marine vessels using that particular facility or channel. Dredged material, or spoils, will either be reutilized as fill material or disposed of on land. Disposal of dredge spoils in the water adjacent to the dredge site may be permissible, provided the requirements in this NCA and associated DEP are satisfied. Dredging and filling in the Meck harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under the auspices of this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Meck Harbor and Channels

Meck Harbor is served from the south and west by inter-atoll channels which run the length and bredth of the atoll connecting USAKA and other islets. Inter-atoll channels lead west and south to Kwajalein other islets. Bigej and Eniwetak passes are to the south and north of Meck, respectively, and provide some access to the open ocean however most vessels arriving at Meck originate from Kwajalein. Inter-atoll channels and passes are for the most part naturally deep and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of inter-atoll channels is essential to USAG-KA operations. The following table shows the major channels, required depths, and current conditions.

Table C-3-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, catamarans, barges	45	Depth satisfactory. Coral heads always a problem	Inter-atoll channel
Eniwetak Pass	Tugs	25	Depth satisfactory. Coral heads always a problem	Natural pass
Bigej Pass	Tugs	45	Possible silting	Natural pass

Meck Islet Marine Facilities/Potential Dredging Projects

Meck Harbor encompasses the area between and adjacent to the protective jetty, cargo/personnel pier and marine ramp (Figure C-3-1). Other port facilities include a 3-pile dolphin pier on the south side of the marine ramp. Each of these facilities requires access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-3-2). Bottom depths at Meck Harbor are generally unsatisfactory at1.5 to 3 meters (4.9 to 9.8 feet) and should be deepened to 4.5 to 5 meters (14.8 to 16.4 feet) to support the larger tugs and the LCUs (Great Bridge). Dredging will occasionally be required to maintain minimum depths. Each of the Meck Harbor facilities are proposed for maintenance dredge and fill operations under this NCA and associated DEP. Routine placement and removal of unconsolidated fill on the Meck marine

ramp to support vessel activities may be covered under a routine project as described in section 1.7.3 of this NCA. The following table describes these facilities and shows the required depths and current conditions.

Table C-3-2 Meck

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Cargo/Personnel Pier	Catamarans, tugs, barges, and LCUs (Great Bridge), police boats	18	Depth unsatisfactory	Needs dredging
Barge Ramp	LCUs (Great Bridge), tug, barges	18	Depth unsatisfactory	Need dredging
Boat Anchorage	Catamarans, tugs, barges, LCUs (Great Bridge), police boats	15	Depth unsatisfactory	Needs dredging
Protective Jetty/Wall	--	--	Satisfactory	Maintain

General Environmental Conditions - Meck Islet Harbor

Marine waters within and adjacent to Meck Harbor as well as the central west lagoon-facing shoreline are classified as Class B waters and are suitable for commercial and industrial use (Figure C-3-1). All other waters adjacent to the Meck Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding Meck Harbor is generally industrial to the east and north. Most Meck Islet maintenance, supply, and fuel storage activities are located just north of the harbor, as are the islet power and water plants, and the sewage leachfield. The lagoonfloor in the harbor area is generally sandy.

There is one industrial stormwater point source discharge in the harbor area (see DEP-12-002.0, *Point-Source Discharges*). The potential for contamination of bottom sediments in the harbor is unknown at this time, however the discharge was evaluated as having a low potential to affect receiving waters and biota by United States Army Public Health Command.

Shorelines along the lagoon in the vicinity of the harbor consist of concrete walls and riprap to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Meck Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Meck Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and USNMFS in December 2012 provides information on the marine biological resources around Meck Harbor (Figure C-3-2).

Meck Harbor is located on the lagoon-facing reef on the western side of the islet. Coral cover remained low, with the greatest abundance and diversity of coral species occurring on the lagoon reef off the southwest corner of the islet. Sixty-three hard coral and four mollusk species were observed in the lagoon from the northern harbor jetty to the southwestern end of the islet and seaward across the inter-islet reef flat off the southern end of the islet to the southeastern corner of the islet. Observations of blue-green algae and black filamentous cyanobacteria were primarily found in the lagoon.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

Dredging at this location is addressed in the 1993 USAKA SEIS which addressed dredging and filling in the atoll as a whole including some shore protection. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Meck marine ramp to support vessel activities as well as for minor repairs to the dolphin pier in 2006.

Figure C-3-1
MECK: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

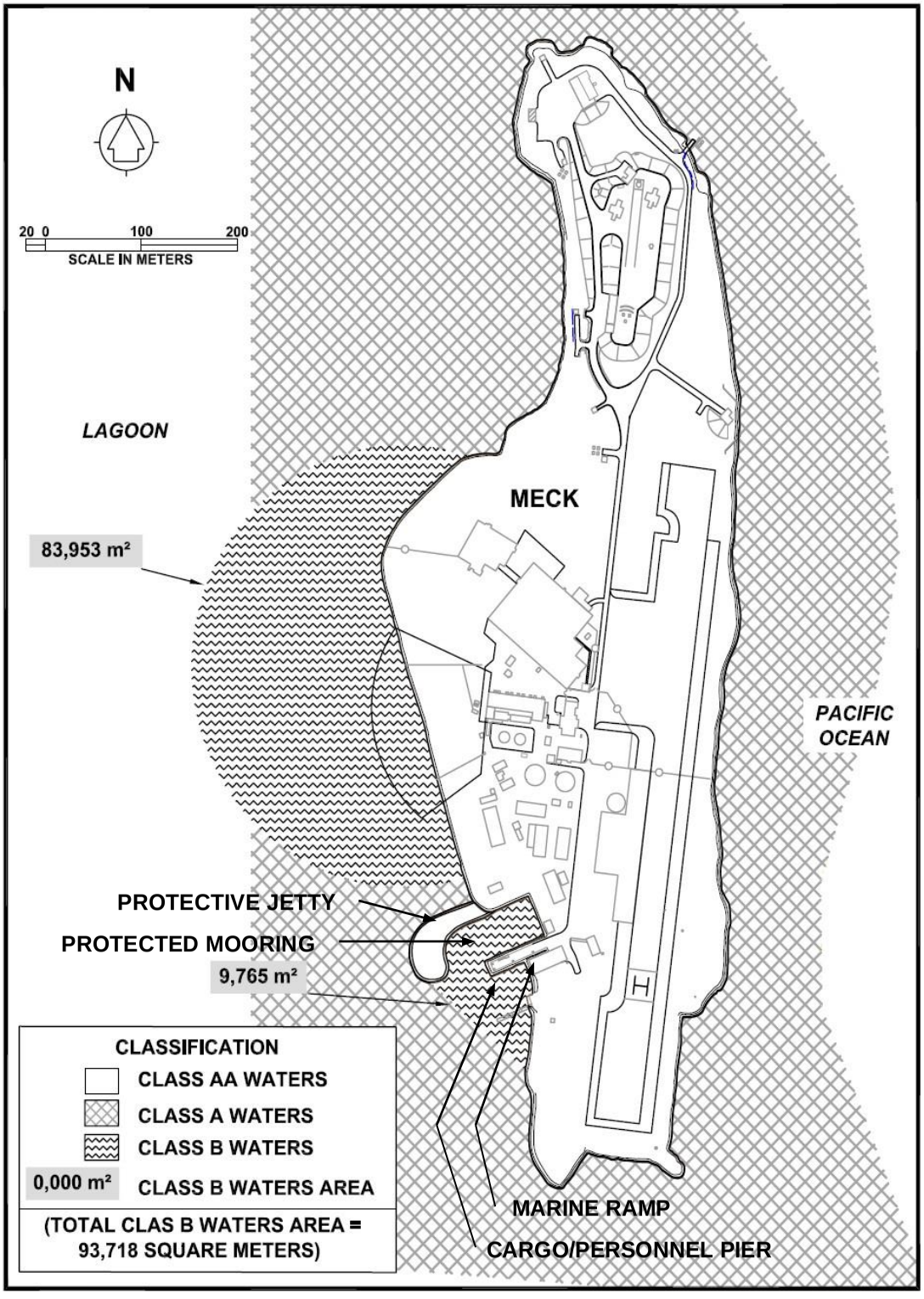


Figure C-3-2
MECK: MARINE BIOLOGICAL RESOURCES

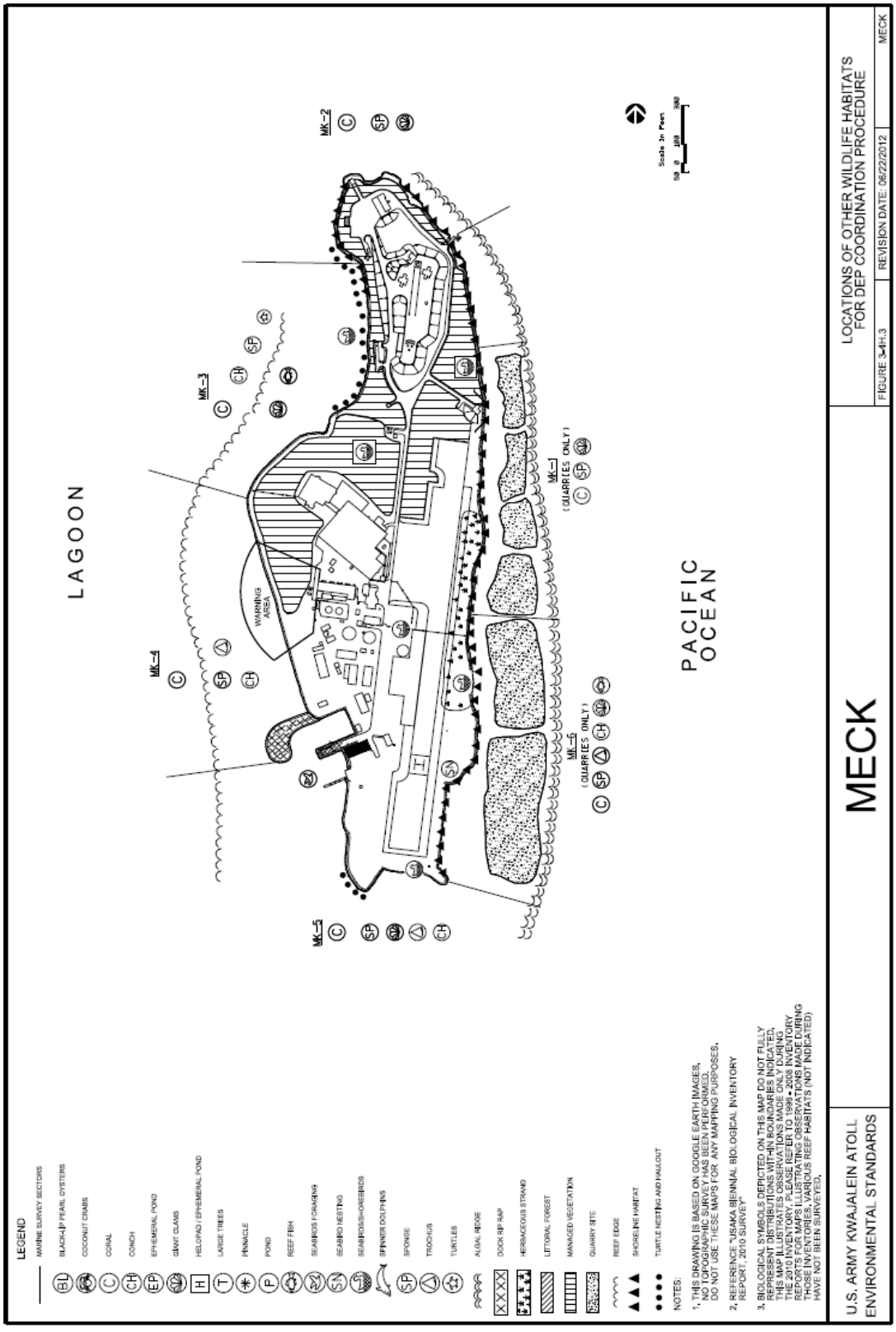
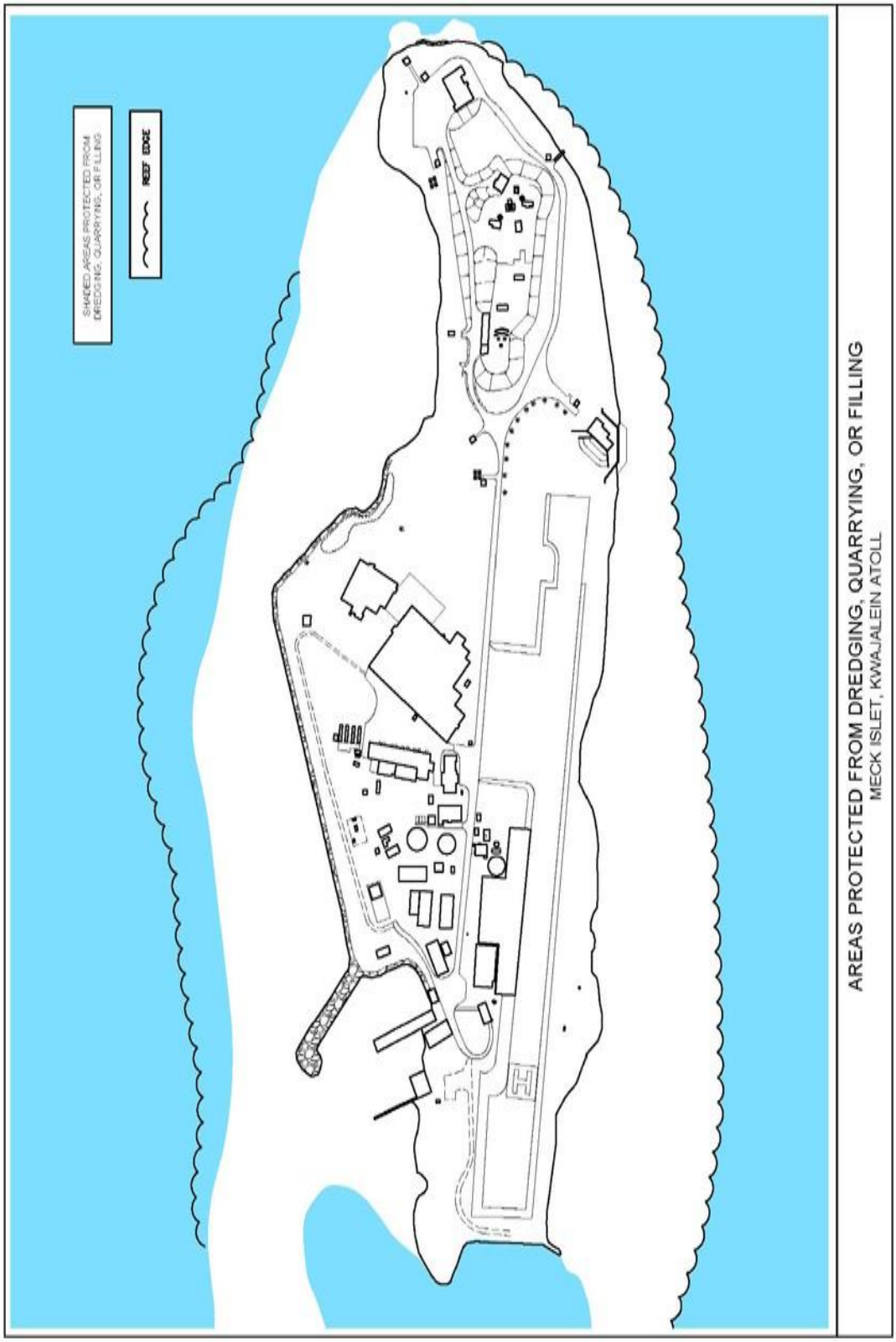


Figure C-3-3
MECK: AREAS PROTECTED FROM DREDGING AND FILLING



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C-4. ENNYLABEGAN ISLET (CARLOS)

General Description:

Ennylabegan is the third largest of the USAKA islands, approximately 71 acres in size. It is bound on the northeast by the Kwajalein Lagoon, on the southwest by the Pacific Ocean, and on the east and west ends by reef flats. The USAG-KA operated power plant on Ennylabegan was shut down permanently in October 2011. While there is no permanent USAG-KA population at Ennylabegan, there are two small Marshallese communities on the east and west ends of the islet.

USAKA only controls the middle two-thirds of the islet. There is no operational airfield at Ennylabegan, but helicopters do make runs to the Ennylabegan heliport on an as-needed basis.

Ennylabegan Harbor is located on the northeast side, near the middle of the islet and consists of a personnel pier and marine ramp, protected by an abandoned concrete hull used as a jetty (Figure C-4-1). The harbor serves as off-loading point for cargo and fuels. Vessels utilizing the harbor include periodic visits by the LCUs, LCMs, marine police boats, occasional tugs and barges and small personal-use boats belonging to or visiting the Marshallese communities. Continued maintenance of the harbor is essential to operations at USAKA.

The remainder of the Ennylabegan shoreline consists of sandy beach with occasional limestone rock or coral outcrops (Figure C-4-2). Concrete seawall and riprap provide shoreline protection in the vicinity of the harbor. Near-shore ocean and lagoon floor is primarily sand with occasional limestone rock or coral. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

An underwater channel leads in from the east to the personnel pier and marine ramp mooring areas. The harbor has been previously dredged. The last major dredging effort was in the late 1980s to a depth of 11 ft. Fill has been placed at locations in the harbor area for shoreline protection and for structure foundations. Dredging is only required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are about 2.5 meters (8.2 feet). When dredging was accomplished in the late 1980s, dredged spoil was barged to Kwajalein for disposal. Dredging and filling in the Ennylabegan harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP.

The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Ennylabegan Harbor and Channels

Ennylabegan Harbor is served from the east by inter-atoll channels which run from Kwajalein harbor to Gea Pass. South Pass and Gea Pass are to the south and north of Ennylabegan, respectively, and provide some access to the open ocean however, most USAKA vessels arriving at Ennylabegan originate and end at Kwajalein. Inter-atoll channels and passes are for the most part naturally deep and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of inter-atoll channels is essential to USAG-KA operations. The following table shows the major channels, required depths, and current conditions.

Table C-4-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to South Pass	Matson container ship, fuel tankers	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel to Ennylabegan Harbor	LCUs (Great Bridge), LCMs, catamarans, Patriot, personal-use boats	15	Depth satisfactory	Inter-atoll channel
Gea Pass	Matson container ship, fuel tankers	100	Depth good	Natural pass
South Pass	LCMs, personal-use boats, KMRSS, LCUs (Great Bridge)	25	Depth satisfactory	Natural pass

Enyylabegan Islet Marine Facilities/Potential Dredging Projects

Ennylabegan Harbor encompasses the area between and adjacent to the personnel pier, marine ramp, and abandoned concrete hull jetty (Figure C-4-1). These facilities require access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-4-2). Bottom depths at the Ennylabegan Harbor are generally unsatisfactory at 2.5 meters (8.2 feet) and should be deepened to 4.5 to 5 meters (14.8 to 16.4 feet) to support the LCUs (Great Bridge). Dredging will occasionally be required to maintain minimum depths. Each of the Ennylabegan Harbor facilities are proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-4-2 Ennylabegan

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Cargo/Personnel Pier	LCUs (Great Bridge), LCMs, personal-use boats	125	Depth unsatisfactory, MLW < 5’	Needs dredging
Marine Ramp	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory, MLW < 5’	Needs dredging
Abandoned Concrete Hull	--	--	Satisfactory	No work req’d

General Environmental Conditions - Ennylabegan Harbor

Marine waters within and adjacent to Ennylabegan Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-4-1). All other waters adjacent to the Ennylabegan Islet shoreline are classified as Class A/AA and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding Ennylabegan Harbor is generally industrial to the south and west. The lagoon floor in the harbor area is generally sandy. .

No point source discharges currently exist in the harbor area and the Ennylabegan power plant cooling water discharge was eliminated in 1999. The potential contamination of bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consist of concrete walls and riprap to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however wind driven swells and storm events can keep suspended particles in a disturbed state.

Other than the concrete hull, which serves as the harbor breakwater, there are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Ennylabegan Harbor is not a cultural/historic area.

Marine Biological Resources - Ennylabegan Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Ennylabegan Harbor (Figure C-4-2).

Ennylabegan Harbor, located on the lagoon-facing reef on the northern side of the islet, is in a windward, high-energy environment exposed to normal trade winds and wind-driven lagoon swells. Coral diversity has remained moderate to high in the area along the lagoon-facing reef from the harbor east to the USAKA property line. Large patches of the calcareous green algae (*Halimeda*) are abundant and a large seagrass meadow (*Halophila minor)* exists in this area. Two species of macro-invertebrates, 50 species of hard corals, and 15 sharks (*Carcharhinidae)* were also observed. Biologists observed evidence of sea turtle and/or fish foraging which was apparent from bite marks on seagrass. Coral diversity has remained low to moderate in the area along the lagoon-facing reef between the harbor and west towards an abandoned pipeline. The filamentous blue-green algae (*Lyngbya)* that dominated the benthic substrate in the 2004 Inventory is no longer as prevalent. However, the calcareous green algae *Halimeda* spp was still present. Three species of macro-invertebrates, 45 species of hard corals and giant coral trout (*Plectropomus laevis)* were also observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging in Ennylabegan Harbor, a U.S. Army Corps of Engineers EA, was done in 1985. Additionally, dredging and filling in the atoll as a whole, to include shore protection, was addressed in the 1993 SEIS in support of the three levels of activity evaluated at USAKA. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Ennylabegan marine ramp to support vessel activities.

Figure C-4-1
ENNYLABEGAN: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

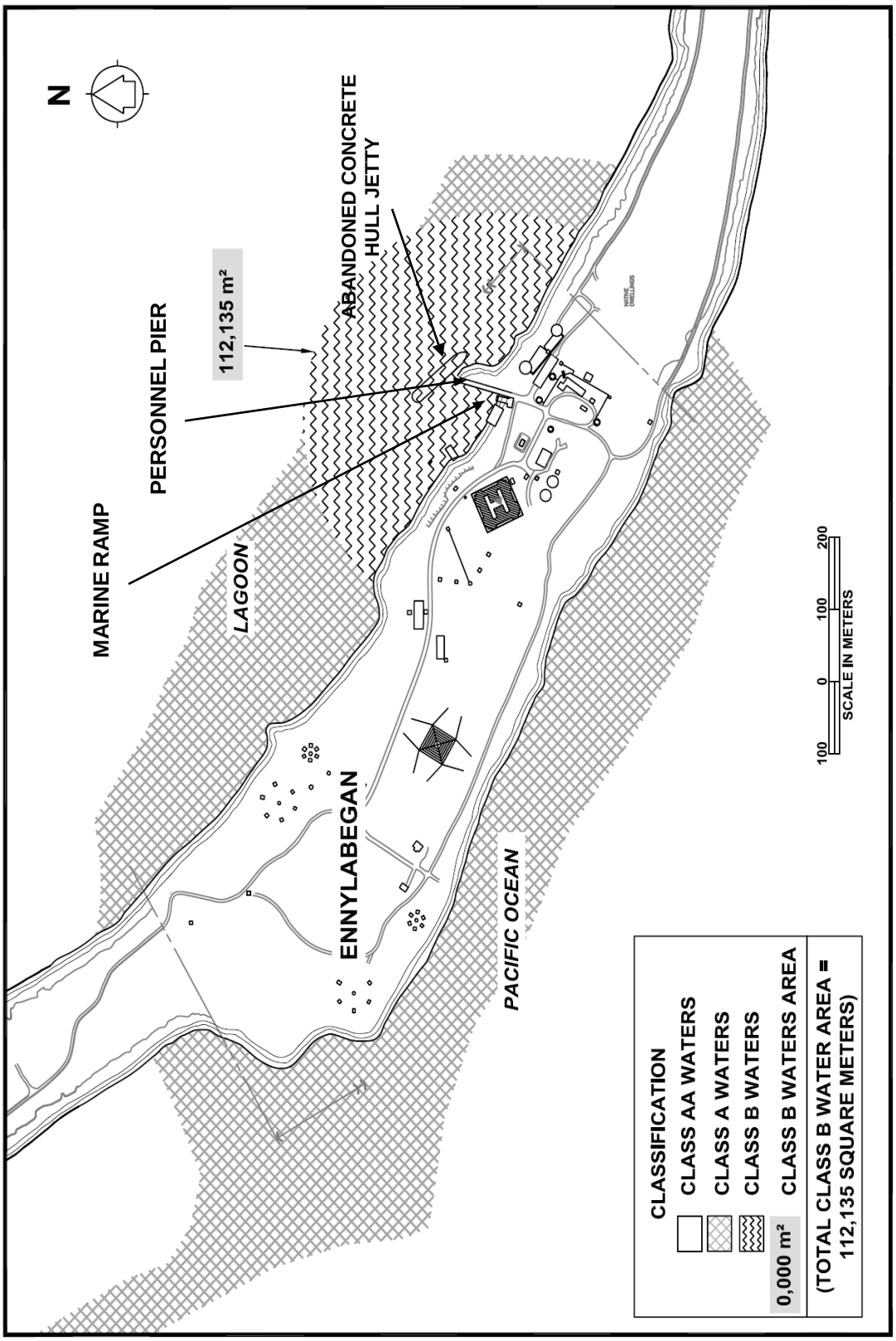


Figure C-4-2
ENNYLABEGAN: MARINE BIOLOGICAL RESOURCES

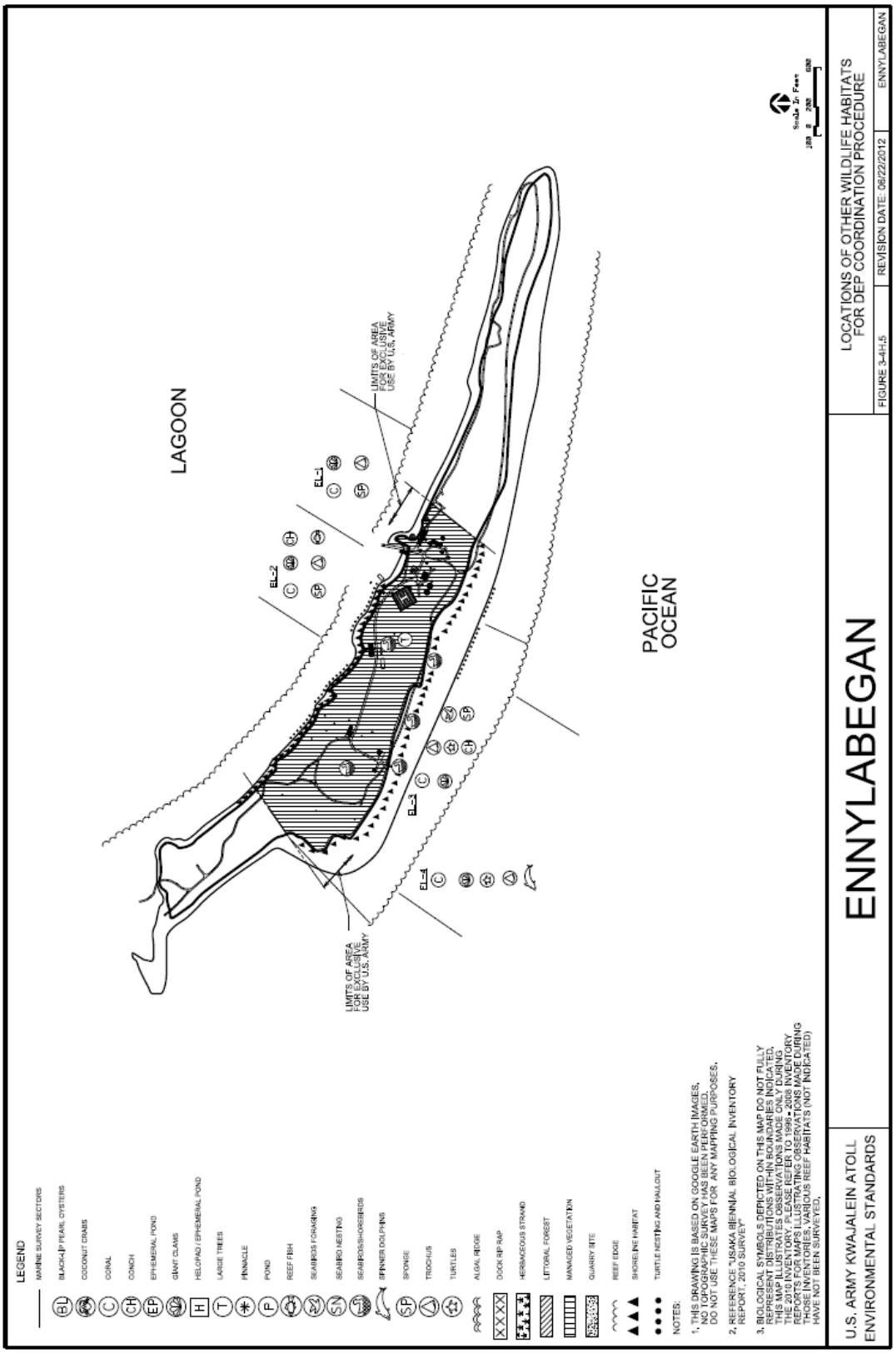
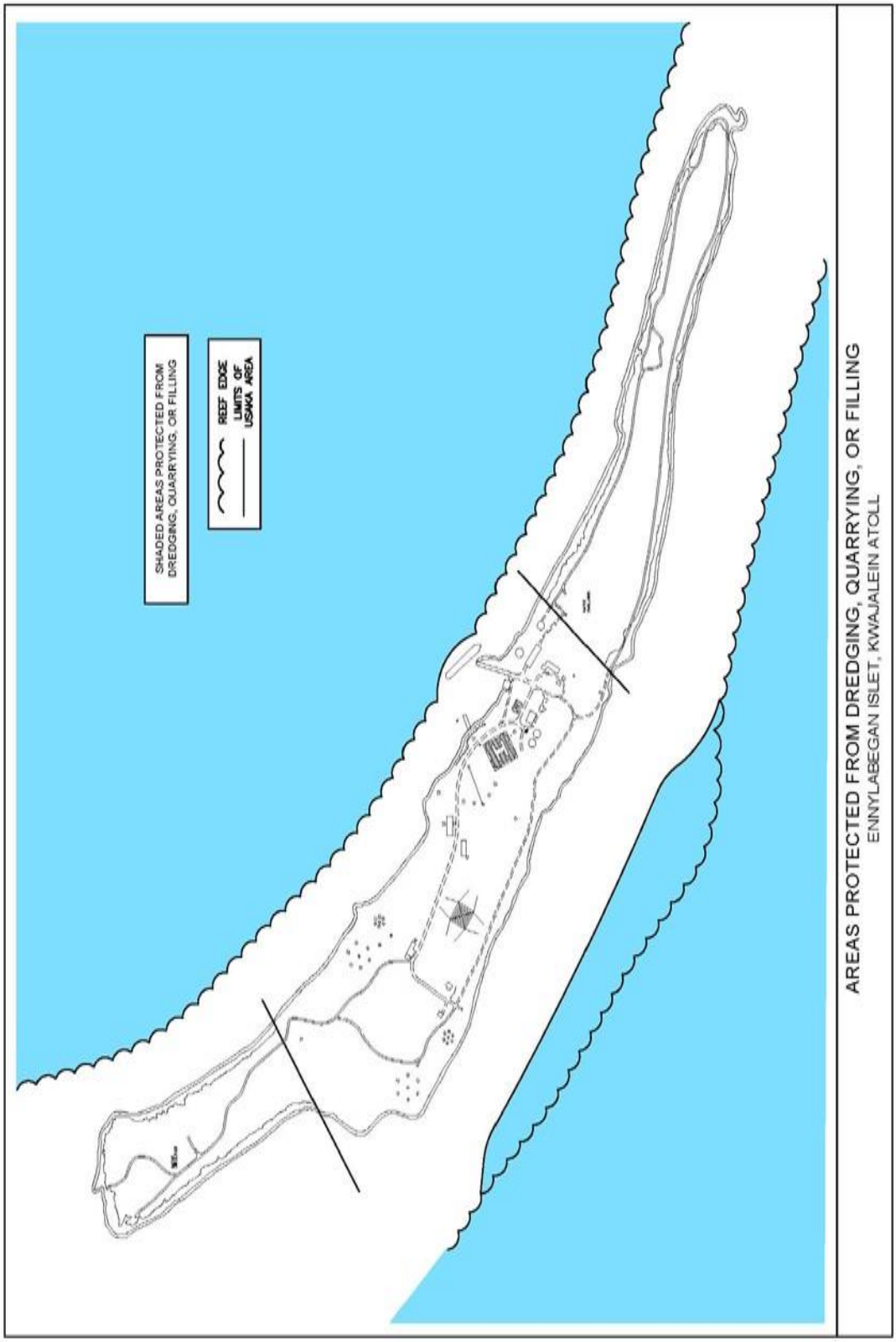


Figure C-4-3
ENNYLABEGAN: AREAS PROTECTED FROM DREDGING AND FILLING



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C-5. ILLEGINNI ISLET

General Description:

Illeginni is the fifth largest of the USAKA islands, approximately 31 acres in size. It is bounded on the north and east by the Kwajalein Lagoon, on the south and west by the Pacific Ocean, and on the east and west ends by lagoon and reef flats. There are two dozen abandoned buildings on Illeginni. There is a routine explosive ordance diposal site located at the north end of the islet. Small areas of the islet are forested and maintained for wildlife conservation. There is no operational airfield at Illeginni, but helicopters do make frequent runs to Illeginni with security and maintenance personnel. There is no permanent or daily work force.

Illeginni Harbor is located on the northeast end of the islet on the lagoon-facing side and consists of a fuel pier, marine ramp and protected mooring area (Figure C-5-1). The harbor serves as the off-loading point for cargo and fuel. The harbor also contains an abandoned cargo/personnel pier. The harbor mooring area was created by quarrying the natural reef to create a deeper inlet. The harbor is protected to the west by the resulting reef edge and to the east by the natural geography of the islet. Vessels utilizing the harbor facilities include the LCUs (Great Bridge), LCMs, and marine police boats. Continued maintenance of the harbor is essential to operations at Illeginni.

The Illeginni shoreline consists of sandy beach and limestone rock with occasional coral outcrops (Figure C-5-2). Near-shore ocean and lagoon floor is primarily sand with occasional limestone rock or coral. There are no point source discharges shown in the harbor area. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

An underwater channel leads from the main Inter-Atoll Channel in the east to Illeginni Harbor. The harbor area has been previously dredged however the date of the last major dredging effort is unknown. Fill has been placed throughout the harbor area for shoreline protection and structure foundations. Dredging is only required in shallow or shoaled areas and to depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are approximately 2.5 meters (8.2 feet). Dredging and filling in the Illeginni Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Illeginni Harbor and Channels

Illeginni Harbor is served from the east by inter-atoll channels connecting to the main Inter-Atoll Channel, which runs from Kwajalein to Roi-Namur. Access to the open ocean from Illeginni would be via South Pass to the south however most vessels arriving at Illeginni originate from Kwajalein. The inter-atoll channels and passes are for the most part naturally deep and dredging is seldom needed Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations. The following table shows the major channels, required depths, and current conditions.

Table C-5-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Naturally deep
Illeginni Harbor Access Channel	LCUs (Great Bridge), LCMs, tugs, barges	25	Depth satisfactory	Naturally deep
Gea Pass	Matson container ship, fuel tankers	100	Depth satisfactory	Natural pass

Illeginni Islet Marine Facilities/Potential Dredging Projects

Illeginni Harbor consists of the area between and adjacent to the fuel pier, marine ramp and abandoned personnel pier within the protected mooring area (Figure C-5-1). These facilities require access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-5-2). Bottom depth at Illeginni Harbor is approximately 4.5 to 5 meters (14.8 to 16.4 feet) currently. Dredging will occasionally be required to maintain minimum depths in order to support the LCUs (Great Bridge). Each of Illeginni Harbor facilities are proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-5-2 Illeginni

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Fuel Pier	Tugs, fuel barges	15	Depth unsatisfactory	Needs dredging
Personnel Pier	--	--	--	Abandoned
Marine Ramp	LCUs (Great Bridge), LCMs	15	Depth unsatisfactory	Needs dredging
Mooring Area	LCUs (Great Bridge), LCMs, tugs, barges	15	Depth unsatisfactory	Needs dredging --
Protective Reef Edge	--	--	Satisfactory	--

General Environmental Conditions - Illeginni Harbor

Marine waters within and adjacent to Illeginni Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-5-1). All other waters adjacent to the Illeginni Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding Illeginni Harbor is generally industrial to the south and west. The lagoon floor in the harbor area is generally sandy.

No point source discharges have been identified in the harbor area. The potential for contamination of bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consist of sandy beach, rock, and riprap to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however wind driven swells and storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Illeginni Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Illeginni Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and NMFS in December 2012 provides information on the marine biological resources around Illeginni Harbor (Figure C-5-2).

Illeginni Harbor, located on the lagoon-facing reef on the northeastern end of the islet is in a windward, high-energy environment. The habitat along the reef adjacent to the western side of the harbor has continued to support a complex community of coral, fish, and invertebrate species, including many species of concern. Coral diversity has remained high throughout this area, particularly along the reef crest and lagoon slope. However, very little fleshy or calcareous algae were observed there. Six species of macro-invertebrates, 88 species of hard corals, and an adult green sea turtle (*Chelonia mydas*) were observed.

Coral diversity has remained moderate to high in the area located on the eastern side of the harbor and the eastern and southern lagoon-facing reef, except in the submarine channel where coral diversity has remained low. Observations of potential stress signaling (*i.e.*, Trematodiasis) were noted after seeing pink blotches on many *Porites* coral colonies. Two species of macro-invertebrates, 56 species of hard corals, giant coral groupers (*Plectropomus laevis*), and one adult green sea turtle (*Chelonia mydas)* were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

Dredging, filling and shore protection at Illeginni is addressed in the 1993 SEIS which discussed the three levels of activity at USAKA, as a whole. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Illeginni marine ramp to support vessel activities.

Figure C-5-1
ILLEGINNI: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILTIES

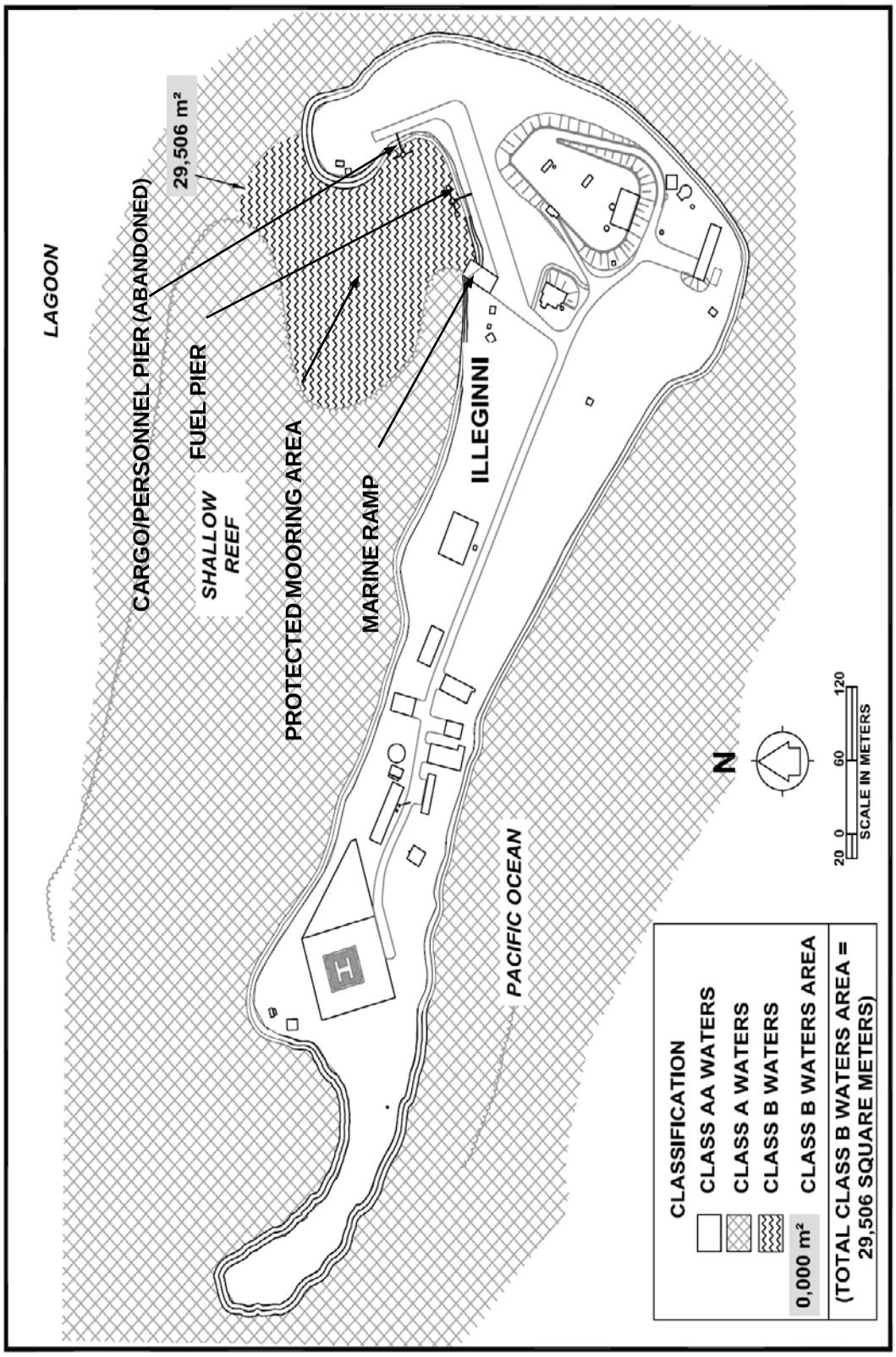


Figure C-5-2
ILLEGINNI: MARINE BIOLOGICAL RESOURCES

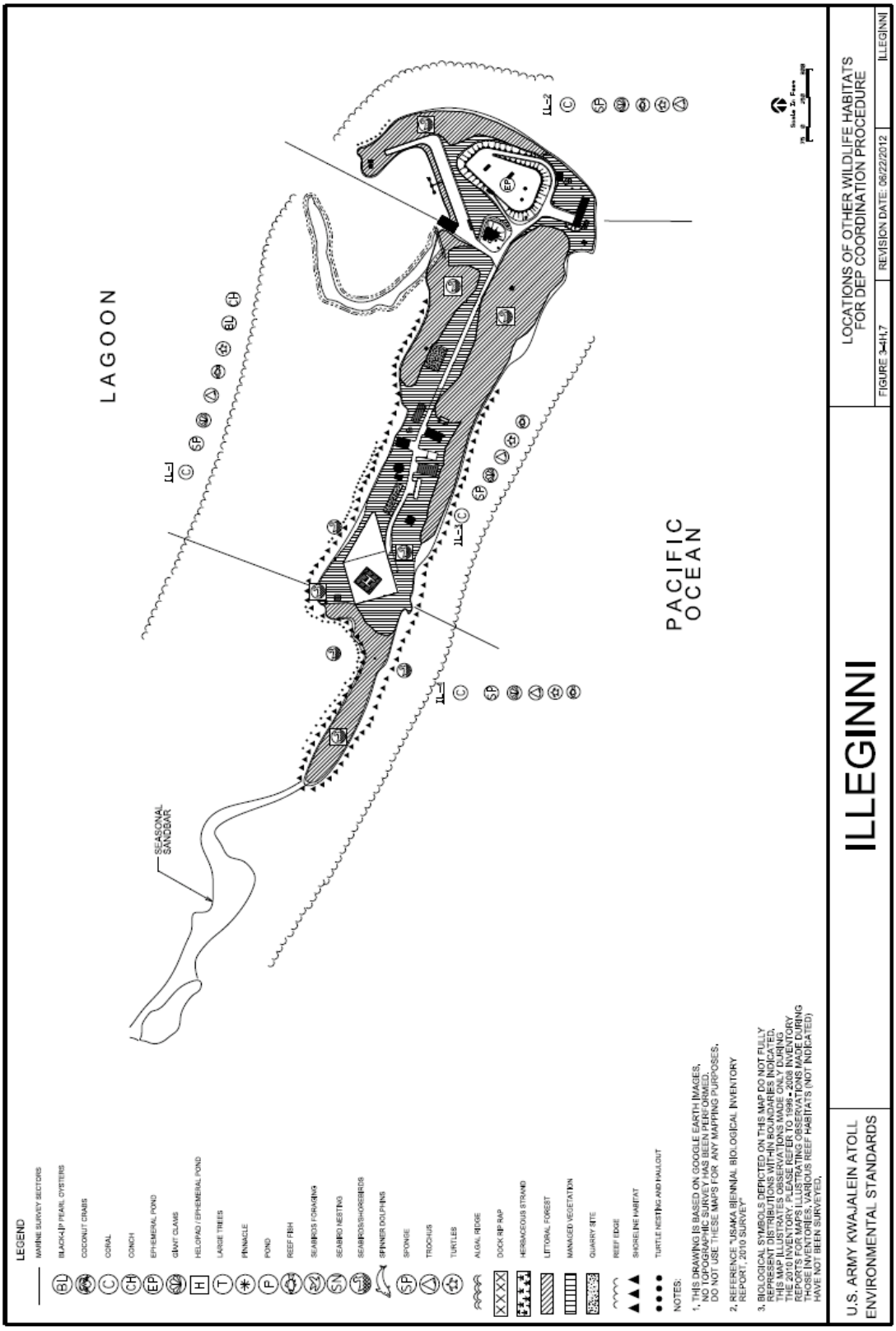
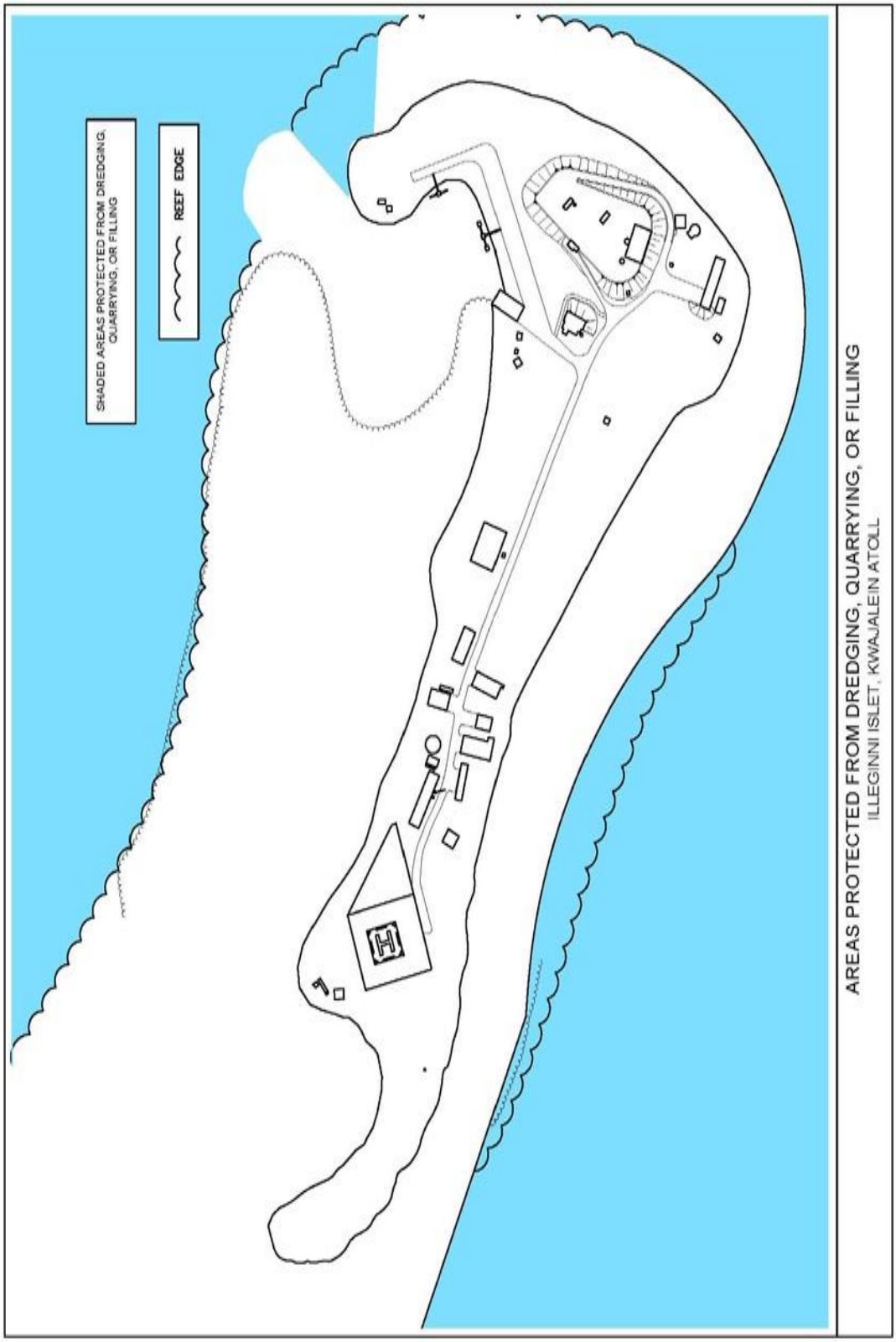


Figure C-5-3
ILLEGINNI: AREAS PROTECTED FROM DREDGING AND FILLING



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C-6. LEGAN ISLET

General Description:

Legan is the sixth largest of the USAKA islands, approximately 18 acres in size. It is bounded on the east by the Kwajalein Lagoon, on the west by the Pacific Ocean, and on the north and south ends by lagoon and reef flats. The majority of the islet is covered by a mixed broadleaf forest and an interior brackish pond. There is no operational airfield at Legan, but helicopters do make frequent runs to Legan with security and maintenance personnel. There is no permanent or daily work force.

Legan Harbor is located on the southeast end of the islet on the lagoon-facing side and consists of a marine ramp and pier enclosed by a protective jetty to the east (Figure C-6-1). Legan Harbor serves as the off-loading point for cargo and fuel. Vessels utilizing the harbor facilities include LCUs (Great Bridge), LCMs, marine police boats and occasional tugs and barges. Continued maintenance of the harbor is essential to operations at Legan.

The Legan shoreline consists of sandy beach and limestone rock close to shore. The islet is surrounded by shallow coral reef that is only open in the vicinity of the harbor (Figure C-6-2). A jetty provides protection along the east side of the harbor. The jetty provides protection of the harbor and must be maintained to ensure safe harbor operations. Near-shore ocean and lagoon floor is primarily sand with occasional limestone rock or coral. There are no point source discharges shown in the harbor area. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

An underwater channel leads from the main Inter-Atoll Channel in the east to Legan Harbor. The harbor has been previously dredged. The last major dredging occurred in the late 1980s to a depth of 11 ft. Fill material has been placed along the jetty and throughout the harbor area for shoreline protection and structure foundations. Dredging is only required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are approximately 2.5 meters (8.2 feet). Dredging and filling in the Legan Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Legan Harbor and Channels

Legan Harbor is served from the east by inter-atoll channels connecting to the main Inter-Atoll Channel, which runs from Kwajalein to Roi-Namur. Access to the open ocean from Legan would be via South Pass to the south however most vessels arriving at Legan originate from Kwajalein. The inter-atoll channels and passes are for the most part naturally deep, and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations. The following table shows the major channels, required depths, and current condition.

Table C-6-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Naturally deep
Legan Harbor Access Channel	LCUs (Great Bridge), LCMs, tugs, barges	15	Depth may be unsatisfactory	Very tight turn to enter
Gea Pass	Matson container ship, fuel tankers	100	Depth satisfactory	Natural pass

Legan Islet Marine Facilities/Potential Dredging Projects

Legan Harbor consists of the area between and adjacent to the pier, marine ramp, and protective jetty (Figure C-6-1). These facilities require access channels for entry and exit, and a large enough area for tug and barge maneuvers or vessel turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-6-2). Bottom depths at Legan Harbor are generally satisfactory at 2.5 meters (8.2 feet), which support the LCM but not the LCU (Great Bridge). There is a very tight turn to enter the harbor which may require occasional dredging. Each of Legan Harbor facilities are proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-6-2 Legan

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Pier	LCUs (Great Bridge), LCMs	12	Depth may be unsatisfactory	May need dredging
Marine Ramp	LCUs (Great Bridge), LCMs	12	Depth may be unsatisfactory	May need dredging
Mooring Area	LCUs (Great Bridge), LCMs	12	Depth may be unsatisfactory	May need dredging
Protective Seawall & Jetty	--	--	Satisfactory	--

General Environmental Conditions - Legan Harbor

Marine waters within and adjacent to Legan Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-6-1). All other waters adjacent to the Legan Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding Legan Harbor is generally industrial to the west. Most USAG-KA facilities at Legan are either located just west or north of the harbor. The lagoon floor in the harbor area is generally sandy with some hard coral near the entrance.

No point source discharges have been identified in the harbor area. The potential for contamination of bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consist of sandy beach, coral boulders, rock, and riprap to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events and wind driven swells can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Legan Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Legan Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The *2010 Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Legan Harbor (Figure C-6-2).

Legan Harbor, located on the lagoon-facing reef on the southeastern end of the islet is in a windward, high-energy environment exposed to normal trade winds and wind-driven lagoon swells. The lagoon reef slope north of the harbor has continued to support a relatively high diversity of coral and non-coral macro-invertebrate species. Ninety-seven species of hard corals and one adult green sea turtle (*Chelonia mydas*) were observed. Macro-invertebrates including mollusks (*Trochus, Lambis, Hippopus,* and *Tridacna*) and one whip coral were observed. The harbor bottom is primarily sand, and coral diversity has remained relatively low along the northern wall of the harbor entrance.

While the *2012 Marine Biological Inventory* that was published by USFWS and USNMFS in December 2013 did not focus on specific areas within the 11 USAKA islets, some Mid-Atoll Corridor stations were in close proximity to four of the USAKA islets.

Located on a patch reef near Legan Islet in the central-west region of the USAKA Mid-Atoll Corridor the reef appeared complex and diverse. High levels of living corals intermixed with algae and sand greatly influenced the shallow flat and slope landscape topographies. Sand with intermittent coral and rock formations appeared to be the main habitat below surveyed depths. Observations of tangled fishing line were found on top of the reef. Forty-eight species of hard corals, three species of macro-invertebrates, and six species of reef fish were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging in Legan Harbor, a U.S. Army Corps of Engineers EA, was done in 1985. Additionally, dredging and filling in the atoll as a whole, to include shore protection, was addressed in the 1993 SEIS in support of the three levels of activity evaluated at USAKA. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Legan marine ramp to support vessel activities.

Figure C-6-1
LEGAN: CLASSIFICATION OF COASTAL-WATER USE; LOCTION OF HARBOR FACILITIES

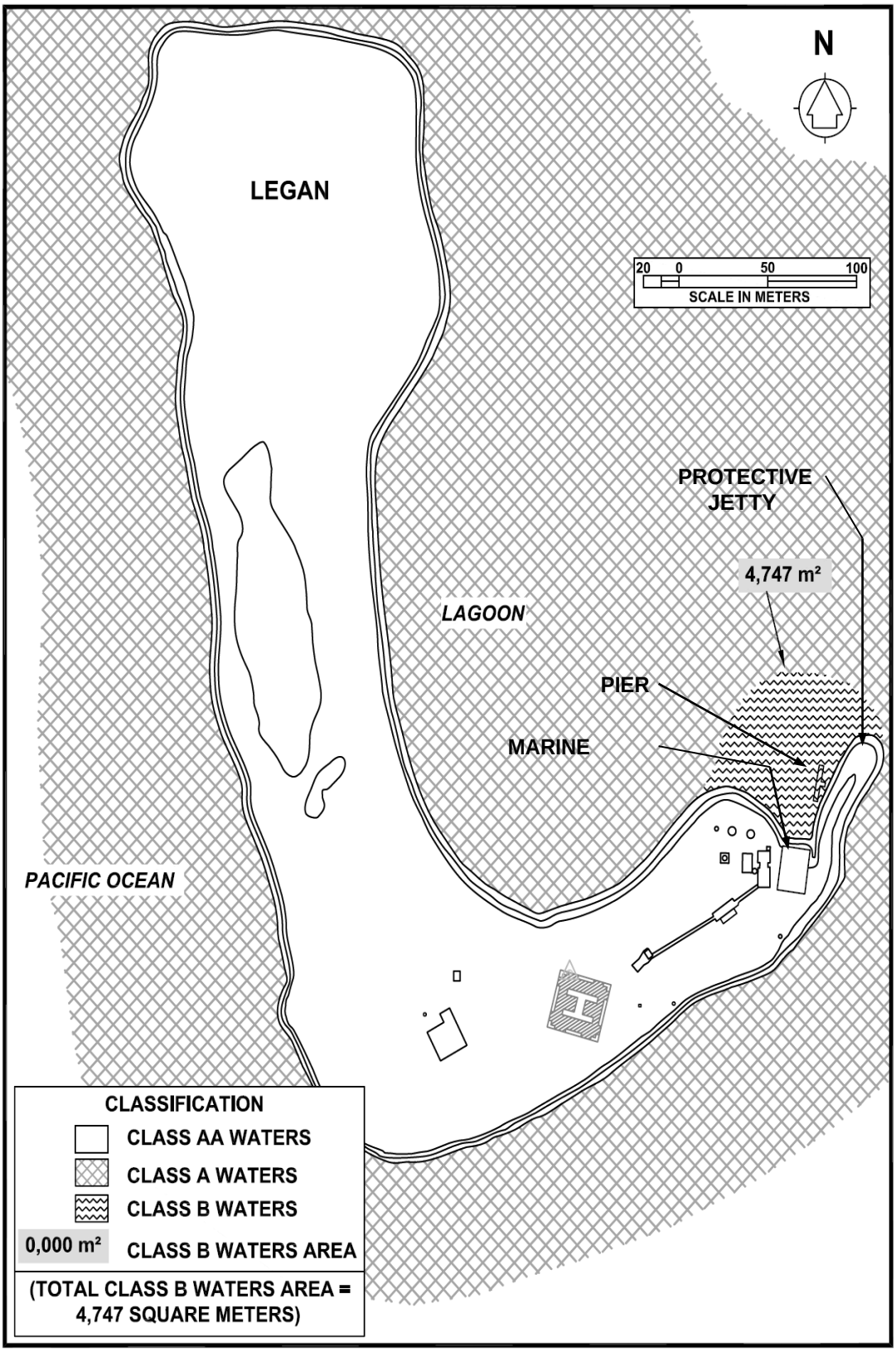


Figure C-6-2
LEGAN: MARINE BIOLOGICAL RESOURCES

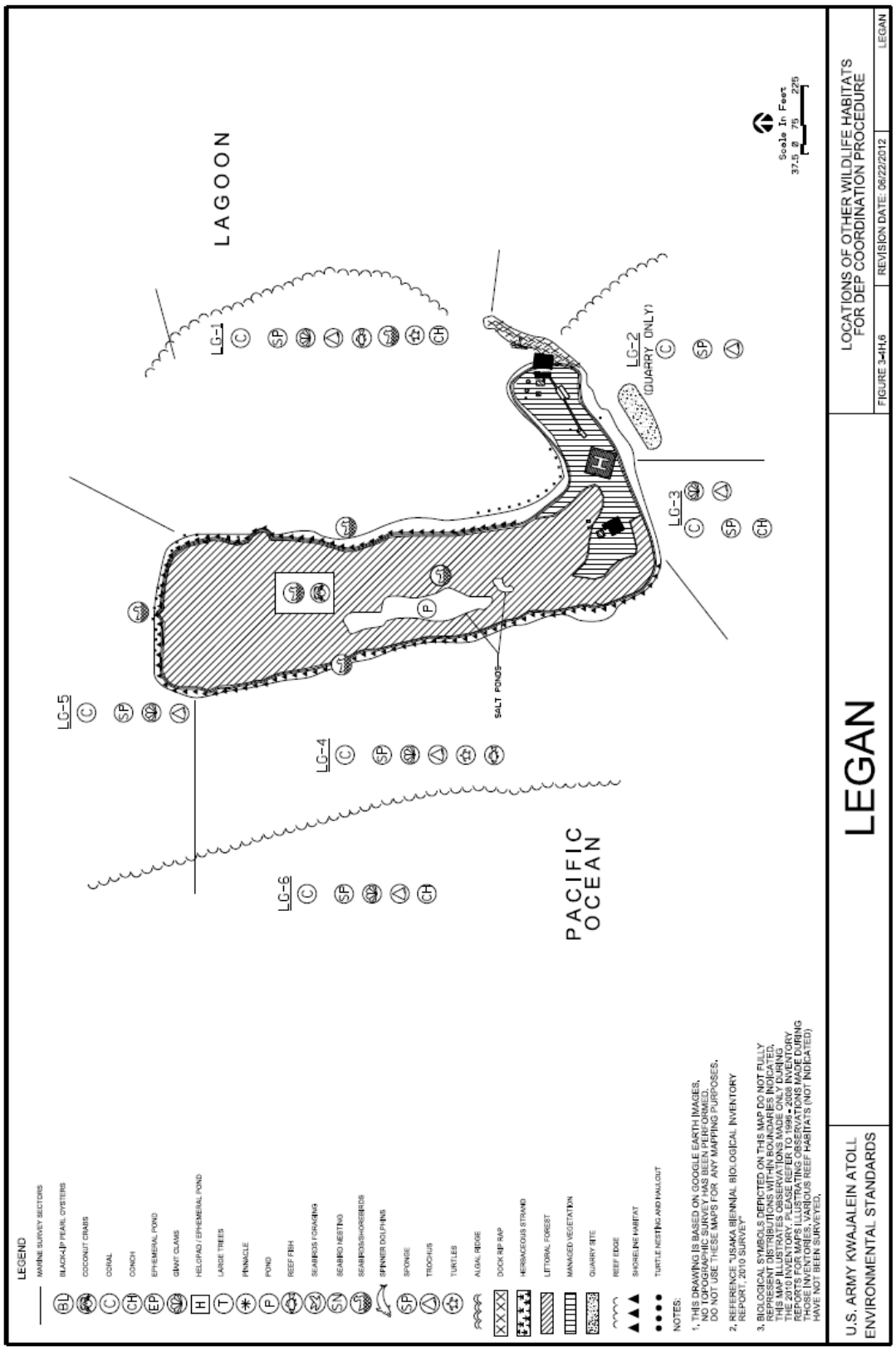
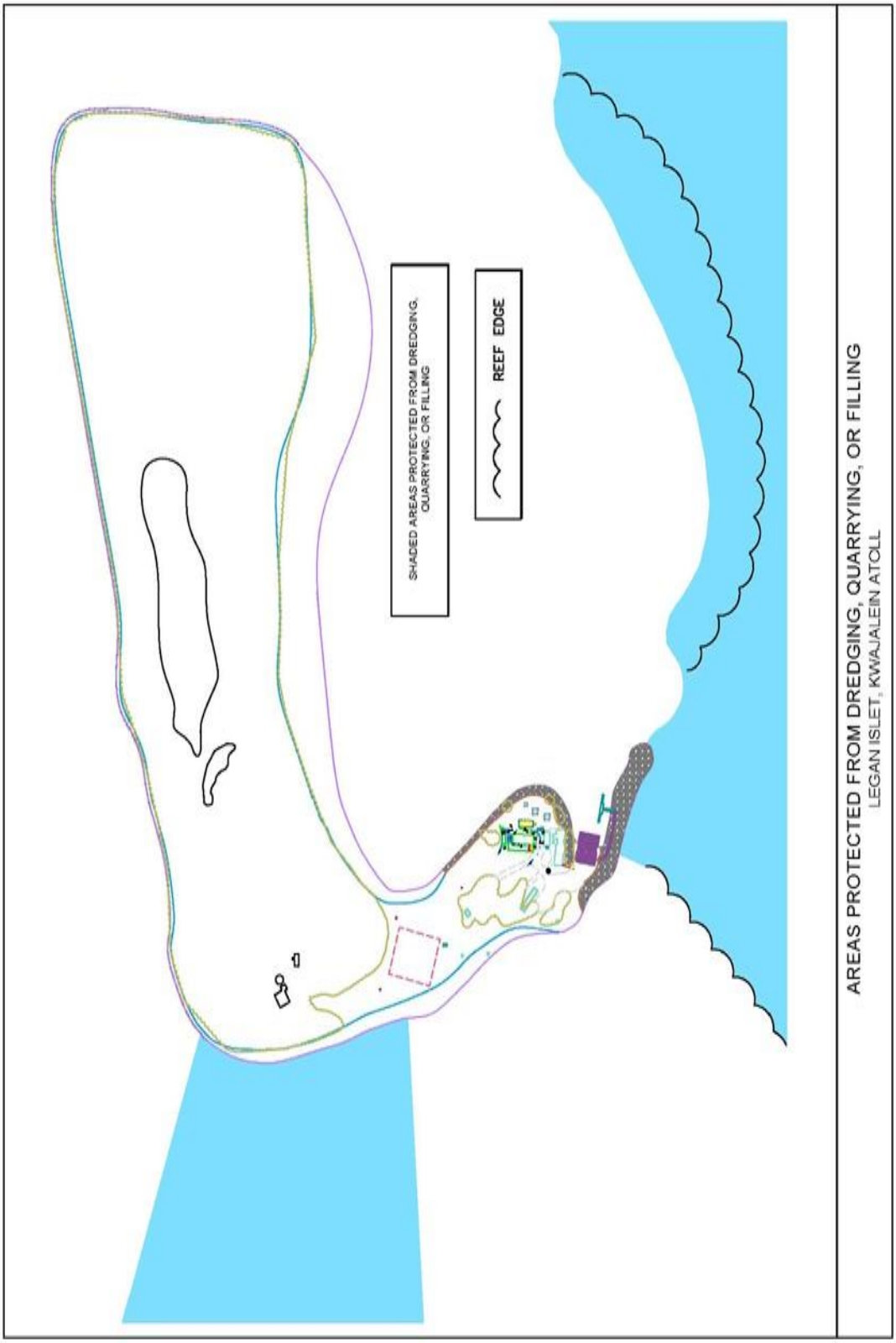


Figure C-6-3
LEGAN: AREAS PROTECTED FROM DREDGING AND FILLING



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C-7. GAGAN ISLET

General Description:

Gagan is one of the smallest USAKA islands, approximately 6 acres in size. It is bounded on the northeast by the Pacific Ocean, on the southwest by the Kwajalein Lagoon, and on the east and west ends by lagoon and reef flats. Mixed broadleaf forest covers the undeveloped portions of the islet. There is no operational airfield at Gagan, but helicopters do make occasional runs to Gagan with security and maintenance personnel. There is no permanent or daily work force.

Gagan Harbor is located on the southwest end of the islet on the lagoon-facing side and consists of a marine ramp and pier enclosed to the north and south by jetties (Figure C-7-1). Gagan Harbor serves as the off-loading point for cargo and fuel. Vessels utilizing the harbor facilities include the LCUs (Great Bridge), LCMs, marine police boats and occasional catamarans, tugs and barges. Continued maintenance of the harbor is essential to operations at Gagan.

The majority of the Gagan shoreline is sandy beach with riprap in the vicinity of the two jetties and the harbor mouth (Figure C-7-2). The jetties provide protection along the north and south sides of the harbor and must be maintained to ensure safe harbor operations. Near-shore ocean and lagoon floor is primarily sand with occasional limestone rock and coral off the south jetty. There are no point source discharges shown in the harbor area. Ocean currents and waves are primarily from the northeast and can be severe during major ocean storms.

An underwater channel leads from the main Inter-Atoll Channel in the west to Gagan Harbor. The harbor has been previously dredged as well as a fairly large area outside the harbor to the west and north however the date of the last major dredging effort is unknown. Fill has been placed throughout the harbor area for shoreline protection and structure foundations. Only the area in the harbor between the jetties is covered by this NCA. Dredging is only required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are approximately 2.5 meters (8.2 feet). Dredging and filling in the Gagan Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Gagan Harbor and Channels

Gagan Harbor is served from the west by inter-atoll channels connecting to the main Inter-Atoll Channel, which runs from Kwajalein to Roi-Namur. Access to the open ocean from Gagan would be via North Pass in the north or Bigej channel to the south however most vessels arriving at Gagan originate from Kwajalein or Roi-Namur. The inter-atoll channels and passes are for the most part naturally deep, and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations at Gagan. The following table shows the major channels, required depths, and current condition.

Table C-7-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Naturally deep
Gagan Harbor Access Channel	LCMs, catamarans, LCUs (Great Bridge), tugs, barges	12	Depth may be unsatisfactory	Naturally deep

Gagan Islet Marine Facilities/Potential Dredging Projects

Gagan Harbor consists of the area between the two protective jetties including the pier and marine ramp (Figure C-7-1). These facilities require access channels for entry and exit and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-7-2). Bottom depths at Gagan Harbor are generally unsatisfactory at 2.5 meters (8.2 feet) and should be deepened to 4.5 to 5 meters (14.8 to 16.4 feet) to support the LCUs (Great Bridge). Dredging may occasionally be required to maintain minimum depths. Each of Gagan Harbor facilities are proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-7-2 Gagan

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Pier	LCMs, tugs, fuel barges	15	Depth unsatisfactory	Needs dredging
Marine Ramp	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory	Needs dredging
Mooring Area	LCUs (Great Bridge), LCMs, catamarans	12	Depth unsatisfactory	Needs dredging
Protective Jetties	--	--	Satisfactory	--

General Environmental Conditions - Gagan Harbor

Marine waters within and adjacent to Gagan Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-7-1). All other waters adjacent to the Gagan Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area surrounding the harbor is generally industrial to the north and east. The lagoon floor in the harbor area is generally sandy.

No point source discharges have been identified in the harbor area. The potential for contamination of bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consist of sandy beach and riprap to prevent erosion and protect harbor structures. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc. in the areas to be dredged. Gagan Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Gagan Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Gagan Harbor (Figure C-7-2).

Gagan Harbor is located on the lagoon-facing reef on the southeastern end of the islet. Although the 2010 Inventory did not survey Gagan Harbor, the lagoon areas west and east of the harbor provide valuable information on biological diversity within adjacent habitats which could indicate potential for migration of biological resources into the harbor area.

Along the southeastern end of the islet, the reef is in a windward, high-energy environment. Immediately lagoonward of the quarry, the reef flat is current-swept, low-relief pavement. Off the southeast corner of the islet is a deeper, more protected shelf with coral-covered outcrops and other high-relief features. Several large boulders have remained lodged on the reef flat among much overturned plate coral as a result of large storms. Refuge was provided for a variety of reef fish, juvenile fish, and large aggregations of larval fish due to a high density of sea anemones (*Heteractis and Stichodactyla).* Eleven octopi, as well as a resident population of garden eels were observed. Four species of macro-invertebrates and 70 species of hard corals were also observed.

Along the lagoon-facing reef between the northern harbor jetty and the northwestern corner of the islet the reef is sheltered from normal trade winds and swells by Gagan Islet and is in a relatively low-energy environment. Coral diversity on the lagoon reef slope is high. West of the shallow reef the habitat is largely sand flats with coral covered pinnacles dotting the bottom. Five species of macro-invertebrates, 82 species of hard corals, three adult green sea turtles (*Chelonia mydas*), and a Giant coral groupers (*Plectropomus laevis*) were observed.

While the *2012 Marine Biological Inventory* that was published by USFWS and USNMFS in December 2013 did not focus on specific areas within the 11 USAKA islets, some Mid-Atoll Corridor stations were in close proximity to four of the USAKA islets.

Habitat along the lagoon slope in northeast quadrant of the USAKA Mid-Atoll Corridor, just north of Gagan, is defined by sloping sand below consolidated limestone reef slope with crevices, small caverns, living coral and macroalgae resources. Mainly defined by hard limestone coral aggregations and sand, the reef crest and flat were complex and diverse. Coral bleaching was observed in the area. Forty-five hard corals, six species of macro-invertebrates, and four species of reef fish were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

Dredging, filling and shore protection at Gagan is addressed in the 1993 SEIS which discussed the three levels of activity at USAKA, as a whole. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Gagan marine ramp to support vessel activities.

Figure C-7-1
GAGAN: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

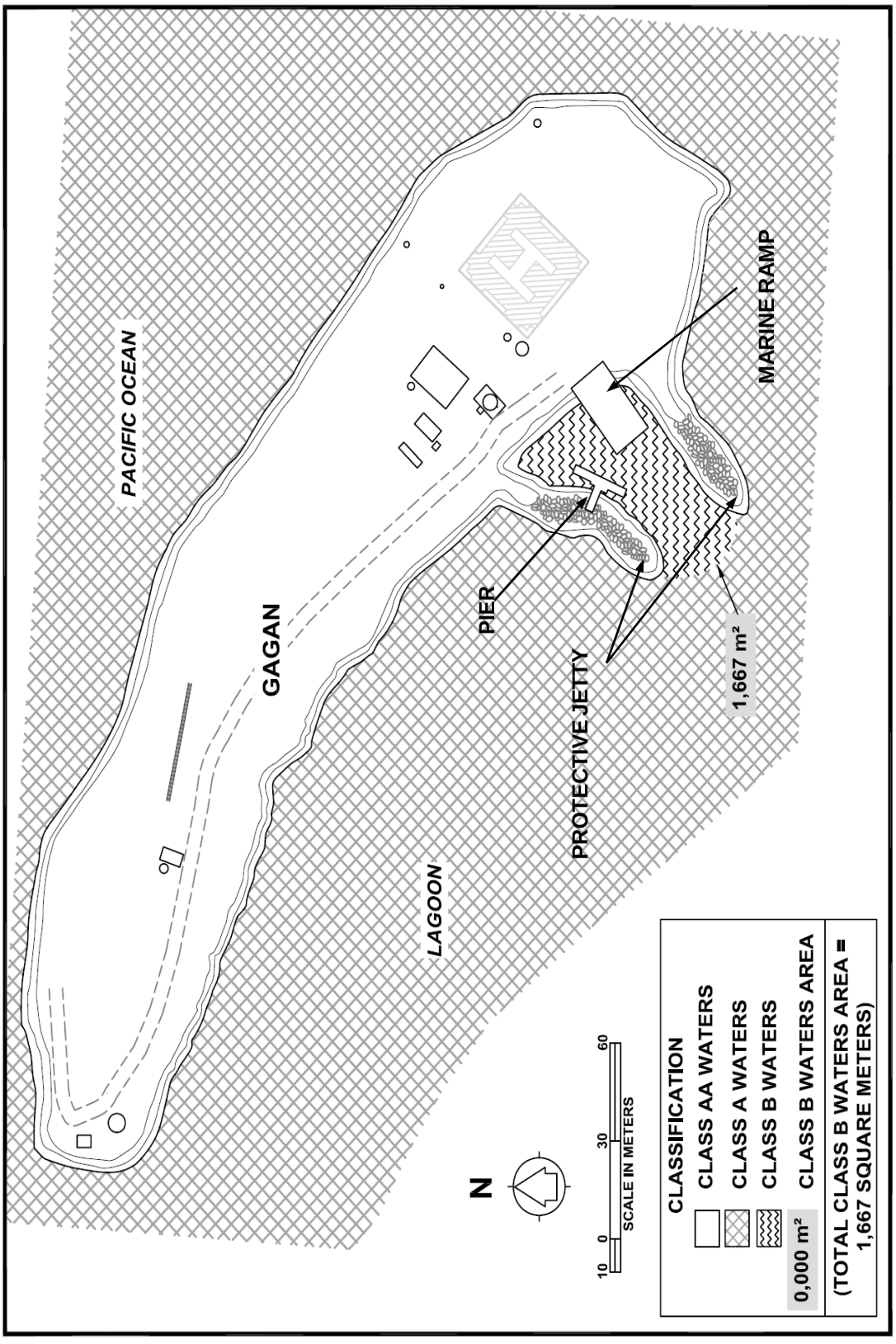


Figure C-7-2
GAGAN: MARINE BIOLOGICAL RESOURCES

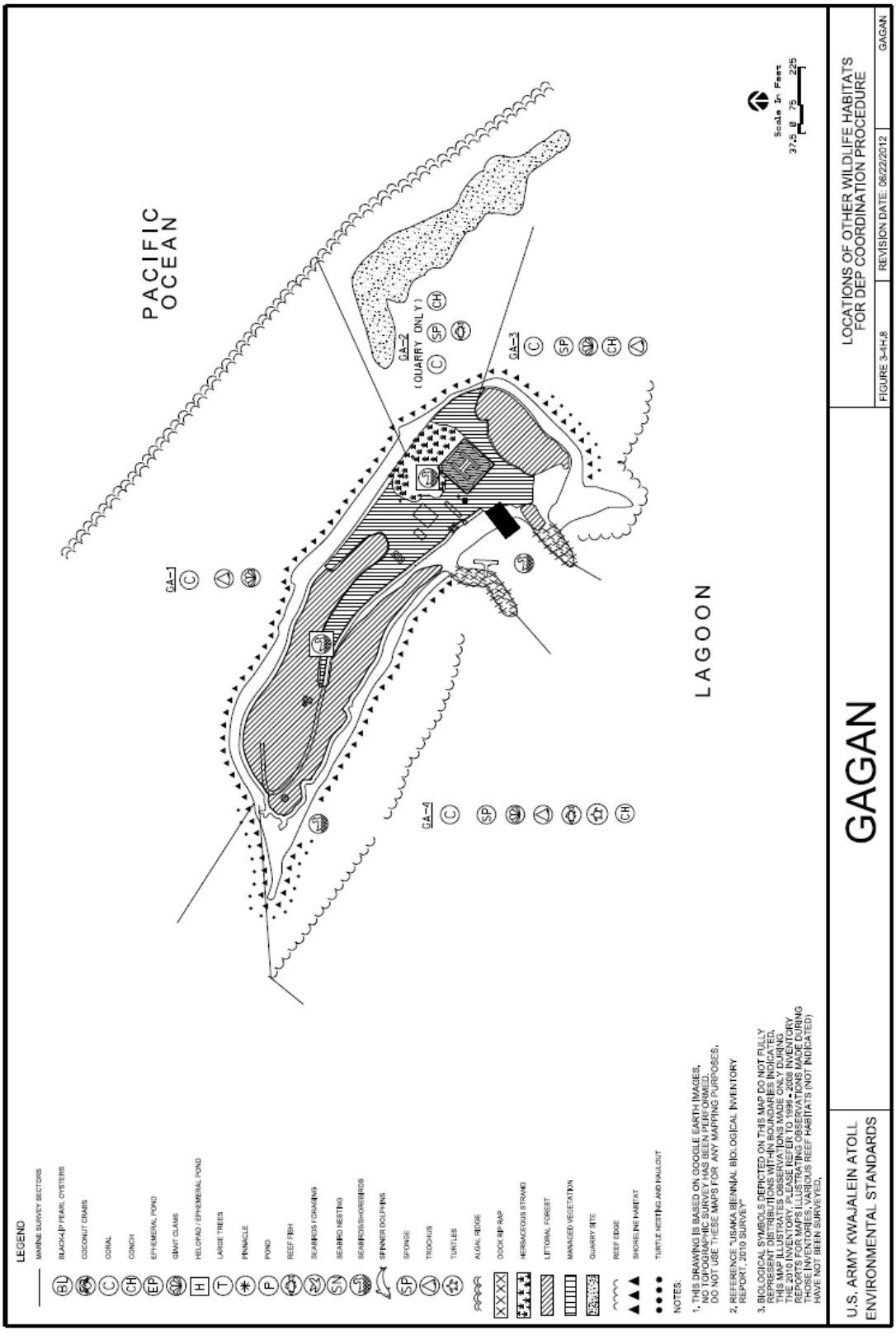
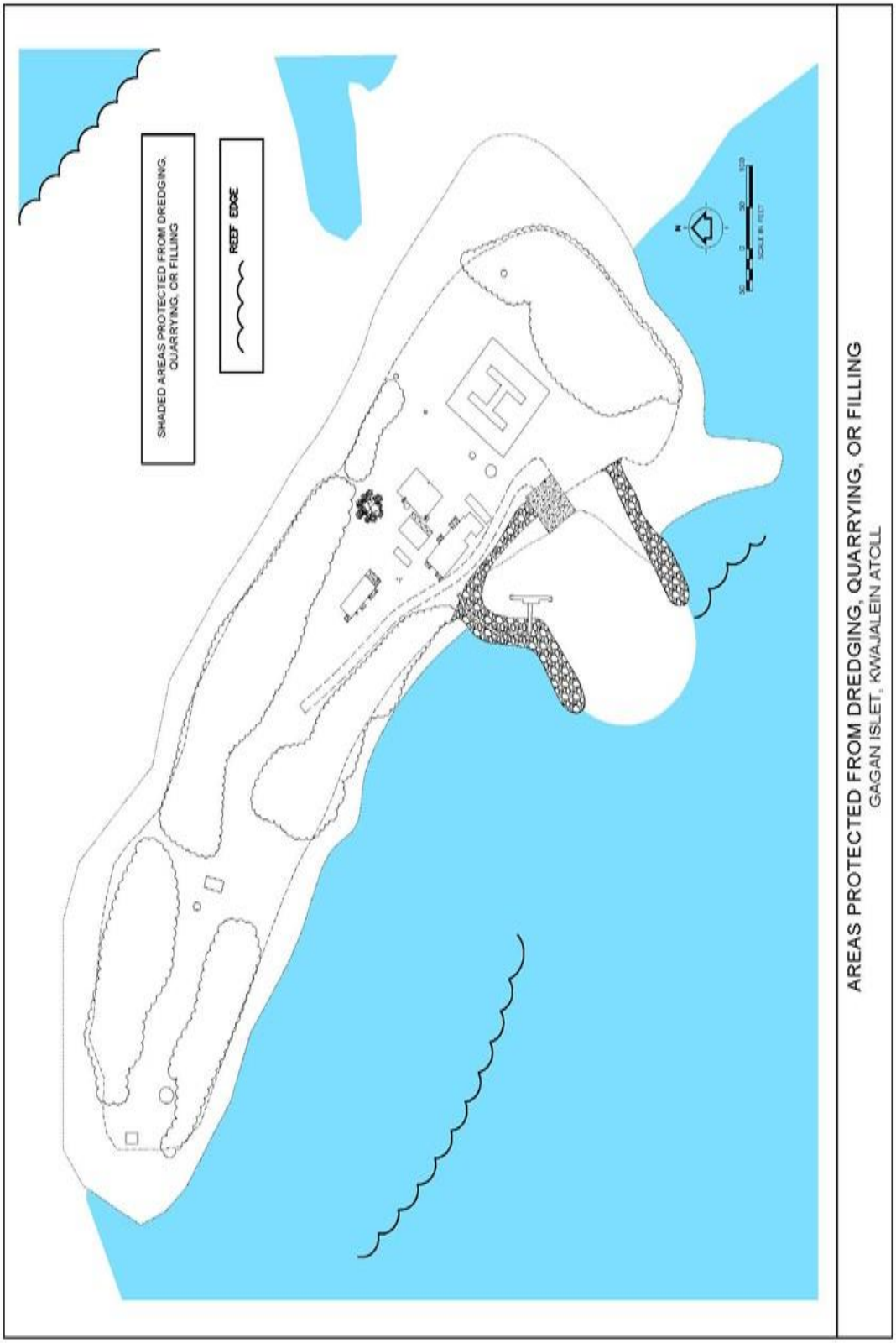


Figure C-7-3
GAGAN: AREAS PROTECTED FROM DREDGING AND FILLING



C-8. GELLINAM ISLET

General Description

Gellinam is the smallest of the USAG-KA islands, approximately 5 acres. It is bounded on the east by the Pacific Ocean and on the west by the Kwajalein Lagoon. An herbaceous strand runs along the east and west edges of the islet and a littoral forest is located in the center of the northern third of the islet. There is no operational airfield at Gellinam, but helicopters do make occasional runs with security and maintenance personnel. There is currently no permanent or daily work force.

Gellinam Harbor is located on the southwest end of the islet on the lagoon-facing side and consists of a marine ramp and fuel pier enclosed to the north and south by riprap breakwater jetties approximately 180 and 240 feet in length, respectively (Figure C-8-1). Gellinam Harbor serves as the off-loading point for cargo and fuel. Vessels utilizing the harbor facilities include the LCUs (Great Bridge), LCMs, and marine police boats. Continued maintenance of the harbor is essential to operations at Gellinam.

The majority of the Gellinam shoreline is sandy beach with riprap in the vicinity of the two jetties and the harbor mouth (Figure C-8-2). The jetties provide protection along the north and south sides of the harbor and must be maintained to ensure safe harbor operations. There are no point source discharges in the harbor area. Ocean currents and waves are primarily from the northeast and can be severe during storms.

An underwater channel leads from the main Inter-Atoll Channel in the west to Gellinam Harbor. The harbor has been previously dredged. The last major dredging occurred in the late 1980s to a depth of 11 ft. Fill has been placed along the finger jetties and throughout the harbor area for shoreline protection and structure foundations. Dredging is only be required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are about 9 feet. Dredging and filling in the Gellinam Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Gellinam Harbor and Channels

Gellinam Harbor is served from the west by inter-atoll channels, which connect to the main Inter-Atoll Channel, which runs from Kwajalein to Roi-Namur. Access to the open ocean from Gellinam could occur via North Pass to the north or from Bigej channel or Eniwetak passage to the south however most vessels arriving at Gellinam originate from Kwajalein or Roi-Namur. The inter-atoll channels and passes are for the most part naturally deep, and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations at Gellinam. The following table shows the major channels, required depths, and current conditions.

Table C-8-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCU (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Naturally deep
Gellinam Harbor Access Channel	LCMs, LCUs (Great Bridge), catamarans	9	Depth satisfactory	Naturally deep

Harbor Facilities/Potential Dredging Projects

Gellinam Harbor consists of the area between the two protective jetties including the pier and marine ramp (Figure C-8-3). These facilities require access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-8-2). Bottom depths at Gellinam Harbor are generally unsatisfactory at 9 feet and should be deepened to 4.5 to 5 meters (14.8 to 16.4 feet) to support the LCUs (Great Bridge) and fuel barges. Dredging may occasionally be required to maintain minimum depths. Each Gellinam Harbor facility is proposed for maintenance dredge and fill operations under this NCA. The following table describes these facilities and shows the required depths and current conditions.

Table C-8-2 Gellinam

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Pier	LCMs, tugs, fuel barges	15	Depth unsatisfactory	Needs dredging
Marine Ramp	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory	Needs dredging
Mooring Area	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory	Needs dredging
Protective Jetties	--	--	Satisfactory	--

General Environmental Conditions – Gellinam Harbor

Marine waters within and adjacent to Gellinam Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-8-1). All other waters adjacent to the Gellinam Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area to both the north and south of the harbor is generally industrial. The lagoon floor in the harbor area is typically sandy.

No point source discharges have been identified in the harbor area. The potential for contamination of bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consists of sandy beach, coral rock, and riprap to prevent erosion. Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc., in the areas to be dredged. Gellinam harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources – Gellinam Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Gellinam Harbor (Figure C-8-2).

Gellinam Harbor is located on the lagoon-facing reef on the southwestern end of the islet. Although the 2010 Inventory did not survey Gellinam Harbor, the lagoon areas north and south of the harbor provide valuable information on biological diversity within adjacent habitats which could indicate potential for migration of biological resources into the harbor area.

The area along the lagoon-facing reef between the islet's northwestern corner and northern harbor jetty is largely protected from normal trade winds and swells by the islet and is in a relatively low-energy environment. Coral diversity has remained low near the northwestern corner and moderately high near the jetty. Since the 2004 Inventory, there has been some coral recovery from past storm events and strong westerly swells that caused major damage to coral colonies. This was seen with small-scale areas of live hard coral stands amongst algae-covered broken corals, rocks, rubble, and sand patches. Within sand habitat, two spotted eagle rays (*Aetobatis narinari*) were observed foraging. Five species of macro-invertebrates, 56 species of hard corals, Napoleon wrasse (*Cheilinus undulatus*), and one juvenile green sea turtle (*Chelonia mydas*) were observed at this station.

The area between the end of the islet and the southern harbor jetty is somewhat protected, but the rest of the area is in a windward, high-energy environment exposed to normal trade winds and swells. On the reef flat southeast of the islet, coral diversity has remained low. However, a diverse coral reef community has remained intact on the lagoon reef off the southwestern corner of the islet. A recent accumulation of sand and coral debris has formed a berm along the southern edge of the islet. Blue-green algae (*Lyngbya*) has colonized several areas within this station but its density was observed to be lower compared to the 2004 Inventory. Four species of macro-invertebrates and 71 species of hard corals were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging in Gellinam Harbor, a U.S. Army Corps of Engineers EA, was completed in 1985. Additionally, dredging and filling in the atoll as a whole, to include shore protection, was addressed in the 1993 SEIS in support of the three levels of activity evaluated at USAKA. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Gellinam marine ramp to support vessel activities.

Figure C-8-1
GELLINAM: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

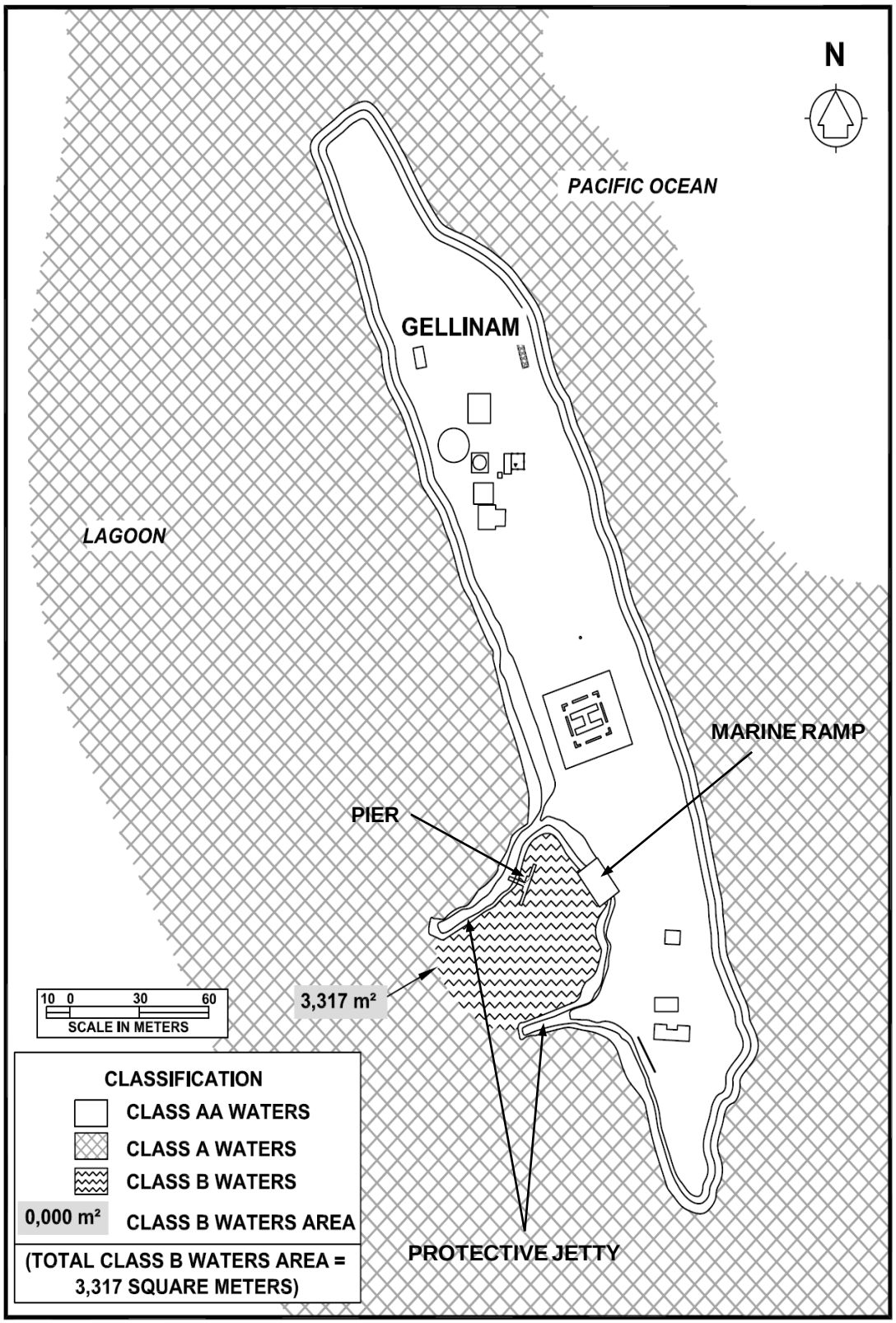


Figure C-8-2
GELLINAM: MARINE BIOLOGICAL RESOURCES

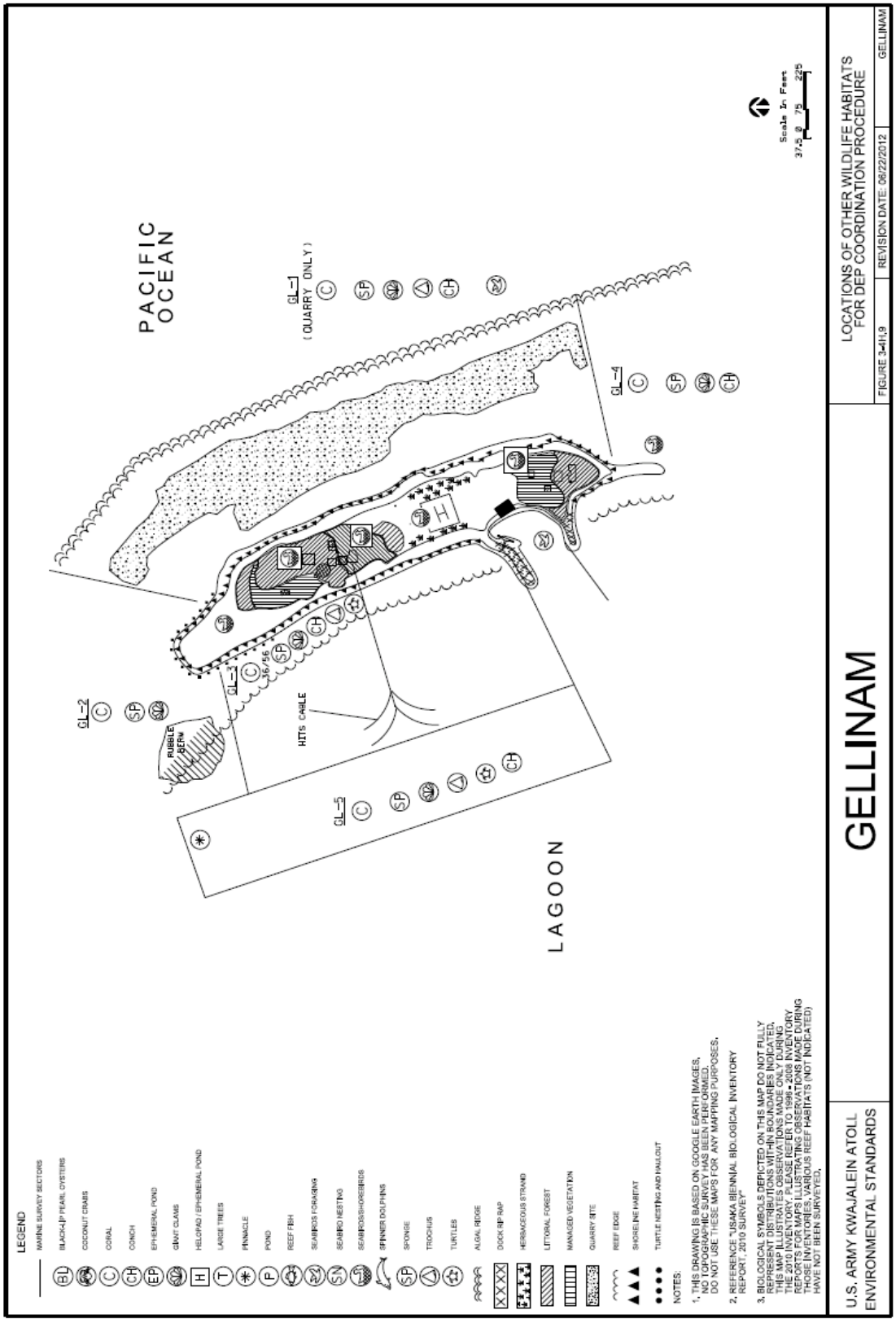
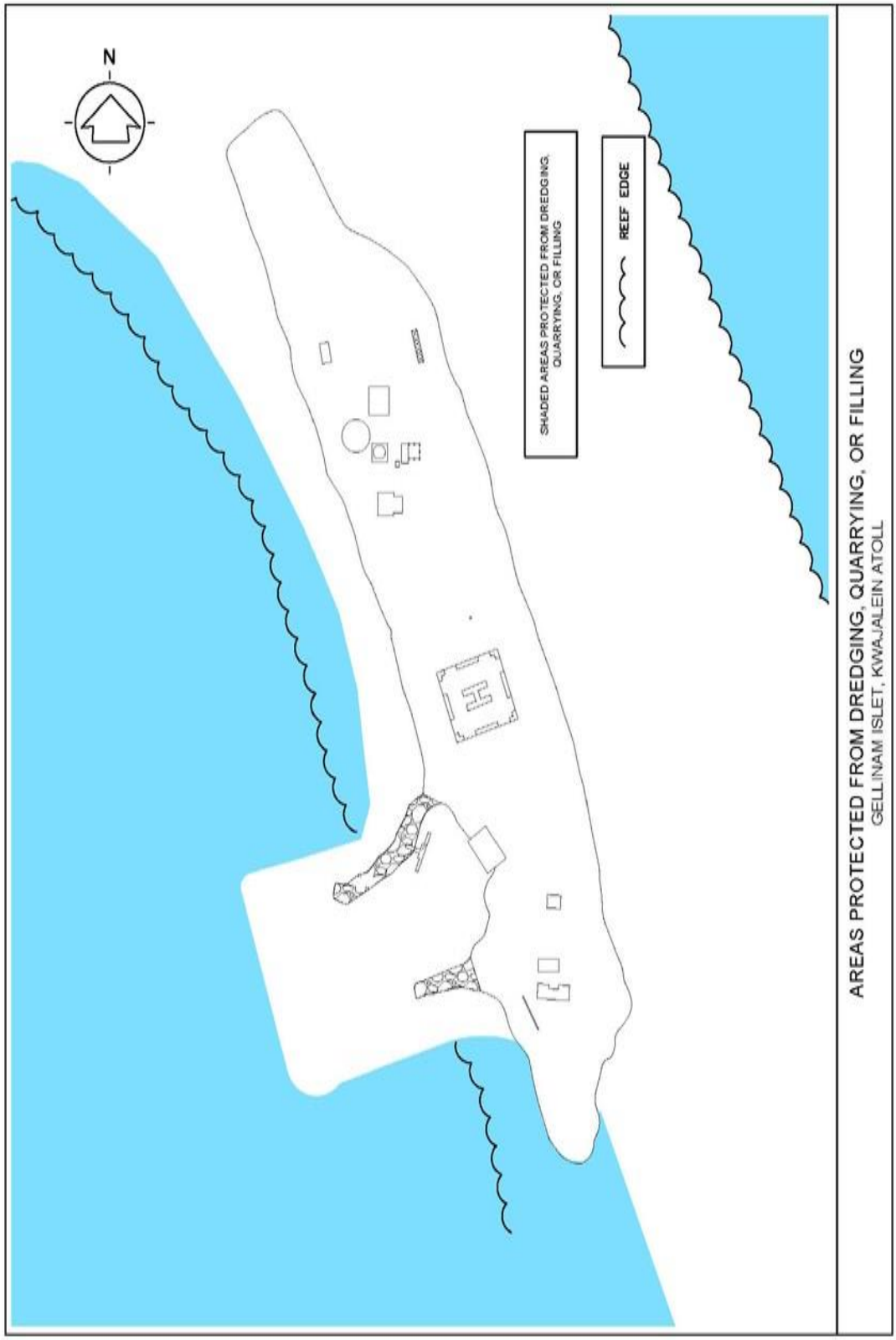


Figure C-8-3
GELLINAM: AREAS PROTECTED FROM DREDGING AND FILLING



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C-9. OMELEK ISLET

General Description

Omelek is one of the smallest USAKA islets, approximately 11 acres in size. It is bounded on the east by the Pacific Ocean, and on the west by the Kwajalein Lagoon. Reef flats surround the islet. A mixed broadleaf forest covers the extreme northern end of the islet and a small pocket in the northeast section of the islet. Other pockets of forest exist in the southeast and extreme southern edges of the islet. There is no operational airfield at Omelek, but helicopters do make occasional runs to Omelek with security and maintenance personnel.

Omelek Harbor is located on the west side of the islet on the lagoon-facing side and consists of a marine ramp and pier enclosed to the north and south by riprap jetties (Figure C-9-1). Omelek Harbor serves as the off-loading point for cargo and fuel. Vessels utilizing the harbor facilities include the LCUs (Great Bridge), LCMs, catamarans, and marine police boats. Continued maintenance of the harbor is essential to operations at Omelek.

The majority of Omelek is sandy beach with riprap in the vicinity of the two jetties and the harbor mouth (Figure C-9-2). The jetties provide protection along the north and south sides of the harbor and must be maintained to ensure safe harbor operations. There are no point source discharges in the harbor area. Ocean currents and waves are primarily from the east/northeast and can be severe during storms.

An underwater channel leads from the main Inter-Atoll Channel in the west to Omelek Harbor. The harbor has been previously dredged before and the date of the last major dredging isunknown. Fill has been throughout locations in the harbor area for shoreline protection and structure foundations. Only the area in the harbor between the jetties is covered by this NCA. Dredging is only be required in shallow or shoaled areas and to the depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are approximately 10 feet. Dredging and filling in the Omelek Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Omelek Harbor and Channels

Omelek Harbor is served from the west by inter-atoll channels, which connect to the main Inter-Atoll Channel, which runs from Kwajalein to Roi-Namur. Access to the open ocean from Omelek could occur via North Pass to the north or from Bigej channel or Eniwetak Passage to the south however most vessels arriving at Omelek originate from Kwajalein or Roi-Namur. The inter-atoll channels and passes are for the most part naturally deep, and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations at Omelek. The following table shows the major channels, required depths, and current conditions.

Table C-9-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs, tugs, barges	45	Depth satisfactory	Naturally deep
Omelek Harbor Access Channel	LCMs, LCUs (Great Bridge), catamarans	12	Depth satisfactory	Naturally deep

Omelek Islet Marine Facilities/Potential Dredging Projects

Omelek Harbor consists of the area between the two protective jetties including the fuel pier and marine ramp (Figure C-9-1). These facilities require access channels for entry and exit, and a large enough area for tug and barge maneuvers or boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facilities (See Table C-9-2). Bottom depths at the Omelek Harbor are generally unsatisfactory at 10 feet and should be deepened to 4.5 to 5 meters (14.8 to 16.4 feet) to support the LCUs (Great Bridge). Dredging may occasionally be required to maintain minimum depths. Each Omelek Harbor facility is proposed for maintenance dredge and fill operations under this NCA and associated DEP. The following table describes these facilities and shows the required depths and current conditions.

Table C-9-2 Omelek

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Pier	LCMs, LCUs (Great Bridge)	12	Depth unsatisfactory	Needs dredging
Marine Ramp	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory	Needs dredging
Mooring Area	LCUs (Great Bridge), LCMs	12	Depth unsatisfactory	Needs dredging
Protective Jetties	--	--	Satisfactory	--

General Environmental Conditions – Omelek Harbor

Marine waters within and adjacent to Omelek Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-9-1). All other waters adjacent to the Omelek Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area to the south, southeast and east of the harbor contains the majority of the industrial facilities. The lagoon floor in the harbor is mostly sandy.

There are no point source discharges in the harbor. The potential contamination of the bottom sediments in the harbor is unknown at this time.

Shorelines along the lagoon in the vicinity of the harbor consist of sandy beach, coral rock, and riprap to prevent erosion. Marine currents in the area generally flow to the south and Marine currents in the area generally flow to the south and uncontrolled suspended sediment particles can be expected to move in this direction. Wave action in the lagoon is generally calm, between 0-3 feet, however storm events can keep suspended particles in a disturbed state.

There are no known sunken vessels, buried ordnance, etc., in the areas to be dredged. Omelek Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources – Omelek Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Omelek Harbor (Figure C-9-2).

Omelek Harbor is located on the lagoon-facing reef on the western side of the islet. Although the 2010 Inventory did not survey Omelek Harbor, the lagoon areas north and south of the harbor provide valuable information on biological diversity within adjacent habitats which could indicate potential for migration of biological resources into the harbor area. The northern end of the islet is in a moderate to high-energy environment due to currents that intermittently sweep across the reef into the lagoon. Closer to the northern harbor jetty the area is sheltered by the islet and is a relatively low-energy environment. Coral cover and diversity has remained high towards the northern end of the islet. Observations of broken, algal-covered coral branches were noted as a possible result of turtle foraging and/or remnants of storm damage from previous years. There were also a few branching coral colonies observed with bleached tissue. Seventy species of hard corals, six species of macro-invertebrates, and the Napoleon wrasse (*Cheilinus undulatus*) were observed. Over time, the coral community should return to pre-storm damage levels through natural recovery.

The area south of the southern harbor jetty across the inter-islet reef flat to the southwestern corner of the islet is a moderate-energy environment with good windward flushing into the lagoon. Coral diversity was observed to be high, with most corals occurring toward the lagoon. Dead, broken corals with algal overgrowth, possibly resulting from turtle foraging and /or storm-related damage were also observed in this area. There was a large area on the outer slope adjacent to Omelek Harbor entrance channel covered by cyanobacteria (*Lynbya sp.*). Eighty-six species of hard coral, six species of macro-invertebrates, and the Napoleon wrasse (*Cheilinus undulates*) were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging, and filling and shore protection at Omelek was the 1993 SEIS which discussed the three levels of activity at USAKA, as a whole. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Omelek marine ramp to support vessel activities.

Figure C-9-1
OMELEK: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

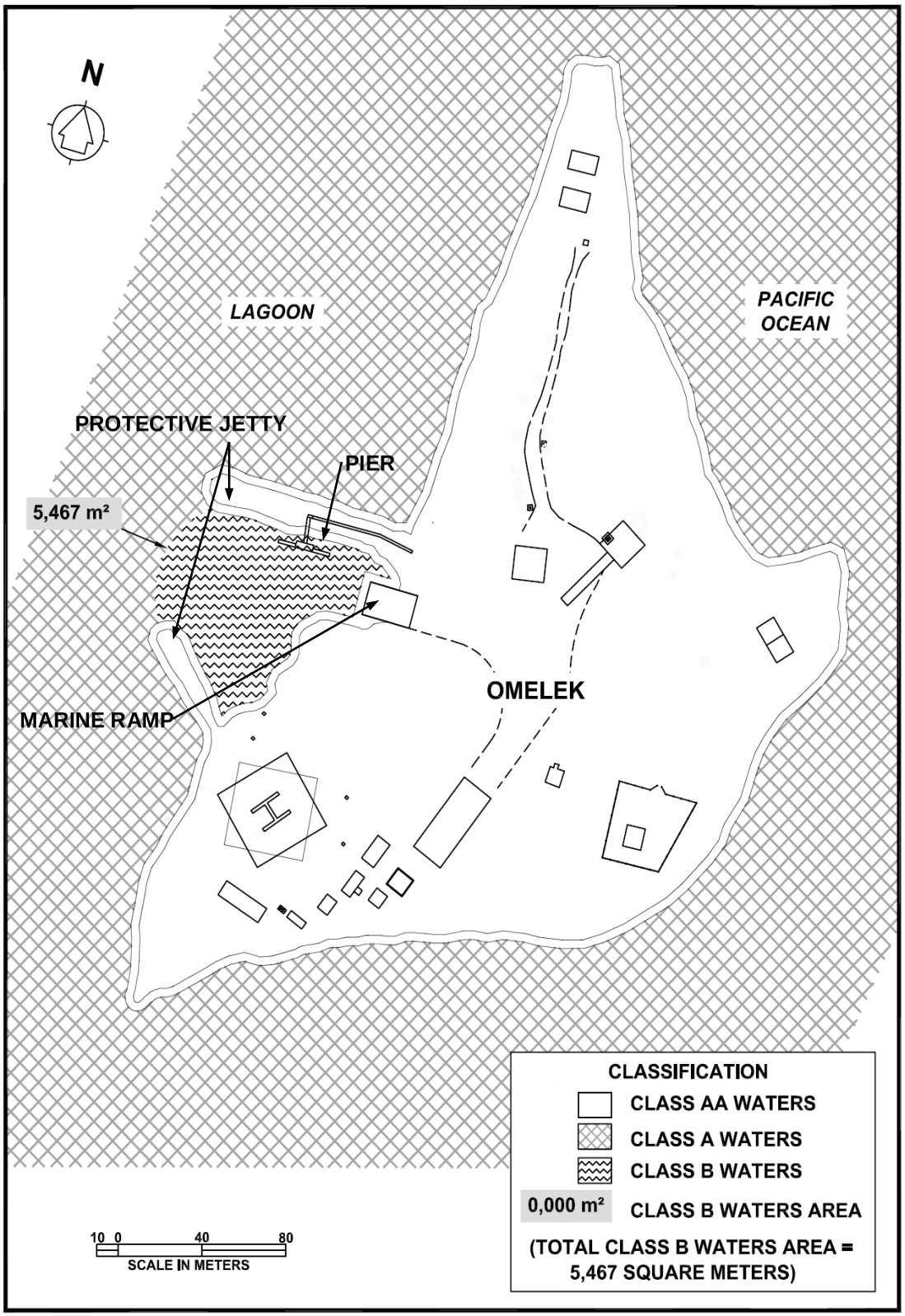


Figure C-9-2
OMELEK: MARINE BIOLOGICAL RESOURCES

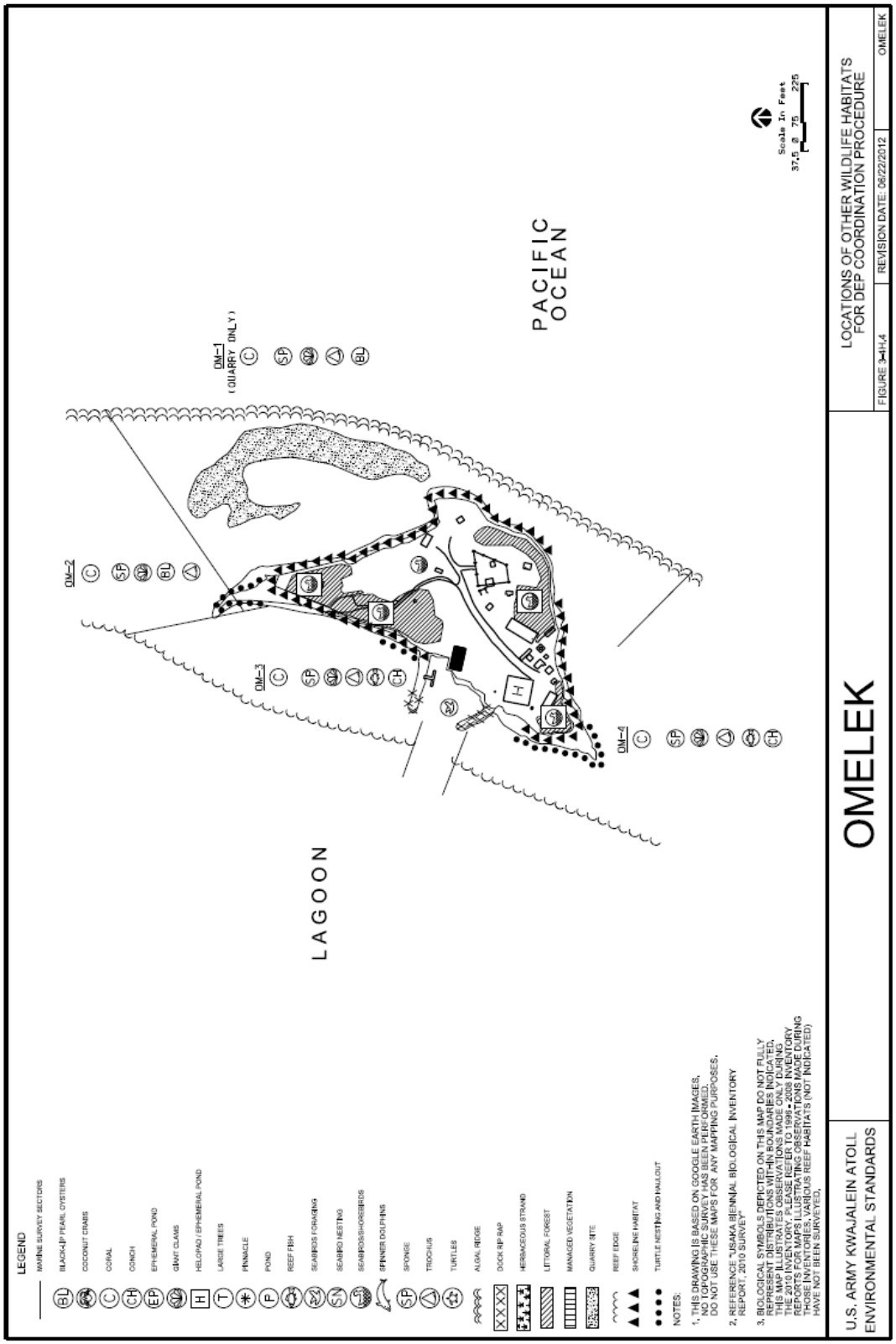
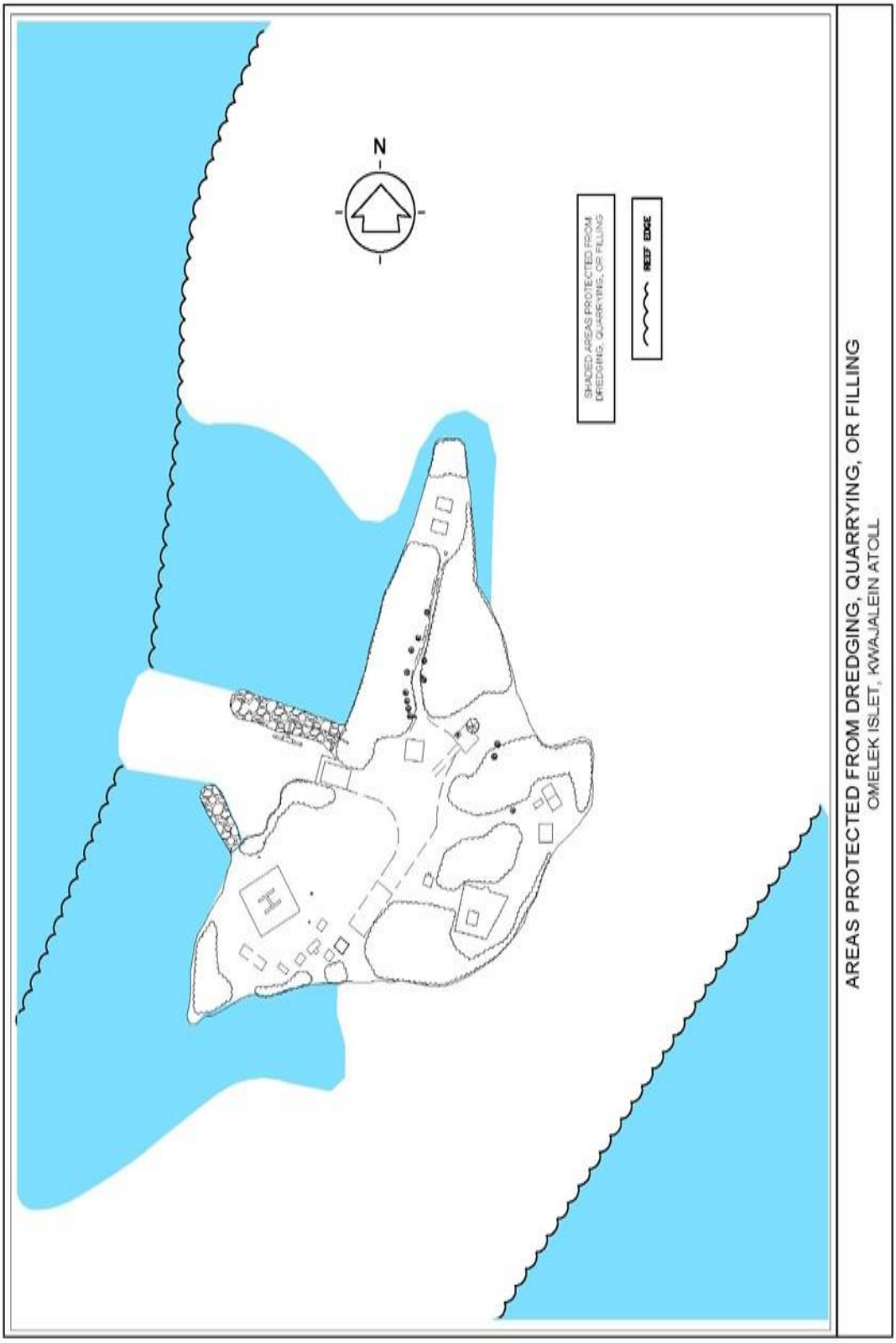


Figure C-9-3
OMELEK: AREAS PROTECTED FROM DREDGING AND FILLING



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C-10. ENIWETAK ISLET

General Description

Eniwetak is one of the smaller USAKA islets measuring approximately 15 acres. Eniwetak is a dedicated conservation area and unauthorized access is restricted. Eniwetak sits slightly west of the east reef and is surrounded by the Kwajalein Lagoon. Though well inside the lagoon, the area around Eniwetak is influenced by high energy currents that sweep into the lagoon via the Eniwetak Passage. Approximately two thirds of the islet is covered with pisonia forest, which is considered valuable habitat for nesting seabirds/shorebirds. The forest is also one of the only remaining stands of pisonia in the USAKA islets and is considered a valuable plant area. Helicopter runs to Eniwetak occur rarely and only for the purpose of maintaining the existing helipad.

Eniwetak Harbor is located on the southwest end of the islet and is enclosed to the north and south by riprap jetties (Figure C-10-1). Remnants of an abandoned fuel pier are present. A marine ramp is noted in Figure C-10-1 however the area consists of a sloped sandy beach. Vessels arriving at Eniwetak Harbor typically anchor offshore and ferry personnel to shore via rowboat. The only vessel regularly utilizing the harbor facilities is The Patriot, although occasional use of LCMs and marine police boats may be necessary. A minimum depth of 8 feet must be maintained to support these vessels. Continued maintenance of the harbor and port are essential to operations at Eniwetak.

The majority of the Eniwetak shoreline is sandy beach with riprap in the vicinity of the two jetties and the harbor mouth (Figure C-10-2). The jetties provide protection along the north and south sides of the harbor and must be maintained to ensure safe harbor operations. Near shore lagoon floor is primarily sand with occasional limestone rock and some coral. There are no point source discharges in the harbor area. Ocean currents can sometimes affect Eniwetak on the southern and eastern shore via the Eniwetak Passage and can be severe during major storms.

An underwater channel leads from the main Inter-Atoll Channel in the west to Eniwetak Harbor. The harbor has been previously dredged however the date of the last major dredging is unknown. Fill has been placed throughout the harbor area for shoreline protection and structure foundations. Only the area in the harbor between the jetties is covered by this NCA. Dredging is only be required in shallow or shoaled areas and to depths necessary to support marine vessels using that particular facility or channel. Current harbor depths are about 8 feet deep extending 100 feet from the shoreline. Dredging and filling in the Eniwetak Harbor area is consistent with areas protected from dredging, quarrying or filling by the WQMP.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

Maintenance and repair to existing shoreline protection and to shoreline or in-water structure foundations may involve placement of fill including rock, armor stone, concrete or concrete rubble, etc. To the extent these repairs are not construction of new structures, do not add to the existing land area, do not cover or otherwise impact valuable marine resources, involve no reef

quarrying operations, and employ the controls necessary to protect the environment (see Section 5.0 of this NCA), these repairs are proposed for inclusion under this NCA and associated DEP. The project description and review procedures listed in Section 5.0 of this NCA and associated DEP will be used.

Eniwetak Harbor and Channels

Eniwetak Harbor is served from the west by the inter-atoll channels which connect to the main Inter-Atoll Channel which runs from Kwajalein to Roi-Namur. Access to the ocean from Eniwetak could be accomplished via the Eniwetak Passage or the Bigej Channel to the southeast or via North Pass to the North however most vessels visiting Eniwetak originate Kwajalein or Roi-Namur. The inter-atoll channels and passes are for the most part naturally deep, and dredging is seldom needed. Coral heads are potential obstacles within these channels which usually can be marked and avoided. Maintenance of the inter-atoll channels is essential to USAG-KA operations at Eniwetak. The following table shows the major channels, required depths, and current conditions.

Table C-10-1 Major Channels

CHANNEL	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Kwaj Cargo Pier to Inter-Atoll Channel	LCUs (Great Bridge), LCMs	45	Depth satisfactory	Inter-atoll channel
Inter-Atoll Channel	LCUs (Great Bridge), LCMs	45	Depth satisfactory	Naturally deep
Eniwetak Harbor Access Channel	LCMs, Patriot	8 feet deep, 100 feet from shoreline	Depth satisfactory	Current controlling depth is 8 feet

Eniwetak Islet Marine Facilities/Potential Dredging Projects

Eniwetak Harbor consists of the area between the two protective jetties including the pier and marine ramp (Figure C-10-1). These facilities require access channels for entry and exit, and a large enough area for boat turn-around and mooring. Bottom depths must support the draft of vessels expected to use or visit the facility (See Table C-10-2). Bottom depths at the Eniwetak Harbor are generally satisfactory at 8 feet. Dredging may occasionally be required to maintain minimum depths. Each Eniwetak Harbor facility is proposed for maintenance dredge and fill operations under this NCA. The following table describes these facilities and shows the required depths and current conditions.

Table C-10-2 Eniwetak

LOCATION	DESIGN VESSEL	DEPTH TO BE MAINTAINED (FT) @ MLW	CURRENT CONDITION	REMARKS
Pier	--	--	--	Abandoned
Marine Ramp	LCMs, Patriot	8	Depth satisfactory	--
Mooring Area	Patriot	8	Depth satisfactory	--
Protective Jetties	--	--	Satisfactory	--

General Environmental Conditions – Eniwetak Harbor

Marine waters within and adjacent to Eniwetak Harbor are classified as Class B waters and are suitable for commercial and industrial use (Figure C-10-1). All other waters adjacent to the Eniwetak Islet shoreline are classified as Class A and are to be maintained for recreational use and propagation of aquatic life.

The land area immediately northeast and southeast of the harbor as well as the northeast side of the islet contains abandoned industrial facilities. Approximately two-thirds of the islet is covered by a pisonia forest and is a protected plant and animal habitat. The lagoon floor in the harbor is generally sandy.

No point source discharges have been identified in the harbor area. The potential for contamination of bottom sediments in the harbor is generally unknown at this time.

There are no known sunken vessels, buried ordnance, etc., in the areas to be dredged. Eniwetak Harbor is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources – Eniwetak Harbor (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Eniwetak Harbor (Figure C-10-2).

Eniwetak Harbor is located on the lagoon-facing reef on the southwestern end of the islet. Although the 2010 Inventory did not survey Eniwetak Harbor, the lagoon areas north and south of the harbor provide valuable information on biological diversity within adjacent habitats which could indicate potential for migration of biological resources into the harbor area.

Though well inside the lagoon, the area around Eniwetak is influenced by high-energy currents that sweep into the lagoon through Eniwetak Passage. The eastern end of the islet is in a wave-swept, high-energy environment and the western end is somewhat more protected. Suspended sediment increases from east to west, reducing water quality and visibility. The green macro-alga *Caulerpa racemosa* has remained the dominant biological component of the substrate at the northwestern corner of the islet. Multiple patches of seagrass (*Halophila* minor), five species of macro-invertebrates and 56 species of hard corals were observed.

The reef flat along the southern side of the islet between the islet's eastern corner and southern harbor jetty is situated in a high-energy environment, exposed to strong currents associated with Eniwetak Passage. In general, the reef flat is slightly deeper and more protected near the southwestern corner of the islet. Coral and macro-invertebrate species diversity have remained high. Recruitment was noticeably high for Tridacnids. Small reef fish have replaced *Trapezia* crabs as occupants of the interstitial spaces between branches of most *Pocillopora* coral colonies. Coral debris has continued to accumulate along the telecommunication cables, forming small mounds of rubble that scour the substrate. Two species of macro-invertebrates, 68 species of hard corals, and one juvenile green sea turtle (*Chelonia mydas*) were observed.

While the *2012 Marine Biological Inventory* that was published by USFWS and USNMFS in December 2013 did not focus on specific areas within the 11 USAKA islets, some Mid-Atoll Corridor stations were in close proximity to four of the USAKA islets.

One station near Eniwetak Islet was located on a patch reef in the central-east region of the USAKA Mid-Atoll Corridor. Observations of high levels of living corals intermixed with broken coral, algae and sand were seen within a complex and diverse reef. Sand and intermittent coral and rock formations appeared to be the main habitat visible below surveyed depths. Fifty species of hard corals, the wire coral *Cirrhipathes* sp, giant clams (*Tridacna maxima and T. squamosal),* and eight species of reef fish were observed. On the opposite side of this transect Forty-seven species of hard corals, five macro-invertebrates, and six species of reef fish were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

The last NEPA document specifically addressing dredging, filling and shore protection at Eniwetak was the 1993 SEIS which discussed the three levels of activity at USAKA, as a whole. NEPA evaluation has been conducted in 2012 for routine placement and removal of unconsolidated fill on the Eniwetak marine ramp to support vessel activities.

Figure C-10-1
ENIWETAK: CLASSIFICATION OF COASTAL-WATER USE; LOCATION OF HARBOR FACILITIES

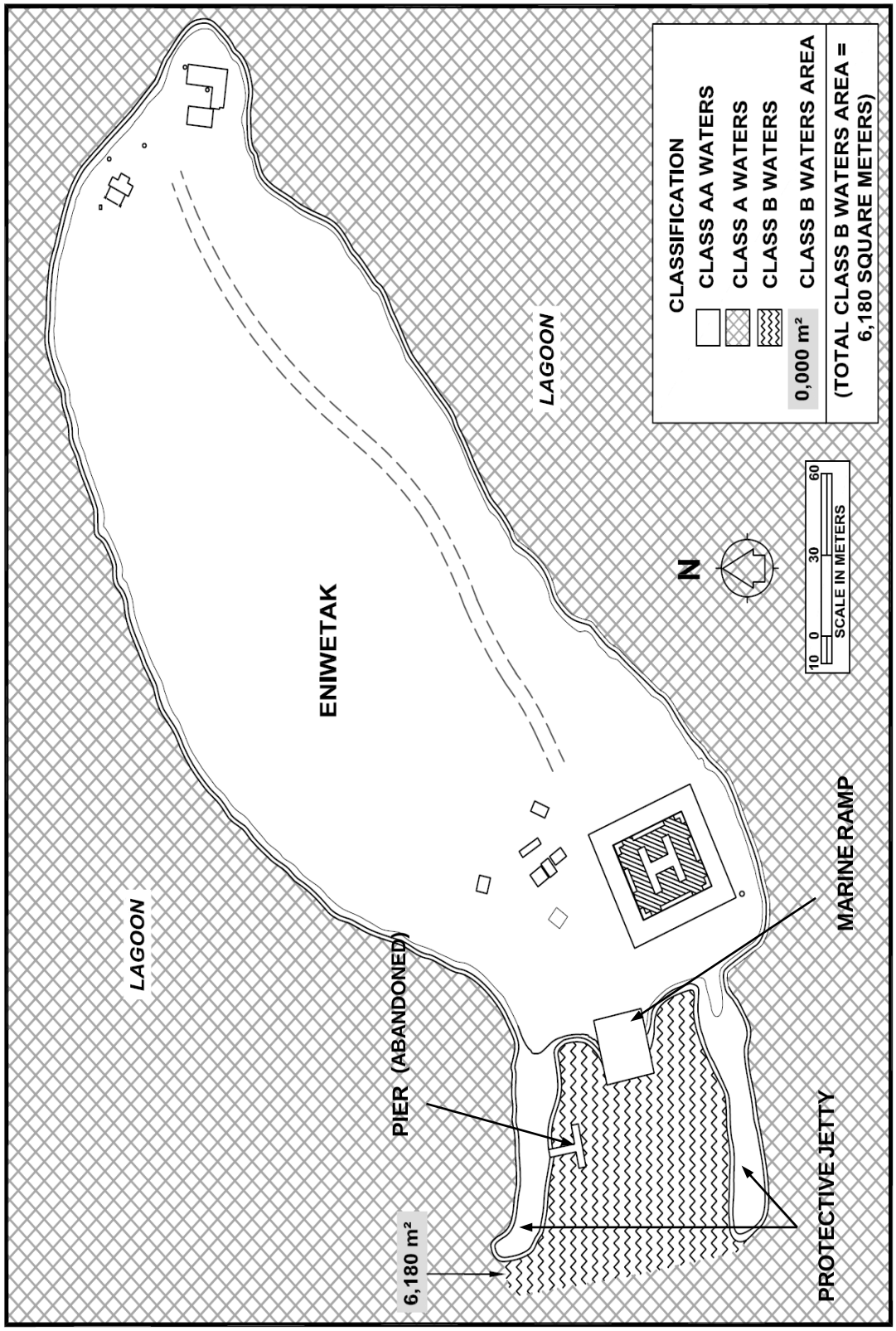


Figure C-10-2
ENIWETAK: MARINE BIOLOGICAL RESOURCES

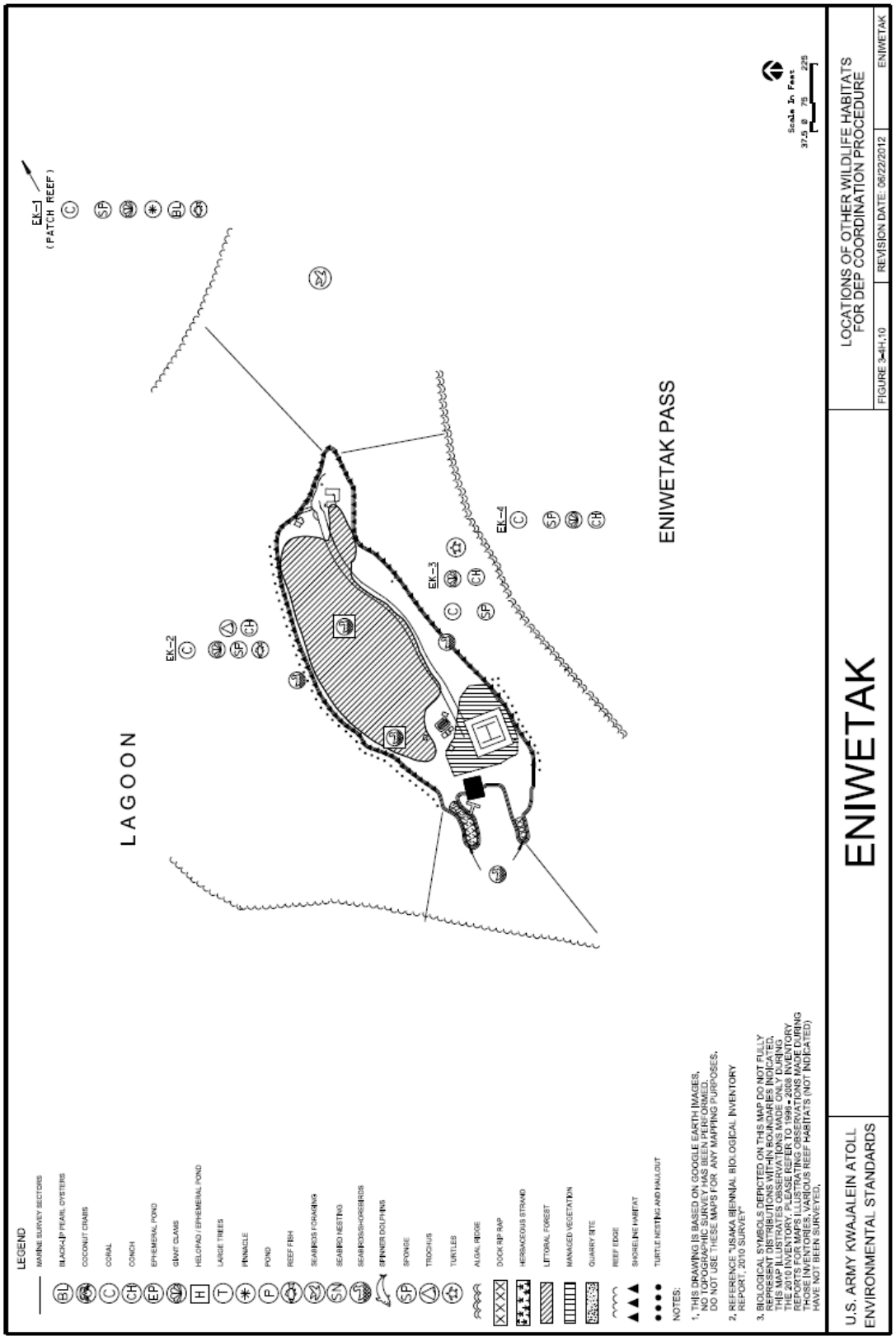
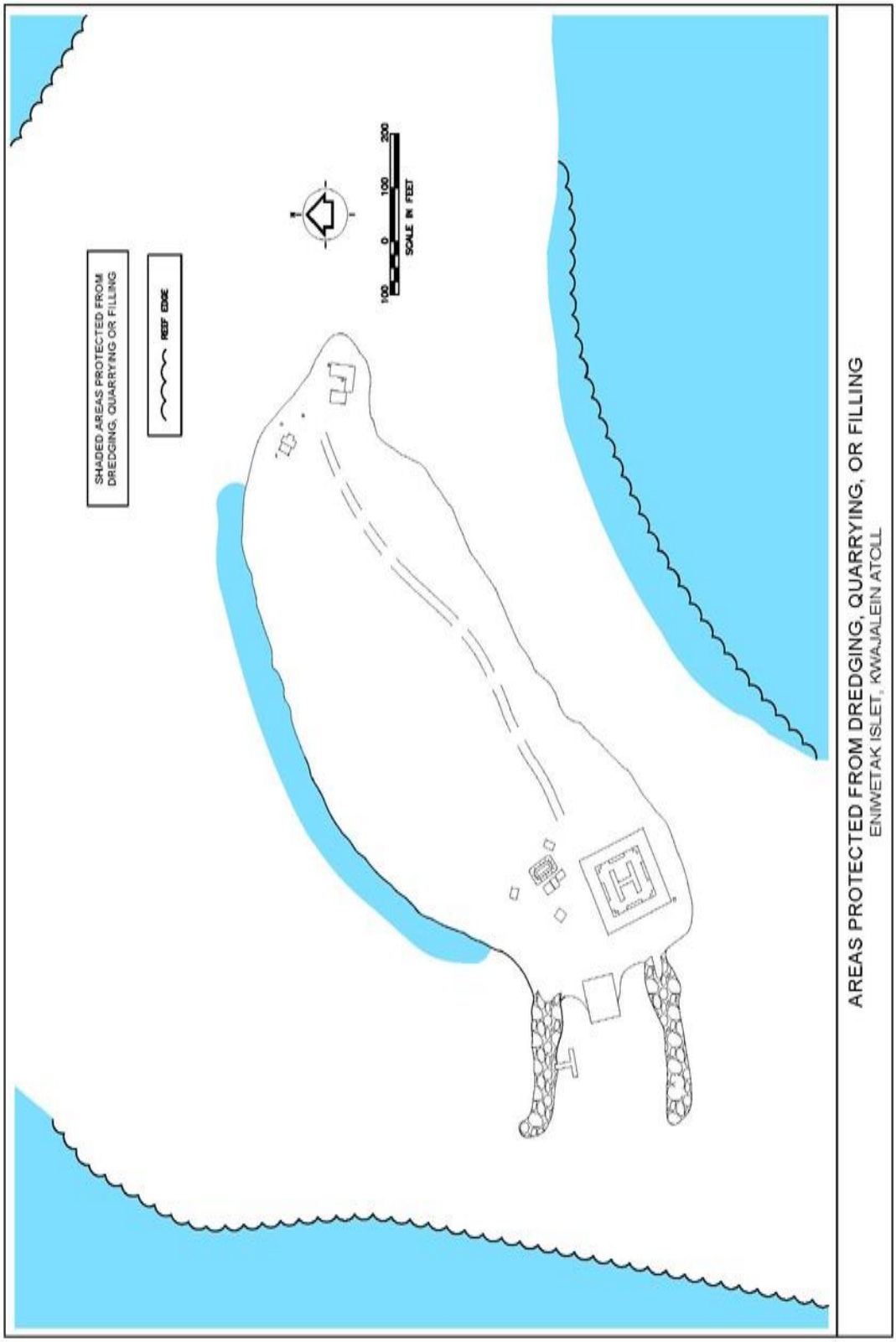


Figure C-10-3
ENIWETAK: AREAS PROTECTED FROM DREDGING AND FILLING



C-11. ENNUGARRET ISLET

General Description:

Ennugarret is a heavily forested 24 acre islet located directly southeast of Roi-Namur (Figure C-11-1). The leased portion of the islet is 6 acres. Ennugarret is bordered on the northeast by the Pacific Ocean and on the southwest by the Kwajalein Lagoon. Besides periodic visits by campers and fisherman, this islet has been left virtually undisturbed since World War II. Old cement foundations of a former pier and buildings, a downed antenna tower, and the remains of small-gauge rails in the littoral forest provide evidence of past human use of the islet. Managed vegetation was present on part of the islet at one time, but the islet is now dominated by native vegetation (Figure C-11-2). There is no operational airfield at Ennugarret. There are no operational harbor facilities. There is no permanent or daily work force.

Maintenance and Repair to Existing Shore Protection and Shoreline Structures by Filling

The area around the Ennugarret shoreline is protected from dredging and filling consistent with areas protected from dredging, quarrying or filling by the WQMP.

Ennugarret Harbor and Channels

Not applicable. Ennugarret does not have a harbor or channel.

Ennugarret Islet Marine Facilities/Potential Dredging Projects

Not applicable. Ennugarret does not have existing marine facilities.

General Environmental Conditions - Ennugarret Lagoon

Marine waters in the Ennugarret area are classified as Class A/AA waters, with the AA designation on the lagoon side (Figure C-11-1).

There are no known sunken vessels, buried ordnance, etc., in the areas to be dredged. Ennugarret Islet is not a cultural/historic area.

Section 5 of the WQMP provides further description of the environmental conditions of the marine waters surrounding the islet.

Marine Biological Resources - Ennugarret Lagoon (Plants, Grasses, Corals, Fishes, Threatened and Endangered Species)

The 2010 *Inventory of Endangered Species and Other Wildlife Resources* that was published by USFWS and USNMFS in December 2012 provides information on the marine biological resources in and around Ennugarret (Figure C-11-2).

Ennugarret's lagoon-facing reef between the southwestern and northwestern corners of the islet is sheltered by the islet from normal trade winds and swells and is in a relatively low-energy environment. The reef substrate is dominated by sand with large thickets of branching *Acropora* corals and clusters of reef outcrops that are nearly 100% covered with corals. Coral density has remained greatest within the southern portion of the area, and mollusks have continued to be well represented throughout area. The 2004 blue-green algae (*Lyngbya*) bloom that had expanded to most areas throughout the station was not at the same level during the 2010 inventory. Throughout the station, juvenile parrotfish (Scaridae) were observed feeding on algae. Five species of macro-invertebrates and 48 species of hard corals were observed.

Environmental Controls

See Section 5.0 of this NCA for recommendations on environmental controls for dredge and/or fill projects at USAKA. Final selection of environmental controls for any proposed projects will be determined by NEPA review, evaluation of the project area for presence of marine-biological and cultural/historic resources, definition of project geometry and dredging method(s), and appropriate water and sediment sampling and testing. Any or all of the measures listed in Section 5.0 may be required.

Available/Last NEPA Document

Dredging and filling in the atoll as a whole, including shore protection, was addressed in the 1993 SEIS in support of the three levels of activity evaluated at USAKA. No other NEPA documentation specifically addressing dredging or filling at Ennugarret has been completed.

Figure C-11-1
ENNUGARRET: CLASSIFICATION OF COASTAL WATER USE

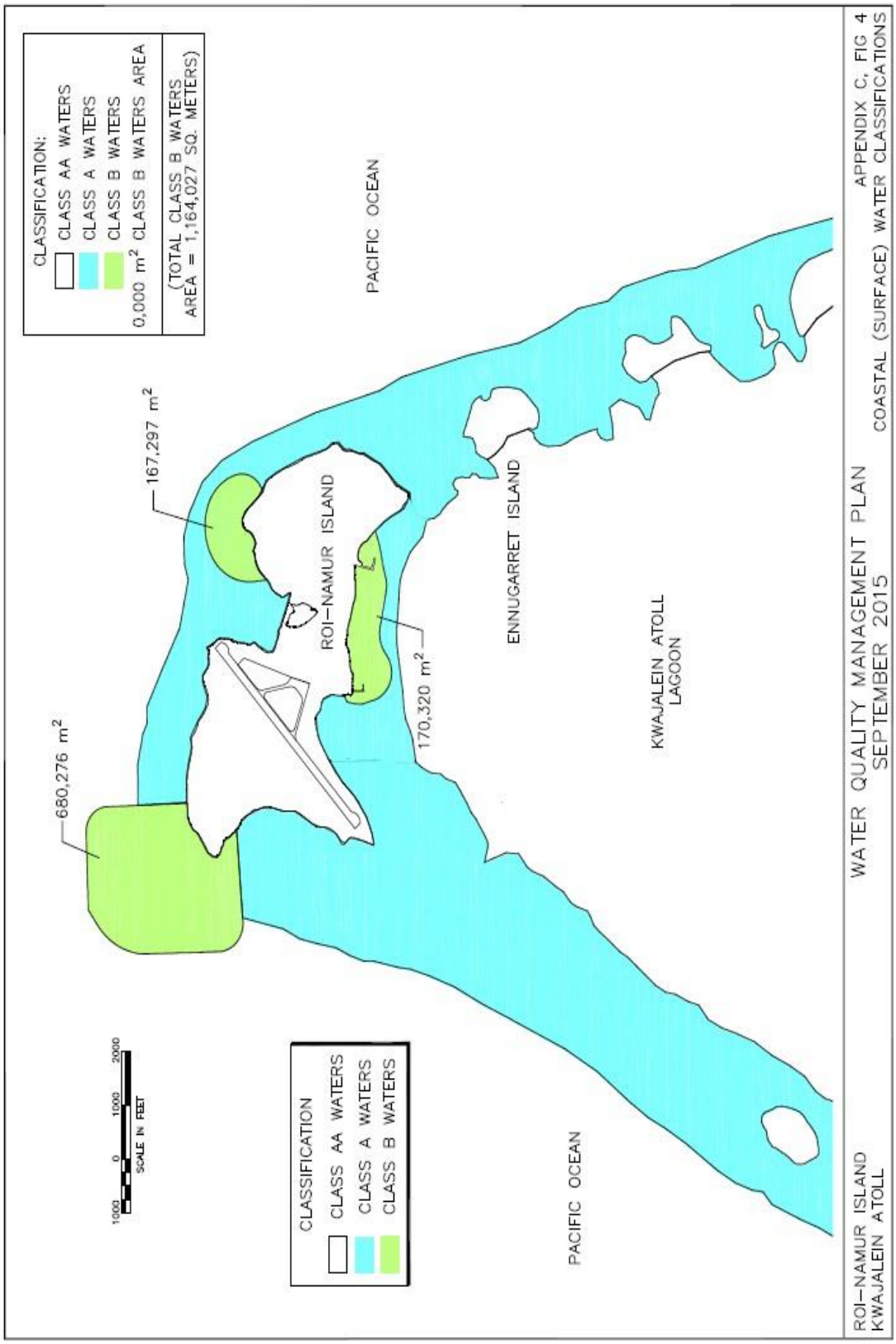


Figure C-11-2
ENNUGARRET: MARINE BIOLOGICAL RESOURCES

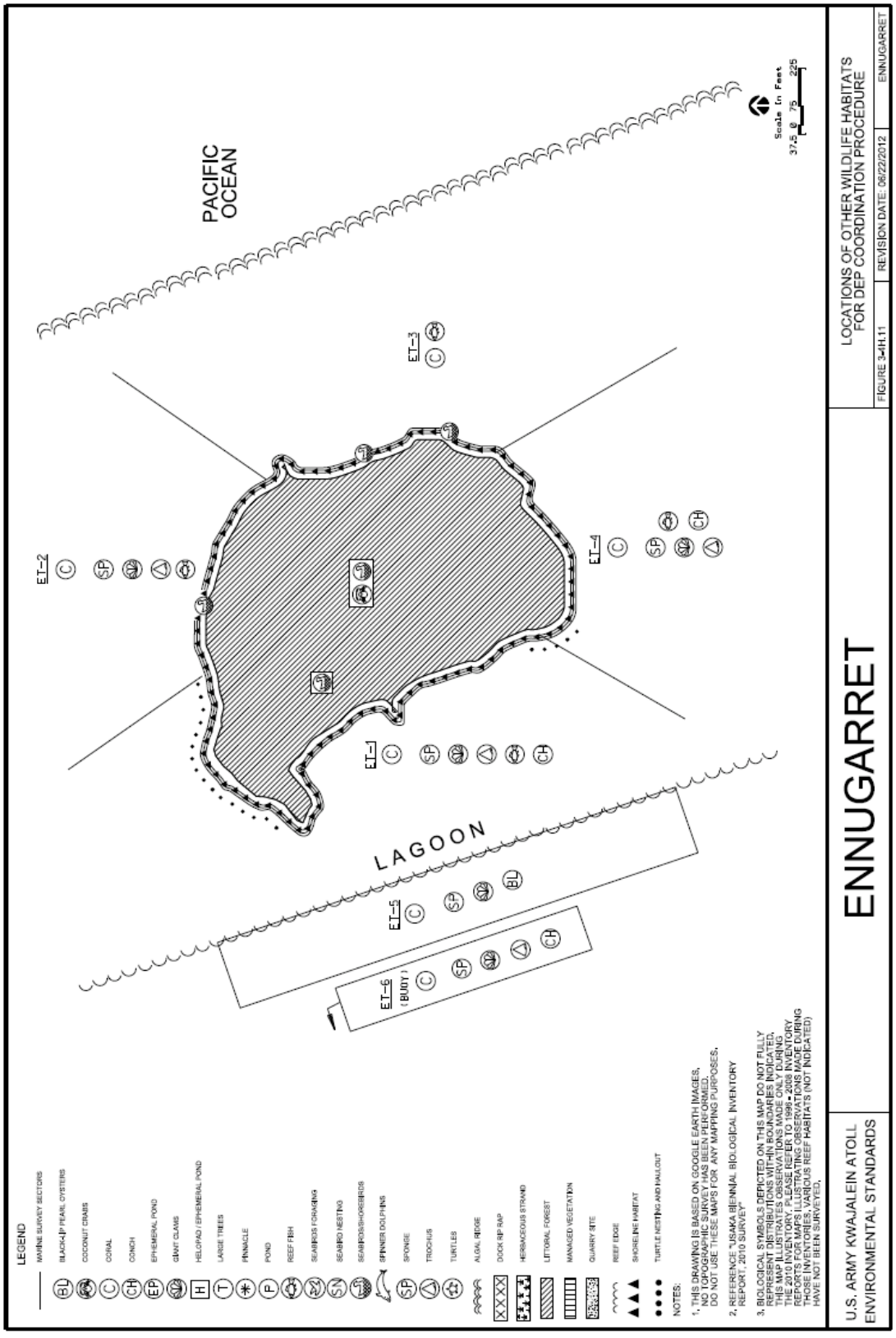
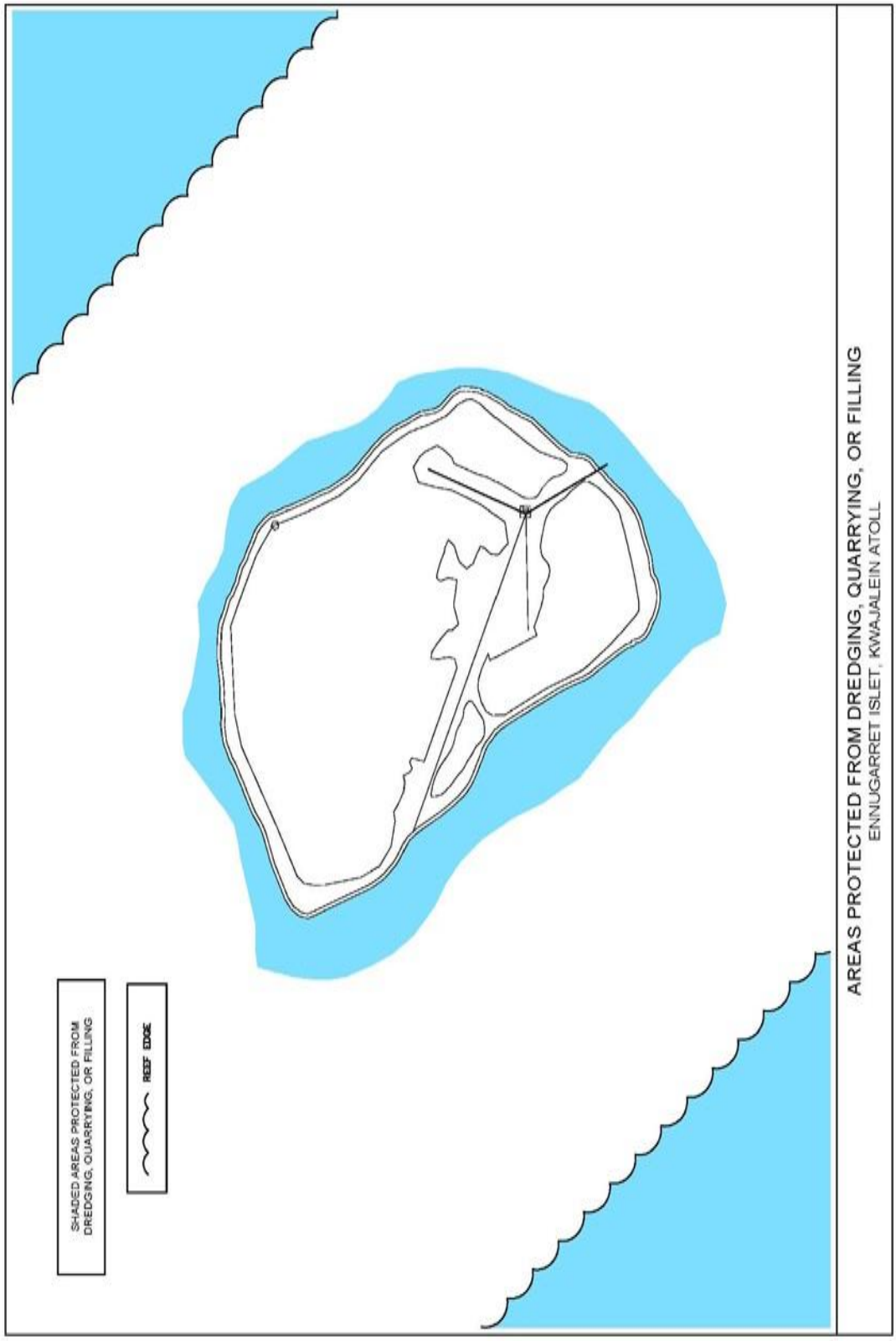


Figure C-11-3
ENNUGARRET: AREAS PROTECTED FROM DREDGING AND FILLING



NCA - APPENDIX D

UNITED STATES ARMY KWAJALEIN ATOLL (USAKA) SHORELINE PROTECTION SURVEY

TELEDYNE SOLUTIONS INC.

FEBRUARY 24, 2007

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USAKA ISLETS SHORELINE PROTECTION SURVEYS

FEBRUARY 24 – MARCH 2, 2007

U.S. ARMY KWAJALEIN ATOLL/
RONALD REAGAN BALLISTIC MISSILE DEFENSE TEST SITE
IN THE
REPUBLIC OF THE MARSHALL ISLANDS

SURVEY CONDUCTED BY
JIM HARDIN AND JOHN MORAN
TELEDYNE SOLUTIONS, INC.

The individual Islet Reports identify areas with existing shoreline protection, areas with critical erosion or non-critical erosion, and areas that have no signs of erosion and no previous shoreline protection. The reports also include an aerial photo of each islet showing the areas mentioned above. The numbers on the aerial photos correspond to photos and descriptions included in the report.

The following table defines the colors used in the aerial photos:

Severity Determination

Property Condition	**Color Designation**
Previous shoreline protection	Green
No shoreline protection	(none)
Non-critical erosion	Yellow
Critical erosion	Red

Omelek

Survey Conducted on
24 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Omelek Existing Shoreline Protection

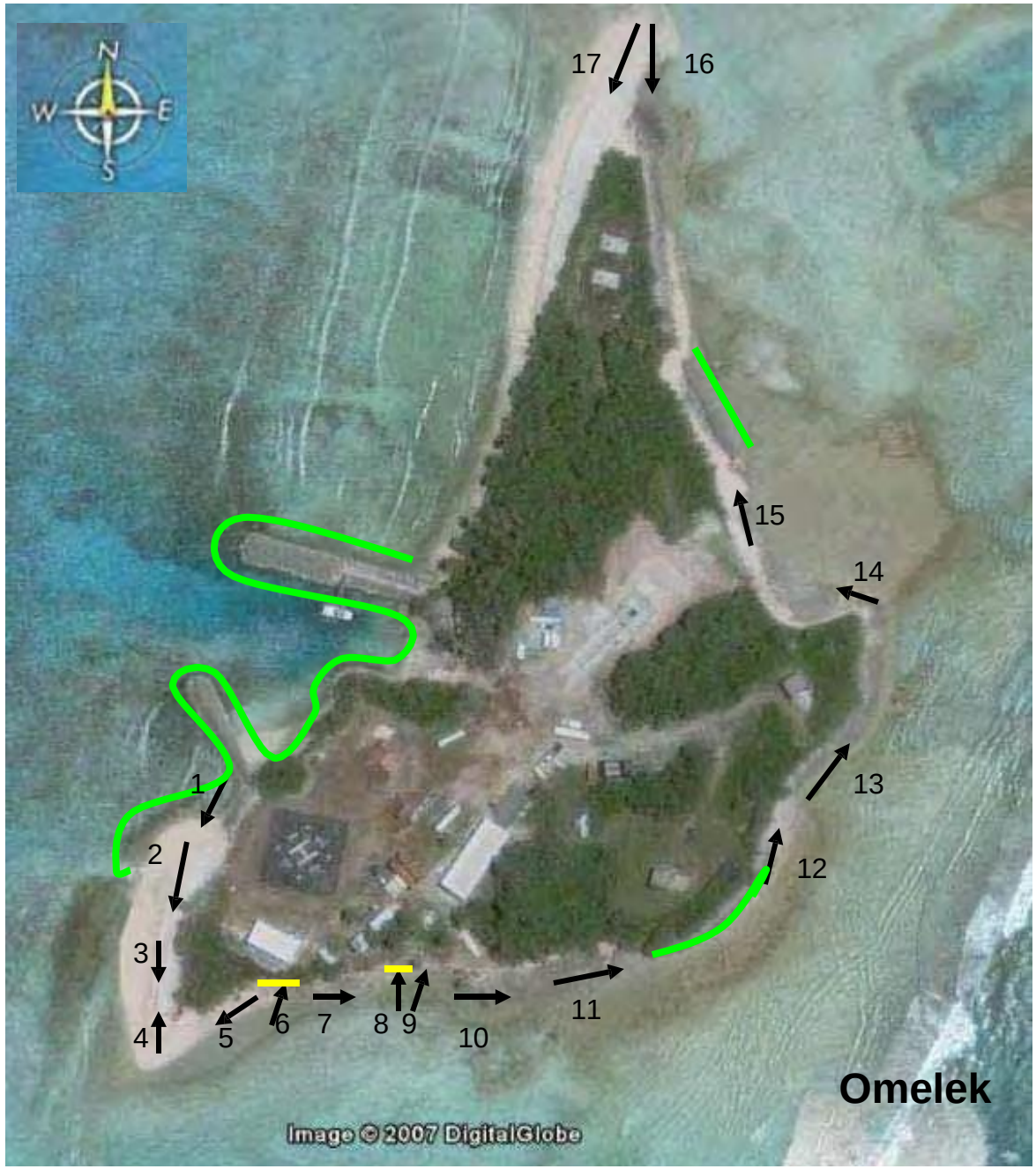
- OM-4, Photos 1 & 2 – Armor stone south of the harbor
- OM-4, OM-1, Photos 2 – 10 – Natural beach sand, cobble and rock
- OM-1, Photo 11 - Armor stone on southeast corner of island
- OM-1, Photos 12 -14 – Natural beach sand, cobble and rock on the east side of island
- OM-1, Photos 15 & 16 – Poured concrete protection to natural beach sand, cobble and rock
- OM-3, Photo 17 – Natural beach sand to cobble and rock north of the harbor
- OM-Harbor – Armor stone protection

Omelek Areas of Critical Erosion

- None

Omelek Areas of Non-critical Erosion

- OM-4, photos 6 & 8 – Ledging in the south portion of the island
- Note: Space-X proposes to protect portions of the island's shoreline to protect areas of the island planned for development to support space launch facilities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Omelek
Image © 2007 DigitalGlobe


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1

OM-04 Lagoon Side

Description: South of harbor

Shoreline protection: Armor stone to natural beach

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact, marine species near shore

Tide: 1.5’

2

OM-04 Lagoon Side

Description: South of harbor

Shoreline protection: Natural beach cobble

Vegetation: Managed vegetation to littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact, marine species near shore

Tide: 1.5’

3

OM-04 Lagoon Side

Description: Southern island tip

Shoreline protection: Natural beach cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore, marine species near shore

Tide: 1.5’

4

OM-04 Southeast Tip

Description: Southern island tip

Shoreline protection: Natural beach cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore, marine species near shore

Tide:1.5’


5


6


7


8

5

OM-01 Southern Portion of Island

Description: Southern island

Shoreline protection: Natural beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore

Tide: 1.5’

6

OM-01 Southern Portion of Island

Description: North Portion of harbor and pier

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore

Tide: 1.5’

7

OM-01 Southern Portion of Island

Description: Southern portion of island

Shoreline protection: Natural beach rock

Vegetation: Managed vegetation to littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide:1.5’

8

OM-01 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Natural beach rock

Vegetation: Managed vegetation to littoral shrub

No threatened facilities, some ledging

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’


9


10


11


12

9

OM-01 Ocean Side

Description: Southeastern portion of island

Shoreline protection: Natural beach cobble and rock

Vegetation: Managed vegetation

No threatened facilities, undercutting vegetation

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

10

OM-01 Ocean Side

Description: Southeastern portion of island

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore

Tide: 1.5’

11

OM-01 Ocean Side

Description: Eastern portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore

Tide: 1.5’

12

OM-01 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Armor stone to natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’


13


14


15


16

13

OM-01 Ocean Side

Description: Eastern portion of island

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

14

OM-01 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact, marine species in quarry area

Tide: 1.5’

15

OM-01 Ocean Side

Description: Northeastern portion of island

Shoreline protection: Natural beach sand to rock and poured concrete

Vegetation: Managed vegetation to littoral forest

No threatened facilities

Low potential for cultural resource impact, marine species in quarry area

Low potential for natural resource impact

Tide: 1.5’

16

OM-01 Ocean Side

Description: Northeastern portion of island

Shoreline protection: Natural beach sand to cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact, marine species in quarry area

Tide: 1.5’

OM-03 Lagoon Side

Description: North of Harbor

Shoreline protection: Beach sand to cobble

Vegetation: Littoral shrub to forest

No threatened facilities

Low potential for cultural resource impact

Potential shore bird habitat near shore

Tide: 1.5’

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Gagan

Survey Conducted on
25 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Gagan Existing Shoreline Protection

- GA-1, Photos 1 & 2 – Armor stone in harbor area
- All other areas natural beach sand, cobble and rock

Gagan Areas of Critical Erosion

- Photos 14, 15, 17 – WWII pillbox

Areas of Non-critical Erosion

- Photo GA-07-Ledging at southwest tip of island


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Image © 2007 DigitalGlobe
Gagan
Pointer 9°17'13.77" N 167°32'13.58" E elev 12 ft
Streaming 100%
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1


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4

1

GA Gagan Harbor

Description: North harbor jetty and pier

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

2

GA Gagan Harbor

Description: Central harbor and ramp

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

3

GA-03 Gagan Lagoon Side

Description: Beach south of harbor

Shoreline protection: Natural beach sand and cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

4

GA-03 Gagan Lagoon Side

Description: Southwest tip of island

Shoreline protection: Natural beach to natural beach rock

Vegetation: Littoral shrub to littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’


5


6


7


8

5

GA-03 Gagan

Description: Soutwest to south portion

Shoreline protection: Natural beach rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

6

GA-03 Gagan

Description: South to southeast portion

Shoreline protection: Natural beach rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

7

GA-02 Gagan Ocean Side

Description: Ledging on southeast corner of island off of helipad

Shoreline protection: Natural beach stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

8

GA-02 Ocean Side

Description: Southeast portion

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5'


9


10


11


12

9

GA-02 Ocean Side

Description: Southern portion of east side of island

Shoreline protection: Reef and natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

10

GA-02 Ocean Side

Description: East side of island, two drainage pipes extend into ocean

Shoreline protection: Reef and natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

11

GA-02 Ocean Side

Description: East side

Shoreline protection: Reef and natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

12

GA-02 Ocean Side

Description: Northern portion of east side

Shoreline protection: Reef and natural reef rock

Vegetation: Littoral shrub

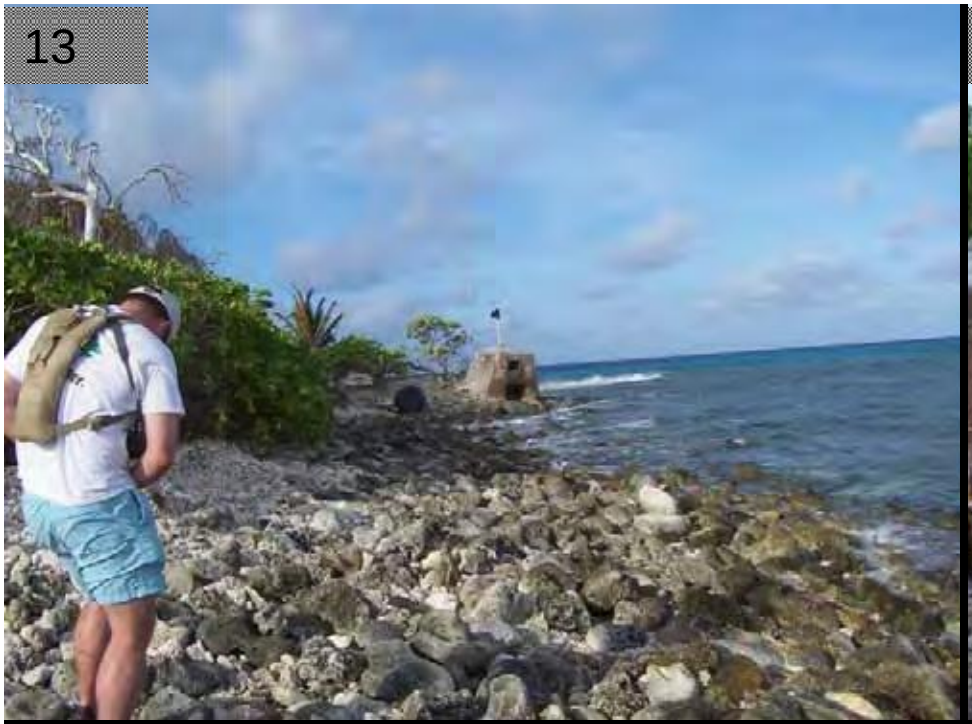
No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

13



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GA-02 Gagan North

Description: North portion of island

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

Japanese pill box impacted

Cultural (WWII) resource impact

Low potential for natural resource impact

Tide: 2.6’

14

GA-02 Gagan North

Description: North portion of island

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

Unused (abandoned) dome close to shoreline

Cultural (WWII) resource impact

Low potential for natural resource impact

Tide: 2.6’

15

GA-02 Gagan North

Description: North portion of island

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

Japanese pill box impacted

Cultural (WWII) resource impact

Low potential for natural resource impact

Tide: 2.6’

16

GA-04 Gagan North

Description: North portion of island

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

Japanese pill box impacted

Cultural (WWII) resource impact

Low potential for natural resource impact

Tide: 2.6’

17

GA-04 Gagan Lagoon Side

Description: Northwest portion of island, ledging noted in area of abandoned dome

Shoreline protection: Natural beach rock to cobble

Vegetation: Littoral forest

Ledging in the area of abandoned dome

Cultural (WWII) resource impact

Low potential for natural resource impact

Tide: 2.7’

18

GA-04 Gagan Lagoon Side

Description: Gagan lagone side north of harbor

Shoreline protection: Natural beach rock

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.7’

19

GA-04 Gagan Lagoon Side

Description: Gagan lagoon north of harbor

Shoreline protection: Natural beach rock

Vegetation: Littoral forest to shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.7’

18

19

Roi-Namur

Survey Conducted on
25 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Roi-Namur Existing Shoreline Protection

- RN-1, Photo 1, 2 – Concrete seawall with armor stone.
- RN-1, Photos 3 - 9 – Armor stone.
- RN-1, Photo 10 – Loose concrete and metal debris
- RN-1, Photos 11 - 13 – Armor stone
- RN-1, Photo 14 – Debris placed
- RN-1, Photo 15 – Concrete debris
- RN-1, Photo 16 – Armor stone, poured concrete and concrete debris
- RN-1, Photo 17 – Armor stone
- RN-1, Photos 18, 19 – submerged protection
- RN-2, Photo 20 – Armor stone and debris
- RN-2, Photo 22 – Armor stone
- RN-2, Photo 23 – Concrete seawall with armor stone

Roi-Namur Existing Shoreline Protection Continued

- RN-2, Photo 24 – Concrete seawall
- RN-2, Photo 25 – Armor stone
- RN-3, Photo 26 – Armor stone and concrete debris
- RN-3, Photo 27 – Armor stone and debris
- RN-3, Photos 28 & 29 – Armor stone
- RN-3, Photo 34 – Concrete debris wall, armor stone; Old concrete slab poured on beach under seawall
- RN-3, Photo 35 – Armor stone
- RN-3, Photo 36 – Earthen berm with vegetation
- RN-3, Photo 37 – Armor stone, debris
- RN-3, Photos 38 & 39 – Armor stone
- RN-4, Photo 41 – Armor stone
- RN-4, Photo 43 – Armor stone seawall with concrete debris

Roi-Namur Existing Shoreline Protection Continued

- RN-4, Photo 44 – Armor stone seawall
- RN-4, Photo 48 – Armor stone and concrete
- RN-4, Photo 49 – Armor stone and concrete debris
- RN-4, Photo 50 – Concrete debris
- RN-4, Photo 51 – Armor stone and concrete debris
- RN-5, Photo 52 – Sheet piling
- RN-5, Photos 53 & 54 – Armor stone and concrete debris
- RN-5, Photo 56 – Seawall of debris
- RN-5, Photo 57 – Concrete seawall
- RN-5, Photo 60 – Armor stone and concrete
- RN-5, Photo 65 – Concrete and armor stone
- RN-5, Photos 66 & 67 – Armor stone

Roi-Namur Existing Shoreline Protection Continued

- RN-6, Photo 69 – Armor stone
- RN-6, Photo 70 – Armor stone and concrete debris
- RN-6, Photo 73 – Armor stone
- RN-7, Photo 77 – Armor stone
- RN-9, Photo 80 – Armor stone and concrete debris
- RN-9, Photo 81 – Armor stone and poured concrete
- RN-9, Photo 82 – Armor stone, concrete debris
- RN-9, Photo 83 – Armor stone, concrete and metal debris
- RN-9, Photo 84 – Armor stone wall
- RN-9, Photo 87 – Armor stone
- RN-9, Photo 90 – Concrete seawall
- RN-9, Photos 92 - 95, 97– Armor stone seawall

Roi-Namur Areas of Critical Erosion

- RN-1, Photos 17 - 19 – Round Japanese bunker on the north shore of Roi
- RN-3, Photos 31 & 32 - West shore critical erosion near WWTP; road undercut
- RN-4, Photos 40 & 41 – South shore near end of runway
- RN-5, Photos 57 - 58, 61 - 62 – Critical erosion in front of Third Island Store

Roi-Namur Areas of Non-critical Erosion

- RN-1, Photo 12 – Non-critical erosion evident at tree line
- RN-3, Photo 30 – Northwest shore with evidence of erosion; 30 inch ledge has formed due to loss of soil
- RN-4, Photo 44 – Seawall with some erosion evident
- RN-4, Photos 45 & 47 – Non-critical erosion at tree line
- RN-4, Photos 49 - 51 – Shoreline west of main port terminal
- RN-5, Photo 59 – Erosion at beach east of Yokahoma pier
- RN-9, Photos 85 & 86 – North shore of Namur looking southwest; ledge caused by erosion
- RN-9, Photos 94 - 97 – North shore near end of runway; bottom of seawall undercut


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Image © 2007 DigitalGlobe
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Roi-Namur
Pointer 9°23'50.79" N 167°28'13.85" E elev 4 ft
Streaming 100%
Eye alt 5300 ft


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Shoreline
area off limits
during survey
due to RF
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Image © 2007 DigitalGlobe
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Roi-Namur
Pointer 9°23'42.24" N 167°28'45.73" E elev 8 ft
Streaming 100%
Eye alt 5300 ft

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RN-01 Ocean Side

Description: North shore near end of runway

Shoreline protection: Concrete seawall with armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

2

RN-01 Ocean Side

Description: North shore near end of runway

Shoreline protection: Concrete seawall with armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

3

RN-01 Ocean Side

Description: Seawall show with road around the airfield

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

4

RN-01 Ocean Side

Description: End of concrete seawall and transition to armor stone wall overgrown with shrubs

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.9’

5

RN-01 Ocean Side

Description: North shore of Roi side of the island

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

6

RN-01 Ocean Side

Description: North shore of Roi

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

7

RN-01 Ocean Side

Description: North shore

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.9’

8

RN-01 Ocean Side

Description: North shore

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Japanese bunker is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.9’

9

RN-01 Ocean Side

Description: North shore of Roi

Shoreline protection: Armor stone ends and cobble and sand beach follows

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.8’

10

RN-01 Ocean Side

Description: North shore of Roi

Shoreline protection: Some loose concrete and metal debris

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.8’

11

RN-01 Ocean Side

Description: Old outfall on north shore of Roi

Shoreline protection: Some armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.7’

12

RN-01 Ocean Side

Description: Non-critical erosion evident at tree line

Shoreline protection: Some armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.7’

13

RN-01 Ocean Side

Description: North shore on Roi

Shoreline protection: Some armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

14

RN-01 Ocean Side

Description: Sand and gravel beach on north shore of Roi

Shoreline protection: Some debris placed

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.6’

15

RN-01 Ocean Side

Description: Near dome on north shore of Roi

Shoreline protection: Concrete debris

Vegetation: Managed vegetation

Dome could be threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

16

RN-01 Ocean Side

Description: Illegal concrete fill pour on top of tree near dome on north shore of Roi

Shoreline protection: Armor stone, poured concrete, & concrete debris

Vegetation: Managed vegetation

Dome could be threatened

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.5’

17

RN-01 Ocean Side

Description: North shore sandy beach

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

18

RN-01 Ocean Side

Description: Round Japanese bunker on the north shore of Roi

Shoreline protection: none at present. Some submerged protection can be seen.

Vegetation: Littoral shrubland
No threatened facilities

Bunker is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.5’

19

RN-01 Ocean Side

Description: Japanese Bunker on north shore

Shoreline protection: Submerged protection

Vegetation: Littoral shrubland

No threatened facilities

Bunker is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.5’

20

RN-02 Ocean Side

Description: North shore west of Japanese bunker

Shoreline protection: Scattered armor stone and debris

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.5’

21

RN-02 Ocean Side

Description: North shore looking west

Shoreline protection: None, scattered debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

22

RN-02 Ocean Side

Description: North shore with debris

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

23

RN-02 Ocean Side

Description: Northwest shore

Shoreline protection: Concrete seawall with armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

24

RN-02 Ocean Side

Description: North shore

Shoreline protection: Concrete seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

25

RN-02 Ocean Side

Description: Wastewater treatment plant discharge line location on northwest point

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

26

RN-03 Ocean Side

Description: Northwest point looking southeast

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

27

RN-03 Ocean Side

Description: Northwest shore

Shoreline protection: Armor stone and debris

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

28

RN-03 Ocean Side

Description: Northwest shore approaching the wastewater treatment plant (WWTP)

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

29

RN-03 Ocean Side

Description: West shore looking northwest. Discarded bunker on shoreline

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Bunker may be a WWII cultural resource

Low potential for natural resource impact

Tide: 2.4’

30

RN-03 Ocean Side

Description: Northwest shore with evidence of erosion. A 30 inch ledge has formed due to loss of soil

Shoreline protection: None

Vegetation: Managed vegetation

No threatened facilities
Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

31

RN-03 Ocean Side

Description: West shore critical erosion near WWTP

Shoreline protection: none

Vegetation: Managed vegetation

Road is threatened to be undercut

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

32

RN-03 Ocean Side

Description: Road near WWTP where erosion is undercutting it

Shoreline protection: None

Vegetation: Managed vegetation

Road is threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

33

RN-03 Ocean Side

Description: West shore looking south from WWTP. WWII Bunker discarded on the beach

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Bunker is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.4’

34

RN-03 Ocean Side

Description: West shore looking north towards ammunition storage

Shoreline protection: Concrete debris wall and armor stone. Old concrete slab poured on beach under seawall

Vegetation: Managed vegetation
No threatened facilities
Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.3’

35

RN-03 Ocean Side

Description: Southwest shore near beach houses

Shoreline protection: Small area of armor stone but mostly unprotected sandy beach

Vegetation: Managed vegetation and Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.3’

36

RN-03 Ocean Side

Description: Southwest shore near the golf course
Shoreline protection: Earthen berm with vegetation in front

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

37

RN-03 Ocean Side

Description: Southwest shore near landfill

Shoreline protection: Armor stone and debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

38

RN-03 Ocean Side

Description: Southwest point of Roi near landfill

Shoreline protection: Armor stone to unprotected sandy beach

Vegetation: Managed vegetation to Littoral shrubland

No threatened facilities
Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

39

RN-03 Ocean Side

Description: Southwestern shore at the landfill

Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

40

RN-04 Lagoon Side

Description: South shore near end of runway. Erosion of sand is evident.

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

41

RN-04 Lagoon Side

Description: Sandy beach near end of runway airfield. Erosion of sand evident.

Shoreline protection: none in foreground, armor stone at end of beach

Vegetation: Managed vegetation

Road might be threatened in the future

Low potential for cultural resource impact
Loss of beach will impact turtle nesting area

Tide: 2.2’

42

RN-04 Lagoon Side

Description: Southwestern point at end of airfield looking southwest

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

43

RN-04 Lagoon Side

Description: Seawall south of airfield

Shoreline protection: Armor stone seawall with concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

44

RN-04 Lagoon Side

Description: Seawall with some erosion evident

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

45

RN-04 Lagoon Side

Description: Sandy beach with non-critical erosion at tree line

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Impacts to turtle nesting and haulout area

Tide: 2.2’

46

RN-04 Lagoon Side

Description: Sandy beach along airfield runway

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Turtle nesting and haulout area

Tide: 2.2’

47

RN-04 Lagoon Side

Description: Sandy beach shore along airfield. Erosion evident at the tree line

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Loss of habitat for turtle nesting and haulout

Tide: 2.2’

48

RN-04 Lagoon Side

Description: Boat ramp in between sandy beach

Shoreline protection: Armor stone and concrete

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

49

RN-04 Lagoon Side

Description: Shoreline west of main port terminal

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

Road on backside of building is threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

50

RN-04 Lagoon Side

Description: Shoreline west of main port terminal

Shoreline protection: Concrete debris

Vegetation: Managed vegetation

Road on backside of building is threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

51

RN-04 Lagoon Side

Description: Shoreline west of main port terminal

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

52

RN-05 Lagoon Side

Description: Barge dock and mooring area. Sheet piling is corroding.

Shoreline protection: Sheet piling

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

53

RN-05 Lagoon Side

Description: East side of pier

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

54

RN-05 Lagoon Side

Description: East of pier

Shoreline protection: concrete debris and armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

55

RN-05 Lagoon Side

Description: Sandy beach on central portion of the south shore

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

56

RN-05 Lagoon Side

Description: South shore sandy beach

Shoreline protection: Seawall of debris ends, none behind beach

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

57

RN-05 Lagoon Side

Description: East side of Yokahoma pier

Shoreline protection: Concrete seawall

Vegetation: Managed vegetation

Third Island store is threatened

Yokahoma pier is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.1’

58

RN-05 Lagoon Side

Description: Critical erosion in front of Third Island store

Shoreline protection: none

Vegetation: Managed vegetation

Third Island store is threatened

Yokahoma pier is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.1’

59

RN-05 Lagoon Side

Description: Erosion of beach east of Yokahoma pier

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

60

RN-05 Lagoon Side

Description: West side of Yokahoma Pier

Shoreline protection: Armor stone and concrete

Vegetation: Managed vegetation

No threatened facilities

Yokahoma pier is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.1’

61

RN-05 Lagoon Side

Description: Third Island store is threatened by erosion

Shoreline protection: none

Vegetation: Managed vegetation

Third Island store is threatened

Yokahoma pier is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.1’

62

RN-05 Lagoon Side

Description: Third Island store

Shoreline protection: none

Vegetation: Managed vegetation

Building is threatened

Yokahoma pier is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.1’

63

RN-05 Lagoon Side

Description: East of the Yokahoma Pier looking towards the Dive Club. Rusted out ship is in the water
Shoreline protection: none in foreground

Vegetation: Managed vegetation and Littoral shrubland

No threatened facilities
Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.1’

64

RN-05 Lagoon Side

Description: Looking west towards Yokahoma Pier; natural reef and sand beach; some concrete debris and a rusted out ship on shorline

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.1’

65

RN-05 Lagoon Side

Description: Seawall in front of Dive Club

Shoreline protection: Concrete and armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

66

RN-05 Lagoon Side

Description: East of Dive Club looking back to the west. Two old concrete structures in the water

Shoreline protection: Armor stone behind beach

Vegetation: Littoral shrubland

No threatened facilities

Concrete structures could be Japanese pillboxes

Low potential for natural resource impact

Tide: 2.1’

67

RN-05 Lagoon Side

Description: Sand and gravel beach near antenna

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1’

68

RN-05 Lagoon Side

Description: South shore towards southeastern point

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Turtle nesting and haulout habitat

Tide: 2.1’

69

RN-06 Ocean Side

Description: Southeast point looking northeast

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

70

RN-06 Ocean Side

Description: Natural reef with armor stone and concrete debris

Shoreline protection: Armor stone and concrete debris

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.0’

71

RN-06 Ocean Side

Description: Natural reef on southeast shore

Shoreline protection: None

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

72

RN-06 Ocean Side

Description: Round Japanese bunker on southeast shore

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Bunker is a WWII cultural resource

Low potential for natural resource impact

Tide: 2.0’

73

RN-06 Ocean Side

Description: Southeastern shore looking southwest; natural reef and sand beach

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

74

RN-07 Ocean Side

Description: East shore with natural reef and sandy beach

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

75

RN-07 Ocean Side

Description: East shore looking west

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

76

RN-07 Ocean Side

Description: East shore looking south

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

77

RN-07 Ocean Side

Description: East shore looking north

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

78

RN-07 Ocean Side

Description: At boundary between sector RN-07 and RN-08 looking south on the east shore

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

79

RN-08 Ocean Side

Description: East shore looking north from eastern point. North of this point could not be surveyed due to high radio frequency tests

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.0’

80

RN-09 Ocean Side

Description: North shore on Namur side of island near large satellite dish; looking northeast

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 2.0’

81

RN-09 Ocean Side

Description: Old outfall on north shore of Namur

Shoreline protection: Armor stone and poured concrete

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

82

RN-09 Ocean Side

Description: North shore of Namur

Shoreline protection: Armor stone and concrete debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

83

RN-09 Ocean Side

Description: North shore of Namur with natural reef and debris

Shoreline protection: Armor stone and concrete and metal debris

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 1.9’

84

RN-09 Ocean Side

Description: North shore of Namur

Shoreline protection: Armor stone wall

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

85

RN-09 Ocean Side

Description: North shore of Namur looking southwest. Erosion is evident.

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 1.9’

86

RN-09 Ocean Side

Description: Close-up picture of ledge caused by erosion

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

87

RN-09 Ocean Side

Description: Concrete debris on north shore of Namur

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

88

RN-09 Ocean Side

Description: Northern shore of Namur looking east

Shoreline protection: see previous picures

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

89

RN-09 Ocean Side

Description: Central area on north shore between Roi and Namur looking east

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

90

RN-09 Ocean Side

Description: Natural reef with seawall overgrown with vegetation

Shoreline protection: concrete seawall

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

91

RN-09 Ocean Side

Description: Central area on north shore between Roi and Namur looking west

Shoreline protection: none

Vegetation: Littoral forest No

threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

92

RN-09 Ocean Side

Description: East side of Roi looking south

Shoreline protection: Armor stone seawall

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

93

RN-09 Ocean Side

Description: East side of Roi near airfield runway

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

94

RN-09 Ocean Side

Description: North shore near end of runway

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

95

RN-09 Ocean Side

Description: North end of the runway

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

96

RN-09 Ocean Side

Description: North end of runway

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

97

RN-09 Ocean Side

Description: bottom of seawall is being undercut

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

Seawall should be monitored for further undercutting

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

Kwajalein

Survey Conducted on
26 February and 2 March 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Kwajalein Existing Shoreline Protection

- KI-12, Photo 1 – Armor stone
- KI-12, Photo 2 – Natural beach
- KI-8,12,11, Photos 3 - 17 – Armor stone and concrete fill
- KI-11, Photos 18 - 19 – Natural beach
- KI-11, Photos 20, 22 - 23 – Concrete pier
- KI-3, Photos 21, 25 - 30 – Armor stone & concrete
- KI-3, Photos 31 - 34 – Natural beach
- KI-3, Photos 35 - 37 - Natural beach and sparse armor stone and concrete
- KI-12, Photos 38 - 41 – Concrete slab and armor stone

Kwajalein Existing Shoreline Protection Continued

- KI-3, Photos 42 - 47 – Natural beach and sparse armor stone and concrete
- KI-3,14, Photos 48 - 53 – Armor stone and concrete slab
- KI-14, Photo 54 – Natural beach
- KI-14, Photos 55 - 57 – Armor stone
- KI-14, Photos 58 - 64 – Sea wall
- KI-13, Photos 66 - 69 – Armor stone
- KI-Emon Beach, Photos 70 - 73 – Natural beach

Kwajalein Existing Shoreline Protection Continued

- KI-4,5, Photos 74 - 79 – Armor stone
- KI-5, Photos 82 - 83 – Sea wall to armor stone
- KI-5, Photo 84 – Natural beach sand and cobble
- KI-5,6, Photos 85 - 103 – Natural beach cobble and rock with intermittent concrete slabs and armor stone
- KI-6,7, Photos 103 - 127 – Natural reef and beach sand, cobble and rock
- KI-7, Photos 128 - 130 – Natural beach sand and cobble
- KI-7, Photos 131 & 132 – Armor stone and concrete fill

Kwajalein Areas of Critical Erosion

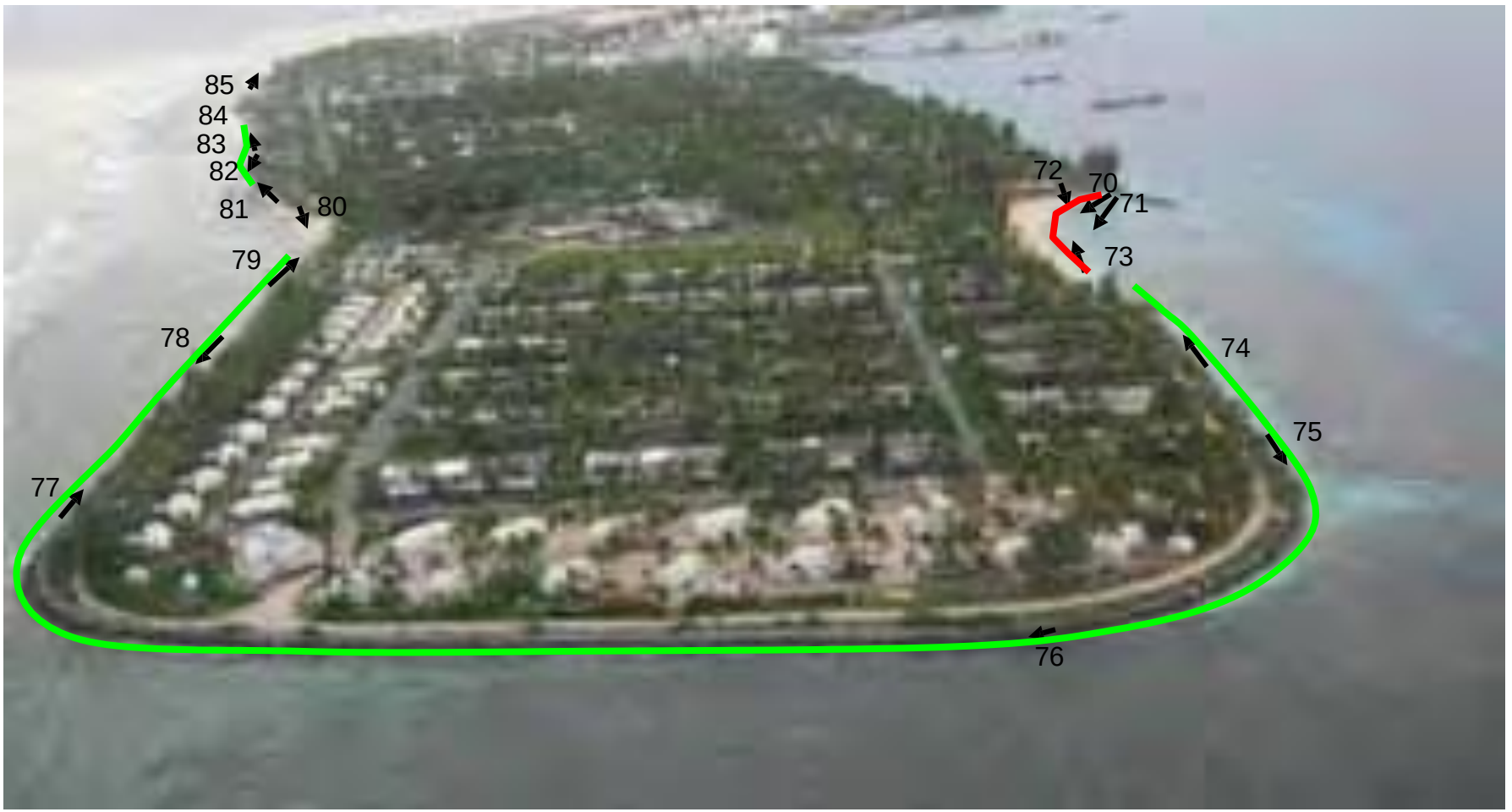
- KI-3,11, Photos 19 - 23 – Barge Slip Ramp area
- KI-3, Photos 33 - 37 & 43 - 47 – MPS36 area
- KI-12, Photos 38 - 41 – “Pet Cemetery” area
- KI-5, Photos 94 - 96 – Adult Pool to Kwaj Lodge area

Kwajalein - Areas of Non-critical Erosion

- KI-3, Photos 28 & 30 – Ledging at Building 1011
- KI-14, Photos 58 - 63 – Signs of undercutting erosion at harbor sea wall
- KI-6, Photo 113 – Ledging at Golf Course
- KI-7, Photo 131 – Ledging west of runway

Central and Western Portion of Island

Northeast Portion of Island



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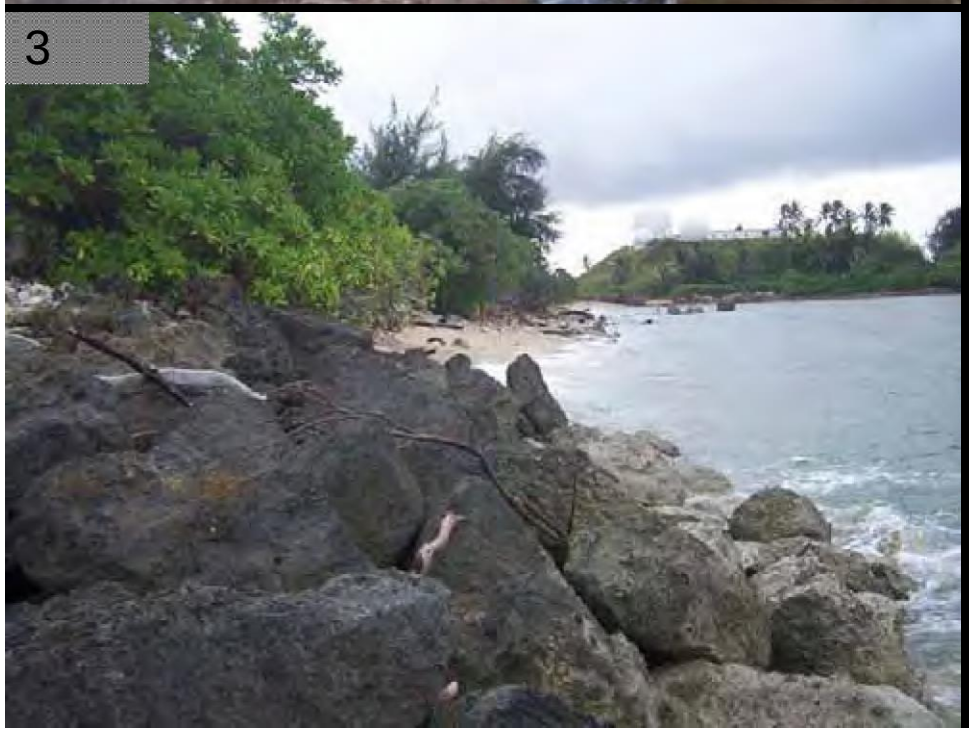
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KI-12 Ocean Side

Description: “Sharkpit” area

Shoreline protection: Armor stone, concrete block & metal fill

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

2

KI-12 Ocean Side

Description: “Mt. Olympus” area

Shoreline protection: Beach sand, cobble & rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

3

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

4

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone & metal fill

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

38

39

40

41

38

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Concrete & metal debris fill

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.0'

39

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: N/A

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.0'

40

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Concrete & metal debris fill

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.0'

41

KI-12 Ocean Side

Description: "Pet Cemetery"

Shoreline protection: N/A

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.0'


5


6


7


8

5

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

6

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone, concrete slab and beach rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

7

KI-12 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone, concrete slab and beach rock Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

8

KI-08 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

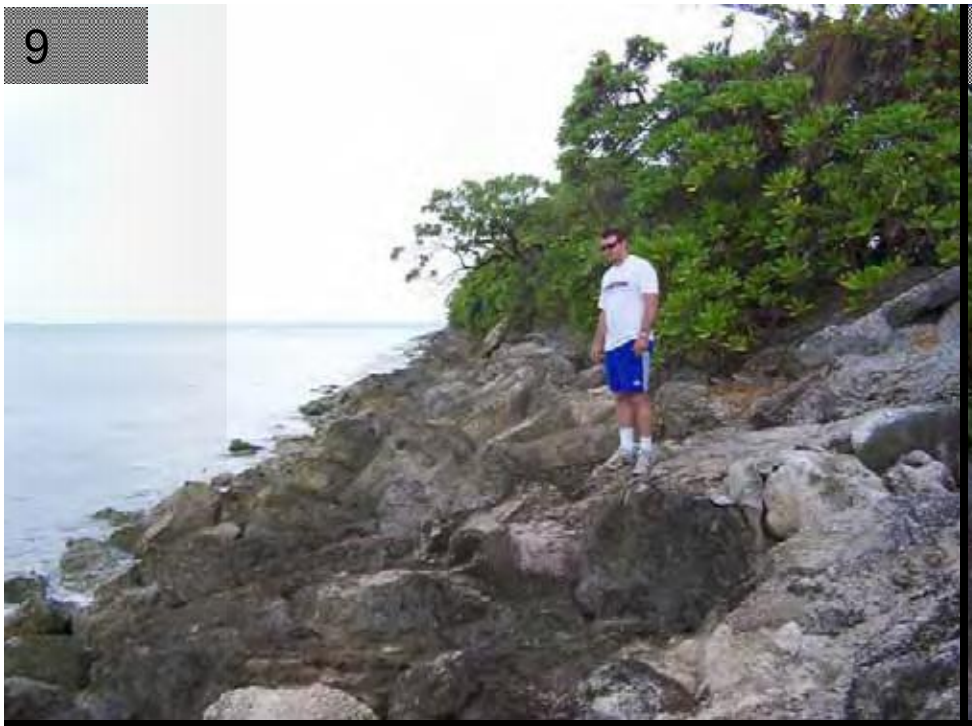
Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'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10


11


12

9

KI-08 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

10

KI-08 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

11

KI-08 Ocean Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'

12

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 2.2'


13


14


15


16

13

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

14

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

15

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

16

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'


17


18


19


20

17

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

BSR erosion

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

18

KI-11 Lagoon Side

Description: Western portion of island

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

19

KI-11 Lagoon Side

Description: Barge slip ramp

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

20

KI-11 Lagoon Side

Description: Barge slip ramp

Shoreline protection: Concrete pier

Vegetation: None

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'


21


22


23


24

21

KI-03 Lagoon Side

Description: Barge slip ramp

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

22

KI-11 Lagoon Side

Description: Barge slip ramp

Shoreline protection: Concrete pier

Vegetation: None

BSR Erosion

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2'

23

KI-11 Lagoon Side

Description: Barge slip ramp

Shoreline protection: Concrete pier

Vegetation: None

BSR Erosion

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3'

24

KI-03 Lagoon Side

Description: East of barge slip ramp

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3'

25

26

27

28

25

KI-03 Lagoon Side

Description: East of barge slip ramp

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3'

26

KI-03 Lagoon Side

Description: East of barge slip ramp

Shoreline protection: Armor stone & poured concrete

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3'

27

KI-03 Lagoon Side

Description: East of barge slip ramp

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3'

28

KI-03 Lagoon Side

Description: East of barge slip ramp, ledging

Shoreline protection: Armor stone

Vegetation: Littoral shrub and managed vegetation

Ledging

Low potential for cultural resource impact

Low potential for natural resource impact

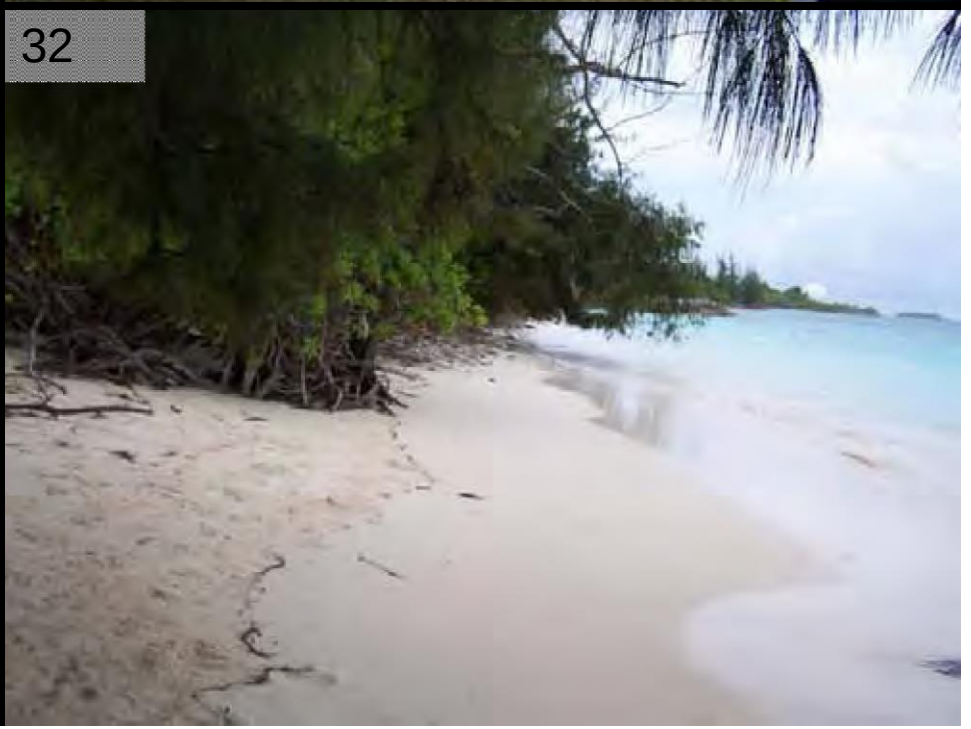
Tide: 2.4'

29

30

31

32



29

KI-03 Lagoon Side

Description: West of Coral Sands Beach

Shoreline protection: Beach rock & concrete slab

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1'

30

KI-03 Lagoon Side

Description: West of Coral Sands Beach, ledging

Shoreline protection: Beach rock & concrete slab

Vegetation: Managed vegetation

Ledging near cable tray stand

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1'

31

KI-03 Lagoon Side

Description: Coral Sands Beach

Shoreline protection: Beach sand

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1'

32

KI-03 Lagoon Side

Description: Coral Sands Beach

Shoreline protection: Beach sand

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.1'


33


34


35


36

33

KI-03 Lagoon Side

Description: Coral Sands to MPS36, erosion between Coral Sands beach and MPS36

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

34

KI-03 Lagoon Side

Description: Coral Sands to MPS36, erosion between Coral Sands beach and MPS36

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

35

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

36

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

MPS-36

Shoreline Protection Project Area

Pictures 33-37 & 43-47

37

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

Roadway threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

43

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub

Roadway threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'

44

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Beach sand & cobble, sparse concrete slab

Vegetation: Littoral shrub

Roadway threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0'


45


46


47


48

45

KI-03 Lagoon Side

Description: East of MPS-36 area

Shoreline protection: Armor stone

Vegetation: Beach sand & cobble

Erosive ledge

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

46

KI-03 Lagoon Side

Description: East of MPS-36 area

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No facilities threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

47

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Beach sand & sparse concrete slab

Vegetation: Managed vegetation

Roadway threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

48

KI-03 Lagoon Side

Description: MPS36, erosion undercutting roadway

Shoreline protection: Armor stone

Vegetation: Littoral shrub

Roadway threatened

Low potential for cultural resource impact

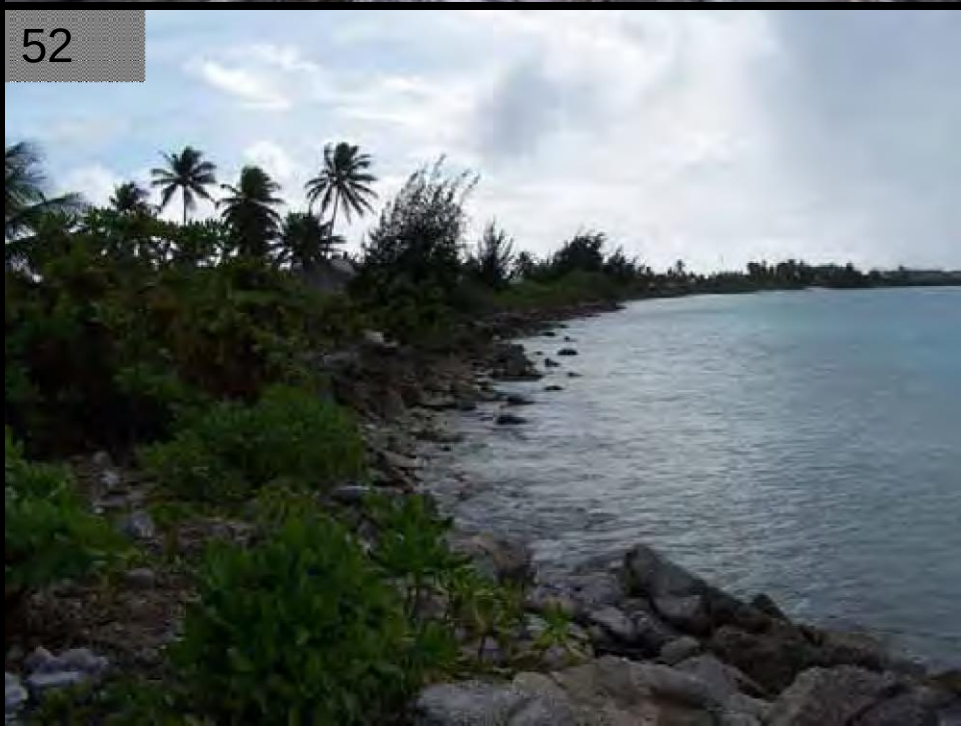
Low potential for natural resource impact

Tide: 1.9'


49


50


51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49

KI-03 Lagoon Side

Description: Central lagoon

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

50

KI-03 Lagoon Side

Description: Central lagoon

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

51

KI-03 Lagoon Side

Description: Central lagoon

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

52

KI-03 Lagoon Side

Description: West of Camp Hamilton

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'


53


54


55


56

53

KI-14 Lagoon Side

Description: Camp Hamilton area

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

54

KI-14 Lagoon Side

Description: Camp Hamilton area

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

55

KI-14 Lagoon Side

Description: East of Camp Hamilton area

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

56

KI-14 Lagoon Side

Description: East of Camp Hamilton area

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'


57


58


59


60

57

KI-14 Lagoon Side

Description: Harbor – Fuel Pier, some signs of undercutting at sea wall

Shoreline protection: Armor stone & sea wall

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

58

KI-14 Lagoon Side

Description: Harbor, some signs of undercutting at sea wall

Shoreline protection: Sea wall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

59

KI-14 Lagoon Side

Description: Harbor, some signs of undercutting at sea wall

Shoreline protection: Sea wall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

60

KI-14 Lagoon Side

Description: Harbor, some signs of undercutting at sea wall

Shoreline protection: Sea wall

Vegetation: None

No threatened facilities

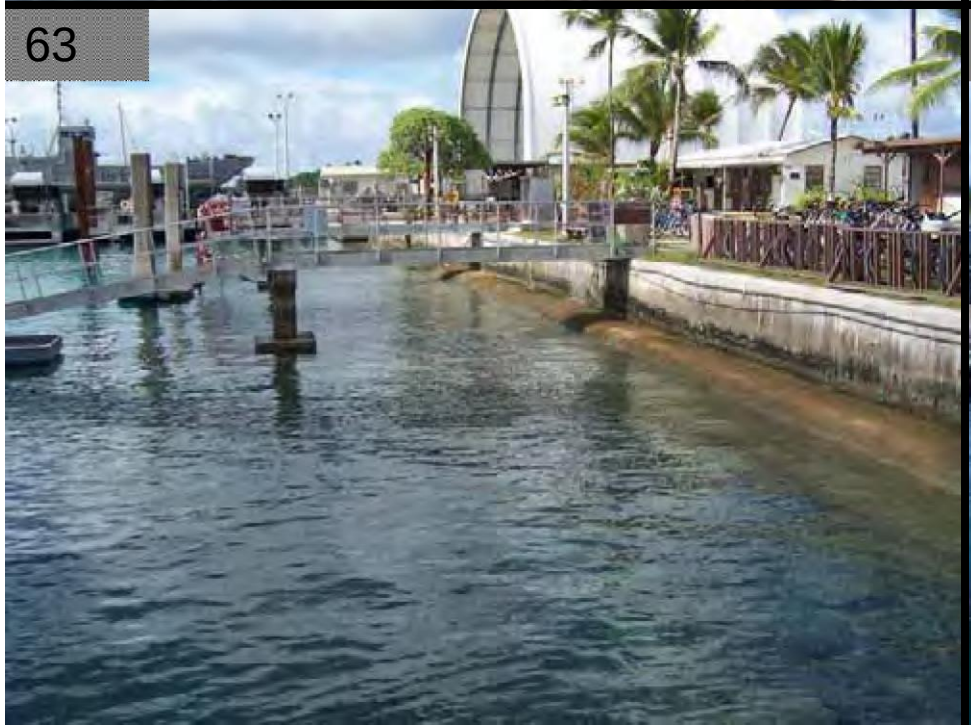
Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'


61


62


63


64

61

KI-14 Lagoon Side

Description: Harbor, some signs of undercutting at sea wall

Shoreline protection: Sea wall

Vegetation: None

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

62

KI-14 Lagoon Side

Description: Harbor – Small Boat Marina, some signs of undercutting at sea wall

Shoreline protection: Sea wall

Vegetation: None

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9'

63

KI-14 Lagoon Side

Description: Harbor

Shoreline protection: Sea wall

Vegetation: None

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'

64

KI-14 Lagoon Side

Description: Harbor

Shoreline protection: Sea wall

Vegetation: None

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'


65


66


67


68

65

KI-14 Lagoon Side

Description: Harbor to Emon Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'

66

KI-13 Lagoon Side

Description: Harbor to Emon Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'

67

KI-13 Lagoon Side

Description: Harbor to Emon Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'

68

KI-13 Lagoon Side

Description: Harbor to Emon Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'


69


70


71


72

69

KI-13 Lagoon Side

Description: Harbor to Emon Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential turtle nesting

Tide: 1.8'

70

Emon Beach Lagoon Side

Description: Emon Beach, beach sand loss

Shoreline protection: Beach sand

Vegetation: Managed vegetation

Beach threatened

Low potential for cultural resource impact

Potential turtle nesting

Tide: 1.8'

71

Emon Beach Lagoon Side

Description: Emon Beach, beach sand loss

Shoreline protection: Beach sand

Vegetation: Managed vegetation

Beach threatened

Low potential for cultural resource impact

Potential turtle nesting

Tide: 1.8'

72

Emon Beach Lagoon Side

Description: Emon Beach, beach sand loss

Shoreline protection: Beach sand

Vegetation: Managed vegetation

Beach threatened

Low potential for cultural resource impact

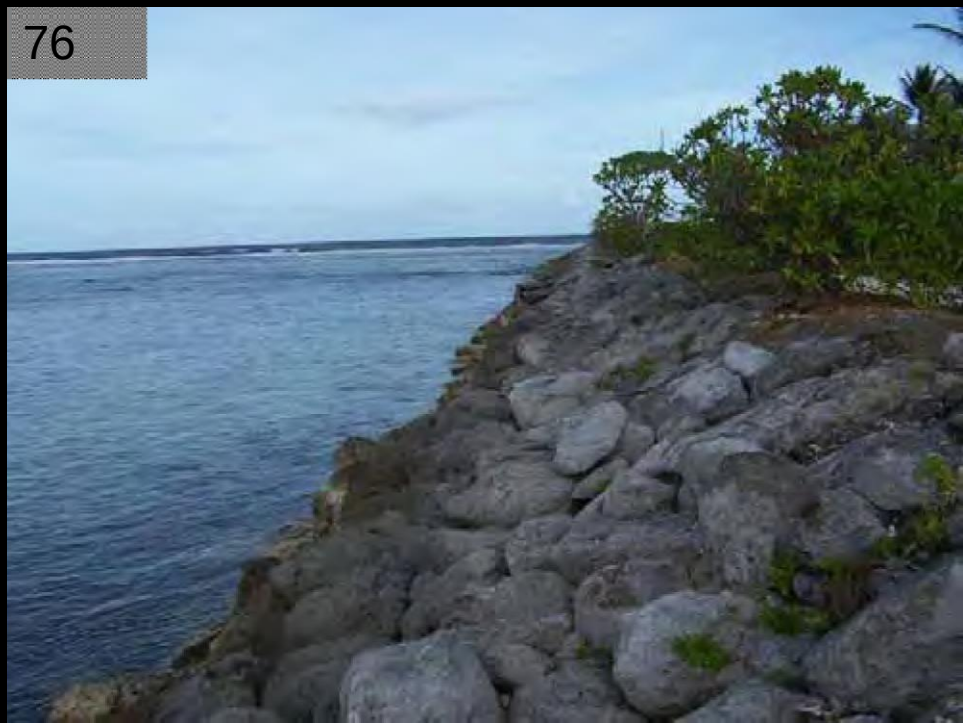
Potential turtle nesting

Tide: 1.8'


73


74


75


76

73

Emon Beach Lagoon Side

Description: Emon Beach, beach sand loss

Shoreline protection: Beach sand

Vegetation: Littoral shrub

Beach threatened

Low potential for cultural resource impact

Potential turtle nesting

Tide: 1.8'

74

KI-04 Lagoon Side

Description: Emon Beach to North Point

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.8'

75

KI-04 Lagoon Side

Description: Emon Beach to North Point

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8'

76

KI-04 Lagoon Side

Description: North Point

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.8'

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79

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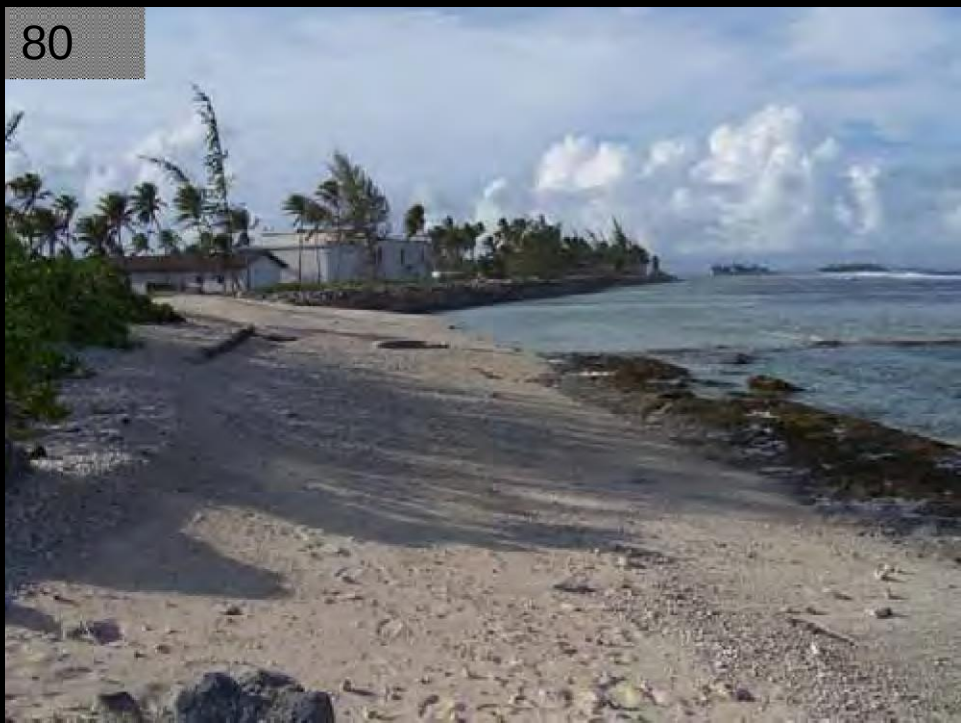


77

KI-05 Ocean Side

Description: North Point to Glass Beach

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

78

KI-05 Ocean Side

Description: North Point to Glass Beach

Shoreline protection: Armor stone & sea wall

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

79

KI-05 Ocean Side

Description: North Point to Glass Beach

Shoreline protection: Armor stone & sea wall

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

80

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub

No threatened facilities

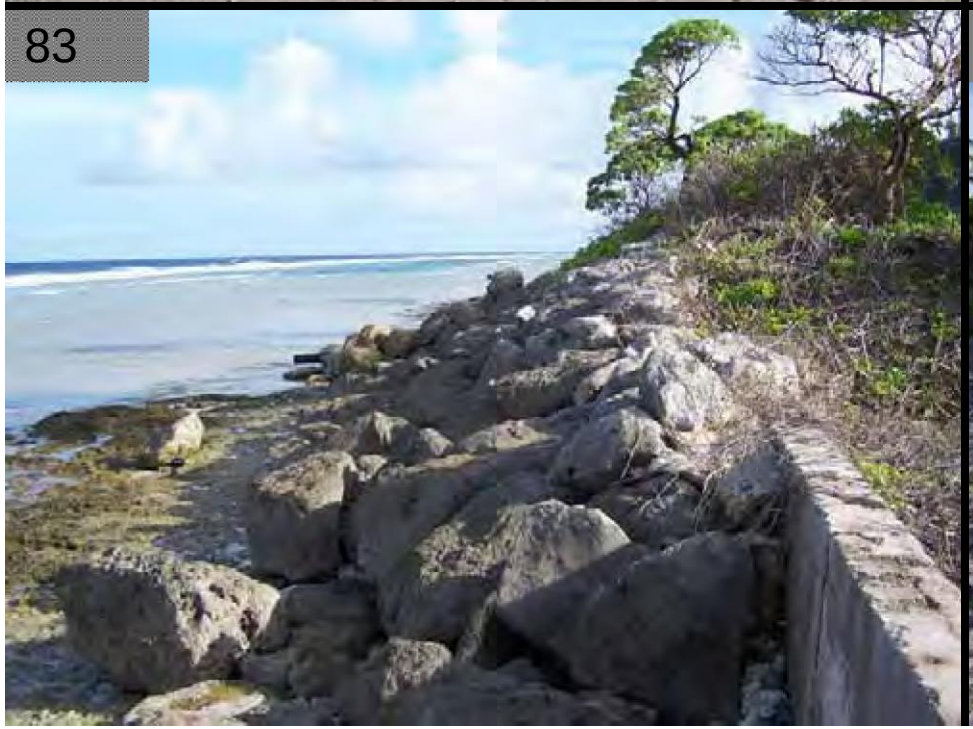
Low potential for cultural resource impact

Shoreline habitat

Tide: 1.7'


81


82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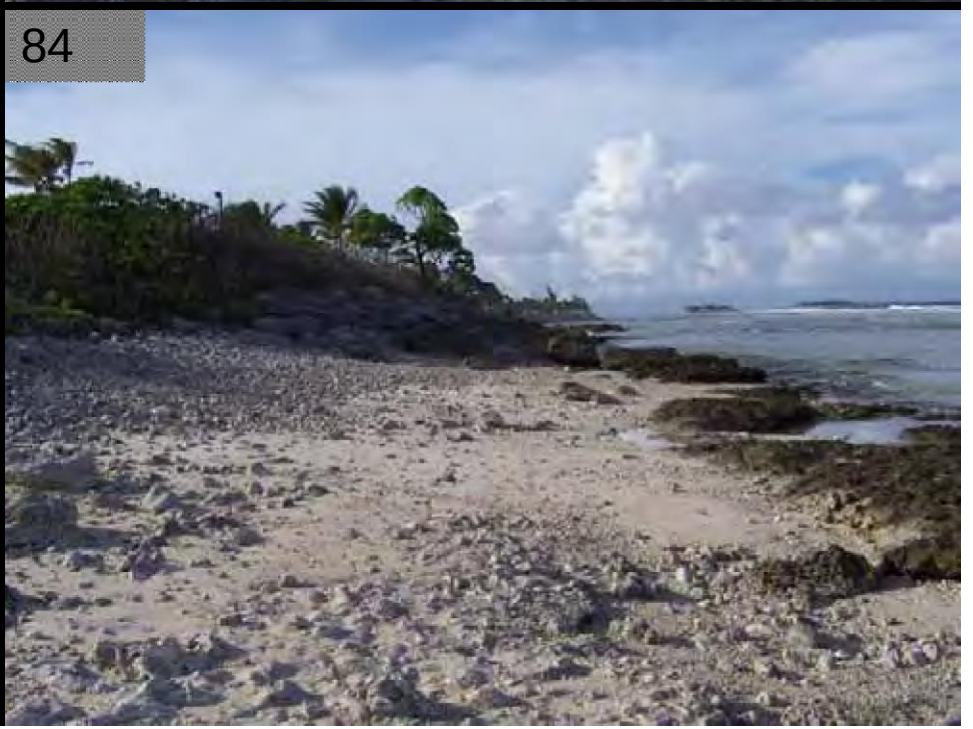

84

81

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Beach sand & sea wall

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

82

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Sea wall and concrete block

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

83

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Sea wall and armor stone

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

84

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Natural reef, beach cobble, rock & sand

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'


85


86


87


88

85

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Beach sand, cobble & stone, & reef rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

86

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Armor stone & beach rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

87

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Armor stone & beach rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

88

KI-05 Ocean Side

Description: Housing area

Shoreline protection: Beach rock & cobble

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'


89


90


91


92

89

KI-05 Ocean Side

Description: Across from BQ’s

Shoreline protection: Armor stone, concrete slab, beach rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

90

KI-05 Ocean Side

Description: Across from BQ’s, erosive ledge

Shoreline protection: Armor stone, concrete slab, beach rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

91

KI-05 Ocean Side

Description: Across from BQ’s

Shoreline protection: Beach sand & rock, sea wall

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

92

KI-05 Ocean Side

Description: Across from BQ’s

Shoreline protection: Beach sand & rock

Vegetation: Littoral shrub

No threatened facilities

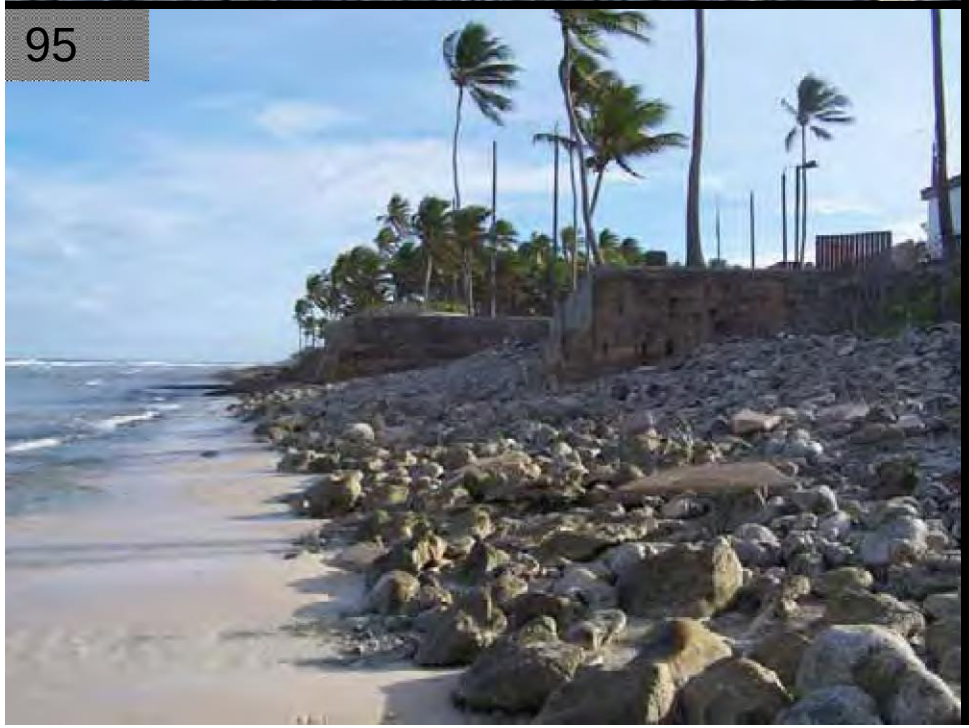
High potential for cultural resource impact

Shoreline habitat

Tide: 1.7'


93


94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96

93

KI-05 Ocean Side

Description: Adult Pool area

Shoreline protection: Beach cobble & rock, concrete slab

Vegetation: Littoral shrub

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

94

KI-05 Ocean Side

Description: Adult Pool area

Shoreline protection: Beach cobble & rock, sea wall

Vegetation: Littoral shrub

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

95

KI-05 Ocean Side

Description: Adult Pool area

Shoreline protection: Beach cobble & rock, sea wall

Vegetation: Littoral shrub

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

96

KI-05 Ocean Side

Description: Adult Pool area

Shoreline protection: Beach cobble & rock, sea wall

Vegetation: Littoral shrub

Exposed EOD, and pool sea wall threatened

Low potential for cultural resource impact

Shoreline habitat

Tide: 1.7'

97

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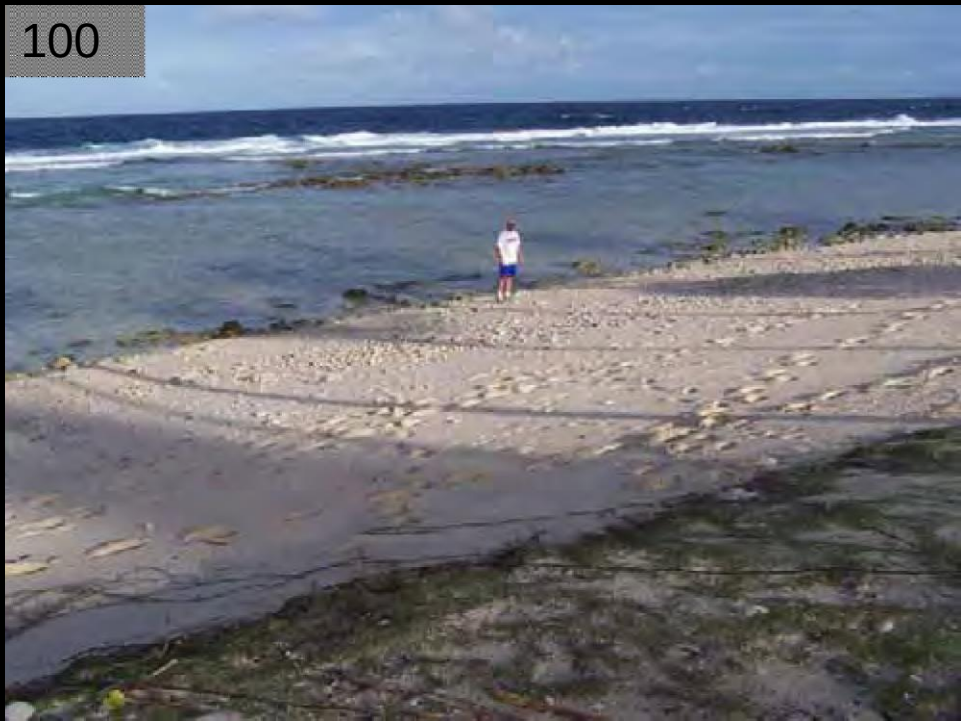
99

100



97

KI-05 Ocean Side

Description: Adult Pool to Kwaj Lodge

Shoreline protection: Reef, beach sand, cobble and rock

Vegetation: Littoral shrub

EOD exposed, loss of soil

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'

98

KI-05 Ocean Side

Description: Adult Pool to Kwaj Lodge

Shoreline protection: Reef, beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'

99

KI-05 Ocean Side

Description: Adult Pool to Kwaj Lodge

Shoreline protection: Beach sand & cobble

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'

100

KI-05 Ocean Side

Description: Adult Pool to Kwaj Lodge

Shoreline protection: Beach sand & cobble

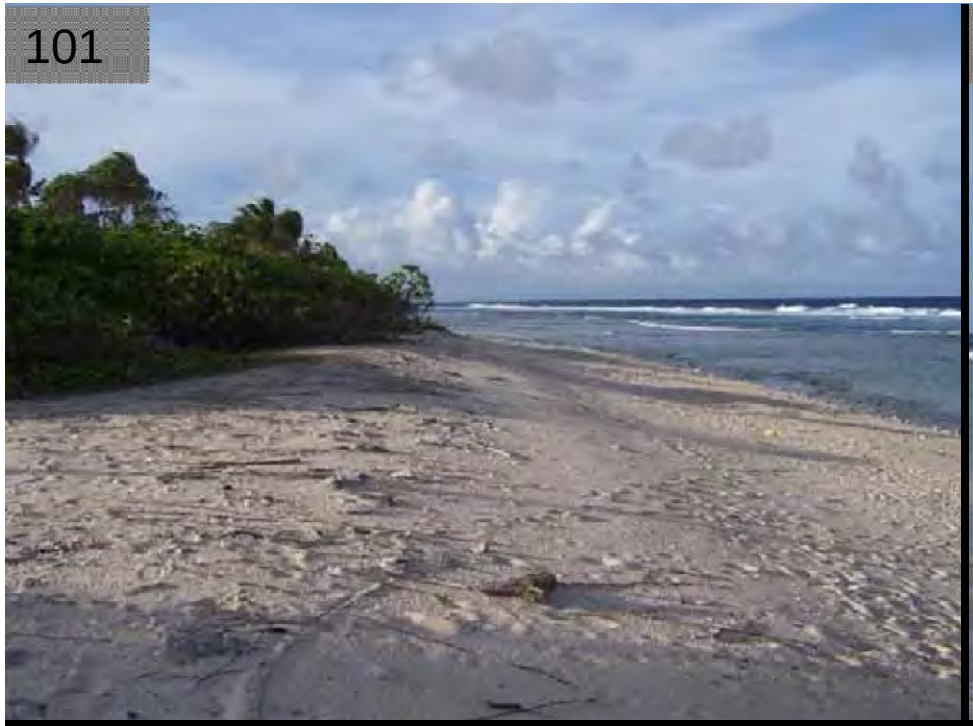
Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'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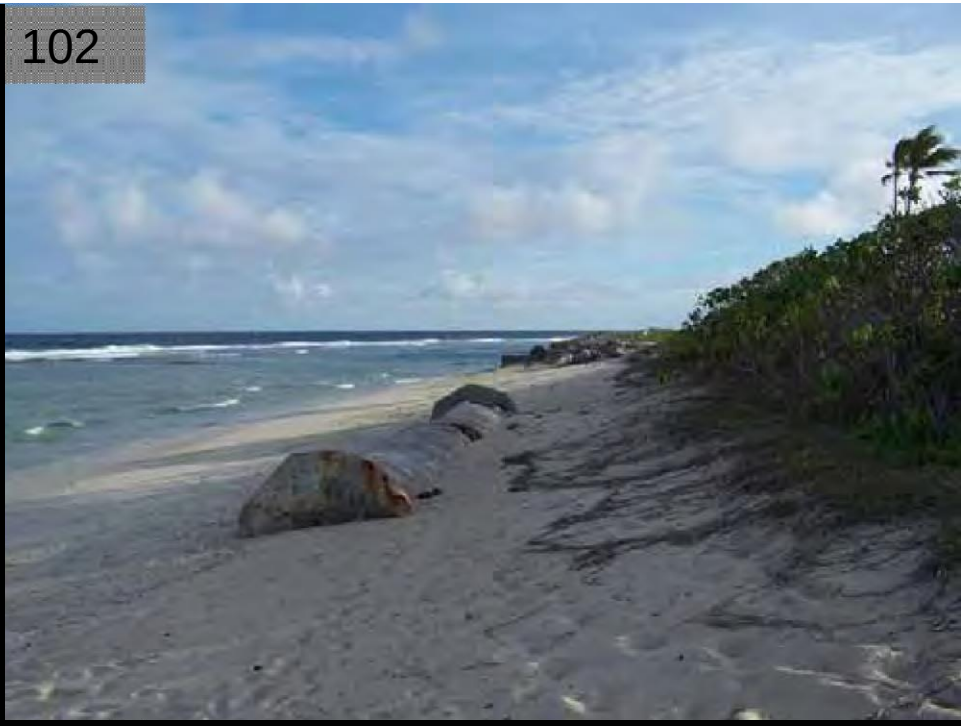
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104

101

KI-05 Ocean Side

Description: Kwaj Lodge

Shoreline protection: Beach sand

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'

102

KI-05 Ocean Side

Description: Kwaj Lodge

Shoreline protection: Beach sand

Vegetation: Littoral shrub

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 1.6'

103

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Beach sand, armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.6'

104

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Armor stone & concrete to beach sand & cobble

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.6’


105


106


107


108

105

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Beach sand & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.6’

106

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 0.6’

107

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 0.5’

108

KI-06 Ocean Side

Description: East end of runway

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 0.5’


109


110


111


112

109

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

High potential for cultural resource impact

Shoreline habitat

Tide: 0.5’

110

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.5’

111

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.5’

112

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.4’


113


114


115


116

113

KI-06 Ocean Side

Description: Golf course, erosive ledge

Shoreline protection: Armor stone & beach rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.4’

114

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone& beach rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.3’

115

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone& beach rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.3’

116

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & beach rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.3’


117


118


119


120

117

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone, concrete, beach rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.2’

118

KI-06 Ocean Side

Description: Golf course, erosive ledge

Shoreline protection: Concrete block & beach cobble

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.2’

119

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Armor stone & concrete block

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.2’

120

KI-06 Ocean Side

Description: Golf course

Shoreline protection: Beach cobble & rock, concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.2’


121


122


123


124

121

KI-07 Ocean Side

Description: Golf course

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Moderate potential for cultural resource impact

Shoreline habitat

Tide: 0.1’

122

KI-07 Ocean Side

Description: Golf course

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.1’

123

KI-07 Ocean Side

Description: Bunker area

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.1’

124

KI-07 Ocean Side

Description: Bunker area

Shoreline protection: Armor stone

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.1’


125


126


127


128

125

KI-07 Ocean Side

Description: Bunker area

Shoreline protection: Beach cobble & rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

126

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Armor stone & concrete slab

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

127

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Concrete slab & metal fill

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

128

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Beach sand, cobble & rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’


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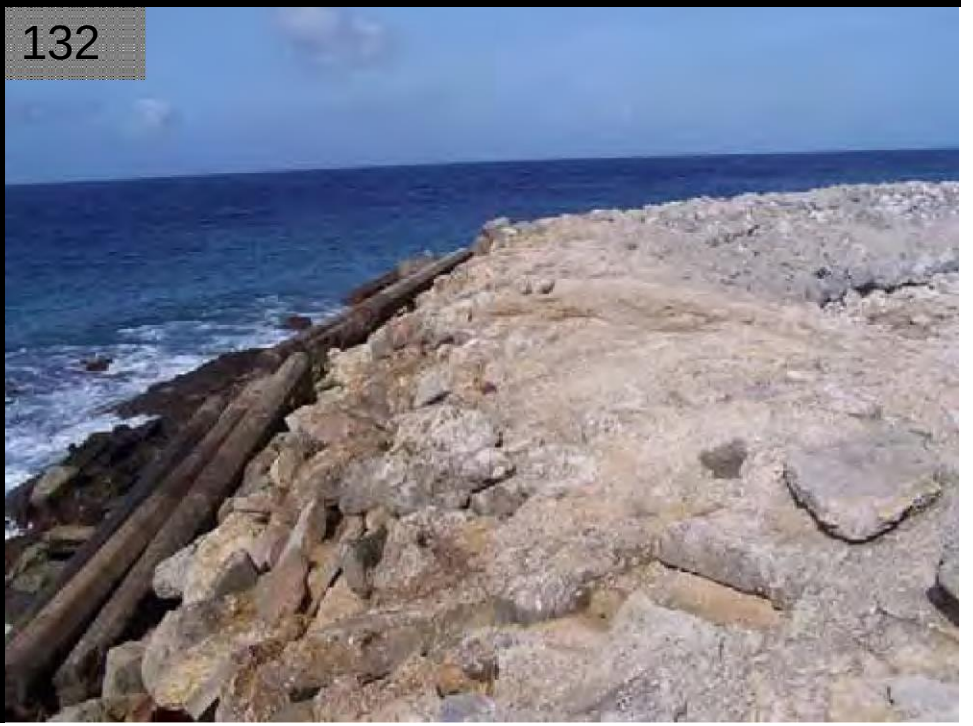
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129

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Beach sand, cobble & rock

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

130

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Beach sand, cobble & rock to metal fill

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

131

KI-07 Ocean Side

Description: West end of runway, erosive ledge

Shoreline protection: Armor stone & metal fill

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

132

KI-07 Ocean Side

Description: West end of runway

Shoreline protection: Armor stone, concrete slab & poured concrete

Vegetation: Littoral shrub & managed vegetation

No threatened facilities

Low potential for cultural resource impact

Shoreline habitat

Tide: 0.0’

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Gellinam

Survey Conducted on
27 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Gellinam Existing Shoreline Protection

- GL-3, Photos 1 & 2 – Armor stone
- GL-3, Photo 5 – Armor stone covered with vegetation
- GL-1, Photos 10, 12, 15 - 17 – Armor stone
- GL-4, Photos 18 – 20 – Armor stone
- GL-4, Photos 21 & 22 – Armor stone
- GL-Harbor, Photos 23 - 25 – Armor stone

Gellinam Areas of Critical Erosion

- None

Gellinam Areas of Non-critical Erosion

- GL-Harbor, Photos 23 & 24 – Northern side of the southern harbor jetty

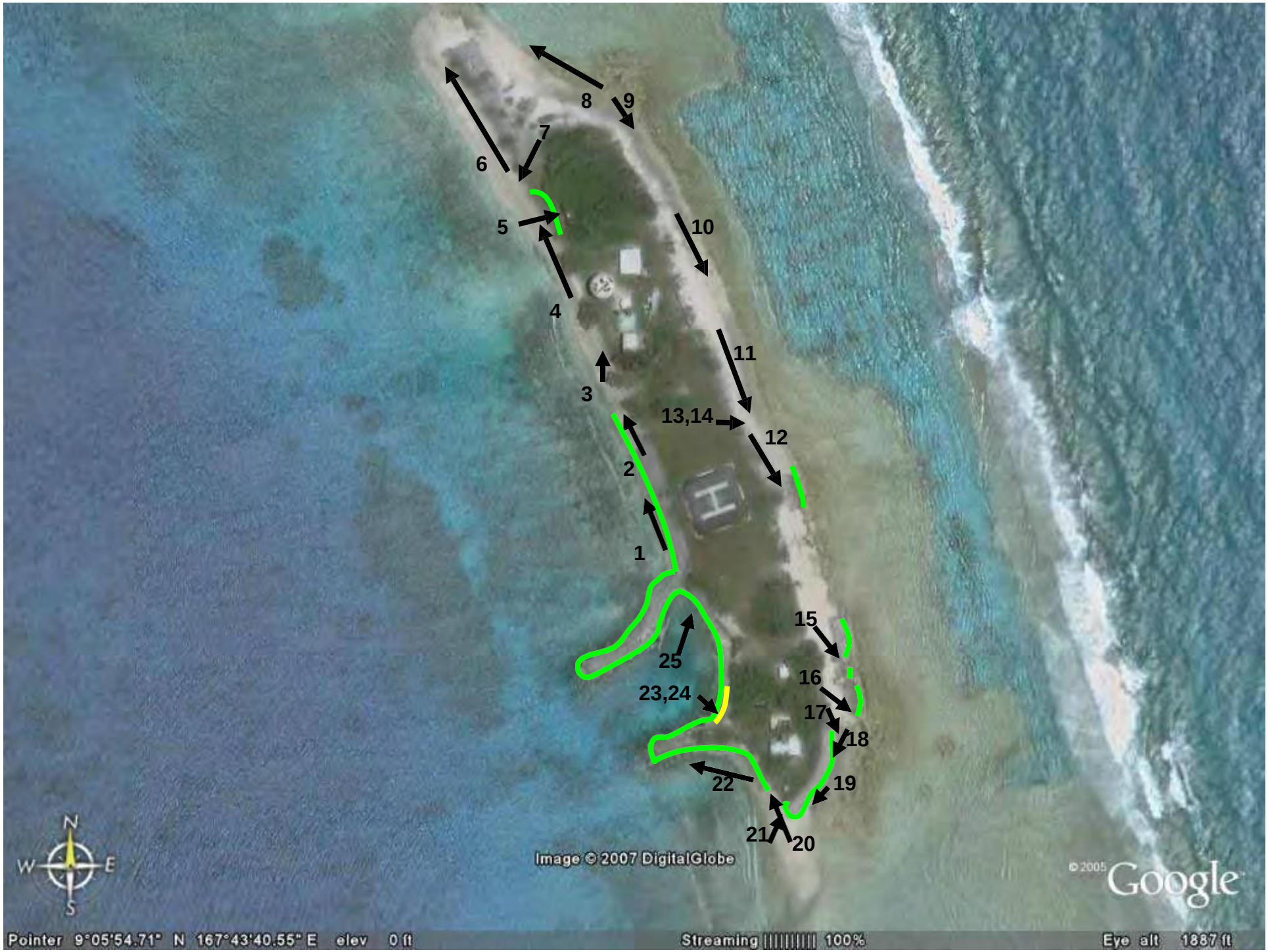
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Image © 2007 DigitalGlobe
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Pointer 9°05'54.71" N 167°43'40.55" E elev 0 ft
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Eye alt 1887 ft

1

GL-03 Lagoon Side

Description: West shoreline near helipad

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

2

GL-03 Lagoon Side

Description: Central western shoreline

Shoreline protection: Some armor stone and natural

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

3

GL-03 Lagoon Side

Description: Shoreline in front of abandoned facilities

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

4

GL-03 Lagoon Side

Description: North end of western shoreline

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

5

GL-03 Lagoon Side

Description: Northern part of western shoreline

Shoreline protection: Armor stone covered with vegetation

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

6

GL-02 Lagoon Side

Description: North point of island

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

7

GL-02 Lagoon Side

Description: Vegetation behind shoreline, coconut

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

8

GL-02 Ocean Side

Description: North point of Island

Shoreline protection: none, but some armor stone above high tide elevation

Vegetation: none

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

9

GL-01 Ocean Side

Description: North end of island looking southeast

Shoreline protection: none

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

10

GL-01 Ocean Side

Description: Eastern shoreline looking south

Shoreline protection: Some scattered armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

11

GL-01 Ocean Side

Description: Sandy/gravel beach on eastern shore

Shoreline protection: None

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

12

GL-01 Ocean Side

Description: Shoreline east of helipad

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

13

GL-01 Ocean Side

Description: Shoreline north of the helipad

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

14

GL-01 Ocean Side

Description: Shoreline north of the helipad

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

15

GL-01 Ocean Side

Description: Armor stone and cobble clusters

Shoreline protection: Armor stone with gaps

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

16

GL-01 Ocean Side

Description: Southern end of eastern shoreline

Shoreline protection: Armor stone (with gaps)

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

17

GL-01 Ocean Side

Description: Southern end of eastern shoreline

Shoreline protection: Armor stone with gaps

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

18

GL-04 Ocean Side

Description: Southern shoreline

Shoreline protection: Armor stone

Vegetation: Littoral shrubland / forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.9’

19

GL-04 Ocean Side

Description: Southern shoreline

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

20

GL-04 Lagoon Side

Description: Southwestern tip of island looking north

Shoreline protection: Armor stone with gaps

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

21

GL-04 Lagoon Side

Description: North

Shoreline protection: Armor stone with gaps

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

22

GL-04 Lagoon Side

Description: Southern side of harbor jetty

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

23

GL Harbor

Description: Northern side of southern harbor jetty. Erosion is shown in photo.

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

24

GL Harbor

Description: Harbor area where erosion is present

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

25

GL Harbor

Description: Harbor looking northeast

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.0’

Meck

Survey Conducted on
27 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Meck Existing Shoreline Protection

- MK-5, Photo 1 – Concrete ramp and dock, armor stone seawall
- MK-5, Photos 2 & 3 – Armor stone, armor stone seawall
- MK-5, Photo 4 – Concrete dock and sheet piling
- MK-5, Photo 5 – Armor stone seawall with stone protrusions
- MK-5, Photo 6 – Sheet piling
- MK-5, Photo 7 – Sheet piling and armor stone
- MK-5, Photos 8 & 9 – Concrete rubble with armor stone cobbles, and scrap metal
- MK-5, Photos 10 - 12 – Armor stone
- MK-5, Photo 13 – Sand and gravel in front of armor stone covered in vegetation

Meck Existing Shoreline Protection Continued

- MK-6, Photo 15 – Reef in front of armor stone
- MK-6, Photos 16 & 17 – Armor stone, armor stone wall
- MK-1, Photos 18, 19 – Armor stone
- MK-1, Photo 20 – Placed cobbles and small armor stone
- MK-1, Photo 21 – Concrete with armor stone
- MK-1, Photo 22 – Concrete wall, armor stone
- MK-1, Photo 23 – Sand and gravel in front of armor stone
- MK-1, Photo 24 – Armor stone and metal debris

Meck Existing Shoreline Protection Continued

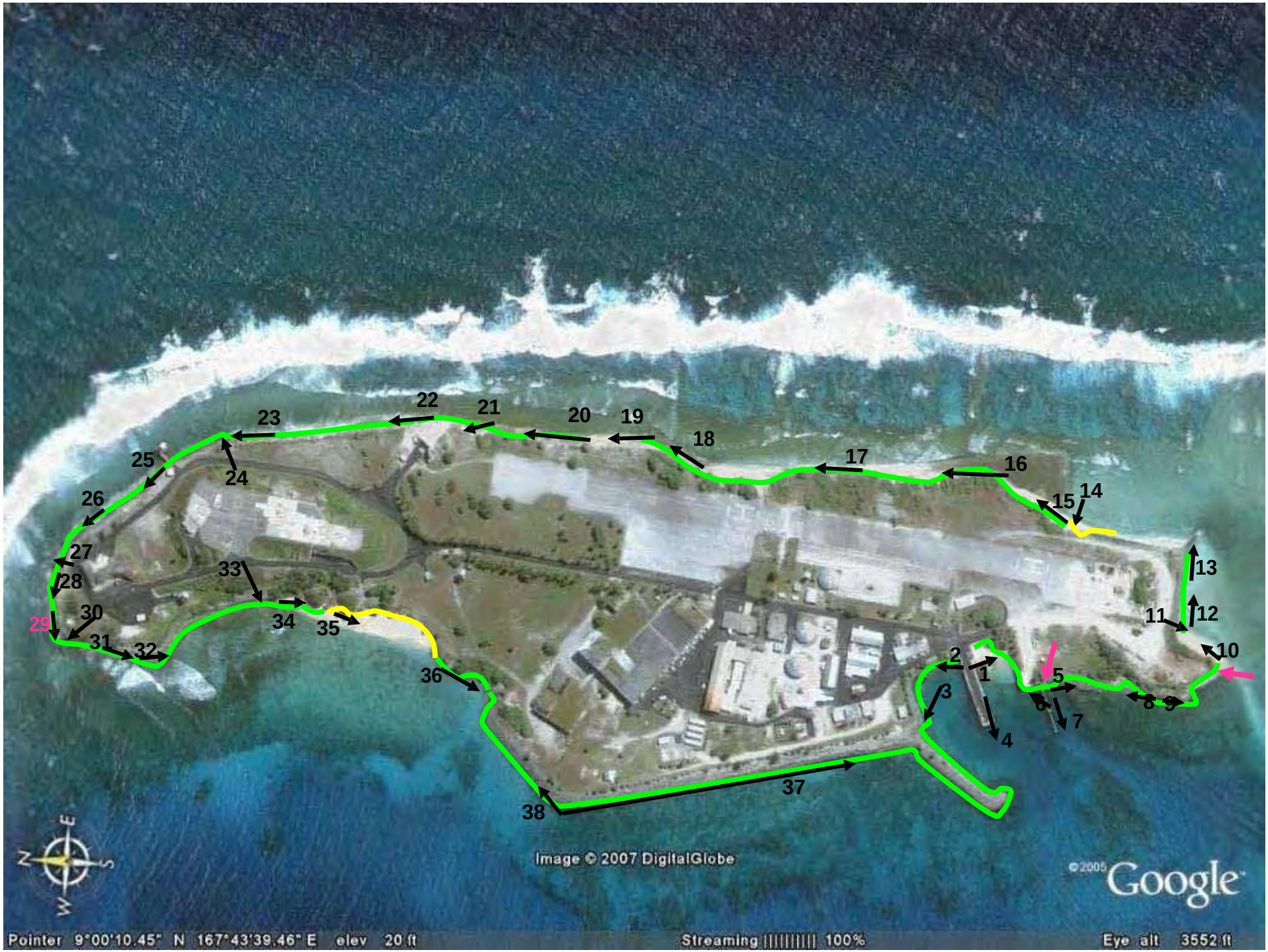
- MK-2, Photo 25 – Armor stone
- MK-2, Photo 26 – Armor stone and concrete cylinders
- MK-2, Photo 27 – Armor stone below concrete cylinders
- MK-2, Photos 28 - 30 – Armor stone
- MK-2, Photo 31 – Gravel in front of armor stone
- MK-2, Photo 32 – Armor stone
- MK-3, Photo 33 – Sand and gravel in front of armor stone
- MK-3, Photos 34 & 36 – Armor stone
- MK-4, Photos 37 & 38 – Armor stone seawall

Meck Areas of Critical Erosion

- None

Meck Areas of Non-critical Erosion

- MK-6, Photo 14 – Southeastern Point; non-critical erosion with ledge
- MK-3, Photo 35 – Erosion at beach and vegetation boundary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MK-05 Lagoon Side

Description: Harbor ramp

Shoreline protection: Concrete ramp and dock, armor stone seawall

Vegetation: Some Trees

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

2

MK-05 Lagoon Side

Description: Harbor

Shoreline protection: Armor stone

Vegetation: Some Trees

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

3

MK-05 Lagoon Side

Description: North jetty of harbor

Shoreline protection: Armor stone seawall

Vegetation: Some trees

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

4

MK-05 Lagoon Side

Description: Dock

Shoreline protection: Concrete Dock and sheet piling

Vegetation: none

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide:2.2’

5

MK-05 Lagoon Side

Description: South side of harbor looking south

Shoreline protection: Armor stone seawall with stone protrusions

Vegetation: Some trees

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

6

MK-05 Lagoon Side

Description: South Side of Harbor looking north

Shoreline protection: Sheet piling

Vegetation: Some trees

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide:2.2’

7

MK-05 Lagoon Side

Description: Fuel Pier

Shoreline protection: Sheet Piling and Armor stone

Vegetation: Some tress

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

8

MK-05 Lagoon Side

Description: Southeast shoreline looking North

Shoreline protection: Concrete rubble with armor stone and cobbles

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

9

MK-05 Lagoon Side

Description: Southeast shoreline looking south towards point
Shoreline protection: Concrete rubble with cobbles and scrap metal

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

10

MK-05 Lagoon Side

Description: Southern shore beach in front of armor stone seawall
Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Potential for natural resource impact due to turtle haulout and nesting

Tide: 2.2’

11

MK-05 Lagoon Side

Description: Southern Point

Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

12

MK-05 Lagoon Side

Description: Southern shoreline

Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.2’

13

MK-05 Lagoon Side

Description: Southern shore and southeastern point
Shoreline protection: Sand and gravel in front of armor stone covered in vegetation

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

14

MK-06 Ocean Side

Description: Southeastern Point. Non-critical erosion with ledge

Shoreline protection: None

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

15

MK-06 Ocean Side

Description: Eastern Shoreline near helipad

Shoreline protection: Reef in front of armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

16

MK-06 Ocean Side

Description: Eastern Shore

Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

17

MK-06 Ocean Side

Description: Eastern Shore

Shoreline protection: Armor stone wall

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

18

MK-01 Ocean Side

Description: Eastern shoreline

Shoreline protection: Armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

19

MK-01 Ocean Side

Description: Central Eastern shoreline

Shoreline protection: Some small armor stone, other areas have none

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

20

MK-01 Ocean Side

Description: Central Eastern shoreline

Shoreline protection: Placed cobbles and small armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.3’

21

MK-01 Ocean Side

Description: Eastern Shoreline on northern portion of island

Shoreline protection: Concrete with armor stone

Vegetation: Herbaceous strand

Facility is directly on the shoreline

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

22

MK-01 Ocean Side

Description: Storage facility near launch complex

Shoreline protection: Concrete wall, armor stone

Vegetation: Herbaceous strand or none

Facility is directly on the shoreline.

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

23

MK-1 Ocean Side

Description: North end island

Shoreline protection: Sand and gravel in front of armor stone

Vegetation: Herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

24

MK-1 Ocean Side

Description: North end of island

Shoreline protection: Armor stone and metal debris

Vegetation: none

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

25

MK-02 Ocean Side

Description: North end of island near tower

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

26

MK-02 Ocean Side

Description: North end of island

Shoreline protection: Armor stone and concrete cylinders

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

27

MK-02 Ocean Side

Description: North end of island

Shoreline protection: Armor stone below concrete cylinders

Vegetation: none

Facility could be threatened if seawall fails

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

28

MK-02 Ocean Side

Description: North end of island

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

Facility could be threatened if seawall fails

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

29

MK-02 Ocean Side

Description: Concrete dumped onto existing shoreline protection

Shoreline protection: Armor stone

Vegetation: none

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

30

MK-02 Ocean Side

Description: North end of island near BLDG 5089

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

Facility could be threatened in future

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.4’

31

MK-02 Lagoon Side

Description: North end of island

Shoreline protection: Gravel in front armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

32

MK-02 Lagoon Side

Description: North end of runway

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

33

MK-03 Lagoon Side

Description: North end of island looking down from launch complex
Shoreline protection: Sand and gravel in front of armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

34

MK-03 Lagoon Side

Description: Western coast on north end of island

Shoreline protection: Armor stone behind sandy beach

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

35

MK-03 Lagoon Side

Description: Signs of erosion at beach and vegetation boundary
Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential for natural resource impact due to turtle nesting and haulout area

Tide: 2.5’

36

MK-03 Lagoon Side

Description: Western shoreline

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

37

MK-04 Lagoon Side

Description: Western shoreline looking south with seawall extending to the harbor
Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

38

MK-04 Lagoon Side

Description: Western shoreline looking north

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 2.5’

Pink arrow

MK-05 Lagoon Side

Description: Concrete poured on vegetation at shoreline

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential for natural resource impact

Tide: 2.2’

Pink Arrow

MK-05 Lagoon Side

Description: Concrete poured on vegetation at shoreline

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential for natural resource impact

Tide: 2.2’

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Ennylabegan

Survey Conducted on
28 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Ennylabegan Existing Shoreline Protection

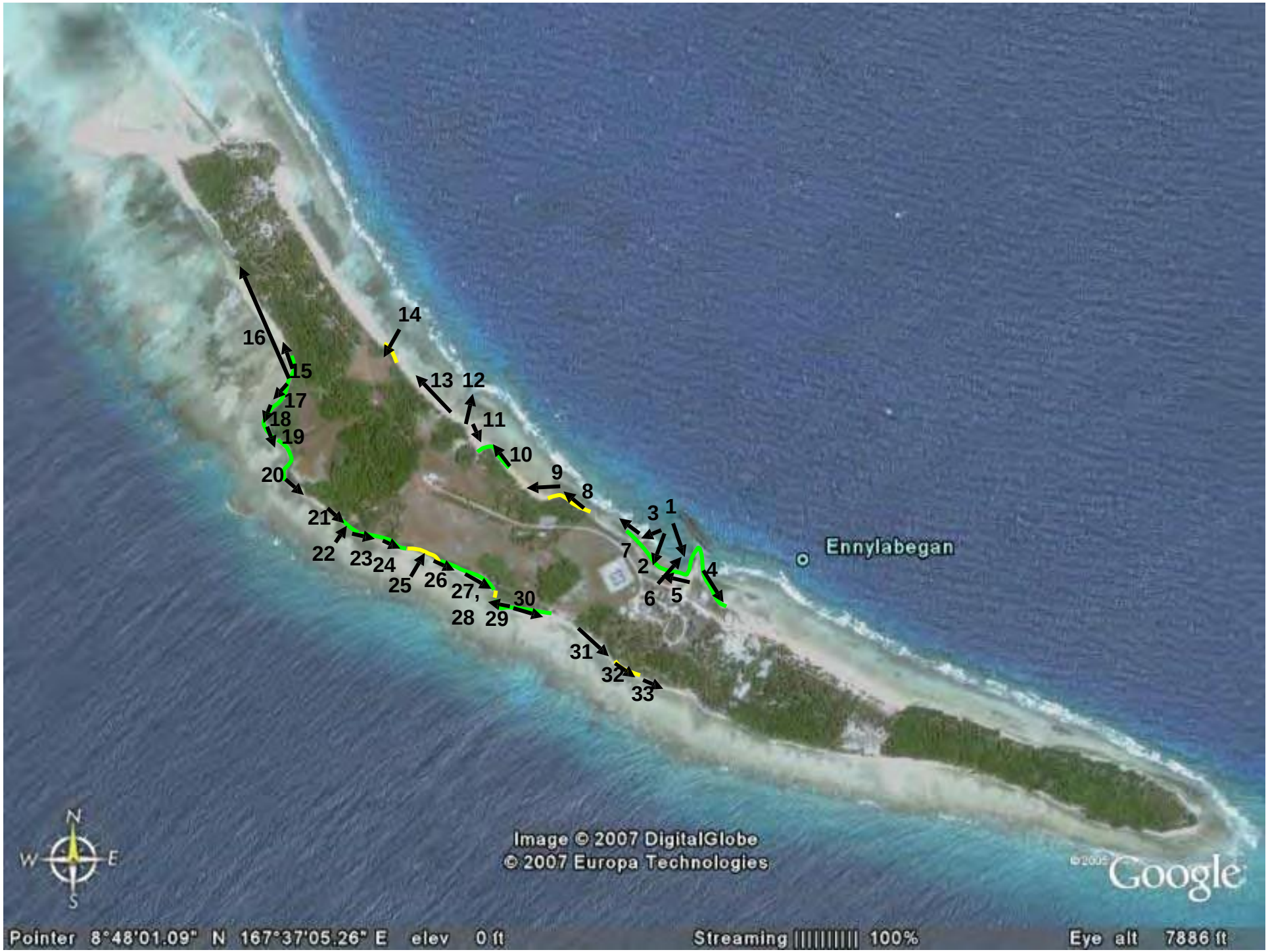
- EL-1, Photo 1 – Pier and armor stone
- EL-1, Photos 2 - 5 – Armor stone
- EL-1, Photo 6 – Armor stone, concrete barge
- EL-1, Photo 7 – Armor stone
- EL-2, Photos 9 & 10 – Armor stone
- EL-2A, Photos 11 & 14 – Armor stone
- EL-3, Photos 15, 17 – 19, 21, 23 – Armor stone
- EL-3, Photo 22 – Concrete wall
- EL-3, Photo 24 – Armor stone and concrete pieces
- EL-3, Photos 25 - 30 – Armor stone

Ennylabegan Areas of Critical Erosion

- None

Ennylabegan Areas of Non-critical Erosion

- EL-2, Photo 8 – Tree roots exposed
- EL-2A, Photo 14 – North end of leased area near antenna; erosion of sandy beach
- EL-3, Photo 25 – Sandy beach is eroding and creating a ledge; on western shoreline
- EL-3, Photo 28 – Some erosion evident; sand and gravel beach in between armor stone protected areas
- EL-3A, Photo 32 – Areas of beach erosion (ledge forming) at the tree line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EL-01 Lagoon Side

Description: Harbor, looking southeast

Shoreline protection: Pier and armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

2

EL-01 Lagoon Side

Description: Harbor looking southwest

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

3

EL-01 Lagoon Side

Description: North side of harbor

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

4

EL-01 Lagoon Side

Description: North end

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

5

EL-01 Lagoon Side

Description: Harbor, looking northwest

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

6

EL-01 Lagoon Side

Description: Harbor, looking northeast

Shoreline protection: Armor stone, concrete barge

Vegetation: none

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

7

EL-02 Lagoon Side

Description: East shoreline north of helipad. Armor stone atop natural reef

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

8

EL-02 Lagoon Side

Description: Beach erosion present. Tree roots are exposed.

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

9

EL-02 Lagoon Side

Description: Natural reef and sandy beach on eastern shore
Shoreline protection: none in foreground, armor stone on far side

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

10

EL-02 Lagoon Side

Description: Armor stone behind sandy beach on eastern shore

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

11

EL-02A Lagoon Side

Description: North end of armor stone, looking southeast. Sandy beach to the north

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

12

EL-02A Lagoon Side

Description: Sandy beach with natural reef jetty

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

13

EL-02A Lagoon Side

Description: Sandy beach

Shoreline protection: none, small pile of armor stone in distance

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

14

EL-02A Lagoon Side

Description: North end of leased area near antenna; erosion of sandy beach

Shoreline protection: Armor stone

Vegetation: Managed vegetation, Littoral shrubland

Antenna guy wire bases may be threatened

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 1.0’

15

EL-03 Ocean Side

Description: North end of leased part of island on western shore, looking north

Shoreline protection: Armor stone atop natural reef

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact
Low potential for natural resource impact

Tide: 1.1’

16

EL-03 Ocean Side

Description: North end of island beyond leased area; sandy beach, looking north

Shoreline protection: none

Vegetation: Littoral shrubland No

threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

17

EL-03 Ocean Side

Description: Natural reef in front of armor stone on the northern part of leased area

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

18

EL-03 Ocean Side

Description: Natural Reef with armor stone on western shoreline

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

19

EL-03 Ocean Side

Description: Natural reef with armor stone on western shoreline

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

20

EL-03 Ocean Side

Description: Sand and gravel beach

Shoreline protection: none

Vegetation: Littoral shrubland and managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

21

EL-03 Ocean Side

Description: Natural reef with sand and cobble beach on western shoreline

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

22

EL-03 Ocean Side

Description: Old concrete seawall on western shore

Shoreline protection: Concrete wall

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

23

EL-03 Ocean Side

Description: Loose, large armor stone atop natural reef

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

24

EL-03 Ocean Side

Description: Western shoreline with natural reef and beach comprised of cobbles and sand

Shoreline protection: Armor stone and concrete pieces
Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

25

EL-03 Ocean Side

Description: Non-Critical erosion on western shoreline. Sandy beach is eroding and creating a ledge.
Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Erosion threatens turtle nesting and haulout area

Tide: 1.2’

26

EL-03 Ocean Side

Description: Central part of western shoreline

Shoreline protection: Loose armor stone

Vegetation: Littoral shrubland and Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

27

EL-03 Ocean Side

Description: Thin sandy beach on western shore

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

28

EL-03 Ocean Side

Description: Sand and gravel beach in between armor stone protected areas. Some erosion evident

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Erosion would threaten turtle nesting and haulout area

Tide: 1.2’

29

EL-03 Ocean Side

Description: Western shore looking northwest

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

30

EL-03 Ocean Side

Description: Sand and gravel beach in front of overgrown armor stone wall west of helipad

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

31

EL-03A Ocean Side

Description: Sand and gravel beach with natural reef southwest of helicopter approach area

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

32

EL-03A Ocean Side

Description: Areas of beach erosion (ledge forming) at the tree line

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

33

EL-03A Ocean Side

Description: South end of leased part of island. Old concrete foundation disposed of on beach

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

Legan

Survey Conducted on
28 February 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Legan Existing Shoreline Protection

- LG-1, Photos 1, 2 – Armor stone seawall
- LG-2, Photos 3, 4 – Armor stone
- LG-5, Photo 18 – Armor stone
- LG-1, Photos 25 - 27 – Armor stone

Legan Areas of Critical Erosion

- None

Legan Areas of Non-critical Erosion

- LG-1, Photos 25 & 26 – Shoreline just north of helipad looking east


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LG-01 Lagoon Side

Description: Harbor area

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation and herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

2

LG-01 Lagoon Side

Description: North

Shoreline protection: Armor stone seawall

Vegetation: Managed vegetation and herbaceous strand

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

3

LG-02 Lagoon Side

Description: Southern shore looking west

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide:0.8’

4

LG-02 Lagoon Side

Description: Southern shore looking west

Shoreline protection: Armor stone

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.8’

5

LG-02 Lagoon Side

Description: Southern shore just south of the helipad

Shoreline protection: Natural

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

6

LG-03 Lagoon Side

Description: Southern shore just south of the helipad. Recent vegetation removal can be seen.

Shoreline protection: Natural

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

7

LG-03 Lagoon Side

Description: Southern shoreline

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

8

LG-03 Lagoon Side

Description: Southwestern point of island

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

9

LG-04 Ocean Side

Description: Southwestern point looking north

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

10

LG-04 Ocean Side

Description: Southwestern shore looking north

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 0.9’

11

LG-04 Ocean Side

Description: Western shoreline

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

12

LG-04 Ocean Side

Description: Western shoreline

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

13

LG-04 Ocean Side

Description: Western shoreline

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

14

LG-04 Ocean Side

Description: Saltwater pond just inland from western shore

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

15

LG-04 Ocean Side

Description: Saltwater pond looking south

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

16

LG-04 Ocean Side

Description: Western shoreline

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.0’

17

LG-04 Ocean Side

Description: North portion of western shore

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

18

LG-05 Ocean Side

Description: North shore looking east

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

19

LG-05 Ocean Side

Description: North shore, typical reef with eel

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

20

LG-05 Lagoon Side

Description: North

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

21

LG-05 Lagoon Side

Description: North shore looking west

Shoreline protection: none

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

22

LG-01 Lagoon Side

Description: Northern section of eastern shore

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

23

LG-01 Lagoon Side

Description: Eastern shoreline

Shoreline protection: none

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.1’

24

LG-01 Lagoon Side

Description: Eastern shore with sandy beach

Shoreline protection: none

Vegetation: Littoral shrubland

No threatened facilities

Low potential for cultural resource impact

Sand erosion could impact the turtle nesting and haulout area

Tide: 1.2’

25

LG-01 Lagoon Side

Description: Shoreline just north of the helipad looking east. Erosion is evident.

Shoreline protection: Armor stone

Vegetation: Managed vegetation

Helipad could be threatened if erosion gets worse

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

26

LG-01 Lagoon Side

Description: Close up of erosion area near helipad looking west

Shoreline protection: Armor stone

Vegetation: Managed vegetation

Helipad could be threatened if erosion gets worse

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

27

LG-01 Lagoon Side

Description: Western portion of the harbor

Shoreline protection: Armor stone

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.2’

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Illeginni

Survey Conducted on
01 March 2007

By Jim Hardin & John Moran

Teledyne Solutions, Inc.

Huntsville, Alabama

Illeginni Existing Shoreline Protection

- IL-1, Photos 1-7 – Natural beach sand, cobble and rock northwest of the harbor
- IL-1, Photo 8 – Armor stone and concrete forms protecting building lagoon side
- IL-1 through IL-4, Photos 9-26 – Natural beach sand, cobble and rock on western portion of island
- IL-4, Photo 27 – Armor stone and metal debris on portion of ocean side of helipad
- IL-3, Photos 28-34 – Natural reef cobble and rock; ocean side central portion of island
- IL-2, Photos 35-39 – Armor stone at southeast tip of island with a small sandy beach between armor stone sections
- IL-2, Photos 40-47 – Natural beach sand, cobble and rock on eastern end of island
- Harbor, Photos 48-51 – Armor stone protected harbor

Illeginni Areas of Critical Erosion

- IL-4, Photo 16 – Ledging west of helipad threatening detection tower
- IL-3, Photo 34 – Ledging on ocean side near facility 9061

Illeginni Areas of Non-critical Erosion

- IL-1, Photo 2 – Ledging north of harbor
- IL-1, Photo 11 – Ledging on lagoon side of helipad


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Illeginni
Pointer 9°05'11.78" N 167°28'17.50" E elev 0 ft
Streaming 100%
Eye alt 3682 ft


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3


4

1

IL-01 Lagoon Side

Description: Northwestern portion of harbor

Shoreline protection: Natural reef cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.7’

2

IL-01 Lagoon Side

Description: Northwestern portion of harbor with 4’ of ledging undercutting vegetation

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.7’

3

IL-01 Lagoon Side

Description: Northwestern portion of harbor

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.7’

4

IL-01 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Natural reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.7’


5


6


7


8

5

IL-01 Lagoon Side

Description: North of harbor

Shoreline protection: Natural reef and beach sand

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.8’

6

IL-01 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Natural reef and beach sand

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.8’

7

IL-01 Lagoon Side

Description: Natural reef with two large concrete blocks

Shoreline protection: Natural reef and beach sand

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.8’

8

IL-01 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Natural reef rock with armor stone and concrete barrier

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.8’


9


10


11


12

9

IL-01 Lagoon Side

Description: North portion of island

Shoreline protection: Natural beach sand and cobble

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 0.8’

10

IL-01 Lagoon Side

Description: North portion of island at helipad

Shoreline protection: Natural beach sand and cobble

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 0.9’

11

IL-01 Lagoon Side

Description: North portion of island at helipad, ledging north of helipad

Shoreline protection: Natural beach sand and cobble

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 0.9’

12

IL-01 Lagoon Side

Description: North portion of island at helipad

Shoreline protection: Natural beach sand and cobble

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 0.9’


13


14


15


16

13

IL-04 Northwestern Tip

Description: Northwest of helipad

Shoreline protection: Reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.0’

14

IL-04 Northwestern Tip

Description: Northwest of helipad

Shoreline protection: Reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.0’

15

IL-04 Northwestern Tip

Description: Northwest of helipad

Shoreline protection: Reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.1’

16

IL-04 Northwestern Tip

Description: Northwest of helipad, ledging near tower

Shoreline protection: Reef cobble and rock

Vegetation: Littoral shrub

Tower facility north of helipad threatened

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.1’


17


18


19


20

17

IL-04 Lagoon Side

Description: Northwest portion of island

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 1.1’

18

IL-04 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 1.1’

19

IL-04 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide: 1.1’

20

IL-04 Lagoon Side

Description: North Portion of harbor and pier

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat, turtle nesting

Tide:1.2’


21


22


23


24

21

IL-04 Ocean Side

Description: Northwestern portion of island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

22

IL-04 Ocean Side

Description: Northwestern portion of island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

23

IL-04 Ocean Side

Description: Northwestern portion of island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

24

IL-04 Ocean Side

Description: Northwestern portion of island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.4’

25

26

27

28

25

IL-04 Ocean Side

Description: South of helipad

Shoreline protection: Beach sand, cobble and rock

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

26

IL-04 Ocean Side

Description: South of helipad

Shoreline protection: Beach sand, cobble and rock

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

27

IL-04 Ocean Side

Description: South of helipad

Shoreline protection: Beach sand, cobble and rock

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.2’

28

IL-03 Ocean Side

Description: South of helipad

Shoreline protection: Beach sand, cobble and rock

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Potential shoreline habitat

Tide: 1.3’

29

30

31

32

29

IL-03 Ocean Side

Description: South central portion of island

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Managed vegetation

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

30

IL-03 Ocean Side

Description: South central portion of island

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

31

IL-03 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’

32

IL-03 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.3’


33


34


35


36

33

IL-03 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Beach sand, cobble and rock with intermittent armor stone and concrete

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.4’

34

IL-03 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Beach sand, cobble and rock with intermittent armor stone and concrete

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.4’

35

IL-02 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Beach sand, cobble and rock with intermittent armor stone and concrete

Vegetation: Littoral forest Detection

building 9061 threatened

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.4’

36

IL-02 Ocean Side

Description: North Portion of harbor and pier

Shoreline protection: Armor stone

Vegetation: Littoral forest

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’


37


38


39


40

37

IL-02 Southeastern Portion of Island

Description: Southeastern island

Shoreline protection: Beach and reef sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

38

IL-02 Southeastern Portion of Island

Description: Southeastern island

Shoreline protection: Beach and reef sand, cobble and rock and armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

39

IL-02 Southeastern Portion of Island

Description: Southeastern island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

40

IL-02 Southeastern Portion of Island

Description: Southeastern island

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

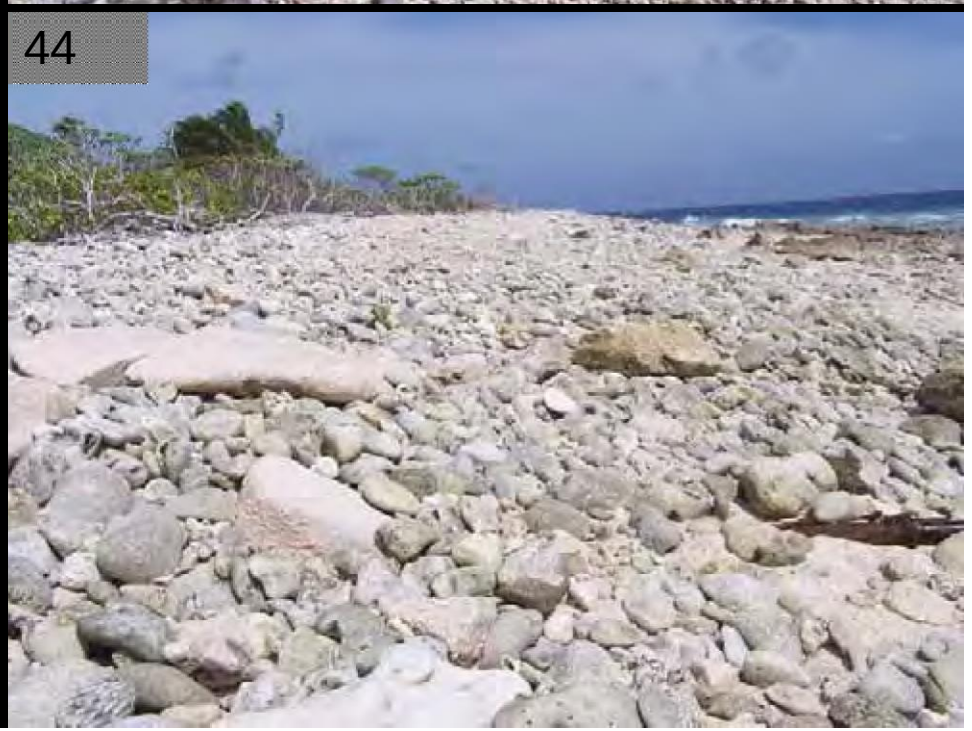
Low potential for natural resource impact

Tide: 1.5’


41


42


43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41

IL-02 Southeastern Portion of Island

Description: Southeast island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

42

IL-02 Southeastern Portion of Island

Description: Southeast island

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.5’

43

IL-02 Southeastern Portion of Island

Description: Beach sand, cobble and rock

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact
Tide:1.6’

44

IL-02 Southeastern Portion of Island

Description: Beach sand, cobble and rock

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.6’


45


46


47


48

45

IL-02 Southeastern Portion of Island

Description: North Portion of harbor and pier

Shoreline protection: Reef rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.6’

46

IL-02 Southeastern Portion of Island

Description: North Portion of harbor and pier

Shoreline protection: Beach sand, cobble and rock

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Potential turtle nesting

Tide: 1.7’

47

IL-02 Southeastern Portion of Island

Description: North Portion of harbor and pier

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.7’

48

IL-02 Harbor

Description: North Portion of harbor and pier

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact
Tide: 1.7’

49

50

51

49

IL-02 Harbor

Description: Harbor

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

50

IL-02 Harbor

Description: Harbor

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

51

IL-02 Harbor

Description: Harbor

Shoreline protection: Armor stone

Vegetation: Littoral shrub

No threatened facilities

Low potential for cultural resource impact

Low potential for natural resource impact

Tide: 1.8’

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NCA - APPENDIX E

SHORELINE INVENTORY FOR THE ISLANDS OF KWAJALEIN, ROI-NAMUR, AND MECK

U.S. ARMY CORPS OF ENGINEERS

FEBRUARY 2009

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SHORELINE INVENTORY FOR THE ISLANDS OF ROI-NAMUR, KWAJALEIN AND MECK

U.S. ARMY KWAJALEIN ATOLL
MARSHALL ISLANDS

FEBRUARY 2009

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U.S. ARMY COPRS OF ENGINEERS

HONOLULU DISTRICT

THROUGH

PROGRAMS AND PROJECT MANAGEMENT DIVISION

BY

ENGINEERING AND CONSTRUCTION DIVISION

CIVIL WORKS TECHNICAL BRANCH

PREFACE

1. The undersigned, of CEPOH-EC-T, traveled to Kwajalein Atoll to conduct site investigations on the islands of Roi-Namur, Kwajalein and Meck during the period of 20 through 27 February 2009. The investigations included inspection, classification and documentation of existing shore protection works and vulnerability of infrastructure to wave and inundation damages. While in Kwajalein Atoll, USAKA employee James Landgraff provided logistical support. Points of contact on Roi-Namur and Meck were Floyd Corder and Kelly Ferguson, respectively. All dates referenced herein are bases on Hawaii Standard Time.

2. Three shoreline classifications are used to describe the existing conditions for each of the 149 distinct reach of shoreline inspected. Those are “Critical”, “Potentially Critical” and “Non-Critical”. “Critical” shorelines are those that are both eroding (unstable and/or unarmored) and adjacent to strategic infrastructure. Shoreline reaches that are low in elevation and susceptible to coastal flooding and inundation are also considered “Critical”. “Potentially Critical” shorelines are those where infrastructure is not immediately threatened, but may become critical in the near future. “Non-Critical” shorelines are either eroding or stable but for this classification there are no facilities located adjacent to the shoreline.

3. During 21 and 26 February, a total of 37,335 feet of shoreline was inspected on Kwajalein. Approximately 2,462 feet was identified as Critical while 2,425 feet were determined to be Potentially Critical. The balance of the shoreline was classified as Non-Critical since it was either armored sufficiently or there was no infrastructure threatened. Critical areas of shoreline erosion on Kwajalein included reaches of the airport perimeter road, housing on the oceanside of the road and a dock bulkhead.

4. The undersigned inspected the shoreline of Roi-Namur on 22 February and 23 February. Of the 23,545 feet of shoreline inspected, approximately 5,279 feet was determined to be Critical. The highest priority reach was found in the “Causeway” area between Roi and Namur. In this reach there is approximately 1,000 feet of shoreline that needs to be armored to reduce the potential for flooding of the interior section of the island. Potential solutions include the construction of either a breakwater or seawall in this reach. Other areas of Critical erosion are threatening a telemetry dome and one end of the airport runway. Another 1,803 feet of shoreline was classified as “Potentially Critical” and should be monitored for signs of increased erosion.

5. Meck, the smallest of the islands with approximately 10,249 feet of shoreline, was inspected on 25 February. Three Critical reaches were identified for immediate stabilization. These reaches total approximately 571 feet of shoreline and include 398 feet along the northern tip of the island, 85 feet where a fiber

optics cable makes landfall on the island and 90 feet of beach adjacent to the harbor boat ramp. Approximately 1,746 feet of shoreline was determined to the Potentially Critical with the balance or the reaches being Non-Critical.

6. General observations were also made on existing and future shore protection for the islands. One item of note is that all vegetation should be removed from existing engineered shore protection structures since it will tend to dislodge armor and underlayer stone. Also, any repairs or new rubble mound structures should incorporate a notched toe. The toe stone of the structures should be embedded into the limestone reef a depth of at least 2/3 of their diameter. To facilitate future construction of rubble mound structures on Kwajalein Atoll, as much stone as possible should be mined and stockpiled from the reef now while it is still an option.

7. For additional information concerning this report, contact the undersigned at 808-438-0581.

/s/
THOMAS D. SMITH, P.E
Hydraulic Engineer

I. BACKGROUND

1. The Honolulu District (POH) of the Pacific Ocean Division, U.S. Army Corps of Engineers was retained by U.S. Army Kwajalein Atoll (USAKA) to inventory shoreline conditions on the islands of Roi-Namur, Kwajalein and Meck following impacts of a large wave event occurring in December 2008. During the event, waves overtopped the shoreline and various coastal structures along north, northwest and northeast facing beaches on Roi-Namur. Damages from wave inundation included saltwater contamination of fresh water lens wells, flooding of critical infrastructure, wide-spread scattering of soil, sand, coral rubble, rocks and other debris. Post-event recover efforts included implementation of water restrictions, construction of temporary shore protection measures, debris removal and erection of earth berms to reduce the impacts of additional wave events forecast by the local emergency management authorities. Short-term emergency shoreline stabilization and long-term shore protection planning to reduce risk and exposure on the islands of Roi-Namur, Kwajalein and Meck are subsequently being investigated by USAKA. The first step in this process is provided in this report in the form of a shoreline inventory for the islands.

2. POH conducted site investigations to assess the condition of existing shore protection structures as well as unarmored shorelines on the islands from 20 to 27 February 2009. Three shoreline classifications are used to describe the existing conditions for each of the 149 distinct reach of shoreline inspected. Those are “Critical”, “Potentially Critical” and “Non-Critical”. “Critical” shorelines are those that are both eroding (unstable and/or unarmored) and adjacent to strategic infrastructure. Shoreline reaches that are low in elevation and susceptible to coastal flooding and inundation are also considered “Critical”. “Potentially Critical” shorelines are those where infrastructure is not immediately threatened, but may become critical in the near future. “Non-Critical” shorelines are either eroding or stable but for this classification there are no facilities located adjacent to the shoreline.

3. The shoreline inventory for Roi-Namur is provided in Plate 1, Table 1 and associated photographs. Figure 1 is an aerial photograph of Roi-Namur showing waypoint locations R1 through R47 as well as shoreline classification and shoreline condition for each reach between waypoints. Shoreline classifications include Engineered, Dumped Rip Rap, Stable Beach and Unstable Beach. The engineered coastal structures category is comprised of revetments, seawalls, groins and boat ramps. The dumped rip rap category designates reaches of shoreline where scrap concrete, random rocks and limestone boulders have been placed on the beach as a temporary measure to slow recession. This material has not been placed as per an engineered design and will tend to scatter and scour into the beach face thereby loosing its ability to reduce wave energy over time. Stable and unstable beaches are those that appear to be either stationary or receding, respectively.

II. ROI-NAMUR

4. Reach R1 is 891 feet of shoreline located on the lagoon side of the island and is classified as a “Non-Critical Stable Beach”. Figure 1a and Figure 1b show the beginning of the reach looking left at R1 and the end of the reach looking from R2, respectively. No short- or long-term actions are recommended for this reach. Reach R2 (687 feet) is a continuation of the beach in reach R1, but it appears to be actively eroding based on observable undermining of shoreline vegetation in the reach (see Figure 2a and 2b). No short- or long-term actions are recommended for this reach.

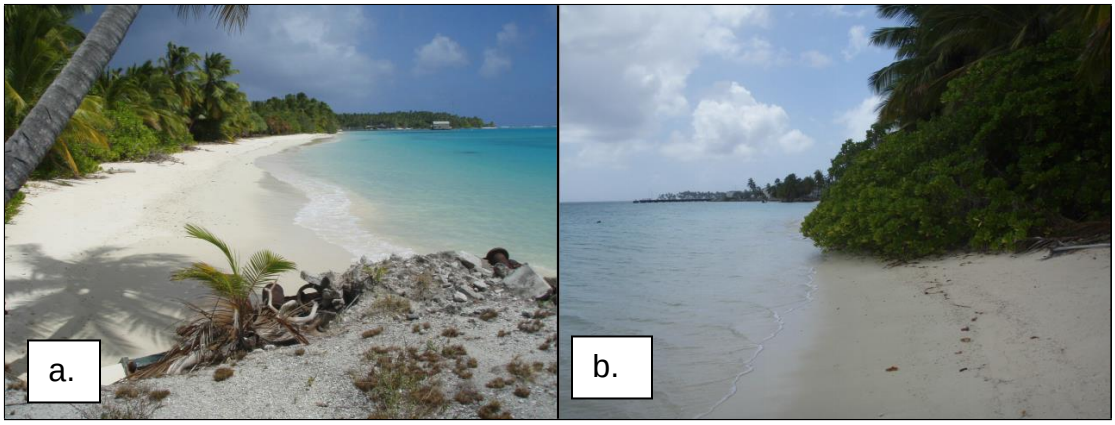


Figure 1a and 1b: The figures show the beginning and end of the non-critical stable beach located in reach R1, respectively.

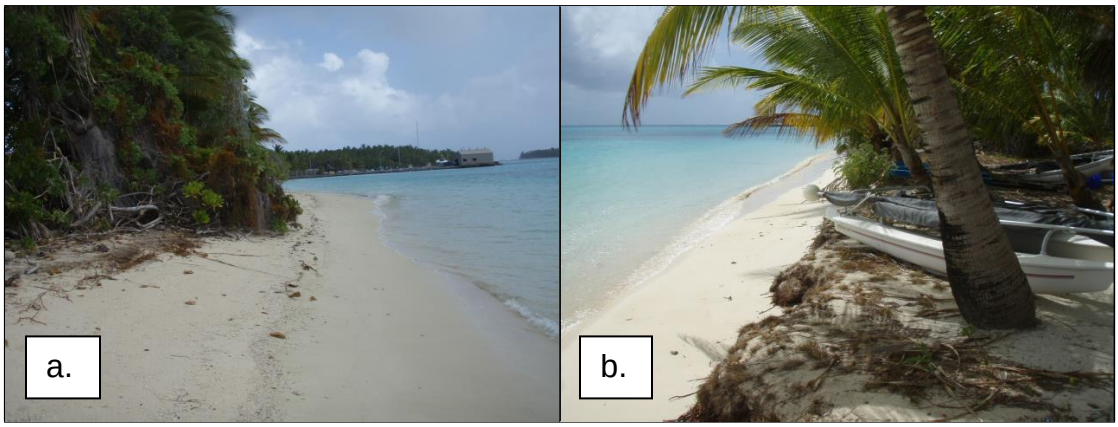


Figure 2a and 2b: The beginning and end of the non-critical unstable beach located in reach R2, respectively.

5. Reach 3 (Figure 3a and 3b) is comprised of 92 feet of shoreline armoring and is classified as an “Engineered Revetment”. The structure is made up of small armor stone with a median weight of approximately 200 pounds. Revetment crest elevation and crest width are approximately +4 feet (above mean lower low water tidal datum) and 3 feet, respectively. Reach 4 Figure 4a and 4b) begins at the approximately 30-foot wide pier with the remainder of the reach being

stabilized by a seawall in good condition with a crest elevation of about +5 feet (MLLW).

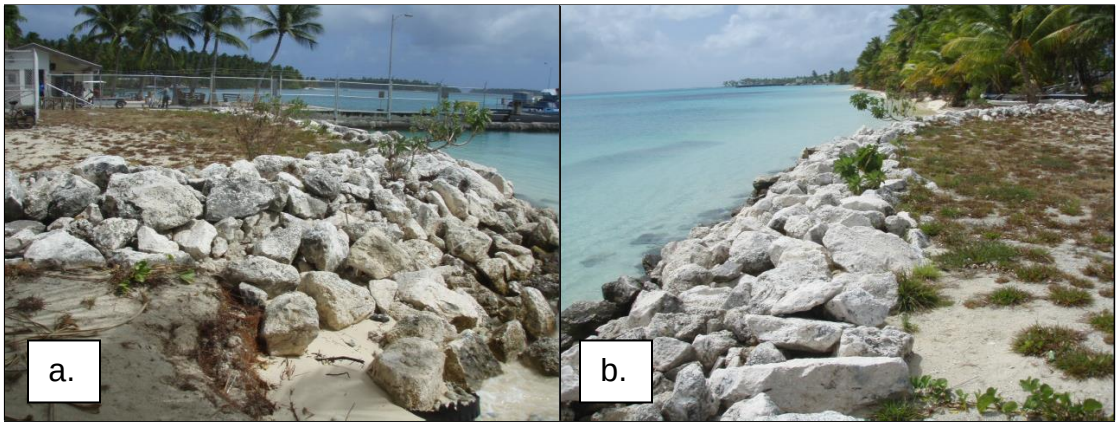


Figure 3a and 3b: The beginning and end of the low crested revetment located in reach R3, respectively.

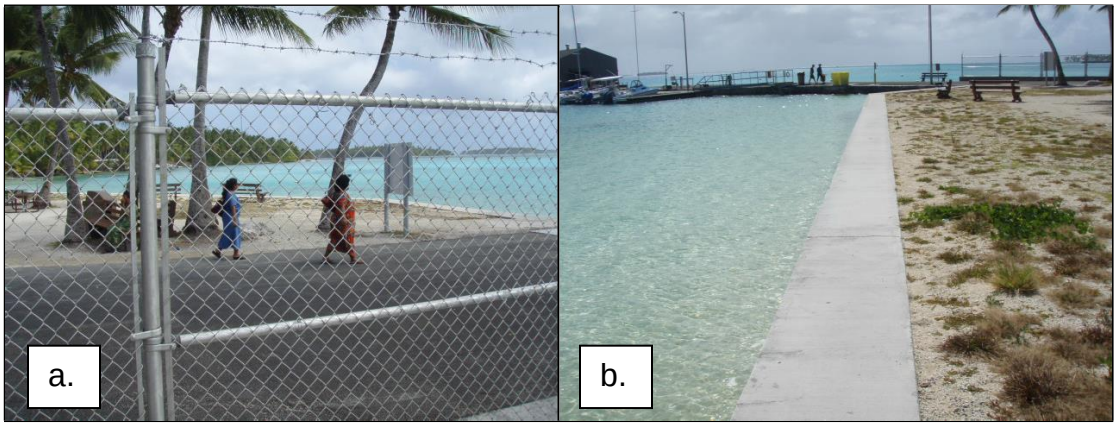


Figure 4a and 4b: The figures show the pier deck at the beginning and seawall at the end of reach R3, respectively.

6. Reaches R5 through R11 consist of non-critical areas of unstable beach, dumped rip rap and a marginally effective seawall fronting the scuba club's shoreline. The total length of these reaches is approximately 4,890 feet. Figure 5a is a picture of the scuba club seawall and dock located in reach R6. The seawall is low-crested and has been grouted with concrete. The structure will tend to protect the shoreline from erosion, but it is not high enough to reduce wave overtopping during storm events. Figure 5b was taken in reach R8 at the location of a communications antenna. Antenna guy wires and an anchor block are shown in the figure. The revetment protecting the area was in good condition at the time of the inspection.

7. Reaches R12 and R13 are potentially critical in that there are tracking and telemetry facilities located within direct proximity of the shoreline in these reaches. Existing shore protection along the 272 feet of R12 shoreline consists of an earth berm that was erected following the December 2008 wave event (see

Figure 6a). The earth berm has a crest elevation of approximately +5 feet (MLLW), crest width of 4 feet and side slopes of 1 vertical on 2 horizontal (1V to 2H). This berm was constructed as an emergency response to concerns for additional high waves following the initial event and not as a long-term solution to erosion and inundation. R13 is potentially critical due to the fact that the existing engineered revetment is in need of repair (Figure 6b). The 621-foot long revetment is constructed of 2 ton to 3 ton armor stone with a crest elevation of +8 (MLLW) and a crest width of 5 feet. The revetment crest and tie backs on either end of the structure should be repaired as funds become available.

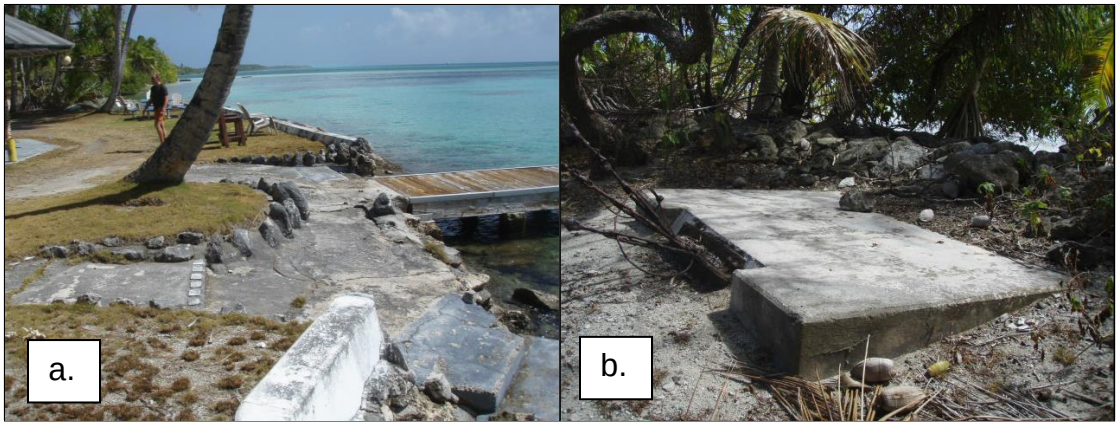


Figure 5a and 5b: Figure 5a is a picture of the low-crested seawall that has been constructed to stabilize the shoreline in front of the scuba club property. Figure 5b shows the antenna guy wire and anchor block that is protected by an engineered revetment.

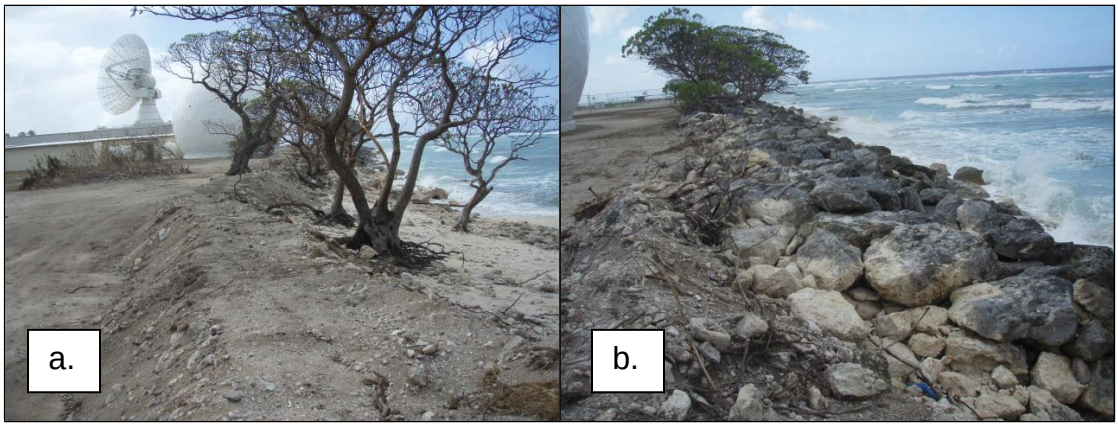
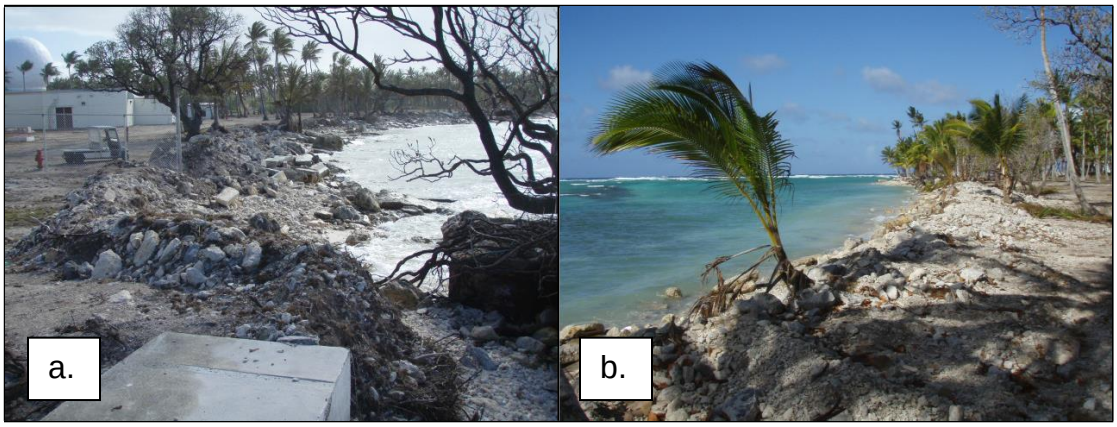


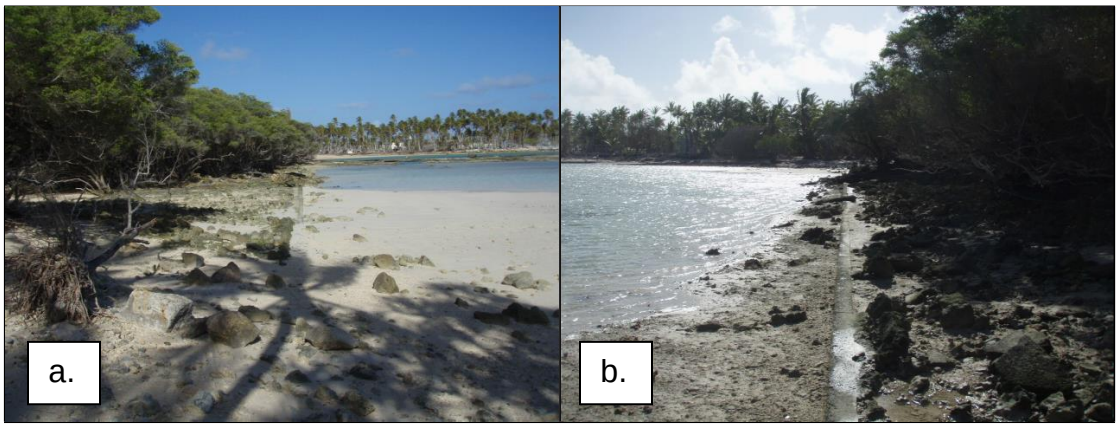
Figure 6a and 6b: Figure 6a displays the earth berm that was constructed after the December 2008 wave event. Figure 6b shows the start of reach R13 in which the existing revetments tie backs and crest sustained significant damage.

8. Reaches R14 through R18 extend along 3,030 feet of shoreline that is in critical need of stabilization. Limestone and concrete rip rap has been dumped along the R14 shoreline (Figures 7a and 7b) in an attempt to slow recession and reduce inundation, but the resulting rubble berm is only temporary in nature similar to emergency efforts implemented in R12. Construction of a tri-bar

revetment is recommended for this 1,530-foot length of shoreline. Reaches R15 through R18 comprise a 1,500-foot length of shoreline that was filled to connect the previously individual islands of Roi and Namur (see Figures 8a and 8b). The area can be characterized as unstable beach with a low lying backshore that is highly susceptible to inundation due to high ocean water levels and wave action. During the December 2008 wave event, the area was the main source of flooding and associated wave induced damages. In order to cost effectively mitigate a portion of the flood risk in this area, construction of a steel sheet pile seawall is recommended. The seawall would tie into the existing engineered revetment located in reach R19.



Figures 7a and 7b: The figures show the limits of a 1,530-foot length of critical shoreline where limestone and concrete rip rap has been dumped to slow erosion and reduce inundation. Construction of a tri-bar revetment is recommended in this area.



Figures 8a and 8b: The figures provide perspective on how low the backshore elevation is between the points R16 and R18. Construction of a steel sheet pile seawall is recommended in this area.

9. A revetment with a crest elevation of approximately +15 feet (MLLW), crest width of 10 feet and armor stone weighing from 3 tons to 5 tons extends along the 563-foot length of reach R19. The revetment is in good condition except for the tie back at the beginning of the reach. The armor stones in that area need to

be reset in order that the structure does not continue to unravel (see Figures 9a and 9b).

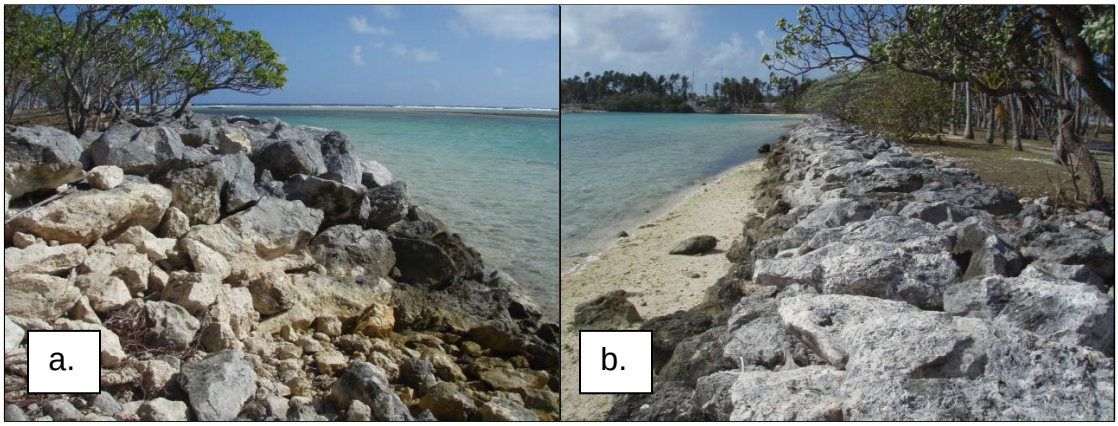
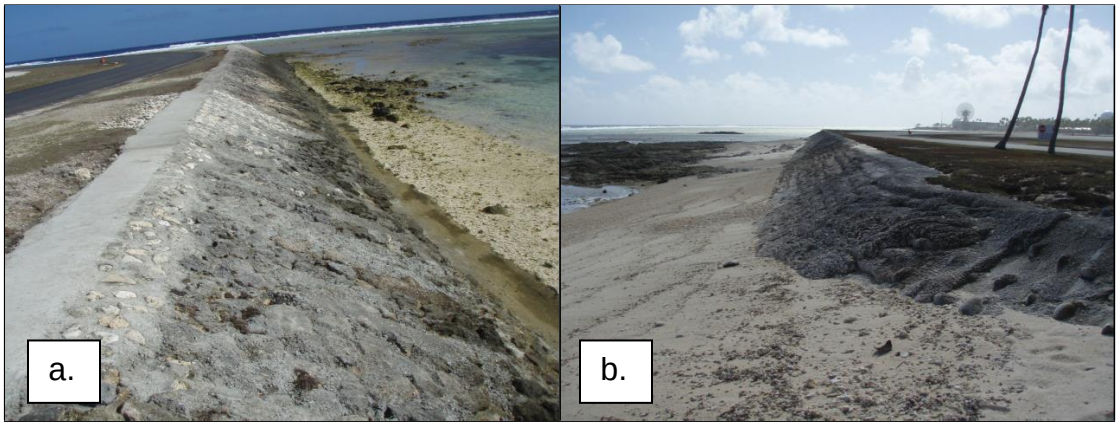


Figure 9a and 9b: Figure 9a shows existing condition of the tie back at the start of R19. Armor stones in this area need to reset to ensure that the structure does not continue to unravel. For the most part, the revetment in R19 is in good conditions as evidenced by Figure 9b.

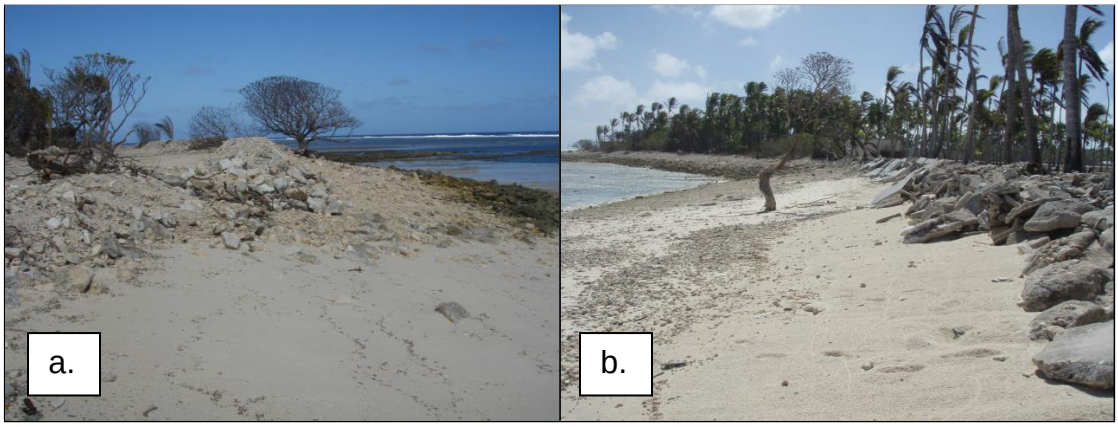
10. A Japanese constructed seawall extends along the 830-foot length of shoreline from reach R20 through R22 (Figures 10a,b). The seawall consists of an impervious surface of grouted rocks and has a crest elevation of about +10 feet (MLLW), crest width of 2 feet and a side slope of 1 vertical on 1.5 horizontal. Waves are able to overtop the low crested structure during times of high tide and small incident waves. During significant wave event such as the one experienced in December 2008, large quantities of water are able to inundate the runway and fresh water lens wells located in the area. This area is currently categorized as non-critical since the Japanese seawall does effectively stabilize the shoreline in these reaches. The structure on the other hand does not mitigate inundation of the runway and fresh water lens wells as mentioned previously. Long-term strategies for reducing coastal flooding and inundation should consider raising the elevation of the seawall, construction of an offshore breakwater, paving of the entire area between the seawall crest and the runway as well as other structural options.

11. Reaches R23 (294 feet) and R24 (804 feet) have been significantly altered since the December 2008 wave event. In an attempt to shore up coastal defenses in this area, a large quantity of concrete rubble and limestone rocks have been mounded into a berm at the shoreline (Figures 11a,b). This dumped rip rap could be stabilized on its landward extent by the construction of a concrete rubble masonry (CRM) wall to an elevation of +14 (MLLW). The CRM wall would serve as a backstop for the rip rap and would naturally accumulate in front of the wall thereby creating an effective wave and surge dissipater. Unlike a tri-bar revetment, the cost of a CRM wall would be relatively low and the in situ material would naturally be incorporated into the seaward extent of the structural system. One drawback of this type of shore protection is that the rip rap will be

dynamic under the force of large waves and the resultant debris field would have to be pushed back into place following extreme wave events.

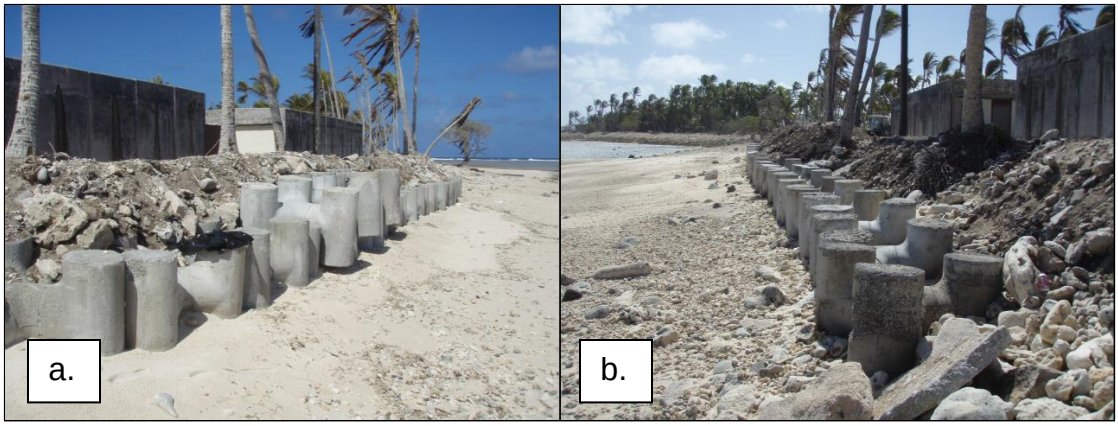


Figures 10a and 10b: The figures provide a view of the beginning and end of the Japanese constructed seawall extending along the R20 to R22 shoreline, respectively. In Figure 10b, sand can be seen to have built up on the far end of the Japanese seawall. This area could potentially be used as a source of beach fill. A pilot project to determine if sand will refill the area if it is excavated down to the toe of the seawall could be investigating in this location.



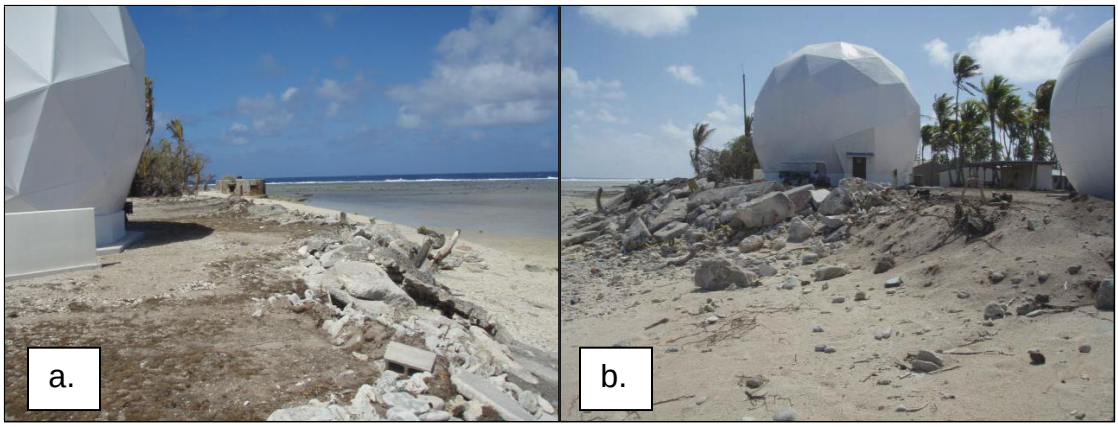
Figures 11a and 11b: The extent of the rip rap material that has been pushed into the shape of an earth berm along the R23 through R24 shoreline are shown in the figures.

12. Excess tri-bar concrete armor units have been randomly stacked in a horizontal alignment and an earth berm has been pushed up behind the units as temporary shore protection for threatened building in reach R25 (see Figure 12a,b). The tri-bars appear to weigh approximately 2 tons each. Considering the way in which the units were placed, the overall structure will only be as effective as dumped rip rap in providing short-term protection to upland development. It is recommended that an engineered tri-bar concrete armor unit tri-bar revetment be constructed along reach R25 (167 feet) and the adjoining 300 feet of reach R26.



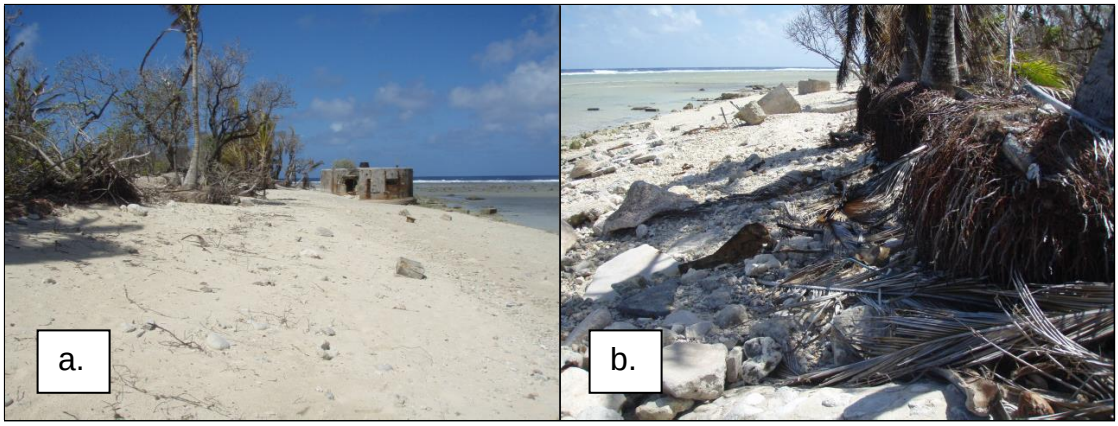
Figures 12a and 12b: The figures were taken along reach R25 where tri-bar concrete armor units have been randomly placed. An earth berm can also been seen on the landward side of the tri-bars. This area is classified as critical and in need of emergency shore protection designed to protect existing infrastructure.

13. Reach R27 is one of the most critical lengths of shoreline on Roi-Namur as can be seen in Figures 13a and 13b. The shoreline in this reach is unstable and rip rap has been dumped to slow recession, attenuate wave energy and reduce coastal inundation. Telemetry domes located near the shoreline have a low foundation elevation and are in danger of being damaged by the next significant wave event. Similar to all of R25 and a portion of R26, this area is classified as critical and is in need of emergency shore protection designed to protect existing infrastructure.



Figures 13a and 13b: Critical erosion can be seen in the figures. Concrete rip rap has been dumped in reach R27 in an attempt to protect telemetry domes located close to the shoreline.

14. Non-critical erosion extends along the 718 feet of shoreline between R28 and R30. A Japanese pill box is situated at the water's edge near the start of R28. Wave action has scarped the backshore and shoreline vegetation is being undermined and destroyed. No action is recommended in these reaches at this time, but if the dump site located upland of this area looses significant capacity due to shoreline erosion, remedial action may be required in the future.



Figures 14a and 14b: The 718-foot length of shoreline between reaches R28 and R30 is generally unstable, but since there are no upland facilities being threatened, the area is considered to be non-critical. Figure 14a shows a Japanese pill box located close to the shoreline and active erosion is apparent in Figure 14b as evidenced by newly exposed palm tree root balls.

15. The next set of critical reaches includes R31 through R35. Unlike the other critical reaches discussed previously, this area has been stabilized with engineered shore protection structures. R31 and R32 include 211 feet of Japanese seawall that was not directly damaged by the December 2008 wave event, but significant scour and scarping did occur behind the structure. This area is in need of emergency repair to ensure that the backfill behind the seawall is not lost. If this material does scour further, the seawall will most likely collapse inward on itself. In Figure 15a, the eroded backfill on the crest of the seawall is evident. It should also be noted that the large pieces of concrete rip rap shown in Figure 15a should be removed to reduce the threat of impact load damage to the seawall. Figure 15b also shows the extent of erosion that occurred behind the Japanese seawall as a result of the December 2008 wave event.

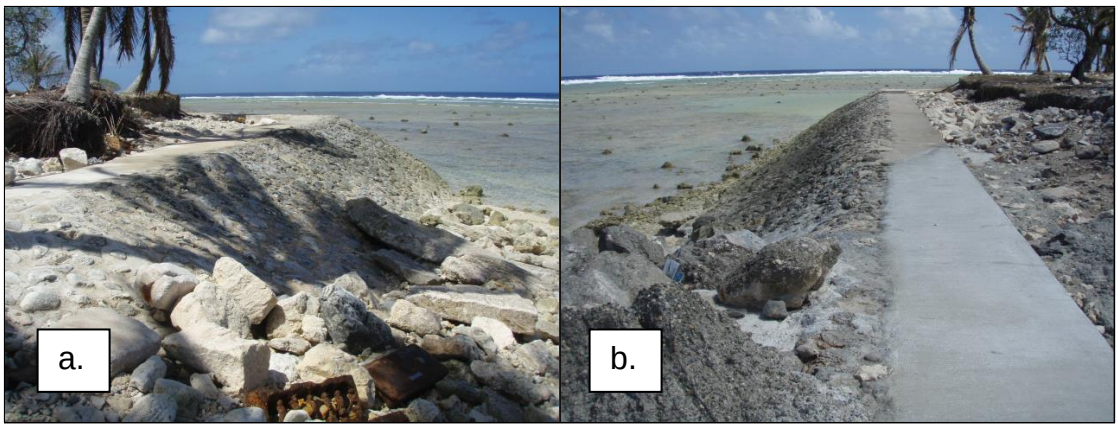
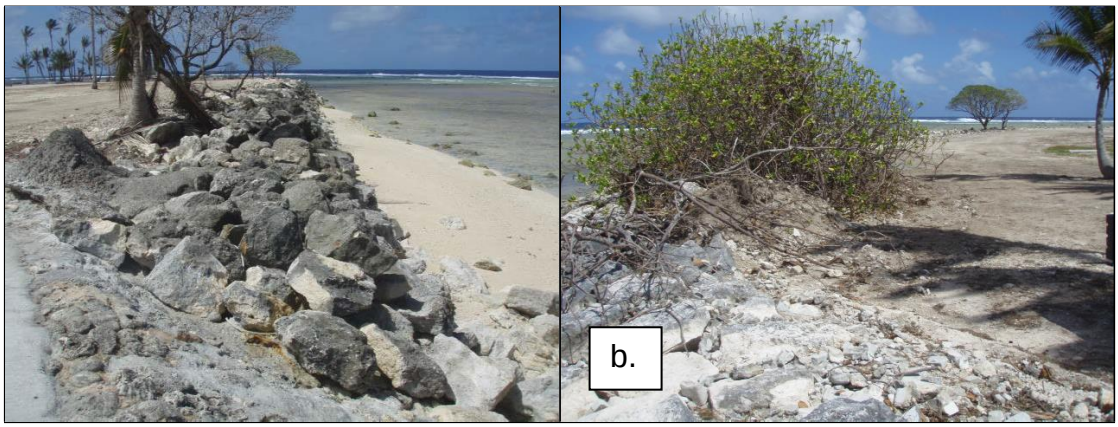


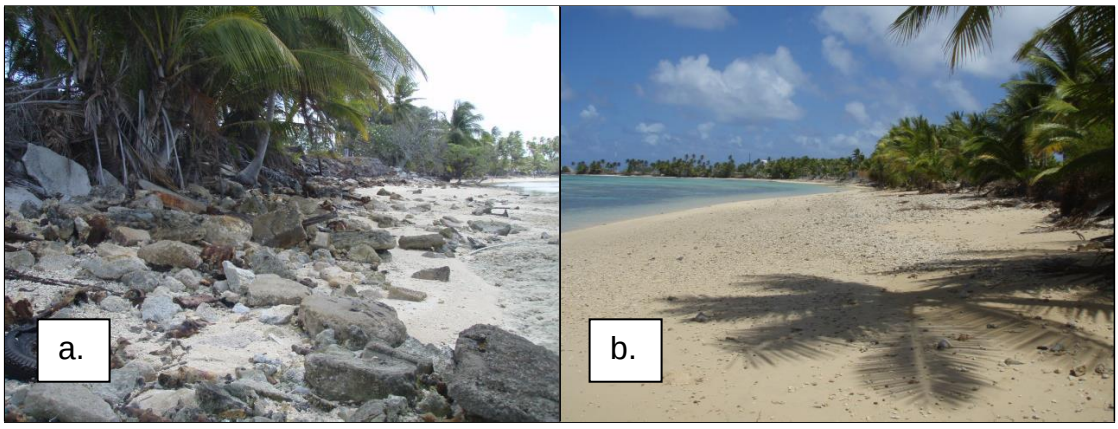
Figure 15a and 15b: Japanese seawall with leeside damage and unwanted concrete rubble. Armor stones for the adjacent rock revetment can be seen scattered across the reef in the background of both figures.

16. An engineered revetment extends along the next 1,071 feet of critical shoreline located within R33 through R35 (Figures 16a and 16b). The revetment was significantly damage by the recent wave event and requires emergency repair to restore an adequate level of protection to the “Speed Ball” launch complex. Armor stones that were dislodged during the event can be seen scattered on the reef in the previous set of figures. It is assumed that the existing armor stone (both from the structure footprint and out on the reef) can be used to rebuild the revetment. The revetment will need to be tied into the Japanese seawall at one end and a tie back will need to be constructed on the other end. Toe stones should be grouted into a notch in the reef with at least 2/3 imbedment.



Figures 16a and 16b: Rock revetment that was significantly damaged during the December 2008 wave event (R33 through R35). The revetment requires emergency repair utilizing existing armor stones.

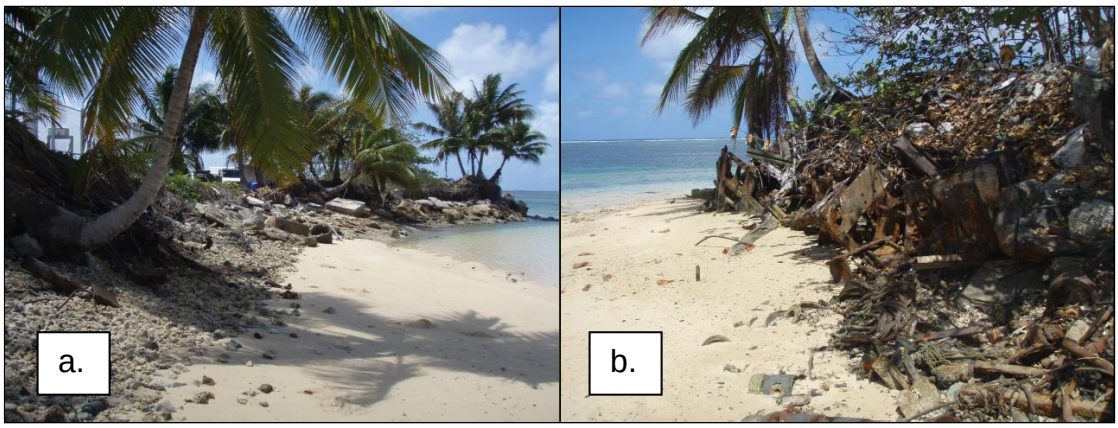
17. R36 is a 2,218-foot reach of mainly unstable shoreline along which a large quantity of concrete rip rap has been dumped (Figures 17a and 17b). The reach starts with dumped rip rap (Figure 17a) and ends with a relatively wide sandy beach (Figure 17b). There is also a vegetated earth berm located along the backshore in much of the reach.



Figures 17a and 17b: The beginning of reach R36 contains a large quantity of

dumped rip rap (Figure 17a) where as it ends with a relatively wide sandy beach (Figure 17b).

18. Reach R37 is the location of an old landfill area which is currently being used as a hazardous materials handling area. Much of the landfill debris is being exposed by active erosion along the reach. Figure 18a shows the extent of shoreline erosion with palm trees falling over along the backshore and debris exposed on the beach face. Around the point, large pieces of metal extrude from the beach face and backshore as displayed in Figure 18b. This 316-foot of shoreline is considered to be in potentially critical condition due to the sensitive nature of the hazardous material facility in its lee.

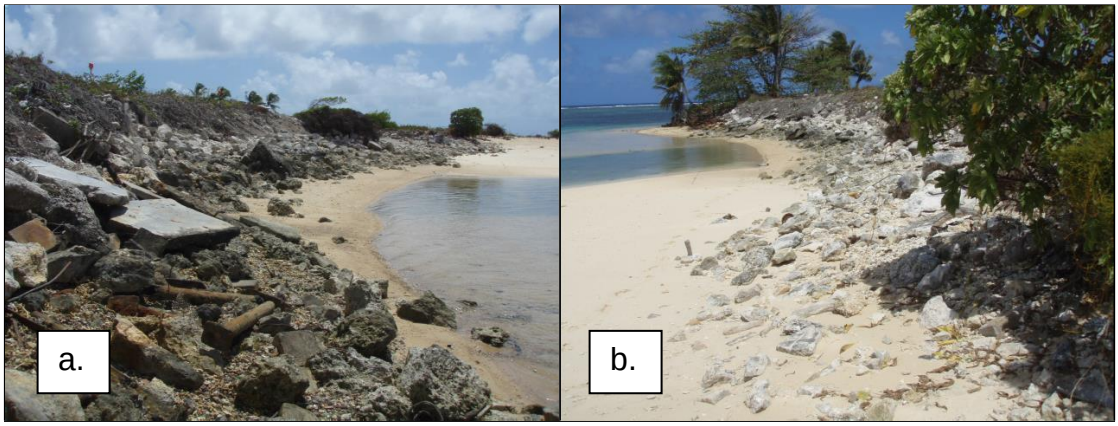


Figures 18a and 18b: Active beach erosion and exposed landfill debris exist along both sides of the point of land in Reach R37 as shown in Figure 18a and Figure 18b.

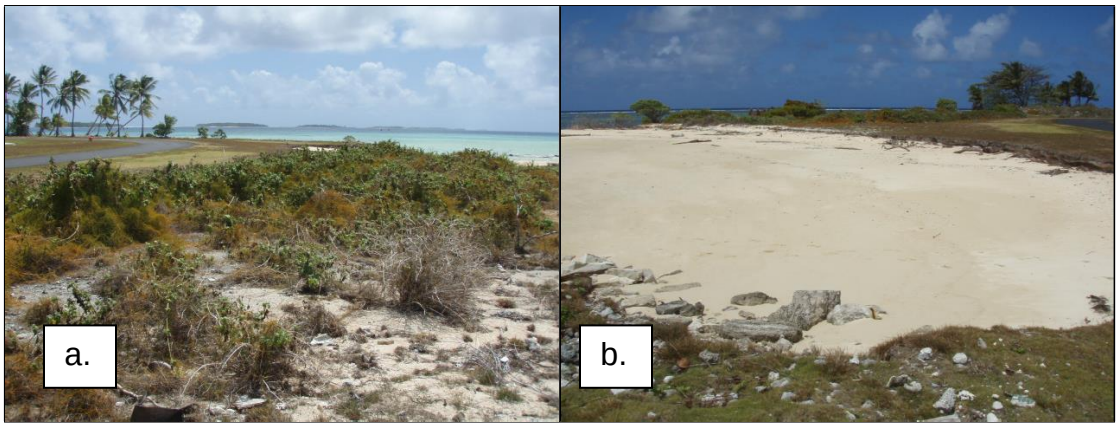
19. Reach R38 consists of a 216-foot length of shoreline that is marginally stabilized with dumped rock. The reach is in the vicinity of the runway, but is considered to be non-critical since there is a relatively wide buffer of land between the shoreline and the runway perimeter road. Figures 19a and 19b display the extent of the dumped rock in this reach.

20. The next 280 feet of shoreline encompasses the location where a sandy spit had developed at the end of the runway prior to the December 2008 wave event. Following the event, the spit that existed along reach R39 completely disappeared and the shoreline eroded within approximately 30 feet of the runway perimeter road (see Figure 20a). In Figure 20b, sand can be seen to have accreted following the wave event indicating that spit re-formation is ongoing. The shoreline could be stabilized with construction of a revetment, but promotion of spit growth through the placement of a terminal groin would be more cost effective and a more natural solution to the problem. A terminal groin could be constructed at the upper limit of R39 with a length of up to 200 feet from the existing shoreline. The groin would intercept littoral sediment that would be otherwise transported offshore by the strong tidal currents which impact this end of the island. Based on past spit generation, it would be consistent to anticipate

the eventual reestablishment of the spit given the influence of the terminal groin on littoral transport.

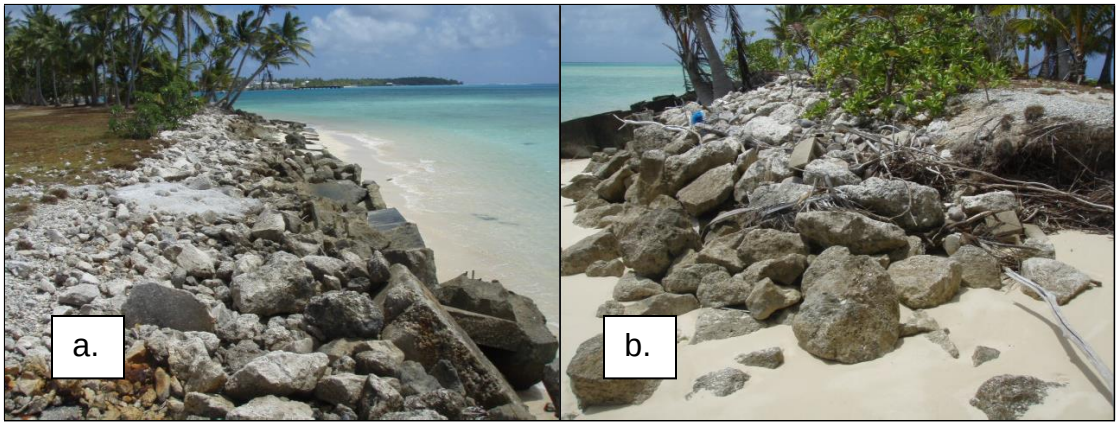


Figures 19a and 19b: The extent of dumped rip rap in R38 is shown in figures.



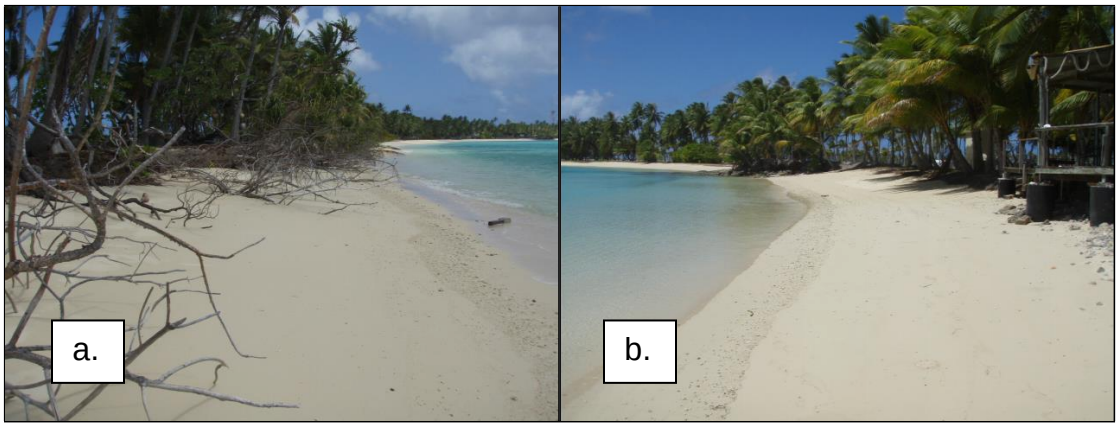
Figures 20a and 20b: Figure 20a shows how close recent shoreline recession has gotten to the runway perimeter road in reach R39. Figure 20b is evidence that the sand spit which existed prior to the December 2008 wave event is starting to reform.

21. Response to the unstable shoreline condition in reach R40 until this point in time has consisted of dumping rip rap to slow recession. The 365-foot reach is located on the downdrift end of the sandy lagoon beach. Sand is naturally transported past this reach in a westerly direction due to the predominant littoral drift. Future engineering in this portion of shoreline should consider the response to erosion in R39. If a revetment is constructed in R39, then it should be extended into R40 to ensure comprehensive protection of the runway and the perimeter road. If a terminal groin is constructed at the beginning of R39, then the existing dumped rip rap should be removed from R40 to optimize potential spit growth and facilitate equilibration of the R40 shoreline. Figures 21a and 2b show the dumped rip rap along the R40 reach.



Figures 21a and 21b: The figures show the dumped rip rap located in reach R40.

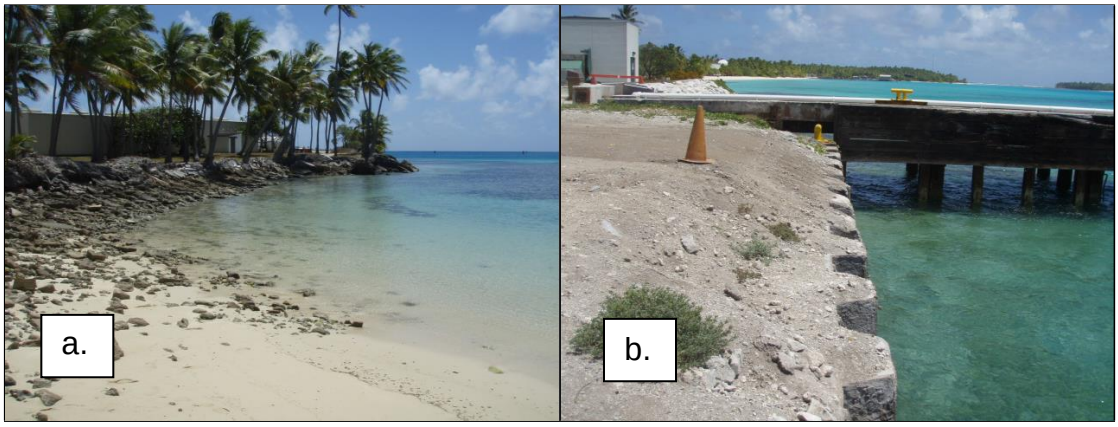
22. The next three reaches (R41, R42 and R43) extend along approximately 504 feet of sandy lagoon shoreline. There are signs of active erosion in R41, but for the most part these reaches are comprised of scenic sandy beaches ideal for recreational purposes. Erosion at the western limit of R41 (see Figure 22a) transitions into relatively wide mild sloped beaches in R42 and R43 (see Figure 22b). These beaches provide sand to the littoral system which ultimately feeds the spit at the end of the runway. It is recommended that no immediate coastal engineering efforts be implemented in these non-critical reaches. The beach bar and cabanas in these reaches should be relocated landward if the shoreline threatens their foundations.



Figures 22a and 22b: Active shoreline recession at the beginning of R41 and the relatively wide sandy beach at the end of R43 are shown in Figure 22a and Figure 22b, respectively.

23. The final four reaches on Roi-Namur (R44, R45, R46 and R47) have all been classified as non-critical. The 568-foot long reach R44 consists of dumped rip rap that is currently helping to stabilize the shoreline (Figure 23a). Upland development along the reach is not in immediate danger of sustaining wave induced damages. A sheet pile seawall has been constructed in R45. The 58-foot long seawall is in fair condition. Although it only extends to an elevation of

approximately +7 feet (MLLW), fill has been placed to approximately +10 feet (MLLW) in its lee which creates a somewhat unsafe condition for vehicular and pedestrian traffic (see Figure 23b). Reach R46 (shown in Figure 24a) is 201 feet long and has been stabilized through construction of a revetment with armor stone weighing less than 1-ton and a crest elevation of approximately +7 feet (MLLW). The last reach (R47) consists of 507 feet of dumped rip rap showing no signs of recent damage (Figure 24b).



Figures 23a and 23b: Figure 23a displays the dumped rip rap that has been placed in R44 while Figure 23b shows the fill that has been placed above the top of the steel sheet pile wall in R45.

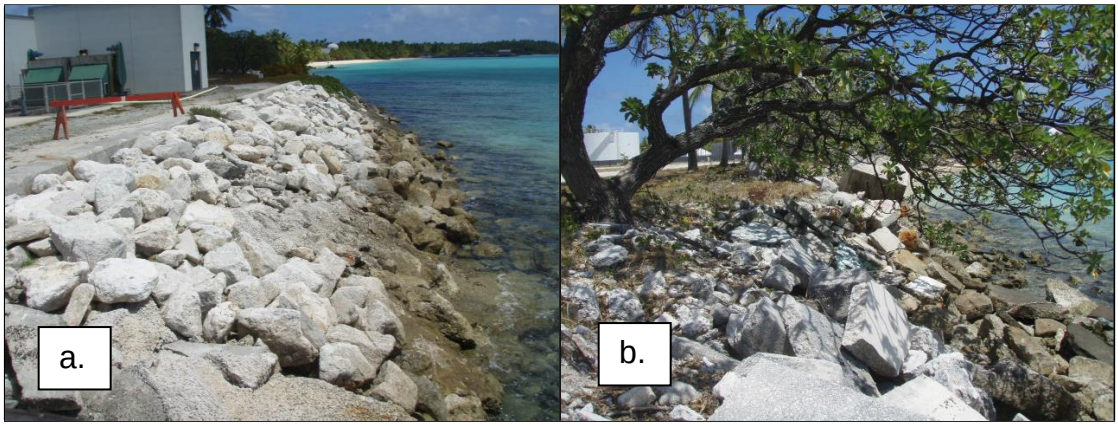


Figure 24a and 24b: The R46 seawall and R47 dumped rip rap are shown in Figure 24a and Figure 24b, respectively.

III. KWAJALEIN (to be inserted)

IV. MECK (to be inserted)

IV. EMERGENCY SHORE PROTECTION

24. Following the December 2008 wave event, USAKA immediately initiated efforts to clean up the extensive debris fields of sand, rock, coral and limestone created by the wave inundation. Suitable material was bulldozed and shaped into unconsolidated earth berms along critical lengths of shoreline. These earth berms were constructed as temporary protection against additional wave events that were forecasted to impact the island during the 2008 storm season. Figure 6a shows the earth berm that was constructed adjacent to the telemetry domes on Roi-Namur. Although these earth berms were constructed as temporary mitigation to wave inundation, they could be stabilized with various types of overlays to serve as an intermediate solution to the problem. Figure A1 displays a marine mattress with geotextile fabric pinned to its underside. This mattress/fabric erosion control system could be placed on top of the earth berms to increase their stability and ultimate longevity. The mattresses are 1-foot thick by 5-foot wide. The mattresses can be fabricated in lengths of up to 35 feet. They can be filled on site with 3 inch to 6 inch rock. Under wave and water attack, the leading edge of the mattresses are able to articulate into any ensuing scour hole to cut off undermining. As a unit, the system can withstand the direct impact of small waves and strong currents. The geotextile fabric ensures that the underlying earth berm material is not allowed to migrate out of place. The marine mattress geogrid material is manufactured by Tensar International Corporation.

25. Another method to stabilize the earth berms would be to place sand-filled geotextile bags and fabric on top of the earth berms similar to the marine mattress treatment. ELCORock Bags and Mega Containers are manufactured by ELCO Solutions Pty Ltd., an Australia-based geotextile manufacturer. ELCORock Bags and Mega Containers are constructed of a Polyester staple fiber non-woven needle-punched geotextile. This type of geotextile provides protection against the harsh marine environment, allows the Bags and Mega Containers to deform to uneven base conditions, and provides the necessary friction angle for stacking. The material is vandal-resistant and the outside can be lined with an ultraviolet-resistant fabric for longer life. ELCORock Bags and Mega Containers have been used for a variety of shore protection structures, including seawalls, revetments, groins, jetties, and artificial reefs. The Bags come in various sizes, including standard 0.35 cubic meters, 0.75 cubic meters, and 2.5 cubic meters; larger custom sizes can be made (see table for conversions between Metric and English units). When full of sand, the 0.75 cubic meters and 2.5 cubic meters containers weigh approximately 3,300 lbs and 10,000 lbs respectively. A typical cross-sections and placement schematic are shown in Figure A2. The Bags would be better suited for the present application than the Mega Containers.

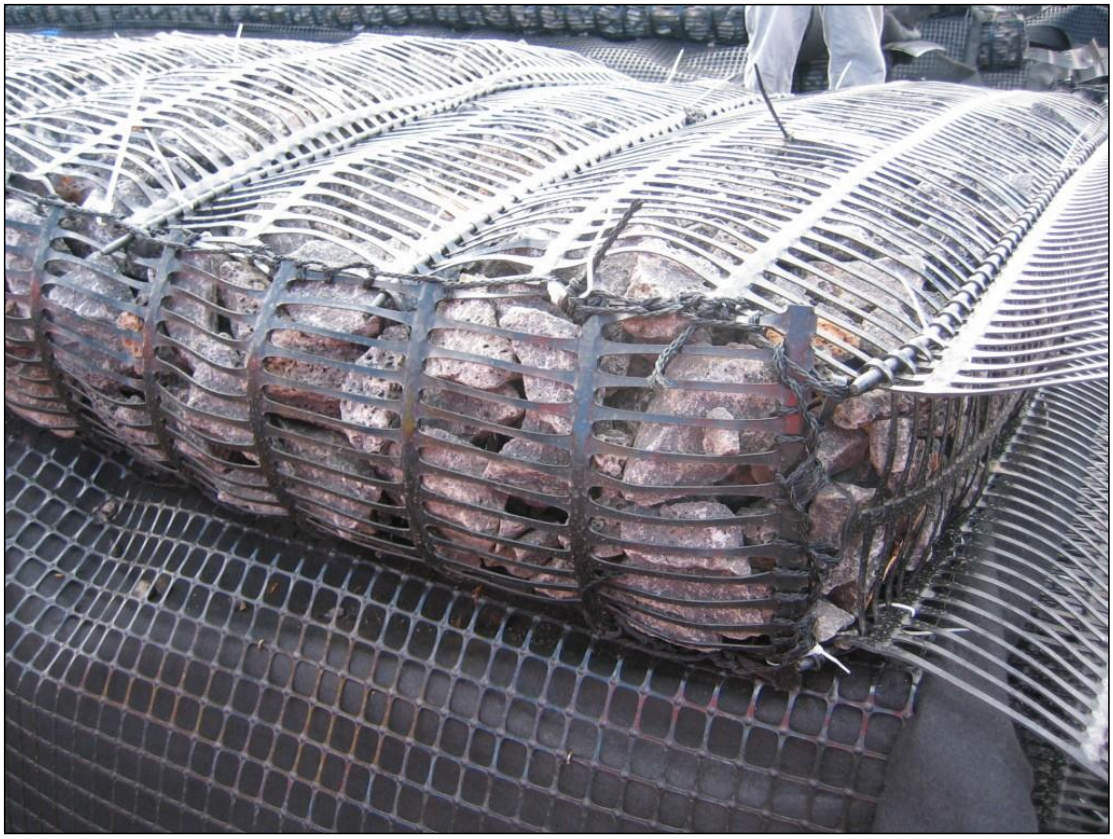


Figure A1: Rock filled marine mattress with underpinned geotextile fabric.

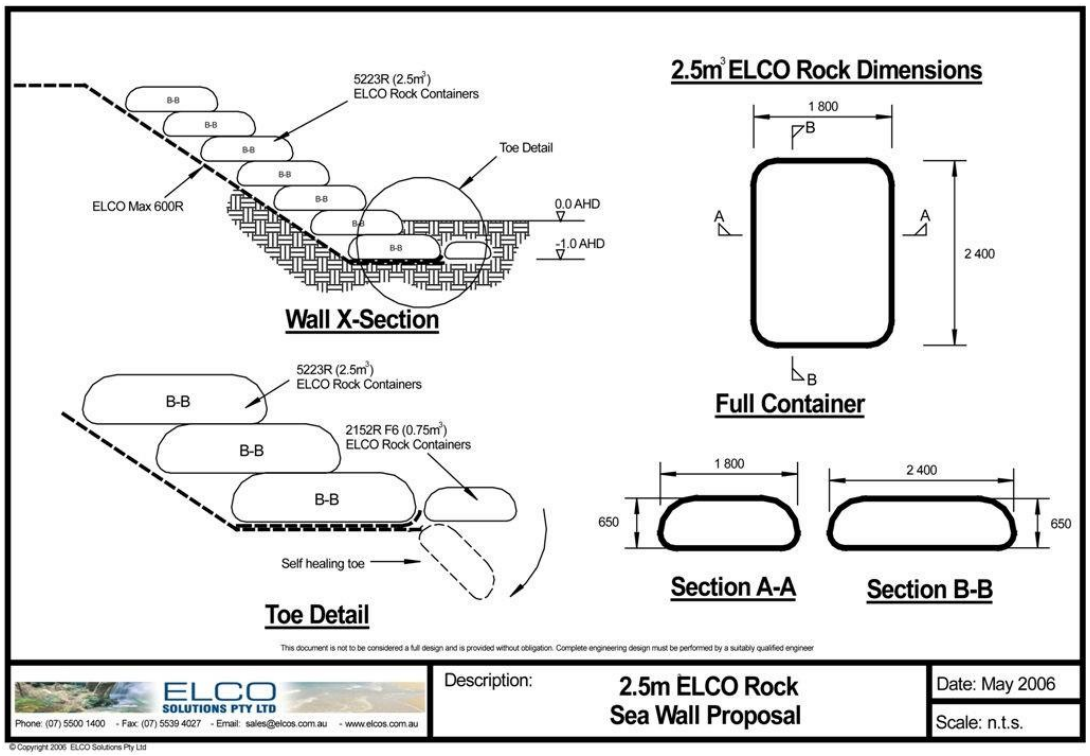


Figure A2. Typical cross section of an ELCORock bag seawall.

Equivalent volumes

Metric (m^3)	English (cu. yd.)
0.35	0.46
0.75	0.98
2.5	3.3
80	105
110	144
170	222
210	275

26. ELCORock Bags offer the option of being filled with dry sand, wet sand, or slurry. For filling, a 0.35 cubic meters or a 0.75 cubic meters bag is placed in a hopper, filled with dry sand, and sewn shut. A photo of the filling process is shown in Figure A3. The 2.5 cubic meters bags are placed in a specially-constructed hopper which also provides support for the bags, filled with either dry sand, wet sand, or slurry and then sewn shut. A repair system is available consisting of an adhesive which is applied to the fabric and then further attached with screws.

Figure A3: ELCORock Bags being filled on site.

VI. CRITICAL SHORE PROTECTION

27. As documented in this report, there are critical areas of shoreline requiring immediate stabilization on the islands of Roi-Namur, Kwajalein and Meck. Design alternatives for these critical reaches of shoreline include construction of revetments or seawalls. Revetments can either be built with rock or concrete armor units. Seawalls for the present application could be fabricated out of steel sheet pile since the limestone substrate on the islands precludes driving less rigid materials. A less expensive method of seawall construction is also provided below as an alternative to having to drive steel sheet piles into limestone.

28. Figure A4 is a photograph of the existing rock revetment that extends along a portion of the embayment on the north coast of Roi-Namur. This revetment consists of 3 ton to 5 ton armor stone and appears to have functioned adequately since its construction. The limestone armor stones have been properly sized for the incident wave climate. If suitable armor stone is available, it is recommended that similar structures be considered for construction along critical shoreline reaches identified in this report. If limestone is not available, the concrete armor units displayed in Figure A5 and Figure A6 could be utilized. Figure A5 shows a Samoa Stone revetment that was recently constructed in the village of Vatia on the island of Tutuila, American Samoa. That project was the first application of Samoa Stone, but physical model tests and initial project performance indicate that these units would be suitable for the present application. Figure A6 displays a tribar revetment also located on Tutuila. Tribars have a rich history of satisfactory performance and can also be used for breakwater applications similar to the harbor breakwater on Meck. The tribar revetment cross section used to develop the cost estimates for this report was modeled after the Tutuila structure and is provided in Figure A7.

29. Seawalls are effective in stabilizing shorelines and can also provide flood protection to upland development. It is assumed that steel sheet pile can be driven into the limestone substrate that exists in the critical reaches identified for application of this type of shore protection in this report. Sheet pile walls may be divided into two basic categories; (a) cantilever and (b) anchored. Anchored sheet pile walls are recommended for the present application. In the construction of anchored sheet pile walls, sheet piles may be driven into the ground and then the backfill placed on the land side, or the sheet pile may first be driven into the ground and the soil in front of the sheet pile dredged. In any case, the soil used for the backfill behind the sheet pile wall is usually granular. The soil below the dredge line may be sandy or clayey soil. The surface of the soil on the water side is referred to as the mud line or dredge line. The sequence for construction of a dredged structure is to first drive the sheet piles. Following that, backfill is placed up to the anchor level and the anchor system is placed. Backfill is then placed to the top of the sheet pile wall and then the soil on the front side of the wall is dredged if necessary. Figure A8 provides typical cross sections for sheet pile walls designed with various anchoring systems (deadman, sheet pile and grout).

Figure A4: Revetment with rock armor stones located on Roi-Namur.

Figure A5: Samoa Stone concrete armor unit revetment.

Figure A6: Tribar concrete armor unit revetment.

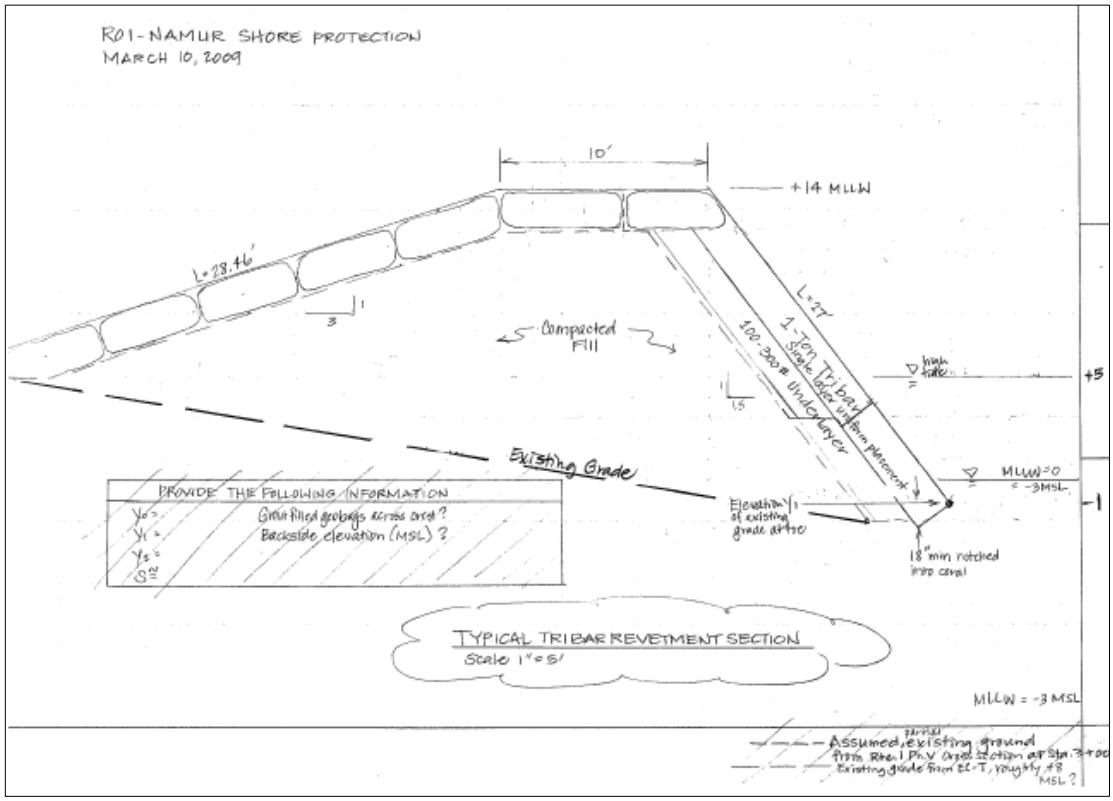


Figure A7: Tribar concrete armor unit revetment cross section used for conceptual cost estimates in this report.

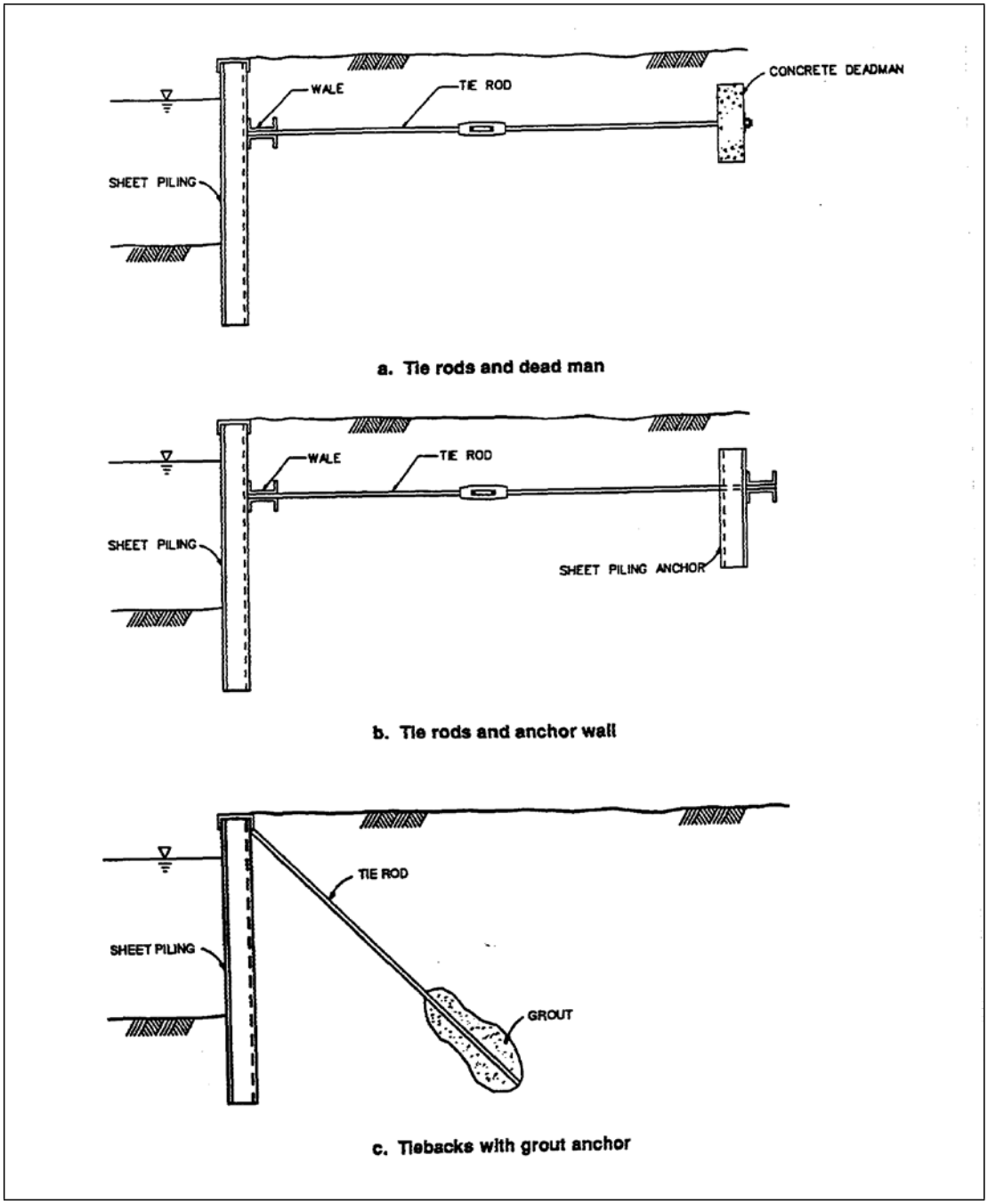


Figure A8a, A8b and A8c: Sheet pile walls with concrete deadman (a), sheet pile (b) and grout anchor systems.

30. Figure A9 is the conceptual design used for the sheet pile wall cost estimates prepared for this report. Figure A10 provides a cross section of an alternative seawall design that may be more cost effective than a sheet pile wall in selected reaches of critical erosion identified in this report. The design incorporates a concrete rubble masonry (CRM) wall and marine mattresses. The CRM wall would be designed to be stable as a function of its weight while the marine mattresses would prevent scour and undermining from compromising the stability of the wall. The CRM wall would also promote accumulation of coral rubble that naturally builds up along many reaches of shoreline on the islands. This coral rubble would serve as an effective wave energy dissipater. During large storm events, a percentage of the coral rubble would probably be scatter landward. Therefore, there would be some level of maintenance associated with this type of shore protection over its useful life.

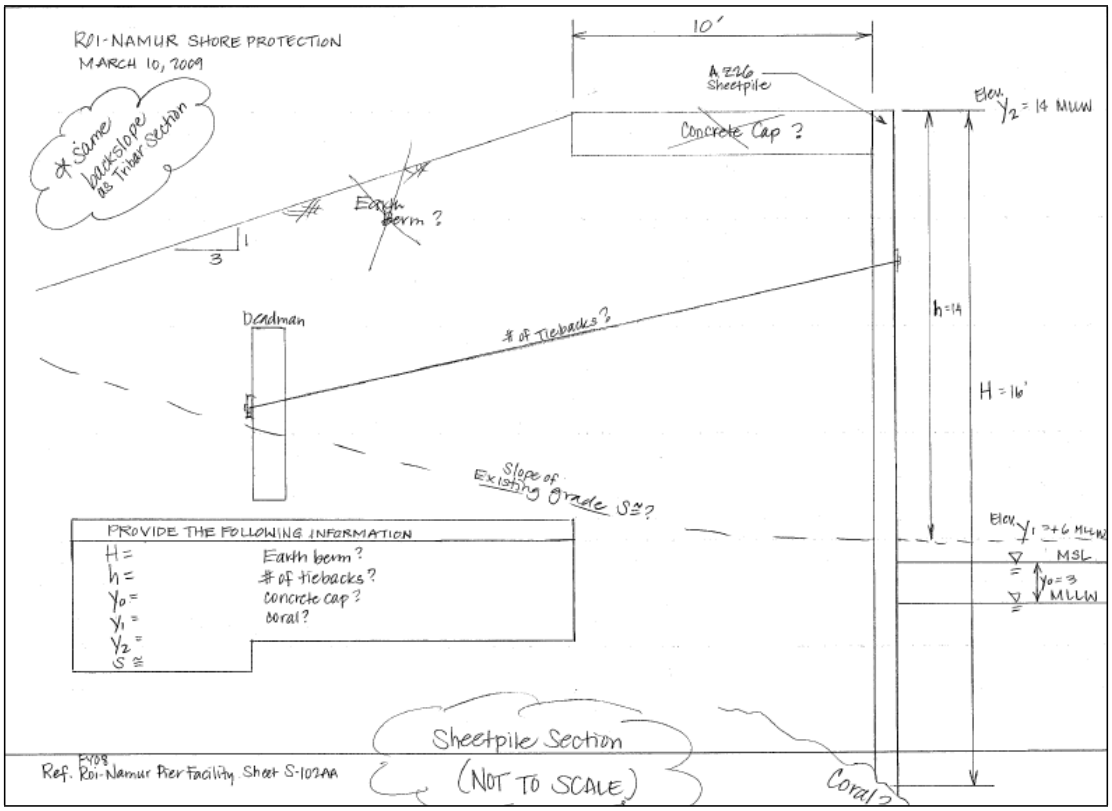


Figure A9: Steel sheet pile wall cross section used for conceptual cost estimates in this report.

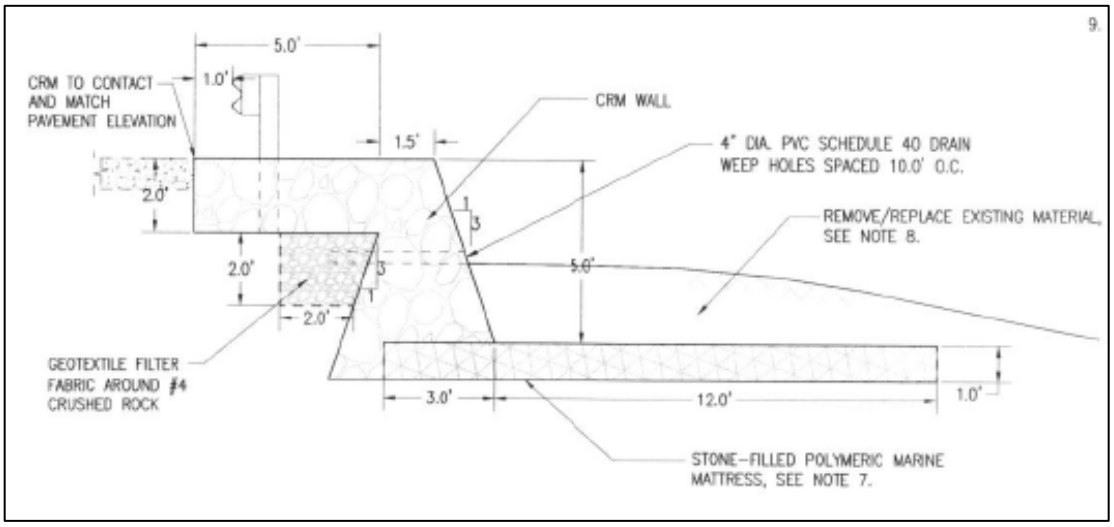


Figure A10: Concrete rubble masonry seawall with marine mattress scour protection.

KWAJALEIN ATOLL
SHORELINE INVENTORY

Roi-Namur Island: 22 February 2008

EMERGENCY SHORE PROTECTION TYPES
Japanese Seawall Crest Repair
Tri-bar Revetment
Sheet Pile Seawall

WAYPOINT ORIGINAL	WAYPOINT NEW	REACH LENGTH ft	PHOTOGRAPHS RIGHT	PHOTOGRAPHS LEFT	CRITICAL ft	POTENTIALLY CRITICAL ft	NON CRITICAL ft	CLASSIFICATION	TYPE	COMMENT
43	R1	891	83	84			891	Stable Beach	Beach	Stable beach starting at small headland
44	R2	687	85	86			687	Unstable Beach	Beach	Active non-critical erosion, 5-foot earth berm
45	R3	92	87	88			92	Engineered Revetment	Revetment	Revetment crest elevation at +4 feet with 200lb limestone armor.
46	R4	174	89	90			174	Engineered Seawall	Seawall	Pier deck and seawall in good condtion with crest elevation of +5 feet
47	R5	551	91	92			551	Unstable Beach	Beach	Non-critical beach erosion
48	R6	131	93	94			131	Engineered Seawall	Seawall	Scuba Club shoreline with maginal seawall
49	R7	602	95	96			602	Unstable Beach	Beach	Non-critical beach erosion
50	R8	254	97	98			254	Engineered Revetment	Revetment	Anchor for antenna guy wire at start of reach
51	R9	881	99	100			881	Dumped Rip Rap	Revetment	Dumped rock and earth berm (low and narrow)
52	R10	940	103	104			940	Unstable Beach	Beach	Non-critical beach erosion
53	R11	1,531	105	106			1,531	Unstable Beach	Beach	Pill box within 20 feet of shoreline
54	R12	272	107	108		272		Unstable Beach	Beach	New earth berm with crest at about +5 feet above MLLW
55	R13	621	109	110		621		Engineered Revetment	Revetment	Large armor stone revetment with crest at about +8 feet (MLLW). Need to fix landside pc
56	R14	1,531	111	112	1,531			Dumped Rip Rap	Revetment	Lots of dumped rubble and rip rap
57	R15	194	113	114	194			Unstable Beach	Beach	Re-assessed from Non-critical to Critical. Low eroding shoreline.
58	R16	370	115	116	370			Unstable Beach	Beach	Low elevation unarmored beach
59	R17	576	117	118	576			Unstable Beach	Beach	Critical erosion area with new upland earth berm
60	R18	359	119	120	359			Dumped Rip Rap	Revetment	Scallop shaped erosion flanking of adjacent revetment
61	R19	563	121	122			563	Engineered Revetment	Revetment	Substantial armor stone revetment. Need to reset tie back.
62	R20	262	123	124			262	Engineered Seawall	Seawall	Low crested impervious Japanese seawall
63	R21	224	125	126			224	Engineered Seawall	Seawall	Low crested impervious Japanese seawall
64	R22	344	129	130			344	Engineered Seawall	Seawall	Low crested impervious Japanese seawall. Sand backpass source.
65	R23	294	127	128			294	Dumped Rip Rap	Earth Berm	Coral limestone cobbles. Construct CRM back stop.
66	R24	804	131	132			804	Dumped Rip Rap	Earth Berm	Coral limestone cobbles. Construct CRM back stop.
67	R25	167	133	134	167			Dumped Rip Rap	Earth Berm	Limestone rubble with crest at +10 feet (MLLW)
68	R26	894	135	136	300	594		Dumped Rip Rap	Earth Berm	Emergency placed 2-ton Tribars. First 300 feet of reach is critical
69	R27	220	137	138	220			Dumped Rip Rap	Revetment	Telemetry Domes within 20 feet of shoreline
70	R28	131	139	140			131	Unstable Beach	Beach	Non-critical beach erosion
71	R29	366	141	142			366	Dumped Rip Rap	Earth Berm	Pill box in the water and new earth berm pushed to +10 to +15 feet (MLLW)
72	R30	221	143	144			221	Unstable Beach	Beach	Base dump facility
73	R31	72	145	146	72			Engineered Seawall	Seawall	Japanese Seawall crest damage need repair.
74	R32	139	147	148	139			Engineered Seawall	Seawall	Japanese Seawall crest damage need repair.
75	R33	377	149	150	377			Engineered Revetment	Revetment	Armor stones blown out and spread across reef. Revetment needs total rehabilitation
76	R34	225	151	152	225			Engineered Revetment	Revetment	Revetment needed to protect "Speed Ball" launch complex.
77	R35	469	153	154	469			Engineered Revetment	Revetment	Revetment needed to protect "Speed Ball" launch complex.
78	R36	2,218	155	156			2,218	Dumped Rip Rap	Revetment	Reach starts as rubble and ends with sandy beach. High vegetated upland earth berm
79	R37	316	157	158		316		Dumped Rip Rap	Revetment	Landfill and hazmat area
80	R38	216	159	160			216	Dumped Rip Rap	Revetment	Shoreline stablized by dumped rubble.
81	R39	280	161	162	280			Unstable Beach	Beach	Runway access road within 30 feet of shoreline. Eroded sand spit that could be stablized
82	R40	365	163	164			365	Dumped Rip Rap	Revetment	No additional hardening necessary at this time
83	R41	1,056	165	166			1,056	Unstable Beach	Beach	Sandy beach that should be left unarmored
84	R42	607	167	168			607	Stable Beach	Beach	Beach provides sand to the littoral system
85	R43	724	169	170			724	Stable Beach	Beach	Beach huts should be relocated if erosion persists
86	R44	568	171	172			568	Dumped Rip Rap	Revetment	Infrastructure not in immediate danger.
87	R45	58	173	174			58	Engineered Seawall	Seawall	Seawall in fair condition
88	R46	201	175	176			201	Engineered Revetment	Revetment	Small armor stone revetment in good condition
89	R47	507	177	178			507	Dumped Rip Rap	Revetment	No signs of recent unstabilizing events
43	R1	23,545			5,279	1,803	16,463			

Table 1: Shoreline inventory for the island of Roi-Namur. Original waypoint numbers as assigned by the GPS unit are shown in Column A (Original), plates show “NEW” waypoint numbering as provided in Column B. Photographs taken looking right and left at each waypoint are number according to the information provided in Column D and Column E, respectively.

KWAJALEIN ATOLL
SHORELINE INVENTORY

Kwajalein Island: 21 & 26 February 2009

EMERGENCY SHORE PROTECTION TYPES
Tri-bar Revetment
Seawall Backfill and Repair

WAYPOINT ORIGINAL	WAYPOINT NEW	REACH LENGTH ft	PHOTOGRAPHS RIGHT	PHOTOGRAPHS LEFT	CRITICAL ft	POTENTIALLY CRITICAL ft	NON CRITICAL ft	CLASSIFICATION	TYPE	COMMENT
1	K1	225	1	2			225	Dumped Rip Rap	Beach	Loose dumped concrete rubble
2	K2	478	3	4			478	Engineered Revetment	Revetment	Good revetment with +12-foot crest elevation. Need to remove vegetation from structure.
3	K3	287	5	6			287	Dumped Rip Rap	Beach	Loose dumped concrete rubble
4	K4	1,531	7	8			1,531	Engineered Revetment	Revetment	Good revetment. Need to notch toe stones into reef.
5	K5	3,168	9	10			3,168	Dumped Rip Rap	Beach	Start of reach contains significant fraction of coral rubble.
6	K6	114	11	12			114	Dumped Rip Rap	Seawall	Underdesigned seawall made of concrete blocks.
7	K7	755	13	14			755	Dumped Rip Rap	Revetment	Large stone and rubble could be reset to stabilize.
8	K8	485	15	16			485	Dumped Rip Rap	Revetment	Smaller stone and coral rubble.
9	K9	1,267	17	18			1,267	Engineered Revetment	Revetment	Revetment protects corner of runway. Reset tie back stones on most of the island's revetments.
10	K10	845	19	20	200	645		Dumped Rip Rap	Beach	Critical along 200 feet of upper end or reach
11	K11	934	21	22			934	Stable Beach	Beach	Beach is in good condition and development is well upland of shoreline.
12	K12	396	23	24			396	Engineered Revetment	Revetment	New perched berm with sliding toe blocks and small crest stones. This is not a preferred design.
13	K13	130	25	26			130	Engineered Seawall	Seawall	Seawall in fair condition with coral rubble at toe.
14	K14	519	27	28			519	Dumped Rip Rap	Beach	Scattered concrete and coral rubble. Pool water outfall location.
15	K15	163	29	30			163	Engineered Seawall	Seawall	Aging seawall with toe stone. Some seawall panels have been dislodged and flanked.
16	K16	143	31	32	143			Dumped Rip Rap	Beach	Eroding beach with dumped concrete in front of the Beach Bar
17	K17	139	33	34	139			Dumped Rip Rap	Revetment	Critical to protect threatened Pump Station
18	K18	576	35	36			576	Dumped Rip Rap	Revetment	Long reach of dump rubble with larger stone at upper end.
19	K19	737	37	38	737			Dumped Rip Rap	Beach	Housing close to shoreline and threatened.
20	K20	184	39	40			184	Dumped Rip Rap	Beach	Unstable beach with small concrete and coral rubble.
21	K21	283	41	42			283	Engineered Revetment	Revetment	Revetment in good condition protects the pool house. Need to remove vegetation in the structure.
22	K22	537	43	44	537			Engineered Seawall	Seawall	Commander's Quarters has low crested seawall and no toe protection.
23	K23	738	45	46			738	Stable Beach	Beach	Sandy stable beach between seawalls.
24	K24	1,214	47	48			1,214	Engineered Seawall	Seawall	Seawall in good condition with splash apron rocks on crest.
25	K25	860	51	52			860	Engineered Revetment	Revetment	Good revetment with reducing stone size from oceanside to lagoonside of the reach.
26	K26	874	53	54			874	Engineered Revetment	Revetment	Good revetment with increasing stone size along upper portion of reach.
27	K27	520	55	56			520	Stable Beach	Beach	Beginning of sandy stable beach
28	K28	127	57	58			127	Stable Beach	Beach	Towards the end of sandy stable beach
29	K29	110	59	60			110	Engineered Groin	Groin	Groin stabilizes sandy beach, but backpassing has been necessary in the past.
30	K30	2,798	61	62			2,798	Engineered Revetment	Revetment	Long reach of revetment in good condition
31	K31	676	63	64			676	Engineered Seawall	Seawall	Revetment and seawall in good condition
32	K32	1,267	65	66			1,267	Engineered Seawall	Seawall	Seawall in good condition stabilizes harbor shoreline.
33	K33	40	67	68	40			Engineered Revetment	Revetment	Low revetment doesn't protect unpaved road.
34	K34	150	X	X			150	Engineered Revetment	Revetment	Revetment with no photographs
35	K35	1,003	69	70			1,003	Engineered Revetment	Revetment	Same revetment in good condition.
36	K36	422	71	72		422		Engineered Revetment	Revetment	Marginal revetment protecting telemetry dome complex

Table 2: Shoreline inventory for the island of Kwajalein.

37	K37	377	73	74			377	Stable Beach	Beach	Sandy stable beach
38	K38	1,742	75	76			1,742	Engineered Revetment	Revetment	Yacht Club revetment in good condition
39	K39	475	77	78	475			Unstable Beach	Beach	Road blocked off and needs to be protected or relocated
40	K40	543	79	80			543	Unstable Beach	Beach	Eroding beach with no upland development threatened
41	K41	344	333	334		344		Unstable Beach	Beach	Erosion could threaten facilities in the near future
42	K42	716	81	82		716		Engineered Revetment	Beach	Revetment in fair condition with crest elevation of +8', crest width of +4' and up to 2-ton stone
129	K43	298	335	336		298		Unstable Beach	Beach	Erosion could threaten facilities in the near future
130	K44	67	337	338			67	Engineered Revetment	Revetment	Revetment in fair condition with crest elevation of +8', crest width of +4' and up to 1-ton stone
131	K45	37	339	340	37			Engineered Seawall	Seawall	Seawall loosing backfill behind needs immediate repair!
132	K46	188	341	342			188	Engineered Seawall	Seawall	Seawall in fair condition
133	K47	56	343	344	56			Engineered Seawall	Seawall	Seawall loosing backfill behind needs immediate repair!
134	K48	98	345	346	98			Engineered Revetment	Revetment	Reset existing revetment crest stone and tieback
135	K49	26	347	348			26	Engineered Boat Ramp	Boat Ramp	Boat ramp in good condition
136	K50	66	349	350			66	Engineered Revetment	Revetment	Revetment in fair condition (C.E.=+8',C.W.=4',A.S.=1 ton)
137	K51	255	351	352			255	Stable Beach	Beach	Relatively wide beach width
138	K52	436	353	354			436	Dumped Rip Rap	Revetment	Revetment with small dumped concrete rubble
139	K53	1,162	355	356			1,162	Engineered Revetment	Revetment	Revetment in good condition but vegetation needs to be removed
140	K54	454	357	358			454	Engineered Revetment	Revetment	Revetment in good condition but vegetation needs to be removed
141	K55	590	359	360			590	Engineered Revetment	Revetment	Revetment in good condition but vegetation needs to be removed
142	K56	630	361	362			630	Engineered Revetment	Revetment	Revetment in good condition but vegetation needs to be removed
143	K57	459	363	364			459	Engineered Revetment	Revetment	Revetment in good condition but vegetation needs to be removed (C.E.=+10',C.W.=3',A.S.=1-5 ton)
144	K58	64	365	366			64	Dumped Rip Rap	Revetment	Unstable beach with small concrete and coral rubble.
145	K59	1,320	367	368			1,320	Dumped Rip Rap	Revetment	Unstable beach with small concrete and coral rubble.
146	K60	204	369	370			204	Dumped Rip Rap	Revetment	Unstable beach with small concrete and coral rubble.
147	K61	802	371	372			802	Dumped Rip Rap	Revetment	Unstable beach with small concrete and coral rubble.
148	K62	173	373	374			173	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+18',C.W.=8',A.S.=1-2 ton)
149	K63	1,056	375	376			1,056	Dumped Rip Rap	Revetment	Reach with randomly dumped rock transitioning into 300 feet of beach with storm water outfall
1	K1	37,335			2,462	2,425	32,448			

Table 2 (continued): Shoreline inventory for the island of Kwajalein.

KWAJALEIN ATOLL
SHORELINE INVENTORY

Meck Island: 25 February 2009

EMERGENCY SHORE PROTECTION TYPES
Tri-bar Revetment
CRM Beach Face
Reset Revetment Stone

WAYPOINT ORIGINAL	WAYPOINT NEW	REACH LENGTH ft	PHOTOGRAPHS RIGHT	PHOTOGRAPHS LEFT	CRITICAL ft	POTENTIALLY CRITICAL ft	NON CRITICAL ft	CLASSIFICATION	TYPE	COMMENT
90	M1	409	255	256			409	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+15',C.W.=15',A.S.=4-8 ton)
91	M2	1,109	257	258			1,109	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+15',C.W.=15',A.S.=2-4 ton)
92	M3	357	259	260			357	Engineered Breakwater	Breakwater	Breakwater Trunk in good condition (C.E.=+12',C.W.=15',A.S.=1 ton,Tri-bars=2-ton)
93	M4	26	261	262		26		Engineered Breakwater	Breakwater	Breakwater Head tri-bars popping out at water line at about -8 degrees from centerline (C.E.=+12',C.W.=15',A
94	M5	340	263	264			0	Engineered Breakwater	Breakwater	Need to remove small stone off crest of breakwater head. Backtracking on breakwater a distance of 340 feet
95	M6	143	265	266			143	Engineered Revetment	Revetment	Revetment in good condition but need to remove vegetation (C.E.=+15',C.W.=15',A.S.=2-4 ton)
96	M7	198	267	268			198	Engineered Revetment	Revetment	Revetment in fair condition but need to remove vegetation (C.E.=+15',C.W.=15',A.S.=2-4 ton)
97	M8	241	269	270			241	Engineered Pier	Seawall	Sheet pile pier in good condition
98	M9	34	271	272			34	Engineered Pier	Seawall	Sheet pile pier in good condition
99	M10	220	273	274			220	Engineered Pier	Seawall	Sheet pile pier in good condition
100	M11	12	275	276	12			Unstable Beach	Beach	Critical erosion adjacent to boat ramp
101	M12	49	277	278			49	Engineered Boat Ramp	Boat Ramp	Boat ramp in good condition but threatened by undermining
102	M13	76	279	280	76			Unstable Beach	Beach	Critical erosion adjacent to boat ramp
103	M14	182	281	282			182	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+15',C.W.=15',A.S.=1-3 ton)
104	M15	52	283	284			52	Engineered Seawall	Seawall	Sheet pile seawall in fair condition with large storm water outfall at end of reach
105	M16	216	285	286			216	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+15',C.W.=15',A.S.=3-6 ton)
106	M17	378	287	288			378	Unstable Beach	Dumped Rip	Non-critical unstable beach erosion
107	M18	194	289	290			194	Unstable Beach	Beach	Coral limestone rubble
108	M19	280	291	292			280	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+15',C.W.=2',A.S.=2-5 ton)
109	M20	83	293	294			83	Engineered Groin	Groin	Groin in good condition (C.E.=+15'-+4',C.W.=2',A.S.=1 ton)
110	M21	78	295	296			0	Engineered Groin	Groin	Backtracked 78 feet on groin
111	M22	440	297	298			440	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+12',C.W.=2',A.S.=1-3 ton)
112	M23	119	299	300			119	Stable Beach	Beach	Stable beach behind a high area in the offshore reef
113	M24	105	301	302			105	Unstable Beach	Beach	Non-critical unstable scarped beach erosion
114	M25	96	303	304			96	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+10',C.W.=2',A.S.=1-5 ton)
115	M26	304	305	306			304	Dumped Rip Rap	Revetment	Dumped concrete and coral rubble
116	M27	264	307	308			264	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+8',C.W.=6',A.S.=1-25 ton). Need to reset tieback
117	M28	1,003	309	310		1,003		Dumped Rip Rap	Beach	Potentially critical erosion if undermining of old runway is a concern
118	M29	247	311	312		247		Engineered Seawall	Seawall	Seawall in fair to good conditions. Need to remove small rubble and place toe stone. Seawall is holding wate
119	M30	626	313	314			626	Dumped Rip Rap	Beach	Non-critical unstable beach erosion with small dumped rock and coral rubble
120	M31	470	315	316		470		Engineered Revetment	Revetment	Revetment in fair condition (C.E.=+12',C.W.=8',A.S.=2-5 ton). Need to reset crest and remove rubble that wa
121	M32	300	317	318	300			Dumped Rip Rap	Revetment	Dumped concrete and coral rubble on critical reach of shoreline
122	M33	98	319	320	98			Dumped Rip Rap	Revetment	Dumped concrete and coral rubble on critical reach of shoreline
123	M34	242	321	322			242	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+12',C.W.=15',A.S.=1-3 ton). Need to reset tieback and remove vegetatio
124	M35	120	323	324			120	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+12',C.W.=15',A.S.=1-3 ton).
125	M36	394	325	326			394	Engineered Revetment	Revetment	Revetment in good condition (C.E.=+12',C.W.=15',A.S.=1-3 ton). Need to reset tieback

Table 3: Shoreline inventory for the island of Meck.

126	M37	438	327	328			438	Stable Beach	Beach	Stable beach with pea-sized coral at start grading to fine-grained sand at end of reach
127	M38	221	329	330			221	Engineered Revetment	Revetment	Revetment in fair condition (C.E.=+7',C.W.=2',A.S.=1-3 ton).
128	M39	85	331	332	85			Engineered Revetment	Revetment	Revetment in fair condition (C.E.=+15',C.W.=15',A.S.=4-8 ton). Fiber optic cable landfall that needs to be prot
90	M1	10,249			571	1,746	7,514			

Table 3 (continued): Shoreline inventory for the island of Meck.

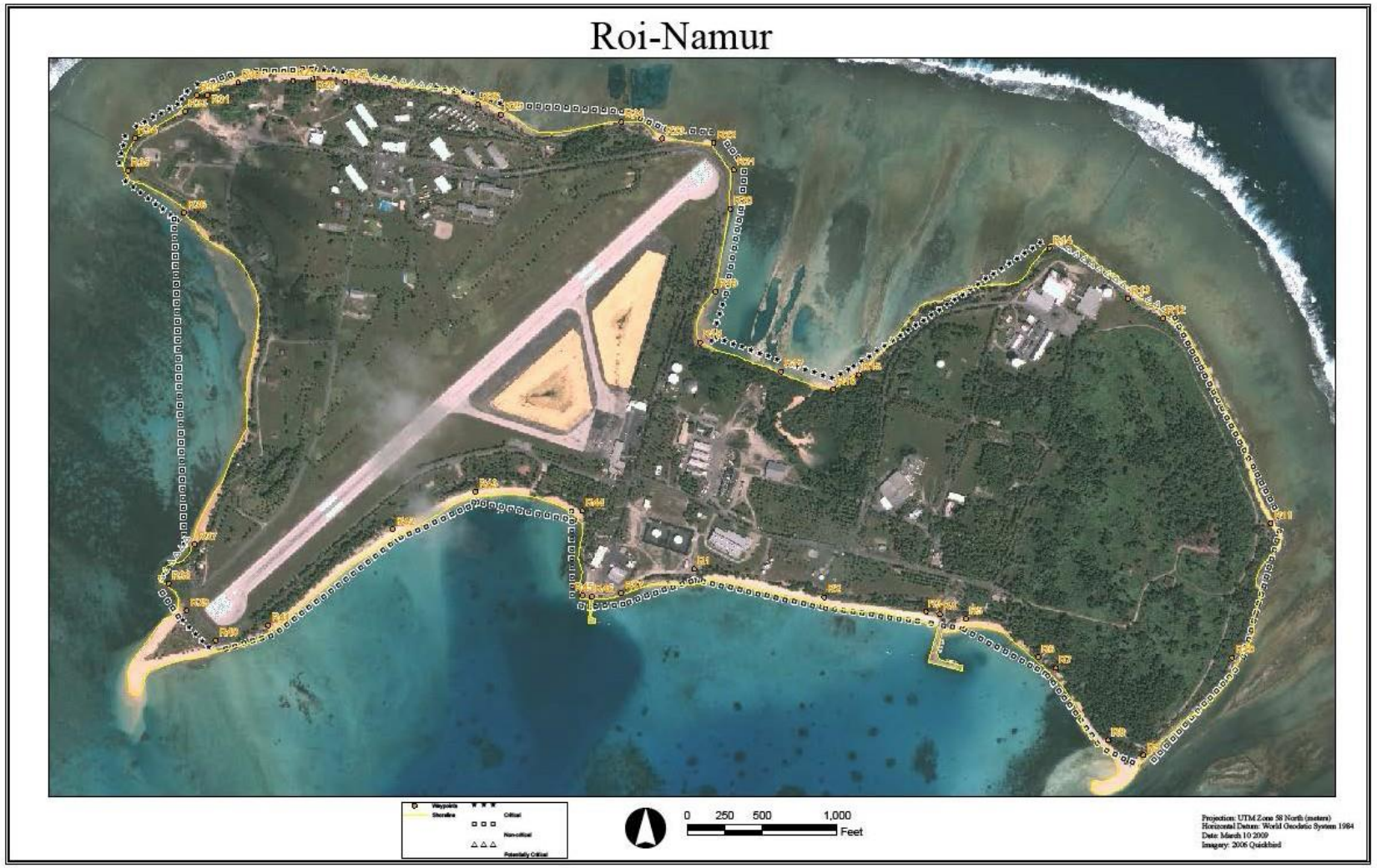


Plate 1: Shoreline atlas for the island of Roi-Namur. Shoreline reaches are classified as “CRITICAL”, “POTENTIALLY CRITICAL” and “NON-CRITICAL”.

Plate 2: Shoreline atlas for the island of Kwajalein. Shoreline reaches are classified as “CRITICAL”, “POTENTIALLY CRITICAL” and “NON-CRITICAL”.

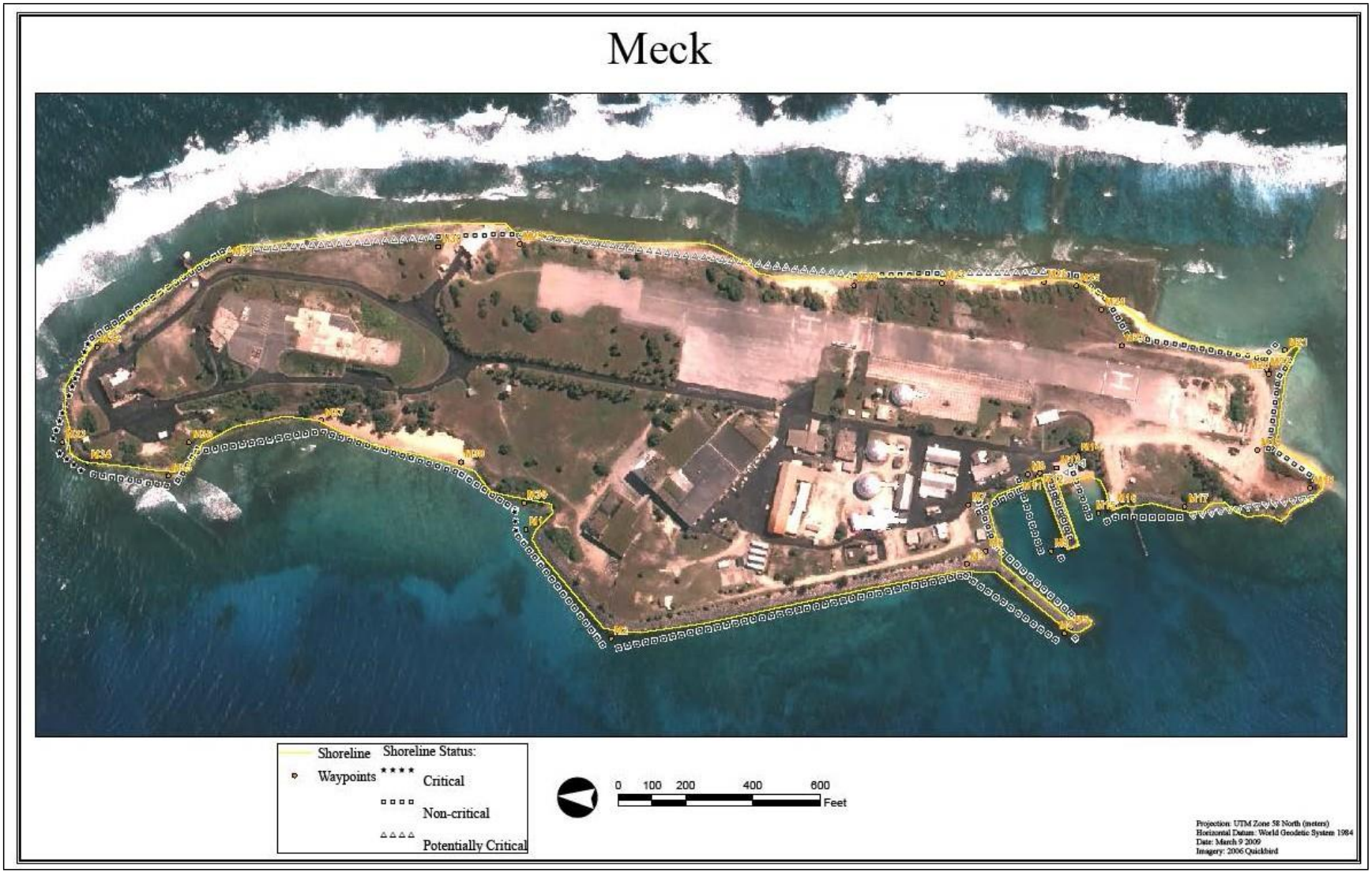


Plate 3: Shoreline atlas for the island of Meck. Shoreline reaches are classified as “CRITICAL”, “POTENTIALLY CRITICAL” and “NON-CRITICAL”.

NCA - APPENDIX F

CRITICAL EROSION AREAS ON ROI-NAMUR

KWAJALEIN RANGE SERVICES

JULY 2016

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CRITICAL EROSION AREAS ON ROI-NAMUR

BACKGROUND

- In 2007 a survey was conducted by Teladyne of the shoreline conditions on nine of the USAG-KA-controlled islets. The survey identified critical erosion areas observed during the survey and findings were published in the *2007 USAKA Shoreline Protection Survey*.

- In 2008 storm surges, heavy winds, and extreme high tide resulted in inundation of Roi-Namur and jeopardized the integrity of the shorelines.

- One year later, in 2009, the United States Army Corps of Engineers conducted another survey of USAG-KA-controled islets. This time the focus of the survey was on Roi-Namur, Kwajalein, and Meck. Again, shoreline areas that were eroding and adjacent to strategic infrastructure were identified as critical erosion areas.

- In February of 2015 another survey was conducted. Led by the USAG-KA Environmental Engineer, the sole focus was on critical erosion areas on Roi-Namur. The areas identified as "critical" were revised based upon this survey and are shown below.

REVISION OF CRITICAL EROSION AREAS

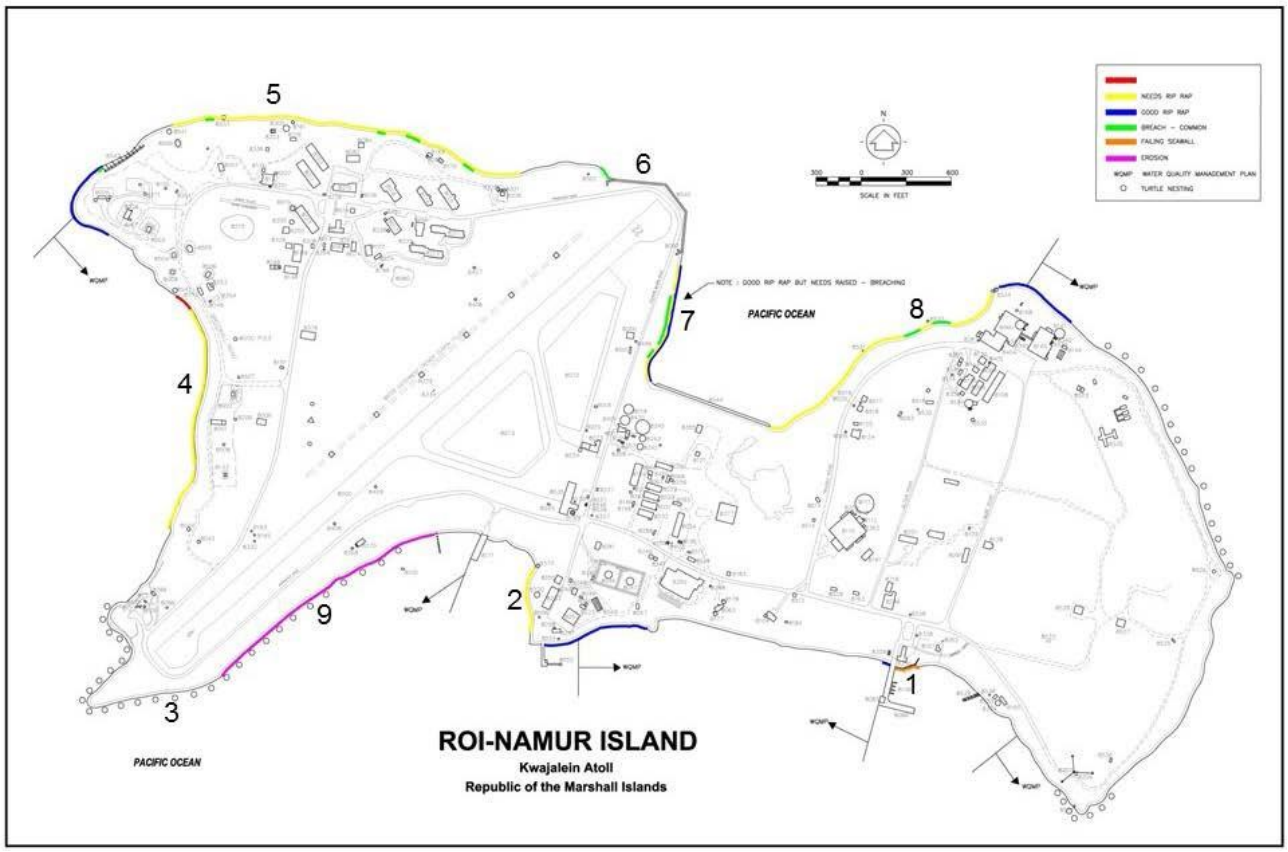

Figure 1 – Critical Erosion Areas Identified in 2015

1) Yokohama Pier Area

Cracking and undercutting of the concrete wall near the security check point was evident.

Figure 2 – Cracking was evident on the abutment near the Yokohama Pier area.

2) Japanese Pillbox Area

The area near the pillbox below was reported to be impacted by surf.

Figure 3 – Inadequate riprap was observed near the pillbox area.

3) Southwest End of Runway, Lagoon Side

No armoring or shoreline protection structures were observed along this area.

Figure 4 – Undercutting near the vegetation line and loss of beach sand was apparent.

4) Waste Water Treatment Plant, Along Speedball

An erosion ledge was observed along the roadway, from the waste water treatment plant and running southward along Speedball Road.

Figure 5 – Concrete slabs previously placed as emergency shoreline protection.

Figure 6 – Inundation occurred here as evidenced by the washed ashore rocks.

5) Southeastern Shore of Roi, Near Beach Shacks

Small scale, temporary efforts such as placing sandbags to slow erosion were placed in front of some structures. Significant erosion and undercutting were observed.

Figure 7 – Undercutting reveals the roots of the trees above.

6) Northern Shore of Roi

Although the shoreline in front of the radars appeared well protected with existing rip rap, significant erosion and undercutting was seen east of the radars.

Figure 8 – Undercutting was observed along the shoreline.

7) Tank Trap Area, Northeast of Dyess Army Airfield

Reports of inundation over the tank trap were noted during the survey. Such activity presents a potential hazard to the nearby airfield and drinking water catchment source.

Figure 9 – Sand acts as a ramp allowing waves to breach near the airfield.

8) East of the Historic Japanese Air Operations Building

Although some rip rap was present, the height was insufficient so as to allow seawater to breach over the shoreline.

Figure 10 – Insufficient rip rap allows seawater breaching onto the road.

9) Northwestern Shore of Namur, West of TRADEX

The small rip rap in place on the shoreline was insufficient and allowed seawater breaching.

Figure 11 – Insufficient shoreline protection allows seawater breaching.