Integrated Natural Resources Management Plan

Wake Island Airfield, Wake Atoll
Kōke`e Air Force Station, Kaua`i, Hawai`i
Mt. Ka`ala Air Force Station, O`ahu, Hawai`i

April 2017

Integrated Natural Resources Management Plan

Wake Island Airfield; Kōke`e Air Force Station, Kaua`i, Hawai`i; and Mount Ka`ala Air Force Station, O`ahu, Hawai`i

Prepared for:

Pacific Air Forces Regional Support Center

Contract: FA8903-10-D-8601-0089
Project: YGFZ330313

April 2017

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
WAKE ISLAND AIRFIELD, KŌKE`E AIR FORCE STATION, KAUA`I, HAWAI`I
AND
MOUNT KA`ALA AIR FORCE STATION, O`AHU, HAWAI`I

The Integrated Natural Resources Management Plan (INRMP), dated April 2017, has been prepared in accordance with regulations, standards, and procedures of the Department of Defense; Air Force Instruction 32-7064, *Integrated Natural Resources Management*; Air Force Policy Directive (32-70, *Environmental Quality*; and the Sikes Act Improvement Act (as amended through 2013 (16 United States Code §670a et seq.), in cooperation with the United States Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration (NOAA), and the Hawai`i Department of Land and Natural Resources (DLNR). The management of natural resources in this INRMP reflects the mutual agreement of all parties.

To the extent that availability of agency resources permit, the USFWS, NOAA, Hawai`i DLNR, and the United States Air Force, by signature of their agency representative, do hereby agree to enter into an agreement program for the conservation, protection, and management of natural resources present on Wake Island Airfield; Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount (Mt.) Ka`ala AFS, O`ahu, Hawai`i through implementation of this INRMP. The intention of this agreement is to manage natural resources on Wake Island Airfield, Kōke`e AFS, and Mt. Ka`ala AFS in a manner that best integrates the interests and missions of the agencies charged with conservation, protection, and management of the natural heritage in the public interest. This agreement may be modified and amended by mutual agreement of the authorized representatives of the three agencies. This agreement will become effective upon the date of the last signatory and shall continue in full force until terminated by written notice to the other parties, in whole or in part, by any of the parties signing this agreement.

By their signatures below, or an enclosed letter of concurrence, all parties grant their concurrence and acceptance of the following document.

Approving Officials:

Commander, Pacific Air Forces Regional Support Center (Colonel Frank Flores)	**Date**
611th Civil Engineer Squadron, Natural Resources Program Manager (Joel Helm)	**Date**
United States Fish and Wildlife Service (Robyn Thorson)	**Date**
National Oceanic and Atmospheric Administration (Michael Tosatto)	**Date**
Hawai`i Department of Land and Natural Resources (Suzanne Case)	**Date**

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2018 ANNUAL REVIEW AND COORDINATION PAGE

This page is used to certify the 2018 annual review and coordination of the Integrated Natural Resources Management Plan (INRMP) for Wake Island Airfield; Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount Ka`ala AFS, O`ahu, Hawai`i.

By their signatures below, the certifying officials acknowledge that the 2018 annual review and coordination of the INRMP has occurred.

Approving Officials:

Commander, Pacific Air Forces Regional Support Center (Print name)	**Date**
611th Civil Engineer Squadron, Natural Resources Program Manager (Print name)	**Date**
United States Fish and Wildlife Service (Print name)	**Date**
National Oceanic and Atmospheric Administration (Print name)	**Date**
Hawai`i Department of Land and Natural Resources (Print name)	**Date**

(Insert Annual Review Comments)

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2019 ANNUAL REVIEW AND COORDINATION PAGE

This page is used to certify the 2019 annual review and coordination of the Integrated Natural Resources Management Plan (INRMP) for Wake Island Airfield; Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount Ka`ala AFS, O`ahu, Hawai`i.

By their signatures below, the certifying officials acknowledge that the 2019 annual review and coordination of the INRMP has occurred.

Approving Officials:

Commander, Pacific Air Forces Regional Support Center (Print name)	**Date**
611th Civil Engineer Squadron, Natural Resources Program Manager (Print name)	**Date**
United States Fish and Wildlife Service (Print name)	**Date**
National Oceanic and Atmospheric Administration (Print name)	**Date**
Hawai`i Department of Land and Natural Resources (Print name)	**Date**

(Insert Annual Review Comments)

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2020 ANNUAL REVIEW AND COORDINATION PAGE

This page is used to certify the 2020 annual review and coordination of the Integrated Natural Resources Management Plan (INRMP) for Wake Island Airfield; Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount Ka`ala AFS, O`ahu, Hawai`i.

By their signatures below, the certifying officials acknowledge that the 2020 annual review and coordination of the INRMP has occurred.

Approving Officials:

Commander, Pacific Air Forces Regional Support Center (Print name)	**Date**
611th Civil Engineer Squadron, Natural Resources Program Manager (Print name)	**Date**
United States Fish and Wildlife Service (Print name)	**Date**
National Oceanic and Atmospheric Administration (Print name)	**Date**
Hawai`i Department of Land and Natural Resources (Print name)	**Date**

(Insert Annual Review Comments)

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2021 ANNUAL REVIEW AND COORDINATION PAGE

This page is used to certify the 2021 annual review and coordination of the Integrated Natural Resources Management Plan (INRMP) for Wake Island Airfield; Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount Ka`ala AFS, O`ahu, Hawai`i.

By their signatures below, the certifying officials acknowledge that the 2021 annual review and coordination of the INRMP has occurred.

Approving Officials:

Commander, Pacific Air Forces Regional Support Center (Print name)	**Date**
611th Civil Engineer Squadron, Natural Resources Program Manager (Print name)	**Date**
United States Fish and Wildlife Service (Print name)	**Date**
National Oceanic and Atmospheric Administration (Print name)	**Date**
Hawai`i Department of Land and Natural Resources (Print name)	**Date**

(Insert Annual Review Comments)

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
WAKE ISLAND AIRFIELD, KŌKE`E AIR FORCE STATION KAUA`I, HAWAI`I
AND MOUNT KA`ALA AIR FORCE STATION O`AHU, HAWAI`I

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1. EXECUTIVE SUMMARY

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to clearly define the goals and objectives for natural resources management on Wake Island Airfield (WIA); Kōke`e Air Force Station (AFS), Kaua`i, Hawai`i; and Mount (Mt.) Ka`ala AFS, O`ahu, Hawai`i. This INRMP was prepared in accordance with the Sikes Act Improvement Act (SAIA) as amended through 2013; Air Force Instruction (AFI) 32-7064, *Integrated Natural Resources Management* (United States Air Force [USAF] 2014a); and Air Force Policy Directive (AFPD) 32-70, *Environmental Quality* (USAF 1994a). The United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), and the Hawai`i Department of Land and Natural Resources (DLNR) have reviewed and signed this INRMP, indicating their mutual agreement with the Commanding Officers regarding natural resources management on these installations.

This INRMP revises and combines the existing INRMPs for Wake Atoll (the Atoll), Kōke`e AFS, and Mt. Ka`ala AFS (USAF 2008a, 2007), includes a discussion of the natural resources on the installations, and reviews natural resources activities undertaken at the installations. This INRMP provides the USAF and its partnering agencies with a description of the installations and their surrounding environments, and presents various management practices designed to mitigate negative impacts and enhance the positive effects of the installations' missions on local ecosystems. These recommendations are balanced against the requirements of the USAF to accomplish its missions at the installations at the highest possible level of efficiency. To obtain an accurate assessment of the installations' influences, analyses were conducted to determine the physical and biotic nature of the installations and their surrounding environments, as well as the operational activities taking place at each installation. In some cases, the implementation of some of these recommendations sacrifices the improvement of the natural resources in deference to the safety and efficiency of the missions.

This INRMP is a guide for the management and stewardship of all natural resources present on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS, while ensuring the successful accomplishment of the military missions. The INRMP was developed using an interdisciplinary approach in which information was gathered from a variety of organizations. Guidance was also solicited from a variety of federal and state agencies. A group of stakeholders was formed, which included key installation personnel and individuals from various agencies that have an interest in the sites and the management of their resources. Representatives from the following federal and state regulatory agencies comprised the team of stakeholders: USFWS, NOAA, and the Hawai`i DLNR. Presidential Proclamation 8336 resulted in the USFWS and NOAA absorbing specific management responsibilities for the newly established Pacific Remote Islands Marine National Monument. In addition the USFWS posses a unique separate role to manage the submerge lands surrounding Wake Atoll out to 12 nautical miles as a unit of the National Wildlife Refuge System per Dept. of Interior Order No. 3284. These varying perspectives allowed for an accurate portrayal of the status and management needs of local ecosystems, balanced against the requirement for the installations to accomplish their mission(s) at the highest possible level of efficiency. As a result, the probable effects of installations' operations on the surrounding natural resources were projected, allowing for the development of possible operational alternatives that minimize impacts on the environment.

Participation by representatives from the USFWS, NOAA, and Hawai`i DLNR satisfies the provisions of the Sikes Act (16 United States Code [U.S.C.] §670a et seq.). The Sikes Act requires the preparation of an INRMP in cooperation with USFWS and the appropriate state fish and wildlife agency (i.e., the Hawai`i DLNR). In addition, it is required that the resulting plan reflect the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources.

Endangered Species Act (ESA) Section 4(a)(3)(B(i) directs the Secretary of the Interior to not designate as critical habitat any lands, or other geographical areas owned or controlled by the Department of Defense (DOD) that are subject to an INRMP that provides a benefit to the species for which critical habitat is proposed. Through an INRMP, the Air Force (AF) fulfills its ESA Section 7(a)(1) responsibilities by managing natural resources in a way that conserves endangered and threatened species, subject to the Sikes Act Section 101(b)(1)(I) limitation that there be no net loss in the capability of installation lands to support the military mission.

This INRMP, in addition to other biological data, may be utilized to preclude a military installation from a future critical habitat designation. However, INRMP approval via signature from the National Marine Fisheries Service (NMFS), USFWS, and the State of Hawai`i does not automatically result in preclusion of critical habitat designation, given that authority lies not with the remote office signatories, but rather with the Secretary of the Interior. The ESA does not require additional special management/critical habitat designation if adequate management and protection are already in place. Adequate special management or protection is provided by a legally operative INRMP that addresses the maintenance and improvement of the primary constituent elements important to the species and manages the long-term conservation of the species. Three criteria are used to determine if such special management and protection are provided: (1) there is a conservation benefit, (2) there are assurances that the management plans will be implemented, and (3) there are assurances that the conservation efforts will be effective. These three criteria will be met through the strategies presented in this INRMP; therefore, designation of critical habitat is neither necessary nor legally required.

The maintenance and enhancement of biological diversity is particularly important in the management of natural resources and will be accomplished through the implementation of specific management practices identified in this INRMP. Biodiversity is simply defined as "the variety of life and its processes" (Keystone Center 1991). Biodiversity does not just describe how many species there are or how evenly they are represented in a given community. Rather, biodiversity can be applied on four basic levels: genetic diversity, species diversity, ecosystem diversity, and landscape diversity. Genetic diversity refers to the variation of genotypes within a species that influences different characteristics among individuals or populations. Species diversity refers to the number of different kinds of species within a given area. Ecosystem diversity refers to the number, relative proportions, and interactions among communities within an ecosystem. Landscape diversity can be defined as the composition of and interactions among ecosystems across a defined landscape. By protecting a mosaic of habitats that supports the greatest variety of life and its processes, this INRMP will help perpetuate the form and function of native communities, thus enhancing the long-term viability of the sites and ensuring their sustainability for implementing their missions.

The plan presents practicable alternatives and recommendations that would minimize impact on the installations' missions while providing for management and stewardship of natural resources that would conserve and enhance existing ecosystems on the installations.
The overriding goals for this INRMP are to:

1. Update the INRMP when environmental or mission conditions change as required by the Sikes Act (16 U.S.C. 670a) and Department of Defense Instruction (DODI) 4715.03.

2. Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment.

3. Maintain partnerships with agencies involved in wildlife management and utilize expertise from agencies, if appropriate and cost effective, for implementation of INRMP projects.

4. Provide quality outdoor recreation experiences for civilian, active duty, and contract work staff that do not deteriorate ecosystem integrity or the USAF mission.

5. Utilize law enforcement expertise from cooperating DOD and Department of Interior (DOI) agencies to monitor activities on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS and educate installation personnel on restrictions applicable to the sites' resources.

6. Manage Wake Atoll, Mt. Ka`ala AFS, and Kōke`e AFS using a regional ecosystem-based approach that manages sensitive species and their associated ecosystems while protecting the operational functionality of the sites' missions.

7. Maintain healthy and stable soils by rehabilitating damaged areas in order to reduce sediment inputs into the watershed that degrade water quality.

8. Minimize non-point source pollution of both surface and groundwater in the watershed through the implementation of best management practices (BMPs).

9. Comply with United States Army Corps of Engineers (USACE) and the Hawai`i Department of Health Clean Water Branch regulations pertaining to wetlands.

10. Maximize use of native plant species and avoid introduction of invasive, exotic species during revegetation activities.

11. Support a Wildland Fire Management Program to protect high value natural resources areas and operational facilities from catastrophic wildfire while conserving resources and military operational flexibility.

12. Develop and employ a systematic approach for onshore and offshore biosecurity, inclusive of rapid response.

13. Implement the Bird Aircraft Strike Hazard (BASH) Plan to lessen occurrences of bird aircraft strikes.

14. Complete an assessment of shallow water coral reef systems and establish a long-term index -based monitoring program for coral reef health in areas of key importance to the USAF mission.

15. Ensure that management actions prescribed in this INRMP are consistent with, and do not conflict with, management prescribed in the Integrated Cultural Resources Management Plans (ICRMPs) for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

16. Collect, store, and maintain data about historical conditions, trends, and current status for critical indicators of ecological integrity and sustainability and use Geographic Information System (GIS) information as a benchmark for developing future natural resources management goals and objectives.

17. Develop an understanding of the potential impacts to natural resources associated with climate change and develop strategies to address climate change impacts to natural resources.

From these goals and objectives, management actions were identified that structure this Plan's guidance. However, each of the management strategies described in this Plan should be monitored so that modifications can be made during implementation as conditions change.

Throughout the development of this INRMP, management issues were identified in a number of natural resources subject areas. Some of these natural resources topics of concern could have an adverse impact on missions or future planning operations. One of the purposes of this INRMP is to identify goals and objectives for the installations and to obtain workable and useful solutions for each topic of concern. Concerns involving natural resources constraints to planning and mission operations are discussed in detail in **Chapter 6** of this INRMP. Concerns are grouped into management sections according to their relevance in **Chapter 8** of this INRMP. **Chapter 10** provides a list of projects to be implemented for each installation based on the concerns discussed in **Chapter 8**.

This INRMP will serve as a planning tool for the USAF Commanding Officers for WIA, Kōke`e AFS, and Mt. Ka`ala AFS. As opportunities become available to seek funding for environmental projects or as mitigation for future activities, this Plan will serve as a priority list to better enable natural resources personnel to practice effective ecosystem management. This Plan is not intended to be a definitive list of projects that will be automatically funded upon enactment. It provides guidance to the resource managers on strategies to employ to meet the goals of the INRMP. The USAF will implement recommendations in the INRMP within the framework of regulatory compliance, national USAF mission obligations, anti-terrorism and force protection limitations, and funding constraints. Any requirement for the obligation of funds for projects in

this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law, including the Anti-Deficiency Act, 31 U.S.C. §1341.

2. GENERAL INFORMATION

An INRMP is a long-term planning document designed to guide a DOD natural resources manager in the management of natural resources to support an installation's mission while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity.

This INRMP complies with the SAIA of 1997, as amended through 2013 (16 U.S.C. 670a et seq.), which requires the preparation, implementation, revision, and review of an INRMP for each military installation in the United States and its territories with significant natural resources. This Plan is prepared in cooperation with the USFWS, NOAA, and the state fish and wildlife agency, which for Hawai`i is the DLNR.

This INRMP provides for the conservation and rehabilitation of natural resources and the sustainable multipurpose use of resources subject to safety requirements and military security. It provides for no net loss in the capability of installation lands to support the military mission and other activities as considered appropriate to the military. The document provides for management of wildlife and land, habitat enhancement and modification, and the establishment of natural resources management objectives and timeframes. The INRMP also addresses sustainable use by the public of natural resources to the extent that such use is possible and is not inconsistent with other needs, public access where appropriate, and the enforcement of natural resource laws and regulations.

More detail on the purpose of this INRMP, management authorities, and legislative drivers for management is provided in the following sections.

2.1 PURPOSE AND SCOPE

This INRMP has been developed for use by WIA; Kōke`e AFS, Kaua`i, Hawai`i; Mt. Ka`ala AFS, O`ahu, Hawai`i; and the USAF in accordance with AFI 32-7064, *Integrated Natural Resources Management* (USAF 2014a); AFPD 32-70, *Environmental Quality* (USAF 1994a); DODI 4715.03, *Environmental Conservation Program* (DODI 2011); DOD Manual 4715.03 *INRMP Implementation Manual* (DOD 2013a); and the provisions of the Sikes Act (16 U.S.C. §670a et seq.). The INRMP provides a description of the installations (e.g., location, history, and mission), information about the surrounding physical and biotic environments, and an assessment of the impacts on natural resources as a result of mission activities. It also recommends various management practices, in compliance with federal, state, and local standards designed to mitigate negative impacts and to enhance the positive effects of the installations' missions on local ecosystems.

This INRMP is the primary tool for managing the installations' ecosystems while ensuring the successful accomplishment of the military missions at the highest possible levels of efficiency. It is a guide for the management and stewardship of natural resources present on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS. A multiple-use approach will be implemented to allow for the presence of mission-oriented activities, as well as environmental quality through efficient management of natural resources.

Specific management practices identified in this INRMP have been developed to enhance and maintain biological diversity within the sites. Specifically, management practices should:

- Minimize habitat fragmentation and promote natural pattern and connectivity of habitats
- Protect native species and discourage non-native, invasive species
- Protect rare and ecologically important areas
- Protect unique sensitive environments
- Maintain or mimic natural processes
- Protect genetic diversity
- Restore species, communities, and ecosystems
- Monitor impacts on biodiversity.

Each of the management strategies described in this plan should be monitored so that modifications can be made during implementation if site conditions change.

Ecosystem sustainability is the key to both biological diversity and human existence. It is the goal of this INRMP to successfully integrate ecological sustainability with goals and objectives that will sustain communities and the operational missions of WIA, Kōke`e AFS, and Mt. Ka`ala AFS.

2.2 MANAGEMENT PHILOSOPHY

This INRMP was developed using an interdisciplinary approach and information gathered from a variety of organizations including federal and state agencies. A group of stakeholders was formed, which included key installation personnel and individuals from agencies that have interest in Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS and the management of their resources. Representatives from USFWS, NOAA, and Hawai`i DLNR were invited to comprise the stakeholder's team. Correspondence with these agencies was documented and satisfies the requirements of 32 Code of Federal Regulations (CFR) Part 989, as amended, *The Environmental Impact Analysis Process*.

Government stakeholders have reviewed preliminary editions of this INRMP and provided the USAF with information on the marine and terrestrial ecosystems, as well as ecosystem management strategies applicable to the environment of the sites. As a result of the coordination, the probable effects of installation operations on the surrounding natural and cultural resources will be projected. This approach also allowed for insight into possible operational alternatives, which could result in reduced impacts on natural resources on the installations and in surrounding areas.

Participation by representatives from the USFWS, NOAA, and Hawai`i DLNR satisfies the provisions of the SAIA (16 U.S.C. §670a et seq.), which requires the preparation of an INRMP in cooperation with USFWS and the appropriate state fish and wildlife agency. In addition, it is required that the resulting plan reflects the mutual agreement of the parties concerning conservation, protection, and management of fish and wildlife resources. The SAIA also requires public comment on the INRMP at its inception and during revisions.

The INRMP presents practicable alternatives and recommendations to allow for the protection and enhancement of natural resources and conservation of existing ecosystems, while minimizing impacts on the installation's missions.

2.3 AUTHORITY

This INRMP is developed under, and proposes actions in accordance with, the applicable DOD and USAF policies, directives, and instructions. AFI 32-7064, *Integrated Natural Resources Management*, provides the necessary direction and instruction for preparing an INRMP (USAF 2014a). Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions that include DODI 4715.03, *Natural Resources Conservation Program* (DOD 2011); DOD Manual 4715.03 *INRMP Implementation Manual* (DOD 2013a); AFPD 32-70, *Environmental Quality* (USAF 1994a); AFI 32-7065, *Cultural Resources Management* (USAF 2014b); and AFI 32-7064. DODI 4715.03 provides direction for DOD installations in establishing procedures for an integrated program for multiple-use management of natural resources. AFPD 32-70 discusses general environmental quality issues, including proper cleanup of polluted sites, compliance with applicable regulations, conservation of natural resources, and pollution prevention. Finally, AFI-32-7065 provides guidance on the preservation of cultural resources at USAF installations. **Appendix C** summarizes key legislation and guidance used to create and implement this INRMP.

To ensure that this INRMP properly addresses all aspects of the natural resources present on the installations and proposes actions that are in accordance with USAF goals and objectives, this Plan and all its components are subject to review by the 611th Civil Engineer Squadron (CES) Environmental Compliance Section and Air Force Civil Engineer Center (AFCEC)/Facility and Engineering Directorate Pacific Environmental (CFPE) AFCEC, Pacific Division Environmental & Real Property Branch. Similarly, all changes to be incorporated into this Plan must be approved by the installations' Commander, USFWS, NOAA, and Hawai`i DLNR.

This INRMP is in effect from the date of approval; however, the Operational Component Plans should be updated annually during preparation of the installations' environmental budget. Annually, this Plan should be reviewed internally to assess the suggested management practices in terms of their appropriateness for current conditions at the installations. The installations should also coordinate annually with the USFWS, NOAA, and Hawai`i DLNR to review and assess conservation goals and objectives and the status of the Natural Resources Conservation metrics. Plans shall be updated or revised in future years using the guidance laid out within the 2013 Tripartite INRMP Memorandum of Understanding (DOD et al. 2013). The 2013 Tripartite INRMP Memorandum of Understanding illustrates the responsibilities and actions required of

each respective signatory as it applies to the creation, update, revision, review, and approval of INRMPs.

2.4 WAKE ISLAND AIRFIELD ROLES AND RESPONSIBILITIES

Commander, Detachment1 (Det 1), Pacific Air Forces Regional Support Center (PRSC) (PRSC /Det1/CC)

Under current (2017) operations, there are four USAF personnel (the Det 1 Commander and three non-commissioned officers) present at Wake Island to oversee and augment the Base Operation Support (BOS) contractor. The Det 1 Commander has the overall responsibility to oversee the functions of the BOS contractor and will:

1. Ensure that natural resources at WIA are managed in accordance with federal laws and USAF regulations

2. Ensure that all personnel and contractors implement this management plan

3. Ensure that all visitors and personnel on Wake are briefed on the natural resources' significance of the Atoll and their responsibilities to protect these resources

4. With the assistance of 611 CES/Environmental Element (CEIE) Natural Resources Program Manager (PM), take measures to resolve or mitigate adverse effects of the military mission on the natural resources of the Atoll

5. Under authority of 33 CFR 935.162 and with the assistance of the 611 CES/CEIE Natural Resources PM, designate restricted areas (if needed) and prohibit activities as necessary to protect natural resources

6. Implement this INRMP for WIA.

611 CES/CEIE

The 611 CES/CEIE oversees the management of the natural resources at WIA, including activities that have the potential to adversely affect the natural resources of the Atoll. The Environmental Element acts as the clearinghouse for approval of activities related to natural resources within the 611 CES, and has responsibility to ensure the flow of information is made available to all installation PMs.

611 CES, Natural Resources PM (611 CES/CEIE)

The 611 Natural Resources PM must be knowledgeable about WIA natural resources, the laws and regulations that govern them, and the 611 CES mission at WIA in order to appropriately and effectively execute program requirements. The Natural Resource PM may be assisted in the management of these resources by a support contractor; however, ultimate oversight and

responsibility resides with the Natural Resources PM. The 611 CES/CEIE Natural Resources PM shall:

1. Obtain certification, education, and training appropriate to his or her responsibilities and experience

2. Oversee the management of WIA natural resources

3. Provide natural resources management information to PRSC/Det 1/CC and BOS contractor for incorporation into the newcomer's briefings and the Wake Island Code

4. Retain records of natural resources management activities at WIA for the administrative record

5. Serve as a clearinghouse for all communication regarding natural resources of the Atoll

6. Serve as the technical expert and primary point-of-contact for all natural resources-related inquiries from the PRSC/Det 1/CC and the BOS contractor

7. Serve as the primary regulatory point-of-contact for all natural resources-related issues on behalf of the 611 CES/CEIE

8. Review military construction project plans for compliance with laws and regulations related to the protection of natural resources at WIA

9. Ensure that all AF Form 813s are reviewed for impacts to natural resources at WIA

10. Provide technical review of all draft Public Announcements and Memoranda of Agreement for natural resources compliance at WIA

11. Ensure the INRMP is current, accurate, and in compliance with applicable laws and regulations

12. Review the ICRMP for consistency with the INRMP.

BOS Contractor

The WIA BOS contractor is also commonly referred to as the Installation Support Service contractor. The WIA BOS contractor provides support for many of the day-to-day needs of the installation population and transiting aircraft (e.g., food services, aircraft re-fueling, health services, fire suppression, emergency response, and spill response). The BOS contractor has an Environmental Manager and onsite Environmental Technician who run and operate the natural resources program in accordance with this INRMP and guidance from the 611 CES, Natural Resources PM. He or she shall have a solid understanding of the federal laws and regulations that govern the natural resources of the Atoll. The WIA BOS Environmental Manager/Officer

must also have an understanding of how and when to seek direction and guidance regarding natural resource management issues or concerns from the 611 CES/CEIE Natural Resources PM.

The BOS contractor shall:

1. Follow and implement this INRMP (per current Installation Support Service contract and AFI 32-7064)

2. Ensure that natural resources of WIA are protected from BOS contractor work order requirements and recreational activities

3. Conduct a newcomer's briefing at the arrival of all new visitors the WIA. Ensure that the WIA newcomer's briefing includes current and accurate natural resources information

4. Monitor the implementation of mitigation measures called out on all AF 813s, National Environmental Policy Act (NEPA) documents, and work plans and report measures that are not carried out and implemented as the 611 CES/CEIE Natural Resources PM intended

5. Ensure compliance with the Wake Island Operating Guidance for Environmental Compliance and the Protection of Natural Resources,and report any non-compliance to the 611 CES/CEIE Natural Resources PM per this INRMP (50 CFR part 665 Subparts E and F)

6. Ensure quarterly bird and turtle monitoring is conducted at WIA in accordance with the government-approved protocols as called out in this INRMP

7. Ensure coordination with the 611 CES/CEIE/Natural Resources PM has been done for all vegetation maintenance; coordination may include a field survey for the presence of nesting birds (see Sections 3.3.1 and 8.8 for further information on these field survey requirements).

2.5 INTEGRATION WITH OTHER PLANS

This INRMP is intended to be compatible with other WIA, Kōke`e AFS, and Mt. Ka`ala AFS planning documents. In preparing this document, other plans consulted included:

- Wake Island Operating Guidance, Environmental Compliance and Protection of Natural Resources (2017)

- Wake Island Fishing Log and Annual Data Collection Sheet (2016)

- Biological Control, Survey, and Management Plan for WIA, Kōke`e AFS, Kauai, Hawai`i and Mt. Ka`ala AFS, Oahu, Hawai`i (2015)

- WIA BASH Plan (2016)

- Wake Island Biosecurity Management Plan (2015)
- WIA ICRMP (2016)
- Mt. Ka`ala AFS and Kōke`e AFS ICRMP- Draft (2008).

The Wake Island Operating Guidance (**Appendix O**) was developed to provide guidelines and information to those who enjoy recreational activities at Wake Atoll, including recreational activites in the marine environments. This USFWS approved document establishes guidelines to support and maintain healthy recreational activities while protecting the Atolls' terrestrial and marine ecosystems for many years to come. Waters surrounding the Atoll are part of the Pacific Remote Islands Marine National Monument (PRIMNM) out to the seaward limit of the United States Exclusive Economic Zone, 200 nautical miles from the mean low water. In accordance with the establishment of the PRIMNM, the Secretary of the Interior, though the USFWS, has primary authority to manage all fishing-related activities between the mean low-watermark seaward to 12nm. The Secretary of Commerce, through NOAA, and in consultation with the Secretary of the Interior, shall within the Monument Expansion (12 – 200nm) have primary responsibility with respect to fishery-related activities regulated pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Pub. L. No. 94-265 (codified at 16 U.S.C. 1801-1884), as amended (2007) and any other applicable legal authorities in waters from 12 nautical miles to the boundary of the United States Exclusive Economic Zone at 200 nautical miles. It is the intent of the PRSC to assist these agencies in protecting the mission of the PRIMNM through the implementation and enforcement of the Wake Island Operating Guidance. The marine recreational guidelines established in the Wake Island Operating Guidance will be implemented until further instruction or updated regulations have been provided by the USFWS and NOAA. Component Plan A consists of the USFWS Wake Atoll Fisherman's Log Sheet, this system will track numbers of fishermen, gear types used, level of effort, and harvest information that will be collected and provided to the USAF, USFWS and NOAA. The collection and review of this data by the USAF and our regulatory partners (USFWS and NOAA) will ensure the Wake Atoll fishery is managed responsibly, impacts to sensitive species are avoided, and a quality fishing experience can be had now and into the future. Component Plan A also includes a USFWS developed spreadsheet titled "Wake Island Annual Fishing Data Collection Sheet"; the intent of this data sheet is to begin collecting information about the various marine related recreational activities at Wake Atoll.

The Biological Control, Survey, and Management Plan for WIA, Kōke`e AFS, Kauai, Hawai`i and Mt. Ka`ala AFS, Oahu, Hawai`i (**Component Plan B**) provides the results of invasive and non-native species surveys conducted on the three installations as well as a management plan to address those species. The Plan relates the methods and results of the invasive and non-native plant and animal surveys for each installation, presents information about the relevant invasive plants and animals, and provides general management methods and philosophies along with current management methods for each of the installations.

The purpose of the WIA BASH Plan (**Component Plan C**) is to minimize aircraft and pilot exposure to potentially dangerous bird/animal wildlife strikes in the local flying area of WIA.

The plan is based on hazards encountered at WIA from resident and seasonal bird populations, and other animals. The plan helps WIA management to properly identify existing hazards as they occur. Based on operational needs, Airfield management can assess associated risks, identify best practices to minimize/control those risks, and coordinate/advise local decision authorities and/or transient aircrews of current, real time bird/wildlife threats to aircraft operations. Recommended actions (advisories/restrictions) to enhance overall flight safety and mission support are provided based on the assessment of operational needs and the existing bird/wildlife safety threats (Chugach Federal Solutions, Inc. [Chugach] 2014).

The 2015 Wake Island Biosecurity Management Plan (**Component Plan D**) was created to guide the USAF in carrying out the responsibility for the prevention, rapid response, and control of non-native species on Wake Atoll. The spread of invasive species is now recognized as one of the greatest threats to the ecological and economic well-being of the planet according to the International Maritime Organization; the need and policies of biosecurity management will continue to evolve as global commerce, trade, and travel continue to exist and grow (International Maritime Organization 2015).

The ICRMPs for Wake Atoll, Mt. Ka`ala AFS, and Kōke`e AFS identify the cultural resources, including both historic architecture and archaeological resources at the installations. The ICRMPs identify the installation's mission and the mission impacts on cultural resources at each facility. Each ICRMP identifies general cultural resources management goals and objectives for the Installations to follow (USAF 2008b, 2008c). Similar to IRNMPs, ICRMPs are on a similar 5-year revision cycle. The Wake Atoll ICRMP was finalized in 2016, and the Mt. Ka`ala AFS and Kōke`e AFS ICRMPs are covered under a separate document which is expected to be finalized in 2017 (Draft ICRMP, Koke'e and Mt. Ka`ala Long Range Radar Sites, 2016).

It is important that the goals and objectives of the INRMP are consistent with other non-DOD planning documents, including the Hawai`i Comprehensive Wildlife Conservation Strategy (CWCS) (for Kōke`e AFS and Mt. Ka`ala AFS).

Congress asked each state to develop a wildlife action plan, known technically as a CWCS. The proactive plans examine the health of wildlife and prescribe actions to conserve wildlife and vital habitat before they become rarer and more costly to protect. The Hawai`i CWCS focuses on preventative measures and threat abatement. The major threats to Hawai`i's wildlife include habitat loss and degradation, invasive species introductions, excessive extractive uses, uneven compliance with existing laws, management constraints, and inadequate funding for research and management. Hawai`i's CWCS is a collaborative effort involving partners such as government agencies; non-profit organizations; universities; private landowners; researchers and scientists; community members; partnership initiatives; resource user groups such as hunters, recreationists, fishermen, and Native Hawaiians; and the public at large. Primary staffing and project management is provided by the Hawai`i DLNR and the University of Hawai`i Pacific Cooperative Studies Unit. Hawai`i's CWCS team developed advisory groups, conducted workshops and public meetings, and used a website as well as a mailing list to jointly develop its CWCS through a collaborative process. This approach to the overall planning and strategy development was chosen in the recognition that conserving and protecting Hawai`i's unique native wildlife and habitats for future generations is everyone's responsibility, duty, and honor

(Hawai`i DLNR 2013). The Hawai`i CWCS was acknowledged during the development of this INRMP and efforts were taken to be consistent with management strategies described.

3. INSTALLATION OVERVIEWS

3.1 LOCATION AND AREA

3.1.1 Wake Atoll

Wake Atoll

Wake is a small coral atoll in the Pacific Ocean (Micronesia) approximately 2,200 miles west of the Hawaiian Islands, 1,600 miles east of Guam, 2,000 miles southeast of Japan, and 690 miles north of Kwajalein Atoll. Wake Atoll lies at approximately 19˚17' 1.854" north latitude and 166˚39' 4.566" east longitude (World Geodetic System [WGS] 84). The Atoll has a total land area of approximately 2.73 square miles and a total circumference of approximately 10 miles. The Atoll consists of three islands (Peale, Wake, and Wilkes islands) arranged in a "V" pattern with a shallow lagoon that is open to the ocean on the northwest side (**Figure 3-1**).

Wake Island has four distinct areas of activity: the airport, the industrial area, downtown, and the Missile Defense Agency (MDA) area. The airport consists of a 9,850-foot (ft) runway, supporting taxiways, tarmacs, airport terminal, and various navigational aids. The industrial area includes aviation and Airfield maintenance shops, fire and rescue, aircraft fueling support facilities, Civil Engineering, and supply and warehouse buildings. Other industrial facilities in the area include offices, water collection, and distribution centers. The downtown area supports housing, cafeteria, laundromat, medical, retail, and recreational buildings. The MDA area supports a variety of testing and training mission-related equipment and infrastructure, which is primarily located within the southeastern region of Wake Island.

Welcome to Wake Atoll

3.1.2 Kōke`e Air Force Station

Kōke`e AFS is a radar tracking station of the 611th PRSC operated by the Hawai`i Air National Guard (HIANG). A nearby microwave antenna station (MAS), Kōke`e MAS, supports communications and is considered part of the installation for this INRMP. Kōke`e AFS is located in the northwestern quadrant of the island of Kaua`i, at approximately 22˚8' 53.281" north latitude and 159˚38' 42.713" west longitude (WGS 84). Kōke`e AFS includes 10.09 acres surrounded by forest and is within Kōke`e State Park on the Kahuama`a Flat of the Alaka`i Plateau. The main road into Kōke`e State Park passes immediately to the west of the installation and is used year-round by tourists, hunters, military personnel, and other state park visitors.

Looking northwest toward Kōke`e AFS

The Kōke`e MAS is located on a 1.25-acre triangular piece of land within Waimea State Park. The facility is bordered on its eastern side by Waimea Canyon Road (State Route 550) near Mile Marker 9, approximately 9.5 miles south of Kōke`e AFS (**Figures 3-2 and 3-3**). Except for the road, the site is surrounded by forest.

Looking south on Route 550 at Kōke`e MAS

3.1.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is a radar station that tracks air traffic throughout the Hawaiian Islands for both military and civilian purposes. The 611th PRSC is responsible for Mt. Ka`ala AFS. The 169th Aircraft Control & Warning Squadron HIANG is a tenant on the site.

Looking northeast from Mt. Ka`ala AFS

Mt. Ka`ala AFS includes 6.6 acres at the summit of Mt. Ka`ala, which is at the northern end of the Wai`anae Mountain Range. Mt. Ka`ala rises 4,025 ft above mean sea level and is the highest point on

O`ahu. The station is approximately 20 miles northwest of Honolulu and 17 miles northwest of Joint Base Pearl Harbor-Hickam. The site is accessed from a steep and winding road that starts in Waialua, on the north shore of O`ahu. Mt. Ka`ala AFS is located at approximately 21˚30' 27.761" north latitude and 158˚8' 31.962" west longitude (WGS 84) (**Figure 3-4**).

3.2 INSTALLATION HISTORY

3.2.1 Wake Atoll

No evidence of prehistoric cultural resources has been identified on Wake Atoll. The remoteness and lack of fresh water sources other than rainfall probably discouraged settlement of the Atoll by native Pacific populations (USAF 2008a).

Wake Atoll was discovered in 1568 by Spanish explorers and was then forgotten for more than 200 years. The Atoll was subsequently rediscovered in 1796 by British Captain William Wake and explored in 1841 by United States Navy Commander Charles Wilkes and naturalist Titian Peale. The Atoll was claimed by the United States in 1898, with formal possession established in 1899 for use as a trans-Pacific cable station.

The United States Navy was given jurisdiction over Wake Atoll in 1934 by President Franklin Roosevelt. Development of the Atoll did not commence until the following year when Pan American Airlines received permission to establish a seaplane refueling base on Peale Island. Pan American Airlines subsequently built a single-story hotel, rainwater catchments, and several other support buildings and structures to support its weekly trans-Pacific flight service.

Plans were developed in 1938 for an outlying military base on Wake Island; however, construction on the Atoll for a submarine and seaplane base by the United States Navy did not begin until January 1941. United States Marines arrived on the base in August 1941, along with a small naval contingent. The base was approximately 65 percent complete and supported a population of more than 1,700 civilian and military personnel, when the Japanese invaded and overran the island in December 1941. The island was occupied by Japanese forces for the remainder of World War II.

The Japanese continued the development of Wake Atoll during their occupation by constructing a runway, support buildings, and a defense system. Allied planes flew approximately 27 bombing missions on the islands during the occupation. Because of frequent bombing by the United States, many of the Japanese structures were constructed underground, or were embanked. The islands reverted back to American control in September 1945, after the Japanese surrender. The Atoll was again placed under the jurisdiction of the United States Navy.

In 1947, jurisdiction over the Atoll was passed from the United States Navy to the Civil Aeronautics Administration, which later became the Federal Aviation Administration (FAA). During that time, contractors for the Military Air Transport Services and later the Military Airlift Command provided service to transient USAF aircraft while at Wake Atoll. Pan American Airlines, Trans-Ocean Airlines, British Overseas Airline Corporation, and others reestablished commercial airline services, which lasted until 1972. A United States Coast Guard (USCG)

Station was also established on Peale Island after the war and was abandoned in 1971. Long-Range Aid to Navigation radar facilities were established by the USCG on Wilkes Island. During the height of post-World War II use of Wake Atoll, the island population was nearly 2,000 and an elementary school was constructed. The school and many of the houses used by the families have been torn down due to disrepair or as a result of asbestos problems. The development of long-range jet aircraft diminished the need for Wake Atoll as a refueling stop for commercial aircraft; and, in 1972, the FAA transferred jurisdiction of its facilities on the islands to the USAF. Military Airlift Command had responsibility for the islands from July 1972 to June 1973, at which time responsibility was transferred to the Pacific Air Forces (PACAF). The Atoll briefly served as a transit point and refugee camp for Vietnamese refugees in the 1970s.

Beginning with the United States Army's HAVE MILL project in 1974, Wake Island has been used for test missile launches. In 1987, as part of the Strategic Defense Initiative, the predecessor of the present-day MDA, Wake Island was selected as a test location for Project Starbird anti-missile defenses, with facilities located near Peacock Point. In 1994, the United States Army assumed administrative command of Wake Island to support further missile testing. The Army used Wake Island to test the Theater Missile Defense system in support of the Ballistic Missile Defense Organization's target and defensive missile systems. To support this mission, target missiles were launched from Wake Island and intercepted by defensive missiles launched from the United States Army Kwajalein Atoll. Missiles were not kept on the island, but were shipped there and launched for specific tests. In 1999, the Army's mission was further expanded to include liquid propellant target missile launches, which were used as targets for anti-missile interceptors (USAF 2008b). Previous environmental documents for these Army and MDA programs are listed below.

Related Environmental Documentation:

- Project Starbird Environmental Assessment, October 1987
- Wake Island Environmental Assessment, January 1994
- Wake Island Launch Center Supplemental Environmental Assessment, October 1999
- Ballistic Missile Defense Organization Cooperative-Engagement-Capability/Phased Array Tracking Radar to Intercept of Target (PATRIOT) Interoperability Test, July 2000
- Theater High Altitude Area Defense (THAAD) Pacific Test Flights Environmental Assessment, December 2002
- MDA Mobile Launch Platform Environmental Assessment, June 2004
- Minuteman III Modification Environmental Assessment, December 2004
- MDA Mobile Sensors Environmental Assessment, September 2005

- MDA Wake Island Supplemental Environmental Assessment, February 2007
- Flexible Target Family Environmental Assessment, October 2007
- Integrated Flight Tests at United States Army Kwajalein Atoll/Ronald Reagan Ballistic Missile Defense Test Site Environmental Assessment, July 2012
- Integrated Flight Test at Wake Atoll Enviornmental Assessment, May 2015.

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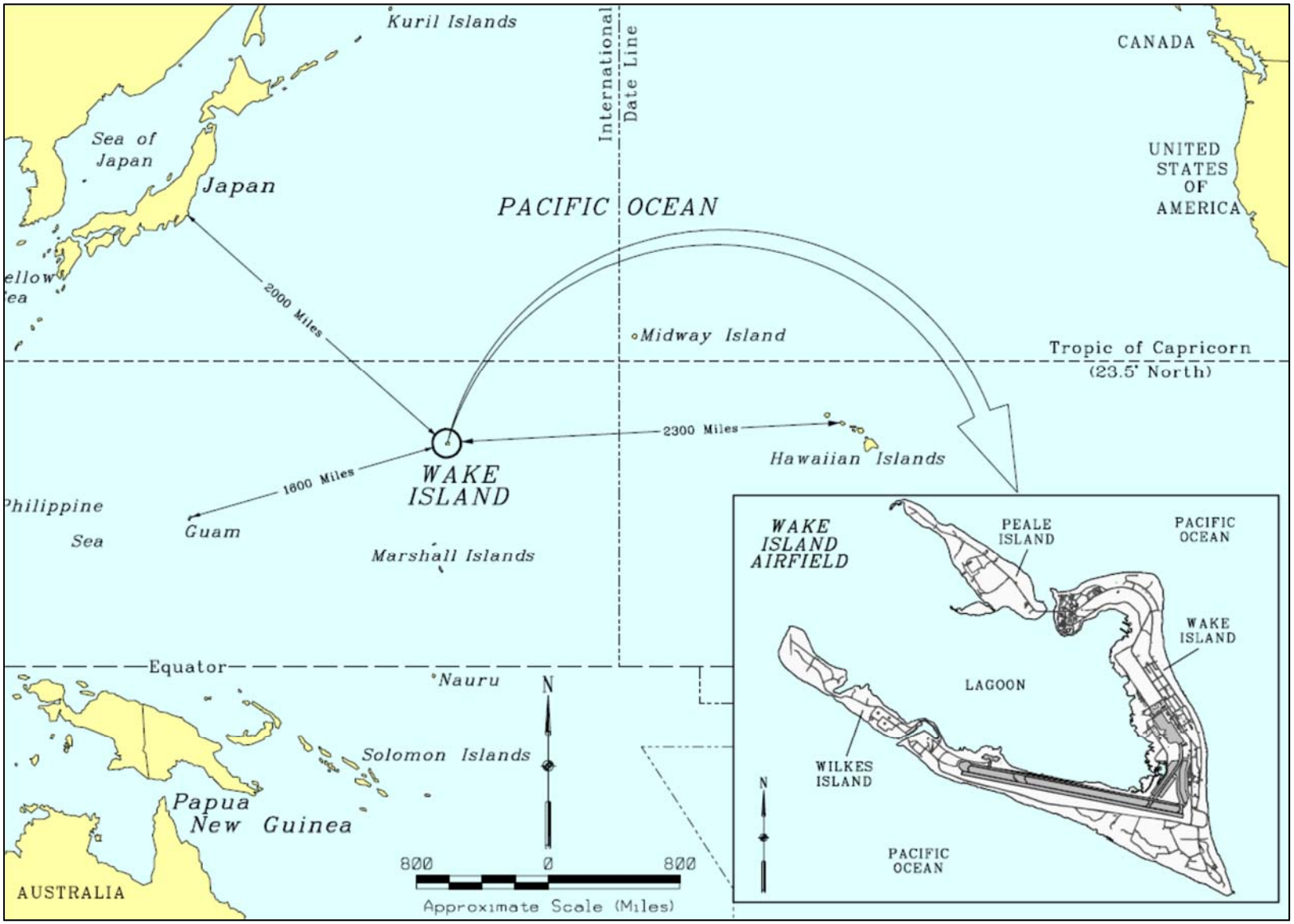
Figure 3-1. Location of Wake Atoll



Source: CH2M HILL in EA Engineering, Science, and Technology, Inc. (EA 2013a).

Figure 3-2. Location of Kōke`e Air Force Station

Figure 3-3. Location of Kōke`e Microwave Antenna Station

Figure 3-4. Location of Mt. Ka`ala Air Force Station

The United States Army operated the Airfield from 30 September 1994 until 1 October 2002, when the USAF resumed direct responsibility for island operations.

On 6 January 2009, President George W. Bush established the PRIMNM, which encompassed Wake Atoll, Baker Island, Howland Island, Jarvis Islands, Johnston Atoll, Kingman Reef, and Palmyra Atoll, and the surrounding waters up to 50 nautical miles. On 24 September 2014, the monument boundaries at Wake Atoll, Jarvis Island, and Johnston Atoll were extended out to 200 nautical miles from mean low water to encompass all submerged lands and waters out to the seaward extent of the United States Exclusive Economic Zone. However, terms of establishment specified that the Secretary of Defense shall continue to manage Wake Atoll according to the terms and conditions of an Agreement between the Secretary of the Interior and Secretary of the AF.

Presently, PRSC/Det 1 operates Wake Atoll. The installation functions in support of contingency deployments, serves as an emergency landing facility, provides fuel storage, and supports the needs of the DOD. Management of the day-to-day operations is currently under a BOS contract.

Wake Atoll is an unincorporated territory of the United States. EO 11048, Part I (Administration of Wake Island and Midway Island [Part 1-Wake Island]) (5 September 1962), designated the Secretary of the Interior responsible for the civil administration of the Atoll. The order gave the Secretary all executive, legislative, and judicial authority necessary for that administration. The Department of the AF became responsible for the civil administration of the Atoll on 24 June 1972 through a Memoranda of Agreement between the Department of the AF and the DOI. The Memoranda of Agreement is included in **Appendix D**. Because of its unique jurisdictional setting, only federal natural resource and wildlife protection laws apply to Wake Atoll. No state, territorial, or commonwealth natural resource or wildlife protection laws apply (USAF 2008a).

3.2.2 Kōke`e Air Force Station

Kōke`e AFS was temporarily used as a radar station during World War II and was returned to the (then) Territory of Hawai`i at the end of 1949. In 1958, PACAF asked the HIANG to construct two permanent Aircraft Control and Warning facilities at Kōke`e. Construction of the facilities began in August 1960, and was completed in early 1961. In March 1961, Det 1, 109th Aircraft Control and Warning Squadron moved from Punamano AFS at Kahuku, O`ahu, to Kōke`e AFS. In October 1961, the name of the squadron was officially changed to the 150th Aircraft Control and Warning Flight. The 150th Aircraft Control and Warning Flight was the only HIANG unit outside O`ahu, this unit is now referred to as the 169th Air Defense Squadron (ADS).

In 1963, in response to concerns voiced by the State of Hawai`i over potential conflicts with the development of the Kalalau lookout, for recreational purposes, the original 20.55 acres considered for the station was reduced to the present 10.09 acres. In 1984, the station lost 23 positions when the Hawai`i Regional Operations Control Center (HIROCC) (now the Hawai'i Regional Air Operations Center [HIRAOC]) was established at Wheeler Air Force Base (now Wheeler Army Airfield, and its mission changed to backing up HIROCC operations. In 1989, the mission was modified to add "day only" control capability.

3.2.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS was originally constructed and developed by the United States Army in 1944 as a Very High Frequency Radio Station and Base Camp. The installation was abandoned by the United States Army in 1948 and remained unused until 1962. Because of their similar needs for air traffic control, the FAA and HIANG agreed in April 1962 to develop the site jointly. The installation became fully operational for its current mission of providing detection and tracking of aircraft operating near the Hawaiian Islands in July 1965.

3.3 MILITARY MISSION

3.3.1 Wake Atoll

The mission of WIA is to provide support to contingency operations, emergency and planned diverts, and other missions as necessary for operations in the Pacific theater and beyond.

At present, the activities provided under the BOS contract include:

- Produce potable water and maintain the reverse osmosis systems
- Maintain and operate the fuel systems
- Maintain and operate electrical power generation and distribution
- Maintain food inventory and consumables—provide 2,100 hot meals per week with a surge capacity of 3,100 meals per week
- Provide support for up to 300 additional personnel
- Provide fire protection and emergency services
- Provide for Airfield and runway maintenance
- Maintain grounds, building, equipment, and vehicles
- Provide refuse collection operations where collected domestic/recycled waste is transported to the solid waste accumulation area
- Maintain all heating, cooling, and air conditioning systems
- Repair and maintain the electrical grid
- Maintain channel buoys in the marina
- Maintain long-range radios and other communications

- Provide services of a full-time, board-certified medical physician
- Implement biological monitoring
- Implement offshore and onshore biosecurity operations
- Implement the WIA BASH Plan.

In addition, to minimize potential for impacts to birds, the WIA BOS contractor Environmental Manager/Officer is required to conduct site surveys for nesting birds in areas awaiting vegetation maintenance. The project proponent is required to coordinate a site visit with the BOS contractor, Environmental Manager/Officer before proposed site vegetation maintenance occurs. The BOS Environmental Manager/Officer will gather at a minimum the following information:

- Location (Identified on a map)
- Vegetation description
- Photos of the project area
- Nesting information
- Description of the vegetation maintenance to occur and maintenance point-of-contact.

The BOS Environmental Manager/Technician then coordinates the information above with the 611 CES/CEIE Natural Resources PM for final approval and recordkeeping purposes.

The MDA utilizes Wake Atoll in a non-permanent capacity. The MDA was established to manage and integrate all missile defense programs and technologies into one Ballistic Missile Defense System (BMDS). MDA is responsible for developing and testing conceptual BMDS. Two of the priorities of missile defense are to: (1) defend the United States and its deployed forces, allies, and friends; and (2) employ a BMDS that consists of layers of defenses to intercept ballistic missiles in all phases of their flight (boost, midcourse, and terminal) against all ranges of threats (short, medium, intermediate, and long).

In 2014, the MDA conducted an Environmental Assessment to evaluate utilizing WIA and the surrounding Pacific Broad Ocean Area for conducting system-level flight tests that integrate multiple BMDS components. Potential MDA mission activities may include Aegis BMDS launches and interceptor missiles, and THAAD and PATRIOT elements. Short, medium, and intermediate range ballistic missile targets would be launched from a C-17 or similar aircraft and air-breathing drones would be launched from Gulfstream or similar aircraft. Short-range ballistic missile targets could also be launched from Wake Island.

Additionally, various sensors and other test assets may be used to collect and record critical test data to include employment of interceptor missiles (THAAD or PATRIOT or both from Wake and/or Aegis BMDS in the adjacent Broad Ocean Area); sensors (AN/TPY-2 [FBM] and

associated SATCOM/CDIN, HF radar, TTS, AEDC Optics, ELTS, etc.); and target missiles (ground launch from Wake and/or as a support area for air launch), noting that a particular integrated flight test would involve either interceptor launches or target launches from Wake, but not both.

The Integrated Flight Tests would demonstrate the integrated BMDS operational effectiveness against ballistic missile and air-breathing targets in an operationally realistic flight test. Land-based BMDS elements, such as THAAD and/or PATRIOT, would be located on Wake Island while the ship-based Aegis BMDS would operate in the Pacific Broad Ocean Area near Wake Island. These elements would engage appropriate ballistic missile and air-breathing targets and could launch interceptors to collide with and destroy the targets. Various fixed and mobile sensors and other test assets would be used to facilitate data collection and communications. MDA proposes to conduct Integrated Flight Tests starting in the fourth quarter of Fiscal Year (FY) 2015.

The MDA Environmental Assessment also evaluated supporting integrated flight test operations from Wake Atoll, rather than limit it to THAAD and Aegis. The decision would also include use of PATRIOT at Heel Point or Peacock Point (concurrent with THAAD), target launches from Wake, and AN/TPY-2 operations in the Peacock Point area near Building 1654. The proposed locations of MDA support facilities and 300-meter launch debris zones associated with the launch areas are shown in **Figure 3-5**. **Figure 3-6** shows the proposed location of the Radar Communications Site and the Radar Keep Out Zone.

The USAF Technical Applications Command also operates a remote monitoring station and deep-sea listening post on Wake.

Other non-DOD missions on Wake Atoll include the collection of seismic data by the United States Geological Survey and the University of Hawai`i at Manoa and operation of a remote weather station by NOAA to support regional forecasting.

3.3.2 Kōke`e Air Force Station

Kōke`e AFS is an air traffic detection and tracking site operated under the PRSC. The unit responsible for the facility is the 169 ADS of the 154$^{th}$ Air Wing, HIANG. The facility is operated by HIANG as part of the HIRAOC. Kōke`e AFS is one of two vital radar sites: Mt. Ka`ala AFS is the other, serving the HIRAOC based at Wheeler Army Airfield. The two facilities provide 24-hour surveillance information to the Hawaiian Air Defense Network, under the central organization of HIRAOC. Kōke`e AFS and Mt. Ka`ala AFS are responsible for detecting and tracking all aircraft operating in the Hawaiian Islands area. Data from Kōke`e AFS are routed by fiber optic to HIRAOC at Wheeler Army Airfield. The installation also provides assistance to military and civilian aircraft during emergencies. There are four tenant organizations at Kōke`e AFS: HIANG, USCG, FAA, and Department of the Navy.

3.3.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is also operated and maintained by the 169 ADS, HIANG. The facility is operated by HIANG as part of the HIRAOC. Mt. Ka`ala AFS is one of two vital radar sites; Kōke`e AFS is the other, serving HIRAOC. The two facilities provide 24-hour surveillance information to the Hawaiian Air Defense Network, under the central organization of HIRAOC. Kōke`e AFS and Mt. Ka`ala AFS are responsible for detecting and tracking all aircraft operating in the Hawaiian Islands area. Data from Kōke`e AFS are routed by microwave relay to Mt. Ka`ala, and then routed by microwave relay to HIRAOC. Radar data collected at Mt. Ka`ala AFS are shared with the FAA for normal traffic control use. Mt. Ka`ala AFS also provides assistance to military and civilian aircraft during emergencies.

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Figure 3-5. Proposed Locations of Missile Defense Agency Support Facilities

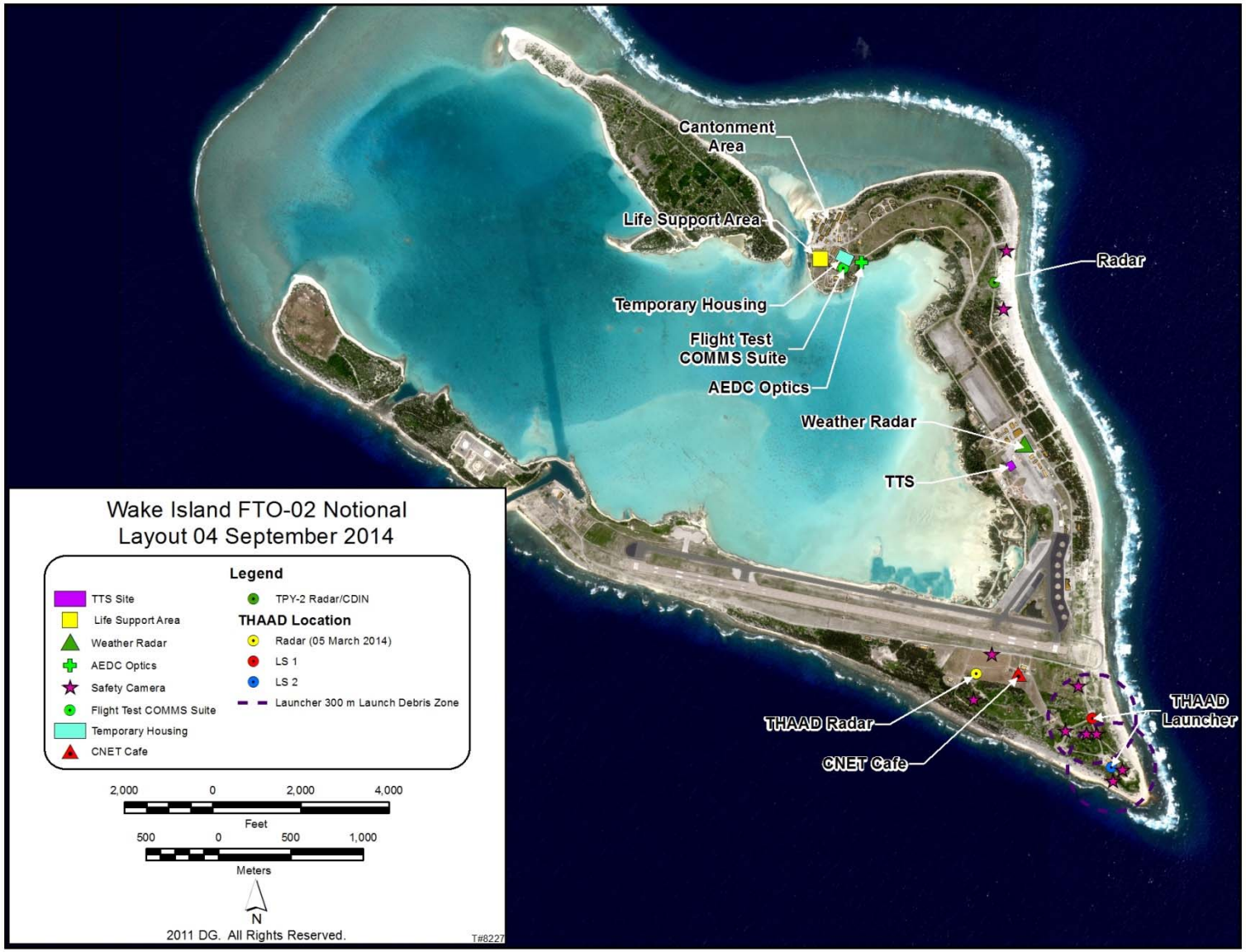
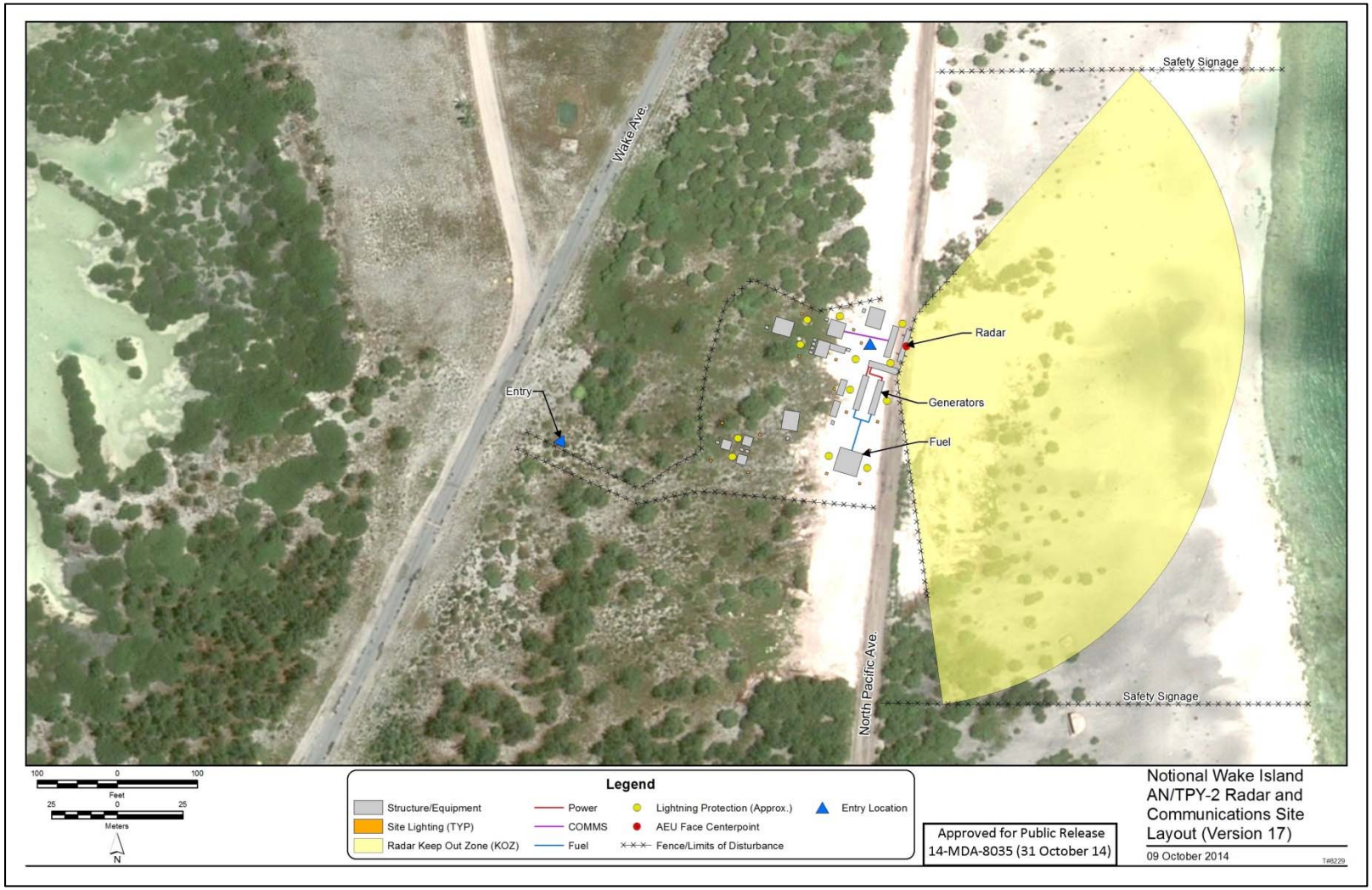


Figure 3-6. Proposed Radar Communications Site



3.4 SURROUNDING COMMUNITIES

3.4.1 Wake Atoll

There are no surrounding communities to Wake Atoll. Fewer than 100 personnel currently reside on Wake Atoll. Four of the personnel are active duty USAF assigned to Wake Atoll. This includes the Det 1 Commander, one contracting officer technical representative, and two contracting officer's representatives. The BOS contractor employs approximately 20 United States civilians in administrative and oversight positions. A majority of the population consists of Thai nationals who execute the majority of day-to-day work accomplished on the island.

3.4.2 Kōke`e Air Force Station

The community area associated with Kōke`e AFS is Kaua`i County. There are 22 communities associated with Kaua`i County; however, there are no permanent residences within several miles of the station. Therefore, the population and demographic information for Kōke`e AFS will be based on the 2012 Census data for the entire county. The use of Kōke`e State Park as a popular recreation and destination, particularly for hunting and hiking in the surrounding forests, has made the community familiar with the Kōke`e AFS.

The population of Kaua`i County was 68,434 in 2012 (United States Census Bureau 2013a). Of the 2012 population, 33 percent were Asian, 32 percent Caucasian, and 9 percent Pacific Islander. Eighty-nine percent of the Kaua`i County population was high school graduates, and 24 percent had a Bachelor's degree or higher level of education.

The labor force of Kaua`i County was 35,346 in 2012. Of this labor force, approximately 20 percent were employed in arts, entertainment, recreation, and accommodations and food service; and 13 percent were employed in education, health care, and the social assistance industry. Other industries of significant employment for Kaua`i County are retail, construction, and management (United States Census Bureau 2013b).

3.4.3 Mt. Ka`ala Air Force Station

The nearest residential areas, commercial establishments, or farms are 3-5 miles away on the lower slopes of the mountains. The surrounding communities of Mt. Ka`ala AFS are Makaha, Mā‘ili, Waialua, and Wai`anae. These areas are primarily rural and are not subject to as much military presence as some of the more urban communities. The public may be brought into contact with Mt. Ka`ala AFS as a result of its close proximity to the Mt. Ka`ala Bog area, which is a relatively well-known natural reserve area that is visited frequently by hikers.

The total population of the Mt. Ka`ala AFS surrounding communities was 34,803 in 2010 (United States Census Bureau 2010), which is nearly 2 percent of the population of the island of O`ahu. Of the surrounding communities, Wai`anae had the largest population and Waialua had the smallest population. The ethnic distribution of these areas was 24 percent Native Hawaiian or Other Pacific Islander, 18 percent Asian, and 14 percent Caucasian. Six percent of the Mt. Ka`ala AFS community areas' population did not speak English. Twenty-three percent of the

population was high school graduates, and 5 percent had a Bachelor's degree or higher level of education.

The labor force of the Mt. Ka`ala AFS community areas was 15,117 people (43 percent) in 2010 (United States Census Bureau 2010); only 1 percent was employed by the armed forces. Of the labor force, 18 percent were employed in educational, health, and social services; 11 percent were employed in art, entertainment, recreation, accommodations, and food service; and 10 percent were employed in retail trade. Only 2 percent of the community was employed in agriculture, forestry, or fishing.

3.5 LOCAL AND REGIONAL NATURAL AREAS

3.5.1 Wake Atoll

Wake Atoll is surrounded by the 200-mile United States Fishery Conservation Zone within which fishery resources are managed and regulated by the Western Pacific Regional Fisheries Management Council. The lagoon supports a large population of fish and the reefs have a diverse assemblage of reef fish.

On 6 January 2009, the PRIMNM was established. The National Monument includes Wake Atoll along with Baker, Howland, and Jarvis islands; Johnston Atoll; Kingman Reef; and Palmyra Atoll. Proclamation 8336 prohibits commercial fishing within the Monument, but gives the Secretary of Commerce, through NOAA, primary responsibility for managing fishery-related activities from 12 to 50 nautical miles from the islands. On 24 September 2014, the Monument boundaries at Wake Atoll, Jarvis Island, and Johnston Atoll were extended out to 200 nautical miles. The Department of the AF became responsible for the civil administration of the Atoll on 24 June 1972 through a Memoranda of Agreement between the Department of the AF and the DOI. The Memoranda of Agreement is included in **Appendix D**. Per Secretary of the Interior Order No. 3284, the DOI manages the areas surrounding Wake Atoll from the mean low water line out to 12 nautical miles as part of the National Wildlife Refuge System. The USAF manages the Atoll according to 32 CFR 935.1(b) which defines Wake as including"Wake, Peale, and Wilkes Islands, and the appururtenant reefs, shoals, shores, bays, lagoons, keys, territorial waters, and superadjacent airspace of them."

The DOI designated Wake Atoll as a National Historic Landmark in October 1985. Wake Atoll is recognized as one of the nation's most significant historic resources associated with World War II in the Pacific, and trans-Pacific aviation prior to the war.

3.5.2 Kōke`e Air Force Station

Kōke`e AFS is within Kōke`e State Park and is surrounded by many square miles of native forestland. The area surrounding Kōke`e AFS is visited by thousands of tourists annually and is also used by hunters for permitted hunting of pigs and goats. Kōke`e AFS is located on Waimea Canyon Road approximately 2.5 miles north of the Kōke`e Lodge and the Kōke`e State Park campground. There are also other privately maintained camps within the state park area. The Kalalau Lookout, which is a popular viewpoint and picnic area overlooking the Kalalau Valley

along the Na Pali coastline of Kaua`i, is located approximately 0.25 miles north of Kōke`e AFS. Kōke`e AFS is approximately 2 miles south of the north shore of Kaua`i.

Kōke`e MAS is in Waimea State Park on Waimea Canyon Road, which is the main access road to both Waimea State Park and the forests of Kōke`e State Park. The site is situated on the ridge to the west of Waimea Canyon, a deep canyon known as the "Grand Canyon" of the Hawaiian Islands. Trails and viewpoints into the canyon are located within 1 mile of the installation. The surrounding lands are also used for permitted hunting.

3.5.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is immediately surrounded by forests and shrub lands in the state-owned Mt. Ka`ala Natural Area Reserve (NAR). The reserve has native plant communities, including a rare montane 70-acre bog area near the mountain peak known as the Mt. Ka`ala Bog area, and associated native bird species. The Mt. Ka`ala Bog area has been designated a State Natural Resource Area by the Hawai`i DLNR. Beyond the natural reserve area are state forest reserves that include most of the upper elevations of the Wai`anae Mountains. Military lands of the Schofield Barracks Military Reservation lie approximately 2 miles to the east and southeast of Mt. Ka`ala AFS. Road access to the installation and to the Mt. Ka`ala NAR is restricted to authorized personnel only, although there are trails that lead up to the mountaintop and bog area from both sides of the Wai`anae Mountains. The nearest residential areas, commercial establishments, or farms are 3-5 miles away on the lower slopes of the mountains.

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4. PHYSICAL ENVIRONMENT

4.1 CLIMATE

4.1.1 Climate Change

Climate change is expected to play a significant role in DOD's ability to fulfill its mission in the future. The ecosystem effects of climate change will likely be incremental and challenging to distinguish and assess. Scientific research indicates that climate change will have long-term, irreversible, adverse consequences on natural resources, including terrestrial and aquatic habitats. Climate-related effects are already being observed at installations throughout the United States and overseas. The physical changes are projected to include rising temperatures, sea level rise and increases in both heavy downpours and the periods of drought. These changes could cause effects on Wake Atoll such as more rapid shoreline erosion causing changes to the configuration of the shoreline. Given a documented rate of sea level rise of 0.12 inches (in.) per year since 1992, physical changes in the marine and terrestrial environments of Wake Atoll are expected (NOAA 2014a). There has been an increase in the frequency of rogue waves in the recent past at Wake Atoll that might be related to climate change.

The 25 November 2013 revision of the INRMP Implementation Manual (DOD Manual 4715.03) requires that INRMPs address planning for climate change impacts to natural resources (DOD 2013a). The Instruction states that analysis to assess potential impacts of climate change should be predictive in nature, relying on models to plan for probable complex and indirect changes that are likely to happen in the future. Based on the assessments, natural resources management strategies to address climate change should be developed or improved.

By taking a proactive, flexible approach to vulnerability assessment and adaptation planning that recognizes uncertainty and incorporates the best available science, the USAF can keep pace with changing climate patterns and minimize their impact on Wake Atoll, Kōke`e AFS and Mt. Ka`ala AFS operations. Models are currently the only way to project future changes for the installations, and to evaluate needed research, data collection, and potential management strategies. This will require an adaptive process of developing, validating, and improving forecast models to develop new and improved existing natural resources management strategies to address global climate change impacts to natural resources and protected species and species of concern. **Section 8.18** provides management actions to conduct vulnerability assessment on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS to support development of climate change management strategies for natural resources on the three installations.

4.1.2 Wake Atoll

The climate of Wake Atoll is tropical maritime. Northeast trade winds dominate the island and winds blow steadily throughout the year with little variation. More than 50 percent of wind observations taken during the year are from the east to the northeast. The yearly average wind speed is 13.8 miles per hour (USAF 2008a).

Temperature variation on Wake Atoll is minimal with a yearly maximum of 95 degrees Fahrenheit (°F) (35 degrees Centigrade [°C]) and a minimum of 68°F (20°C). Relative humidity ranges from 69 to 80 percent. Mean monthly temperatures range from 76°F (24.4°C) to 83°F (28.3°C). February, the coldest month of the year, has an average daily high of 82°F (27.7°C) and an average daily low of 72°F (22.2°C). August is generally the warmest month with an average daily high of 88°F (31.1°C) and an average daily low of 77°F (25°C). Dense polar air masses occasionally push southward through the region during the winter months. The record low temperature of 64°F (17.8°C) for Wake Atoll was recorded in December 1954 during one of these events.

Rainfall is light averaging only about 35 in. per year (Weatherbase 2015). Rain showers occur most often between midnight and sunrise. The wettest season is from July through October. This coincides with the Pacific typhoon season. During this period, rainfall can be significant during storm episodes. Cloud cover is reported to be about 50 percent, but clouds are heaviest during the late summer and early fall typhoon season, when cumulus clouds predominate.

4.1.3 Kōke`e Air Force Station

Precipitation and temperature records from the weather station nearest to Kōke`e AFS in proximity and elevation were collected to characterize climatic conditions at the station. This station is located approximately 1.7 miles southwest of the AFS at the Kōke`e State Park ranger station. The estimated annual precipitation at Kōke`e AFS is 69 in. In contrast, the annual rainfall at Mt. Waialeale, which is 10 miles from Kōke`e AFS, has an average annual rainfall of 480 in. Mt. Waialeale has the world's highest recorded average annual rainfall. Temperatures at Kōke`e AFS average about 55°F in January and 64°F in August.

4.1.4 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is located in a tropical montane forest setting typical of the higher windward elevations of O`ahu. The closest climate station with long-term records is approximately 2 miles south of the installation. Climate conditions can vary strongly over short distances in the Wai`anae Range, so accurate climate data for Mt. Ka`ala AFS is not available. The climate at Mt. Ka`ala AFS is mild but rainy. The available information suggests that mean annual rainfall in this area is almost 92 in. Historically, December is the wettest month. Actual (but unmeasured) precipitation is thought to be higher due to frequent heavy condensation on vegetation (fog drip).

4.2 LANDFORMS

4.2.1 Wake Atoll

Wake Atoll is a typical coral atoll. An atoll is a ring-like coral island enclosing a lagoon. Atolls originate from oceanic volcanoes that rise above the ocean surface. Deflation of the magma chamber and subsidence and erosion, over time, reduces the extent of the volcanic cone and allows coral communities to develop around the edges. When the subsidence rate is relatively slow (and about equal to the rate of coral growth), the coral continues to flourish. As the cone

subsides beneath the surface, the associated coral reef remains surrounding the location of the former volcanic crater. The crater, now represented by a lagoon, may have one or more coral islands established on the former rim around the crater.

Wake Atoll is collectively comprised of three islands: Peale, Wake, and Wilkes islands (**Figure 3-1**). The three islands enclose the shallow lagoon on three sides. The three islands form a "V" or "wishbone" shape pointed to the southeast. Wake Island is the largest of the three islands and comprises the outer perimeter of the eastern half of the Atoll. Peale and Wilkes islands continue the length of the wishbone's "arms" on the north and south, respectively. The natural channel between Wilkes and Wake islands is currently blocked by a solid fill causeway. The channel between Peale and Wake islands was spanned by a concrete causeway constructed by the occupying Japanese forces during World War II, and later a wooden bridge (now burned down). The lagoon is open on its northwestern end, except for the coral reef that surrounds the Atoll and completes the lagoons enclosure.

The islands have an average elevation of 12 ft and a maximum elevation of 21 ft above mean sea level (amsl). The outside, seaward face of Wake Island maintains a fairly uniform elevation of approximately 18 ft, with a gradual slant toward the center of the island and then to the lagoon (USAF 2008a). Each of the islands is characterized by fairly level terrain. However, the excavation of World War II tank traps and other defensive trenches on Wilkes and Peale islands has resulted in some localized rugged terrain. There are three high points on the Atoll, each exceeding 20 ft: on the northern tip of Wake Island at Heel Point; on Peale Island about 500 yards from Toki Point, which is at the northwest tip of the island; and on Wilkes Island on the lagoon side about 750 yards from Kuku Point, which is at the northwest tip of the island (USAF 2008a).

Collectively, the three islands include approximately 1,747 acres. Each arm of the "wishbone" is approximately 4 miles in length, and combined they measure nearly 9 miles from tip to tip. The widest point of the Atoll is 2 miles, measured between Heel Point and Peacock Point on Wake Island. The Pacific shoreline and lagoon shoreline combined measure nearly 25 miles (USAF 1994b).

Broad coral-cobble beaches occur along the northern seaward sides of Peale and Wake islands. The beaches range in width from 20 to about 170 yards, with an average width of 100 yards. Mobile limestone cobbles contacting weathered ancient coral heads have created a relatively smooth pavement in the intertidal zone. Natural sandy terraces and embankments exist only in limited locations. The most notable sandy terraces and embankments occur along the northern coast of Peale Island and the western and northwestern shores of Wilkes Island. Some pristine white sand beaches occur on the lagoon side of Peale Island.

4.2.2 Kōke`e Air Force Station

Kōke`e AFS lies on the Kahuama`a Flat of the Alakai Plateau, a gently eastward-sloping plain at an elevation of approximately 4,200 ft amsl (**Figure 4-1**). The station is situated on a knoll that rises approximately 40 ft from the lower portions of the installation. The station is surrounded by forest.

Kōke`e MAS is at an elevation of 2,900 ft amsl (**Figure 4-1**). On the northern and western sides, the terrain drops steeply. The southern side descends more gently toward a small gully, while the east side borders Waimea Canyon Road (State Route 550).

4.2.3 Mt. Ka`ala AFS

Mt. Ka`ala AFS is located on a small flat area at the summit of Mt. Ka`ala, in the Wai`anae Mountain Range, the highest point on the island of O`ahu (elevation approximately 4,020 ft amsl). The terrain within the installation boundary is relatively even, but steep slopes fall away from the installation on three sides (**Figure 4-2**).

4.3 GEOLOGY AND SOILS

4.3.1 Wake Atoll

The ground surface on Wake Atoll is composed of disintegrated coral interspersed with coral cobble. A typical pedogenic profile consists of sand, shells, coral, and limestone that are often intermixed. The substrate is coarse-grained and almost completely composed of calcium carbonate and is droughty and desiccating to plants. Fertility is very low due to the lack of essential nutrients and organic matter. Soil formation processes are precluded by high winds, high waves, and localized inundation of the atoll. As a result, soil formation on Wake Atoll is minimal.

4.3.2 Kōke`e Air Force Station

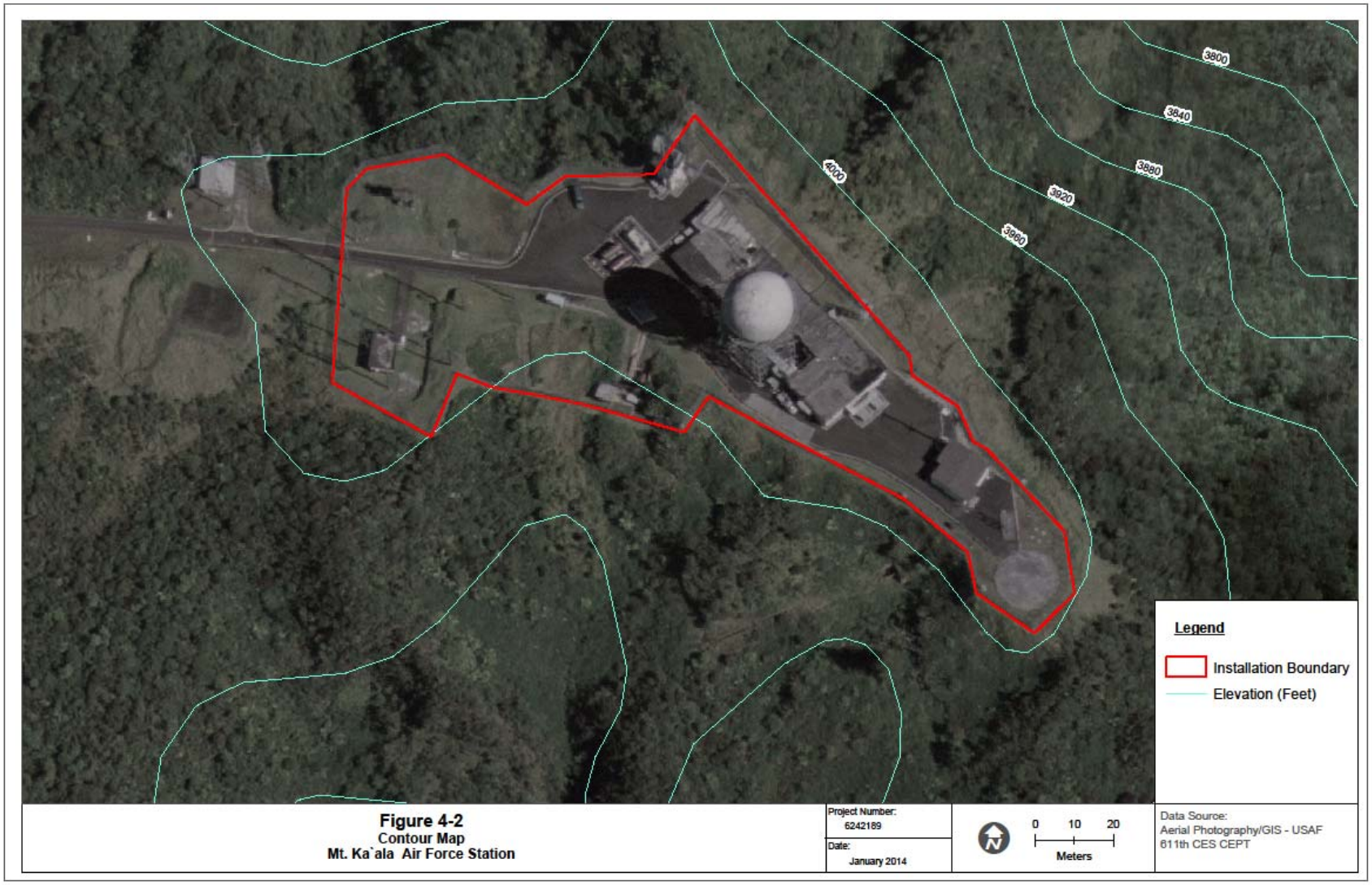
Kōke`e AFS is underlain by rocks of the Napali formation in the Waimea Canyon Volcanic Series. The typical Napali column is a sequence of repeated thin flows of basalt 2,700 ft or more in thickness that accumulated on the flanks of the Kaua`i shield volcano. Rocks have weathered in place, forming thick saprolitic soils with occasional rock outcrops in the gully walls.

Two phases of the Kōke`e soil series occur on, and adjacent to Kōke`e AFS: Kōke`e silty clay loam, 0-35 percent slopes; and Kōke`e silty clay loam, 35-70 percent slopes. The Kōke`e series consists of deep, well drained upland soils that formed in material weathered from basic igneous rock, probably with some additions of volcanic ash and/or ejecta. Runoff is medium to rapid depending on slope, and permeability is moderately rapid. Depth to soft weathered rock ranges from 28 to 56 in. Depth to bedrock ranges from 40 to 60 in. (United States Department of Agriculture [USDA]-Natural Resources Conservation Service [NRCS] 2013). **Figure 4-3** depicts soils mapped on Kōke`e AFS.

Soils at Kōke`e MAS are mapped as Mahana silt loam, 20-35 percent slopes. There is a small area of rough and broken land mapped on the south central boundary of the site. The Mahana series consists of very deep, well drained upland soils that formed in material weathered from volcanic ejecta, basic igneous rocks, and volcanic ash. Runoff is slow to very rapid depending on slope, and permeability is moderately rapid (USDA-NRCS 2013). **Figure 4-3** also depicts soils mapped on Kōke`e MAS.

Figure 4-1. Contour Map for Kōke`e Air Force Station and Kōke`e Microwave Antenna Station

Figure 4-2. Contour Map for Mt. Ka`ala Air Force Station



4.3.3 Mt. Ka`ala Air Force Station

O`ahu consists of two volcanoes: the older Wai`anae volcano and the more easterly Ko`olau volcano. The area around Mt. Ka`ala AFS is within lava flows and vent deposits associated with the Kolekole member of the Pliocene aged (2.5-5.3 million years ago) Wai`anae Volcanics. The Kolekole member consists of alkali basalt lava flows and cinder deposits containing olivine phenocrysts (large embedded crystals) and common fragments of gabbro, pyroxenite, and dunite. Plagioclase fragments are also locally abundant (Sherrod et al. 2007).

Two soil mapping units occur on Mt. Ka`ala AFS including the Alakai mucky peat, 0-30 percent slopes; and the Tropohumults-Dystrandepts association. The Alakai series consists of deep, very poorly drained soils that formed in organic material overlaying clay weathered from basalt on uplands on O`ahu. Runoff is slow and permeability is slow to moderately slow below the muck layer (USDA-NRCS 2013). The Alakai mucky peat supports a unique bog ecosystem (USAF 2007). Tropohumults occur on narrow ridge tops and are well drained and strongly acidic to extremely acidic. Dystrandepts occur on steep side slopes and narrow ridge tops, are well drained, and are medium to strongly acidic (USDA-NRCS 2013). **Figure 4-4** depicts soil types for Mt. Ka`ala AFS.

4.4 HYDROLOGY

4.4.1 Wake Atoll

4.4.1.1 Groundwater

Due to Wake Atoll's small area, flat topography, and substrate, groundwater resources are extremely limited. Shallow brackish groundwater lenses occur in the highly permeable sands. Any fresh rainwater that infiltrates into the permeable substrate is less dense than the underlying brackish groundwater and remains segregated on top of the brackish water. Freshwater runoff in developed areas (runways, rooftops, roadways, and side) tends to drain rapidly into the lagoon or the Pacific Ocean. As a result, groundwater on the Atoll is brackish and non-potable.

4.4.1.2 Surface Water

The lagoon covers approximately 1.5 square miles in area. The lagoon is shallow and averages 10 ft in depth, but ranges from 1 to 12 ft in depth depending on the tidal condition. Depths at the mouth of the lagoon are around 15 ft. The lagoon includes an intertidal zone of reefs with rocky or coral substrate and large areas of sandy bottom. Water in the lagoon is often turbid due to the ocean and tidal currents mixing the sediments.

Deep water surrounds the entire Atoll. Inside the lagoon, the mean tide range is approximately 1.5 ft (DOI 2014). Low tides have a stand of 2-3 hours (DOI 2014). Tidal flow through the lagoon has been disrupted as the result of historical activities conducted at the Atoll. The solid fill causeway connecting Wake with Wilkes Island completely obstructs any natural flow. Re-contouring of the shoreline has likely caused the currents within the lagoon to shift. Based on *Notes on the Geography and Natural History of Wake Island* compiled by E.H. Bryan in

1959, the Tangier Expedition recorded depths of up to 15 ft in the lagoon in 1923 (Bryan 1959). Individuals stationed on Wake Island in the 1970s and 1980s indicated that large expanses of living coral occurred in the lagoon, along with a diverse assemblage of invertebrates and fishes (USAF 2008a); the lagoon can no longer be qualitatively described in such a manner.

Bathymetric surveys of the Wake Lagoon have not been conducted. Sparse soundings were conducted by NOAA (National Geophysical Data Center [NGDC] NOAA 2010). The NGDC of NOAA developed digital elevation and bathymetry models for Wake Atoll in 2009. NGDC developed a methodology to convert satellite image ocean color to estimate bathymetric depths in the lagoon.

Based on the modeling, the lagoon ranges in depth from less than 1.5 ft to about 6.5 ft in the eastern half of the lagoon and from approximately 6.5 ft to over 15 ft at its mouth in the western half of the lagoon (NGDC NOAA 2010).

4.4.2 Kōke`e Air Force Station

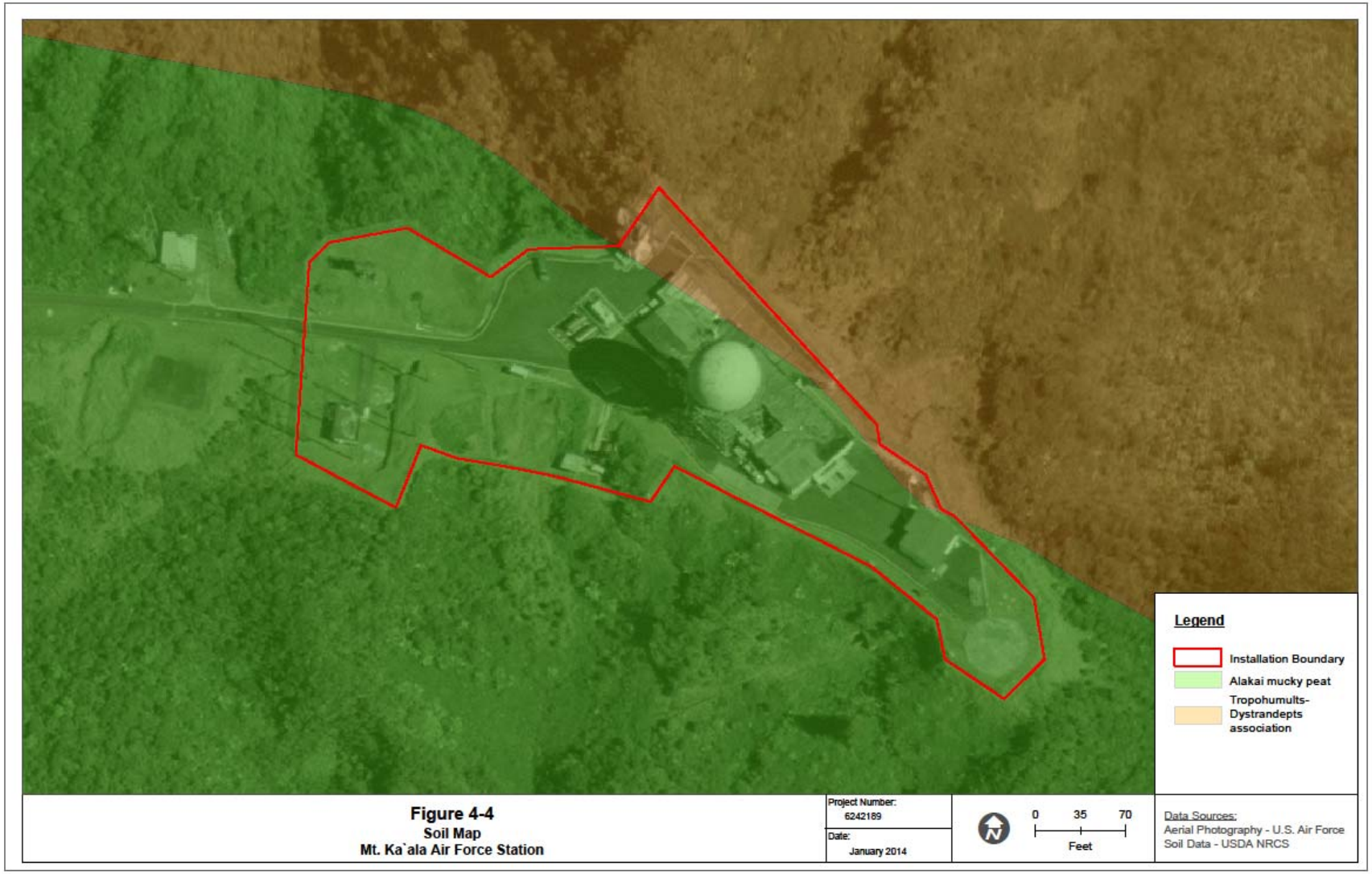
Runoff on Kōke`e AFS is rapid due to steep slopes. There are no streams or surface water features on the site.

4.4.3 Mt. Ka`ala Air Force Station

There are no streams or permanent surfaces water features on Mt. Ka`ala AFS (USAF 2007). Mt. Ka`ala AFS is at the peak of Mt. Ka`ala and the boundaries of three watersheds meet at the installation. The Mt. Ka`ala Bog is immediately adjacent to the installation on its southwestern boundary.

Figure 4-3. Soil Map for Kōke`e Air Force Station and Kōke`e Microwave Antenna Station

Figure 4-4. Soil Map for Mt. Ka`ala Air Force Station



5. ECOSYSTEMS AND THE BIOTIC ENVIRONMENT

5.1 ECOSYSTEM CLASSIFICATION

5.1.1 Wake Atoll

To aid in implementing ecosystem management, hierachical systems using ecological principles can be used for classifying the world's lands and oceans. Using a bioclimatic approach, Bailey (1989) classified the world's ecosystems. Under Bailey's (1995) oceanic classification system, Wake Atoll lies within the Trade Winds Division of the Tropical Domain. With the small size of Wake Atoll, it gets lost in the broad Trade Winds Division and the system provides little insight into the ecological dynamics that shape the biota of the Atoll. Recently Spalding et al. (2007) presented another hierarchal marine ecoregion classification system that is somewhat more sophisticated than earlier efforts. Under this hierarchy, Wake Atoll lies within the Eastern Indo-Pacific Realm; Marshall, Gilbert, and Ellis Islands Province; and the Marshall Islands Ecoregion.

Using the concepts of island biogeography proposed by MacArthur and Wilson (1967), the variety of biota, both flora and fauna, to be expected on Wake Atoll is a subset of all of the terrestrial species occurring within the Marshall Islands Ecoregion. To a large degree, the variety of naturally occurring, or indigenous, species that might be expected is:

- Directly proportional to the size of the island
- Indirectly proportional to the distance to the nearest mainland
- Indirectly proportional to the distance between islands.

Essentially this says that the smaller and the further the island is from the mainland and other "stepping stones," the fewer number of species will naturally occur. In reality, the vast oceanic distances severely limit the type and number of species that can survive the journey to such remote locations (Rauzon 2001).

Waters surrounding Wake Atoll are included in the PRIMNM (**Figure 5-1**). The PRIMNM was established in January 2009 and, at that time, incorporated approximately 86,888 square miles within its boundaries, which extended 50 nautical miles from the mean low water lines of Howland, Baker, and Jarvis islands; Johnston, Wake, and Palmyra atolls; and Kingman Reef. On 24 September 2014, the Monument boundaries at Wake Atoll, Jarvis Island, and Johnston Atoll were extended out to 200 nautical miles. This extended the area within the Monument to 490,000 square miles. The PRIMNM comprises the most widespread collection of coral reef, seabird, and shorebird protected areas under a single jurisdiction. This Marine National Monument is managed by USFWS in consultation with NOAA. Per Secretary of the Interior Order No. 3284, the DOI manages the areas surrounding Wake Atoll from the mean low water line out to 12nm. The Secretary of Commerce through NOAA, and in consultation with the Secretary of the Interior, has primary responsibility with respect to fishery-related activities (from 12 – 200 nm) regulated pursuant to the MSA, Pub L.No. 94-256 (codified at16 U.S.C. 1801-1884), as amended (2007) and any other applicable legal authorities.

5.1.2 Kōke`e Air Force Station

Kōke`e AFS lies within the Pacific Islands Ecoregion. The Pacific Islands Ecoregion includes Hawai`i, Guam, American Samoa, Northern Mariana Islands, Palau, Micronesia, and the Marshall Islands. Coral reefs that provide a large diversity of habitat types for many species were developed by volcanoes and earthquake areas that surround the rim of the Pacific Ocean.

5.1.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS also lies within the Pacific Islands Ecoregion as described above under Kōke`e AFS.

5.2 VEGETATION

5.2.1 Historic Vegetative Cover

5.2.1.1 Wake Atoll

The environmental conditions conducive to developing complex and varied plant associations are lacking on Wake Atoll. The lack of soils, soil nutrients, and organic matter is made more inhospitable by rapid drainage through the porous calcareous substrate in undeveloped areas. With minimal topographic relief, there is little opportunity for the development of microclimatic conditions. High temperatures and limited rainfall keeps the island in a perpetual state of drought. An average annual rainfall of 35 in. (Weatherbase 2015) provides little drought relief. Combined with harsh ambient environmental conditions, the natural vegetation of Wake Atoll has been subjected to some extreme human disturbance as well as periodic natural disturbances.

Human disturbance reached a peak during the 3 years of Japanese occupation beginning in December 1941. During that period, pre-existing American fortifications were greatly expanded by the Japanese leaving scarcely any of the ground untouched. Ditches, tank traps, platforms, ruined buildings, gun emplacements, revetments, and underground facilities were nearly everywhere. Frequent bombardment by American planes and occasionally ships further ravaged the landscape. Starving Japanese soldiers consumed any edible plant materials. A few years after the war, Fosberg (1959) mentions a personal source who reported that the vegetation over the island was generally about a foot high in 1947, with the exception of a few small areas. Fosberg (1959) also described the pisonia (*Pisonia grandis*)/cordia (*Cordia subcordata*) forest as "the most stable and mesophytic vegetation type" on Peale Island in 1953. However, he returned in 1969 to find that almost the entire vegetation type had succumbed to the "overzealous use of a bulldozer" (Fosberg and Sachet 1969). In a few nearby areas, only clumps of "fairsized" pisonia and cordia trees remained. Other vegetation noted by Fosberg (1959) included casuarina (*Casuarina equisetifolia*). On Wake Atoll, Fosberg (1959) reported that casuarina "were doing well around the Transocean Air Lines Compound and buildings elsewhere" in 1953. In the 1970s, casuarina was extensively planted (both as an ornamental and for purposes of forming wind breaks) in the former housing area of Wake Island (USAF 2008a).

Figure 5-1. Location of the Pacific Remote Islands Marine National Monument on Wake Atoll

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The conditions at Wake Atoll are fairly typical of the coral atolls of the Marshall, Ellis, and Gilbert islands province in the western Pacific. These conditions lead to a set of predictable natural plant communities from one atoll to another. The frequent occurrence of tropical storms and typhoons subjects the Atoll to a regime of frequent and often devastating disturbances. The low elevation makes the Atoll very susceptible to damage from high winds and waves generated by tropical storms. In the 43-year period between 1952 and 1994, at least 19 typhoons occurred within 100 nautical miles (about 115 statute miles) of Wake Atoll (Hitchcock 1996). In 1992, two typhoons caused extensive damage to the base infrastructure. Heavy damage occurred again with high wave action from a typhoon in July 1994 and high water from a tsunami in February 1998 (Space and Missile Defense Command [SMDC] 1999). Super typhoon Ioke in August 2006 not only damaged base infrastructure but also dramatically thinned out the vegetation by stripping leaves and terminal branches of casuarina and tournefortia *(Tournefortia argentea*) trees and completely washed over the northern end of Peale Island uprooting almost all vegetation.

5.2.1.2 Kōke`e Air Force Station

The past and current regional vegetation surrounding Kōke`e AFS is diverse mesic forest. This forest type is typically found in lowland (<5,000-ft elevation), moist or mesic environments where annual rainfall is between 50 and 100 in. This plant association is extensive in Kōke`e State Park and also in the Wai`anae Mountains on O`ahu. This vegetation type generally has a diversity of tree species, none of which is dominant (Gagne and Cuddihy 1990); however, `ōhi`a (*Metrosideros polymorpha*) was the most common tree in the vicinity of Kōke`e AFS (EA 1996). Kōke`e MAS is surrounded by koa (*Acacia koa*) forest on the northern, western, and southern sides. This forest type is dominated by koa, with subdominants including `ōhi`a, silk oak (*Grevillea robusta*), and black wattle (*Acacia mearnsii*).

5.2.1.3 Mt. Ka`ala Air Force Station

The historic vegetation in the area of the installation can be presumed to have resembled the regional vegetation, which is `ōhi`a wet forest. This native plant community has also been referred to as a cloud forest since it occurs in the cloud zone. High rainfall, daily cloud cover, acid soils, low temperatures, and exposure to the trade winds are typical of this environment. The low-statured forest (6-10 ft tall in most places) is characterized by gnarled, spreading, many-branched trees and a well-developed shrub layer. Epiphytic and terrestrial mosses, liverworts, ferns, and smaller vascular plants are abundant. `Ōhi`a is the dominant tree species. Scattered through this low forest are somewhat taller trees, `ōlapa (*Cheirodendron trigynum*), and lapalapa (*Cheirodendron platyphyllum*). The shrub layer is dense and includes species such as the Hawaiian holly (*Ilex anomala*); kanawao (*Broussaisia arguta*), a member of the hydrangea family; the anise-scented alani (*Melicope clusiifolia*); a native blueberry, the `ōhelo kau la`au (*Vaccinium calycinum*); and Maui mirrorplant (*Coprosma ochracea*), a member of the coffee family. The ground is covered by a dense, spongy layer of mosses and liverworts with scattered clumps of ferns, such as `akōlea (*Athyrium microphyllum*) and Hawai`i teinsorus fern (*Diplazium sandwichianum*), and heads mākole (*Coprosma granadensis*), a creeping herb with colorful orange-red berries.

5.2.2 Current Vegetative Cover

5.2.2.1 Wake Atoll

The harsh climate, inhospitable substrate, and regime of frequent, catastrophic disturbance combine to maintain the natural vegetation in an early successional stage. Ecologically, each of the indigenous species can be considered a pioneer species with broad ecological tolerance for high salinity, droughty conditions, and frequent disturbance. Three natural plant associations can be described on the unimproved grounds of Wake Atoll based loosely on a moisture gradient. The most xeric, or driest, is the tournefortia forest that occurs on coral rubble and shell substrates. Slightly more mesic conditions support the cordia forest. The hydric association of pemphis (*Pemphis acidula*) scrub is found on saturated sandy substrates. Other common vegetative communities include casuarina forest, ruderal vegetation, and mowed/maintained vegetation.

Tournefortia is the most widespread of the native trees on the Wake Atoll. Mature trees seldom exceed 20 ft in height. Tournefortia is usually the first woody plant to occur on the cobble beaches of the windward, northeastern sides of Peale and Wake islands. They appear to thrive in some of the least fertile, most xeric conditions on the Atoll. Along the beach, they often occur as neatly rounded shrubs reaching 3-6 ft in height. In these locations, especially along the northeastern coastline, they often occur in association with caevola (*Scaevola sericea* var. *taccada*). Inland, where there is some shelter, tournefortia forms open, almost pure stands. This is especially true on Peale Island where most of the central portion of the island is fully forested. In these locations, cordia is a common associate, especially in the slightly lower areas where the remnants of Japanese World War II defensive structures are still evident. Presumably, these somewhat lower areas accumulate some organic matter and may retain some moisture.

Cordia is a small to medium sized tree native to the Pacific that grows to an average of 23-33 ft. This tree prefers warm coastal areas on the leeward side of islands, but can tolerate semi-moist inland areas. Cordia has made a comeback on Peale Island since being bulldozed in the 1960s.

Pemphis is a closely branched shrub with very hard wood. It is the predominant species lining the lagoon margin on Wake, Wilkes, and Peale islands. It is also the dominant species lining the open brackish ponds on the golf course, behind the petroleum, oil, and lubricants (POL) area, and the detention basin at the northeastern end of the flightline. A well-developed community is likewise present around the wetland areas of Wilkes Island. The pemphis scrub is best developed on the saturated sandy substrates of the lagoon margin; however, it persists inland on the drier sandy flats that adjoin the lagoon; along the edges of the brackish ponds, it again occupies the saturated zone immediately adjacent to the open water. The most common associate is seaside purslane (*Sesuvium portulacastrum*). Seaside purslane is a prostrate, mat-forming, fleshy plant. It is visually striking with glossy green leaves and bright red stems. It is common along the saturated zone of the lagoon on all three islands and the edges of the brackish ponds on Wake and Wilkes islands.

Casuarina forests on the islands are typically associated with a minimal understory and ground layer. Casuarina is well-adapted to the austere substrate conditions of tropical atolls and once

introduced can be an aggressive invasive plant. It tends to crowd and shade out native vegetation. It has allelopathic properties so it is able to prevent seed germination of other species. As a result, the casuarina forest rapidly progresses toward being a monoculture. Casuarina forests are characterized by low species richness and diversity. While they provide nest sites for arboreal nesting birds, they preclude the ground nesting sooty terns (*Onychoprion fuscatus*) and gray-backed terns (*Onychoprion lunatus*). Where casuarina invades sandy beaches, their dense root structure prevents sea turtles from digging burrows (USFWS 1999). Casuarina trees have been exported and planted throughout the subtropics and tropics, worldwide. Well-developed stands of the aforementioned species occur in the former housing, industrial, and MDA areas of Wake Island; much of the eastern half of Wilkes Island; and to a lesser extent on Peale Island. Left alone, casuarina trees present a very real threat to overtake the entire Atoll.

Ruderal vegetation is found in disturbed or altered habitats that typically receive occasional mowing or other disturbance. Since disturbance and habitat alteration characterize all areas of the Atoll, the frequency of ground maintenance and mowing activities is the key factor. Ruderal areas support mostly introduced or weedy plant species and are found primarily on Wake Island on semi-improved grounds. At these locations, the ground cover is generally over 50 percent with bare shell/coral/sand substrate clearly visible.

Mowed/maintained vegetation occurs in areas where routine grounds maintenance and mowing occurs. These areas occur primarily on Wake Island (e.g., Airfield, housing areas, and adjacent to roads). Selective grounds maintenance is performed on Wilkes Island in the vicinity of the POL yard. No grounds maintenance activities are conducted on Peale Island. Like ruderal areas, mowed/maintained areas support mostly introduced or weedy plant species. Ground cover in the mowed/maintained areas is generally over 50 percent with bare shell/coral/sand substrate clearly visible.

Surveys to update vegetation mapping were conducted on Wake, Wilkes, and Peale islands from 1 to 31 October 2013 by EA. The revised vegetation maps are included in **Figures 5-2a** through **5-2k**.

Wake, Wilkes, and Peale islands were separated into a series of habitat management units (HMUs). The HMUs were delineated to assist in the development of natural resources management actions and approaches, and for determining level of effort that could be expected to implement actions within a given HMU. The HMU descriptions provide some site-specific detail useful for determining appropriate management actions within the units. Specific management actions can be developed and applied to each of the units, or to a group of HMUs depending on management goals and available resources. Most of the HMUs are defined by physical boundaries such as roads, beaches, or other features that could act as fire breaks, and are not based on the boundaries of vegetation communities. **Figure 5-3** shows the HMUs delineated on Wake Atoll. **Figures 5-4a through 5-4k** show the HMUs with vegetation mapping units based on the surveys conducted from 1 to 31 October 2013. Each of the vegetation mapping units shown in the figures includes a unique designator number. **Table 5-1** provides the acreage of each of the vegetation mapping unit polygons delineated on the Atoll. The vegetation

mapping units in the table are identified by the unique designator numbers shown on **Figures 5-4a** through **5-4k**.

Sixty-five HMUs were delineated on Wake Atoll. The acreages of each HMU, general locations, boundary descriptions, and their general topographic characteristics are included below. More detailed descriptions of the HMUs including vegetation communities, characteristic plant species, and invasive species characterizing each unit are included in the Biological Control, Survey, and Management Plan for Wake Atoll, Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS that is included as **Component Plan B**. **Table 5-2** provides the acreage of each HMU on Wake Atoll and the percent coverage of vegetation communities characterizing each of the 65 units. Note that the acreage total for the HMUs in Table 5-2 is greater than the total for vegetative cover in **Table 5-1**. The total acreage for the HMUs is greater because it includes built structures within the HMUs. The vegetative acreage only includes actual vegetation coverage and does not include built structures. HMUs were also developed for Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS and are described in Sections 5.2.2.1 and 5.2.2.2. The most up-to-date list of vegetation occurring on Wake Atoll, Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS can be found in **Appendix E**.

The HMUs provide a baseline for determining the level of effort and management approaches for invasive plant species in the Biological Control, Survey, and Management Plan for Wake Atoll, Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS (**Component Plan B)**. Tables 5-1 and 5-2, and in the Biological Control, Survey, and Management Plan, Tables 2-1 and 2-2 include approximate percent cover, recommended management actions, approximate labor hours, and cost for primary targeted invasive species in each of the HMUs. Additional invasive species that occur in the HMUs, but that were not identified as primary management targets in the tables, are identified in the descriptions of the HMUs in **Component Plan B**. Management approaches for these species are discussed within the text of the Biological Control, Survey, and Management Plan. The HMUs also provide a tool for prioritizing invasive species management actions. For example, areas on Wilkes and Peale islands where casuarina is encroaching onto the islands can be identified based on the HMUs and management actions and strategies can be developed that target one or several HMUs based on the estimated level of effort and available resources.

Figure 5-2a-k. Vegetation on Wake Atoll.

Figure 5-2b
Vegetation on Wake Atoll

Figure 5-2c
Vegetation on Wake Atoll

Figure 5-2d
Vegetation on Wake Atoll

Figure 5-2e
Vegetation on Wake Atoll

Figure 5-2f
Vegetation on Wake Atoll

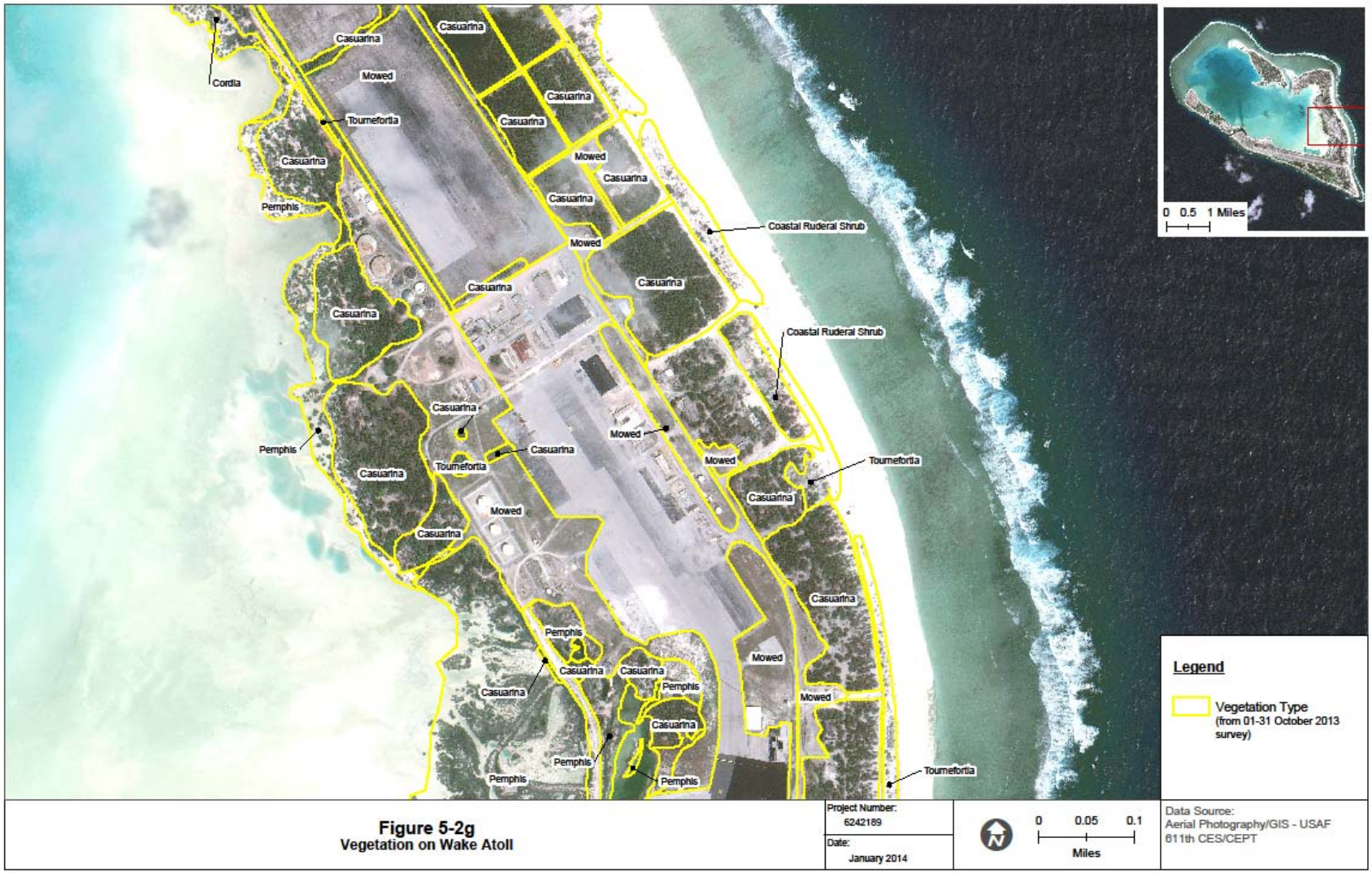

Figure 5-2g
Vegetation on Wake Atoll

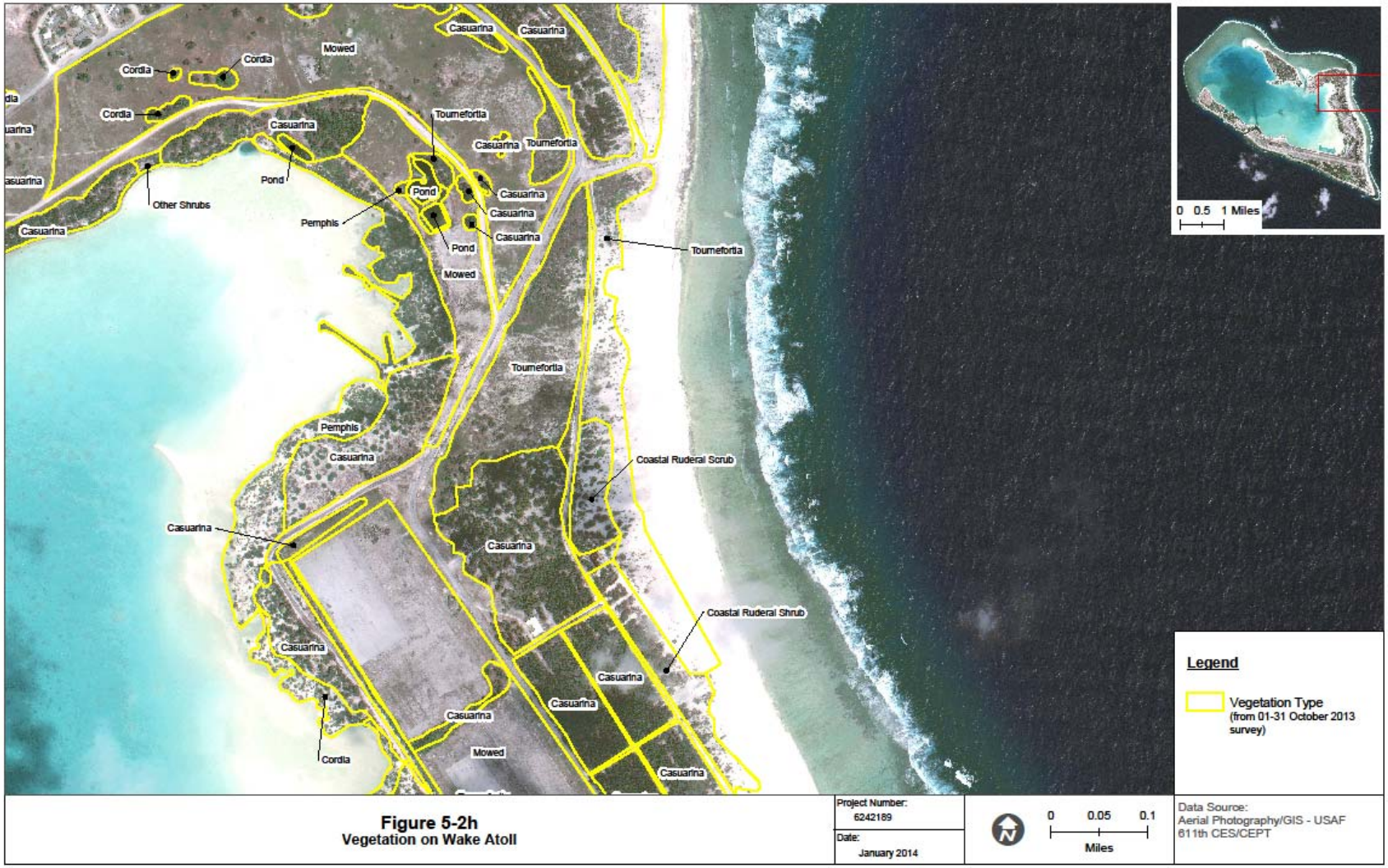

Figure 5-2h
Vegetation on Wake Atoll

Figure 5-2i
Vegetation on Wake Atoll

Figure 5-2j
Vegetation on Wake Atoll

Figure 5-2k
Vegetation of Wake Atoll

Figure 5-3. Location of Habitat Management Units on Wake Atoll

Wake Atoll HMU-1

HMU-1 is approximately 37 acres located in the northern section of Wilkes Island. The HMU is characterized by mowed/ruderal scrub habitat with a fringe of tournefortia adjacent to the beach along its north, west, and east sides. Topography in HMU-1 is disturbed and generally flat lying.

Looking north across HMU-1

Wake Atoll HMU-2

HMU-2 is approximately 26 acres located in the southeastern section of Wilkes Island. Topography in HMU-2 is disturbed with areas of gently rolling to rugged terrain.

Wake Atoll HMU-3

HMU-3 is approximately 22.02 acres located in the southwestern section of Wilkes Island. The topography of HMU-3 is disturbed with areas of gently rolling to rugged terrain. Characteristic vegetation in HMU-3 is the same as HMU-2.

Treated Casuarina in HMU-2

Wake Atoll HMU-4

HMU-4 is approximately 18.66 acres located on Wilkes Island to the southeast of the submarine channel. HMU-4 is bordered on the north and northeast by Wilkes Avenue, on the southwest by ocean shoreline, and to the southeast by an unnamed road associated with the POL yard. Topography in HMU-4 is disturbed with some areas of rugged terrain associated with excavations and areas of pushed up rubble and rock.

Ruderal scrub in HMU-4

Wake Atoll HMU-5

HMU-5 is approximately 21.14 acres located in the northern tip of the section of Wilkes Island to the southeast of the submarine channel. HMU-5 is bordered by the lagoon shoreline to the north, Wilkes Avenue to the south, the POL yard area to the east, and the submarine channel to the west.

Topography in HMU-5 generally slopes toward the lagoon and is characterized by disturbed rolling terrain with scattered rock piles.

Wake Atoll HMU-6

HMU-6 is approximately 13.31 acres located at the southeast end of Wilkes Island just northwest of the inlet channel to the marina and along the ocean shoreline to the southwest of the fuel tank area. Topography in HMU-6 is disturbed with some areas of rugged terrain associated with excavations, a dump area, and areas of pushed up rubble and rock.

Casuarina along the shoreline in HMU-6

Wake Atoll HMU-7

HMU-7 is approximately 19.56 acres associated with the POL yard in the southeast section of Wilkes Island.

Wake Atoll HMU-8

HMU-8 is approximately 5.61 acres located in the southeast corner of Wilkes Island. HMU-8 is bordered on the north by the lagoon, the south and east by Wilkes Avenue, and the northwest by HMU-5. The HMU is characterized by disturbed topography along the lagoon shoreline.

Wake Atoll HMU-9

HMU-9 is approximately 4.03 acres located at the southeast end of Wilkes Island along the northwest side of the marina entrance channel. The HMU is characterized primarily by casuarina forest on disturbed gently rolling topography. There is an unimproved two-track road that runs north to south through the HMU.

Wake Atoll HMU-10

HMU-10 is approximately 59.67 acres located along the southern shore of the lagoon between the west end of the causeway to Wilkes Island and Taxiway B. The HMU is bordered by the lagoon on the north, Taxiway E to the south, Taxiway B to the east, and Wilkes Island to the west. The topography of HMU-10 is disturbed and primarily flat lying.

Wake Atoll HMU-11

HMU-11 is approximately 32.23 acres located at the southwest end of Wake Island. It is bordered on the northwest by the marina channel, on the southeast by the Airfield Clear Zone, on the northeast by the marina basin and on the southwest by the ocean. The topography of HMU-11 is scraped and flat lying.

Scrub vegetation and tournefortia in HMU-11

Wake Atoll HMU-12

HMU-12 is approximately 30.03 acres located south of the west end of the runway. The HMU is bordered on the northeast by Elrod Drive, the southwest by the ocean, the southeast by HMU-13, and the northwest by an unnamed road and HMU-11. The topography is disturbed and somewhat flat lying.

Tournefortia scrub in HMU-13

Wake Atoll HMU-13

HMU-13 is approximately 18.43 acres located south of the runway. It is bordered on the northeast by Elrod Drive, on the southwest by the ocean, on the southeast by HMU-14 and on the northwest by HMU-12. The topography of HMU-13 is flat and disturbed with some piles of dump material.

Wake Atoll HMU-14

HMU-14 is approximately 18.70 acres located south of the runway. It is bordered on the north by Elrod Drive, on the south by the ocean, on the east by HMU-15 and HMU-16, and on the west by HMU-13. The topography of HMU-14 is disturbed and somewhat flat lying.

Looking west along the north side of HMU-15

Wake Atoll HMU-15

HMU-15 is approximately 12.40 acres located south of the runway. The HMU is bordered on the north by Elrod Drive and on the south, east and west by HMU-14 and HMU-16. HMU-15 is

within the solid waste disposal area. There are also some historical Japanese aircraft parking structures in the HMU.

Wake Atoll HMU-16

HMU-16 is approximately 36.17 acres located south of the eastern end of the runway. HMU-16 is bordered by the solid waste disposal area to the west, Buildings 1607 and 1609 to the north, the ocean shoreline to the south, and an unnamed road to the east. The topography of HMU-16 is disturbed with some areas of rugged terrain associated with the dump, excavations, and areas of pushed up rubble and rock.

Wake Atoll HMU-17

HMU-17 is approximately 5.40 acres located adjacent to the runway. The HMU is bordered by Elrod Road on the north and HMU 16 on the south, east, and west. The topography of HMU-17 is disturbed and scraped flat.

Wake Atoll HMU-18

HMU-18 is approximately 12.49 acres located north of the runway. The site is bordered on the north by HMU-33, the south by Taxiway E, the east by Taxiway B, and the west by the lagoon. The topography of HMU-18 is characterized by flat lying coastal terrain that has been disturbed in areas by placement of a road, pipeline, and other structures.

Wake Atoll HMU-19

HMU-19 is approximately 10.82 acres located south of the eastern end of the runway adjacent to the ocean shoreline. The site is bordered on the north by HMU-16 and HMU-20, the south by the ocean shoreline, the east by HMU 24, and the west by HMU-16. The topography of HMU-19 is disturbed with areas of rugged terrain associated with a dump area near the northern end of the site, and other land disturbance activities.

Wake Atoll HMU-20

HMU-20 is approximately 7.21 acres. Building 1615 is just to the west and the MDA is to the east of the site. Unnamed roads border the site on its north, south, and west sides. The site borders HMU-19 on its southern side. The topography of HMU-20 is disturbed and mounded. There is a large dump area in the central section of HMU-20 that is surrounded by a fringe of casuarina forest.

Passion fruit on tournefortia in HMU-20

Wake Atoll HMU-21

HMU-21 is approximately 21.97 acres. HMU-21 is south of the eastern end of the runway and is bordered by HMU-22 to the north, an unnamed roadway to the south, HMU-23 to the east, and HMU-17 to the west. This site includes the MDA. The topography of HMU-21 is disturbed and somewhat flat lying with some hummocky areas associated with past land disturbance activities.

Wake Atoll HMU-22

HMU-22 is approximately 8.18 acres located south of the east end of the runway. It is bordered on the north by Elrod Drive, the south by HMU-21, the east by an unnamed road, and the west by HMU-17. The topography of HMU-22 is disturbed and flat lying.

Wake Atoll HMU-23

HMU-23 is approximately 11.32 acres located south of the east end of the runway. It is bordered on the north by Elrod Drive, the south and east by unnamed roads, and the west by HMU-21 and HMU-22. The topography of HMU-23 is disturbed and flat lying.

Wake Atoll HMU-24

HMU-24 is approximately 12.42 acres located south of the east end of the runway adjacent to the coast. HMU-24 is bordered by an unnamed road to the north, the ocean shoreline to the south, HMU-21 and HMU-25 to the east, and HMU-19 and HMU-20 to the west. The topography of HMU-24 is disturbed and primarily flat lying.

Wake Atoll HMU-25

HMU-25 is approximately 24.50 acres located south of the eastern end of the runway adjacent to the coast. The site is bordered on the north and east by unnamed roads, the south by the ocean shoreline, and the west by HMU-24. The topography of HMU-25 is disturbed and primarily flat lying.

Wake Atoll HMU-26

HMU-26 is approximately 34.43 acres located adjacent to the eastern corner of the runway. The site is bordered on the north by Elrod Drive, the south by an unnamed road, the east by the access road to Peacock Point, and the west by an unnamed road. The topography of HMU-26 is disturbed and primarily flat lying.

Mowed habitat in HMU-26 and HMU-65

Wake Atoll HMU-27

HMU-27 is approximately 26.16 acres located south of the eastern end of the runway. The site is just west of Peacock Point and is bordered on the north and west by unnamed roads, the south by the shoreline of the ocean, and the east by HMU-28. The topography of HMU-27 is disturbed and somewhat flat lying.

Wake Atoll HMU-28

HMU-28 is approximately 17.64 acres located in the southeastern corner of Wake Island, adjacent to Peacock Point. The topography of HMU-28 is disturbed with somewhat flat terrain that generally slopes toward the beach. There are pushed up piles of rock and rubble in the northwestern section of the site.

Wake Atoll HMU-29

HMU-29 is approximately 34.38 acres located south of the Airfield on the southeastern shoreline of Wake Island. It is bordered on the north by Elrod Drive, the south by Peacock Point and HMU-28, the east by the ocean shoreline, and on the west by an unnamed road. The topography of HMU-29 is disturbed and graded with some mounded areas.

Wake Atoll HMU-30

HMU-30 is approximately 16.82 acres located in the eastern section of Wake Island. The monument area that is across Wake Avenue from Base Operations is in the central section of the HMU. The site is bordered on the north by an unnamed road, on the south by the east end of the Airfield, on the east by HMU-31, and on the west by Wake Avenue. The topography of HMU-30 is flat.

Wake Atoll HMU-31

HMU-31 is approximately 37.68 acres located along the eastern shoreline of Wake Island. The site is bordered on the north by HMU-53 and HMU-54 near the northern tip of Wake Island; the east end of the Airfield to the south; the ocean shoreline on the east; and unnamed roads, Saipan Avenue, and North Pacific Avenue on the west. The topography of HMU-31 is disturbed and generally flat lying with several hummocky or mounded areas associated with past land disturbance activities.

Sparse tournefortia scrub in the southern section of HMU-31

Wake Atoll HMU-32

HMU-32 is approximately 4.83 acres located along the eastern portion of Wake Island north of the monument area. The site is bordered on the north and south by unnamed roads, on the east by Saipan Avenue, and on the west by Wake Avenue. The topography of HMU-32 is disturbed and generally flat, but rolling or hummocky in some areas.

Wake Atoll HMU-33

HMU-33 is approximately 30.37 acres located along the eastern lagoon shoreline of Wake Island. It is bordered on the north by HMU-39, on the south by HMU-18, on the east by Lagoon Road, and on the west by the lagoon. The topography of HMU-33 is primarily flat lying coastal marsh terrain with disturbed and mounded areas associated with a pipeline and Lagoon Road. HMU-33 is characterized by tidal inlets and tidal marsh.

Fiddler crabs in tidal marsh habitat in HMU-33

Wake Atoll HMU-34

HMU-34 is approximately 15.47 acres located along the eastern lagoon section of Wake Island. The site is bordered by the fire department and HMU-40 to the north, Taxiway B to the south, Taxiway B and the fire department to the east, and Lagoon Road to the west. The topography of HMU-34 is primarily flat lying with coastal marsh terrain and a tidal pond area.

Wake Atoll HMU-35

HMU-35 is approximately 14.16 acres located on the ocean side of the eastern section of Wake Island. The site is bordered by 4th Street to the north, an unnamed road on the south, Saipan Avenue on the east, and Wake Avenue on the west. The topography of HMU-35 is disturbed and primarily flat lying. There are several structures in HMU-35.

Wake Atoll HMU-36

HMU-36 is approximately 3.01 acres located east of the Airfield fire department on the eastern side of Wake Island. The site is bordered on the north by 5th Street, on the south by 4th Street, and on the east and west by unnamed roads. The topography of HMU-36 is disturbed and generally flat lying.

Wake Atoll HMU-37

HMU-37 is approximately 6.52 acres located east of the Airfield fire department on the eastern side of Wake Island. The site is bordered on the north by 5th Street, on the south by 4th Street, on

the east by an unnamed road, and on the west by Wake Avenue. The topography of HMU-37 is disturbed and generally flat lying.

Wake Atoll HMU-38

HMU-38 is approximately 9.57 acres located near the ocean side of the eastern section of Wake Island. The site is bordered by 6th Street to the north, 5th Street to the south, North Pacific Avenue to the east, and Wake Avenue to the west. The topography of HMU-38 is disturbed and generally flat lying.

Casuarina and tournefortia along the eastern side of HMU-38

Wake Atoll HMU-39

HMU-39 is approximately 18.31 acres located on the eastern shore of the lagoon to the west of the Airfield fire department. The site is bordered on the north by HMU-49, on the south by HMU-33, on the east by HMU-40 and HMU-41, and on the west by the lagoon. The topography of HMU-39 is disturbed with areas of mounded terrain.

Wake Atoll HMU-40

HMU-40 is approximately 14.62 acres located just to the west of the Airfield fire department. The site is bordered on the north by Gull Street, on the south by HMU-34, on the east by the Airfield fire department, and on the west by Lagoon Road. The topography of HMU-40 is disturbed and flat lying.

Wake Atoll HMU-41

HMU-41 is approximately 4.45 acres located adjacent to the eastern shore of the lagoon. The site is bordered on the north by HMU-49, the south by HMU-40, the east by Canton Avenue, and the west by the lagoon and HMU-39. The water plant is located within HMU-41. The topography of HMU-41 is disturbed and primarily flat lying, but slopes down to the lagoon on its western side.

Tangantangan adjacent to building in HMU-41

Wake Atoll HMU-42

HMU-42 is approximately 43.06 acres located on the east-central section of Wake Island. The topography of HMU-42 is flat and graded.

Vegetation in HMU-42

Wake Atoll HMU-43

HMU-43 is approximately 3.37 acres located on the eastern section of Wake Island to the east of Wake Avenue. The site is bordered on the northwest by 7th Street, on the southeast by 6th Street, on the northeast by an unnamed road, and on the southwest by Wake Avenue. The topography of HMU-43 is disturbed and flat lying.

Wake Atoll HMU-44

HMU-44 is approximately 3.41 acres located on the eastern section of Wake Island to the northeast of Wake Avenue. The site is bordered on the northwest by 7th Street, on the southeast by 6th Street, on the northeast by North Pacific Avenue, and on the southwest by an unnamed road. The topography of HMU-44 is disturbed and flat lying.

Wake Atoll HMU-45

HMU-45 is approximately 3.27 acres located on the eastern section of Wake Island to the northeast of Wake Avenue. The site is bordered on the northwest by 8th Street, on the southeast by 7th Street, on the northeast by North Pacific Avenue, and on the southwest by an unnamed road. The topography of HMU-45 is disturbed and flat lying.

Wake Atoll HMU-46

HMU-46 is approximately 3.28 acres located on the eastern section of Wake Island to the northeast of Wake Avenue. The site is bordered on the northwest by 8th Street, on the southeast by 7th Street, on the northeast by an unnamed road, and on the southwest by Wake Avenue. The topography of HMU-46 is disturbed and flat lying.

Wake Atoll HMU-47

HMU-47 is approximately 4.81 acres located in the northeastern section of Wake Island to the east of Wake Avenue. The site is bordered on the northwest by 9th Street, on the southeast by 8th Street, on the northeast by North Pacific Avenue, and on the southwest by Iwa Jima Avenue. The topography of HMU-47 is disturbed and flat lying.

Wake Atoll HMU-48

HMU-48 is approximately 5.22 acres located in the northeastern section of Wake Island to the east of Wake Avenue. The site is bordered on the northwest by 9th Street, on the southeast by 8th Street, on the northeast by Iwa Jima Avenue, and on the southwest by Wake Avenue. The topography of HMU-48 is disturbed and somewhat flat lying.

Wake Atoll HMU-49

HMU-49 is approximately 13.96 acres located on the lagoon coast on the eastern section of Wake Island. The site is bordered to the northwest by HMU-51, on the southeast by the lagoon and HMU-41, on the northeast by Canto Avenue, and on the southwest by the lagoon. The topography of HMU-49 is disturbed with areas of mounded terrain.

Open Casuarina forest in HMU-49

Wake Atoll HMU-50

HMU-50 is approximately 29.50 acres located on the northern end of the eastern section of Wake Island. The site is bordered to the north and west by Wake Avenue, on the south by 9th Street, and on the east by North Pacific Avenue. The topography of HMU-50 is disturbed and flat lying.

Wake Atoll HMU-51

HMU-51 is approximately 43.24 acres located on the lagoon coast at the northern end of the eastern section of Wake Island. The site is bordered to the north and west by Hewa Road, on the south by HMU-49 and an unnamed road, on the east by Wake Avenue, and on the west by the lagoon. The topography of HMU-51 is disturbed and gently rolling with areas of mounded terrain.

Wake Atoll HMU-52

HMU-52 is approximately 45.33 acres located in the northern end of the eastern portion of Wake Island. HMU-52 includes the golf course. The site is bordered to the north and east by Wake Avenue, on the south by Heiwa Road, and on the west by HMU-58. The topography of HMU-52 is disturbed and somewhat flat lying.

Wake Atoll HMU-53

HMU-53 is approximately 10.26 acres located at the northeastern tip of Wake Island. The site is bordered to the north, east, and south by unnamed roads and on the west by Wake Avenue. The topography of HMU-53 is disturbed and flat lying.

Mowed/maintained vegetation in HMU-53

Wake Atoll HMU-54

HMU-54 is approximately 8.65 acres located at the northeastern tip of Wake Island. The site is bordered to the north by HMU-55, on the south by an unnamed road, on the east by the ocean shoreline, and on the west by an unnamed road. The topography of HMU-54 is disturbed and somewhat rolling.

Wake Atoll HMU-55

HMU-55 is approximately 13 acres located at the northeast shore of Wake Island. The site is bordered on the north by ocean shoreline, on the south by an unnamed road, and on the east and west by two-track roads. The topography of HMU-55 is disturbed and somewhat flat lying. The topography slopes down to the ocean along the shoreline.

Wake Atoll HMU-56

HMU-56 is approximately 2.90 acres located at the northeastern tip of Wake Island. The site is bordered on the north, east, and west by unnamed roads and on the south by Wake Avenue. The topography of HMU-56 is disturbed and flat lying.

Wake Atoll HMU-57

HMU-57 is approximately 19.64 acres located at the northern end of the eastern portion of Wake Island. The site is bordered on the north by ocean shoreline, on the south by Wake Avenue, on the east by a two-track road, and on the west by an unnamed road. The topography of HMU-57 is disturbed and somewhat flat lying. There is a somewhat steep bank sloping down to the shoreline.

Open ruderal scrub in HMU-57

Wake Atoll HMU-58

HMU-58, the housing area, is approximately 61.73 acres located at the northwestern tip of the eastern section of Wake Island. The topography of HMU-58 is disturbed and flat lying.

Characteristic habitat in HMU-58

Wake Atoll HMU-59

HMU-59 is approximately 12.34 acres located on the southern lagoon side of Peale Island. HMU-59 is separated from the rest of Peale Island at high tide by a narrow tidal cut. The topography of HMU-59 is disturbed and undulating.

Wake Atoll HMU-60

HMU-60 is approximately 58.18 acres located on the southern end of Peale Island. The site is bordered on the north by Pan Am Road and HMU-63, on the south and west by the lagoon, and on the east by Peale Avenue and Pan Am Road. The topography of HMU-60 is disturbed and undulating with areas of excavated and pushed up terrain.

Casuarina in HMU-60

Wake Atoll HMU-61

HMU-61 is approximately 28.97 acres located on the southeastern shore of Peale Island. The site is bordered on the north by HMU-64, on the south by HMU-60, on the east by the ocean shoreline, and on the southwest by Peale Avenue. The topography of HMU-61 is disturbed and undulating with areas of excavated and pushed up terrain.

Wake Atoll HMU-62

HMU-62 is approximately 41.49 acres located in the central area of Peale Island. The site is bordered on the north, south, and west by Pan Am Road and on the east by Peale Avenue. The topography of HMU-62 is disturbed and undulating with areas of excavated and pushed up terrain.

Sea grape and Casuarina in HMU-62

Wake Atoll HMU-63

HMU-63 is approximately 51.06 acres located at the northwestern end of Peale Island. The site is bordered on the north by ocean shoreline, the south by HMU-60 and Pan Am Road, the east by Peale Avenue, and the west by the lagoon shoreline. The topography of HMU-63 is disturbed and undulating with areas of excavated and pushed up terrain.

Wake Atoll HMU-64

HMU-64 is approximately 18.76 acres located on the northeastern shore of Peale Island. The site is bordered on the north by HMU-63, the south by HMU-61, the east by ocean shoreline, and the west by Peale Avenue. The topography of HMU-64 is disturbed and undulating with areas of excavated and pushed up terrain.

Wake Atoll HMU-65

HMU-65 is approximately 357.39 acres located on the southeastern section of Wake Island. The HMU includes the WIA and associated clear zones and infrastructure. The topography of HMU-65 can be described as disturbed and flat lying.

Mowed vegetation at the west end of HMU-65

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Figures 5-4a-k. Dominant Vegetation in Habitat Management Units on Wake Atoll

Figure 5-4b
Vegetation and Habitat Mapping Units on Wake Atoll

Project Number: 6242189
Date: January 2015

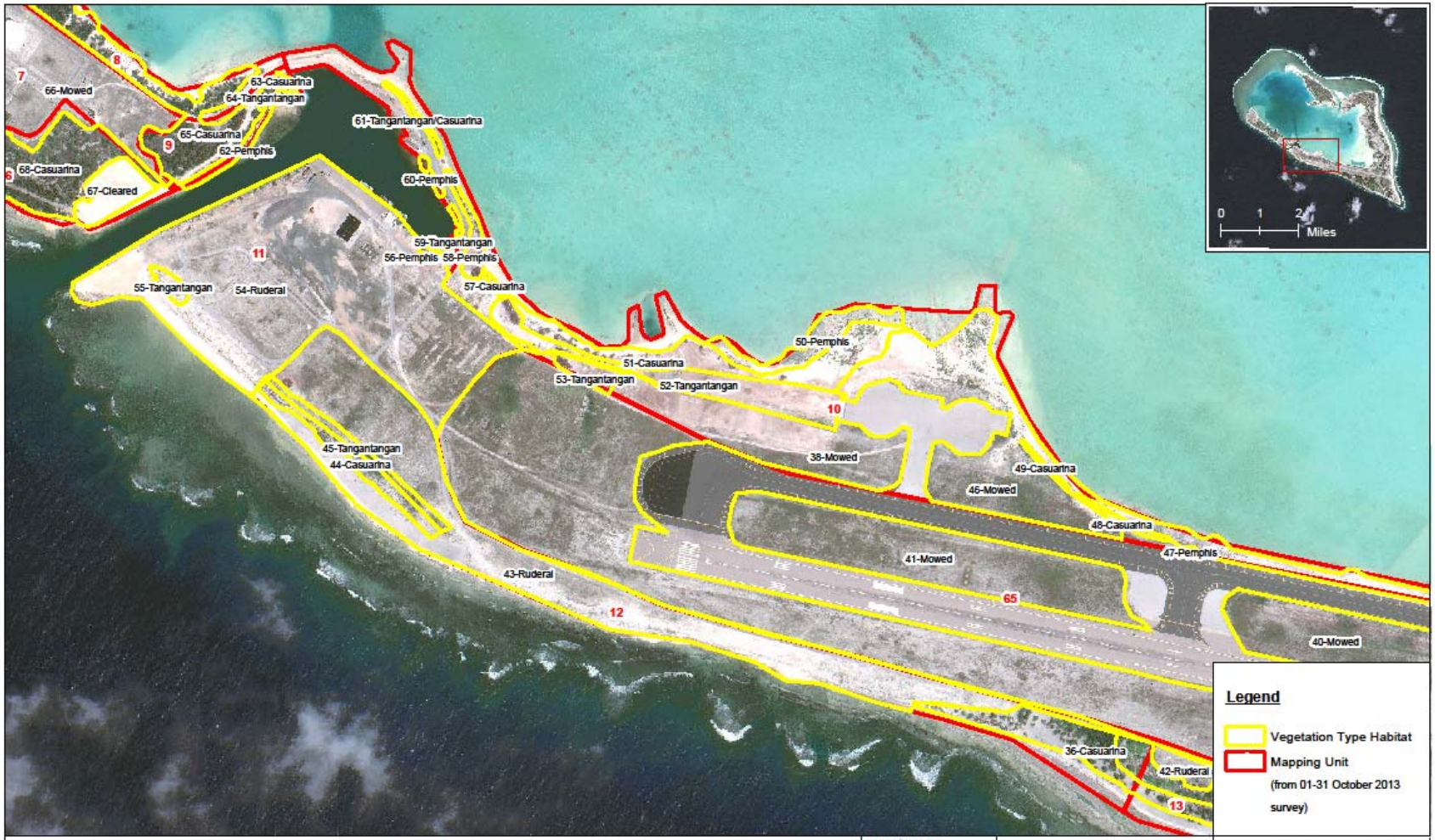

Figure 5-4c
Vegetation and Habitat Mapping Units on Wake Atoll

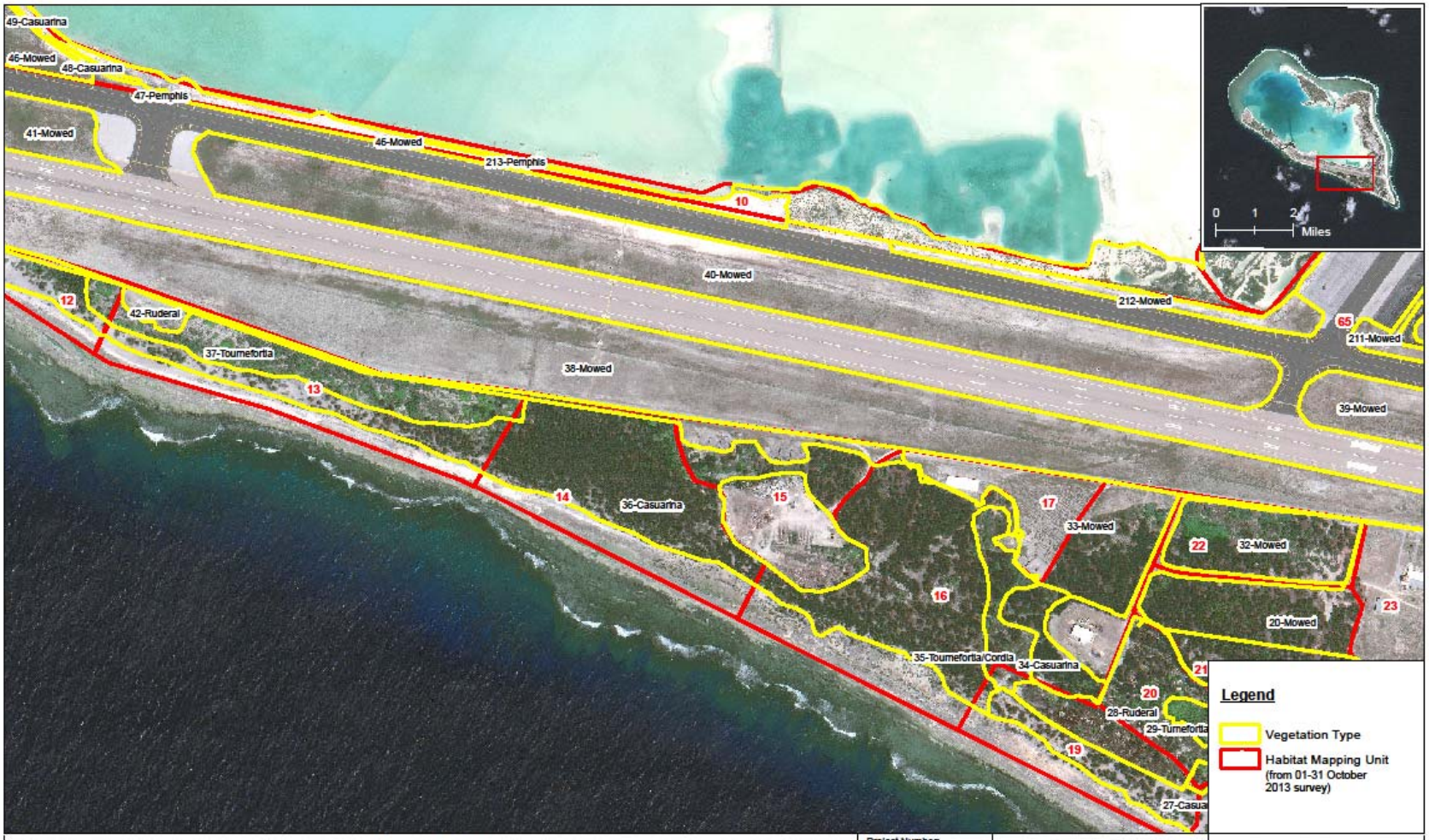
49-Casuarina
46-Mowed
48-Casuarina
47-Pemphis
41-Mowed
46-Mowed
213-Pemphis
10
40-Mowed
212-Mowed
65
211-Mowed
39-Mowed
12
42-Ruderal
37-Tournefortia
38-Mowed
13
14
36-Casuarina
15
17
33-Mowed
22
32-Mowed
16
23
20-Mowed
35-Tournefortia/Cordia
34-Casuarina
21
20
28-Ruderal
29-Tournefortia
19
27-Casua
0 1 2 Miles
Legend
Vegetation Type
Habitat Mapping Unit
(from 01-31 October
2013 survey)
Figure 5-4d
Vegetation and Habitat Mapping Units on
Wake Atoll
Project Number:
6242189
Date:
January 2015
N
0 250 500
Feet
Data Sources:
Aerial Photography/GIS - USAF
611th CES/CEPT

Figure 5-4e
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4f
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4g
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4h
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4i
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4j
Vegetation and Habitat Mapping Units on Wake Atoll

Figure 5-4k
Vegetation and Habitat Mapping Units on Wake Atoll

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Table 5-1. Wake Atoll Vegetation Mapping Unit Acreages

Vegetation Unit	Area (acres)
1-Tournefortia	1.53
2-Ruderal	11.18
3-Tournefortia	9.55
4-Ruderal	3.37
5-Cordia	0.15
6-Tournefortia/Scaevola	1.46
7-Cordia	0.68
8-Ruderal	0.93
9-Tournefortia	0.00
10-Tournefortia	1.45
11-Tournefortia/Scaevola	9.28
12-Tournefortia	18.83
13-Casuarina	0.65
14-Scaevola	0.44
15-Tournefortia	9.72
16-Ruderal	5.75
17-Mowed	7.73
18-Pluchea	3.38
19-Mowed	3.71
20-Mowed	19.21
21-Cordia	0.70
22-Cordia	0.18
23-Pluchea	1.16
24-Tournefortia	2.39
25-Scaevola	6.82
26-Scaevola	5.41
27-Casuarina	7.49
28-Ruderal	9.19
29-Turnefortia/Scaevola	1.00
30-Scaevola	4.61
31-Casuarina	4.26
32-Mowed	7.11
33-Mowed	11.34
34-Casuarina	2.78
35-Tournefortia/Cordia	3.49
36-Casuarina	41.65
37-Tournefortia	8.20
38-Mowed	112.67
77-Casuarina	1.45
78-Casuarina	1.48
79-Tournefortia	38.27
80-Pemphis	1.37
81-Cordia	3.76
82-Mowed/Ruderal	34.12
83-Tournefortia	2.76

Vegetation Unit	Area (acres)
39-Mowed	7.86
40-Mowed	35.79
41-Mowed	12.81
42-Ruderal	0.92
43-Ruderal	24.59
44-Casuarina	1.56
45-Tangantangan	1.06
46-Mowed	17.06
47-Pemphis	0.06
48-Casuarina	0.32
49-Casuarina	0.12
50-Pemphis	1.94
51-Casuarina	4.61
52-Tangantangan	4.16
53-Tangantangan	0.69
54-Ruderal	31.94
55-Tangantangan	0.40
56-Pemphis	0.10
57-Casuarina	0.10
58-Pemphis	0.77
59-Tangantangan	0.15
60-Pemphis	0.17
61-Tangantangan/Casuarina	0.26
62-Pemphis	0.75
63-Casuarina	0.13
64-Tangantangan	0.18
65-Casuarina	6.99
66-Mowed	21.47
67-Cleared	1.72
68-Casuarina	9.44
69-Scaevola	4.26
70-Casuarina	0.16
71-Casuarina	0.41
72-Tournefortia	8.76
73-Cordia	1.53
74-Casuarina	19.61
75-Pemphis	2.31
76-Pemphis	2.15
117-Casuarina	0.97
118-Casuarina	0.25
119-Casuarina	0.30
120-Casuarina	0.41
121-Cordia	0.26
122-Casuarina	0.27
123-Casuarina	0.27

Vegetation Unit	Area (acres)
84-Tournefortia	125.29
85-Grassland	5.15
86-Cordia	5.95
87-Tangantangan	0.01
88-Tangantangan	0.00
89-Tangantangan	0.01
90-Tangantangan	0.01
91-Cordia	0.68
92-Cordia	0.44
93-Casuarina	0.99
94-Cordia	6.71
95-Cordia	4.43
96-Tournefortia/Casuarina	3.07
97-Cordia Mix	1.65
98-Cordia	1.01
99-Tournefortia	0.62
100-Cordia	0.49
101-Pisonia	1.02
102-Cordia	5.22
103-Pemphis	12.96
104-Pemphis	8.02
105-Casuarina	1.90
106-Casuarina	9.29
107-Tangantangan	0.01
108-Casuarina	0.08
109-Casuarina	0.49
110-Casuarina	1.65
111-Tangantangan	0.23
112-Casuarina	0.21
113-Casuarina	0.28
114-Casuarina	4.22
115-Tangantangan/Casuarina	0.07
116-Casuarina	0.39
158-Tournefortia	2.30
159-Mowed	38.82
160-Casuarina	0.55
161-Casuarina	11.73
162-Casuarina	0.90
163-Coastal Ruderal Scrub	2.96
164-Coastal Ruderal Shrub	4.62
165-Casuarina	4.16
166-Casuarina	4.39
167-Cordia	0.58
168-Pemphis	1.33
169-Casuarina	4.25
170-Casuarina	2.72
171-Casuarina	2.81
172-Mowed	25.23

Vegetation Unit	Area (acres)
124-Casuarina	7.33
125-Tangantangan	0.06
126-Coastal Ruderal Scrub	20.96
127-Cordia	0.94
128-Cordia	0.47
129-Tournefortia	9.56
130-Casuarina	7.88
131-Casuarina	1.06
132-Casuarina	0.28
133-Tournefortia	1.49
134-Casuarina	0.15
135-Casuarina	0.70
136-Casuarina	2.15
137-Cordia	0.41
138-Cordia	0.07
139-Cordia	0.38
140-Casuarina	0.16
141-Mowed	41.11
142-Other Shrubs	0.23
143-Casuarina	5.04
144-Pemphis	14.73
145-Pond	0.25
146-Mowed	10.13
147-Pemphis	0.56
148-Tournefortia	0.41
149-Pond	0.53
150-Pond	0.27
151-Casuarina	0.21
152-Casuarina	0.12
153-Casuarina	7.15
154-Tournefortia	10.28
155-Tournefortia	12.44
156-Casuarina	0.76
157-Casuarina	4.30
198-Casuarina	1.23
199-Pemphis	0.11
200-Pemphis	0.67
201-Casuarina	7.48
202-Mowed	5.66
203-Mowed	2.54
204-Tournefortia	3.40
205-Casuarina	8.82
206-Mowed	2.33
207-Tournefortia	6.03
208-Ruderal	8.19
209-Pond	2.27
210-Pemphis	1.06
211-Mowed	7.45

Vegetation Unit	Area (acres)
173-Casuarina	5.18
174-Pemphis	4.13
181-Mowed	0.36
182-Casuarina	2.37
183-Mowed	1.52
184-Casuarina	7.92
185-Mowed	2.96
186-Mowed	0.52
187-Coastal Ruderal Shrub	2.49
188-Tournefortia	2.12
189-Casuarina	2.85
190-Casuarina	2.02
191-Pemphis	40.52
192-Casuarina	0.11
193-Pemphis	1.39
194-Casuarina	0.26
195-Pemphis	3.08
196-Casuarina	0.86
197-Pemphis	0.99

Vegetation Unit	Area (acres)
212-Mowed	3.22
213-Pemphis	0.23

Total Acres **1281.65**

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Table 5-2. Wake Atoll Habitat Management Unit Acreages and Percent Cover of Vegetation Community Types

Percent Cover of Vegetation Communities by HMU

HMU Number	HMU Area (acres)	Casuarina	Casuarina-Mixed	Coastal Ruderal Scrub	Coastal Ruderal Scrub-Mixed	Cordia	Cordia-Mixed	Herbaceous	Mixed Forest Fringe	Mixed Shrub	Mowed/Maintained	Mowed/Maintained Mixed	Ornamental	Other Trees/Shrubs/Plants	Pemphis	Pemphis-Mixed	Ruderal Mixed	Ruderal Scrub	Scaevola	Scaevola-Mixed	Sourbush Scrub	Tangantangan	Tournefortia	Tournefortia-Mixed	Unvegetated	Vines	Total
1	37.00										90												10				100
2	26.00	20													10								70				100
3	22.02	10													10								80				100
4	18.66	30				10														20				40			100
5	21.14	70						5																25			100
6	13.31	75																					15		10		100
7	19.56										100																100
8	5.61	65																						20		15	100
9	4.03	70																		15		15					100
10	59.67	20													25			45				10					100
11	32.23	2															95					3					100
12	30.03	3															94					3					100
13	18.43	30															15						55				100
14	18.70	85									10					5											100
15	12.40	25									10							65									100
16	36.17	65									20													15			100
17	5.40	2									98																100
18	12.49	1														98								1			100
19	10.82	60																						40			100
20	7.21	70																						30			100
21	21.97	30				5					30										10			25			100
22	8.18										100																100
23	11.32										100																100
24	12.42	30																	70								100
25	24.50	5									10								40					45			100
26	34.43										35							30	5					30			100
27	26.16	10																10					20	60			100
28	17.64						25																	75			100
29	34.38	2																					98				100
30	16.82	10										70											20				100
31	37.68	20																						80			100
32	4.83	90								10																	100
33	30.37	10								15	5				70												100
34	15.47	30									35				35												100
35	14.16	80								10	10																100
36	3.01	75								25																	100
37	6.52	85								5	10																100
38	9.57	95									5																100
39	18.31	75									5				20												100
40	14.62	5									90												5				100
41	4.45	2									96											2					100
42	43.06	5							5		90																100
43	3.37	75									25																100
44	3.41	50									50																100
45	3.27	100																									100
46	3.28	85									15																100
47	4.81	100																									100
48	5.22	85									15																100
49	13.96	35	30												30										5		100
50	29.50	30									15												55				100
51	43.24	35									45				15							5					100
52	45.33	3							2		95																100
53	10.26		80								20																100
54	8.65	15		45																			40				100
55	13.00	35			20																		45				100
56	2.90	50								20	30																100
57	19.64	45			8						10											2		35			100
58	61.73	10									80			7								3					100
59	12.34	35													65												100
60	58.18	15													25							2		58			100
61	28.97	30																				4		66			100
62	41.49	15				43																	42				100
63	51.06	5															10					2		83			100
64	18.76	8				20																2		70			100
65	357.39	1									95		1									3					100
Number of HMUs with Vegetation Community Present		**58**	**2**	**1**	**2**	**4**	**1**	**1**	**2**	**6**	**32**	**1**	**1**	**1**	**10**	**2**	**4**	**4**	**3**	**2**	**1**	**13**	**13**	**18**	**2**	**1**	
Vegetation Community Total (acres)	1660.51	306	12	4	4	25	4	1	3	8	640	12	4	4	83	13	67	48	20	4	2	27	138	227	2	1	

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5.2.2.2 Kōke`e Air Force Station

The grounds of Kōke`e AFS are entirely developed and landscaped inside the security fence, and in an approximately 6-ft wide area around the outside perimeter of the fence. There are no naturally occurring native species within the fenced area at Kōke`e AFS; however, native vegetation occurs outside of the fence within the leased area of the facility. This area is characterized by a diverse mesic forest. Kōke`e MAS is, for the most part, cleared adjacent to structures. The area surrounding the structures is characterized by koa forest.

Vegetation was characterized during site visits conducted at Kōke`e AFS in November 2013. Kōke`e AFS and Kōke`e MAS were divided into three HMUs. HMU-1 includes the area within the security fence at Kōke`e AFS, HMU-2 includes the leased land outside of the fence, and HMU-3 includes Kōke`e MAS (**Figure 5-5**). A description of the topography and dominant vegetation for each of the HMUs is described below. **Figure 5-6** includes the HMUs and vegetation mapped on Kōke`e AFS and Kōke`e MAS.

Kōke`e AFS HMU-1

Kōke`e HMU-1 is approximately 4.18 acres and includes the area within the security fence. The HMU is characterized by disturbed rolling topography associated with a knoll. There are several small outcrop areas in the HMU. Vegetation in the HMU is mowed and maintained with scattered planted fruit and ornamental shrubs and trees. Grass species in the HMU are characterized by kikuyugrass (*Pennisetum clandestinum*), narrow-leaved carpetgrass (*Axonopus fissifolius*), common velvet grass (*Holcus lanatus*), pangola grass (*Digitaria eriantha ssp. pentzii*), and yellow foxtail (*Setaria parviflora*). Other vegetation characterizing the site includes narrowleaf plantain (*Plantago lanceolata*), daisy fleabane (*Erigeron karvinskianus*), common dandelion (*Taraxacum officinale*), woodland strawberry (*Fragaria vesica*), smooth cat's ear (*Hypochaeris glabra*), and cathedral bells (*Kalanchoe pinnata*). Patches of mosses also occur in the mowed area. Examples of planted trees and shrubs include methley plum (*Prunus cerasifera*), common pear (*Pyrus communis*), apple (*Pyrus malus*), pine (*Pinus* sp.), and hydrangea (*Hydrangea macrophylla*).

Mowed and maintained grass in Kōke`e HMU-1

Kōke`e AFS has a Support Agreement with the United States Navy at Barking Sands for grounds maintenance. Based on correspondence with John Burger at Barking Sands on 26 March 2014, all equipment is cleaned with power wash and/or high-speed blowers to remove seeds, mud, dust, and debris prior to leaving Barking Sands to conduct mowing at Kōke`e AFS.

Invasive species observed in HMU-1 during November 2013 site visits include kikuyu grass, common velvet grass, narrowleaf plantain, daisy fleabane, woodland strawberry, and cathedral bells.

Kōke`e AFS HMU-2

Kōke`e HMU-2 is approximately 3.9 acres and includes the leased area outside of the security fence. The topography of the site is characterized by rolling topography that decreases in elevation to the west. Vegetation in the HMU is characterized by mowed/maintained habitat adjacent to the entrance and in a narrow strip around the perimeter of the site, and forest and shrub habitat across most of the remainder of the site. Vegetation in the mowed/maintained area is the same as described for HMU-1. Vegetation in the canopy of forested habitat in HMU-2 is characterized by `ōhi`a (*Metrosideros polymorpha*), `ōlapa, `ohe (*Tetraplasandra* sp.), olopua (*Nestegis sandwicensis*), koa, `ōhi`a hā (*Syzygium sandwicensis*), ala´a (*Pouteria sandwicensis*), `ahakea lau li` i (*Bobea brevipes*), and firetree (*Morella faya*).

View along the fence line in Kōke`e HMU-2

The forest understory is somewhat open and is characterized by a number of shrubs including sawtooth blackberry (*Rubus argutus*), fragrant mokihana (*Melicope anisata*), Hawai`ian holly, māmane mamani (*Sophora chrysophylla*), olomea (*Perrottetia sandwicensis*), po`olā (*Claoxylon sandwicense*), kōi (*Coprosma kauensis*), and ha`'iwale (*Cyrtandra longifolia*). Examples of vine and herbaceous vegetation in the forest and open areas includes banana poka (*Passiflora tarminiana*), common vetch (*Vicia sativa*), montbretia crocosmia (*Crocosmia crocosmiiflora*), pa`iniu (*Astelia argyrocoma*), `uki`uki (*Dianella sandwicensis*), daisy fleabane, trailing periwinkle (*Vinca major*), woodland strawberry, yellow ginger (*Hedychium flavescens*), kāhili ginger (*Hedychium gardnerianum*), kikuyu grass, and yellow foxtail. Examples of ferns characterizing the site include `ama`u (*Sadleria cyatheoides*), laukahi (*Elaphoglossum aemulum*), uluhe (*Dicranopteris linearis*), palapalai (*Microlepia strigosa*), hō‘i‘o (*Diplazium sandwichianum*), and pala`ā (*Odontosoria chinensis*).

Invasive species observed in HMU-2 during November 2013 site visits include firetree, sawtooth blackberry, banana poka, daisy fleabane, woodland strawberry, yellow ginger, kāhili ginger, and kikuyu grass. Other invasive plant species that have been documented on Kōke`e AFS are included in the Biological Control, Survey, and Management Plan in **Component Plan B.**

Figure 5-5. Location of Habitat Management Units at Kōke`e Air Force Station and Kōke`e Microwave Antenna Station

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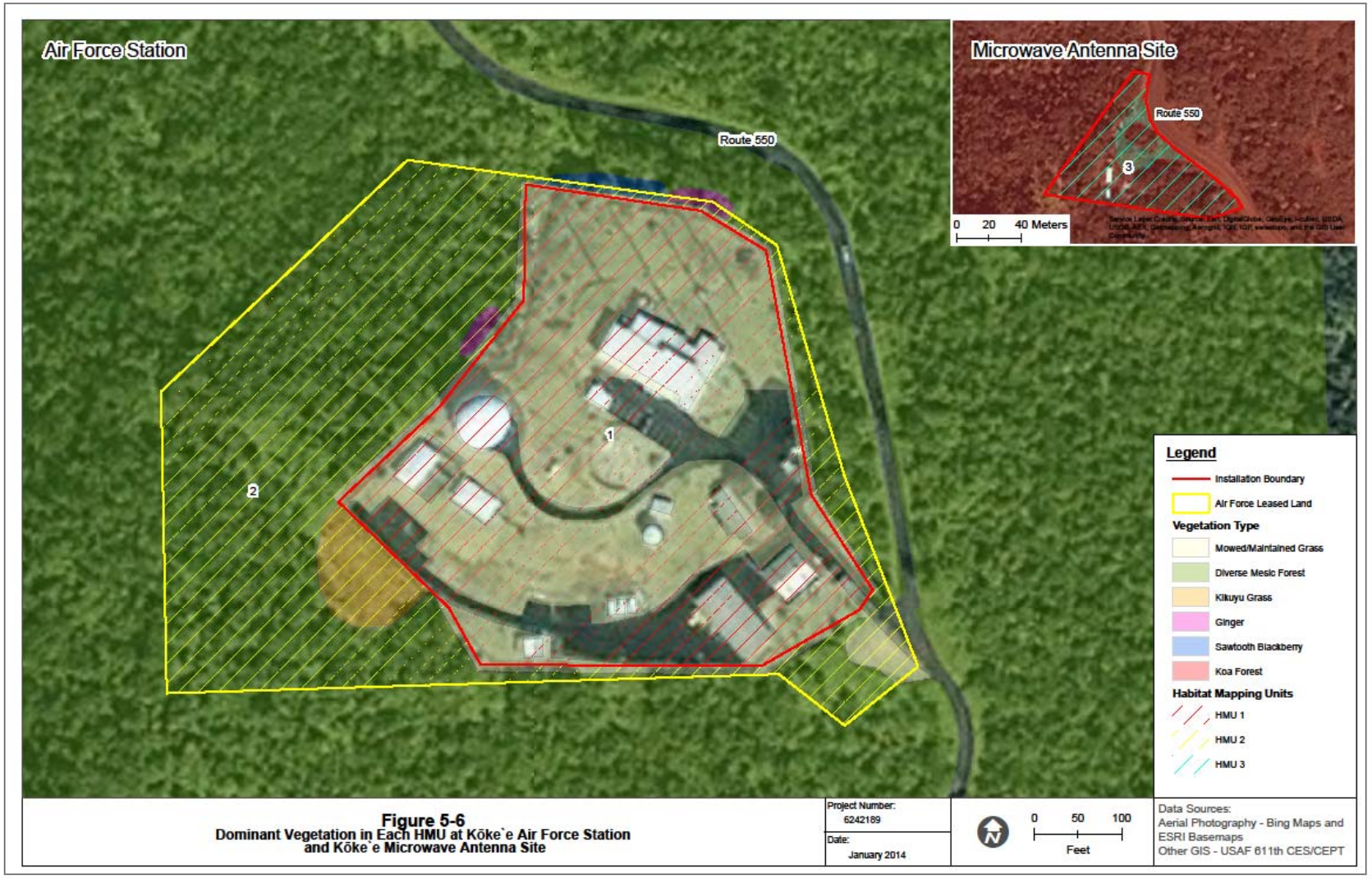
Figure 5-6. Dominant Vegetation in Each Habitat Management Unit at Kōke`e Air Force Station and Kōke`e Microwave Antenna Station



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Kōke`e AFS HMU-3

Koa forest adjacent to Kōke`e MAS

Kōke`e HMU-3 is approximately 1.5 acres and includes Kōke`e MAS. The topography of the site adjacent to the antenna and associated structures is disturbed and decreases in elevation to the west and south on relatively steep slopes. The site is bordered by Route 550 to the east. The site, excluding the facility structures and unpaved access road, is characterized by koa forest, with some herbaceous vegetation immediately adjacent to structures. Herbaceous vegetation adjacent to the structures is characterized by narrow-leaved carpetgrass, common velvet grass, molasses grass (*Melinis minutiflora*), kikuyu grass, narrowleaf plantain, Florida tassel flower (*Emilia fosbergii*), common dandelion, and smooth cat's ear. Vegetation associated with the koa forest includes koa, guava (*Psidium* sp.), strawberry guava (*Psidium cattleianum*), Java plum (*Syzygium cumini*), uluhe, and lantana (*Lantana camara*).

Invasive species observed in HMU-3 during November 2013 site visits include kikuyu grass, common velvet grass, narrowleaf plantain, molasses grass, strawberry guava, Java plum, and lantana.

5.2.2.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is located in a vegetation/climate zone characterized by montane wet forest plant associations (Wagner et al. 1990). Largely native plant associations constitute the vegetation in the vicinity of the installation. Mt. Ka`ala AFS was almost entirely cleared of historic vegetation communities when it was developed. Native vegetation occurs in only a few places, in narrow strips adjoining the installation boundary, outside of the fence line. This vegetation is part of the `ōhi`a wet forest community described above in Section 5.2.1.3. Most of the vegetated areas on the site consist of mowed turf and weedy forbs, with a small number of ornamental plantings.

Vegetation was characterized on Mt. Ka`ala AFS during a site visit conducted on 13 November 2013. The entire site was considered one HMU (**Figure 5-7**). **Figure 5-8** shows vegetation mapped on Mt. Ka`ala AFS. A description of the topography and dominant vegetation for the HMU is provided below.

Mt. Ka`ala AFS HMU-1

Mowed and maintained vegetation on Mt. Ka`ala AFS

Mt. Ka`ala HMU-1 is approximately 3.1 acres and includes all of the fenced area of the installation. The topography of Mt. Ka`ala AFS is disturbed and primarily flat lying. The site was scraped in the past to create flat lying topography. There is a depression within the fence line adjacent to the south-central boundary associated with the pump house. Vegetation on the site is mowed and maintained. Grasses on the site are characterized by kikuyu grass, Bermuda grass, Hilo grass (*Paspalum conjugatum*), Vasey's grass (*Paspalum urvillei*), annual bluegrass (*Poa annua*), and West Indian dropseed (*Sporobolus indicus*). Other herbaceous plants associated with the mowed/maintained area include common toad rush (*Juncus bufonius*), montbretia crocosmia (*Crocosmia* sp.), common dandelion, oriental hawksbeard (*Youngia japonica*), chickweed (*Cerastium fontanum*), common plantain (*Plantago major*), and narrowleaf plantain. Additional plants associated with the pumphouse area include hydrangea, sawtooth blackberry, Maui pamakani (*Ageratina adenophora*), and impatiens (*Impatiens walleriana*).

Invasive species observed in Mt. Ka`ala HMU-1 during the 13 November 2013 site visit include kikuyu grass, Bermuda grass, Vasey's grass, West Indian dropseed, and sawtooth blackberry.

Figure 5-7. Location of HMU-1 at Mt. Ka`ala Air Force Station

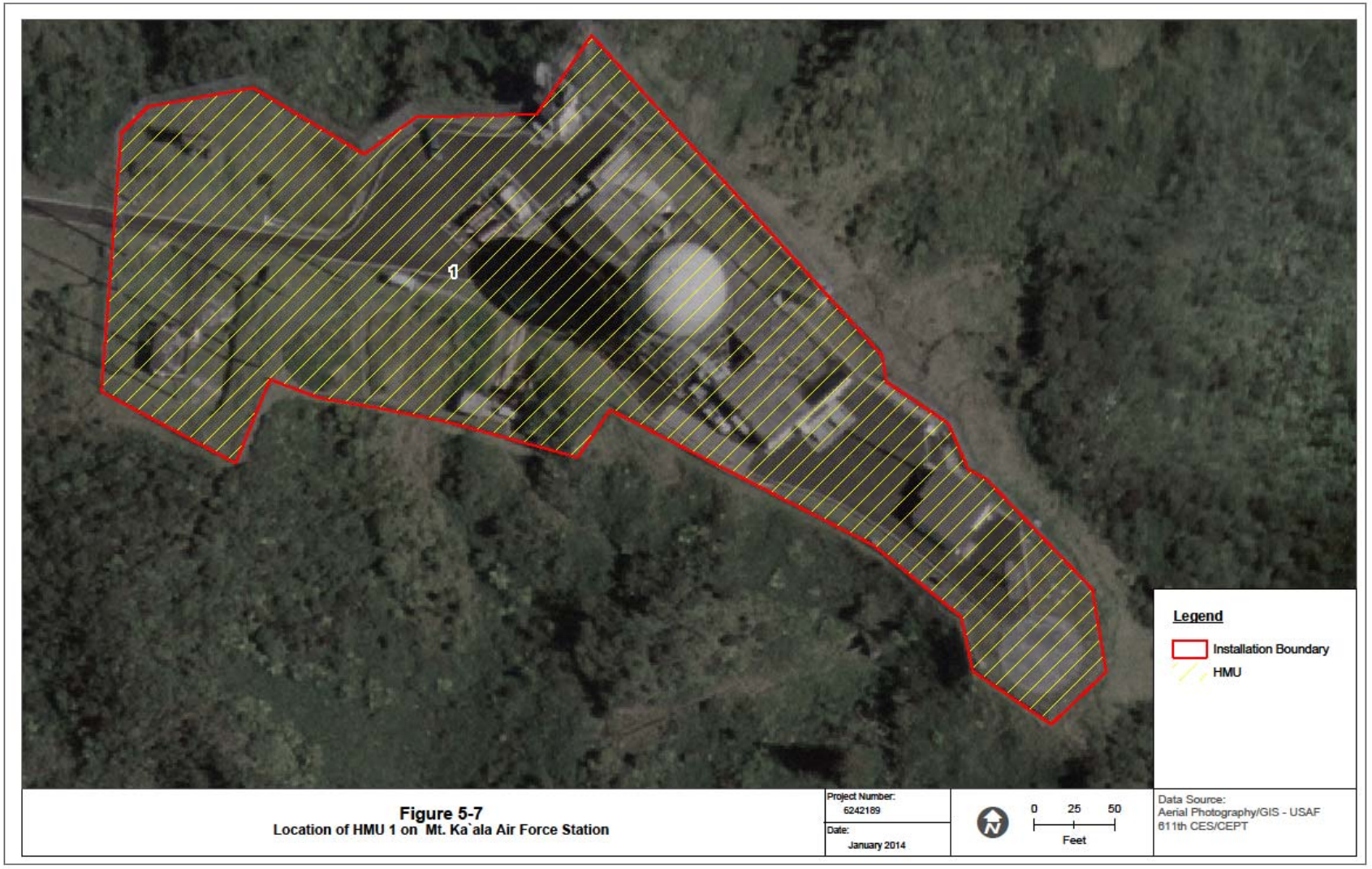
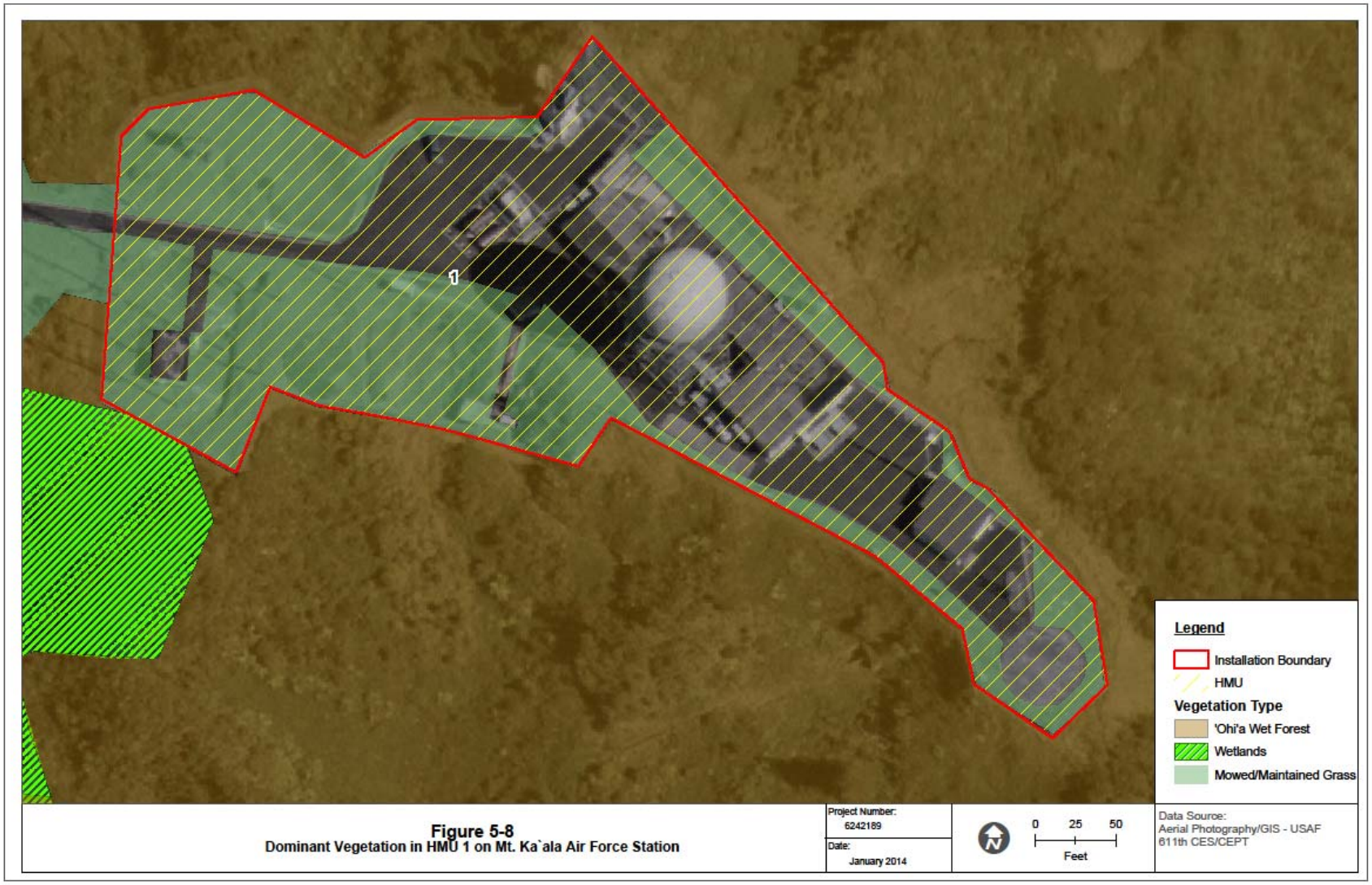


Figure 5-8. Dominant Vegetation in HMU-1 at Mt. Ka`ala Air Force Station



5.2.3 Turf and Landscaped Areas

Turf and landscaped areas throughout Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS are described above under the HMUs for each site.

5.3 FISH AND WILDLIFE

5.3.1 Wake Atoll

Mammals

Cats and Dogs

Cat observed on Wake Island in 2011.

There are no indigenous mammals on Wake Atoll. Historically, dogs and cats resided with the residents on the Atoll. There currently are no dogs (*Canis familiaris*) on the Atoll. Historically, domesticated cats (*Felis catus*) were kept by island residents and naturalized feral cats were common on all three islands. A cat eradication program was funded in 2000 and three collaborating organizations, Endangered Species Recovery Council, Wildlife Management International of New Zealand, and Marine Endeavours began a concerted effort to remove feral cats from Wake Atoll. By January 2004, approximately 170 cats had been removed. In June 2007, Rauzon and Gilardi (2007) reported that a few cats (4 individuals) were present, 2 of which were known pets (spayed and taken care of by island residents). The remaining cats were probably the same gender because no cat reproduction was detected. In 2010/2011, Pacific Rim Conservation (PRC) conducted biological monitoring surveys. During these surveys, three feral cats were observed in November 2010 and February 2011 (PRC 2011). One cat was observed on a two-track road behind the housing area during the site visit for this INRMP in October 2013. It appeared to be the same cat that is shown in the photo. Based on correspondence with Maureen Raleigh on 28 March 2014, there are 2 domesticated cats remaining on Wake Island. Ms. Raleigh cares for both cats. Both cats are females. One cat appears to be part Siamese and the other is grey and striped. Both cats are believed to be around 17 years old and are tame. There was a third cat on the island; however, it died in 2013. It was a small black cat that arrived with a barge in 2006. The cat remained wild, but was trapped during the rat eradication program to avoid being poisoned.

There will be no pets allowed on Wake Atoll after the currently remaining pets die, with the exception of certified working service dogs, which will only be approved on a case-by-case basis by the 611 CES/CEIE Natural Resource PM in conjunction with the Det 1 Commander.

Rats

Polynesian rat on Wake Atoll in October 2013

Two species of rats, Polynesian rat (*Rattus exulans*) (also referred to as the Pacific rat) and the Asian house rat (*Rattus tanezumi*), were inadvertently introduced to Wake Atoll. Polynesian rats were thought to have been introduced to the Atoll by early Micronesian explorers. The Asian house rat was thought to be introduced by Vietnamese refugees during the 1970s, when it was observed that associated cargo was contaminated with rats. The Polynesian rat, in particular, and the Asian house rat became extremely abundant throughout Wake Atoll. The Norway rat (*Rattus norvegicus*) and the black rat (*Rattus rattus*) might have occurred on Wake Atoll previously (SMDC 1999), but a 1-month-long rat reconnaissance survey conducted in October 2007 by 15 Air Wing, USFWS, USDA, United States Environmental Protection Agency (USEPA), and rat-eradication experts from the United States and abroad, resulted in no observations of these species (USAF 2008a).

Observations in April and May of 2008 indicated that rats were particularly abundant along the road from the garbage dump area to the port/marina and also on Wilkes Island at the bird sanctuary (Chugach 2011). PRC documented and tracked changes in the relative abundance of rats on Wake Island in October/November 2010 and January/February 2011. Live and dead rats were recorded along a previously established driving route, which included the downtown area of Wake Island and areas surrounding the runway. A total of six surveys were completed during the monitoring period. The average rat abundance along the driving transects in October/November 2010 was 30.1 and 32.3 in January/February 2011. The highest number of live rats recorded was 54 in October 2010. All rats observed were small and appeared to be Polynesian rats (PRC 2011).

Helicopter conducting aerial baiting on Peale Island during the 2012 rat eradication effort

Rats are known to prey upon seabird eggs and chicks, native plants, and other invertebrates, and have caused the extinction and extirpation of multiple species world-wide. They also cause damage to arrestor tapes, buildings, and other infrastructure; contaminate food stores; and can pose a potential health threat.

An effort was made in May 2012 to eradicate the Polynesian rat and Asian house rat from the Atoll. This USAF-funded project was implemented by a

collaborating group representing USFWS, Island Conservation, Pathfinder Aviation, and the 611th Air Support Group PACAF. Efforts included primarily aerial baiting, hand-broadcasting of baits, and the use of bait stations. The rodenticide used in the eradication effort was Brodifacoum 25W. A Supplemental Label for Brodifacoum 25W Conservation to control and eradicate Polynesian and Asian house rats on Wake Atoll (USEPA Registration No. 56228-36) was issued by USEPA on 4 April 2012 to address special application requirements for the Atoll. The supplemental label only applied to Wake Atoll and expired on 1 September 2014. A copy of the supplemental label is included in **Appendix F**.

Aerial baiting was initiated on 13 May 2012 with the first application and concluded on 23 May 2012 with the second application. Aerial broadcasting could not be used in some areas as a result of the need to comply with federal regulations and site-specific requirements of the USAF. Hand-broadcasting of bait and use of bait stations was applied in aerial exclusion zones, buffer areas, and inside and outside of buildings. Approximately 147 acres associated with the runway and taxiways and fuel storage areas were not baited due to federal and USAF restrictions (Brown et al. 2013). The hand-broadcasting and bait station operations occurred concurrently with the aerial operation, and most bait stations were maintained periodically until November 2012.

A permit (Permit No. MB73909A-0) was obtained from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i for the take of migratory birds in the course of the eradication efforts. The permit issued pursuant to 50 CFR 21.27 (Migratory Bird Permits, Special Purpose Permits) included special measures to prevent bait from entering the water including hand broadcasting of baits near the water and the baiting of canopy trees that overhang water by hand. The permit also required the submittal of a report of activities by 31 January 2013 and 31 January 2014 including the number and species of migratory birds taken, the date they were taken, the manner in which the birds were taken, condition of the bird, disposition of the bird, and an evaluation of how to avoid similar incidents in the future. In May 2012, 2 birds, a Pacific golden plover (*Pluvialis fulva*) and a ruddy turnstone (*Arenaria interpres*), were found dead and assumed to have been killed by Brodifacoum 25W. The reason for their death was not confirmed. A copy of the take permit along with a copy of the 2012 Annual Report are included in **Appendix F**.

The rat eradication project required the 611th Air Support Group to obtain a National Pollutant Discharge Elimination System (NPDES)-Pesticide General Permit for the aerial broadcast of a rodenticide adjacent to a United States body of water. The 611th Air Support Group submitted a Notice of Intent to the USEPA for the permit (No. MWG87A005), which became effective on 2 March 2012.

On 1 June 2012, a juvenile Polynesian rat was found inside a bait station. Observation of a live rat was made on 25 June 2012, and another was observed in a different location on 30 June 2012. Site-specific actions were taken to target these rats. Approximately 3-4 months later, more observations of surviving rats were made. Increasing numbers of Polynesian rats sighted or caught on Wake Island confirmed that the eradication was unsuccessful (Brown et al. 2013). All rats that were caught since the eradication effort were identified as Polynesian rats. No surviving or re-establishing rats have been detected on Peale Island. The USDA confirmed in 2014 that all

remaining rats on Wake Atoll are Polynesian rats and that the Asian house rat has been eradicated. Eradication of the Polynesian rat from Wake and Wilkes islands was not successful. Since the May 2012 eradication effort, the Polynesian rat population has been rapidly rebounding. Polynesian rats were commonly observed in the evening in the golf course area and roads along the shoreline during site visits conducted in October 2013 in association with this INRMP. During recent (2014) discussions between Kristen Rex (611 CES/CEIE, contractor) and Wake personnel, it was stated that rat numbers are increasing in the housing areas and are noticeably heavier on the runway and at the terminal buildings. Site visits in 2014 identified ongoing rat nesting at arrestor cables and barrier sheds on the runway. Higher rat numbers at the arrestor cables pose a large safety concern for active runways; and the increased numbers at the terminal building pose a biosecurity threat to incoming and outgoing cargo and passengers. Rat logs have been provided to Wake personnel to record the increased occurrence of rats around aircraft. Ongoing efforts to control the rat, including the use of bait stations, are being implemented. Some efforts have been made to control rat populations in and around the commensal and marina areas since August 2012; however, these efforts have been very localized with the primary focus on biosecurity as well as health and safety. An approach for a follow-on eradication effort is being developed and evaluated for implementation.

A review of the planning, design, and implementation of the 2012 rat eradication project was conducted by Brown et al. (2013) and a range of recommendations were provided, of relevance to possible future eradication attempts on Wake Atoll (Brown et al. 2013). The review focused on the factors contributing to the unsuccessful eradication attempt from Wake and Wilkes islands; an assessment of whether the strategy, design, planning, and implementation of the eradication and biosecurity program were adequate to expect a reasonable probability of success; and what lessons could be learned and applied to a future eradication attempt on Wake Atoll, including identifying any additional research needs. The following provides a summary of some key findings of the Brown et al. (2013) review.

The most important included at least one and probably an interaction of the following three issues:

1. Several factors were identified that might have contributed to the unsuccessful eradication. Bait gaps or localized shortages in bait availability created by poor understanding of habitats such as pemphis and underground and abandoned structures, inadequately designed baiting methodology in commensal and intertidal environments, and complicated combinations (and integration) of various baiting methodologies, all exacerbated by low overall bait rates with insufficient buffer and some known application errors or difficulties.

2. Rat breeding during the operation causing temporal or spatial unavailability of bait to juveniles emerging from natal nests, or more speculatively, behavioral avoidance of bait by a small percentage of females.

3. A poor understanding of the interaction between the two species that might have provided inadequate bait accessibility for the Polynesian rat.

The assessment of the strategy, design, planning, and implementation of the eradication effort identified several issues including:

1. Deviation from established best practice procedures that have been developed overseas, but which are largely directly applicable everywhere.

2. Lack of a structured project process that would have helped identify and resolve many issues that needed further investigation.

3. An on-off approach to the project over a number of years that probably contributed to a lack of flow in the project process.

4. The inability of some key project personnel to fully commit to the project, or focus on its planning.

5. A lack of knowledge of the island by some key project staff that may have led to some errors and omissions in the planning process.

6. Concerns regarding methodology and the number of information gaps in the planning that should have led to the consideration of postponing the project until those issues were more fully addressed.

7. There was a diffusion of responsibility for project success or failure across multiple project managers and multiple organizations. One dedicated project manager from start to finish, with a core staff and the support of an advisory team, would have more likely been aware of project weaknesses and either fixed or mitigated them.

A summary of key lessons identified by Brown et al. (2013) from the 2012 eradication project includes:

1. Existing eradication best practice documents have been developed that could be used as a basis to develop specific tropical island versions of eradication best practices. These documents need to be used in the development of future operational plans and baiting strategies, and any deviations from such best practice principles need to be justified within the documents.

2. A thorough and connected planning process needs to be followed with attention to ensuring that all aspects of each step are addressed adequately. Vital components of the planning process such as the Feasibility Study and Commensal Rat Plan, need to address all the key issues and need to be critically reviewed by independent eradication experts.

3. Compliance with regulations and island manager-imposed conditions is a necessity; however, the acceptance of such restrictions where they may cause deviation from eradication best practice principles should be acknowledged by operational planners and stakeholder agencies as potentially compromising the prospects for a successful outcome. Wherever federal or site-specific requirements compromise efficacy, they

need to be identified early so that a special exemption can be sought, or the risks openly acknowledged by all parties.

4. Agreements on paper need to match the practicality of successful implementation on the ground.

5. Focus needs to be given to island residents and how they can be incentivized to help maximize the potential for successful eradication.

6. There needs to be greater demonstrated response to prior data and to reviews of project documents and methodology.

7. Optimizing circumstances for eradication is more difficult when there are over-riding priorities on the island (i.e., operation of the air-field). Contingency planning is needed to ensure only the most essential operations occur during the brief window of active bait distribution.

8. A single project manager should lead the eradication process. The project manager should have a high degree of rat eradication expertise and should be allowed to operate relatively freely and with some flexibility within the bounds of an Operational Plan that has been approved by all key stakeholders.

9. Key staff on the eradication team should have considerable familiarity with Wake Atoll, its inhabitants and its off-island managers, and ideally the project manager should be directly involved in the project from beginning to end.

10. Greater flexibility is required in the determination of bait rates, either by more detailed bait uptake research or building in a more appropriate margin for error in the bait rates. Allowances need to be permitted for adaptive situations, such as extra baiting levels in special treatment areas or supplemental application where baiting has been deemed insufficient.

11. Stakeholders should be prepared to postpone the project if pre-determined conditions are not met at pre-determined times.

12. The Feasibility Study for the eradication project needs to identify all issues of concern, and subsequent work should attempt to resolve the issues before the operational planning commences. The entire feasibility assessment and subsequent planning process needs to be revisited and the key issues addressed more fully prior to implementing a second attempt to eradicate Polynesian rats on Wake Atoll.

13. Resources should be allocated for post-operational monitoring. Options such as post-operational use of rodent-detecting dogs to detect any surviving rats should be evaluated. Any detection made could be followed up by pre-determined emergency response measures.

14. Bait palatability needs further research, especially where abundant alternative food resources occur and when rat breeding is occurring. The possible effect of ant activity on bait palatability to rodents also warrants investigation. Preference trials could be conducted between ant-tainted and fresh bait palatability to rats.

15. More data should be collected on rat population and breeding indices, in conjunction with plant phenology (especially known rat food sources) and year-to-year climate cycles and variation, to further refine the optimum times to undertake eradication on Wake Atoll and other tropical islands.

16. Immediate pre-drop monitoring should be completed on rat and crab densities to ensure to the extent possible that populations (or crab activity) are comparable to earlier data. Any increases in numbers should warrant re-evaluation of intended bait rates.

17. Staff scheduling should ensure all legal and critical staffing requirements (i.e., presence of authorized pesticide handlers and GIS personnel) are covered at all stages of the project. Potential replacements also need to be identified and be available if required, rather than have the project compromised by the loss of a key person.

At the request of the 611 CES/CEIE (PACAF), DOD Certified Entomologists Lieutenant Colonel Teig and Captain Mundal visited Wake Atoll in March of 2013 to evaluate the effectiveness of aerial application of rodenticides conducted in May 2012 to eradicate rats, and to make recommendations for future management. Based on their observations, the team recommended that quarterly surveillance and baiting of Polynesian rats be continued by a team of DOD Certified Pesticide Applicators, a baiting and trapping strategy be developed to improve success, nighttime surveys be conducted to identify if the Polynesian rat population is growing, and ironwood trees and thatch (controlled burns) be removed to reduce favorable food and harborage for the rats (Teig 2013).

As a follow up to the analysis of rodent eradication efforts conducted in March, Lieutenant Colonels Mark Breidenbaugh and Karl Haagsma conducted a site visit in April 2013 (USAF 2013). The purpose was to follow up on the analysis of rodent eradication efforts begun by the team in March. Directed by their initial findings, the trip's objective was to further examine the scope of rodent infestations on Wake as well as to develop a preliminary course of action for future invasive species control. Based on the site visit, the team noted that trapping and surveillance activities suggested that although the Polynesian rat population appeared to be growing, the majority of the rats seemed to be located in a few generalized areas, including in and around the landfill area, and in and around the golf course area adjacent to Heel Point (USAF 2013). Several potential forms of competition for ground baiting were identified including a potential lack of competiveness of the bait with natural food sources over time. They noted that the rats, in addition to undoubtedly feeding on a wide variety of food, were also likely consuming the fruits of ironwood trees, Asteraceae flower heads and sedge rhizomes (USAF 2013). They also noted that ants were a significant competitor for the ground-based baits. Hermit crabs and cockroaches (e.g., *Periplaneta americana*) were also observed eating the baits (USAF 2013). The team noted that ground station baiting is one of the best options for rodent population suppression; however, the key factor is to maintain availability of the baits and

prevent infestation of unwanted organisms into the bait stations. The team suggested focusing the baiting efforts in areas that appear to have the densest populations of rodents, with the caveat that steps be taken simultaneously to prevent bait uptake by competing organisms. They suggested that the level of effort would require several personnel committed to these activities on a full-time permanent or semi-permanent basis (USAF 2013). Because of the associated expense, they suggested that an intense trapping period with multiple workers be utilized. The team also suggested the control of ironwood trees and the removal of their thatch to improve success of rat control efforts. The team indicated that another aerial eradication effort could be effective if the alternative food source and refugia issues could be adequately addressed (USAF 2013). The entomologist reports from the March and April 2013 site visits are included in **Appendix G**.

The USAF began partnering with the USDA in 2014 to conduct studies on the efficacy of rodenticide baits for control of wild caught Polynesian rats on Wake Atoll. A large component of the project included conducting taste preference trails (palatability studies) on rats that may support future efforts to eradicate the remaining Polynesian rat population on Wake Atoll. Testing for resistance to anti-coagulant compounds was also a component of the project. Brodifacoum baits were used for the recent (2012) eradication efforts on Wake Atoll; however, it is unknown if brodifacoum is efficacious against the local population of Polynesian rats, or if the baits are palatable and thus consumed by the rats. The 2014 USDA-led research efforts on the Atoll also yielded census and index surveys for the seabird, shorebird, and waterfowl populations using the atoll. In March 2015, USDA returned to Wake to conduct the second portion of the semi-annual seabird and shorebird surveys as well as lagoon fish sampling for heavy metals and Brodifacoum residuals from the rat eradication project.

Birds

Sooty terns on Wilkes Island in October 2013

Wildlife on Wake Atoll is dominated by a diversity of seabirds and migratory shorebirds and waterfowl. Wilkes and Peale islands support large numbers of resident and migratory seabirds and visiting winter resident shorebirds and waterfowl. Prior to the presence of humans on Wake Atoll, the islands likely supported a diverse assemblage of seabirds and shorebirds. Accounts from the Tanager Expedition in 1923 noted observations of 19 species of birds including many that are currently present (Bryan 1942). Japanese feather hunters from the early part of the 20th Century adversely affected bird populations. The destruction of habitat prior to, and during World War II devastated the remaining bird populations. Surveys that followed the war found very few birds present (Bryan 1959; Fosberg 1959). It was not until the early 1990s that seabird species richness and population sizes began to increase. Recent surveys by the Endangered Species Recovery Council (Ogden Environmental and Energy Services, Co., Inc.1999) and Rauzon and Gilardi (2007) recorded 32

bird species on Wake Atoll. A robust biological monitoring protocol was developed by the University of Missouri and Pacific Islands Conservation Research Association (PICRA) in 2008. Using the protocols, biological monitoring was conducted in 2009 and 2010 by PICRA (PICRA 2009, 2010). In October 2010, Marine Endeavors was contracted by the BOS contractor to conduct biological monitoring of seabirds and wetland/shorebirds on Wake Atoll. Monitoring occurred from October to November 2010 and from January to February 2011. A total of 12 species of seabirds and 15 species of wetland and shorebirds were observed during these surveys. The species recorded in the surveys are further discussed below.

Ten shorebird surveys were conducted by USFWS on Wake and Peale islands between late 2011 and Summer 2012 as part of the Wake Atoll Rat Eradication Shorebird Survey to measure an index of shorebirds prior to the broadcast application of the anticoagulant rodenticide Brodifacoum during the Wake Atoll Rat Eradication Project (USFWS 2012). Eight shorebird species were surveyed over the 10 survey events. Surveys were conducted along three routes representing three general habitat types. One route was located on Peale Island; the other two were located on Wake Island. Summaries of the results of the survey are included in the following discussions of shorebird species on Wake Atoll.

The USDA and Marine Endeavours were contracted in 2014 to conduct seabird and shorebird surveys in alignment with the historical protocols, with the exception of several warranted deviations from the protocol. In 2015, Marine Endeavours was awarded the opportunity to continue Wake's biological monitoring on a quarterly basis, with a special emphasis placed on the monitoring of avian communities. The PICRA and USDA modified protocols are included in **Appendix H** for further information pertaining to survey methodologies.

Bird nesting areas on Wake Atoll are shown in **Figure 5-9**. The following pages present more details on species of seabirds, migrating shorebirds, and waterfowl identified on Wake Atoll during recent surveys. In addition, **Appendix E** includes the most up-to-date complete list of birds that have been documented on Wake Atoll based on the Status of Birds of Wake Atoll (Rauzon et al. 2008) and surveys that have been conducted since the document was compiled.

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Figure 5-9. Bird Nesting Areas on Wake Atoll

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Seabirds

Laysan Albatross

Laysan albatross near the gate to the bird sanctuary on Wilkes Island in March 2013

The Laysan albatross (*Phoebastria immutabilis*) is a small albatross that is mostly white. Its back, upper wings and tail are dark brown and it has a dark patch around the eye. Its feet extend beyond its tail in flight (Pratt et al. 1989). It is a bird of the open ocean and is rarely seen near land except on breeding islands (Pratt et al. 1989). The Laysan albatross is known to have nested on Wake Atoll in the past few years. The nest initiation season for this species usually begins in late November and continues through early December. The incubation period lasts 63-66 days. Traditional nesting areas include the northern end of the eastern side of the runway and the MDA area near Peacock Point. During the 2010/2011 PRC monitoring surveys, 7 individual Laysan albatrosses were observed, including 2 breeders and 5 non-breeders. One Laysan albatross nest was active during the monitoring in January and February 2011. It was located alongside the easternmost road in the MDA area under a tournefortia tree. This was also the location of a nest during the breeding season in 2009 and 2010. Non-nesting Laysan albatross were observed daily during the survey on Wake and Wilkes islands. The most frequent utilized site was in the open fields north and west of the main MDA offices/old air traffic control tower. When 2 or more birds were observed, they were often engaged in courtship displays or sitting together allopreening. These behaviors indicated signs that the pair might attempt to nest in the area in the future. Other areas where Laysan albatross were observed included the east side of the causeway connecting Wake and Wilkes islands, an open field at the southwestern corner of Wake Island, south of the boat harbor and the fuel farm (PRC 2011).

Kristen Rex (611 CES/CEIE, non-federal entity) observed 3 Laysan albatross in the vicinity of the gate to the bird sanctuary on Wilkes Island in March 2013 (see the photo of 2 of the Laysan albatross). Two of the birds were in proximity to a nest, but there was no egg. Based on correspondence with Kyle Kimber (Environmental Technician with Chugach on Wake Atoll) on 28 March 2014, a Laysan albatross laid an egg in a nest at the gate to the bird sanctuary. The bird sat on the nest for approximately 2 weeks. Two additional Laysan albatross were also present in the area. All 3 birds left for approximately 3 weeks. One bird returned after 3 weeks and then left. The egg was still on the nest in April 2014. A Laysan albatross also laid an egg in the MDA area near the end of November 2013. The bird remained with the nest until the end of January 2014, when it left Wake Atoll. There was no sign of a hatchling or the egg after the bird left.

Black-Footed Albatross

Source: Lloyd 2007

Black-footed albatross

The black-footed albatross (*Phoebastria nigripes*) is dark brownish gray with a white band at the base of the tail on the upper side. The base of its bill is white (Pratt et al. 1989). It is a bird of open oceans and offshore waters (Pratt et al. 1989). It has nested on Wake Atoll in previous years in the MDA area, near the old dispensary, and also on Wilkes Island. During the January and February 2011 PRC monitoring surveys, black-footed albatrosses were observed on three occasions. Observations included 3 individuals soaring offshore, off the east end of the runway and overland in the Peacock Point area; 2 individuals were observed on a coral rubble berm on the east side of the easternmost road in the MDA area; and 1 individual was observed soaring over the open fields around the MDA offices and offshore. No nests were observed during the surveys (PRC 2011). A single black-footed albatross was observed by Kyle Kimber flying/circling around the fuel pier and marina area in the March-April timeframe in 2014.

Wedge-Tailed Shearwater

Wedge-tailed shearwater on Wilkes Island in October 2013

The wedge-tailed shearwater (*Puffinus pacificus*) is a medium sized bird with a long wedge-shaped tail. It has a slate colored bill that turns down at the end and flesh colored legs (Pratt et al. 1989). There are 2 morphs of the wedge-tailed shearwater. The light morph is dark brown above with grayish white below. The dark morph is dark brown above with dark gray below. It is a bird of the open ocean and offshore waters (Pratt et al. 1989). Wedge-tailed shearwaters have previously nested on the southwestern side of the cleared area on Wilkes Island, to the north and west of the twisted metal rods. Two colonies of wedge-tailed shearwaters developed on Wake Island following the elimination of feral cats. One colony developed in the vicinity of the MDA and 1 near the fuel farm. The colonies were greatly affected by the storm surge associated with Typhoon Ioke. Wedge-tailed shearwaters nest in burrows

Wedge-tailed shearwater in burrow on Wilkes Island in October 2013

(Pratt et al. 1989). The Peacock Point colony adjacent to the MDA assembly building was reduced from over 20 active burrows to 6 apparently active burrows. The colony near the fuel farm was reduced to a few burrows. Both sites were flooded then covered with floating debris that blocked access to burrows. Occupied burrows can be identified by the presence of fresh digging, footprints, feathers, droppings, and a strong musky odor. During the October 2010 PRC monitoring surveys, a total of 60 occupied burrows in the traditional nesting area on Wilkes Island were observed. All burrows were located within a 1.06-acre area in the southwestern portion of the cleared area on Wilkes Island. Eight of the burrows contained live, fully feathered shearwater chicks. A single wedge-tailed shearwater was also observed flying in the downtown area in October 2010 (PRC 2011). In July 2013, 3 adult wedge-tailed shearwaters were observed by Kristen Rex (611 CES/AFCEC and CFPE) on the walking path on Wilkes Island just prior to the open nesting field. Several active burrows were also observed in the Wilkes Island nesting area during site visits conducted in October 2013 in association with this INRMP. In March 2014, a colony of approximately 30 wedge-tailed shearwaters was observed nesting in the open field on Wilkes Island.

Masked Booby

The masked booby (*Sula dactylatra*) is the largest of the boobies. Adults are white with blackish brown flight feathers and tail. It has a black face mask. Its legs, bill, and feet are typically gray in the Pacific, but are olive to grayish green in its eastern range (Pratt et al. 1989). Masked booby numbers began increasing on Wilkes Island since cat control began in 1996, and numbers continued to increase dramatically when the cats were eradicated in 2007. In 2007, Rauzon and Gilardi counted 25 nests and 60 masked boobies on Wilkes Island, which was an increase from 1996. During the October 2010 PRC monitoring surveys, a total of 32 masked booby nests and 82 adults were observed. In February 2011, a total of 58 masked booby nests and 89 adults were observed. Nests in all developmental stages were present during both surveys, indicating that masked boobies have a protracted nesting season on Wake Atoll. Data indicate that masked boobies exhibit 2 nesting peaks, 1 in summer (July-August) and 1 in winter (January-February). The breeding cycle (incubation to fledging) lasts approximately 5 months, and this species can raise multiple broods in 1 year (PRC 2011). Masked booby adults and juveniles were commonly observed on Wilkes Island during site visits conducted in October 2013 in association with this INRMP. Adults were also observed on nests with eggs during the October 2013 site visits.

Masked booby and chick on Wilkes Island in October 2013

Brown Booby

The brown booby (*Sula leucogaster*) is clearly marked with brown on the back, head, and chest and white on the underside. The female is larger than the male. The male's face is blue and the female's face is yellow-green. The bill and face vary from green to yellow (Pratt et al. 1989). Brown boobies nest on Wilkes Island. In 2007, Rauzon and Gilardi counted approximately 165 brown booby nests and 315 adults in one evening at dusk. Since brown booby nesting is protracted through the season, a total nesting population reaching 500 birds may be present on the Atoll. During the October 2010 PRC monitoring survey, a total of 57 nests and 237 adults were observed in the Wilkes Island colony. The majority of the nests contained fully feathered juveniles, indicating that the survey was conducted late in the nesting season. A total of 127 adults were also observed roosting along the shoreline and on the rocks off the tip of Wilkes Island. In February 2011, only 1 nest and 100 adults were observed in the colony. More than 1 dozen newly constructed nests were observed, but the nests were empty. Nests were being attended by 1 adult, or a pair of adults, indicating that the birds might have been preparing the nests. A total of 29 adults roosting along the shoreline were also observed in February 2011. Evening counts in October 2010 recorded 211 adults returning from sea to Wilkes Island; evening counts in February 2011, recorded only 62 adults. These data support that brown boobies are less active on Wilkes Island during the winter months. A Brewster's brown booby (*S.l. brewsteri*), a subspecies of the brown booby, was observed on Wilkes Island in October 2010 and in January and February 2011. The bird was attending a newly constructed nest in January 2011. This subspecies typically breeds in the eastern Pacific and is rare in the central Pacific (PRC 2011). Brown booby adults and juveniles were commonly observed on Wilkes Island and on offshore rocks and structures during site visits conducted in October 2013 in association with this INRMP.

Brown boobies on Wilkes Island in October 2013

Red-Footed Booby

The red-footed booby (*Sula sula*) is the smallest of the boobies. There are two primary plumage phases in adult red-tailed boobies. The white phase is primarily white with dark flight

Red-footed booby on Wilkes Island in October 2013

feathers. The brown phase is brown with a white belly, rump and tail. All phases have straight pale blue bills, bright red feet and bare pink facial skin at base of the bill (Audubon 2014). Juveniles are all brown with a gray bill and feet (Pratt et al. 1989). Red-footed boobies are birds of the open ocean often far from land (Pratt et al. 1989). In June 2007, Rauzon and Gilardi (2007) estimated the red-footed booby (*Sula sula*) to have a population of at least 1,500 birds on Wake Atoll. Red-footed booby numbers have been difficult to estimate because they roost and nest in dense tournefortia forest on Wilkes Island. Results from the 2010/2011 PRC monitoring surveys indicated that red-footed boobies used an area of 18.5 acres in the center of Wilkes Island. During evening arrival counts in October 2010, a total of 1,174 red-footed boobies were observed; and, in February 2011, 122 were observed. Nest surveys were not conducted; however, six nests were encountered during vegetation monitoring in October 2010 and 3 nests were encountered in February 2011 (PRC 2011). Red-footed boobies were commonly observed on Wilkes Island during site visits conducted in October 2013 in association with this INRMP. Juveniles were observed in nests in tournefortia trees in the central area of Wilkes Island during the 2013 site visits.

Great Frigatebird

The great frigatebird (*Fregata minor*) is a large bird with long slender wings and deeply forked tail. It has a blue-gray to black hooked bill. Adult males are black with an iridescent purple-green mantle and a bright red inflatable throat pouch. The female is larger than the male and is black with a diagonal buff bar on the upper wing, white breast and grayish throat. Juveniles have a dark chestnut head and breast separated from a white belly by a dark band (Pratt et al. 1989).

Great frigatebirds on power cable on Wilkes Island in October 2013

Great frigatebirds roost on the cables that cross the submarine channel on Wilkes Island. They also roost in tournefortia along with red-footed boobies on Wilkes Island north of the submarine channel, and in tournefortia at the north end of Wilkes Island. In 2007, an estimated 300 roosting great frigatebirds were observed in tournefortia along the beach on the western side of Wilkes Island, and Hebshi and Patrick (2007) documented the presence of two nests. During the October 2010 surveys conducted by PRC, a total of 511 great frigatebirds were observed on Wilkes Island. These included 341 birds resting on cables and casuarina trees near the submarine channel and 170 birds roosting on tournefortia, casuarina, and cordia trees around the perimeter of the island. In February 2011, a total of 118 great frigatebirds were observed on Wilkes Island, mostly roosting in tournefortia trees along the northwestern edge of the open colony area. No nests were observed during the 2010/2011 PRC monitoring surveys. One female lesser frigatebird (*Fregata ariel*) was observed in a great frigatebird roosting area near the

causeway to Wilkes Island in October 2010 (PRC 2011). Great frigatebirds were observed on the cables that cross the submarine channel on Wilkes Island, in tournefortia along with red-footed boobies on Wilkes Island north of the submarine channel, and in tournefortia at the north end of Wilkes Island during site visits conducted in October 2013 in association with this INRMP.

Red-Tailed Tropicbird

The red-tailed tropicbird (*Phaethon lepturus*) is a robust medium sized tropicbird that is white with bright red stiff central tail feathers and a bright red down curving bill. It has a distinctive black eye stripe and the legs and feet are black (Pratt et al. 1989). It also has black streaks on the sides of the body and at the base of the wing. Juveniles have black bars on the head, back, and undersides of the wings. Juveniles do not have the tail streamers (Pratt et al. 1989).

Red-tailed tropicbirds nesting adjacent to Wilkes Avenue in October 2013

Red-tailed tropicbirds nest on Wake Island. Rauzon and Gilardi (2007) estimated 100 red-tailed tropicbirds were present on the Atoll, largely on Wake Island. Several pairs were seen prospecting on Wilkes Island, both in the designated refuge area and along the shore near the Prisoner of War Memorial. In 2010 and 2011, data on red-tailed tropicbirds were collected opportunistically while conducting other monitoring. In January and February 2011, 23 active nests on Wake Island (6 nests) and Wilkes Island (17 nests) were observed (PRC 2011). Red-tailed tropicbirds were regularly observed flying over Wake Island during site visits conducted in October 2013 in association with this INRMP. Two active nests were also observed along Wilkes Avenue between the gate to the Wilkes Island bird nesting area and the submarine channel, and 1 was observed along the shore near the Prisoner of War Memorial during the October 2013 site visit associated with this INRMP.

Sooty Tern

Sooty tern adults and chicks on Wilkes Island in October 2013

The sooty tern (*Onychoprion fuscatus*), also commonly referred to as black-back sooty terns, is dark brown (appearing black) on its upper parts and white on its under parts. The forehead is white back to the eye and there is a black eye line from the bill to the back of the head. The tail is forked. Juveniles are dark sooty brown with buff feather edges and a white belly (Pratt et al. 1989). Sooty terns have been historically found to nest on Wilkes Island, the northern end of Peale Island, and along the northeastern side of the runway on Wake Island. In February 2007, a total of 192,000 nests were estimated; and, in January 2008, a total of 109,000 nests were estimated. During the October and November 2010 monitoring surveys, no sooty tern nests were encountered; however, single birds were observed and small groups of birds were observed flying over the Atoll. A flock of approximately 10,000 sooty terns were observed over the water northwest of Kuki Point on Wilkes Island one evening in October 2010. In January and February 2011, a large, sooty tern nesting colony, approximately 11.54 acres in size with approximately 113,584 nests, was present on Wilkes Island. The size of the sooty tern nest area and the number of nests were expected to increase past the February 2011 data collection period. No nests were recorded in October/November 2010 (PRC 2011). Sooty and gray-backed tern eggs and chicks were reported along the road down the center of Peale Island by the BOS contractor in July 2013. The area where the eggs and chicks were observed was made off limits to foot traffic while the eggs and chicks were present. Sooty tern adults, juveniles, and chicks were abundant in the cleared nesting area in the northern section of Wilkes Island during site visits conducted in October 2013 in association with this INRMP.

Sooty tern chick on Wilkes Island in October 2013

Gray-Backed Tern

The gray-backed tern (*Onychoprion lunatus*) is a dark-backed tern with a long deeply forked tail. It resembles the sooty tern but has a grey back instead of a black one (Pratt et al. 1989). The back is palest on its upper parts. It has a black cap and narrow white forehead with black eye

line from the bill to the back of the head. The breast, underparts, and outer tail feathers are white.

Source: Starr and Starr 1999

Gray-backed tern with egg

There is a black eye line from the bill to the back of the head (Pratt et al. 1989). The gray-backed tern historically nested on Peale Island adjacent to the north shore. Typhoon Ioke destroyed the colony on Peale Island, but it reformed again in October 2007. In 2007, about 10 terns were counted in the area near the end of the runway. Eggs were just being laid in the first week of June. Another individual pair was observed by Rauzon and Gilardi (2007) to be nesting away from the main colony along the runway taxiway apron and lagoon edge. During the 2010/2011 monitoring surveys, no gray-backed terns were observed on Wake Island (PRC 2011). Gray backed and sooty tern eggs and chicks were reported along the road down the center of Peale Island by the BOS contractor in July 2013. The area where the eggs and chicks were observed was designated as off limits to foot traffic while the eggs and chicks were present.

Black Noddy

Black noddy on Peale Island in October 2013

The black noddy (*Anous minutus*) has sooty black plumage and a white cap that blends into the dark neck. There is a white crescent on the lower eyelid. They have black legs and feet. The black noddy is similar to the brown noddy, but is smaller, darker, and has a longer narrower bill (Pratt et al. 1989). Black noddies were estimated to have 2,000 nests in the casuarina trees around Wake Atoll in 2007 (Rauzon and Gilardi 2007). Wilkes Island has also been known to provide nesting habitat for black noddies. During the 2010 and 2011 monitoring surveys, black noddies were surveyed on Wake Island in 10 separate monitoring plots. In October 2010, a total of 177 adult birds and 13 active nests were observed. In February 2011, a total of 7 adult birds and 1 active nest were observed. These data indicated that relatively few black noddy nests are initiated during the winter months (PRC 2011). Black noddies were commonly observed during site visits

conducted in October 2013 in association with this INRMP. Black noddies and nests were common in casuarina in and around the billeting area in October 2013.

Brown Noddy

The brown noddy (*Anous stolidus*) is a dark brown tern with a pale cap. It has a long narrowly wedge-shaped tail and brown legs and feet (Pratt et al. 1989). The brown noddy is larger and approximately twice the weight of the black noddy. Brown noddies nest on both Wake and Wilkes Island. Rauzon and Gilardi (2007) estimated 600 brown noddies nesting in the casuarina and several nesting on the ground on both Wilkes and Wake islands. Brown noddy monitoring was conducted by PRC on Wake Island in 2010 and 2011 in 10 separate monitoring plots. No monitoring was conducted on Wilkes Island. In October 2010, a total of 50 adult birds were observed. No adults were observed in the February 2011 monitoring. In addition, no brown noddy nests were observed during either sampling period. These data indicate that brown noddies might regularly spend the winter months away from Wake Atoll (PRC 2011). Brown noddies were commonly observed offshore on structures emerging above the water during site visits conducted in association with this INRMP.

Source: Guest 2005

Brown noddy and chick

White Tern

The white tern (*Gygis alba*) is a small white seabird with a black eye ring, and shallowly forked tail. It has a heavy bill that is mostly black with blue at the base. The bill is shaped like an elongated triangle. The legs and feet are slate blue (Pratt et al. 1989). White terns do not build nests; they lay their eggs on small depressions or forks in tree branches. The white tern nests primarily on branches in casuarina on Wake, Wilkes, and Peale islands. In 2007, Rauzon and Gilardi (2007) estimated about 500 white terns nesting in casuarina on the Atoll. During the 2010 and 2011 PRC surveys, white terns were monitored in 10 plots on Wake Island that contained a variable number of casuarina trees.

White terns on Wilkes Island in October 2013

In October 2010, a total of 16 adult birds, 1 active nest, and 2 juveniles were observed. In February 2011, a total of 16 adult birds and 1 large chick were observed. The low number of nests recorded indicates that surveys were completed outside the peak nesting season for the white tern (PRC 2011). White terns were commonly observed on the Atoll during site visits conducted in association with this INRMP, primarily in openings associated with casuarina forests, or around clumps of casuarina in the billeting area.

Shorebirds

Pacific Reef Heron

The Pacific reef heron (*Egretta sacra*) is a medium-sized heron that shows non-sexual dimorphism, with either birds having entirely white plumage or charcoal gray plumage. They have short greenish yellow legs, a heavy yellow beak, gold-yellow colored eyes and the surrounding areas of their faces normally have a greenish to yellow cast. The throats and chins of the gray variety are marked by a narrow, white stripe. There is a less common pied morph that is white and variably mottled with slate gray (Pratt et al. 1989). Pacific reef herons typically feed on varieties of ocean-based fish, crustaceans, and mollusks (Pratt et al. 1989). No Pacific reef herons were observed during the 2010 and 2011 PRC monitoring surveys, or during previous surveys; however, during site visits conducted in October 2013 in association with this INRMP, a Pacific reef heron (pied morph) was observed on Peale Island along the shoreline in HMU-60.

Pacific reef heron on Peale Island in October 2013

Pacific Golden Plover

The Pacific golden plover (*Pluvialis fulva*) is a common migrant in much of the Pacific. It has dark brown upperparts, speckled with gold to pale yellow or white. A white stripe extends from the forehead, over the eyes, to the wings. Breeding males are solid black from the chin to under the tail. Females are duller in color (Bird Web 2014). Pacific golden plovers are commonly observed throughout open areas on Wake Atoll including the golf course, runway, and reef flats. During the 2010/2011 PRC

Pacific golden plover on Wake Island in October 2013

monitoring surveys, the Pacific golden plover was the most common species observed in the wetlands and in the exposed mudflats. A total of 94 individuals were recorded in the wetland areas and 262 individuals were recorded in the mudflats (PRC 2011). A total of 270 Pacific golden plovers were recorded during the surveys conducted between 15 November 2011 and 26 July 2012 as part of the USFWS Wake Atoll Rat Eradication Shorebird Surveys. Pacific golden plovers were recorded during each of the 10 survey events. Pacific golden plovers were also commonly observed, primarily in mowed habitats, during site visits conducted in association with this INRMP in October 2013.

Lesser Sand Plover

The lesser sand plover (*Charadrius mongolus*) is gray-brown with a white eyebrow and forehead. Its underparts are white with a gray brown patch on the side of the breast. Its legs are dark grey. The breeding plumage has a broad rufus breast band (Pratt et al. 1989). The lesser sand plover is an uncommon migrant in western Micronesia, but are rare migrants in the Marshall Islands. In December 2006, there was a single report of this species from Wake Atoll (Rauzon et al. 2008). One single lesser sand plover in basic non-breeding plumage was observed in October 2010 on the exposed mud flats at the southern end of the lagoon at low tide (PRC 2011).

Source: Harrison 2011

Lesser sand plover

Wandering Tattler

The wandering tattler (*Tringa incana*) is a sandpiper that is dark gray with lighter gray undersides. It has a white stripe from its bill to the back of its head. The bill is black and its legs are dull yellow. Its breading plumage is heavily barred on the undersides with bold bars on the undertail (Pratt et al. 1989). Wandering tattlers are common wintering birds to Wake Atoll. In March 1999, Rauzon et al. (2008) reported approximately 75 wandering tattlers scattered around the island on rocky reefs and in small wetland ponds primarily located on Wake Island. In the 2010/2011

Source: USFWS 2013a

Wandering tattler

PRC surveys, wandering tattlers were observed in nearly every survey event, with a total of 20 individuals recorded in the wetlands and 6 individuals recorded in the exposed mudflats at the southern end of the lagoon. Incidental observations were also recorded in other areas of the island, including up to 4 birds at the submarine channel on Wilkes Island (PRC 2011). A total of 11 wandering tattlers were observed during four survey events associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys.

Gray-Tailed Tattler

The gray-tailed tattler (*Tringa brevipes*) is very similar to the wandering tattler. The upper parts, underwings, face, and neck are grey, and the belly is white. They have short yellowish legs and a bill with a pale base and dark tip. The best distinction between the gray-tailed tattler and the wandering tattler is the call; the grey-tailed tattler has a two-syllable too-weet, and the wandering tattler has a rippling trill of short whistles that trail off at the end (Pratt et al. 1989). The gray-tailed tattler is a rare visitor to Wake Island with only five previous records of single birds in 1996, 1998, 1999, 2004, and 2007. During the 2010/2011 PRC monitoring surveys, 1 or 2 gray-tailed tattlers were observed on several visits. These birds were most often observed in the ponds and tidal channels (seven occurrences), but occasionally on the exposed mudflats at the southern end of the lagoon (two occurrences) (PRC 2011).

Gray-tailed tattler in wetland on Wake Island

Whimbrel

The whimbrel (*Numenius phaeopus*) is a large wader with a distinctive long dark brown down-curved bill and long gray legs (Pratt et al. 1989). It is gray-brown with brown streaks on its upper sides, neck, and breast. Its belly and rump are white. It has a dark brown crown, a grayish line above its eye, and a dark brown line that runs over its eyes like a mask (Nature Works 2014). The whimbrel is a fairly common migrant in the Marshall Islands; however, only 1 individual whimbrel had been documented on Wake Island in October 2007 (Rauzon et al. 2008).

Source: Daniels 2009.

Whimbrel

During the 2010/2011 PRC monitoring surveys, a total of 5 whimbrels were recorded on the exposed mudflats at the southern end of the lagoon and 7 were recorded in wetland areas (PRC 2011).

Bristle-Thighed Curlew

The bristle-thighed curlew (*Numenius tahitiensis*) is a large, brown-streaked shorebird with long curved bill. It has a striped head, dark eye-line, and a contrasting white eyebrow. Its rump and tail are cinnamon brown and its legs and feet are blue-gray (Pratt et al. 1989). Its legs trail behind its tail during flight. A bristle-thighed curlew was observed on 10 occasions at several locations in the 2010/2011 PRC surveys. Areas where the bird was observed included wetlands, the interior of Peale Island, and the eastern shoreline near Peacock Point. All observations were of 1 individual bristle-thighed curlew (PRC 2011). A total of 37-39 bristle-thighed curlews were observed during nine survey events associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys. A bristle-thighed curlew was also observed at the abandoned USCG station and on the shoreline of Peale Island during site visits conducted in association with this INRMP in 2013.

Bristle-thighed curlew on Peale Island in October 2013

Ruddy Turnstone

The ruddy turnstone (*Arenaria interpres*) is a shorebird with short orange legs and a thick pointed bill. It has a distinctive black or gray and white pattern on its head and breast. Its back is reddish brown and its tail is white with a black terminal band. It has a highly distinctive black and white pattern on its wings and tail in flight (Pratt et al. 1989). The ruddy turnstone is considered to occur on Wake Island in low numbers. However, during the 2010/2011 PRC monitoring surveys, ruddy turnstones were observed on almost all visits to the wetlands (47 individuals) and mudflats (54 individuals). In addition, a group of 24 turnstones were observed roosting at dusk in the Wilkes Island bird nesting area (PRC 2011). A total of 31 ruddy turnstones were observed during six survey events associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys. Several individuals and small flocks of ruddy turnstones were observed in different locations,

Source: Hillewaert 2011

Ruddy turnstone

primarily in association with mowed habitat, during site visits conducted in association with this INRMP in October 2013.

Sanderling

The sanderling (*Calidris alba*) is a small stocky sandpiper. It is light gray on its back and white on its undersides. It has a distinctive black patch at the bend of its wing and its legs and bill are black. It has a distinctive white wing stripe when it is in flight (Pratt et al. 1989). Sanderlings are uncommon, but regular migrants in the Marshall Islands. On Wake Atoll, there have been 7 individual records of sanderlings from 1963 through 2007 (Rauzon et al. 2008). On several occasions during the 2010/2011 PRC monitoring surveys, 1-3 sanderlings were observed foraging in the mudflats at the southern end of the lagoon near the wetlands on several occasions (a total of 11 occurrences) (PRC 2011).

Source: Daniels 2008a

Sanderling

Pectoral Sanderling

The pectoral sanderling (*Calidris melanotos*) is a large sanderling, but is quite variable in size. Its upper parts and breast are buff with brown streaks. The color ends abruptly on the lower breast and the belly is white. Its legs are yellowish green (Pratt et al. 1989). Pectoral sanderlings are rare migrants in Micronesia. In 2007, 2 pectoral sanderlings were photographed in the wetlands (Rauzon et al. 2008). During the 2010/2011PRC monitoring surveys, 2 pectoral sanderlings were observed foraging in the wetlands and a single bird was observed foraging in a tidal channel adjacent to the wetlands in October (PRC 2011).

Pectoral sanderling in wetlands on Wake Island

Sharp-Tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*) is similar to the pectoral sanderling, but it is thinner and more reddish with a prominent chestnut cap and white eyebrow. The breast has a diffuse orange color and there are rows of chevrons along its sides (Pratt et al. 1989). The sharp-tailed sandpiper is considered an uncommon, but regular migrant to the Marshall Islands. In 2007, a total of 24 sharp-tailed sandpipers were observed on Wake Atoll (Rauzon et al. 2008). During the October/November 2010 PRC monitoring surveys, sharp-tailed sandpipers were

observed in the wetlands during each survey, with a total of 56 occurrences recorded. In addition, 4 individuals were recorded on the exposed mudflats at the southern end of the lagoon. No sharp-tailed sandpipers were recorded in January/February 2011 (PRC 2011). A total of 4 sharp-tailed sandpipers were observed during one survey event on 11 November 2011 associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys. A sharp-tailed sandpiper was also observed in mudflats associated with a wetland adjacent to the Airfield and POL fuel area during site visits conducted in association with this INRMP in 2013.

Sharp-tailed sandpiper on Wake Island in October 2013

Ruff

The ruff (*Philomachus pugnax*) is a large sandpiper with the male being much larger than the female. The female and the non-breeding male have grey-brown upperparts and primarily white underparts. They appear thick necked and small headed with long legs and a stocky body. The breeding male has variable brightly colored neck ruffs; however, this has not been recorded in the tropical Pacific. The ruff is found in mudflats and occasionally along shorelines (Pratt et al. 1989). Two ruffs were recorded on 15 November 2011 and 1 was recorded on 27 February 2012 on Wake Island during survey events associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys.

Source: Garg 2009

Ruff

Dunlin

The dunlin (*Calidris alpina*) is a short-legged sandpiper with a long bill that is drooped at the tip. It has streaking on the neck, a reddish brown back and cap, and whitish underparts with a black belly. The bill and legs are dark. It is found in association with mudflats and sandy beaches usually with other small sandpipers (Pratt et al. 1989). One dunlin was

Source: Daniels 2008b

Dunlin

recorded on Wake Atoll on 27 February 2012 during survey events associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys.

Long-Billed Dowitcher

The long-billed dowitcher (*Limnodromus scolopaceus*) is a large, plump, long-billed sandpiper with a prominent strip of white up the center of its back. It feeds in freshwater ponds and less often in tidal flats (Pratt et al. 1989). The long-billed dowitcher is a rare bird on Wake Atoll, with only two records from 2003 through 2007 (Rauzon et al. 2008). During the 2010/2011 PRC surveys, a single long-billed dowitcher was observed in two separate incidents in October/November 2010. The bird was first observed in a small wetland on the southwestern corner of Wilkes Island, and then recorded roosting at dusk in the Wilkes Island bird nesting area (PRC 2011). One long-billed dowitcher was observed during the 15 November 2011 survey associated with the 2011 and 2012 USFWS Wake Atoll Rat Eradication Shorebird Surveys.

Long-billed dowitcher observed on Wilkes Island

Waterfowl

During the 2010/2011 PRC monitoring surveys, wetland areas were surveyed on eight occasions in October and November 2010 and on seven occasions in January and February 2011. Sites surveyed on Wake Island included the ponds (observed from three separate observation points), stormwater detention basin, and the tidal channels (observed from two separate observation points). Exposed mudflats in the southern end of the lagoon were surveyed during low tide. Incidental observations of shorebirds were also recorded at other locations, including the small wetland on the southeastern corner of Wilkes Island, the golf course ponds, and shoreline areas throughout the Atoll.

Female Eurasian wigeon, female northern pintail and, and female northern shoveler in a wetland area on Wake Island

Northern Shoveler

The northern shoveler (*Anas clypeata*) is a medium-sized duck with a spatulate bill, blue forewing, green area on the wing (speculum), and orange legs. The adult male has a green head, white breast, chestnut belly and black rump. The female is mottled brown except for on the upper wing (Pratt et al. 1989). Documented observations of northern shovelers on Wake Atoll are uncommon. Two female northern shovelers were observed in 1996 and 1 male was observed in 1999 (Rauzon et al. 2008). During the 2010/2011 PRC surveys, 1 female northern shoveler was observed in wetlands on four separate occasions (PRC 2011).

Northern Pintail

The northern pintail (*Anas acuta*) is a slender long-necked duck with a long tail. It has a brown speculum with a trailing white edge. The male is gray with a brown head and white breast. It has a very long pointed tail and a white line up the side of the neck. The female is mottled brown and has a shorter tail than the male (Pratt et al. 1989). The northern pintail usually occur in low numbers on Wake Island. In October 2007, a flock of 26 northern pintails were observed (Rauzon et al. 2008). During the October/November 2010 monitoring conducted by PRC, northern pintails were observed on every visit to the wetlands with a total of 30 females recorded. A single female northern pintail was observed with a male green-winged teal (*Anus crecca*) on three separate occasions in the Wilkes Island wetland in February 2011 (PRC 2011). One female northern pintail was observed in wetlands adjacent to the WIA and POL fuel area during site visits conducted in association with this INRMP in October 2013.

Eurasian Wigeon

The male Eurasian wigeon (*Anas penelope*) is gray with a chestnut head with a buff forehead and crown. It has a pinkish breast, white patch on the forewing and black posterior bordered with white. The female is dark brown and rusty or gray on the head (Pratt et al. 1989). Eurasian wigeons have been recorded in three separate occurrences from 1999 through 2007, with a total of 9 individuals observed (Rauzon et al. 2008). During the October 2010 PRC surveys, a single female Eurasian wigeon was observed in the ponds on two separate visits, but flew into the tidal channels, or exposed mudflats when approached (PRC 2011).

Eurasian Green-Winged Teal

The Eurasian green-winged teal (*Anas crecca*) is a small, gray-brown duck with a green patch on the wing. The male's head is chestnut with a broad green streak behind the eye. The bill and legs are gray. The female is mottled brown and has a green patch on the wing and a faint stripe above the eye (Pratt et al. 1989). Eurasian green-winged teals were recorded on three separate occasions in February 2011 surveys conducted by PRC. Observations included a single male together with a female northern pintail on Wilkes Island. This was the first recorded occurrence of this species on Wake Atoll (PRC 2011).

Other Bird Species

During the 2010/2011PRC monitoring surveys, other incidental bird sightings included the short-eared owl (*Asio flammeus*). The owl was observed flushing from a roost in a tournefortia tree on Wilkes Island southeast of the wetland in February 2011 (PRC 2011). There have been other records of short-eared owls on the island, including in 2003 (Rautzon et al. 2008). Two non-native bird species, including the feral chicken (*Gallus gallus*) and rock pigeon (*Columba livia*), were also observed during the 2010/2011 monitoring surveys. Feral chickens, including 3 roosters and 6 hens, were recorded in the downtown area and on the golf course on several occasions in January and February 2011. Rock pigeons were introduced to the island in the 1960s; however, in October 2010, the environmental department on the island stated that only one rock pigeon remained on the island and all other individuals were removed. During the 2010/2011 PRC monitoring survey, this single rock pigeon was observed daily near the dining hall (PRC 2011).

Reptiles and Amphibians

Two species of geckos and 2 species of skinks were collected on Wake Island during the Tanager Expedition in 1923 (Bryan 1959). The geckos included the mourning gecko (*Lepidodactylus lugubris*) and the stump-toed gecko (*Gehyra mutilata*). Skinks collected during the expedition included the snake-eyed skink (*Cryptoblepharus boutonii*) and the azure-tailed skink (*Emoia cyanura*). The house gecko (*Hemidactylus frenatus*) also occurs on Wake Atoll and is common in and around buildings and structures.

Mourning gecko on Wake Island

The mourning gecko is common on Wake Atoll. It has a characteristic black bar that extends along each side of the head from the snout through the eye and onto the neck. There are wavy chevron markings that vary in intensity and extend down its back. The tail is slightly flattened and has a distinct angular edge along its side (Kerr 2013; Fritts et al. Undated). Females are capable of reproducing even though no males occur and any adult female can establish a population. The species is common in habitats that furnish cover from direct sunlight and it is often active during the day in reduced light conditions inside structures (Fritts et al. Undated).

Source: Maugh 2013

Stump-toed gecko

The stump-toed gecko, also called the mutilating gecko, is variable in color and can vary from pink to pinkish-grey to yellowish-tan. It typically has small light spots on its back. The stump-toed gecko reaches a length of up to 5 in. and has a stocky body form with a slightly flattened tail (Kerr 2013; Fritts et al. Undated). It occurs in a wide variety of habitats and is found in forested areas in rotten trunks and under bark. It also occurs in buildings and other structures (Fritts et al. Undated). There are no recent recordings of the stump-toed gecko on Wake Atoll.

House gecko in the billeting area on Wake Island

The house gecko is cream, tan, or brown in color. Its color can be uniform, or marbled with darker markings. This is the only gecko that has enlarged spine-like scales arranged in rings on the tail. It reaches a length of up to 6 in. (Kerr 2013; Fritts et al. Undated). The house gecko is a common inhabitant of houses and developed areas in general. It is also found in forested areas. The house gecko is common in the billeting buildings on Wake Island.

The azure-tailed skink is common on Wake Atoll. The azure-tailed skink is best identified by a sharply defined, light-colored mid-dorsal line that extends from the tip of the snout to the bright azure tail. Most adults have at least two additional lateral light colored stripes on a dark brown background. Adults reach approximately 5 in. in length.

Azure-tailed skink on Wake Island

There are no recent recordings of the snake-eyed skink on Wake Atoll. The snake-eyed skink is slender with relatively small limbs for the size of its body and tail. Its eyelids are permanently fused over the eye so the eye always appears to be open. The skink is brownish black with 3 golden dorsal stripes that fuse into two stripes on the tail. The snake-eyed skink can be found on rocks and tree trunks but is usually in close proximity to salt water (Kerr 2013 and Fritts et al. Undated).

In March 1949, a brown tree snake (*Boiga irregularis*) was collected on Wake Island (Bryan 1959). No other accounts of brown tree snakes have been reported on the island.

PRC conducted monitoring surveys for sea turtles in October/November 2010 and January/February 2011. PICRA completed turtle surveys in April of 2010. Sea turtle surveys

completed during the aforementioned time periods focused primarily on shoreline areas identified as having suitable nesting habitat. Sea turtle activity was surveyed weekly on Wake, Peale, and Wilkes islands by walking along the shorelines identified as having suitable nesting habitat. No signs of sea turtles were recorded on any of the shoreline areas surveyed (PRC 2011; PICRA 2010). The federally threatened green sea turtle (*Chelonia mydas*) is regularly observed in the nearshore ocean and lagoon waters at Wake Atoll and 1 was observed near the marina channel in 2013 during site visits associated with this INRMP.

Invertebrates

Strawberry hermit crabs (*Coenobita perlata*) are very common on Wake Atoll. They are a terrestrial hermit crab that is present in most habitats, and they are commonly found in the shade during the day. They feed nocturnally on any available food and commonly scavenge in garbage. They eat decaying material such as dead fish and rats. They also eat the rodenticides in rat bait stations and have been observed eating bird eggs and chicks on Wilkes Island. In October/November 2011 and January/February 2011, PRC recorded the number of hermit crabs observed during the rat surveys in the downtown and runway areas. A total of 37 hermit crabs were recorded in the six surveys, with 12 hermit crabs being the highest number observed in one survey (PRC 2011). Hermit crabs were regularly observed, sometimes in large numbers, during the 2013 site visits associated with this INRMP.

Hermit crab on Casuarina on Wake Island

Several other species of hermit crabs occur on the shore and in associated tidal pools. Hermit crabs identified in tidal pools during biological surveys for intertidal community abundance and composition at the Peacock Point Dump Site on Wake Island in 2013 (Section 5.6.1) included dwarf zebra hermit crabs (*Calcinus laevimanus*), electric blue hermit crabs (*Calcinus elegans*) and yellow tip hermit crabs (*Calcinus latens*) (EA 2013a).

At least 2 other species of land crabs *(Geograpsus crinipes* and *Geograpsus* sp.) are also present on Wake Atoll. *Geograpsus* sp. digs burrows in the casuarina and tournefortia forests. Horned ghost crabs (*Ocypode ceratophtala*) are found in sandy deposits within the intertidal zone. Fiddler crabs (*Uca* sp.) occur in the pemphis/seaside purslane wetlands along the lagoon margin and pond edges.

Horned ghost crab on Wake Atoll

Thin-shelled rock crabs (*Grapsus tenuicrustatus*) are common in the intertidal zone and were regularly observed during site visits conducted in October 2013 in association with this INRMP. Thai support personnel eat the thin-shelled rock crab. Other crabs associated with Wake Atoll include the flat rock-crab (*Percnon planissimum*), red-eyed crab (*Eriphia sebana*), *Leptodius exaratus*, *Leptodius sanguineus*, *Lydia annulipes*, *Pilodius aerolatus*, *Pilumnus longicornis, Pseudozius caystrus*, and sponge crab.

Fiddler crabs on Wake Island

In 2009, an arthropod monitoring survey was conducted by PICRA. The goal of the survey was to collect baseline information on the arthropod fauna on Wake Atoll, identify the presence of native arthropods, and assist in detection of harmful resident and newly arrived pest species. Twenty-four random sites were sampled for arthropods. Four sites were sampled in each of the following habitat types: pisonia/cordia, tournefortia, pemphis wetland, seabird breeding colony, grassland, and casuarina. A total of 2,170 specimens representing 148 species were collected and identified. Some of the arthropods collected included jumping spiders (*Salticidae* sp.), larder beetles (*Dermestidae* sp.), rove beetles (*Staphylinidae* sp.), click beetles (*Elatridae* sp.), springtails (*Collembola* sp.), biting midges (*Ceratopogonidae* sp.), fruit flies (*Drosophillidae* sp.), wasps (*Brachonidae* sp.), soft ticks (*Argasidae* sp.), tiger and lichen moths (*Arctiidae* sp.), leaf miners (*Gracillariidae* sp.), and tropical house crickets (*Gryllodes sigillatus*) (Hebshi et al. 2011).

Thin-shelled rock crab on Wilkes Island

Scorpion sp. on Wake Island

Several scorpions were observed on Wake Island during site visits conducted in 2013 for this INRMP. The scorpions were not identified to species.

The following invasive ant species have been documented on the Atoll: fire ant (*Solenopsis geminate*), bigheaded ant (*Pheidole megacephala*), *Paratrechina* spp., and long-legged ant (*Anoplolepis gracilipes*) (Hebshi and Patrick 2007).

5.3.2 Kōke`e Air Force Station

Mammals

No indigenous mammals are known to reside within Kōke`e AFS. The installation within the fence is characterized primarily by mowed turf. The area outside of the fence is characterized by native mesic forest. Two mammals were recorded on Kōke`e AFS during surveys conducted in 1996: the federally endangered Hawai`ian hoary bat (*Lasiurus cinereus semotus*) that is endemic to Hawai`i and the Norway rat (EA 1996). Additional discussion of the Hawai`ian hoary bat is included under Threatened and Endangered Species and Species of Concern (SOC) in Section 5.5.2. Other mammals that may occur at the installation include rabbits (*Sylvilagus* spp.), cats, and feral pigs (*Sus scrofa*). No mammals were observed on the site during the November 2013 site visit associated with the 2014 INRMP.

Information on mammals documented at Kōke`e MAS is lacking. Except for the area immediately adjacent to individual structures, the site is not fenced. The area surrounding the antenna and structures is characterized by kao forest. There is the potential for wildlife species associated with the surrounding forest to occasionally occur within the boundaries of the site. No mammals were observed on the site during the November 2013 site visit associated with this INRMP; however, there was abundant sign of rutting by feral pigs.

Birds

A total of 14 bird species were observed on and adjacent to Kōke`e AFS during January 1997 surveys. Of these, 5 were native and 9 were non-native species. The mowed turf habitat is typically used by non-native species such as sparrows, doves, and other ground feeders, and by the native migratory Pacific golden plover. Golden plover, red junglefowl (*Gallus gallus*), zebra dove (*Geopelia striata*), common myna (*Acridotheres tristis*), and house finch (*Carpodacus mexicanus*) were all observed on the installation grounds. In addition, the native `elepaio (*Chasiempis sandwichensis*), a type of flycatcher, was observed on the improved portion of the site. The northern

Banded Hawai`ian goose on Kōke`e AFS in November 2013

cardinal (*Cardinalis cardinalis*) and red-crested cardinal (*Paroaria coronata*) were also observed. Several bird species were heard and seen in mesic forest on, and adjacent to, the installation. Native birds seen in the surrounding forest were `apapane (*Himatione sanguinea*), common `amakihi (*Hemignathus virens*), and `anianiau (*Hemignathus parvus*). Additional native birds reported in the area include `i`iwi (*Vestiaria coccinea*), Hawai`ian owl (*Asio flammeus sandwichensis*) (a subspecies of the short-eared owl), Newell's shearwater (*Puffinus auricularis newelli*), and Hawai`ian petrel (`ua`u, *Pterodroma phaeopygia sandwichensis*) (Bruner 1990, 1992; Hawai`i Audubon Society 1993). During the November 2013 site visit associated with this INRMP, 1 banded (Band No. 83) Hawai`ian goose, or nēnē (*Branta sandvicensis*), was present and foraging within the fence. Based on correspondence with installation personnel, the goose has been coming to the site since Summer 2013. The Hawai`ian goose is federally endangered (Section 5.5.2). There were several chickens and roosters along with a group of chicks within the fence during the site visit. It was indicated during the site visit that the chickens do not normally stay on the site for extended periods. **Appendix E** contains the most up-to-date list of birds occurring on Kōke`e AFS.

Information on birds documented at Kōke`e MAS is lacking. The area surrounding the antenna and structures is characterized by koa forest. It is likely that some bird species associated with the surrounding koa forest occasionally occur within the boundaries of the site. No bird species were identified on the site during the November 2013 site visit associated with this INRMP.

Reptiles and Amphibians

No information on the reptiles and amphibians associated with Kōke`e AFS or Kōke`e MAS is currently available.

Invertebrates

No information on species of invertebrates associated with Kōke`e AFS or Kōke`e MAS is currently available.

5.3.3 Mt. Ka`ala Air Force Station

Mammals

No indigenous mammals are known to reside within Mt. Ka`ala AFS. The installation is mostly comprised of maintained turf and a small area of shrubs associated with the depression around the pump house. During the November 2013 site visit for this INRMP, installation personnel indicated that rats occur within and outside the fenced facility; however, the species of rat had not been determined. Habitat surrounding the installation is characterized by`ōhi`a wet forest. Mammals associated with the montane wet forest would be expected to occur in the habitat adjacent to the facility. No recent surveys of wildlife on or adjacent to the facility have been conducted. Mammals that have been reported to occur adjacent to the facility include feral dogs, feral pigs, and Norway rats.

Birds

Mt. Ka`ala AFS supports both native and non-native birds. Turf areas throughout the installation are typically used by non-native species of birds such as sparrows, doves, and other ground feeders. In 1996, 3 native Pacific golden plovers were observed within the turf areas at Mt Ka`ala AFS. This shorebird breeds in western Alaska and Siberia and winters on islands across the Pacific Ocean. During the November 2013 site visit for this INRMP, installation personnel indicated that birds occur on the site; however, the species had not been identified. The disturbed shrublands adjacent to the installation also provide habitat for both native and non-native birds. The `ōhi`a' wet forest wetland habitat has a unique, diverse assemblage with a complex structure that provides habitat for several native forest bird species, such as the `apapane (Hawai`i DLNR 1990). In 1996, observers heard a Japanese bush-warbler (*Cettia diphone*) and Japanese white-eye (*Zosterops japonicus*) in the `ōhi`a wet forest outside of the installation boundary (USAF 2007). Several bird species that are expected to occur in the surrounding rain forest are `apapane, common `amakihi, and `i`iwi. These species are native to the Hawaiian Islands. **Appendix E** contains the most up-to-date list of birds occurring on Mt. Ka`ala AFS.

Reptiles and Amphibians

No information on the reptiles and amphibians associated with Mt. Ka`ala AFS is currently available.

Invertebrates

No information on species of invertebrates associated with Mt. Ka`ala AFS is currently available.

5.4 THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

5.4.1 Wake Atoll

Federally protected terrestrial biota on Wake Atoll are limited to the migratory seabirds and shorebirds. These birds are classified as "migratory" and are protected under the Migratory Bird Treaty Act of 1916 (MBTA) (16 U.S.C. 703-712). **Table 5-3** lists the migratory birds that have been documented on Wake Atoll based on Rauzon et al. (2008) and the review of available survey data collected since 2008. Species listed by the USFWS as a Bird of Conservation Concern (BCC) (USFWS 2008) or by the International Union for Conservation of Nature (IUCN) (2015) as Vulnerable (VU) or Near Threatened (NT) are also included in the table. The Pacific reef heron was added to the list based on observations of the pied morph of the species on the shore of Peale Island in October 2013 during site visits associated with this INRMP (see photo in Section 5.3.1).

Table 5-3. Migratory Birds Documented on Wake Atoll

Scientific Name	Common Name	Status
Actitis hypoleucos	Common sandpiper	MBTA
Anas acuta	Northern pintail	MBTA
Anas crecca	Green-winged teal	MBTA
Anas clypeata	Northern shoveler	MBTA
Anas penelope	Eurasian wigeon	MBTA
Anous minutus	Black noddy	MBTA
Anous stolidus	Brown noddy	MBTA
Arenaria interpres	Ruddy turnstone	MBTA
Anas acuta	Pintail duck	MBTA
Anas querquedula	Garganey	MBTA
Asio flammeus	Short-eared owl	MBTA
Aythya fuligula	Tufted duck	MBTA
Branta hutchinsii leucopareia	Aleutian cackling goose	MBTA
Bubulcus ibis	Cattle egret	MBTA
Bucephala clangula	Common goldeneye	MBTA
Calidris acuminata	Sharp-tailed sandpiper	MBTA
Calidris alba	Sanderling	MBTA
Calidris alpine	Dunlin	MBTA
Calidris melanotos	Pectoral sandpiper	MBTA
Charadrius mongolus	Lesser sand plover	MBTA
Egretta sacra	Pacific reef heron	MBTA
Eudynamys taitensis	Long-tailed cuckoo	MBTA
Gygis alba	White tern	MBTA
Fregata ariel	Lesser frigatebird	MBTA
Fregata minor	Great frigatebird	MBTA
Gallinago gallinago	Common snipe	MBTA
Haliaeetus spp.	Sea-eagle	MBTA
Larus atricilla	Laughing gull	MBTA
Larus glaucescens	Glaucous-winged gull	MBTA
Limnodromus scolopaceus	Long-billed dowitcher	MBTA
Milvus migrans	Black kite	MBTA
Numenius phaeopus	Whimbrel	MBTA
Numenius tahitiensis	Bristle-thighed curlew	MBTA, BCC, IUCN Vulnerable
Oceanodroma leucorhoa	Leach's storm-petrel	MBTA
Onychoprion fuscatus	Sooty tern	MBTA
Onychoprion lunata	Gray-backed tern	MBTA
Philomachus pugnax	Ruff	MBTA
Pterodroma nigripennis	Black-winged petrel	MBTA
Phaethon rubricauda	Red-tailed tropicbird	MBTA
Phaethon lepturus	White-tailed tropicbird	MBTA
Phoebastria immutabilis	Laysan albatross	MBTA, BCC, IUCN Near Threatened
Phoebastria nigripes	Black-footed albatross	MBTA, BCC, IUCN Near Threatened
Pluvialis dominica	Pacific golden plover	MBTA
Puffinus auricularis newelli	Newell's shearwater	MBTA, FE
Puffinus griseus/tenuirostris	Sooty shearwater	MBTA
Puffinus nativitatis	Christmas shearwater	MBTA, BCC
Puffinus pacificus	Wedge-tailed shearwater	MBTA

Table 5-3. Migratory Birds Documented on Wake Atoll

Scientific Name	Common Name	Status
Sula dactylatra	Masked booby	MBTA
Sula leucogaster	Brown booby	MBTA
Sula sula	Red-footed booby	MBTA
Tringa brevipes	Gray-tailed tattler	MBTA
Tringa incana	Wandering tattler	MBTA
Tringa melanoleuca	Greater yellowlegs	MBTA

NOTES: Rauzon et al. 2008; IUCN 2015.
FE = Federally Endangered.

There are two records of the federally endangered Newell's shearwater for Wake Atoll, both females (United States National Museum 496561, 496562) (Rauzon et al. 2008). The birds were found on the ground on the night of 15 June 1966 among Sooty Terns at Kuku Point on Wilkes Island. Some measurements included in data sheets suggest they had small ovaries and presumably were immatures or non-breeding birds that strayed from the breeding colonies in the main Hawaiian Islands where laying occurs in early June (Rauzon et al. 2008). There are no other exclusively terrestrial biota, either plant or animal, federally listed as threatened or endangered under the ESA, currently known or reported from Wake Atoll (USAF 2008a). **Table 5-4** provides a list of Wake Atoll species of concern along with their current federal status.

Table 5-4. Wake Atoll Listed Species and Species of Concern

Scientific Name	Common Name	Status
Puffinus auricularis newelli	Newell's shearwater	FE
Bolbometopon muricatum	Bumphead parrotfish	SOC
Cheilinus undulatus	Humphead wrasse	SOC
Chelonia mydas	Green sea turtle	FE
Monachus schauinslandi	Hawaiian monk seal	FE
Tridacna maxima	Giant clam	Low Risk Conservation Dependent
Acropora retusa	Unnamed Coral	FT
Acropora globiceps	Unnamed Coral	FT

NOTES: FT = Federally Threatened.
FE = Federally Endangered.

Federally endangered and threatened species using marine habitats occur within the lagoon and waters surrounding Wake Atoll. During a 1998 terrestrial survey (DOI 1999), the federally threatened green sea turtle was observed multiple times in the nearshore ocean and lagoon waters at Wake Atoll. A green sea turtle was also observed near the marina channel in 2013 and 2016 during site visits associated with this INRMP. The lagoon and the channel between Wake and Peale islands are considered sensitive habitats because green sea turtles have been observed in those areas (USAF 2008a). Shoreline basking and nesting activity, the only terrestrially based behaviors of this marine species, were neither observed during the 1998 survey or reported in the literature as having been observed at Wake Atoll. In addition, there were no sea turtles or nests observed during 2010/2011 monitoring surveys. A potential turtle crawl was observed by Joel Helm, USAF 611 CES/CEIE, during site visits conducted in March/April 2015. The crawl was old and in an area of beach with associated casuarina. The crawl was covered with a thick layer of casuarina needles. The presence of casuarina makes the beach unusable for turtle nesting due to superficial root growth and the accumulation of thick litter fall (Panday et al. 1998). The

species of turtle associated with the crawl was not determined. The federally endangered hawksbill sea turtle (*Eretmochelys imbricata*) has been suspected to occur at Wake Atoll (USAF 1994b). However, there are no records or accounts of confirmed sightings in the literature (DOI 1999).

Hawaiian monk seals, listed as federally endangered, have been historically reported at Wake Atoll (SMDC 1999). Monk seal sightings were historically documented on an occasional basis; however, no reports of sightings have been made in the past two decades. Hawaiian monk seals spend approximately two-thirds of their time at sea feeding on a variety of prey including fish, cephalopods, and crustaceans. When on land, Hawaiian monk seals breed and haul out on sand, corals, and volcanic rock. Critical habitat for the Hawaiian monk seal has been designated under the ESA and includes the northern Hawaiian Islands, but not Wake Atoll.

Green sea turtle in Wake Atoll waters in October 2013

The federally threatened scalloped hammerhead shark (*Sphyrna lewini*), the endangered humpback whale (*Megaptera novaeangliae*) and sperm whale (*Physeter catodon*), and the endangered leatherback sea turtle (*Dermochelys coriacea*) also might be encountered in waters around Wake Atoll; however, their occurrence has not been documented.

In August 2014, NOAA published their final decision to list 22 species of corals in the Federal Register. The 22 species of coral are now protected as threatened under the ESA, including the two corals (elkhorn and staghorn) that were listed as threatened in 2006. Three of the listed species occur in the Pacific remote island areas, which includes Wake Atoll. Corals listed for the region include *Acropora globiceps, Acropora retusa,* and *Acropora speciosa*. In June of 2015, NOAA sent a notification to the Assistant Secretary or the Air Force (per 79 FR 53852) stating that Wake Atoll was currently under consideration for critical habitat designation for the potential presence of three coral species and or essential features of their habitat. The 611 CES/CEIE and the USFWS teamed in July and Aug of 2016to conduct a shallow coral survey at Wake (USAF project # YGFZOS167777). Although the final survey results have not yet been finalized or published, the 611 CES/CEIE does have confirmation from the USFWS that two (*Acropora globiceps, Acropora retusa)* ESA listed coral have been identified to exisit in multiple locations along the southern portion of the atoll (USFWS 2017b). The next annual update of this WIA INRMP will include further details of the status and locations of the two threatened corals. Based off of the results from the USAF and USFWS coral survey in July/August of 2016, the 611 CES/CEIE has developed a Coral Conservation Action Plan (**Appendix S**) which identifies and summaries a series of terrestrial and marine based actions which afford benefits to these listed corals species and thier surrounding habitats. Federal protections are also provided to coral reefs under EO 13089.

The giant clam is listed as "lower risk, conservation dependent" on the IUCN red list. The giant clam is the largest living bivalve mollusk. Giant clams consume sugars and proteins produced by algae that live in their tissues. Algae living within giant clams gain regular access to sunlight for photosynthesis as the clams bask during the day below the water's surface with their fluted shells open with mantles exposed. Dr. Rosewater (1965) has documented that several species of giant clams, in addition to *Tridacna maxima*, once occurred at Wake Atoll. Species with a historical presence at Wake Atoll included *T. gigas* and *T. squamosa*. The giant clam is commonly found in the nearshore waters surrounding the Atoll.

Two fish species, the humphead wrasse and the vulnerable bumphead parrotfish, occur in waters surrounding Wake Atoll. Both the humphead wrasse and the bumphead parrotfish are considered an SOC by the NMFS. NMFS defines an SOC as a species that is not being considered actively for listing under the ESA, but for which significant concerns or uncertainties regarding its biological status and/or threats exist (69 Federal Register 19975). Humphead wrasse and bumphead parrotfish are considered Coral Reef Ecosystem Management Unit Species. Coral Reef Ecosystem Management Unit Species may not be taken by means of spearfishing with scuba gear at night (from 6:00 p.m. to 6:00 a.m.). Harvesting of humphead wrasse and bumphead parrotfish by any method, or the consumption of either species, is strictly prohibited on Wake Atoll.

The humphead wrasse is one of the largest coral reef fish. Adults are commonly found on steep coral reef slopes, channel slopes, and lagoon reefs. Juveniles tend to occur in more branchy corals and seagrass beds. Humphead wrasse prey upon crustaceans, mollusks, other fish, and echinoderms. Humphead wrasse have been overharvested in Micronesia.

Juvenile bumphead parrotfish reside in shallow (0-33 ft), low energy areas such as lagoons, seagrass beds, mangroves, and areas with abundant fleshy algae or patch coral formations. The interior lagoon at Wake Island exhibits a low energy environment with some patch corals providing a probable ideal habitat for juvenile bumphead parrotfish to reside. NOAA conducted a Bumphead Parrotfish Nursery Habitat and Carbonate Chemistry Project on Wake Atoll on 12-26 June 2013. The purpose of the carbonate chemistry component of the project was to collect preliminary carbonate chemistry data to investigate the diel metabolic characteristics (i.e., calcification/dissolution and photosynthesis/respiration) of the coral reef ecosystem on Wake Atoll. The bumphead parrotfish nursery habitat component of the project surveyed for the presence of juvenile bumphead parrotfish. The survey areas were restricted due to base operation activities and Wilkes Island and the surrounding lagoon were off limits. The formal report, issued by NOAA's Pacific Islands Fisheries Science Center in February of 2015, indicated that juvenile bumphead parrotfish were not found during the 13 snorkel surveys on Wake Island and only 5 adult bumphead parrotfish were spotted the entire trip (3 in the lagoon and 2 at the Stoner wreckage) (NOAA 2015).

NOAA plans to conduct a focused assessment of the reproductive and behavioral ecology of the bumphead parrotfish and humphead wrasse at Wake Atoll to help determine whether they represent true keystone species. The project will target generation of crucial baselines (e.g., density, sex ratio, grazing effects) from the unimpacted populations of the fish at Wake Atoll. Objectives of the project are to help determine the spawning and mating characteristics of

bumphead parrotfish and humphead wrasse at a remote and pristine reef and whether these fish serve an ecological role as keystone species on coral reefs. A keystone species is a non-selective predator whose grazing activities allow a higher biodiversity of forage species to thrive, as dominant species are culled back and not allowed to dominate. The project will combine diver visual observations, state-of-the-art digital imaging technology, and experimental manipulations to decipher the direct and indirect roles of the 2 species in coral reef benthic dynamics. In addition, the project will provide insight into the behavior and spawning characteristics of the 2 species. The implementation timeline for the project is scheduled for the latter part of2018.

5.4.2 Kōke`e Air Force Station

Four listed plant species have been recorded near the Kalalau Lookout, approximately 0.25 miles north of Kōke`e AFS (Hawai`i Natural Heritage Program [HNHP] 1995). These species include 3 federally endangered plants: Hawai`i horsenettle (*Solanum sandwicense*) (also called `aiakeakua and pōpolo), O`ahu `aiea (*Nothocestrum peltatum*), and largeflower wild coffee (*Psychotria grandiflora*), and one plant that is a candidate for listing, the Maui buttercup (*Ranunculus mauiensis*) (**Table 5-5**). None of the above species were observed on the installation or within a 50-ft buffer around the installation during the 1996 field surveys (EA 1996). However, the installation is surrounded by a high quality native mesic forest, which presently contains very few introduced or alien plant species. Many of the native species are endemic to Kauai; that is, they are found only on the island of Kauai and nowhere else.

Four listed animal species have been recorded at Kōke`e AFS. These include the federally endangered Hawai`ian goose, Hawai`ian petrel, and Hawai`ian hoary bat, and the federally threatened Newell's shearwater (**Table 5-5**). The Newell's shearwater and Hawai`ian petrel are seabirds that are known to nest near the installation (Telfer 1996). Although adult Newell's shearwaters and Hawai`ian petrels do not nest on Kōke`e AFS or Kōke`e MAS, the birds use the area to commute to and from the ocean to their high elevation nest sites in the mountains. These birds, especially fledglings, are attracted to the lights at the facility and are sometimes injured when they fly into wires and buildings (USFWS 2011). Personnel at Kōke`e AFS have reported finding shearwaters on the ground at the installation (EA 1996). In 2009, remains of a Newell shearwater and possibly a Hawai`ian petrel were discovered during surveys at Kōke`e AFS (USFWS 2011). Grounded birds are turned over to the Save our Shearwaters (SOS) Program, which has an active program to rehabilitate injured birds. In 2009 and 2010, auditory and visual surveys for Newell's shearwater and Hawai`ian petrels were conducted at Kōke`e AFS and Kōke`e MAS. In October 2009, a Newell's shearwater was heard calling, and a Hawai`ian petrel and 2 unidentified seabirds were observed in May 2010. In addition, staff at Kōke`e AFS also reported the observation of up to 6 birds circling the lights at night and finding 2 dead birds on the ground in 2009 (USFWS 2011).

On 1 March 2011, the USAF requested formal consultation with USFWS regarding effects of continued installation operation on the Newell's shearwater and Hawai`ian petrel. It was determined by the USFWS, through the Formal Section 7 Consultation Process, that continuing operations of the Kōke`e AFS and Kōke`e MAS, and installation of USCG Rescue 21 Monopole at Kōke`e AFS would adversely affect the Newell's shearwater and Hawai`ian petrel, but would not jeopardize their survival and recovery in the wild. Reasonable and prudent measures and

conservation measures were presented in the 29 July 2011 Biological Opinion to minimize the impacts of incidental take on listed seabirds at Koke'e AFS.

As part of the implementation of reasonable and prudent measures presented in the Biological Opinion to minimize the impacts of incidental take on listed seabirds, the USAF quickly implemented awareness training at the installation, utilizing the expertise of Angie Merritt of the Save our Shearwater program. In November 2013, Kristen Rex (a non-federal entity in support of the 611 CES/CEIE) conducted a briefing with Kōke`e AFS personnel to stress the importance of keeping windows and doors closed at night, turning off lights when they are not needed, and not feeding feral cats. The briefing took place over the course of 2 days in an effort to capture all installation staff. The first outreach session occurred on 14 November 2013 with an approximate audience of 10 and the second session happened on 15 November with 6 attendees. A PowerPoint presentation was presented; however, the outreach session was directed more toward an informal discussion with the installation staff. The reason for the Section 7 Consultation with USFWS and associated requirements was discussed. Staff shared feedback regarding changes that they have noticed since certain mitigation measures have been implemented. Input from Kōke`e AFS personnel included:

- Window tinting has hindered the ability to see out of the windows at night.
- There has been an increase in myna birds and cardinals flying into the windows at night.
- There has been a noticeable decrease in bugs at night.
- There has been a noticeable decrease in bats at night.
- There are fewer cats on the installation.
- Security staff now have to allow adequate time for their eyes to adjust from the green lighting before driving down the mountain after night shifts.
- A question was asked if there has been any studies on the long-term effects of green light on eyes.
- Some staff asked if the green lights had any effect on the Hawai`ian goose. Staff said that the past summer after the lights were installed, there was a significant decrease in the amount of Hawai`ian geese on the installation property.

In the late summer of 2015, KAFS experienced an unprecedented amount of adult seabird fallout. KAFS went into blackout operating conditions at night for the 2016 seabird breeding season, beginning on 10 May 2016 until 15 December 2016. In August 2016, the 611 CES submitted an updated Biological Assessment to the USFWS for the continuing operations at KASF and the affects of those continuing operation to listed avian species on Kauai. The 611 CES was issued a new Biological Opinion (01EPIF00-2016-F-0497) for their contining mission related activities at KAFS in February 2017 (USFWS 2017a). Reasonable and prudent measures were presented in the 28 February 2017 Biological Opinion to minimize the impacts of incidental

take on listed seabirds at Kōke`e AFS **(Appendix I)**. The reasonable and prudent measures outlined in the new 2017 Biological Opinion are provided in **Section 7.5**.

Other federally threatened and endangered species included in our 28 February 2017 Biological Opinion (01EPIF00-2016-F-0497) and known to exist on post are discussed below:

USAF personnel have observed the Hawai`ian goose on Kōke`e AFS grazing in the mowed grass; however, no Hawai`ian geese have been documented or observed nesting on the installation (USFWS 2011). A flock of approximately 13 goslings was released by the USFWS in an area on the Napali Coast to the north of the installation. The geese occurring on the installation are believed to be members of this flock. The geese appear to be attracted to the areas of mowed grass at Kōke`e AFS for grazing purposes. During the November 2013 site visit associated with this INRMP, 1 banded (Band No. 83) Hawai`ian goose was present and foraging within the fence. The goose has been coming to the site since Summer 2013. In June 2002, the Hawai`ian goose population was reported to be stable and thriving in Kōke`e State Park (Gonsalves 2002).

The Hawai`ian hoary bat is commonly seen at Kōke`e AFS and has been previously reported to occur at the installation. Bats were attracted to Kōke`e AFS by the abundance of insects around the high density flood lights throughout the installation. As mentioned above, there has been a noticeable decrease in bats overall since the green lighting was installed in 2013. An estimated 5 Hawai`ian hoary bats were observed flying around the buildings at the site on the evening of 26 January 1996 (EA 1996). During surveys in October 2009 and May 2010, the Hawai`ian hoary bat was observed continuously during nighttime surveys around the lights. The maximum number of bats observed simultaneously during the October 2009 survey was 3 bats and 4 bats during the May 2010 surveys (USFWS 2011). On 26 February 2013, an injured bat was found outside the entrance to the facility. The bat had a broken wing and later died. The cause of injury was not determined and an incident report was provided to the USFWS.

Based on available information, no invertebrate listed species are known to occur in the vicinity of Kōke`e AFS or Kōke`e MAS. In addition, no listed species were found on Kōke`e MAS, or in the area immediately surrounding the site during 1996 surveys (EA 1996).

Table 5-5. Listed Species Potentially Occurring on Kōke`e AFS

Scientific Name	Common Name	Status	Observed on Kōke`e AFS
Branta sandvicensis	Hawai`ian goose	FE	X
Lasiurus cinereus semotus	Hawai`ian hoary bat	FE	X
Nothocestrum peltatum	O`ahu ‘aiea	FE	
Psychotria grandiflora	Largeflower wild coffee	FE	
Pterodroma phaeopygia sandwichensis	Hawai`ian petrel	FE	X
Puffinus auricularis newelli	Newell’s shearwater	FT	X
Ranunculus mauiensis	Maui buttercup	Candidate for Listing	
Solanum sandwicense	Hawai`i horsenettle	FE	
Oceanodroma castro	Band-rumped storm petrel	FE	
NOTES: FT = Federally Threatened. FE = Federally Endangered.			

5.4.3 Mt. Ka`ala Air Force Station

A total of 27 federally protected plant species have been documented in previous plant surveys conducted in the Mt. Ka`ala NAR, which is located adjacent to Mt. Ka`ala AFS (Hawai`i DLNR 1987). A listing of the species is found in **Table 5-6**; however, it is important to note that none of the listed species have been found directly on the installation property.

The vegetation on Ka`ala AFS is composed almost exclusively of introduced plants, and much of the adjacent area within 50 ft of the installation boundary has been disturbed. Consequently, these areas are unlikely to have any rare plant species. The area to the south of the site boundary supports an `ōhi`a wet forest community that is dominated by native plants. This habitat is likely to contain some rare species. None of the plants observed within the facility during the 2013 field studies associated with this INRMP were rare, threatened, or endangered. However, detailed surveys for listed plant species were not conducted in habitat outside of the fenced facility during the 2013 site visit.

Recent data on the occurrence of threatened and endangered animal species within the Mt. Ka`ala AFS installation boundary are lacking. Based on 1996 data, there are no threatened or endangered animal species within the Mt. Ka`ala AFS installation boundary (HNHP 1995). The Hawai`ian owl, a Hawai`i State Species of Greatest Conservation Need, occurs in the Waianae Mountains and may forage in the vicinity on occasion. It was last recorded along the trail in the Mt. Ka`ala Bog in 1986 (HNHP 1995). The Hawai`ian hoary bat has not been recorded at Mt. Ka`ala AFS. Although the bat is rare on O`ahu, it may potentially forage at the top of Mt. Ka`ala (Bruner 1996). There have been no recent surveys of listed land snails occurring in the Mt. Ka`ala NAR. Three rare species of *Auriculella* (*A. ambusta, A. castanea, and A. tenella*) were observed in a 1988 NAR survey (Hawai`i DLNR 1990). The last record of the federally endangered O`ahu tree snail (*Achatinella mustelina*) from the Mt. Ka`ala NAR is 1987. Only two individuals of this endangered snail were observed in the NAR's western section (Hawai`i DLNR 1990). Since comprehensive snail surveys have not been conducted in the NAR recently, it is possible that species numbers and distributions in and around the NAR have changed. The introduced predatory snail *Euglandina rosea* was reported in the lower gulches of the NAR in 1990 (Hawai`i DLNR 1990). *E. rosea* poses a serious threat to native land snails (Hawai`i DLNR 1990).

Table 5-6. Protected Plant Species Occurring within the Mt. Ka`ala Natural Area Reserve

Scientific Name	Common Name	Status
Abutilon sandwicense	Greenflower Indian mallow	FE
Alectryon macrococcus var. *macrococcus*	Hawai`i alectryon	FE
Alsinidendron trinerve	Mountain alsinidendron	FE
Caesalpinia kavaiensis	uhiuhi	FE
Colubrina oppositifolia	kauila	FE
Ctenitis squamigera	Pacific lacefern	FE
Cyanea grimesiana ssp. *Grimesiana*	Splitleaf cyanea	FE
Cyanea superba ssp. *superba*	Mt. Ka`ala cyanea	FE
Delissea subcordata	Koolau Range delissea	FE

Table 5-6. Protected Plant Species Occurring within the Mt. Ka`ala Natural Area Reserve

Scientific Name	Common Name	Status
Diellia falcata	Sickle island spleenwort	FE
Flueggea neowawraea	Mēhamehame	FE
Hesperomannia arbuscula	Maui island-aster	FE
Hibiscus brackenridgei ssp. *mokuleianus*	Mokulei rosemallow	FE
Isodendrion longifolium	Longleaf isodendrion	FT
Joinvillea ascendens ssp. *Ascendens*	`ohe	Candidate for Listing
Kadua degeneri var. *degeneri*	Waianae Range starviolet	FE
Lobelia niihauensis	Ni´ihau lobelia	FE
Melicope christophersenii	Waianae Range melicope	FE
Neraudia melastomifolia	ma`aloa	IUCN Vulnerable
Nothocestrum latifolium	Broadleaf aiea	Candidate for Listing
Phyllostegia hirsuta	Moloka´i phyllostegia	TE
Phyllostegia mollis	Waianae Range phyllostegia	TE
Pleomele forbesii	Waianae Range hala pepe	TE
Pritchardia Ka`alae		TE
Ranunculus mauiensis	Maui buttercup	Candidate for Listing
Schiedea hookeri	Sprawling schiedea	TE
Tetramolopium lepidotum ssp. *Lepidotum*	Wai´anae Range tetramolopium	TE
NOTES: FT = Federally Threatened. FE = Federally Endangered.		

5.5 WETLANDS

5.5.1 Wake Atoll

Hebshi and Patrick (2007) delineated and characterized wetlands on Wake Atoll in February 2007 according to USACE delineation standards. They found that 58 acres of brackish water wetlands existed on the Atoll, ranging in size from 0.11 to 42.3 acres and are dominated by the facultative wetland plant pemphis along the shorelines. In addition, each wetland had mats of the obligate wetland plant seaside purslane ranging in size from small patches to extensive mats.

Sharp-tailed sandpiper in a tidal wetland on Wake Island in October 2013

A Jurisdictional Determination was not obtained from the USACE for the wetlands delineated by Hebshi and Patrick in 2007. A Jurisdictional Determination establishes concurrence from USACE regarding the delineated boundaries and establishes whether the wetlands are regulated as Water of the United States under the Clean Water Act (CWA). No activities that could result in dredging or the placement of fill, or that could otherwise impact the wetland areas, should occur in or adjacent to the delineated areas to ensure that inadvertent impacts to jurisdictional wetlands do not occur. Any actions that could potentially impact the delineated wetlands will be coordinated with the Honolulu, Fort Shafter, Hawai`i District of USACE prior to implementing the action. These actions will be reviewed for adequacy in terms of compliance with the 10 April 2008 Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR 325-332) and USEPA (40 CFR Part 230). Section 8.7.1 of this INRMP includes management actions that are necessary to update the 2007 wetland delineation and obtain a Jurisdictional Determination for the delineated areas from the Honolulu, Fort Shafter, Hawai`i District of USACE.

Table 5-7 lists size, location, dominant vegetation, and other characteristics of the wetland habitats delineated by Hebshi and Patrick (2007). Locations of the wetlands delineated in 2007 are shown in **Figure 5-10**.

Table 5-7. Wetlands Delineated on Wake Atoll in 2007

Wetland Number	Island	Size (acres)	Dominant Vegetation	Description
1a	Wake	0.29	Pemphis/Seaside Purslane	Separated from lagoon by low, sandy berm
1b	Wake	0.11	Pemphis/Seaside Purslane	Dry, no standing water
1c	Wake	0.03	Pemphis/Seaside Purslane	Tidal wetland contiguous with sand flats
1d	Wake	0.01	Pemphis/Seaside Purslane	Tidal wetland contiguous with sand flats
1e	Wake	0.17	Pemphis	Pond with steep coral cobble sides
1f	Wake	42.34	Emergent Pemphis	Submerged with shallow sand flats
		1.71	Pemphis/Seaside Purslane/Sedge	Vegetation sparse; inundated at high tide
3a	Wilkes	0.31	Pemphis/Seaside Purslane	Tidal wetland contiguous with sand flats
3b	Wilkes	0.80	Pemphis/Seaside Purslane	Pond separated from lagoon by sloping coral cobble beach
4	Wake	0.93	Pemphis/Seaside Purslane	Pond with steep coral cobble sides
5	Wake	6.66	Pemphis/Seaside Purslane	Pond separated from lagoon by raised road/pipeline bed
		0.17	Seaside Purslane	Vegetation sparse; separated from remainder of Wetland 5 by coral berm; seasonally inundated
6	Wake	2.97	Pemphis/Seaside Purslane	Non jurisdictional detention basin between taxiways; steep coral cobble sides
8a	Peale	0.87	Pemphis/Seaside Purslane	Pond separated from lagoon by sand and coral berm
8b	Peale	0.18	Pemphis/Seaside Purslane	Standing water
8c	Peale	0.25	Pemphis/Seaside Purslane	Standing water
8d	Peale	0.46	Pemphis/Seaside Purslane	Tidal wetland contiguous with lagoon; inundated at high tide
8e	Peale	0.15	Pemphis/Seaside Purslane	Pond with steep coral cobble sides

Detention Pond 6 is a man-made basin at the east end of the Airfield that was constructed to deter ponding of runoff on the runway. The detention basin maintains standing water and is an attractant to birds (sometimes high numbers) that presents BASH concerns. The USAF proposes to fill the detention basin to reduce the BASH risk. AFCEC coordinated with the USACE, Honolulu, Fort Shafter, Hawai`i District for a Jurisdictional Determination regarding the detention basin. The USACE determined that the detention basin is a non-tidal, man-made feature that lacks surface connection to navigable water and that it is not a jurisdictional wetland or water of the United States and is not subject to USACE regulatory jurisdiction. The 23 March 2012 Jurisdictional Determination letter states that no Section 10 of the Rivers and Harbors Act (Section 10) permit

Looking northeast toward the detention pond (Wetland 6)

is required for proposed activities to fill in the detention basin. The Jurisdiction Determination is valid for 5 years from the date of issuance. If filling of the detention basin does not occur within the 5-year timeframe, then a new Jurisdictional Determination will need to be obtained and any required permitting obtained prior to conducting dredge or fill activities within the detention basin. The 23 March 2012 Jurisdictional Determination letter is included in **Appendix J**.

5.5.2 Kōke`e Air Force Station

There are no wetlands on Kōke`e AFS or Kōke`e MAS.

5.5.3 Mt. Ka`ala Air Force Station

Approximately 0.1 acres of jurisdictional wetlands has been mapped within the boundary of Mt. Ka`ala AFS. **Figure 5-11** shows the wetland that is on and adjacent to Mt. Ka`ala AFS. This wetland is part of `ōhi`a wet forest habitat associated with the Mt. Ka`ala Bog located on and adjacent to the south and western boundary of the site. The Mt. Ka`ala Bog provides important native plant and wildlife habitat. No other wetland areas have been mapped on the property.

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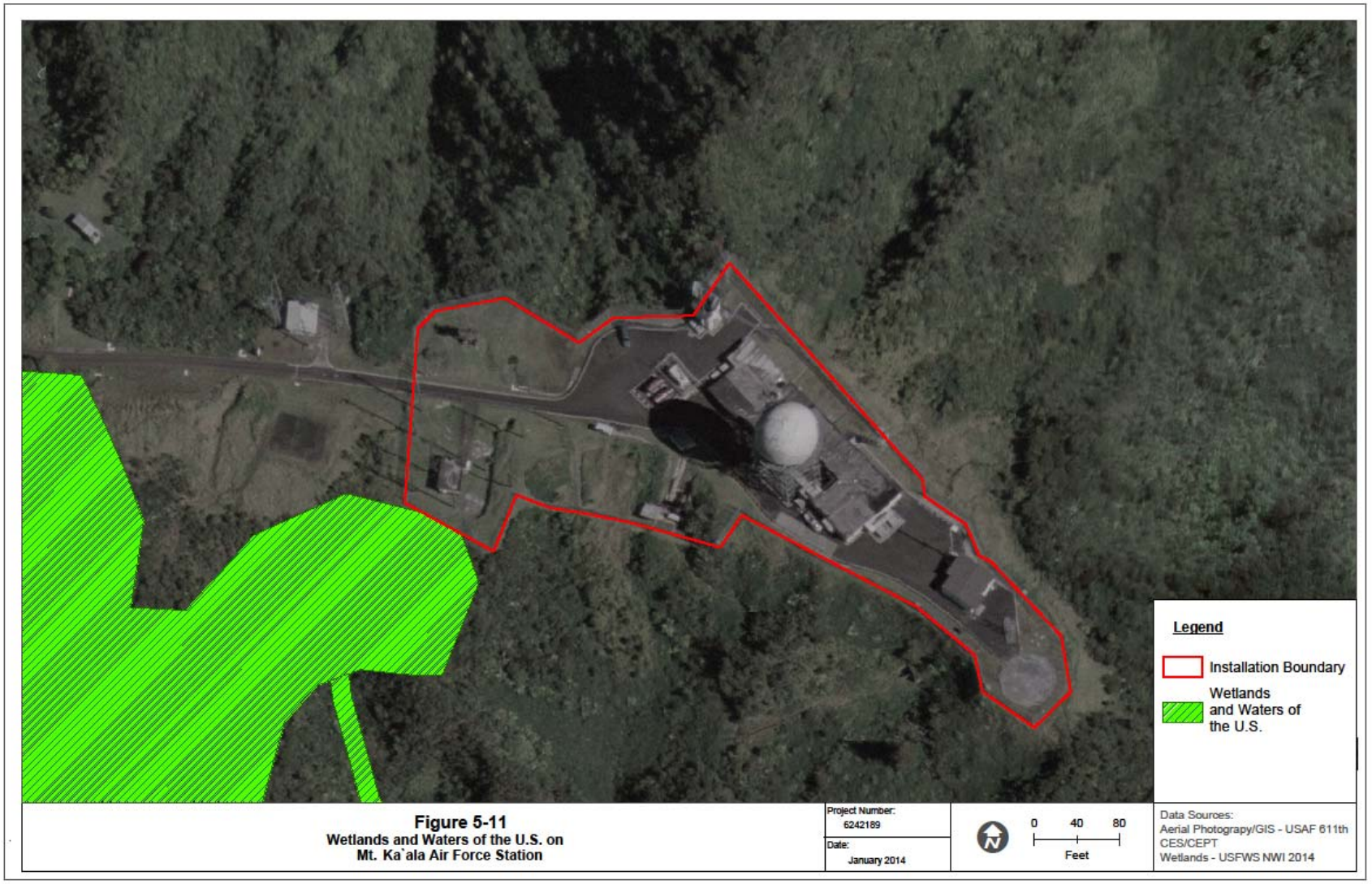
Figure 5-10. Wetlands and Waters of the United States on Wake Atoll

Figure 5-11. Wetlands and Waters of the United States on Mt. Ka`ala Air Force Station



5.6 MARINE RESOURCES

5.6.1 Wake Atoll

Marine habitat at Wake Atoll includes the ocean and the shallow lagoon surrounded by Peale, Wake, and Wilkes islands. The lagoon opens to the ocean on its northwestern side. A coral reef surrounds the Atoll. Outside of the coral reef, ocean depths increase sharply into deep water habitats. The Atoll and surrounding waters are part of the PRIMNM. Per Secretary of the Interior Order 3284 Amendment 1 (32 Aug 2016), the Director of the Interior shall manage the waters and the submerged lands of the PRIMNM and its expansion as a unit of the National Wildlife Refuge System and the Director shall not commence management of the emergent lands at Wake Island, and the Department of the Air Force shall continue to management such emergent lands according to the terms and conditions of the 1972 Agreement between the Secretary of the Air Force and the Secretary of the Interior unless and until such Agreement is terminated. The Atoll includes intertidal zones with the following three substrate types:

- **Fringing reefs** surround the Atoll. Reef areas are composed primarily of rocky or coral substrate. These areas are subject to tidal and ocean currents that remove finer sediments.

- **Patch reefs** are located between the fringing reef and the lagoon and in a few small areas within the lagoon. Patch reef is composed of predominantly coral rubble and a moderate amount of sand. Water depth (6-10 ft) is generally greater than the fringing reef.

- **Sand habitat** is the primary component of the intertidal lagoon. This habitat has a low percentage of rocky or coral substrate and moderate coral rubble. Fine sediments dominate the substrate at depths of 10-12 ft in the western section to only a few inches in the eastern portion. Turbidity is often high in the eastern lagoon because of the preponderance of sand and fine sediments. Tidal pools are present at low tide in the eastern and southern sections of the lagoon.

A baseline marine biological survey in the vicinity of Peacock Point was conducted jointly by the USFWS and the NMFS (USFWS and NMFS 1999). The survey was conducted by USFWS biologists Kevin Foster (algae and non-coral macroinvertebrates) and Michael Molina (coral) and NMFS biologist John Naughton (reef fish). The survey documented the primary species of reef fishes, corals, other macroinvertebrates, and algae encountered at several discharge points at six sites on the seaward reef slope along the southern exposure of the Atoll. Four sites were in the vicinity of Peacock Point, one site was located further west adjacent to the airport runway, and one site was located on the western end of Wilkes Island. A total of 122 species of reef fish, 41 species of coral, 39 species of macroinvertebrates, and 19 species of macroalgae were recorded during the Wake Atoll monitoring survey. None of the species observed during the surveys were considered to be endemic to Wake Atoll (USFWS and NMFS 1999).

Common substrate coverages observed during the baseline marine biological surveys included hard coral, macroalgae (dominant at Wilkes Island site), coralline-algae rubble, and sand (USFWS and NMFS 1999). Coral communities were the most common in the fringing reef and patch reef habitats because of the presence of a hard substrate for attachment, and clearer water.

Common coral in the fringing reef included cauliflower coral (*Pocillopora verrucosa*), plate coral (*Montipora monastriata*), acropora corals (*Acropora* sp.), lesser knob coral (*Cyphastrea serailia*), brain coral (*Goniastrea* sp.), false knob coral (*Monastrea curta*), and golfball corals (*Favia* sp.). Within the lagoon, hump coral (*Porites lutea*) and other boulder corals (*Porites* sp.) were most common (USFWS and NMFS 1999).

The most common macroalgae species observed at the six sites included blue-green algae (*Lyngbya majuscula*), green algae (*Halimeda opuntia*), and brown algae (*Dictyota divaricata*) (USFWS and NMFS 1999). Common echinoderm species observed included tricolor linckia starfishes (*Linckia multiflora*), edible sea cucumbers (*Holothuria edulis*), and rock boring sea urchins (*Echinometra mathaei*). Other common macroinvertebrate species observed included 4 species of coral crabs (*Trapezia* sp.), Christmas tree worms (*Spirobranchus giganteus*), and sponges (*Hippospongia* sp.) (USFWS and NMFS 1999).

Until 2005, knowledge of the shallow water coral fauna of Wake Atoll had been limited to observations contained in a 1979 unpublished list prepared by Maragos (J. Maragos 1979), which was based on qualitative snorkel surveys at five locations on the Atoll and the interagency survey and report (USFWS and NMFS 1999) discussed above. Together, the Maragos and 1999 interagency surveys recorded 52 species from 25 genera. Specimens were also collected from Wake during the 1923 Tanager Expedition (Gregory 1924; Olson 1996); however, no publication treating their taxonomic analysis was produced. In October 2005, reef assessment and monitoring activities were initiated at Wake Atoll by the NOAA, Pacific Islands Fisheries Science Center's Coral Reef Ecosystem Division, as part of a larger multidisciplinary effort to assess and monitor coral reef ecosystems in the United States Pacific Islands (Brainard et al. 2008). Broad-scale towed-diver surveys were conducted to provide a spatial assessment of the composition and condition of shallow-water benthic habitats coupled with site-specific surveys to assess species composition, abundance, percent cover, size distribution, and general health of salient benthic organisms including corals (Kenyon et al. 2013).

Kenyon et al. (2013) applied a multivariate statistical analyses to the data acquired from the broad-scale and site-specific quantitative surveys conducted between 1979 and 2005 to describe the community structure of the shallow-water (<95 ft [<29 meters]) corals in the fore-reef habitat at Wake Atoll; provide a species list of anthozoan and hydrozoan corals; and assess species overlap of Wake corals with the Mariana, northern Marshall, and Hawaiian islands. Based on the study, coral cover in the northeast sector of the Atoll is more than 2.5 times greater than in the southwest sector; and encrusting and massive growth forms dominate in the northeast sector while encrusting and digitate growth forms dominate in the southwest sector. Coral cover and colony abundances are less dominated by a few key genera in the northeast than in the southwest sector, though the genera *Montipora, Pocillopora*, and *Favia* are the most numerically abundant taxa in both sectors. Octocorals account for more than 25 percent of the total coral cover in the northeast sector but less than 5 percent of the total coral cover in the southwest sector. The deep northeast stratum showed among the highest diversity of growth forms as well as the highest total coral cover, octocoral cover, and coralline algal cover. Based on the study, 101 anthozoan and hydrozoan corals have been observed at Wake Atoll during survey activities since 1979. **Appendix E** includes the most up-to-date list of corals occurring in the vicinity of Wake Atoll based on Kenyon et al. (2013) and USFWS unpublished data (USFWS 2017b). The 80 taxa with well-established species

names contain components from the Mariana Islands, northern Marshall Islands, and Hawaiian Islands, but show the closest resemblance to the Mariana Islands (Kenyon et al. 2013). Further survey details from the 2016 USFWS shallow coral reef survey will be included in the next annual Wake Island INRMP as the data becomes available.

In 2013, EA conducted biological surveys for intertidal community abundance and composition at the Peacock Point Dump Site on Wake Island (OT-10 Site). The purpose of the study was to assess whether or not the benthic and epibenthic communities had recolonized at the site since the burn pile had been removed. Three distinct surveys were used to assess community abundance and diversity on the rocky intertidal zone: (1) percent cover of sessile/slow moving organisms, (2) counts of echinoderms along five band transects, and (3) counts of whelks and hermit crabs in tide pools. Comparisons with data collected by C2HM HILL at the site in the January 2010 Remedial Investigation/Feasibility Study (CH2M HILL 2010) were conducted. For comparative purposes, the surveys were conducted at the same Reference Area utilized for the 2010 Remedial Investigation/Feasibility Study at Peacock Point (CH2M HILL 2010). Key findings of the 2013 EA surveys include:

- ***Bare Space***—The percent coverage of bare space increased at all of the sites, including the Reference Site.

- ***Vermetid Dendropoma gregaria Coverage***—Although *D. gregaria* is a major component of intertidal cover on the island, no *D. gregaria* were found during the surveys.

- ***Overall Biomass and Species Richness—***The number of individuals collected from tide pool surveys increased on two transects (Transects 3 and 5), but decreased at the remaining sites in 2013, most notably at the Reference Site. Species richness only increased on one transect (Transect 3).

- ***Species Diversity and Evenness—***Overall, species diversity decreased at all sites except at the burn pile and along one transect (Transect 2). Diversity at the burn pile was similar to the Reference Site. Whereas, diversity was higher at Transects 2, 3, and 5, and lower at Transect 1 (closest to the burn pile). Species evenness increased at all of the sites with the exception of Transect 3.

The above findings show that there has been little recolonization of the benthic intertidal habitat since the removal of the burn pile. Comparisons to the 2010 Ch2M HILL data show a trend of decreasing diversity and increasing bare space across the study site. Contributing factors affecting invertebrate recruitment to the intertidal zone could include high wave action, change in substrate structure after contaminant removal, and a large number of highly mobile large cobbles and remnant copper metal (motor windings, pipes, rods, etc.) in the intertidal zone during incoming tides (EA 2013a). Species identified in the tidal pools included dwarf zebra hermit crabs, electric blue hermit crabs, yellow tip hermit crabs, granulated drupes (*Morula granulata*), spotted drupes (*Drupa ricina*), purple drupes (*Drupa morumb*), black and white cones (*Conus ebraeus*), *Conus* sp. and the snails *Lataxiena fimbriata* and *Thais luteostoma* (EA 2013a).

Common reef fish species observed at Wake Atoll during the 1999 baseline marine biological surveys included squirrelfish (*Holocentridae* sp.), soldierfish (*Myripristinae* sp.), blue-spotted grouper (*Cephalopholis argus*), arc-eye hawkfish (*Paracirrhites arcatus*), bluefin trevally (*Caranx melampgygus*), onespot snapper (*Lutjanus monostigmus*), double bar goatfish (*Parupeneus barberinus*), raccoon butterflyfish (*Chaetodon lunula*), midget reef chromis (*Chromis acares*), yellow-brown wrasse (*Thalassoma ambylycephalum*), whitespot parrotfish (*Scarus forsteni*), convict surgeonfish (*Acanthurus triostegus*), chevron tang (*Ctenochaetus hawaiiensis*), and yellow tang (*Zebrasoma flavescens*) (USFWS and NMFS 1999).

The lagoon supports a large population of fish including bumphead parrotfish (*Bolbometopon muricatum*), mullet (*Mugilidae* sp.), bonefish (*Albula* sp.), convict surgeonfish, flagtails (*Kuhliidae* sp.), goatfish (*Mullidae* sp.), and snappers (*Lutjanidae* sp.). Nearshore fish important for food and recreational purposes include groupers, porgies, and jacks. Sharks are abundant, although black-tipped reef sharks (*Carcharhinus melanopterus*) are notably absent. The grey reef shark (*Carcharhinus amblyrhynchos*) is common around Wake Atoll. The giant clam (*Tridacna maxima*) is commonly found in the nearshore waters surrounding the Atoll. The giant clam, bumphead parrotfish, humphead wrasse (*Cheilinus undulatus)*, and sharks are currently afforded Federal protection under the Convention for the International Trade of Endangered Species of Wild Flora and Fauna.

Giant clam at Wake Atoll

Moray eel in tidal pool on Wilkes Island in October 2013

In February/March 2002, the USAF conducted fish tissue sampling from Wake Island Lagoon as part of a human health risk screening evaluation (USAF 2002). The areas sampled were within the lagoon: Peale Island Bridge, the boat harbor, and Wilkes Inlet. Samples from bonefish, damselfish, goatfish, and squirrelfish were collected from each of the sampling locations. Preliminary fish sampling showed elevated levels of arsenic (USAF 2002). As a result, the decision was made to issue an interim fish advisory for lagoon-caught fish to advise people to stop eating all seafood caught near the Wake Island lagoon until more fish sampling could be conducted (USAF 2002). The Wake Island –Lagoon fish consumption advisory is still in effect and further promotes the catch and release regulations for fish caught in

the lagoon; these regulations can be found in the Wake Island Operating Guidance (**Appendix O**)

A fish sampling effort was conducted on Wake Atoll in August 2012. **Table 5-8** provides the location and types of fish that were collected. **Appendix E** includes the most up-to-date list of fish occurring in the vicinity of Wake Atoll.

Table 5-8. Fish Collected on Wake Atoll in August 2012

Location	Common Name	Scientific Name	Abundance
Ioki Beach House	Bonefish	*Albula* sp.	4
	Bluefin trevally	*Caranax melampygus*	1
	Snake eels	*Ophichtus* sp.	2
Water Plant	Milkfish	*Chanos chanos*	5
Battery Dump Pond	Milkfish	*Chanos chanos*	11
AF Beach House	Bonefish	*Albula* sp.	7
	Bluefin trevally	*Caranax melampygus*	1
Southern Runway/Oceanside	Land Crab	*Geograpsus* sp.	6
Nitro Rock/Wilkes Island	Bluefin trevally	*Caranax melampygus*	7
	Goatfish	*Mullidae* sp.	1
	Bonefish	*Albula* sp.	2
	Blacktail snapper	*Lutjanus fulvus*	1
Peale Island	Blacktail snapper	*Lutjanus fulvus*	4
	Bonefish	*Albula* sp.	5

Fish sampling was conducted in 2012 following the rat eradication project to evaluate whether the brodifacoum bait applied to the terrestrial environment was migrating to and entering the aquatic food chain (USAF 2012a). The Environmental Assessment for the rat eradication project specified that a fish closure would be in effect until such time that samples cleared the fish as being safe for consumption. The primary rationale for testing of lagoon fish/marine invertebrates was to evaluate the need for a continued fishing ban specific to brodifacoum in organisms caught and consumed by Wake Atoll inhabitants (USAF 2012a). Samples for whole-body analysis were collected from the lagoon at five locations where fishing typically occurs, or where there was a higher likelihood that brodifacoum could migrate to the water and potentially enter the food chain. Fish targeted in the sampling included milkfish (*Chanos chanos*), goatfish (*Mulloides flavolineatus*; *Parupeneus barberinus*), 1 top level predator species such as bonefish (*Albula* sp.), bluefin trevally or peppered moray eel (*Gymnothorax picta*), and 2 or 3 edible land crabs. The species were targeted because they are either consumed by human receptors or represent predators that may be eaten by humans, and/or they are bottom feeding or dwelling fish or are likely to bio-accumulate constituents present in sediment or other small fish. If samples exceeded the laboratory method detection limit, then additional sampling could be required (USAF 2012a). Of the 48 individuals tested, only 5 (1 papio and 4 blacktail snapper [*Lutjanus fulvus*]) tested positive for the presence of the compound brodifacoum within their tissues. The Practical Quantification Limits for all sampled fish was <0.001 parts per million (ppm). In order to further understand the potential persistence of this compound in fish surrounding the atoll, the USDA-Wildlife Services completed a fish collection study in Spring 2015; similar areas and species of interest were utilized for the follow-on study. Results from the USDA follow-on fish study were finalized in January 2016. The full results of the 2016 USDA report can be found in **Appendix T**.

Collection of scientific samples for the previously mentioned toxicology studies was coordinated with USFWS law enforcement prior to returning the samples to the mainland or Hawai`i. A USFWS Declaration for Importation or Exportation of Fish and Wildlife is utilized for this type of shipment. In addition, the USFWS requires copies of any permits acquired from the DOD, DOI, or USFWS authorizing the research and collection of marine specimens; and documentation stating the number of specimens, how they are preserved, the location of collection, etc. An example of a completed USFWS Declaration for Importation or Exportation of Fish or Wildlife, request for additional information from USFWS, and authorization letter from the USAF are included in **Appendix K**.

Marine mammals that might occur in the open ocean area surrounding Wake Atoll include several species of whales: the blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale, Cuvier's beaked whale (*Ziphius cavirostris*), and sperm whale (SMDC 1999). Bottlenose (*Tursiops truncatus*) and spinner dolphins (*Stenella longirostris*) may also be present around Wake Atoll. Hawaiian monk seals have been historically sighted at Wake Atoll (SMDC 1999). Monk seal sightings were historically documented on an occasional basis; however, no reports of sightings have been made in the past two decades.

In March 2014, the NOAA Pacific Islands Fisheries Science Center's Coral Reef Ecosystem Division conducted studies from the NOAA ship Hi'ialakai on the coral reef ecosystems around Wake Atoll (NOAA 2014b). The studies are part of an 84 day mission to study coral reef ecosystems associated with Wake Atoll, Guam, and the Commonwealth of the Northern Mariana Islands. The expedition is part of the National Coral Reef Monitoring Plan of NOAA's Coral Reef Conservation Program, which is a long-term, integrated program of coral reef ecosystem monitoring and assessment designed to provide a consistent, comparable flow of information to document and report the status and trends of environmental conditions and living resources of the nation's coral reef ecosystems (NOAA 2014b). Objectives of the study were to conduct Rapid Ecological Assessments of reef fishes, corals, other invertebrates, and algae; retrieve and replace the Autonomous Reef Monitoring Structures that were in place to assess the taxonomic diversity of coral reef species; collect data on water temperature, salinity, carbonate chemistry, and other physical characteristics of the coral reef environment using an assortment of oceanographic monitoring instruments; and assess the potential early effects of ocean acidification on rates of reef carbonate accretion and coral calcification by deploying calcification assessment units and bioerosion monitoring units (NOAA 2014b). In January the PRSC/Det. 1 receievd a 2017 expedition request that will add to information collected during previous baseline monitoring and mapping surveys conducted at Wake Atoll, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) in 2003, 2005, 2007, 2009, 2011, and 2014. The 2017 NOAA expedition is the seventh research voyage in the islands by staff of Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Program.

In August 2014, the Global Environment and Marine Department of the Japan Meteorological Agency conducted oceanographic and marine meteorological observations with the Research Vessel Keifu Maru off of Wake Atoll. The major objectives of the cruise were to monitor ocean conditions and concentrations of greenhouse gasses and marine pollutants in the western North Pacific on a seasonal basis. The cruise recorded vertical profiles of seawater temperatures,

salinity, dissolved oxygen, nutrients, and current and concentrations of greenhouse gasses, and marine pollutants such as heavy metals, oil, and floating tar balls. The research results will be presented in the Japan Meteorological Agency's issues entitled Data of Oceanographic and Marine Meteorological Observation and will be available at: http://www.data.kishou.go.jp/kaiyou/db/vessel_obs/data-report/html/index_e.html.

5.6.2 Kōke`e Air Force Station

There are no aquatic/marine habitats at Kōke`e AFS.

5.6.3 Mt. Ka`ala Air Force Station

There are no aquatic/marine habitats at Mt. Ka`ala AFS.

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6. MISSION IMPACTS ON NATURAL RESOURCES

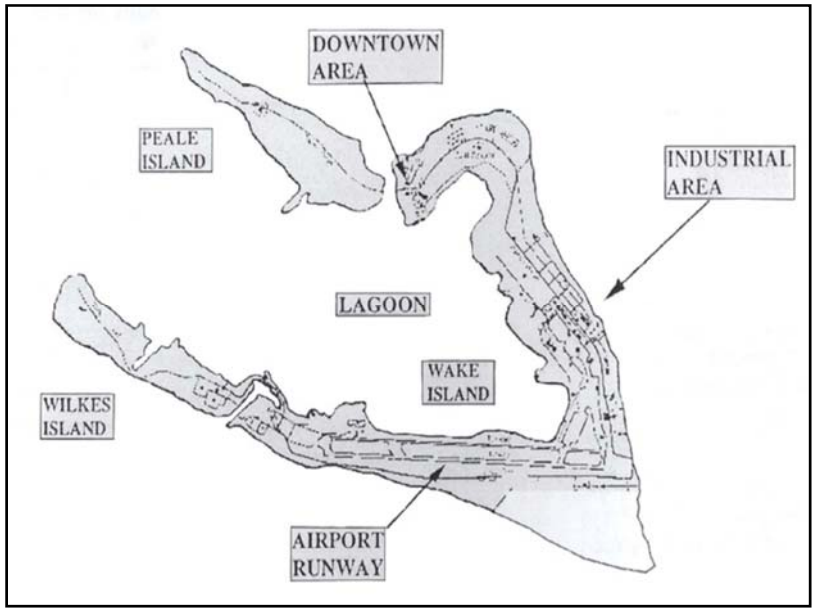
The following sections describe the general environmental effects of operations on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS on installation and surrounding natural resources and constraints to missions and mission planning associated with installation natural resources. Natural resources should be sustained for the use of mission requirements and other purposes rather than be consumed by the mission or degraded over time. In order to achieve this, environmental programs and policies must have the goal of controlling encroachment and preserving an unencumbered environment for the purpose of the mission.

6.1 LAND USE

DoD policy seeks to ensure that current and planned installation activities such as construction requests are coordinated and consistent with activities described in this INRMP. To minimize the potential for land use conflicts, land use and environmental planning needs to be comprehensive and integrated. The Commander of each installation is responsible for ensuring the activities associated with the implementation of this Plan adhere to applicable federal, state, local, and USAF environmental regulations and guidelines. They are also responsible for ensuring the INRMP is implemented and that day-to-day land use decisions are in compliance with the INRMP.

6.1.1 Wake Atoll

Wake Island has three distinct areas of activity: areas including the airport, the industrial area, and the downtown area. The airport consists of a 9,850-ft runway, supporting taxiways, tarmacs, various navigational aids, and vacant areas between active and non-active facilities. The industrial area includes aviation and Airfield maintenance shops, fire and rescue, aircraft fueling support facilities, Civil Engineering, and supply and warehouse buildings. Other industrial facilities in the area include shops, water collection, and distribution structures. The downtown area supports a library; dining hall; medical facility; laundry facility and laundromat; fire station; gym; morale, welfare, and recreation buildings; single-family housing; and billeting (USAF 2012a).



General Layout of Wake Atoll

The local population at Wake Island resides in a combination of billeting dorms, duplexes, and single family homes. The primary billeting area is located downtown within close proximity to most quality of life and community facilities. At full capacity, the billeting facilities (MDA and USAF civilians, contractors, and active duty) can accommodate approximately 300 personnel. A total of 18 duplex units and one single family home are utilized by United States civilians employed through the BOS contract. Housing for USAF personnel includes a single family home for the Base Commander, as well as four additional duplex units for the contracting officer's representative personnel and distinguished visitors.

Wake Atoll also includes Wilkes Island and Peale Island. Wilkes Island contains bulk fuel storage. There are no facilities on Peale Island.

6.1.2 Kōke`e Air Force Station

Kōke`e AFS occupies 10.0 acres of mountaintop habitat within Kōke`e State Park, approximately 3,500 ft amsl. The station is on the Kahuama'a Flat of the Alaka'i Plateau, a gently eastward-sloping plain. It is on a knoll that rises 40 ft above lower portions of the installation. About half the station is fenced and developed to support the mission. The vegetation on the site is mowed and maintained with some landscaped trees and shrubs. Outside the fence, the station is surrounded by relatively undisturbed native koa forest that is part of the island's montane mesic ecosystem.

Kōke`e AFS contains nine buildings including an operations building, generators building, chlorinator shed, supply building, hazardous materials shed, gate house, vehicles building, and two unoccupied buildings. In addition, a radar dome, water tank, diesel tanks, gasoline tanks, and gasoline pump stations are located within the fenced installation.

Kōke`e MAS occupies a triangular piece of unfenced land 1.25 acres in size, approximately 9.5 driving miles south of Kōke`e AFS on Route 550. The site (open space, semi-improved) immediately adjacent to structures is covered with crushed rock. The remainder of the site is within koa forest. Kōke`e MAS includes a communications support antenna with four guy wires fixed to the ground for supports and several small support structures. There is one exterior building light, but it is kept off to prevent vandalism. There are also several red obstruction lights. The site is fully automated, and personnel are rarely present.

6.1.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala includes 6.6 acres at the summit of Mt. Ka`ala, which is at the northern end of the Waianae Mountain Range. Mt. Ka`ala rises 4,025 ft amsl and is the highest point on O`ahu. The site is fenced and includes antennas and ancillary buildings developed to support the mission. The dome and tower of the Air Route Surveillance Radar dominate the site. There is an administrative center building for HIANG and the FAA that has small living quarters should an overnight stay be necessary. Other government agencies have communication equipment buildings within the site fence line.

6.2 CURRENT MAJOR IMPACTS

6.2.1 Wake Atoll

Operating under Very Limited Operations status, operations, BOS, and housing impacts to the natural environment are, for the most part, confined to Wake Island. Wilkes and Peale islands are not involved in mission needs on a routine basis. Current mission impacts include the potential disturbance to, or taking of the birds by, aircraft operations and by tenant organization missions; disturbance of native vegetation associated with past land use and mission operations; potential damage to the local environment through the past and present uses of hazardous materials; and the removal of historic objects from areas designated under National Historic Landmark status. Each of these impacts is discussed below.

***Bird Populations*—**A significant number of migratory and nesting birds inhabit Wake Atoll. Wilkes and Peale islands support large numbers of resident and migratory seabirds and visiting winter resident shorebirds and waterfowl. Aircraft operations have the potential to disturb or inadvertently strike birds during aircraft landings and takeoffs. Disturbance to birds may also occur with other human activities and base operations including runway maintenance, grounds maintenance, cutting or trimming of trees, and unauthorized access to Wilkes Island. Incidental bird deaths may also occur in collisions with motor vehicles. Missile launches are not likely to have a substantial impact on birds due to the infrequency of events and distance from primary bird habitat on Wilkes and Peale islands. Bird species on Wake Island (except for rock doves) are protected by the MBTA. WIA has a Bird Depredation Permit (No. MB077566-0), the calendar year 2017 permit application request was submitted in February 2017, as of the date of this INRMP update the permit has not yet been received. The WIA Bird Depredation Permit is necessary for inadvertent impacts to migratory birds associated with airfield safety and maintenance requirements. The installation has a formal BASH Plan (USAF 2016) that is included as **Component Plan C** of this INRMP. The 2016 Bird Depredation Permit is included in **Appendix L**. The purpose of the BASH Plan is to provide a base program to minimize aircraft exposure to potentially hazardous bird strikes. Operations specific to the BASH Plan include establishing and sustaining a Bird Hazard Working Group, reporting and disseminating information regarding increased potential for aircraft animal strike to all affected assigned and transient personnel, eliminating or reducing environmental conditions that attract birds to WIA through habitat alterations, acting to harass or depredate birds and other animals to reduce the potential for aircraft animal strikes, and performing runway sweeps for dead birds after a bird strike. The BASH exclusion zone around the Airfield needs to be cleared of vegetation 500 ft from the centerline of the runway. This 500-ft distance or is measured perpendicularly from the centerline of the runway and begins at the runway centerline. All vegetation over 3 ft in height within the exclusion zone needs to be cleared. Clearing of vegetation associated with extension of the exclusion zone will be planned to minimize harm to nesting birds. If possible, work will be conducted during non-breeding periods of relevant species. The exclusion zone is shown on the Constraints Map (**Figure 6-1**).

***Vegetation Communities*—**Native vegetation communities on Wake Atoll have been significantly disturbed since the 1930s with especially heavy damage during World War II. Native plants have been physically removed for construction of roads, runways, structures,

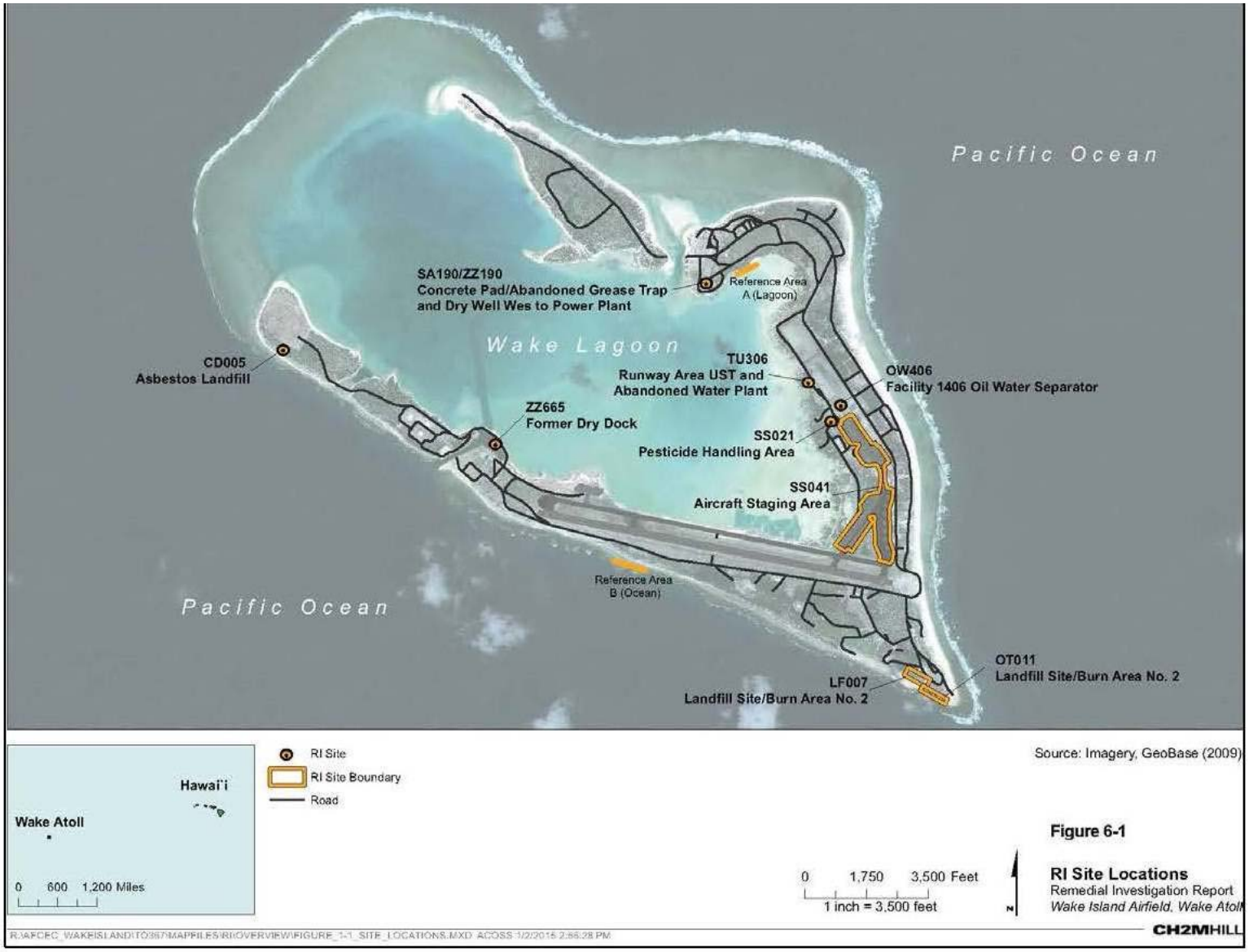
residences, and other support facilities needed for previous and current mission operations. In some areas, native vegetation has been displaced by the introduction of alien plants and noxious weeds, specifically casuarina. Casuarina has resulted in a loss of habitat value and a reduction in biodiversity where it occurs. This is especially true on Wake Island and to a lesser extent on Wilkes and Peale islands. Left alone under a normal typhoon/inundation/drought disturbance regime, most of the introduced species would succumb to the austere conditions of the coral atolls. However, some invasive species like casuarina and sea grapes can become permanently established.

***Past and Present Hazardous Materials Use*—**Throughout the history of military use of Wake Atoll, hazardous materials have been used and discarded in connection with mission support activities. The most commonly used materials have included jet and motor fuels, oil and lubricants, paints, thinners, adhesives, solvents, pesticides, lead-acid batteries, cleaning fluids, hydraulic fluids, and other materials necessary for infrastructure and aircraft support. Present day hazardous materials (primarily generated by aircraft and vehicle maintenance activities) and hazardous waste management are addressed under the 2015 Spill Prevention, Control, and Countermeasure (SPCC) Plan for WIA (USAF 2015) (**Appendix M**). Hazardous materials and hazardous waste management activities at Wake Atoll are coordinated with USEPA Region 9 in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act (RCRA), as amended. Wake Atoll is not presently on the National Priorities List. The National Priorities List is the list of national priorities among known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. It includes hazardous waste sites that are eligible for long-term remedial action, or cleanup, under the Federal Superfund program.

***Environmental Restoration Program*—**As of May 2015, Wake Atoll had 89 Environmental Restoration Program (ERP) sites that included 75 No Further Action , 3 Long-Term Operation and Management, and 11 Remedial Investigation/Feasibility Study/Through Decision Document sites. **Figure 6-1** shows the locations of ERP and remedial investigation sites on Wake Atoll. **Figure 6-2** shows ERP and areas of concern on the Atoll. Further information on the ERP is available at: http://afcec.publicadmin-record.us.af.mil/. Questions related to the ERP for WIA should be directed to the ERP Hotline at: 1-800-222-4137.

There are currently some aboveground storage tanks on Wake Atoll used for fuel storage and water storage that are not part of the Installation Restoration Program (IRP). Three 4-million-gallon steel tanks are located in the POL fuel farm. Two are in use and the third is empty and to be used as reserve only. There are also two 480,000-gallon steel aboveground storage tanks in use at the fueling pads in the industrial area. A single 70,000-gallon tank is currently empty and to be disposed. In addition, there are seven 6,000-gallon relocatable container tanks, one smaller aboveground storage tank at the POL area, and several vehicle refueling tanks and single-walled transfer tanks used to barge the fuel to the island. Secondary containment issues for some of these smaller tanks have not been resolved. Aboveground storage tanks used by the water department include two 2-million-gallon steel tanks and six 300,000-gallon concrete tanks. Additional water storage is available in one 32,000-gallon concrete tank, one 24,000-gallon steel tank, and two 10,000-gallon plastic tanks.

Figures 6-1. Environmental Restoration Program/Remedial Investigation Sites on Wake Atoll



Figures 6-2. Environmental Restoration Program and Area of Concern Designations

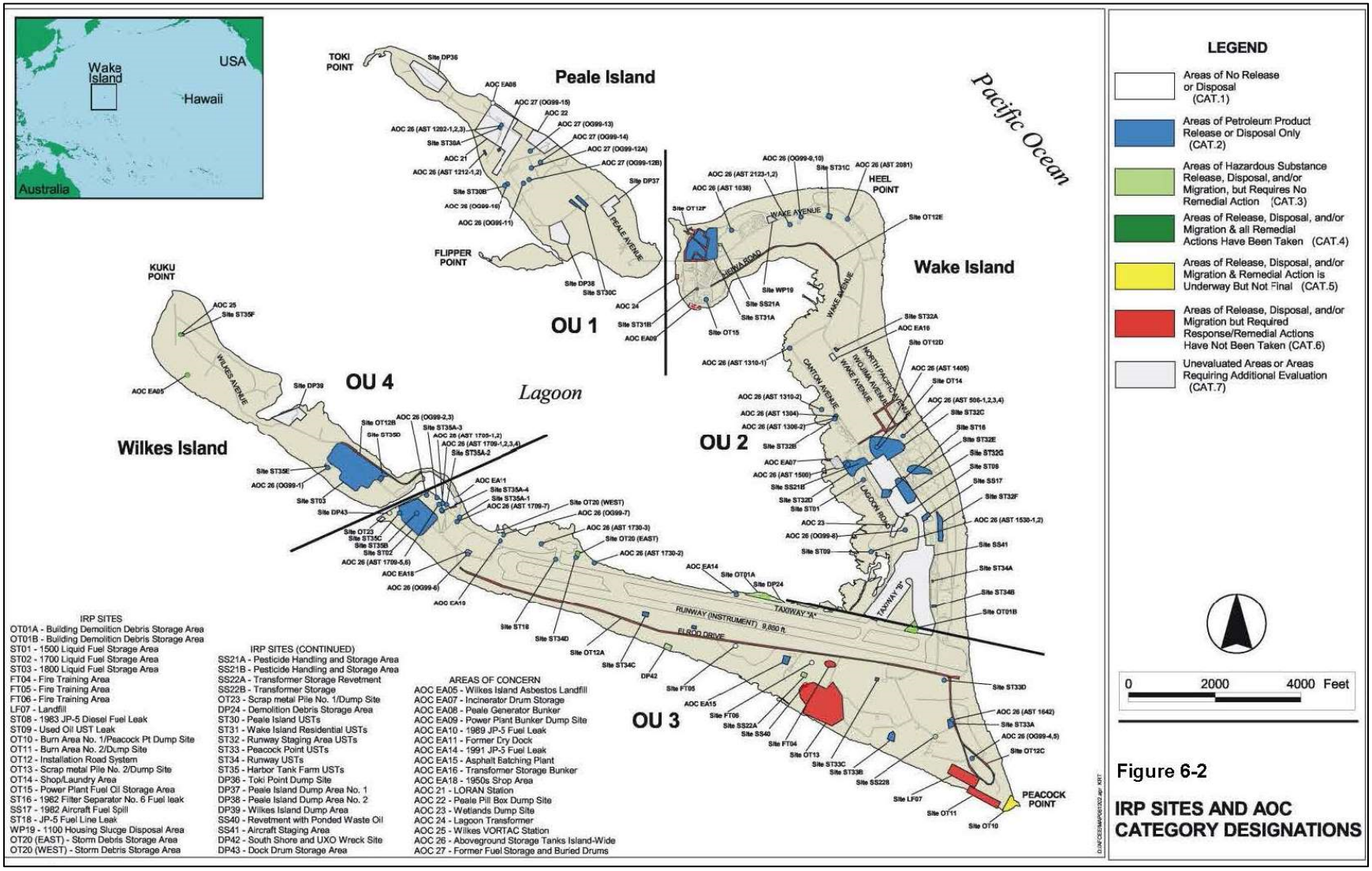


Figure 6-2

IRP SITES AND AOC CATEGORY DESIGNATIONS

Stormwater—A Stormwater Pollution Prevention Plan (SWPPP) is required for coverage under a NPDES permit. The purpose of the plan is to document the stormwater control measures at WIA. An SWPPP was updated in 2016 for WIA (USAF 2016) (**Appendix N**). Pollutants that are exposed to stormwater are typical of most Airfields. Pollutants include POL, solvents, and pesticides associated with the fuel storage areas, fuel transfer areas, and pesticide mixing areas. There are a total of seven outfalls on Wake Atoll. Outfalls 1, 2, and 3 are located on Wilkes Island and are associated with the bulk fuel storage containment areas. Each of these outfalls has a drainage area of approximately 1.5 acres. The valves of these outfalls are always kept closed and locked when not in use. The remaining outfalls are located on Wake Island. Outfall 4 is located at the west end of the runway and is not in a location where refueling occurs. This outfall discharges stormwater collected by a drain in the 8.5-acre grassy area on the western end of the runway directly into the lagoon. Outfall 5 is located south of the motor gasoline storage and transfer area. This outfall discharges stormwater collected by two drains into the wetland/lagoon in the 1500-area. Outfall 6 is located west of the bulk fuel storage containment areas. The outfall discharges stormwater collected by three drains, which have a drainage area of approximately 1 acre, into a ditch in the wooded area west of the bulk fuel storage area. The conveyances to the outfall have valves that remain in the closed/locked position. Outfall 7 is associated with the discharge from the downtown area. Outfall 7 discharges stormwater collected by five drains in the downtown area, which have a drainage area of approximately 1 acre. The outfall pipe discharges into the channel between Peale Island and Wake Island.

BMPs and management of runoff of stormwater outfalls and controls are implemented throughout Wake Atoll. Control measures include minimizing exposure, practicing good housekeeping, maintenance, spill prevention and response, and non-numeric effluent limits. Monitoring of stormwater outfalls is required during storm events when an actual discharge occurs from the site, or when there is a measureable storm event that follows a preceding measureable storm event within 72 hours (3 days). Annual bench mark and quarterly visual monitoring is required and conducted by the onsite Environmental Technician.

Regulated Materials—Studies to identify buildings that contain asbestos or suspected to contain asbestos were conducted in 1987, 1992, and 1997 (USAF 2008a). An Asbestos Management Plan for Wake Atoll was prepared in 1997 in compliance with United States Army Regulation 200-1 (USAF 2008a). Cleanup from the typhoon dominated the asbestos abatement work. During April and May 2007, approximately 200,000 pounds of asbestos-containing material and debris was collected. This suspected asbestos-containing material was stored in 18 sealed bundles and 8 conex containers in the 1500-area. The asbestos-containing material was shipped off-island by barge. In 2014, 40,530 pounds of asbestos-containing material was abated and packaged to be barged to a proper disposal facility in the Northwest Continental United States.

In 1986, a sampling program was performed to identify polychlorinated biphenyl (PCB) containing transformers (over 500 ppm PCBs), PCB-contaminated transformers (50-500 ppm PCBs), and PCB capacitors. Between 1986 and 1993, 12 transformers with PCB concentrations greater than 50 ppm were removed. In 1994, 4 old transformers were discovered in a Japanese bunker on south Wake Island. Final disposition of the 4 transformers is unknown.

In September and October 1997, the USAF initiated a PCB transformer survey to ensure compliance with the Toxic Substances Control Act of 1976 and 40 CFR Part 761. The principal objective of the transformer survey was to delineate those transformers containing PCB dielectric fluid, and to safely remove and properly dispose of the units. A complete data review was performed as an initial investigative strategy. Eighty-one transformers were identified on WIA that necessitated characterization (USAF 2008a). The analysis showed that all transformers sampled between 23 September and 6 October 1997 were below the PCB regulatory threshold of 50 ppm (USAF 2008a) and required no corrective action. Today, PCB collection and storage is limited to old light ballasts.

The presence of lead-based paint is almost certain in buildings constructed on Wake Island prior to the 1978 DOD lead-based paint ban. Most painted surfaces are maintained so that this material is not a health threat. All buildings with a construction date of 1980 or earlier, which may contain lead-based paint, have been identified (USAF 2008a). Today, only project-specific surveys are being conducted. In 2014, a total of 7,811 pounds of lead-based paint was abated and packaged to be barged to a proper disposal facility in the Northwest Continental United States.

***Pesticides and Herbicides*—**Pest management activities on Wake Atoll generally focus on control of insects (mosquitoes, roaches, and ants), vertebrates (rodents), and vegetation. The Pest Management Program is implemented in accordance with the 2013 *Pest Control and Pesticide/Herbicide Management Plan on Wake Island* (Chugach 2013a), and application of pesticides and herbicides is based on a formal schedule as well as on customer request. Pesticides, insecticides, and herbicides used on Wake Atoll include quintox, permenthrine prallethrin, cyufluthrin, tricosene, fipronil, sulfuramid, tricoplyr, resmethrin, boric acid, D-phenothrin, hydramethylnon, cholecalciferol, and carbonate. The Plan can be updated to include pesticides on the Armed Forces Pest Management Board Standard Pesticides list (last updated 1 October 2013) as needed.

A self-contained hazardous materials storage container has been staged on the concrete pad behind the welding shop area (1422) for pesticide storage. The entry doors are locked to prevent unlawful entry. The rooms are provided with metal shelving for storage. Different pesticides are stored as far as practical from each other to prevent cross contamination. A bulletin board is installed to post inventory, advisory information, and material safety data sheets. Entomology Shop personnel record the types and amounts of pesticides and herbicides used (USAF 2008a). The pesticide mixing area is outside and is equipped with a freshwater emergency shower and pesticide spill kit. The mixing area has an impervious dike installed for spill containment. Portable spray equipment is also stored in this area. Pesticide storage is conducted in accordance with USEPA labels.

***Ordnance*—**Two facilities store ordnance on Wake Island for use in missile operations. Explosives used in the destruction of unexploded ordnance from World War II that are occasionally found are brought out to Wake Atoll by Explosive Ordnance Disposal. The unexploded ordnance is usually detonated where found unless detonation in-place would cause facility damage.

Groundwater—There are active and inactive 12 brackish groundwater wells in various locations on Wake Island. Four wells are located at the power plant to provide cooling water. Three wells are located at the water plant, but only 1 is in use; the other 2 are abandoned. Two wells are located at the water booster stations. A well in the MDA area and at a well at Building 1104 were destroyed by Typhoon Ioke and cannot be used. There is a well at the marina; however, it is not used. Brackish water is no longer used for the sanitary sewer system.

6.2.2 Kōke`e Air Force Station

The small size and minimal activities needed to support the military mission at Kōke`e AFS and MAS have minimal impacts that are related mainly to the potential spread of landscaping plants into adjacent habitats. There is the potential for impacts to listed bird species primarily as a result of collision with existing infrastructure (see below).

Hazardous Waste Management—Kōke`e AFS, which includes Kōke`e MAS, is a conditionally exempt small quantity generator. There are no current ongoing problems associated with hazardous waste on Kōke`e AFS or MAS. Underground petroleum storage tanks have been replaced by aboveground storage tanks.

IRP—There are two IRP sites and two areas of concern at Kōke`e AFS that have been identified and are now closed and require no further action. IRP sites include the fenceline and paint thinner disposal area. Areas of concern include the POL shed and contractors' work area and the radar shaft.

Biological Impacts—On 11 August 2016, the USAF requested formal consultation with USFWS regarding effects of continued installation operation on the federally threatened Newell's shearwater, the federally endangered Hawai`ian petrel, band-rumped storm-petrel, and the Hawaiian Nene or goose . The USFWS, through the Formal Section 7 Consultation Process, issued the 611 CES a Biological Opinion (01EPIF00-2016-F0497) for the continuing operations of the Kōke`e AFS, and Kōke`e MAS, in February of 2017 (USFWS 2017a).

6.2.3 Mt. Ka`ala Air Force Station

Mt. Ka`ala AFS is located on a remote mountain peak and is surrounded by sensitive natural resources, but activities in support of the station's mission are highly localized and essentially non-disruptive. The main environmental issues relate to protection of the neighboring native plant communities, stabilization of land at the southeast portion of the facility, and management of stormwater runoff.

Stormwater and Wastewater—Mt. Ka`ala AFS has no industrial activity; therefore, no water pollution permits are required for this installation. The runoff water from the parking area is a potential problem that may impact the Mt. Ka`ala Bog. This potential problem was addressed by implementation of the USAF's Phase II Stormwater Project, which was completed in September 2000.

***Hazardous Waste Management*—**Mt. Ka`ala AFS is a conditionally exempt small quantity generator. The only ongoing potential hazardous waste problems on Mt. Ka`ala AFS are associated with hazardous waste practices from the past. These sites are currently being evaluated by the IRP.

***IRP*—**There are 10 IRP sites and 1 area of concern at Mt. Ka`ala AFS. IRP sites are located at the main diesel storage area, waste/new oil storage, waste oil sump, substation transformer, drum rack outfall, soils near Building 20, northeast disposal site, World War II tunnel, and the Mt. Ka`ala Bog area. The only active IRP site is the main diesel storage area. Groundwater, surface water, soil, and air impacts are being evaluated at each of these sites. The area of concern is located in the disposal area.

***Biological Impacts*—**Mt. Ka`ala AFS is located within native 'ōhi'a wet forest. Past and potential ongoing biological impacts result from the development and landscaping of the installation. There is the potential for invasive non-native plant species to spread from the installation into the adjacent native forest.

6.3 POTENTIAL FUTURE IMPACTS

6.3.1 Wake Atoll

New projects on Wake Atoll associated with mission activities and planned installation upgrades include but are not limited to the following: Peacock Point Communication Terminal Building renovations , repair of the sanitary sewer system , construction of a solar array power station , repair of the underground electrical distribution system , upgrade of the water line system , and multiple runway repair projects, the majority of these project began design in FY16..

New and renovation projects will be assessed through the NEPA process to evaluate potential impacts to natural resources and to determine appropriate mitigation to reduce or offset the impacts.

6.3.2 Kōke`e Air Force Station

Mission activities at Kōke`e AFS and Kōke`e MAS consist primarily of installation operation and maintenance. The USAF has no significant changes planned for the installation; therefore, no new or future mission impacts to natural resources are expected. Future control of invasive plant species, as proposed in this INRMP, would enhance the native plant communities surrounding the site.

6.3.3 Mt. Ka`ala Air Force Station

Mission activities at Mt. Ka`ala consist primarily of installation operation and maintenance. The USAF has no significant changes planned for the installation, so no new or future mission impacts to natural resources are expected. Future control of invasive plant species, as proposed in this INRMP, would enhance the native plant communities surrounding the site.

6.4 NATURAL RESOURCES NEEDED TO SUPPORT THE MILITARY MISSION

The primary purpose of natural resources management at Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS is to support the military mission by maintaining sustainable natural resources as a critical asset upon which to accomplish the missions of the installations. Overall goals of natural resource management include:

- No net loss in the capacity of the installation's lands to support existing and future military operations at Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS
- Ensure military operations are not interrupted due to non-compliance with applicable laws

This INRMP integrates the various aspects of natural resources management into the military missions, and becomes the primary tool for ecosystem management at Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS while ensuring the successful, efficient accomplishment of the military missions. A multiple-use approach will be implemented through use of the INRMP to accommodate the presence of mission-oriented activities and provide for good stewardship, thereby maintaining and improving the quality, aesthetic values, and ecological relationships of the environment. Implementation of this INRMP will promote stewardship practices that protect and enhance natural resources for multiple use and biological integrity, while supporting the military mission.

6.4.1 Wake Atoll

The mission of WIA is to provide support to contingency operations, emergency and planned diversions, and other missions as necessary for operations in the Pacific theater and beyond. The mission of WIA does not require consumption or use of natural resources on Wake Atoll.

6.4.2 Kōke`e Air Force Station

Mission activities at Kōke`e AFS and Kōke`e MAS consist primarily of installation operation and maintenance. The mission of Kōke`e AFS and Kōke`e MAS does not require consumption or use of natural resources on the installations.

6.4.3 Mt. Ka`ala Air Force Station

Mission activities at Mt. Ka`ala consist primarily of installation operation and maintenance. The mission of Mt. Ka`ala AFS does not require consumption or use of natural resources on the installations.

6.5 NATURAL RESOURCES CONSTRAINTS TO MISSION AND MISSION PLANNING

The Sikes Act requires that INRMPs provide for "….no net loss in the capability of military installation lands to support the military mission of the installation" (16 U.S.C. §670a[b][1][I]).

The INRMP enables the installations to meet the requirements of the military mission within the limitations and legal restrictions of the baseline natural resources at the installations. Environmental constraints such as wetlands, bird nesting habitat, and threatened and endangered species dictate where and when certain types of activities can occur to ensure regulatory compliance and long-term sustainability of natural resources on the installations.

6.5.1 Wake Atoll

Natural resources constraints to the mission and mission planning on Wake Atoll are shown in **Figures 6-3a through 6-3c**. Wake Atoll was designated as a National Historic Landmark in 1985 as a result of its significance in association with World War II in the Pacific. There are numerous cultural features on the Atoll associated with the war and the Atoll's significance in early trans-Pacific air travel. On 6 January 2009, President George W. Bush established the PRIMNM, which encompassed Wake Atoll and the surrounding waters up to 50 nautical miles. On 24 September 2014, the monument boundaries at Wake Atoll, Jarvis Island, and Johnston Atoll were extended out to 200 nautical miles. In addition, a diversity of seabirds and migratory shorebirds and waterfowl occur on the Atoll. Wilkes and Peale islands support large numbers of resident and migratory seabirds and visiting winter resident shorebirds and waterfowl. The open terrain and current lack of disturbance on those two islands is conducive for nesting seabirds. As a result, a marine bird reserve has been established on Wilkes Island. Approximately 58 acres of brackish water wetlands also occur on the Atoll, and waters of the United States regulated under Section 404 of the CWA surround the islands in association with the Pacific Ocean and the lagoon. These natural and cultural resources represent constraints that need to be considered when planning or implementing actions that have the potential to affect the resources. It is important to note that the constraints figures do not show all cultural and historical features that occur on the Atoll and site-specific investigations must be completed prior to implementing actions that could impact the resource. The constraints necessitate proper coordination and require actions to be implemented to ensure regulatory compliance, minimization of impacts, and long-term sustainability of natural resources on the installation.

6.5.2 Kōke`e Air Force Station

Some of the natural resources that have the ability to limit activity on Kōke`e AFS are shown in **Figure 6-4**. The primary mission constraints at Kōke`e AFS are impacts to nearby nesting seabirds and the makeup of the soils at the Station. The Kōke`e silty clay loam, 35-70 percent slopes, located at the western end of the installation, has rapid runoff and a severe erosion hazard. The Mahana silt loam, 2-35 percent slopes, occurs over most of the remainder of Kōke`e MAS. It also has a severe erosion hazard rating. These soils represent a constraint to development. The 611 CES is currently engaging with the USFWS to address how to reduce impacts to nearby nesting seabirds and mission activities at Kōke`e AFS.

6.5.3 Mt. Ka`ala Air Force Station

Natural resources that have the ability to limit activity on Mt. Ka`ala AFS are shown in **Figure 6-5**. Mt. Ka`ala AFS is located on Alakai mucky peat, which is a poorly drained soil that is typically not suitable for development activity. Ō'hi'a wet forest is a native plant community

that is found outside the fence line. It may contain rare, threatened, and endangered plant species. 'Ōhi'a wet forest represents a constraint to any development outside of the installation boundary, or other human activity that would adversely affect the native and potentially rare, threatened, and endangered plant species. A probable jurisdictional wetland (0.1 acres inside of the installation perimeter), which is part of the Mt. Ka`ala Bog, is located at the south end of the installation. Lastly, on, and adjacent to, the installation are seven World War II-era structures from the Mt. Ka`ala Aircraft Warning Service Station, including a cable tower and barracks. Preservation of these historic sites inhibits reforestation off of the installation to the extent that they cannot be removed. They also contain asbestos, which is a health hazard.

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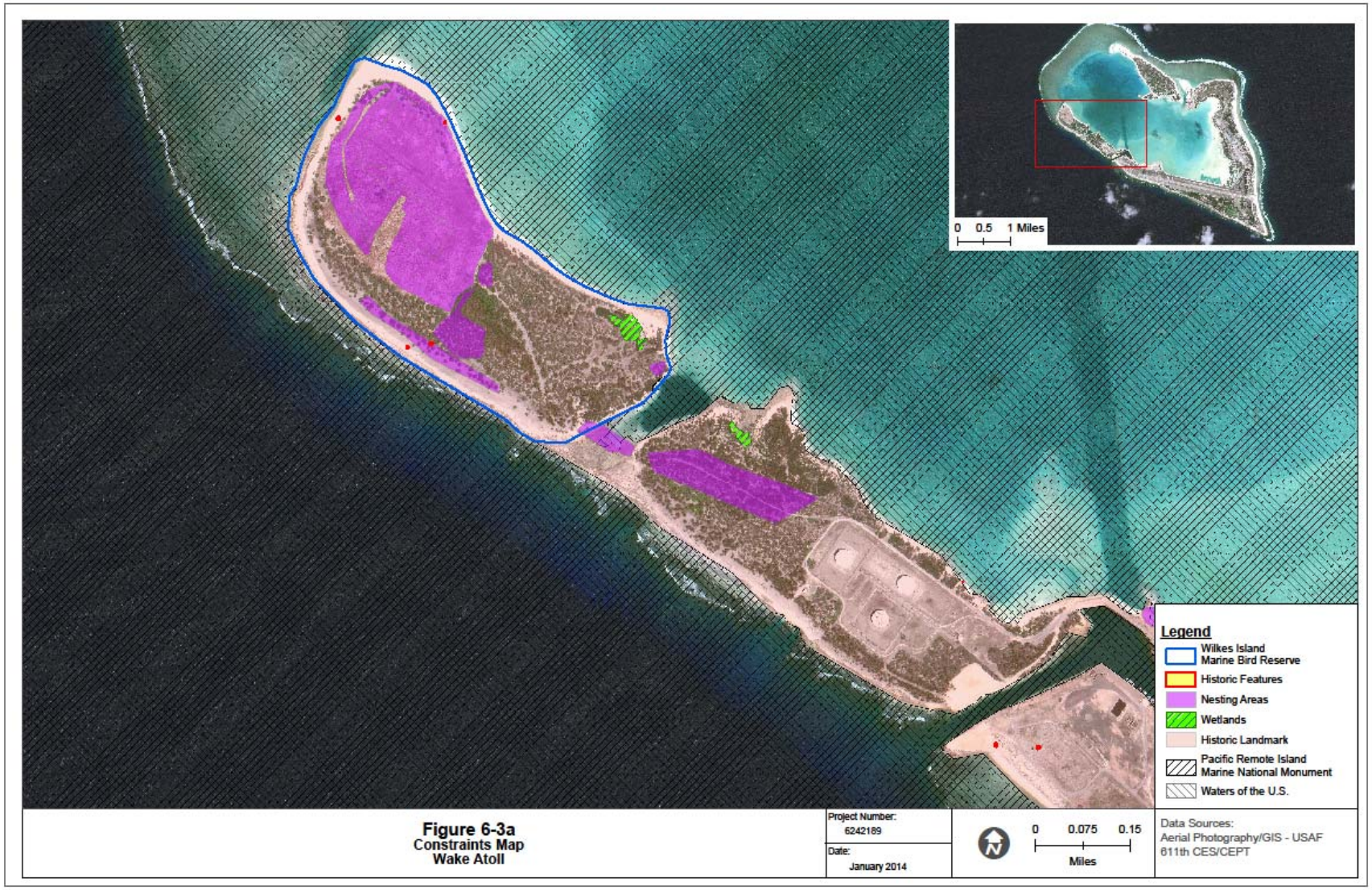
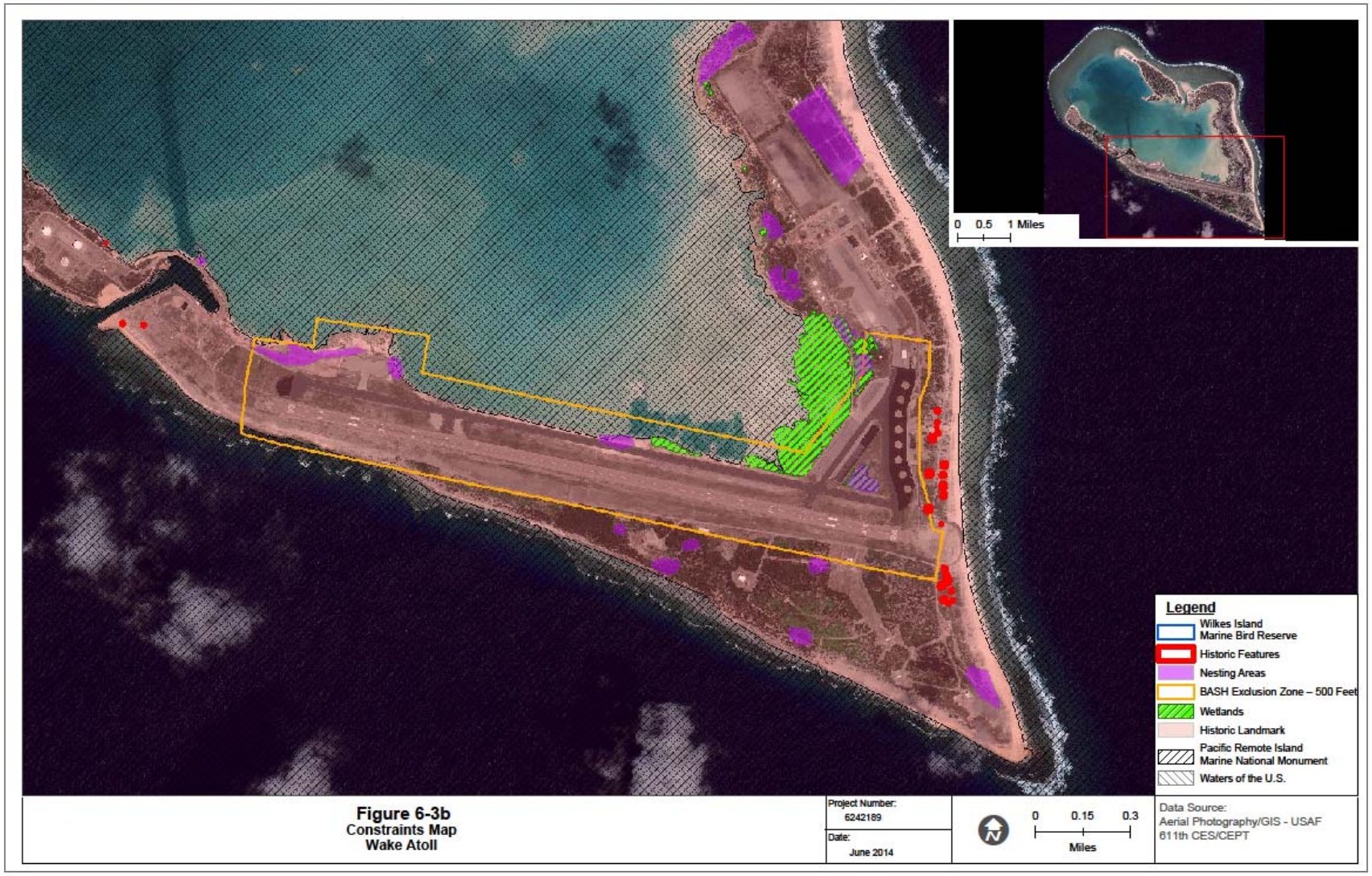
Figures 6-3a-c. Constraints Map, Wake Atoll




0 0.5 1 Miles
Legend
Wilkes Island Marine Bird Reserve
Historic Features
Nesting Areas
BASH Exclusion Zone – 500 Feet
Wetlands
Historic Landmark
Pacific Remote Island Marine National Monument
Waters of the U.S.
Figure 6-3b
Constraints Map
Wake Atoll
Project Number:
6242189
Date:
June 2014
0 0.15 0.3
Miles
Data Source:
Aerial Photography/GIS - USAF
611th CES/CEPT


0 0.5 1 Miles
Legend
Wilkes Island Marine Bird Reserve
Historic Features
Nesting Areas
Wetlands
Historic Landmark
Pacific Remote Island Marine National Monument
Waters of the U.S.
Figure 6-3c
Constraints Map
Wake Atoll
Project Number:
6242189
Date:
June 2014
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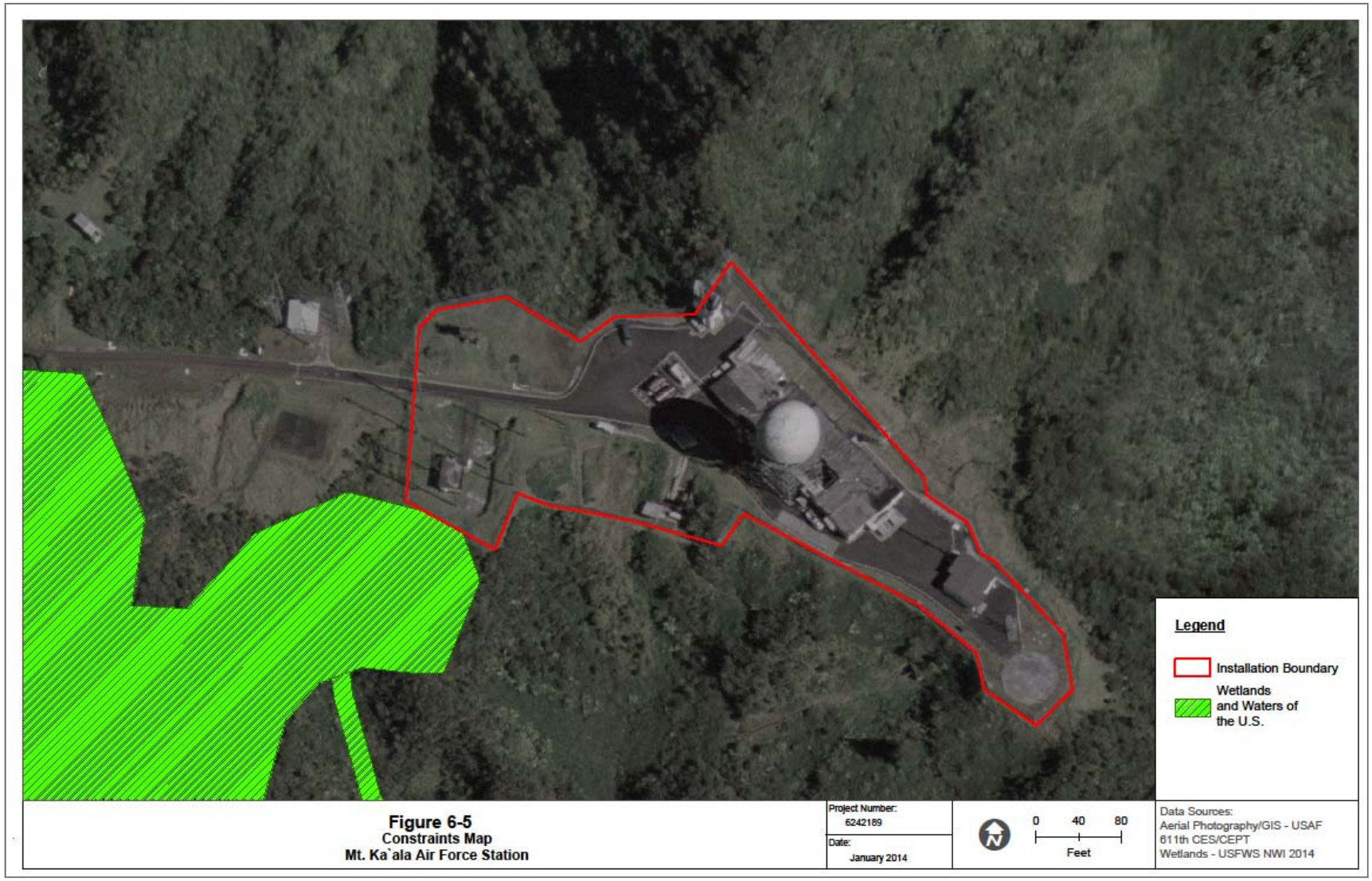
Miles
Data Source:
Aerial Photography/GIS - USAF
611th CES/CEPT

Figure 6-4. Constraints Map, Kōke`e Air Force Station and Kōke`e Microwave Antenna Station

Figure 6-5. Constraints Map, Mt. Ka`ala Air Force Station



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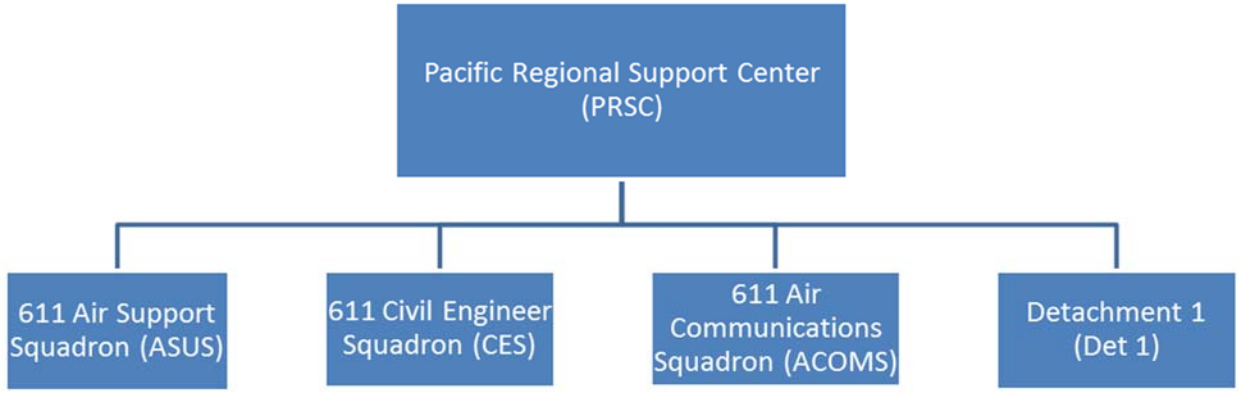
7. NATURAL RESOURCES PROGRAM MANAGEMENT

7.1 NATURAL RESOURCES PROGRAM MANAGEMENT

In 2013, the organization previously responsible for day-to-day operations and management of the installations called out in the INRMP (611th Air Support Group) was inactivated, and the PRSC was activated in its place. The following units were also realigned under the new PRSC through this transition: the 611th Air Communications Squadron, 611th Air Support Squadron, the 611th CES, and Det 1 of the PRSC. The new organizational structure of the PRSC is shown in the figure below.



The PRSC, as a whole, is responsible for the implementation of this INRMP; however there are specific offices of primary responsibility for portions of this INRMP, and those offices are further discussed below in a breakdown of this chain of command with regard to the management and implementation of this plan.

PRSC

The PRSC Commander is responsible for the management and oversight of its four branches (see chart above) all of which report directly to him/her. The Commander of the PRSC acts as the judiciary lead of these four branches and has the ultimate authority over them. The PRSC functions as the support center for its four branches and it does not manage day-to-day operations at any of its active or inactive installation and sites.

611 CES

The CES component of the PRSC serves as the implementation branch and is responsible for multiple programs, including engineering services, environmental compliance, and installation management. This arm of the PRSC has the capabilities and the manpower to execute projects with special expertise in logistics. The CES manages these engineering and environmental

projects from a supervisory and programmatic level and leaves the day-to-day details up to its PMs.

611 CES/CEIE

This Environmental Element has a Branch Chief that supports its PMs through supervisory guidance and regulatory approvals. The Environmental Element Branch Chief is responsible for the ensuring his Natural Resources PM has the tools and resources to properly implement this management plan. The Environmental Element acts as the clearinghouse for approval of activities related to natural resources within the 611 CES, and has the responsibility to ensure the flow of information is made available to all installation PMs.

611 CES, Natural Resources PM (611 CES/CEIE)

The PM is ultimately responsible for implementing the details and projects of this management plan, as well as informing its Branch Chief when there is concern for non-compliance. The 611 Natural Resources PM must have sufficient program knowledge in order to appropriately and effectively execute this INRMP, and to provide guidance to the BOS contractors that support this program at the installation level. The Natural Resources PM has two direct USAF points-of-contact to utilize in the support and execution of this program: 611 CES, Environmental Element Branch Chief and the PRSC/Det 1/CC. It is the responsibility of the Natural Resource PM to properly program funding to support and ensure day-to-day operations at the installation level are carried out according to this management plan.

PRSC/Det 1

The PRSC/Det 1 serves as the USAF presence at PRSC-WIA and is responsible for quality assurance and compliance by contractors, tenants, and Armed Forces members deployed at the installation. The Det Commander reports directly to the PRSC Commander and seeks specific guidance and expertise from various PMs of the PRSC branches. It is the Det's role and responsibility to act as the USAF contracting officer representative on the ground and to inform its chain of command and any contractors or tenants of installation level non-compliance, including issues related to natural resources. The USAF Support Squadron with support of the CES meet twice a year to ensure all aspects of the BOS contract are being executed in accordance with the law.

BOS Contractor

It is the responsibility of the BOS contractor (also commonly referred to as the Installation Support Service contractor) to execute day-to-day operations at PRSC remote installations such as WIA. The BOS contractor has an Environmental Manager and onsite Environmental Technician who provides logistical support and assists with implementation of this plan and enforces the requirements of the plan. The BOS Environmental Manager/Technician is considered the first line of defense for installation natural resources; they are relied on as the eyes and ears of the 611 CES, Natural Resources PM who is supervising from afar. The WIA BOS Environmental Manager/Technician must also have an understanding of how and when to

seek direction and guidance regarding natural resources management issues or concerns from the 611 CES/CEIE Natural Resources PM.

Tenants

The PRSC has a variety of tenants on its installations some related to the INRMP include: the HIANG, MDA, and NOAA. Tenants are required to comply with the INRMP guidance and management strategies.

7.2 FISH AND WILDLIFE MANAGEMENT

The management of fish and wildlife at the three installations discussed in this INRMP is not all the same. The day-to-day management of these resources at WIA is the responsibility of the BOS contractor; meanwhile the day-to-day management of these same resources at Kōke`e and Mt. Ka`ala AFS is the responsibility of the tenant organization that is currently the HIANG. There is no permitted hunting program allowed on these three installations.

Fishing is not available to those at Kōke`e or Mt. Ka`ala AFS; it is, however, available to those at Wake Atoll. The day-to-day management of recreational fishing at the Atoll falls on the individuals fishing and the BOS contractor, with reach-back support and oversight from both Det 1 and the 611 CES/CEIE Natural Resources PM. Fishing is a recreational activity at the Atoll that is greatly valued, and current guidelines for this activity are provided in the April 2017 Wake Island Operating Guidance (**Appendix O)**. The Wake Island Operating Guidance provides current BMPs for fishing within a United States Marine National Monument and on an active USAF installation until further guidance or regulations have been developed by regulators for this recreational activtiy. **Component Plan A** consist of a 611 CES and USFWS developed "Wake Atoll Fishing Log Sheet" for lagoon and pelagic fishing activities. These log sheets provide the 611 CES\CEIE Natural Resources PM, USFWS and BOS contractor a systematic approach to managing this resource from afar and on island by enforcing a tracking system, outlining catch on a quarterly basis, and promoting sustainable fishing practices. The USFWS also provided the 611 CES with a datasheet of various questions to be populated by the 611 CES on an annual fishing basis, these datasheets will be used to evaluate future fishing guidelines for Wake Atoll. The datasheet with various fishing related questions can be found in **Component Plan A**.

7.3 OUTDOOR RECREATION AND PUBLIC ACCESS TO NATURAL RESOURCES

Outdoor recreation and public access to the natural resources at both Kōke`e and Mt. Ka`ala AFS are not available to the general public. The sites are manned 24 hours a day and access is strictly USAF mission related only. While right-of-entry to WIA is also strictly USAF-mission related, the remoteness and length of timeframes between access to this installation drives the need for an outdoor recreational program. These programs consist of bike riding, tennis, basketball, fishing, kayaking, snorkeling, scuba diving, and occasional triathlons. The responsibility of the day-to-day management of these outdoor recreational activities at WIA falls to the BOS contractor with support and oversight by both Det 1, and the 611 CES/CEIE Natural Resources PM.

7.4 CONSERVATION LAW ENFORCEMENT

There are currently no, nor has there historically been a need for, conservation law enforcement officers at any of the three installations involved with this INRMP. These installations are very small and hunting is not permitted on any of these sites. The USAF provides a means for the PRSC to request enforcement assistance from the USFWS, if needed. The PRSC will develop an agreement to use Joint Base Elmendorf-Richardson conservation officers, on an as-needed basis.

Compliance and implementation with this INRMP is part of the conservation law enforcement program at WIA. The responsibility of day-to-day conservation law enforcement at WIA falls to the BOS contractor with reach back support and oversight by both Det 1, and the 611 CES/CEIE Natural Resources PM. All projects at any of these three subject installations are required to comply with this INRMP per the Sikes act.

7.5 MANAGEMENT OF THREATENED AND ENDANGERED SPECIES AND HABITATS

While Chapter 5 of this plan provides the breakdown and comprehensive list of threatened and endangered species on or near these three subject installations, this section is designated for a discussion regarding how the 611 CES/CEIE monitors and manages these species.

Threatened and endangered species at Kōke`e, Mt. Ka`ala AFS, and Wake Atoll are all managed by the 611 CES/CEIE Natural Resource PM remotely. All three of these sites have a blend of tenants and BOS contractors that are onsite 7 days a week; however, there are currently no day-to-day 611 CES assets on any of these three sites. This remote organizational structure of the PRSC is unique to the USAF, and it does provide some management challenges.

The 611 CES/CEIE Natural Resources PM utilizes this management plan as a tool to educate and inform the tenants and BOS contractors about threatened and endangered species on and near these installations, and is reliant on communication from these tenants and BOS contractors to ensure the proper management of these species. Periodic site visits to these installations by the 611 CES/CEIE Natural Resources PM and/or a 611 CES/CEIE Natural Resources contractor allows the tenants and BOS contractors an opportunity for training related to threatened and endangered species and also allows the USAF an opportunity for quality assurance of the program. Monitoring and inventories for threatened and endangered species at these installations is accomplished via the usage of various acquisition tools (Contracts, interagency fund transfers, cooperative agreements, utilization of the on island BOS contractor, etc.). The 611 CES/CEIE Natural Resources PM has the ability to program for and, if funded, provide project oversight during the period of performance, and alerting the contractor officer and contracting specialist to any deviations in scope. Some of the natural resources monitoring requirements such as the seabird and shorebird surveys are written into the BOS contractor scope of work; however, the majority of projects involving monitoring and surveys of natural resources come directly from the 611 CES/CEIE Natural Resources PM.

Of the three subject installations, Kōke`e AFS is the only one with a recent Formal Section 7 Consultation with USFWS, which resulted in the issuance of a Biological Opinion. The

Consultation addressed potential effects of continued installation operations on the Newell's shearwater, Hawai`ian petrel, and the band-rumped storm petrel. The 611 CES submitted an updated Biological Assessment in August 2016 as part of the reintiation part of the Formal Section 7 Consultation with the USFWS. The USFWS issued the 611 CES their new Biological Opinion 01EPIF00-2016-F-0497 in February of 2017. After reviewing the Biological Assessment submitted by the 611 CES, the USFWS issued their Biological Opinion that the proposed continuing operations at KAFS are not liklely to jeopardize the continues existence of the Newell's shearwater, Hawaiian petrel or the band-rumped storm-petrel. The USFWS evaluated the impacts of the proposed action at Kokee AFS, in addition to the proposed conservation measures and determined that there would not be a significant change in the reproduction, number, or distribution of the Newell's shearwater, Hawaiian petrel and Band-rumped storm-petrel.

Furthermore, under Section 7 of the ESA and based off of the same information in the Biological Assessment issued to the USFWS in August of 2016, the USFWS issued a "not likely to adversely affect" determination for the Hawaiian hoary bat and the Hawaiian goose.

7.6 WATER RESOURCES PROTECTION

Although management of water resources at Kōke`e and Mt. Ka`ala AFS is very different compared to WIA, water resources protection at the three sites is very similar. The environmental setting of both Kōke`e and Mt. Ka`ala AFS is similar. The two installations are on islands at elevations of approximately 4,000 ft. Both Kōke`e and Mt. Ka`ala AFS are at the headwaters of several watersheds and both sites receive high amounts of annual rainfall. As a result, the two installations play important roles in the downstream conditions of their associated watersheds. WIA has a very different environmental setting than Kōke`e AFS and Mt. Ka`ala AFS. The Atoll has an average elevation of 12 ft with a maximum of 21 ft and the average annual precipitation is 40 in. The surficial material on the Atoll is highly permeable and precipitation rapidly infiltrates downward or runs off directly into the ocean or lagoon.

Both Kōke`e AFS and Mt. Ka`ala AFS serve missions related mostly to radar and communications, while WIA has a larger operational mission that includes Airfield and industrial type services. Due to the Airfield and industrial type services that occur at Wake, the 611 CES/CEIE maintains a NPDES permit with an associated Stormwater Pollution Prevention Management Plan that are used as tools to help minimize point and non-point source pollution issues. Similar to the Natural Resources PM for the 611 CES/CEIE, there is also a PM that manages the Stormwater and Wastewater Programs for Kōke`e and Mt. Ka`ala AFS remotely.

7.7 WETLAND PROTECTION

There are approximately 58 acres of brackish water wetlands on Wake Atoll, ranging in size from 0.11 to 42.3 acres. A Jurisdictional Determination has not been obtained from USACE for the wetlands on the Atoll. There are no wetlands on Kōke`e AFS or Kōke`e MAS. Approximately 0.1 acre of jurisdictional wetland has been mapped within the boundary of Mt. Ka`ala AFS. The wetland is part of `ōhi`a wet forest habitat associated with the Mt. Ka`ala Bog located on and adjacent to the south and western boundaries of the installation. The Mt. Ka`ala

Bog provides important native plant and wildlife habitat. Section 5.5 provides additional information on wetlands associated with the Atoll and Mt. Ka`ala AFS.

There are no pending CWA Section 404 or 401 permits for any of the wetlands on the Atoll or Mt. Ka`ala AFS. Several of the wetlands on WIA are within historically remediated/closed RCRA sites, some of which require long-term monitoring per Records of Decisions with the USEPA. The remediated and closed RCRA sites are managed by the 611 CES/Restoration Element and are all considered compliant with the requirements of their Records of Decision. Based on funding, the 611 CES/CEIE has a project in place in this INRMP (Goal No. 9, Objective WP-1) to conduct an updated wetland delineation on the Atoll and to obtain a Jurisdictional Determination from USACE for the delineated wetlands.

7.8 GROUNDS MAINTENANCE

The following provides a summary of grounds maintenance responsibilities on the Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

On the Atoll, grounds maintenance is conducted primarily by the BOS contractor; however, there are cases when the 611 CES/Operations Element sends their own crew of USAF personnel out to Wake to conduct larger scale grounds maintenance activities. The BOS contractor's Performance Work Statement outlines the details and frequencies of grounds maintenance for various vegetation categories on the Atoll.

Grounds maintenance on Kōke`e AFS is conducted by the HIANG personnel who work at the installation and by the Navy's Barking Sands grounds maintenance crew. All grounds maintenance activities at Mt. Ka`ala AFS are conducted by HIANG personnel at the site.

7.9 FOREST MANAGEMENT

The Forest Management program element does not apply to WIA, Kōke`e AFS, or Mt. Ka`ala AFS**.**

7.10 WILDLAND FIRE MANAGEMENT

WIA has a Fire Management Plan. The threat of wildfire to both the USAF mission and the natural resources of WIA is significant and recognized. The BOS contractor at WIA is required to train and maintain certified staff available to respond to any wildland fire threats on the installation. The WIA BOS contractor fire response team is on call 24 hours a day. Kōke`e AFS and Mt. Ka`ala AFS do not have Fire Management Plans.

7.11 AGRICULTURAL OUTLEASING

The Agricultural Resources program element does not apply to WIA, Kōke`e AFS or Mt. Ka`ala AFS.

7.12 INTEGRATED PEST MANAGEMENT PROGRAM

WIA has an Integrated Pest Management (IPM) Plan that was authored by the BOS contractor as part of their scope of work. The current 2013 IPM Plan is in need of an update to bring it into compliance with AFI 21-1078. The current day-to-day management of pests on WIA is taken care of by the BOS contractor's civil engineering staff; these day-to-day activities may include control efforts for wasps, ants, roaches, and rats.

The pest management program at WIA is supplemented by the 611 CES/CEIE Wake Island Biosecurity Management Plan (**Component Plan D**), which is designed to prevent the introduction of new and invasive species to Wake. The Wake Island Biosecurity Management Plan was written by the 611 CES/CEIE Natural Resources PM and staff and has been provided to the BOS contractor and Island tenants as a planning and guidance tool for the prevention of the introduction of pests onto WIA; the Wake IPM Plan is used mostly by the BOS contractor for control of pests that are already on the Atoll.

Neither Kōke`e nor Mt. Ka`ala AFS have IPM plans. Both of the installations conduct vegetation maintenance in house by way of mechanical removal in order to maintain setbacks from buildings and fence lines per USAF security protocols. It is not uncommon for both of these sites to have occasional dealings with island nuisance pests within and along the fence line of the installations; some of these pests include rats, as well as feral pigs and cats.

7.13 BASH

Of the three installations involved with this INRMP, the only one that has a BASH program is WIA; neither Kōke`e or Mt. Ka`ala AFS have active runways. The WIA BASH Plan can be found as **Component Plan C**.

The BASH Plan is reviewed on an annual basis and the BASH Hazard Working Group meets semi-annually. The most recent PRSC BASH Hazard Working Group meetings were held on 8 October 2014, 19 May 2015, 2 March 2016, and 2 November 2016.

With WIA playing such an important role for seabirds (both migrant and resident), the Airfield is considered to have a very active BASH concern with a relatively minimal BASH program. The BASH program consists of an annual depredation permit issued to the BOS contractor on behalf of the USAF from the USFWS, Migratory Bird Branch, which requires number logging and annual status reports. The day-to-day BASH program at WIA is managed by the BOS contractor, with particular responsibility to the Airfield Manager and the Environmental Officer and supplemental support and oversight by both Det 1, and the 611 CES/CEIE Natural Resources PM.

7.14 COASTAL ZONE AND MARINE RESOURCES MANAGEMENT

The coastal zone and marine resources element is not applicable to either Kōke`e or Mt. Ka`ala AFS; neither of these sites is near a coastal zone.

Coastal zone and marine resources management is applicable at WIA; however, the Atoll does not fall into any of the Coastal Zone Management Programs as outlined by NOAA, Office for

Coastal Management (http://coast.noaa.gov/czm/mystate/). Furthermore, there is no formal coastal zone protection program, coastal zone barrier resources, or coastal America program involvement for WIA. However, the 611 CES will review and coordinate with NOAA to ensure installation actions are consistent with the policies and procedures of the Coastal Zone Management Act. The 611 CES/CEIE Natural Resource PM does coordinate with appropriate regulatory entities as needed for all projects that may have some level of involvement with coral reefs and marine species. These regulatory entities include: NOAA, NMFS, USFWS and, in some cases, the USACE. For example, the 611 CES/CEIE may have a project in the near future to dredge out the WIA harbor and channel. If this project were to get funded, the 611 CES/CEIE would engage with all three entities noted above to ensure compliance with all federal regulations involving these resources.

7.15 CULTURAL RESOURCES PROTECTION

The Wake Atoll ICRMP was finalized in 2016, and the Mt. Ka`ala AFS and Kōke`e AFS ICRMPs are covered under a separate document which is expected to be finalized in 2017 (Draft ICRMP, Koke'e and Mt. Ka`ala Long Range Radar Sites, 2016).

7.16 PUBLIC OUTREACH

In general, the public outreach element is not applicable to either Kōke`e or Mt. Ka`ala AFS unless there were to be a construction project at either of these sites. There is no appropriate venue for public outreach at Kōke`e or Mt. Ka`ala AFS.

There is a more appropriate forum and need for a small public outreach program at WIA. This program consists of brochures and handouts that are provided during the orientation to the Airfield for all incoming passengers (military, federal employees, and contractors). The terminal building at WIA also provides an area of natural resources reading materials and posters. The outreach materials are typically a combined effort of the 611 CES/CEIE Natural Resources PM and the BOS contractor Environmental Office.

7.17 GEOGRAPHIC INFORMATION SYSTEM

The DOD/USAF standardized requirement for GIS follows the guidance provided in these links:
http://www.sdsfieonline.org/PublicPages/Branches/AF.aspx
http://www.acq.osd.mil/ie/bei/disdi/geospatial_guidancememo041409.pdf.

7.18 CLIMATE CHANGE

Climate change is referred to by the National Academy of Sciences as any significant change in measures of climate (i.e., temperature, precipitation, or wind) lasting for an extended period (decades or longer). Impacts to natural resources from climate change include shifts in species' ranges and distributions, changes in phenology, and in some cases an increase in niche availability that is a concern for islands prone to invasive species incursion. These impacts can be identified, documented, monitored through the usage of long-term biological monitoring programs. The USAF will continue to perform biological monitoring (a program built on the utilization of index based surveys to not only document changes in population levels for biota of

interest, but also the chronology of specific breeding events) in an effort to document impacts to the natural resources of Wake, Kōke`e and Mt. Ka`ala AFS as a result of climate change.

Climate change is a rapidly developing field of study; however, at this time, there is strong evidence linking global climate change to human activities, especially greenhouse gas emissions associated with burning fossil fuels. Some of the activities taking place on Wake Atoll result in fossil fuel consumption. In an effort to reduce on island fuel consumption and offset overall fuel consumption, 168 gasoline "mogas"-powered vehicles were returned to O`ahu. In FY13, the USAF purchased 13 E-ride (electric) vehicles, 12 Kawasaki mules, and 6 new diesel trucks. Deliveries and use of the vehicles began on Wake in FY14. In addition, much of the transportation of personnel on Wake is conducted on bicycles. The resulting reduction in fuel usage has not only reduced net emissions, but it has also resulted in a cost savings. However, even with the implementation of the usage of alternative energy vehicles on Wake, it is acknowledged that specific operations and activities at the installation, including use of vehicles, aircraft, machinery, and maintenance equipment, would contribute to greenhouse gas emissions and ultimately global climate change.

8. MANAGEMENT GOALS AND OBJECTIVES

Specific management objectives and strategies have been identified in a number of subject areas that affect the natural resources present on and immediately adjacent to Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS. This section identifies tasks and objectives for the installations to obtain workable and useful solutions for each management issue identified. This section is divided into 18 subsections, one for each natural resources subject area. For simplicity and clarity within this INRMP, each natural resources topic is assigned an individual "issue number." Each subject area has been abbreviated, as shown in **Table 8-1**. For example, the first management issue in Section 8.1, Natural Resources Program Management, is identified as NRP-1. In addition, a series of tasks are presented following the goal and objective for each management issue. These tasks are consecutively numbered for each management issue. Following the management tasks are the evaluation criteria used to track the status of the resolution of the management issue. A summary of the management actions is provided in **Chapter 10**, Work Plans.

Table 8-1. Integrated Natural Resources Management Plan Subject Area Abbreviations

Section	INRMP Subject Area	Abbreviation
8.1	Natural Resources Program Management	NRP
8.2	Fish and Wildlife Management	FWM
8.3	Outdoor Recreation and Public Access to Natural Resources	OR
8.4	Conservation Law Enforcement	CLE
8.5	Threatened and Endangered Species and Habitats	TE
8.6	Water Resources Protection	WRP
8.7	Wetland Protection	WP
8.8	Grounds Maintenance	GM
8.9	Forest Management	FM
8.10	Wildland Fire Management	WFM
8.11	Agricultural Outleasing	AG
8.12	IPM Program	IPM
8.13	Bird Aircraft Strike Hazard	BH
8.14	Coastal Zone and Marine Resources Management	CZ
8.15	Cultural Resources Protection	CRP
8.16	Public Outreach	PO
8.17	GIS	GIS
8.18	Climate Change	CC

Some of the projects described in this section will be accomplished through interactive partnerships with others. USAF natural resources management staff will initiate partnerships based on the benefits to the regional ecosystem and the local environment. Required projects, which are part of the continued management of Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS, will be internally funded through the USAF.

8.1 NATURAL RESOURCES PROGRAM MANAGEMENT

Operation and management of Wake Atoll, Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS are conducted by different installation personnel, departments, and stakeholders. The management

teams provide support within their areas of expertise to ensure that operation of the installations is implemented successfully. It is necessary that management approaches are consistent between operational units and with natural resources management goals and objectives developed in the INRMP. Coordination with installation operators and consistency of natural resources management goals and objectives developed in the INRMP with other installation operational plans and documents will ensure that natural resources management can be implemented successfully in a manner consistent with the missions of the installations. A summary of Natural Resources Program Management Goals is provided in **Table 8-2**.

Table 8-2. Summary of Natural Resources Program Management Goals

Natural Resources Program Management Goals
• **INRMP Goal No. 1:** Update the INRMP when environmental or mission conditions change as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03.

In order to meet the natural resources program management goal identified in **Table 8-2**, the following management objectives and project definitions have been developed.

8.1.1 Objective NRP-1: On an annual basis, coordinate with installation organizations to ensure there is an understanding of management goals and actions developed in the INRMP and to ensure that management actions developed in the INRMP are consistent with current management instructions and plans.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: Sikes Act and ESA.

Background Information: Coordination with installation operational and management organizations and stakeholders (including USFWS, NOAA, and the Hawai`i DLNR) is necessary to ensure that the goals and objectives of management actions developed in this INRMP are understood and consistent with current ongoing management on the installations. INRMP tasks need to be compatible with management and actions prescribed in other installation plans and documents.

Task(s):

1. Conduct a formal meeting and internal review with installation operational and management organizations on an annual basis to ensure that there is an understanding of goals, objectives, and projects presented in this INRMP.

Monitoring Criteria: Documented completion of the annual coordination meeting and INRMP review.

8.1.2 Objective NRP-2: Conduct external stakeholder annual review and update the INRMP as needed based on pertinent review findings.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: Sikes Act and DODI 4715.03.

Background Information: The INRMP needs to be reviewed internally on an annual basis to assess the suggested management practices in terms of their appropriateness for current conditions at the installations. Recurring annual review with minor update and tripartite coordination is generally performed in-house or by the Installation Support Team, but may include incidental costs associated with physical update of the plan documentation. The installations will coordinate with the USFWS, NOAA, and Hawai`i DLNR to review and assess conservation goals and objectives and to determine if updates to the INRMP need to be made. In addition, the Plan should be updated whenever there is a modification to an installation's mission, or when there is a substantial change to the installation's resources.

Task(s):

1. Conduct annual review with USFWS, NOAA, and Hawai`i DLNR.

2. Utilize internal and external stakeholder comments to update the INRMP.

Monitoring Criteria: The Annual INRMP Review is conducted, concurrence from signatory agencies is obtained, and the INRMP document is amended accordingly.

8.1.3 Objective NRP-3: Every 5 years determine if an update or revision of the INRMP is necessary based on changes in environmental conditions or the mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: Sikes Act and DODI 4715.03.

Background Information: The Sikes Act requires INRMPs to be reviewed for operation and effect no less than once every 5 years.

Task(s):

1. Conduct an internal and external evaluation of the INRMP at a minimum every 5 years to determine if an update or revision is necessary based on changes in environmental conditions or the mission. If determined necessary, make changes to the INRMP to address changes in environmental conditions or the mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03.

2. If aforementioned evaluation identifies changes in environmental conditions or the mission, the modifications to the INRMP will be coordinated with USFWS, NOAA, and Hawai`i DLNR (tripartite coordination), as appropriate.

Monitoring Criteria: An evaluation is conducted at a minimum of every 5 years to determine if changes to the INRMP are necessary to address changes in environmental conditions or the

mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03. If modification of the INRMP is determined to be necessary, changes are coordinated with USFWS, NOAA, and Hawai`i DLNR (tripartite coordination), as appropriate. Concurrence from signatory agencies is obtained.

8.2 FISH AND WILDLIFE MANAGEMENT

The USAF has determined that Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS have sufficient habitat to warrant the preparation of this INRMP.

Wildlife management is defined as manipulation of the environment and wildlife populations to produce desired objectives. Management can be performed in a manner that enhances biodiversity through the re-establishment of native habitats. Conversely, habitat management could be required to decrease the abundance of certain wildlife species to reduce animal damage or bird strike hazards. Traditionally, wildlife management was confined to large tracts of naturally vegetated land. Large areas of Wake Atoll and most of Kōke`e AFS and Mt. Ka`ala AFS are developed. Several areas of undeveloped forest and wetland serve as wildlife habitat on Wake Atoll. A summary of the Fish and Wildlife Resources Management Goals is provided in **Table 8-3**.

Wildlife population and habitat management will attempt to deter animals from foraging or roosting in areas near or adjacent to areas where they would be in opposition to USAF missions, or where they present a risk to safety or practices. Management actions include attracting wildlife to areas away from these areas, and protecting and conserving threatened and endangered species through habitat conservation at selected locations on the installations.

Table 8-3. Summary of Fish and Wildlife Management Goals

Fish and Wildlife Management Goals
• **INRMP Goal No. 2:** Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment. • **INRMP Goal No. 3:** Maintain partnerships with agencies involved in wildlife management and utilize expertise from agencies, if appropriate and cost effective, for implementation of INRMP projects.

8.2.1 Objective FWM-1: Conduct annual surveys to estimate numbers of breeding sea birds, migratory shorebirds, and waterfowl on Wake Atoll. Utilize species phenology to assist the BASH program in mitigating the risk of bird strikes.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: MBTA.

Background Information: Surveys of Wake Atoll seabirds, shorebirds, and waterfowl were conducted in 2009, 2010, 2011, and 2014 (PICRA 2009, 2010; PRC 2011; Hebshi et al. 2011, and Rauzon and Gilardi 2014). Episodic shorebird surveys were conducted by USFWS on Wake and Peale islands between late 2011 and Summer 2012 as part of the Wake Atoll Rat Eradication Shorebird Survey. This specific USFWS-USAF interagency effort was carried out in order to

index shorebird populations prior to the broadcast application of the anticoagulant rodenticide Brodifacoum during the Wake Atoll Rat Eradication Project (USFWS 2012). The USDA and Marine Endeavours were contracted to conduct seabird and shorebird surveys in 2014-2015 by the PRSC and Chugach (via subcontract), respectively. Continuation of annual surveys is necessary to monitor changes in populations, nesting chronology, distribution, and colony health. In addition, the results from such efforts are an aid when attempting to identify potential conflicts with installation activities. Current information on numbers and species phenology over the course of the year will also assist the BASH program in mitigating the risk of bird strikes.

Task (s):

1. Conduct annual monitoring for breeding seabirds, shorebirds, and waterfowl based on monitoring protocols and sampling designs established in the PICRA Monitoring Plan Protocols.

2. Conduct acoustic and decoy attraction trials at Peale Island.

3. Perform pre-vegetation clearing surveys in order to document the absence or presence of MBTA resources.

4. Review requests from contractors and subcontractors as they apply to altering established PICRA Monitoring Plan Protocols. Reject or approve alterations based on applicability to environmental conditions, summary analysis constraints, and feasibility.

5. Prepare an annual summary report presenting the results of the aforementioned surveys to be included in the INRMP for use in monitoring changes in numbers and to ensure that populations remain healthy and are not adversely impacted by installation activities.

6. Provide survey and phenology data to assist the BASH program in mitigating the risk of bird strikes.

Monitoring Criteria: Annual surveys to estimate numbers of breeding sea birds, migratory shorebirds, and waterfowl are completed and survey data are incorporated into the INRMP. Data are provided to the BOS contractor and USAF Flight Safety Offices, in order to assist the BASH program in mitigating the risk of bird strikes.

8.2.2 Objective FWM-2: Conduct follow-up biological surveys to the 2010 terrestrial vegetation, terrestrial arthropods, rats, sea turtles, and intertidal organisms Legacy Resource Management Program surveys.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: MBTA and BASH.

Background Information: Baseline surveys (for either a subset of the following or the entire suite of organisms) of terrestrial vegetation, terrestrial arthropods, rats, and intertidal organisms

were conducted in 2009, 2010 and 2011 (PICRA 2008, 2009, 2010; PRC 2011; Hebshi et al. 2011). Anecdotal information pertaining to vegetation response and rodent distribution was collected in 2014 (USDA 2014; Rauzon and Gilardi 2014). The USDA conducted efficacy and resistance trials using various rodenticide baits in 2014. In addition, trials evaluating food preferences of manufactured baits and naturally occurring food items were carried out in order to guide future planning efforts for a subsequent eradication attempt. All USDA investigations utilized wild caught Polynesian rats on Wake Atoll.

Tasks:

1. Conduct follow-up biological surveys of terrestrial arthropods, rats, sea turtles, vegetation, and intertidal organisms based on the PICRA Monitoring Plan Protocols or government approved modifications of the PICRA Protocols.

2. Prepare a report presenting the results of the surveys and compare data with pre-rat eradication attempt survey results.

Monitoring Criteria: Surveys of terrestrial vegetation, terrestrial arthropods, rats, sea turtles, and intertidal organisms are conducted and survey data are compared to pre-eradication survey data to assess ecological changes on Wake Atoll as a result of the removal of Polynesian rats.

8.2.3 Objective FWM-3: Conduct land crab and herpetofauna surveys on Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act and Fish and Wildlife Coordination Act.

Background Information: Land crab index counts were carried out in 2007 and 2009 in conjunction with rodent eradication planning efforts (engineering-environmental Management, Inc. 2009). The Center for Environmental Management of Military Lands conducted landcrab index surveys in 2014 (Rex 2014). Follow-on surveys are necessary to develop an understanding of species composition, track changes in population dynamics, assist with understanding rodent bait survival, and identify the potential introduction of new landcrab species onto Wake Atoll.

Tasks:

1. Conduct annual index surveys for land crabs and herpetofauna on Wake Atoll.

2. Incorporate the results of the surveys into the INRMP.

Monitoring Criteria: A land crab and herpetofauna index survey is conducted on Wake Atoll and survey data are incorporated into the INRMP.

8.2.4 Objective FWM-4: Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, Magnuson Stevens Fishery Conservation and Management Act 2007 – Reauthorization, and Proclamation 8336, Wake Island Operating Guidance.

Background Information: Implementation of a systematic approach to inventory, monitor, model and assess the effects of recreational fishing on Wake Atoll is needed to support development of appropriate management approaches for the resource.

Tasks:

1. Conduct lagoon and off shore surveys of fish populations, specifically those species that are most commonly consumed by residents.

2. Quantify results from the surveys in a report and summarize the impact from 12 months fishing at the Atoll.

3. The USFWS, NMFS, and PRSC will work together to develop goals for protecting reef species in conjunction with a recreational fishery.

4. A fishry biologist with experience is assessing population dynamics should be brough into this project to help craft an improved data collection log, assess target species populations, and establish species recovery goals.

Monitoring Criteria: Lagoon and off shore surveys of fish populations are conducted and a report summarizing the effects on fish numbers from 12 months of fishing at the Atoll is prepared.

8.2.5 Objective FWM-5: Conduct wildlife surveys on Kōke`e AFS and Kōke`e MAS.

Applicable Installation(s): Kōke`e AFS.

Regulatory Drivers: MBTA, Sikes Act, and ESA.

Background Information: Recent surveys of wildlife have not been conducted at Kōke`e AFS or Kōke`e MAS and, as a result, there is a lack of current biological information of wildlife that occurs on the two facilities.

Tasks:

1. Conduct surveys for wildlife on Kōke`e AFS and Kōke`e MAS. The survey should include the following:

a. Detailed survey protocols and established timelines for their completion to ensure that personnel maintain the most current data available concerning the resources they are managing.

b. Collection of information from the USFWS, Hawai`i DLNR, and other local experts.

2. Incorporate biological survey data into the INRMP as they are collected.

Monitoring Criteria: Wildlife surveys are conducted on Kōke`e AFS and Kōke`e MAS and the survey data are incorporated into the INRMP.

8.2.6 Objective FWM-6: Conduct surveys on Mt. Ka`ala to determine avian, mammalian, and herpetofauna species and numbers on the installation.

Applicable Installation(s): Mt. Ka`ala AFS.

Regulatory Drivers: MBTA, Sikes Act, and ESA.

Background Information: Undeveloped areas within the security fence on Mt. Ka`ala AFS are limited in size and are managed as mowed and maintained habitat. As a result, suitable wildlife habitat is lacking within the fence line. The site is immediately surrounded by the Mt. Ka`ala NAR, and the Mt. Ka`ala Bog Area borders the facility on its southwestern side. Wildlife species associated with the surrounding areas have the potential to occasionally occur within the secured fence line. Some smaller resident species also likely occur within the fenced area of the facility. Recent surveys of wildlife species have not been conducted at Mt. Ka`ala AFS and, as a result, there is a lack of biological information to effectively manage wildlife.

Task(s):

1. Conduct initial baseline surveys for wildlife on Mt. Ka`ala. The survey should include the following:

   a. Detailed survey protocols and established timelines for their completion to ensure that personnel maintain the most current data available concerning the resources they are managing.

   b. Collection of information from the USFWS, Hawai`i DLNR, and other local experts.

2. Incorporate biological survey data into the INRMP as they are collected.

Monitoring Criteria: The planning level surveys for avian, mammalian, and herpetofauna species are completed and survey data are incorporated into the INRMP.

8.3 OUTDOOR RECREATION AND PUBLIC ACCESS TO NATURAL RESOURCES

It is the policy of DOD to make lands accessible to the public for educational or recreational use of natural and cultural resources when such access is compatible with military mission activities; ecosystem sustainability; and other considerations such as security, safety, and fiscal soundness. Section 2904 of the SAIA states that each INRMP shall provide, to the extent appropriate, for the "sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources" and "subject to requirements necessary to ensure safety and military security."

A program for outdoor recreation must account for the basic requirements of healthy natural ecosystems while also coordinating with mission activities. Lands used primarily for military activities, such as Airfields, are excluded from outdoor recreation uses for safety, public health, and security reasons. However, lands that are considered multiple-use areas, outdoor recreation access may be alternated with mission-related activities to accommodate both types of uses.

There is no formal Outdoor Recreation Plan for Wake Atoll. Residents and visiting contractors to the island actively engage in hiking, beach combing, snorkeling, diving, boating, and fishing. Where these activities overlap with natural resources, Wake Island Operating Guidance, Environmental Compliance and Protection of Natural Resources (**Appendix O)** stipulates prohibitions and limitations associated with natural resources.

The Wake Island Operating Guidance (**Appendix O**) has been developed to provide information and educate those who enjoy and appreciate the marine environment at Wake and to establish guidelines to support and maintain a healthy marine ecosystem for many years to come. Waters surrounding Wake Atoll are part of the PRIMNM from the shoreline out to approximately 200 nautical miles from the mean low water line. These waters are collaboratively managed by the USFWS and NOAA. It is the intent of the PRSC to assist these agencies in protecting the mission of the Monument through implementation of the Wake Island Operating Guidance.

The 2016 Wake Island Dive Club Charter (**Appendix P**) was developed to promote safe self-contained underwater breathing apparatus (SCUBA) diving as a means of recreation and sport and to establish basic requirements for safe accomplishment of recreational SCUBA diving for Wake Island residents and visitors.

There is no outdoor recreation or public access to Kōke`e AFS or Kōke`e MAS. Although both sites are located adjacent to a well traveled road that is used to access popular state parks, users of the parks are not generally granted access to the installations for security reasons. Limited size and current land use also limit use of the facilities for recreational activities. There is no outdoor recreation or public access to Mt. Ka`ala. The size of the facility and current land use limits the area available for recreational purposes. Security requirements also restrict access to the facility by the public. The public uses the road to the installation to gain access to the adjacent Mt. Ka`ala Bog preserve and its boardwalk, although access to the preserve is limited and must be authorized by the Hawai`i DLNR, Division of Forestry. Hiking trails also provide access to the bog preserve.

Outdoor recreation opportunities are available to residents and visitors to Wake Atoll. Availability of recreational opportunities is very important due to the remote location of the

Atoll. Wake Atoll is within the PRIMNM and is designated as a National Historic Landmark as a result of its recognition as one of the nation's most significant historic resources associated with World War II in Pacific and trans-Pacific aviation prior to the war. Recreational activities must be conducted in a manner that is consistent with these designations, while providing opportunities to enjoy the natural resources of the Atoll.

The level of enjoyment that is derived from outdoor activities is directly related to the quality of the natural resources present on the Atoll. The purpose of this component of the INRMP is to identify projects that encourage the utilization of the natural resources for outdoor recreational purposes, while protecting and enhancing those resources. A summary of the Outdoor Recreation and Public Access to Natural Resources Goals is provided in **Table 8-4**.

Table 8-4. Summary of Outdoor Recreation and Public Access to Natural Resources Goals

Outdoor Recreation and Public Access to Natural Resources Goals
• **INRMP Goal No. 4:** Provide quality outdoor recreation experiences for civilian, active duty, and contract work staff that do not deteriorate ecosystem integrity or the USAF mission.

The recognition of these goals has led to the identification of a variety of management concerns. A series of management objectives and specific management strategies and the appropriate monitoring criteria have also been developed that address management concerns and their associated goals. The management issues and their related actions for outdoor recreation and public access to natural resources are presented below.

8.3.1 Objective OR-1: Coordinate the Outdoor Recreation Program on Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act.

Background Information: There is no formal plan that describes or coordinates outdoor recreational activities on Wake Atoll besides the Wake Island Operating Guidance for Environmental Compliance and Protection of Natural Resources (**Appendix O**) and the Wake Island Dive Charter (**Appendix P**).

Tasks:

1. Coordinate with users of Wake Atoll to determine recreational uses and needs.

2. Determine recreational uses that are compatible with natural resources management and use restrictions, and develop a plan that provides quality recreational opportunities that sustain ecosystem integrity over time, and that is consistent with existing land use designations.

3. Include protection of corals and historic artifacts as components of the Outdoor Recreation Plan.

4. Include the assessment of opportunities to encourage coral development in recreational SCUBA diving activities.

5. Develop a Wake Island bird identification tri-fold for distribution to Atoll residents and visitors.

6. Create a nature trail or series of trails along existing roads and paths.

7. Develop a tri-fold describing various natural components along the trail(s).

8. Restrict vehicle use on beaches to access for emergency and security reasons consistent with Section 11.3 of AFI 32-7064 (USAF 2014a).

9. Define beach access areas.

10. Coordinate the plan to be consistent with and incorporate applicable components of Wake Island Operating Guidance, Environmental Compliance and Protection of Natural Resources (**Appendix O**).

Monitoring Criteria: Development and implementation of an Outdoor Recreation Plan for Wake Atoll.

8.3.2 Objective OR-2: Implement a fishing permit system to track fishing pressure on Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, Proclamation 8336, and 50 CFR 665 Subpart E and H, Wake Island Operating Guidance.

Background Information: Recreational fishing comprises an important component of outdoor recreation on Wake Atoll. The Wake Island Operating Guidance (**Appendix O**) has been developed to provide information and educate those who enjoy and appreciate the marine environment at Wake Atoll and to establish guidelines to support and maintain a healthy marine ecosystem for many years to come.

Tasks:

1. Ensure that personnel fishing on Wake Atoll are aware of and follow the guidelines in Wake Island Operating Guidance.

2. Include information regarding the fishing program and associated requirements in the newcomers' orientation to Wake Atoll.

3. Gather quarterly fishing log sheets and prepare annual report for submission to USFWS.

4. Monitor island fishing activities to ensure compliance with the Wake Island Operating Guidance.

Monitoring Criteria: Fishing activities on Wake Atoll are conducted consistent with the guidelines and requirements established in the Wake Island Operating Guidance (**Appendix O**).

8.4 CONSERVATION LAW ENFORCEMENT

There are no conservation law officers on Wake Atoll, Kōke`e AFS, or Mt. Ka`ala AFS. The WIA commander and their designated representatives set and enforce all policy within the confines of the WIA mission. Wake Island Operating Guidance (**Appendix O**) provides guidance for the protection of natural resources on Wake Atoll within the purview of the commander of WIA. All personnel are required to follow the guidance and violators may be subject to civil or criminal penalties under the laws and regulations of the United States, including the Uniform Code of Military Justice where applicable. Violations committed by non-DOD contract personnel result in contract review to determine whether appropriate adjustments are necessary under the default provisions of the contract.

There is no public access or outdoor recreation within the fenced areas of Kōke`e AFS and Mt. Ka`ala AFS, as a result of security restrictions. Kōke`e AFS and Kōke`e MAS are surrounded by a state park and conservation law enforcement in the adjacent park areas is the responsibility of the state. Mt. Ka`ala AFS is accessed by an FAA-maintained road. The public uses the road and hiking trails to access the adjacent Mt. Ka`ala Bog Natural Area Preserve; however, access to the area is limited and must be approved by the state DLNR Division of Forestry. The installation commanders are responsible for law enforcement within the secured fenced areas of the facilities. A summary of the Conservation Law Enforcement Goals is provided in **Table 8-5**.

Table 8-5. Conservation Law Enforcement Goals

Conservation Law Enforcement Goals
• **INRMP Goal No. 5:** Utilize law enforcement expertise from cooperating DOD and DOI agencies to monitor activities on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS and educate installation personnel on restrictions applicable to the site's resources.

To meet the goals of conservation law enforcement, the following concerns relative to achieving particular goals have been identified, and objectives and management actions have been designed.

8.4.1 Objective CLE-1: Continue enforcement of natural resources laws and regulations on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: MBTA, ESA, Sikes Act, and Proclamation 8336.

Background Information: Installation personnel responsible for enforcement of environmental regulations need to be fully aware of all mission and recreational-related activities and natural resources laws and regulations that need to be complied with in association with the activities.
Tasks:

1. Conduct meetings as necessary to ensure that installation personnel responsible for enforcement of environmental regulations are aware of planned activities so any compliance requirements can be identified prior to the activity.

2. Installation personnel responsible for enforcement of environmental regulations educate other personnel on natural resources laws and regulations.

3. Inspections of natural resources areas are conducted on a regular basis during mission activities to ensure compliance with environmental regulations.

Monitoring Criteria: Installation personnel responsible for enforcement of environmental regulations are fully aware of planned mission-related activities that require compliance with natural resources laws and regulations. Installation personnel implementing mission or recreational activities are aware of, and comply with, applicable natural resources laws and regulations.

8.5 MANAGEMENT OF THREATENED AND ENDANGERED SPECIES AND HABITATS

There are no federally listed terrestrial plants or animals currently known or reported on Wake Atoll. Federally endangered and threatened species using marine habitats within the lagoon and waters surrounding Wake Atoll include the federally threatened green sea turtle and two coral species (*Acropora globiceps* and *Acropora retusa)*. There are historical records of the federally endangered Hawaiian monk seal in waters surrounding Wake Atoll; however, they have not been observed over the last two decades. Wilkes and Peale islands might provide suitable rest and nesting habitat for green sea turtles. A potential turtle crawl was observed by Joel Helm, USAF 611 CES/CEIE, during site visits conducted in March/April 2015. The crawl was old and in an area of beach with associated casuarina. The crawl was covered with a thick layer of casuarina needles and the species of turtle associated with the crawl was not determined. The federally endangered hawksbill sea turtle has been suspected to occur at Wake Atoll; however, there are no records or accounts of confirmed sightings in the literature. Scalloped hammerhead sharks (*Sphyrna lewini*), humpback and sperm whales, and leatherback turtles might also occur in ocean waters around Wake Atoll.

The humphead wrasse and the vulnerable bumphead parrotfish occur in waters surrounding Wake Atoll. Both the humphead wrasse and the bumphead parrotfish are considered SOC by NMFS. Scalloped hammerhead sharks, humpback and sperm whales, and leatherback turtles could also occur in ocean waters around Wake Atoll.

Wake Atoll is surrounded by a narrow fringing coral reef. The Center for Biological Diversity submitted a petition to add 82 species of coral to the Federal List of Threatened and Endangered

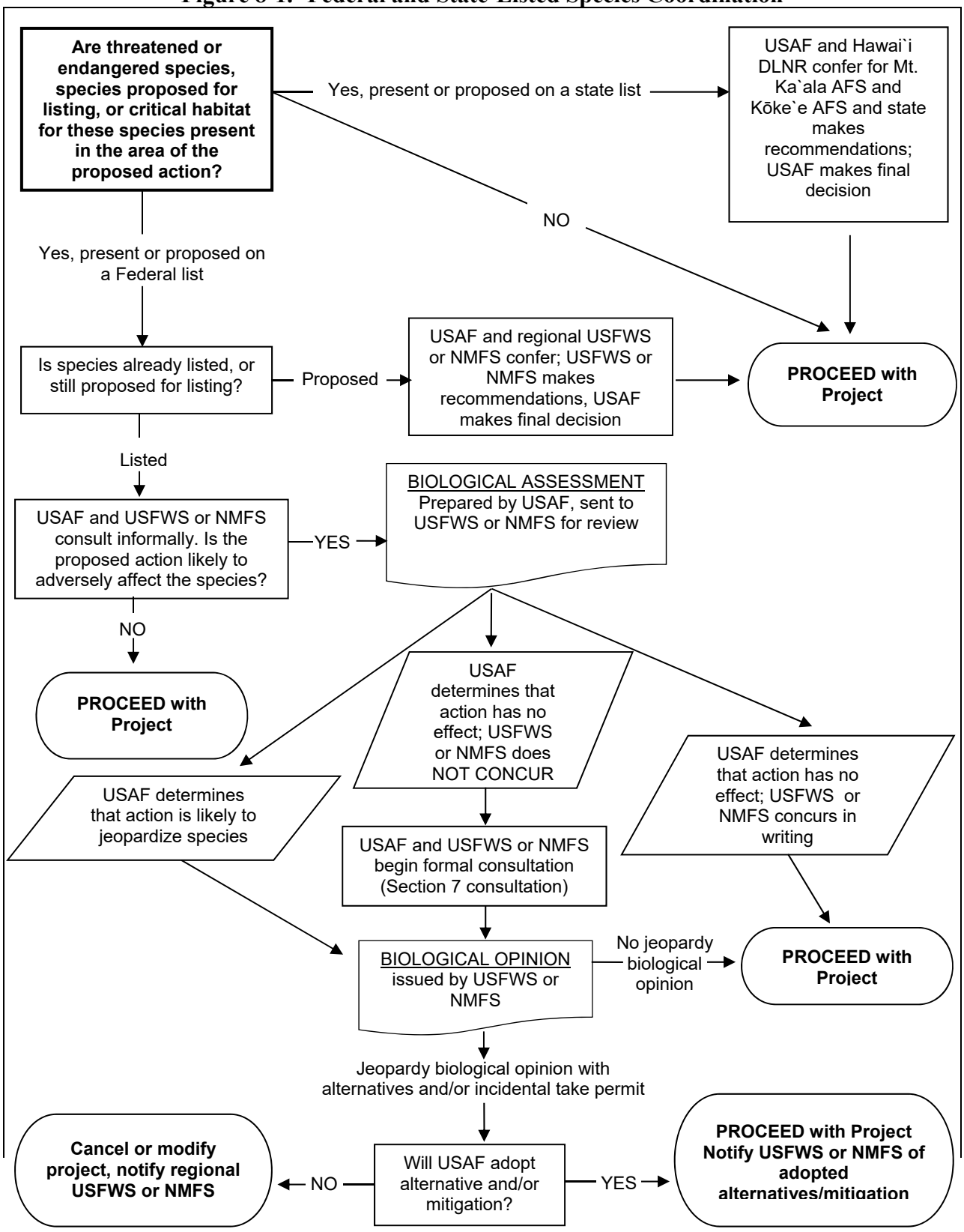
Species and to designate Critical Habitat for those species. In response to the petition, NMFS reviewed the status of 82 "candidate species" of corals. In April 2012, NMFS completed a status review report and draft Management Report of the candidate species of corals. In November 2012, NMFS proposed to list 66 of those petitioned species of corals as threatened or endangered under the ESA. In August 2014, NOAA published a final decision to list 22 species of corals in the Federal Register. The 22 species of coral are now protected as threatened under the ESA, including the two corals (elkhorn and staghorn) that were listed as threatened in 2006. Three of the listed species occur in the Pacific remote island areas which includes Wake Atoll. Corals listed for the region include *Acropora globiceps, Acropora retusa* and *Acropora speciosa*. In the summer of 2016, a USAF and USFWS collaborated coral survey confirmed the presence of two ESA listed corals (*Acropora globiceps* and *Acropora retusa)* along the southern portions of the atoll (USFWS 2017b). Based off of the results of the coral survey from 2016, the 611 CES/CEIE has developed a Coral Conservation Action Plan (**Appendix S**) that identifies both terrestrial and in-water related activities that provide either a direct or indirect benefit to these ESA protected coral species.

Approximately 40 rare plant species have been recorded as occurring in the Mt. Ka`ala NAR, which is adjacent to Mt. Ka`ala AFS. Mountain alsinidendron *(Alsinidendron trinerve)* is listed as endangered and uhiuhi *(Caesalpinia kavaiensis)* is proposed for listing as endangered. No listed species have been documented on the site, or within the maintained buffer around the perimeter fence.

The federally endangered Hawai`ian hoary bat forages for insects on Kōke`e AFS. The federally endangered Hawai`ian petrel and Hawai`ian goose, and the threatened Newell's shearwater are also documented on the installation. The station is also adjacent to (but does not include) designated critical habitat for montane mesic ecosystem species, including nine plant species, the Kauai akepa (*Loxops caeruleirostris*), and the picture-wing fly (*Drosophila attigua*). There are no threatened or endangered species documented on Kōke`e MAS.

Figure 8-1 presents an endangered species coordination decision chart that should be used as part of the planning process for projects that could impact known or potential future populations of threatened or endangered species on the Wake Atoll, Mt. Ka`ala AFS, or Kōke`e AFS. The threatened and endangered species and critical habitats, topics of concern, and associated goals and objectives are presented below.

Figure 8-1. Federal and State-Listed Species Coordination



As summarized in **Table 8-6**, the goal for this section is to manage the sites on a regional ecosystem-based approach that manages sensitive species while protecting the operational functionality of the missions. While single species management is not promoted as a general philosophical management approach on the sites, specific controls are used to protect threatened and endangered species beyond management of the ecosystems. Other procedures in place for management of threatened and endangered species are modifying the ecosystems and human interactions within the environment. The threatened and endangered species and critical habitats topics of concern and associated goals and objectives are presented below.

Table 8-6. Summary of Threatened and Endangered Species and Habitat Management Goals

Threatened and Endangered Species and Habitats Management Goals
• **INRMP Goal No. 6:** Manage Wake Atoll, Mt. Ka`ala AFS, and Kōke`e AFS using a regional ecosystem-based approach that manages sensitive species and their associated ecosystems while protecting the operational functionality of the sites' missions.

8.5.1 Objective TE-1: Conduct annual sea turtle monitoring for nests, crawls, and tracks in areas with potentially suitable nesting habitat on Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: ESA, Sikes Act, and Proclamation 8336.

Background Information: The federally threatened green sea turtle is regularly observed in the lagoon, nearshore reefs, and the channel between Peale and Wake islands. Chapter 8 of AFI 32-7064 (USAF 2014a) requires that all installations conduct basic reconnaissance surveys for federally listed threatened or endangered species. Follow-up reconnaissance surveys are required for federally listed species that may occur on the installation. The federally endangered hawksbill sea turtle is also expected to occur in the area of Wake Atoll; however, it has not been documented. No sea turtle activity was detected in monitoring surveys conducted in February, April, June, July, October, and November of 2010 and December and January 2010-2011 (PRC 2011) in potentially suitable nesting habitat. It is possible that nesting activity could occur due to the frequent occurrence of green sea turtles in the area. A potential turtle crawl was observed by Joel Helm, USAF 611 CES/CEIE, during site visits conducted in March/April 2015. The crawl was old and in an area of beach with associated casuarina. The crawl was covered with a thick layer of casuarina needles. The presence of casuarina makes the beach unusable for turtle nesting due to superficial root growth and the accumulation of thick litter fall (Panday et al. 1998). The species of turtle associated with the crawl was not determined. The frequent occurrence of green sea turtles in waters around Wake Atoll and the observation of an old crawl makes it important to conduct annual surveys to determine if green sea turtles nest on Wake Atoll.

Incidental observations of sea turtles are occasionally made by Wake Atoll personnel and visitors during normal daily activities, and are not recorded. Recording of incidental observations would be useful in developing a better understanding of the occurrence of these species in proximity to Wake Atoll.

The federally threatened scalloped hammerhead shark also has the potential to occur in waters around Wake Atoll; however, their occurrence has not been documented in the past.

Tasks:

1. Conduct annual sea turtle monitoring between April and June in areas with potentially suitable nesting habitat. Suitable habitat currently includes the inner margin of Wilkes and Peale lagoons and the area around the commander's beach house. Habitat conditions may be altered by storm events; therefore, locations of suitable habitat might change.

2. If tracks or nests are found, the following data should be recorded:

    a. Species assessed by track size

    b. Date, time, and current conditions

    c. Nest found, or beach crawl

    d. Geographic coordinates for nest or highest point on the beach

    e. Photos taken of tracks and nests

    f. Comments on disturbance, erosion, or predation

    g. If nests are found, area will be marked to reduce nest loss due to disturbance and trampling.

3. If nests are found, monitoring should continue to record hatchling success.

4. If nesting is determined to be occurring on Wake Atoll, develop management actions to enhance habitat and minimize potential for adverse impacts to nesting areas.

5. Educate Wake Atoll personnel and visitors regarding the occurrence of sea turtles and Hawaiian monk seals in the area of the Atoll.

6. Develop a one-page table to document incidental observations of sea turtles, observation dates, times, locations, and observed behavior.

7. Enlist volunteers to document incidental sightings of these species and identify a natural resources person to collect and compile observation data.

8. Compile a summary report of incidental observations on an annual basis.

9. Conduct annual scalloped hammerhead shark monitoring in waters surrounding Wake Atoll. The results of the annual monitoring are documented on an annual basis.

Monitoring Criteria: Monitoring for sea turtle nesting activity is conducted on an annual basis between April and June. If active nests are found, they are monitored for hatchling success. If nesting activity is determined to be occurring, management actions will be implemented to enhance habitat and minimize potential for adverse impacts to nesting areas. Volunteers document incidental sightings of sea turtles and a summary report of incidental observations is prepared on an annual basis. Annual scalloped hammerhead shark monitoring is conducted in waters surrounding Wake Atoll. The results of the annual monitoring are documented on an annual basis.

8.5.2 Objective TE-2: Conduct a survey and assessment of corals associated with Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, ESA, MSA, Fish and Wildlife Coordination Act, and Proclamation 8336.

Background Information: Wake Atoll is surrounded by a narrow fringing coral reef. Both onshore and in-water activities associated with operations and recreation have the potential to affect corals. Past coral surveys have been conducted in the area of Peacock Point (USFWS and NMFS 1999); however, there have been no surveys to identify corals or the conditions of corals in the entire Wake Atoll system. In August 2014, NOAA published a final decision to list 22 species of corals in the Federal Register. The 22 species of corals are now protected as threatened under the ESA, including the two corals (elkhorn and staghorn) that were listed as threatened in 2006. The occurrence of ESA threatened (*Acropora globiceps* and *Acropora retusa)* corals in the area surrounding Wake Atoll was documented in the summer of 2016 (USFWS 2017b). A good understanding of these corals and their conditions will support development of management actions to ensure that any impacts to corals or the reef system associated with Wake Atoll activities will be minimized.

Tasks:

1. Conduct a comprehensive survey and assessment of corals associated with Wake Atoll inside the lagoon and outer reef, as well as the harbor and channel entrances.

2. As a component of the coral reef survey and assessment, develop GIS-based imagery illustrating coral reef resources around Wake Atoll and within the lagoon.

3. Based on the results of the survey, identify if any additional ESA corals occur in association with Wake Atoll and where they occur.

4. Implement management actions to supplement existing management to avoid impacts to ESA corals, if they are determined to occur in association with Wake Atoll.

5. Develop a coral management plan that identifies both onshore and offshore actions to minimize potential for adverse impacts to corals, including any additional federally threatened species identified to occur in associated with Wake Atoll.

6. Implement management actions identified in the Wake Atoll coral management plan.

Monitoring Criteria: A comprehensive survey and assessment of corals associated with Wake Atoll is conducted. GIS-based imagery illustrating coral reef resources around Wake Atoll and within the lagoon is developed as a component of the survey. Based on the results of the survey, initial management actions are identified to reduce potential for impacts to corals. A coral management plan is developed that identifies both onshore and offshore actions to be implemented to ensure potential for impacts to coral species associated with Wake Atoll are minimized. Management actions identified in the management plan are implemented.

8.5.3 Objective TE-3: Conduct a comprehensive survey to identify potential breeding habitat, juvenile nursery habitat and juvenile status of humphead wrasse and bumphead parrotfish in the surrounding waters of Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: ESA, Sikes Act, and Proclamation 8336.

Background Information: The humphead wrasse and vulnerable bumphead parrotfish occur in waters surrounding Wake Atoll. The ESA threatened scalloped hammerhead shark might also occur in the area. The interior lagoon and waters around Wake Atoll exhibit habitat characteristics that are suitable for these species. There currently is not a good understanding of the extent of potential breeding and nursery habitat or the status of juvenile humphead wrasse and bumphead parrotfish in the surrounding waters of Wake Atoll.

Tasks:

1. Conduct a comprehensive survey to identify potential breeding habitat; juvenile nursery habitat; and the status of juvenile humphead wrasse, bumphead parrotfish. and scalloped hammerhead sharks in the surrounding waters of Wake Atoll.

2. Prepare a report presenting the results of the survey and an assessment of suitable breeding habitat, juvenile nursery habitat and the status of juvenile humphead wrasse, bumphead parrotfish and scalloped hammerhead sharks in the surrounding waters of Wake Atoll.

Monitoring Criteria: A survey to identify potential breeding habitat, juvenile nursery habitat, and juvenile status of humphead wrasse and bumphead parrotfish, and the status of scalloped hammerhead sharks in the surrounding waters of Wake Atoll is conducted and a report is prepared.

8.5.4 Objective TE-4: Conduct a threatened and endangered plant species survey on Mt. Ka`ala AFS to determine if listed plants occur on or in managed and maintained areas adjacent to the perimeter security fence.

Applicable Installation(s): Mt. Ka`ala AFS.

Regulatory Drivers: ESA and Sikes Act.

Background Information: Approximately 40 rare plant species have been recorded as occurring in the Mt. Ka`ala NAR, which is adjacent to Mt. Ka`ala AFS. None of the species have been recorded on the installation. A survey needs to be conducted on Mt. Ka`ala AFS and adjacent to the perimeter security fence to determine if listed species occur in the managed/maintained areas.

Tasks:

1. Conduct a Federal and state listed threatened or endangered plant species survey on Mt. Ka`ala AFS and in managed/maintained areas around the perimeter fence.

2. If listed species are found, implement management actions necessary to avoid impacts to the species.

Monitoring Criteria: A federal and state-listed threatened or endangered plant species survey is conducted on Mt. Ka`ala AFS and in managed/maintained areas around the perimeter fence. Management actions are implemented to avoid impacts to any listed species that are found.

8.5.5 Objective TE-5: Continue implementation of Reasonable and Prudent Measures associated with the Biological Opinion (01EPIF00-2016-F-0497) for the continued operation of the Kōke`e AFS and Kōke`e MAS.

Applicable Installation(s): Kōke`e AFS.

Regulatory Drivers: ESA and Sikes Act.

Background Information: The Biological Opinion for the continued operation of the Kōke`e AFS and Kōke`e MAS was issued the the 611 CES in February of 2017. It was determined by the USFWS, through the Formal Section 7 Consultation Process, that continuing operations of the Kōke`e AFS and Kōke`e MAS, and the installation of USCG Rescue 21 Monopole at Kōke`e AFS would adversely affect the Newell's shearwater and Hawai`ian petrel, but would not jeopardize their survival and recovery in the wild. Reasonable and prudent measures and conservation measures were presented in the Biological Opinion to minimize the impacts of incidental take on listed seabirds at Kōke`e AFS. The reasonable and prudent measures include:

1. Minimization of the direct and indirect effects of lighting at Kōke`e AFS on listed seabirds.

2. Minimization of seabird mortality through on-the-ground activities by developing a project-specific search protocol, training personnel about listed seabird fallout and methods for searching for downed birds, conducting searches for downed listed seabirds, and implementing predator control.

Measures were developed to reduce and eliminate, to the maximum extent possible without compromising the installation's mission, security, or safety, the effects from the operation of Kōke`e AFS and Kōke`e MAS on the listed species. The following actions were developed to implement the reasonable and prudent measures presented in the Biological Opinion and minimize the impacts of incidental take on listed seabirds (status of implementation follows the measure description):

Continued implementation of ongoing measures is important to ensure that incidental take of seabirds is minimized and that proper monitoring and reporting is conducted to support analysis of the effectiveness of impact minimization measures.

Tasks:

1. Continue to conduct outreach, as needed, to ensure that new installation personnel are aware of the importance of seabird fallout reduction, and measures and actions that are in place, or that should be practiced to reduce potential for impacts to listed seabirds.

2. Continue to conduct outreach and training, as needed, to ensure that installation personnel understand the importance of conducting seabird fallout inspection walks and are properly trained to conduct the inspections.

3. Continue to conduct outreach and training, as needed, to ensure that installation personnel are trained to properly document inspection findings, and procedures to be followed if injured or dead seabirds are found.

4. Complete the Kōke`e Downed Bird Log (**Appendix Q**) for all downed, injured, or dead birds. The Kōke`e Downed Bird Log should be available for inclusion in the biannual report for the Continuing Operations of the Kōke`e AFS and Kōke`e MAS.

5. Ensure that the USFWS Pacific Islands Fish and Wildlife Office in Honolulu, Hawai`i is notified within 24 hours of any impacts to threatened or endangered species on the facility. If a dead bird is found, it should be bagged and labeled with the date, time, and location where it was found. Documentation, including a description of the impact, species disposition, pictures, and a map showing where the impacted bird was found and/or impacted should be provided to the USFWS within 72 hours of the finding. If injured birds are found during the fledging season (October-December), they will be taken to the Save Our Shearwaters drop-off location. If injured birds are found outside of the fledgling season, the Hawai`i DLNR, Division of Forestry and Wildlife will be contacted for information regarding an appropriate seabird rehabilitator.

Kōke`e AFS will also continue to implement Conservation Measures associated with the Biological Opinion (01EPIF00-2016-F-0497) for the continued operation of the Kōke`e AFS and Kōke`e MAS and the installation:

1. The USAF will work with USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i to develop methods to increase the visibility of the towers to minimize the impacts on listed species.

2. The USAF will continue to assess inventory; and, as poles or antennae become obsolete or no longer necessary, they will be removed. As the antennae or receivers are replaced, they will be co-locating on to single poles when possible to reduce the number of poles needed. Guy wires will be eliminated where practicable.

3. Assist with island- and state-wide efforts to assess and minimize the effects of communications towers, power transmission lines, lighting, and other infrastructure threats to listed seabirds.

4. Support USFWS in the development of methods to increase the visibility of towers to minimize the impacts on listed species by sharing information gained from Kōke`e AFS and other installations as applicable.

Monitoring Criteria: Compliacne with the monirtoring requirements in the Biological Opinion and Informal Consultation of the U.S. Fish and Wildlife Service for the Proposed Continuing Operations at Kōke'e Air Force Station and Microwave Antenna Site (01EPIF00-2016-F-0497) will be carried oput. It is vital that Installation personnel understand the importance of seabird fallout reduction and measures and actions that are in place, or that should be practiced to reduce potential for impacts to listed seabirds. Installation personnel understand the importance of conducting seabird fallout inspection walks and are properly trained to conduct the inspections. Installation personnel are trained to properly document inspection findings and understand procedures to be followed if injured or dead seabirds are found. Opportunities to support implementation of conservation measures presented in the Biological Opinion (01EPIF00-2016-F-0497) are evaluated and support is provided where possible.

8.5.6 Objective TE-6: Implementation of management measures to ensure that Hawai`ian geese that occasionally forage on Kōke`e AFS are not adversely impacted.

Applicable Installation(s): Kōke`e AFS.

Regulatory Drivers: ESA and Sikes Act.

Background Information: Federally endangered Hawai`ian geese occasionally graze in the mowed grass areas on Kōke`e AFS. No harm to these geese has occurred in the past. Garbage cans on Kōke`e AFS have been secured from feral cats and rats, and a trapping and removal program for feral cats has been implemented. These actions help to minimize potential for adverse effects to the geese that graze on Kōke`e AFS.

Tasks:

1. Regularly inspect garbage cans on Kōke`e AFS to ensure they remain secured from feral cats and rats.

2. Continue to conduct trapping and removal of feral cats from Kōke`e AFS as necessary.

3. Conduct outreach and education so that base personnel understand that the Hawai`ian geese should not be harassed or harmed and that they should not feed the geese or feral cats.

Monitoring Criteria: Base personnel understand the importance of not harassing or harming the Hawai`ian geese. Garbage cans are inspected on a regular basis to ensure they remain secured from feral cats and rats. Base personnel understand that Hawai`ian geese and feral cats should not be fed.

8.5.7 Objective TE-7: Conduct an auditory survey of the occurrence of Hawai`ian hoary bats on Kōke`e AFS.

Applicable Installation(s): Kōke`e AFS.

Regulatory Drivers: ESA and Sikes Act.

Background Information: Past surveys on Kōke`e AFS (PRC 2009, 2010) found bats were present around lights at Kōke`e AFS almost continuously during nighttime hours. Station personnel have noticed a large decrease in the number of bats on Kōke`e AFS since the green lighting has been installed.

Tasks:

1. Install auditory bat recording devices at Kōke`e AFS.

2. Conduct an auditory survey of the occurrence of Hawai`ian hoary bats on Kōke`e AFS.

3. Prepare a report presenting the results of the auditory survey.

4. If possible, based on previously compiled survey data, compare the results of the auditory survey with surveys conducted prior to installation of green lighting to determine if occurrence of the bat has decreased on Kōke`e AFS.

Monitoring Criteria: A survey is conducted to determine occurrence of the Hawai`ian hoary bat on Kōke`e AFS following installation of green lighting.

8.5.8 Objective TE-8: Recover giant clams, *Tridacna gigas* and *T. squamosal,* within the near shore marine environment on Wake Atoll.

Applicable Installation(s): Wake Island.

Regulatory Drivers: Sikes Act, Fish and Wildlife Coordination Act, and Proclamation 8336.

Background Information: Dr. Rosewater (1965) has documented that several species of giant clams, in addition to *Tridacna maxima*, once occurred at Wake Atoll. Species with a historical presence at Wake Atoll included *Tridacna gigas* and *T. squamosa*.

Tasks:

1. Conduct initial baseline surveys to identify potential habitat/nurseries for the giant clam within the near shore marine environment on Wake Atoll. Prior to the survey, information on the giant clam habitat and behavior should be collected from the USFWS, Hawai`i DLNR, and other giant clam experts.

2. Research appropriate and successful ocean-based nursery techniques.

3. Contact aquaculture facilities raising giant clam larvae (spats) that would be available for ocean placement.

Monitoring Criteria: Monitor the success and growth of the giant clam populations.

8.6 WATER RESOURCES PROTECTION

Water resources protection is important to natural resources management because it directly affects water quality and the value of aquatic habitats. Wake Atoll, Mt. Ka`ala AFS, and Kōke`e AFS currently comply with applicable federal, state, and USAF environmental regulations that require the installation to have detailed spill control and response procedures and to implement stormwater pollution prevention BMPs. The objective of these regulations is to prevent pollutants from entering the watershed, thus protecting surface waters. A summary of the Water Resources Protection Goals is provided in **Table 8-7**.

Table 8-7. Summary of Water Resources Protection Goals

Water Resources Protection Goals
• **INRMP Goal No. 7:** Maintain healthy and stable soils by rehabilitating damaged areas in order to reduce sediment inputs into the watershed that degrade water quality. • **INRMP Goal No. 8:** Minimize non-point source pollution of both surface and groundwater in the watershed through the implementation of BMPs.

8.6.1 Objective WRP-1: Minimize potential for impacts to the water resources associated with stormwater runoff and erosion and sedimentation, accidental spills or leakage from vehicles or equipment, and trash and other installation debris and materials.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: CWA and Proclamation 8336.

Background Information: Uncontrolled stormwater runoff, accidental spills, or leakage from vehicles and equipment and litter and improperly contained or secured debris or materials all have the potential to impact groundwater or adjacent or downstream water bodies and associated habitat.

Tasks:

1. On Wake Atoll, implement stormwater and erosion and sediment control strategies and BMPs included in the 2016 WIA SWPPP.

2. On Mt. Ka`ala and Kōke`e AFS, monitor stormwater conveyance structures and erosion and sediment controls to ensure that they are adequate and functioning properly to minimize impacts to adjacent and downstream habitats.

3. Conduct inspections of stormwater and erosion and sediment control BMPs following high flow events to ensure they continue to function properly.

4. On Wake Atoll, implement strategies and BMPs included in the 2015 WIA SPCC Plan.

5. On Kōke`e AFS, implement strategies and BMPs included in the 2009 Kōke`e AFS SPCC Plan.

6. On Mt. Ka`ala, evaluate existing SPCC practices to ensure they are sufficient to minimize potential for impacts to surface and/or groundwater associated with accidental spills or leakage from vehicles or equipment. If determined necessary, develop an SPCC plan specific to Mt. Ka`ala AFS.

7. Regularly pick up and properly dispose of litter and other debris. Conduct inspections as necessary to ensure that litter and trash are kept cleaned up and properly stored.

8. Properly store or secure construction and other operational materials to ensure they are not transported to adjacent water resources by wind, or during other storm events.

Monitoring Criteria: Regular inspections of stormwater and erosion and sediment control BMPs are conducted to ensure they are functioning properly. At a minimum, BMPs are inspected following high flow events to verify that controls and practices are in place and properly functioning and to ensure that potential impacts to water resources associated with accidental spills or leakage from vehicles or equipment are minimized. Regular inspections are also conducted to ensure that trash and other debris are properly contained and not available for transport by wind or other storm events.

8.7 WETLAND PROTECTION

USACE defines wetlands as "those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR Part 328). Wetlands are an important natural system because of the diverse biological and hydrologic functions they perform. These functions can include water quality improvement, groundwater recharge, pollution treatment, nutrient cycling, provision of wildlife habitat and niches for unique flora and fauna, stormwater storage, and erosion protection.

Wetlands are protected as a subset of the "Waters of the United States" under Section 404 of the CWA. The term "Waters of the United States" has broad meaning under the CWA and incorporates deepwater aquatic habitats and special aquatic habitats (including wetlands). Jurisdictional waters of the United States are areas regulated under the CWA and also include coastal and inland waters, lakes, rivers, ponds, streams, intermittent streams, vernal pools, and "other" waters that if degraded or destroyed could affect interstate commerce. Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill materials into the Waters of the United States, including wetlands.

Wetlands are also protected under EO 11990 – Protection of Wetlands (43 CFR 6030) (National Archives and Records Administration 2011). The EO's purpose is to reduce adverse impacts associated with the destruction or modification of wetlands. Secretary of the Air Force Order 791.1 re-delegates authority for the protection of wetlands to the Assistant Secretary of the AF, and indicates that authority may be further re-delegated. In December 2000, the authority was re-delegated to the Major Command (MAJCOM) vice-commanders as chair of the MAJCOM Environmental Protection Committee/Environmental, Safety, Occupational Health Committee (EPC/ESHC). The MAJCOM vice-commanders, as chair of the EPC/ESHC, must sign a finding of no practicable alternative prior to any action within a federal wetland. The finding of no practicable alternative includes consideration of practicable alternatives that will meet justified program requirements to ensure they are within legal authority of the USAF, meet technology standards, are cost-effective, do not result in unreasonable adverse environmental impacts, and other pertinent factors.

The USAF is responsible for identifying and locating jurisdictional waters of the United States, including wetlands occurring on USAF installations where these resources have the potential to be impacted by military mission activities. Such impacts could include construction of roads, buildings, runways, taxiways, navigational aids, and other appurtenant structures or activities as simple as culvert crossings of small intermittent streams, riprap placement in stream channels to curb accelerated erosion, and incidental fill and grading of wet depressions.

The major goal in wetland management is to minimize the impact that the installations' missions have on wetlands. The USAF strives to enhance healthy, functional wetlands that can sustain minor operational influences outside indirect infringement of wetlands. When possible, the goal is set to enhance wetland functions to create wetlands that maximize the values that wetlands have within the ecosystem and to society. It is also the goal to maximize floral diversity of wetland communities, which in turn maximizes the faunal diversity of the ecosystem. To meet the goals of wetland management, the following topics of concern comprise achieving particular goals and present objectives and management actions designed to meet the wetland management goals. **Table 8-8** summarizes the wetland management goals for Wake Atoll and Mt. Ka`ala AFS. There are no wetlands on or immediately adjacent to Kōke`e AFS or Kōke`e MAS.

Table 8-8. Summary of Wetland Protection and Management Goals

Wetland Protection Goals
• **INRMP Goal No. 9:** Comply with USACE and the Hawai`i Department of Health Clean Water Branch regulations pertaining to wetlands.

8.7.1 Objective WP-1: Update the 2007 wetland delineation conducted on Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: CWA and Proclamation 8336.

Background Information: Wetlands on Wake Atoll were delineated in 2007. A Jurisdictional Determination was not obtained from USACE for the delineated wetlands. The delineation needs to be updated and a Jurisdictional Determination should be obtained from USACE to ensure that inadvertent impacts to wetlands do not occur. Any actions that may impact wetlands or other aquatic sites at Wake Atoll must first be reviewed for adequacy in terms of compliance with the 10 April 2008 Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR 325-332) and USEPA (40 CFR Part 230).

Tasks:

1. Contact the Honolulu, Fort Shafter, Hawai`i District of USACE to determine if there are any special requirements for obtaining a Jurisdictional Determination for wetlands delineated on Wake Atoll.

2. Conduct a wetland and waters of the United States delineation on Wake Atoll based on the 1987 USACE Wetlands Delineation Manual and the 2010 Draft Interim Regional Supplement to the USACE Wetland Delineation Manual: Hawai`i and Pacific Islands Region.

3. Obtain a Jurisdictional Determination from the Honolulu, Fort Shafter, Hawai`i District of USACE for the delineated wetlands.

4. Update GIS to include the updated wetland boundary data.

5. Ensure that unavoidable impacts to wetlands are fully mitigated and in compliance with regulations.

6. Finish filling of the engineered detention basin near the runway with non-hazardous construction debris per approval by USACE and USEPA Region 9 and in accordance with recommendations for habitat modifications from the 2014 Wake BASH Assessment.

Monitoring Criteria: The wetland delineation for Wake Atoll is complete, a Jurisdictional Determination has been obtained, and the GIS has been updated to be consistent with the updated delineation. Any unavoidable impacts to wetlands are fully mitigated and in compliance with regulations.

8.7.2 Objective WP-2: Conduct a wetland delineation on Mt. Ka`ala AFS.

Applicable Installation(s): Mt. Ka`ala AFS.

Regulatory Drivers: CWA and Sikes Act.

Background Information: A small area of 'ōhi'a wet forest habitat occurs adjacent to the southwest boundary of Mt. Ka`ala AFS. Currently, 0.1 acres of the wetland is mapped within the station boundaries. A wetland delineation needs to be conducted and a Jurisdictional Determination obtained for wetlands within the boundaries of the station to ensure that inadvertent impacts to wetlands associated with station operations do not occur. Any actions that may impact the wetland at Mt. Ka`ala AFS must first be reviewed for adequacy in terms of compliance with the 10 April 2008 Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR 325-332) and USEPA (40 CFR Part 230).

Tasks:

1. Conduct a wetland and waters of the United States delineation at Mt. Ka`ala AFS based on the 1987 USACE Wetlands Delineation Manual and the 2010 Draft Interim Regional Supplement to the USACE Wetland Delineation Manual: Hawai`i and Pacific Islands Region.

2. Obtain a Jurisdictional Determination from the Honolulu, Fort Shafter, Hawai`i District of USACE for the delineated wetland(s).

3. Ensure that any unavoidable impacts to the wetland are fully mitigated and in compliance with regulations.

Monitoring Criteria: The wetland delineation for Mt. Ka`ala is completed, a Jurisdictional Determination has been obtained, and the GIS has been updated to be consistent with the updated delineation.

8.7.3 Objective WP-3: Educate facility personnel on the locations of wetlands and the need to avoid impacts to the habitats.

Applicable Installation(s): Wake Atoll and Mt. Ka`ala AFS.

Regulatory Drivers: CWA and Sikes Act.

Background Information: Facility personnel need to have an accurate understanding of where wetland habitats occur on Wake Atoll and Mt. Ka`ala AFS in order to avoid impacts to those habitats.

Tasks:

1. Natural resources or environmental personnel should meet with maintenance and other facility personnel to ensure that there is an accurate understanding of the locations of wetland boundaries on the sites.

2. Update GIS as necessary to show accurate locations of wetland boundaries on Wake Atoll and Mt. Ka`ala.

Monitoring Criteria: Personnel whose activities have the potential to impact wetlands are aware of their locations on the installations, and steps that need to be taken prior to implementing an action that has potential to impact the habitats. GIS is updated to accurately show the locations and boundaries of wetlands on Wake Atoll and Mt. Ka`ala.

8.7.4 Objective WP-4: Conduct assessments of projects on Wake Atoll to determine the potential for impacts to jurisdictional wetlands. If impacts to wetlands cannot be avoided, prepare a mitigation plan for the project. Implement the mitigation plan.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: CWA, Sikes Act, and Proclamation 8336.

Background Information: A mitigation plan needs to be developed and implemented for unavoidable impacts to jurisdictional wetlands to ensure there is no net loss of wetland acreage or function on the Atoll.

Tasks:

1. For each planned project at Wake Atoll, determine if jurisdictional wetlands would be impacted.

2. If impacts to wetlands would occur, prepare a mitigation plan for the project.

3. Submit the mitigation plan to the following agencies for review and comment: USACE, USEPA, USFWS, and NOAA-NMFS.

Monitoring Criteria: Mitigation plans are developed, reviewed by the appropriate regulatory agencies, and are implemented for projects on Wake Atoll where impacts to wetlands cannot be avoided.

8.8 GROUNDS MAINTENANCE

Environmentally and economically beneficial landscaping practices can reduce maintenance costs while also providing wildlife habitat. Grounds maintenance can help to maintain and improve the aesthetic appearance of lands controlled by the USAF and can contribute to overall biodiversity and ecosystem health. Planting windbreaks using native species around buildings and parking areas, and reducing mowing are ways to spend dollars more wisely, educate the public about the benefits of reduced maintenance, and become better stewards of the environment.

Installation grounds maintenance personnel perform most grounds maintenance activities on Wake Atoll and Mt. Ka`ala. Grounds maintenance on Wake Atoll is conducted primarily by the

BOS contractor through contract with the USAF. The BOS contractor's Performance Work Statement incorporates grounds maintenance and drainage/erosion control activities on Wake Atoll. The Performance Work Statement states that no action will be taken that will unduly affect wildlife, waterfowl, or habitat on Wake Atoll. The WIA BOS contractor Environmental Manager/Officer is required to conduct site surveys for nesting birds in areas awaiting vegetation maintenance. Grounds maintenance on Kōke`e AFS and Kōke`e MAS is conducted primarily by the Navy through a Support Agreement with the USAF. Normal grounds maintenance operations are focused on lawn care, drainage ditch maintenance, road maintenance, runway maintenance, and Airfield management (Wake Atoll), landscaping maintenance, and pest management.

An integrated grounds maintenance program requires periodic review and upgrading of maintenance practices. Maintenance practices that ensure plants are healthy will reduce the need for intensive chemical treatments. Current maintenance practices should be reviewed to ensure that fertilizer, watering, and pesticide application rates are optimal. Local specialists should be consulted when problems are encountered.

EO 13148, *Greening the Government Through Leadership in Environmental Management*, contains overarching direction regarding management of vegetation in developed areas (National Archives and Records Administration 2011). The order directs federal agencies to strive to promote sustainable management of federal facility lands through the implementation of cost-effective, environmentally sound landscaping practices, and through programs to reduce adverse environmental impacts. Other federal regulations that guide undeveloped vegetation management, as listed in Section 8.14, include the Federal Noxious Weed Act of 1974; EO 13112; Federal Insecticide, Fungicide, and Rodenticide Act; the Federal Plant Pest Act; and the Organic Act.

USAF policies and guidelines regarding grounds maintenance and urban forest management are included in Chapter 12 of AFI 32-7064 (USAF 2014a). This document encourages the use of regionally native plants to the maximum extent possible in landscaped designs, minimizing landscape maintenance, minimizing the need for irrigation, and naturalizing landscaped areas as much as possible. The use of IPM practices is encouraged in both AFI 32-7064 (USAF 2014a) and AFI 32-1053 (USAF 2014c). **Table 8-9** summarizes the grounds maintenance and vegetation and habitat management goals for Wake Atoll, Kōke`e AFS, Kōke`e MAS, and Mt. Ka`ala AFS.

Table 8-9. Summary of Grounds Maintenance Goals

Grounds Maintenance Goals
• **INRMP Goal No. 10:** Maximize use of native plant species and avoid introduction of invasive, exotic species in re-vegetation activities.

Objectives, actions, and monitoring criteria designed to address specific management issues at Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS are presented below.

8.8.1 Objective GM-1: Update the Wake Atoll Land Management Plan to incorporate 2014 BASH Risk Assessment habitat modifications recommendations.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act.

Background Information: Land management activities on Wake Atoll need to be consistent with BASH habitat management goals.

Tasks:

1. Update the Wake Atoll Land Management Plan to incorporate 2014 BASH Risk Assessment habitat modifications recommendations.

2. Coordinate with USFWS on the habitat modifications per the 2014 BASH Risk Assessment.

3. Implement the grounds maintenance and land management goals identified in the updated Land Management Plan and in accordance with the INRMP and the 2014 BASH Risk Assessment Report.

4. Evaluate the potential to convert improved grounds on Wake Atoll to semi-improved grounds.

5. Where applicable, to the maximum extent possible, use regionally native species in grounds maintenance and land management activities consistent with Chapter 12 of AFI 32-7064 (USAF 2014a).

Monitoring Criteria: The Wake Atoll Land Management Plan is updated to incorporate 2014 BASH Risk Assessment habitat modifications recommendations. The grounds maintenance and land management goals identified in the updated Land Management Plan are implemented in accordance with the INRMP and the 2014 BASH Risk Assessment Report.

8.8.2 Objective GM-2: Use native plant species for revegetation and landscaping activities on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS; establish a native plant nursery on Wake Atoll; and develop a central garden on Wake Atoll.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: EO 13148, Sikes Act, and EO 13112.

Background Information: Non-native and invasive species can be introduced to Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS during revegetation efforts and landscaping activities.

Tasks:

1. On Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS, use regionally native plant species for revegetation and landscaping activities consistent with Chapter 12 of AFI 32-7064 (USAF 2014a).

2. Ensure that native species are selected for landscape plantings in accordance with EO 13148 and Chapter 12 of AFI 32-7064 (USAF 2014a).

3. Provide professional advice to assist the grounds landscaping and maintenance program in the use of native species.

4. For Wake Atoll, develop a native plant nursery to provide plants for habitat enhancement, restoration, and landscaping activities.

5. Include native plants that promote pollinator species in the native plant nursery.

6. Develop a central garden on Wake Atoll for growing vegetables and other plants for consumption.

Monitoring Criteria: Regionally native plants are being used for revegetation and landscaping activities on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS consistent with Chapter 12 of AFI 32-7064 (USAF 2014a). A native plant nursery is developed on Wake Atoll to provide plants for habitat enhancement, restoration, and landscaping activities and a central garden is established on Wake Atoll for growing vegetables and other plants for consumption.

8.8.3 Objective GM-3: Control grasses and other vegetation that is spreading out into gravel and paved areas on Kōke`e AFS.

Applicable Installation(s): Kōke`e AFS.

Regulatory Drivers: EO 13148, Sikes Act, and EO 13112.

Background Information: Grasses and other vegetation are spreading into graveled and paved areas of Kōke`e AFS. Once established in graveled areas, maintenance and upkeep of the areas for their intended use will become more difficult and time consuming. Establishment of vegetation in paved areas will result in breakup of the surface over time.

Tasks:

1. Using integrated pest management principals, identify the best method for removing vegetation from the gravel and paved areas on Kōke`e AFS. Determine the best approach for precluding its re-establishment in the future.

2. Based on Task 1, remove vegetation from the gravel and paved areas and conduct identified maintenance to prevent its re-establishment.

Monitoring Criteria: Vegetation is removed from gravel and paved areas and the areas are maintained to prevent re-establishment.

8.9 FOREST MANAGEMENT

There is no forestry management program for WIA, Kōke`e ASF, or Mt. Ka`ala AFS. Development of forestry management programs for the three installations is not practical due to their sizes and current land conditions. For these reasons forest management is not addressed in this INRMP. A summary of the Forrest Management Goals is provided in **Table 8-10**.

Table 8-10. Summary of Forest Management Goals

Forest Management Goals
• Not applicable. Maintenance of existing native trees and removal of invasive species are discussed under Grounds Maintenance and the IPM Management Goals.

8.10 WILDLAND FIRE MANAGEMENT

Federal wildland fire policy requires that all federal lands with burnable vegetation have a fire plan and resources to safely mitigate losses. This policy was adopted by the DOD Wildland Fire Policy Working Group in 1996. DOD fire policy was developed by DOD Instruction 6055.06 Fire and Emergency Services Program. There currently are no Wildland Fire Management Plans for Wake Atoll, Mt. Ka`ala AFS, or Kōke`e AFS. A summary of the Wildland Fire Management Goals is provided in **Table 8-11**.

Table 8-11. Summary of Wildland Fire Management Goals

Wildland Fire Management Goals
• **INRMP Goal No. 11:** Support a Wildland Fire Management Program to protect high-value natural resources areas and operational facilities from catastrophic wildfire while conserving resources and military operational flexibility.

8.10.1 Objective WFM-1: Develop a Wildland Fire Management Plan for Wake Atoll that addresses increases in forest cover and fuel supply.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act and MBTA.

Background Information: Forest cover on Wake Atoll is increasing in large part as a result of the spread of casuarina. As forest cover has become more widespread and dense, the potential for wildland fire has increased. Fuel loads on the forest floors are also increasing. Casuarina is a hard wood and, once ignited, it can produce a hot, long-lasting fire. The high density of ironwood trees in some areas including the former housing area, along with available fuel on the forest floor, increases the risk for wildland fires. The BOS contractor is required to assess and remove excess fuel load to lower the potential risk of wildfire.

Tasks:

1. Assess the current approach for wildland fire management on Wake Atoll.

2. Develop a Wildland Fire Management Plan for Wake Atoll.

3. Include in the Plan pre-action surveys to be conducted by a person with knowledge of Wake Atoll bird species and their nesting habits for wildland fire management actions that could result in bird take. Include implementation of management practices based on the pre-action surveys to avoid bird take.

Monitoring Criteria: The current approach for wildland fire management on Wake Atoll is reviewed and necessary modifications and additional management actions are identified to ensure that an adequate approach to wildland fire management is in place. Based on the evaluation, a Wildland Fire Management Plan is developed for Wake Atoll.

8.10.2 Objective WFM-2: Ensure that plans are in place to address wildland fires at Mt. Ka`ala AFS and Kōke`e AFS.

Applicable Installation(s): Mt. Ka`ala AFS, Kōke`e AFS.

Regulatory Drivers: MBTA and Sikes Act.

Background Information: There are no wildland fire management plans for Mt. Ka`ala AFS or Kōke`e AFS. The facilities do not have the on-station personnel or the necessary equipment to manage wildland fires. Both installations rely on adjacent land managers (State of Hawai`i) for response to wildland fires. Coordination between the facilities and adjacent land managers needs to be conducted to ensure that current plans are in place to respond to wildland fires on the facilities.

Tasks:

1. Coordinate with adjacent land managers to Mt. Ka`ala and Kōke`e AFS to ensure that current plans are in place to respond to wildland fires.

2. Ensure that all installation personnel are aware of actions to be taken in response to wildland fires at the facilities.

Monitoring Criteria: Coordination between Mt. Ka`ala AFS and Kōke`e AFS and adjacent land managers has been conducted and there are plans in place to respond to wildland fires.

8.11 AGRICULTURAL OUTLEASING

There is no agricultural outleasing program for WIA, Kōke`e ASF, or Mt. Ka`ala AFS. Development of agricultural outleasing programs for the three installations is not practical due to their sizes, current land conditions, and restricted access. For these reasons, agricultural

outleasing is not addressed in this INRMP. A summary of the Agricultural Outleasing Management Goals is provided in **Table 8-12**.

Table 8-12. Summary of Agricultural Outleasing Management Goals

Agricultural Outleasing Management Goals
• Not applicable.

8.12 INTEGRATED PEST MANAGEMENT PROGRAM MANAGEMENT

An invasive species is defined in EO 13112, *Invasive Species*, as a species that is non-native (i.e., alien or exotic) to the ecosystem under consideration and whose introduction causes, or is likely to cause economic or environmental harm, or harm to human health. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions. Invasive species control and removal efforts are mandated by Federal, DOD, and USAF regulations and memoranda of agreement such as the following:

- EO 11987, *Exotic Organisms*. Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.

- EO 13112, *Exotic and Invasive Species*. Directs federal agencies whose actions might affect the status of invasive species, to the extent practicable, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

- Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468). Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DOD installations can enter into cooperative agreements with USDA-Wildlife Services to conduct animal control projects.

- Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814. The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

- Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 (104 Stat. 4761, 16 U.S.C. § 4701). Public Law 101-646 establishes a broad Federal program to prevent the introduction of, and control the spread of introduced aquatic nuisance species and the brown tree snake.

- Memorandum of Agreement for Brown Tree Snake Control. 1 June 2011. Executed among the DOI, DOD, USDA, Department of Transportation, National Invasive Species Council, GovGuam, State of Hawai‘i, and CNMI. DOD is the lead agency for developing control techniques for brown tree snake in military situations on Guam and to prevent dispersal in military traffic to other areas. DOD obligations include personnel, support, use of military customs inspection programs, access and information exchange, and development of informational brochures and training.

DOD's natural resources management policy is contained within DODI 4715.03, Natural Resources Conservation Program. This instruction requires installations to follow an ecosystem-based approach to land management, inventory and protect important biological resources, and promote biodiversity. It addresses various aspects of land management including forestry and agricultural operations, management measures for the removal or control of exotic species, beneficial landscaping practices, and habitat restoration and rehabilitation.

DODI 4150.07, DOD Pest Management Program, is a DOD policy to establish and maintain safe, effective, and environmentally sound IPM programs to prevent or control pests and disease vectors that could adversely impact readiness or military operations by affecting the health of personnel or damaging structures, material, or property. Application of the least toxic chemical should be used as a last resort to control nuisance species. IPM should use mechanical, physical, cultural, biological, and educational methods to maintain pests at populations low enough to prevent undesirable damage or annoyance. AFI 32-1053, IPM Program, is a policy to conduct effective pest management programs and established responsibilities and procedures for pest management at USAF installations (USAF 2009).

Table 8-13 presents a summary of the invasive species management goals for Wake Atoll, Kōke`e AFS, or Mt. Ka`ala AFS. The primary goal of invasive species management is to prevent introduction and control, or remove invasive species that are having an adverse effect on native flora and fauna, and to assist in the recovery of healthy native ecosystems that are compatible with the military missions.

Table 8-13. Summary of Integrated Pest Management Program Goals

IPM Program Goals
• **INRMP Goal No. 12:** Develop and employ a systematic approach for onshore and offshore biosecurity, inclusive of rapid response.

8.12.1 Objective IPM-1: Update the IPM Plan per recommendations from USDA-Wildlife Services. Incorporate IPM practices into the management and control of pests.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: Sikes Act and EO 13112.

Background Information: The IPM Plans for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS need to be updated based on recommendations from USDA-Wildlife Services. DODI 4150.07 directs installations to establish and maintain safe, effective, and environmentally sound IPM programs to prevent or control pests and disease vectors that could adversely impact readiness or military operations by affecting the health of personnel, or damaging structures, material, or property. IPM uses mechanical, physical, cultural, biological, and educational methods to maintain pests at numbers low enough to prevent undesirable damage or annoyance. IPM recommends application of the least toxic chemical as a last resort to control nuisance species. There are no current IPM plans for Wake Atoll, Kōke`e AFS, or Mt. Ka`ala AFS.

Tasks:

1. Update the IPM Plan for Wake Atoll based on USDA-Wildlife Services recommendations.

2. Evaluate IPM approaches in place at Kōke`e AFS and Mt. Ka`ala AFS and determine if development of installation-specific IPM plans is needed for the installations.

3. If determined necessary, develop installation-specific IPM plans for Kōke`e AFS and Mt. Ka`ala AFS based on USDA-Wildlife Services recommendations.

4. Evaluate potential for use of mechanical, physical, cultural, biological, and educational methods to maintain pests at populations low enough to prevent undesirable damage or annoyance. Use chemicals only when it is determined that the other approaches will not achieve management goals. Combine use of chemicals with other IPM approaches to reduce the amount of chemicals needed to achieve management goals.

Monitoring Criteria: IPM practices are incorporated into pest management approaches on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS. The IPM Plan for Wake Atoll is updated based on USDA-Wildlife Services recommendations. Installation-specific IPM plans are developed for Kōke`e AFS and Mt. Ka`ala AFS as determined necessary based on the evaluation of current pest management practices.

8.12.2 Objective IPM-2: Develop a Long-Term Management Strategy for top invasive species at Wake Atoll, Koke'e AFS, and Mt. Ka'ala AFS and implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: Sikes Act, ESA, EO 13112, and MBTA.

Background Information: Attributes of island biota include small geographic ranges and population size, low reproductive rates, and lack of the ability to coevolve with invasive species and disturbed habitats. Islands typically have lower numbers of species than mainland areas, which results in fewer predators and competitors that could prohibit the establishment of invasive species. As a result of evolving in isolation, island plants and animals have few defenses when exposed to introduced competitors and predators. These limitations can result in the replacement of native species with exotic and invasive species (Wiles et al. 2003).

Tasks:

1. Develop a Long-Term Management Strategy for top invasive species at Wake Atoll, Koke'e AFS, and Mt. Ka'ala AFS that maps out measures to be implemented annually at each installation.

2. As funding allows and based on recommendations in the plan, implement invasive species management actions presented in the Biological Control, Survey, and Management Plan for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS (**Component Plan B**) applicable to each installation.

Monitoring Criteria: A Long-Term Management Strategy for top invasive species at Wake Atoll, Koke'e AFS, and Mt. Ka'ala AFS is developed and management actions for the control of exotic and invasive species presented in the Biological Control, Survey, and Management Plan are implemented as funding becomes available.

8.12.3 Objective IPM-3: Conduct follow-up rat eradication efforts based on lessons learned from the May 2012 eradication efforts and additional information obtained since the initial efforts.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act ESA, EO 13112, and MBTA.

Background Information: Rat eradication efforts for Polynesian rats and Asian house rats were implemented on Wake Atoll in May 2012. The Asian house rat has not been documented on the Atoll since the May 2012 treatment. Polynesian rats were not completely removed and their population is rebounding. Ongoing efforts are being implemented to control Polynesian rats, but a concentrated follow-up effort similar to the May 2012 eradication efforts with modified and additional strategies based on field research with USDA-Wildlife Services needs to be implemented..

Tasks:

1. Conduct follow-up rat eradication efforts based on lessons learned from the May 2012 eradication efforts, additional information obtained since the initial effort and additional field research conducted by USDA-Wildlife Services.

2. Conduct necessary agency coordination and documentation required to implement the follow-up eradication effort.

3. Develop a contingency plan to be implemented if live rats are found after the second eradication effort.

4. Conduct surveys following the eradication effort to ensure that the effort was successful.

5. Implement the contingency plan if live rats are found following the second eradication effort.

6. Ensure that management practices and protocols presented in Nuisance and Non-Native Species Management-4 are implemented to minimize potential for re-introduction of rats onto Wake Atoll.

Monitoring Criteria: The follow-up rat eradication effort has been implemented on Wake Atoll and post-eradication monitoring indicates that the effort was successful.

8.12.4 Objective IPM-4: Minimize potential for the inadvertent introduction of exotic and invasive species onto Wake Atoll associated with contingency, emergency, and supply operations. Update the Wake Island Biosecurity Management Plan in accordance with recommendations from USAF-Pest Management Board, USDA, and USFWS.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: DOD-Foreign Clearance Guide, ESA, Sikes Act, EO 13112, AFI 32-1053, AFI 32-7064, and Proclamation 8336.

Background Information: WIA currently supports contingency operations, emergency aircraft diversion and recovery, and flights in direct support of the BOS contractor. Rotator/supply flights currently arrive on Wake Atoll every 2 weeks under normal conditions. Barges also transport supplies and equipment to the Atoll two times per year. The aircraft and barges provide potential mechanisms for exotic and invasive species to be introduced, or reintroduced to Wake Atoll.

Rat eradication efforts for Polynesian rats and Asian house rats were implemented on Wake Atoll in May 2012. The Asian house rat has not been documented on the Atoll since the May 2012 treatment. Polynesian rats were not completely removed and ongoing efforts are being implemented to control and eradicate the rat. Reintroduction of Asian house rats, or other species of rats, could occur via contingency, emergency, and supply operations hampering ongoing efforts to eradicate rats on the Atoll. In addition, introduction of the brown tree snake onto Wake Atoll could have severe impacts on birds that occur on the islands.

The coconut rhinoceros beetle (*Oryctes rhinoceros*) was detected on Joint Base Pearl Harbor-Hickam in December 2013. The beetle now occurs across the Base. There is the potential for the beetle to be spread from Joint Base Pearl Harbor-Hickam to Wake Atoll via contingency, emergency, and supply operations. Introduction of the coconut rhinoceros beetle onto Wake Atoll would have major effects on vegetation that characterizes the Atoll.

The little fire ant (*Wasmannia auropunctata*) is also present on Hawai`i and Guam. Introduction of the ant onto Wake Atoll would have serious impacts on the biota of the Atoll and on the ability to conduct operations. The ant could seriously impact birds that occur and nest on the Atoll.

Implementation of management practices and protocols in the Wake Island Biosecurity Management Plan (USAF 2012a) (**Component Plan D**); Defense Transportation Regulation, Part 5, Chapter 511 (DOD 2013b) (**Appendix R**); and the Foreign Clearance Guide are necessary to ensure that inadvertent introduction or reintroduction of rats, brown tree snakes, coconut rhinoceros beetle, little fire ants, or other exotic and invasive species onto the Atoll do not occur.

Tasks:

1. Implement management practices and protocols in the Wake Island Biosecurity Management Plan; Defense Transportation Regulation, Part 5, Chapter 511; the Foreign Clearance Guide; and the Wake Invasive Species Management Plan to ensure that inadvertent introductions or reintroductions of rats, brown tree snakes, or other exotic and invasive species do not occur on Wake Atoll.

2. Update the Wake Island Biosecurity Management Plan in accordance with recommendations from USAF-Pest Management Board, USDA, and USFWS.

3. Develop contingency plans to be implemented if rats, brown tree snakes, or other exotic and invasive species are observed in transport vehicles, equipment, or supplies arriving on Wake Atoll.

4. Assign and train personnel to implement contingency plans to address containment and removal of exotic or invasive species if they arrive on Wake Atoll via transport vehicles, equipment, or supplies.

5. Implement the Invasive Species Protocols for Wake Atoll including:

    a. No live plants or animals can be brought onto Wake Island.

    b. No seeds or food products that contain seeds (including dry fruits) can be brought onto the Atoll, excluding supplies for the cafeteria.

    c. No soil or compost material can be brought onto the Atoll unless approved by the Environmental Department.

    d. No animal products unless dried and in sealed packages are allowed to be imported on to the Atoll, excluding supplies for the cafeteria.

    e. Personnel are required to inspect all luggage, mail, packages, footwear, and clothes for seeds and insect eggs prior to, or immediately upon arrival to Wake Atoll.

    f. All luggage, packages, and mail arriving onto the Atoll can be inspected by designated BOS employees at any time upon arrival on the Atoll.

    g. No salt water can be brought onto the Atoll from outside countries or states. Aquarium articles containing any living organisms, including “live rock” are prohibited.

    h. Dive gear brought to or leaving Wake Atoll must be properly disinfected by submerging for a minimum of 10 minutes in an acceptable disinfection solution, followed by a thorough fresh water rinse, and then hung to air dry. The disinfection

solution should be a 1:32 dilution of commercial bleach in fresh water (1.2 cups bleach per gallon of fresh water).

6. Include the above list of Invasive Species Protocols for Wake Atoll in pre-arrival packages for personnel travelling to Wake Atoll and brief arriving personnel to Wake Atoll on the invasive species protocols.

Monitoring Criteria: The Wake Island Biosecurity Management Plan is updated in accordance with recommendations from USAF-Pest Management Board, USDA, and USFWS. Biosecurity management practices and protocols prescribed in the updated plan, Defense Transportation Regulation, Foreign Clearance Guide, and Wake Invasive Species Management Plan are implemented; contingency plans are in place to address inadvertent introductions of exotic and invasive species; installation personnel are trained to implement contingency actions; and personnel travelling to Wake Atoll are made aware of the invasive species protocols, prior to traveling to the Atoll and when they arrive on the Atoll.

8.12.5 Objective IPM-5: Conduct an assessment of the viability of implementing Hazard Analysis and Critical Control Point planning, or similar methods, as a tool for minimizing potential for introduction of exotic or invasive species such as the brown treesnake, coconut rhinoceros beetle, little fire ants and marine invasive species onto Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act and Proclamation 8336.

Background Information: WIA currently supports contingency operations, emergency aircraft diversion and recovery, and flights in direct support of the BOS contractor. Rotator/supply flights currently arrive on Wake Atoll every 2 weeks under normal conditions. Barges also transport supplies and equipment to the Atoll two times per year. The aircraft and barges provide potential mechanisms for exotic and invasive species to be introduced, or reintroduced to Wake Atoll.

Tasks:

1. Evaluate viability of implementing Hazard Analysis and Critical Control Point (HACCP) planning, or similar methods, for controlling introduction of exotic and invasive species onto Wake Atoll.

2. Ensure that the HACCP emphasizes targeting species with potential to have major impacts to the Atoll's biota and that are currently present on Hawai`i or Guam such as the brown tree snake, coconut rhinoceros beetle and little fire ant.

3. Develop and implement HACCP plans or other similar methods at identified control points, if determined to be feasible as an exotic and invasive species control tool on Wake Atoll.

4. Identify actions to be implemented to ensure that exotic invasive species identified at control points are not introduced onto the Atoll.

Monitoring Criteria: HACCP is evaluated for use on Wake Atoll. HACCPs, or other similar plans, are implemented at identified control points on Wake Atoll.

8.13 BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD

There are no Airfields at Kōke`e AFS or Mt. Ka`ala AFS; therefore, BASH is not addressed in this INRMP for the sites. Airfield activities on Wake Atoll do present potential for BASH; therefore, goals, objectives, and actions to address BASH are presented.

The primary wildlife species with potential for BASH on WIA include resident and migratory birds. However, rats and hermit crabs have the potential to pose Foreign Object Damage risk. Daily and seasonal bird movements create various hazardous conditions. The Airfield runway on Wake is located on the south side of the island between the Pacific Ocean and the lagoon. The environment results in a variety of birds in the area, consisting of a mix of shore birds and some waterfowl. A major bird migration route through Wake Atoll tends to extend from March through late June and some migration occurs in late October through late December. The local avian population increases seasonally. By mid- to late summer, most of the migrating birds have departed. There is also a bird sanctuary on Wilkes Island to the northwest of the WIA. The bird sanctuary and associated nesting area (**Chapter 5**) is maintained to present suitable habitat to attract both resident and migratory birds away from the WIA.

WIA has a BASH Plan (Chugach 2014) that establishes procedures to reduce potential for hazards associated with wildlife airstrike hazards. The BASH Plan is included in this INRMP as **Component Plan C**. No single solution exists to address BASH on Wake Atoll, so the plan presents a variety of techniques involving several organizations for implementation. The Airfield Operations Manager is in charge of the BASH Plan and implementation is tasked to units under the direction of the Wake Atoll Bird Hazard Working Group.

The presence of BASH threat at WIA raises concern about the implementation of wildlife and habitat management actions and their compatibility with the operational missions, and specifically the threat of wildlife strikes with aircraft. For this reason, it is essential that proposed habitat management and enhancement actions are evaluated carefully to determine their effects on BASH and the flying mission. A summary of the Bird/Aircraft Strike Hazard Management Goals is provided in **Table 8-14**.

Table 8-14. Summary of Bird/Aircraft Strike Hazard Management Goals

Bird/Aircraft Strike Hazard Goals
• **INRMP Goal No. 13:** Implement procedures of the BASH Plan to lessen occurrences of bird aircraft strikes.

8.13.1 Objective BH-1: Management, Species, Migratory Birds that INRMP actions are consistent with BASH and MBTA Depredation Permit.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act and MBTA.

Background Information: Management actions that restore or enhance existing habitats have the potential to result in an increase in wildlife use and impact existing species utilizing the habitat. Use of canines has the potential to reduce the attractiveness of areas to increased wildlife use following habitat modifications. Conduct of surveys prior to vegetation clearing can identify occurrence of migratory birds and support documentation of potential effects to the species.

Tasks:

1. Conduct efficacy trials with canine(s) to assess the utility of the tool for reducing the attractive nature of cleared grounds.

2. Conduct pre-vegetation surveys for areas being cleared for the presence of migratory birds in order to document any impact.

Monitoring Criteria: Implementation of management actions developed in the INRMP does not result in an increase in BASH. Potential use of canines for reducing attractiveness of areas to increased wildlife use following habitat modifications is assessed. Surveys are conducted prior to vegetation clearing or habitat modification to identify occurrence of migratory birds and support documentation of potential effects to the species.

8.13.2 Objective BH-2: Coordinate with USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i regarding habitat modifications in accordance with the 2014 Wake BASH Risk Assessment. Continue to assist the installation flight safety office and others in implementing BASH actions presented in the updated 2013 BASH Plan.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: MBTA and Sikes Act.

Background Information: The 2013 BASH Plan needs to be updated based on the Wake 2014 BASH Risk Assessment and coordination needs to be conducted with USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i regarding habitat modifications recommended in the assessment. An effective BASH program requires a cooperative effort between different personnel (i.e., environmental, grounds maintenance, etc.) responsible for maintaining ongoing day-to-day operations of WIA. Information and management support provided by various installation operators is essential for successful implementation of the BASH program.

Tasks:

1. Update the 2013 BASH Plan for WIA in accordance with the 2014 BASH Risk Assessment and seek 11AF/SE approval.

2. Coordinate with USFWS regarding habitat modifications recommended in accordance with the 2014 Wake BASH Risk Assessment.

3. Conduct a review of the 2013 MBTA depredation permit to evaluate if the quantity of take needs is still meeting WIA needs.

4. Natural resources and environmental personnel should assist the installation flight safety office and others in implementing BASH actions presented in the updated 2013 BASH Plan.

5. Natural resources and environmental personnel should be active in the Bird Hazard Working Group, consisting of organizations and personnel involved in the Airfield bird control, habitat management, operations and safety.

Monitoring Criteria: The 2013 BASH Plan is updated in accordance with the 2014 BASH Risk Assessment; coordination is conducted with USFWS regarding habitat modifications recommended in accordance with the 2014 Wake BASH Risk Assessment; the 2013 MBTA depredation permit is evaluated to determine if the quantity of take needs is still meeting WIA needs; and natural resources and environmental personnel are assisting the installation flight safety office and others in implementing BASH actions.

8.13.3 Objective BH-3: Design avian surveys and monitoring based on 2014 recommendations from USDA-Wildlife Services to provide useful information to Airfield managers regarding BASH.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: MBTA and Sikes Act.

Background Information: Removal of dogs and cats and ongoing efforts to eradicate rats from Wake Atoll have resulted in increased species diversity, numbers, and use of available habitats. An understanding of bird species, numbers, and habitat use is necessary to maintain an accurate understanding of BASH concerns. In addition, knowledge of avian numbers and phenology (timing of breeding) over the course of the year will assist the BASH program in assessing and mitigating the risk of bird strikes.

Task:

1. Coordinate with BASH management personnel and USDA-Wildlife Service in the development of avian species survey and monitoring protocols to identify opportunities to include collection of data that would be useful to BASH managers.

2. Develop avian species survey and monitoring protocols to include collection of data that would be useful for evaluating potential BASH concerns and for developing management approaches based on 2014 recommendations from USDA-Wildlife Services.

Monitoring Criteria: Avian surveys and monitoring tasks provide data useful to Airfield managers for BASH management.

8.13.4 Objective BH-4: Monitor the persistence of avian species in the 2.97-acre redesigned stormwater detention basin to determine if the design modification was successful in reducing the risk of BASH.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: MBTA and Sikes Act.

Background Information: The stormwater detention basin at the east end of the Airfield maintains standing water resulting in the attraction of birds (sometimes high numbers) that present BASH concerns. The detention basin is being redesigned to reduce its attraction to birds.

Task:

1. Monitor the persistence of avian species within the re-designed 2.97-acre stormwater detention basin at the east end of the Airfield between Taxiway A and E (Wetland 6) that is being modified in accordance with the USACE waiver.

Monitoring Criteria: Following conversion to a dry detention basin, monitor for changes in bird activity in the area of the detention basin to verify that BASH concerns have decreased in association with the stormwater management facility.

8.14 COASTAL ZONE AND MARINE RESOURCES MANAGEMENT

There are no submerged lands, coastal zone, or marine resources associated with Kōke`e AFS or Mt. Ka`ala AFS. There is no formal Coastal Zone Management Plan for Wake Atoll. Submerged lands, coastal zone, and marine resources management applies to any installation habitat/property that is partially or totally inundated by ocean waters. These areas include intertidal areas and adjacent submerged lands, which for Wake Atoll extend out 12 nautical miles from the coastline in association with the Wake Island National Wildlife Refuge.

There are no day-to-day activities associated with operation of WIA that occur within coastal or submerged lands of Wake Atoll. The transport of supplies and equipment to and from Wake Atoll by barge, typically two times per year, does occur within submerged lands associated with the Atoll. Operational activities on terrestrial habitats associated with Wake Atoll also have the potential to affect adjacent coastal, marine, and submerged lands habitats. In addition, recreational activities both in and adjacent to coastal, marine, and associated submerged lands have potential to affect the resources.

Management of coastal, marine, and submerged lands associated with Wake Atoll will protect and conserve threatened and endangered species through habitat conservation, ensure health and sustainability of coral reefs, and provide continued access for recreational activities. The goals for coastal, marine, and submerged lands management are summarized in **Table 8-15**.

Table 8-15. Summary of Coastal Zone and Marine Resources Management Goals

Coastal Zone and Marine Resources Management Goals
• **INRMP Goal No. 14:** Complete an assessment of shallow water coral reef systems and establish a long term index based monitoring program for coral reef health in areas of key importance to the USAF mission.

8.14.1 Objective CZ-1: Continue to work in coordination with NOAA and the USFWS to support the protection of the PRIMNM that surrounds Wake Atoll. Continue to support NOAA marine rapid environmental assessment cruises, and use information from the cruise reports, combined with information collected by WIA marine habitat surveys, to assess reef habitats and to identify and track trends that may indicate impacts from ongoing actions. Use the information to support adaptive management decisions where applicable to protect marine resources.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, Fish and Wildlife Coordination Act, MBTA, ESA, and Proclamation 8336.

Background Information: The Secretarty of Interior, in consultation with the Secretary of Commerce, has responsibility for management of the monument, including out to 12nm from the mean low water lines of Wake Atoll. The Secreatry of Commer, through NOAA, and in consultation with the Secretary of the Interior, has primary responsibility for management of the monument seaward of 12nm of the mean low water lines at Wake Atoll. Changes in environmental conditions can result in adverse impacts to the reef, nearshore, and lagoon environments. Adverse changes in health of the reef, nearshore, and lagoon environments can go unnoticed if monitoring is not conducted. Identification of changing conditions enables actions to be taken, where appropriate, to potentially address the cause and minimize the impact.

Tasks:

1. Continue to work in coordination with NOAA and the USFWS to meet the goals of the Pacific Marine National Monument that surrounds Wake Atoll.

2. Continue to support marine rapid environmental assessment cruises and Wake Atoll marine surveys conducted by NOAA.

3. Use information from the cruise reports, combined with information collected by WIA marine habitat surveys, to assess reef habitats and to identify and track trends that may indicate impacts from ongoing actions.

4. If the rapid environmental assessment surveys identify adverse changes in conditions, conduct assessments to try to determine the cause of the changes.

5. Implement management actions where appropriate and possible to address adverse changes in conditions in the reef, nearshore, and lagoon environments.

Monitoring Criteria: Support to NOAA and USFWS in meeting the goals of the Pacific Marine National Monument that surrounds Wake Atoll and support for marine rapid environmental assessment cruises conducted by NOAA is continued. Information from the cruise reports is used to identify dramatic changes in the condition of the nearshore, reef, and lagoon environments. Potential management actions are identified to address adverse changes, and are implemented, where appropriate and not in conflict with the military mission.

8.14.2 Objective CZ-2: Coordinate with NOAA-NMFS to conduct an Essential Fish Habitat survey of waters and substrate around Wake Atoll every 3 years.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, ESA, MSA, Proclamation 8336, and National Wildlife Refuge Improvement Act.

Background Information: An Essential Fish Habitat survey of waters and substrate around Wake Atoll has not been conducted to identify areas where federally managed species spawn, breed, feed, and/or grow to maturity.

Tasks:

1. Conduct an Essential Fish Habitat survey of waters and substrate around Wake Atoll every 3 years.

2. In coordination with the USFUWS, prepare a report presenting the results of the Essential Fish Habitat survey.

Monitoring Criteria: An Essential Fish Habitat survey of waters and substrate around Wake Atoll is conducted and a report presenting the results of the survey is prepared every 3 years.

8.14.3 Objective CZ-3: Ensure that recreational activities do not have adverse impacts on submerged lands and corals associated with Wake Atoll.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: Sikes Act, ESA, Proclamation 8336, and National Wildlife Refuge Improvement Act.

Background Information: Residents and visiting contractors to Wake Atoll actively engage in hiking, beach combing, snorkeling, SCUBA diving, boating, and fishing. Recreational activities in shoreline areas and adjacent submerged lands have the potential to adversely impact marine resources if management practices are not in place to ensure impacts do not occur. There currently is no formal outdoor recreation plan for Wake Atoll. **Section 8.3** addresses outdoor recreation and development of an Outdoor Recreation Plan.

Tasks:

1. Conduct an assessment of current recreational activities in coastal and adjacent submerged lands habitat.

2. Assess current SCUBA diving practices and identify opportunities to minimize potential impacts to corals and other marine resources.
3. Support an update to the Wake Atoll Dive Plan.

4. Implement identified management practices to avoid recreational impacts to coastal and marine resources.

5. Coordinate with NOAA-NMFS and USFWS to develop a coral restoration project for the Wake Island Dive Club.

6. Include management practices in the Outdoor Recreation Plan (**Section 8.3**).

7. Implement guidance and requirements addressing coastal and marine resources included in Wake Island Operating Guidance, Environmental Compliance and Protection of Natural Resources (**Appendix O**).

Monitoring Criteria: Management practices are in place to ensure that recreational activities do not have adverse impacts on submerged lands and corals associated with Wake Atoll.

8.14.4 Objective CZ-4: Conduct an assessment to determine the environmental impacts associated with widening the Wake Atoll Marina Channel and improving flow conditions in the Wake Atoll Lagoon by evaluating model flow scenarios between the marina and the lagoon.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: ESA, MSA, and Proclamation 8336.

Background Information: There is a shallow shelf at the entrance to the marina channel on the north side. The location of the shelf requires that vessels and towed barges entering the channel are in direct alignment with the channel to avoid collision. Variation in correct course when entering the channel, as a result of weather conditions, tow line length, or other conditions, can result in collision with the shelf. In addition, natural flows in the lagoon have been disrupted as a result of past activities on Wake Atoll. The Japanese constructed a causeway between Wake and Peale islands that allows for tidal flow; however, flows are more restricted than under natural conditions. The constructed causeway connecting Wake Island to Wilkes Island completely obstructs natural flows. Past re-contouring of the shoreline has also likely caused some modification of currents in the lagoon. Bathymetric charts show a gradual reduction in water depths in the lagoon since World War II.

Tasks:

1. Develop and model terrestrial and marine impacts associated with several different channel modification designs.

2. Evaluate design alternatives that result in improved flow conditions in the Wake Atoll Lagoon.

3. Utilize modeling results to support NEPA analysis of proposed channel modifications.

Monitoring Criteria: An assessment of widening the deep water channel at the entrance to the Wake Atoll Marina entrance is conducted. Modeling results are utilized to support NEPA analysis of proposed channel modifications. An assessment of connecting flows in the Wake Atoll Marina to the lagoon is conducted and methods for connecting the two waters on the northeast bank of the marina are evaluated.

8.14.5 Objective CZ-5: Assess the viability of repairing/replacing the range markers for the entrance channel to the Wake Atoll Marina. Repair or replace the range markers if determined to be feasible.

Applicable Installation(s): Wake Atoll.

Regulatory Drivers: CFR, Title 33, Subchapter C, Part 62.1(a) and (c), and Proclamation 8336.

Background Information: The range markers for the entrance to the Wake Atoll Marina are in disrepair and are not functioning. There is a shallow shelf at the entrance to the channel on the north side. If vessels approach the channel at the wrong angle, they can potentially hit or ground on the shelf. Properly functioning range markers for the channel entrance would reduce potential for collisions.

Tasks:

1. Assess viability of repairing or replacing the range markers for the entrance channel to the Wake Atoll Marina.

2. Repair or replace the range markers if determined to be feasible.

Monitoring Criteria: An assessment of replacing the range markers at the marina entrance is conducted and the range markers are replaced if determined to be feasible.

8.15 CULTURAL RESOURCES PROTECTION

The primary goal of cultural resources management is to ensure that management actions prescribed in this INRMP are consistent, and do not conflict, with management prescribed in the ICRMPs for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS. The 2008 ICRMP for Wake Atoll is currently being revised, and the most recent ICRMPs for Kōke`e AFS and Mt. Ka`ala AFS are included in the 2008 ICRMP Revision for Four USAF Satellite Installations, 15 Air Wing, Joint Base Pearl Harbor-Hickam, Hawai'i.

As a part of INRMP development, the current ICRMPs for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS were reviewed. The purpose of the review was to ensure that management

developed in this INRMP is consistent with cultural resources protection requirements and management actions presented in the ICRMPs. A summary of the Cultural Resources Protection Goals is provided in **Table 8-16**.

Table 8-16. Summary of Cultural Resources Protection Goals

Cultural Resources Protection Goals
• **INRMP Goal No. 15:** Ensure that management actions prescribed in this INRMP are consistent, and do not conflict, with management prescribed in the ICRMPs for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

8.15.1 Objective CRP-1: Educate installation personnel and visitors on the occurrence of cultural resources on the facilities and actions required to avoid impacts to the resources; actions to be taken if previously undocumented cultural resources are discovered, or if unanticipated impacts occur to known resources; and actions to be taken if human remains are discovered.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: National Historic Preservation Act (NHPA), AFI 32-7065, and Sikes Act.

Background Information: Installation personnel and visitors need to be aware of the occurrence of cultural resources on the sites so that inadvertent impacts do not occur to the resources. Previously undocumented resources are often discovered during construction operations, non-cultural resources related surveys, and recreational activities. Unevaluated resources must be treated as if they are significant (AFI 32-7065) (USAF 2014b). In addition, human remains are occasionally encountered on Wake Atoll. Most of the remains are from participants in the World War II battle and subsequent Japanese occupation.

Tasks:

1. Include information on cultural resources that are known to, or have potential to, occur on the installation as part of newcomer's orientation.

2. Inform base personnel and visitors of penalties for intentionally impacting cultural resources.

3. Inform base personnel and visitors on what to do if previously undocumented cultural resources are discovered.
4. If an undocumented cultural resource or archaeological site is discovered during construction or other activities, or there are unanticipated effects on known historic properties, the following procedure should be followed in accordance with AFI 32-7065 (USAF 2014b):

    a. Cease all activities in the vicinity of the discovery/property.

    b. Take steps to secure the area and protect the discovery/property from further damage.

c. Notify the cultural resources representative of the discovery/property.

d. If the discovery/property involves human remains, follow the procedures for dealing with unanticipated human remains.

5. If skeletal remains are encountered on Wake Atoll, the following steps should be taken:

a. Cease all activities in the vicinity of the discovery and secure the area.

b. Notify the installation commander.

Monitoring Criteria: Base personnel and visitors are aware of the occurrence of cultural resources on the facilities and requirements to avoid impacts to the resources. Installation personnel and visitors are aware of steps to be taken if undocumented cultural resource or archaeological sites are discovered on Wake Atoll.

8.16 PUBLIC OUTREACH

Personnel on Wake Atoll consist of USAF and contractors supporting the USAF mission. There are no non-mission-related personnel on Wake Atoll; therefore, there is no public outreach program on the Atoll.

Kōke`e AFS is within Kōke`e State Park and Kōke`e MAS is within Waimea State Park. Kōke`e State Park and Waimea State Park are popular recreation destinations, particularly for hunting and hiking in the surrounding forests; therefore, the facilities are familiar to park users but are off limits to public access.

Mt. Ka`ala AFS is immediately surrounded by forests and shrublands on the state-owned lands of the Mt. Ka`ala NAR. Road access to the installation and to the Mt. Ka`ala NAR is restricted to authorized personnel only, although there are trails that lead up to the mountaintop and the Mt. Ka`ala Bog area from both sides of the Waianae Mountains. The nearest residential areas, commercial establishments, or farms are 3-5 miles away on the lower slopes of the mountains. Limited number of personnel at Mt. Ka`ala AFS, the remote location of the facility, and restricted access to the area limits opportunities for public outreach. A summary of the Public Outreach Goals is provided in **Table 8-17**.

Table 8-17. Summary of Public Outreach Goals

Public Outreach Goals
• There are no public outreach activities at Kōke`e AFS, Mt. Ka`ala AFS, or Wake Atoll given they are closed to public access.

8.17 GEOGRAPHIC INFORMATION SYSTEMS

GIS is a computer system for capturing, storing, checking, integrating, manipulating, analyzing, and displaying data related to positions on the Earth's surface. GIS is used to create information layers used to develop and manipulate maps. GIS data are represented as different layers, each containing data on a particular kind of feature (e.g., soils, wetlands, roads). Each feature is

linked to a position on the graphical image of a map. The data layers are organized to create maps and to perform statistical analysis.

GIS will also provide support for the entire environmental program and the training community. It can be used for complex analyses such as project siting, data interpolations, and risk assessments.

GIS software enables installation staff to capture, store, update, manipulate, analyze, and display all forms of geographically referenced data and tabular information. The training of staff and the allocation of their time to data entry, mapmaking, analysis of data, and interpretation of the results will determine the success of the installation GIS.

Once fully developed, the installation GIS databases can be used for projects such as the following:

- Providing maps
- Selecting suitable areas for construction activities
- Planning land rehabilitation projects
- Providing special maps for Environmental Awareness materials
- Ensuring avoidance of rare species habitats and other areas of special concern during construction projects
- Identifying site options for use during NEPA evaluation of alternative sites
- Calculating drainages and water flows
- Determining bird habitat preferences.

A summary of the GIS Goals is provided in **Table 8-18**.

Table 8-18. Summary of Geographic Information System Goals

GIS Goals
• **INRMP Goal No. 16:** Collect, store, and maintain data about historical conditions, trends, and current status for critical indicators of ecological integrity and sustainability. • Use GIS information as a benchmark for developing future natural resources management goals and objectives.

8.17.1 Objective GIS-1: Continued Use, Development, and Maintenance of GeoBase for Natural Resources Management

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: AFI 32-10112.

Background Information: The GeoBase system must be current and installation personnel need to be proficient in its use to maximize the benefits of this tool in natural resources management.

Tasks:

1. Use GIS information as a benchmark for developing future natural resources management goals and objectives.

2. Use GIS to develop natural resources constraints maps for use in management and planning decisions.

3. Ensure that GIS information is available to biologists, planners, contractors, and others in a quick and timely manner.

4. Annually review GIS data to advise resources managers of needs to update datasets during budget planning and programming.

5. Develop specific language that will be included in all contracts to ensure all spatial data produced are fully compatible with the installation GIS database.

6. Develop a standardized system for recording and mapping significant resource observations (e.g., plants, wildlife, erosion, and damage) when incidentally encountered.

7. Provide annual funding for one person to be responsible for updating and maintaining the GIS database. This should include the necessary hardware, software, and training for the use of GIS.

Monitoring Criteria: Progress will be measured by the effectiveness and accuracy of the GeoBase Natural Resources theme in natural resources planning.

8.18 CLIMATE CHANGE

The 25 November 2013 revision of the INRMP Implementation Manual (DOD Manual 4715.03) requires that INRMPs address planning for climate change impacts to natural resources (DOD 2013a). The Instruction states that analysis to assess potential impacts of climate change should be predictive in nature, relying on models to plan for probable complex and indirect changes that are likely to happen in the future. Based on the assessments, natural resources management strategies to address climate change should be developed or improved. A summary of the Climate Change G oals is provided in **Table 8-19**.

Table 8-19. Summary of Climate Change Goals

Climate Change Goals
• **INRMP Goal No. 17:** Develop an understanding of the potential impacts to natural resources associated with climate change.

- Develop strategies to address climate change impacts to natural resources.

8.18.1 Objective CC-1: Conduct climate change vulnerability assessments on Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Applicable Installation(s): Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.

Regulatory Drivers: DODI 4715.03, Sikes Act, and Proclamation 8336.

Background Information: Assessments of the potential effects of climate change on Wake Atoll, Kōke`e AFS, or Mt. Ka`ala AFS have not been conducted. An understanding of the potential effects of climate change on the three installations is necessary to develop management strategies to address climate change.

The NMFS Monuments Program has contracted for a climate change vulnerability analysis in the Marine National Monuments. The planned completion for the analysis is in 2015. Results of the vulnerability analysis should be considered in the analysis of potential climate change effects on Wake Atoll.

Strategies:

1. Conduct a climate change vulnerability assessment for Wake Atoll.

2. Consider and evaluate the results of the climate change vulnerability analysis conducted by NMFS in the Marine National Monuments as a component of the analysis of potential climate change effects on Wake Atoll.

3. Based on the results of the Wake Atoll climate change vulnerability assessment, identify management strategies to address potential climate change impacts to natural resources.

4. Conduct a climate change vulnerability assessment for Kōke`e AFS.

5. Based on the results of the Kōke`e AFS climate change vulnerability assessment, identify management strategies to address potential climate change impacts to natural resources.

6. Conduct a climate change vulnerability assessment for Mt. Ka`ala AFS.

7. Based on the results of the Kōke`e AFS climate change vulnerability assessment, identify management strategies to address potential climate change impacts to natural resources.

Monitoring Criteria: Climate change vulnerability assessments are conducted on Wake Atoll, Kōke`e AFS, or Mt. Ka`ala AFS, and management strategies to address potential climate change impacts to natural resources are identified.

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9. IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN IMPLEMENTATION

The INRMP program has been organized to ensure the implementation of year-round, cost-effective management activities and projects that meet the requirements of the installations. Various organizations on the installation are responsible for the implementation of the INRMP described below.

Installation Stakeholders—The INRMP Working Group will be responsible for the overall implementation of the INRMP. The INRMP Working Group will be comprised of the key installation personnel for Wake Island, Kōke`e AFS, and Mt. Ka`ala AFS in addition to the USAF PACAF AFCEC/CFPE Natural Resources PM. This INRMP Working Group will assume an oversight role to ensure the effective implementation of this Plan.

The Commander of Wake Island and the Commander of Kōke`e AFS and Mt. Ka`ala AFS will be the official signatories for the INRMP. The Installation's Environmental Managers are responsible for ensuring the activities associated with the implementation of this Plan adhere to applicable federal, state, local, and USAF environmental regulations and guidelines. The USAF PACAF AFCEC/CFPE Natural Resources PM tracks DOD and USAF policies and approves funding for projects and studies identified as a priority in this Plan. The PACAF AFCEC/CFPE Natural Resources PM acts as a technical point-of-contact on all natural resources related activities. Projects proposed in this Plan are reviewed by the Installations' Environmental Managers and the PACAF AFCEC/CFPE Natural Resources PM. Deviation from the projects proposed in this Plan should be independently reviewed by the PACAF AFCEC/CFPE Natural Resources PM.

External Stakeholders—The USFWS, NOAA, and Hawai`i DLNR can provide technical assistance to the installations. Specifically, these agencies will alert the Environmental Managers whenever new species that have the potential for inhabiting the installations are added to the federal and state endangered species lists. In addition, these agencies will be involved in the annual review of the INRMP and updates to the INRMP determined to be necessary as a result of changes in environmental conditions or the mission.

9.2 ANNUAL INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN REVIEW AND COORDINATION REQUIREMENTS

To ensure that this INRMP properly addresses all aspects of the natural resources present on the installations and proposes actions that are in accordance with USAF goals and objectives, this plan and all its components are subject to review by the installation's Environmental Management Office and the PACAF AFCEC/CFPE Natural Resources PM. Similarly, all changes to be incorporated into this Plan must be approved by the installation, USFWS, NOAA, and Hawai`i DLNR.

At a minimum, the Environmental Management Office and the PACAF AFCEC/CFPE Natural Resources PM conduct an annual review of the INRMP in coordination with internal stakeholders and local representatives of the USFWS, NOAA, and Hawai`i DLNR, where applicable. Findings of the annual review are documented in an Annual INRMP Review Summary. Collaborating agency representatives assert concurrence with the findings by signing the Annual INRMP Review Summary (USAF 2014a).

This INRMP is in effect from the date of approval; however, the Operational Component Plans must be updated annually during preparation of the installations' environmental budgets.

9.3 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN UPDATE AND REVISION PROCESS

In accordance with the Sikes Act, the cooperating agencies must review the INRMP on a regular basis, but not less often than every 5 years. Based on the review, it will be determined if the INRMP needs to be updated or revised. An INRMP update consists of minor edits that provide current information, or adjust implementation timelines that would not result in changes to management goals and objectives that are substantively different than those previously agreed to by the cooperating agencies, and would not result in environmental consequences different from those in the existing INRMP. Minor update requirements are identified during the annual INRMP review and coordination. Mutual agreement by cooperating agencies that an updated INRMP remains current as to operation and effect with respect to the Sikes Act is documented by signatures to the Annual INRMP Review Summary document (USAF 2014a).

The INRMP will be revised if changes in the installation mission or land use will alter the biogeophysical environment such that significant edits need to be made to ensure that the INRMP reflects the current natural resources management requirements and appropriate program goals and objectives. The INRMP will be revised if a change in land use or condition will result in environmental impacts not anticipated by the parties to the INRMP when the INRMP was last reviewed as to operation and effect. The need for an INRMP revision is determined during the annual INRMP review (USAF 2014a)

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10. WORK PLANS

The purpose of this section is to present a road map for the execution of specific actions to achieve management goals and objectives identified in this INRMP.

Under the authority and direction of the Commanding Officer, the Environmental Division provides staff for implementing the INRMP management actions, and the Alaska Installation Support Team (PACAF/Operations Division) and Pacific Regional Support Team (AFCEC/CFPE) Natural Resources PM would provide technical assistance when necessary.

Tables 10-1, 10-2, and **10-3** summarize the management actions identified in **Chapter 8** for each installation and propose priorities for their implementation. The actions proposed for this INRMP are aggressive, and might not be accomplished within the established timelines due to a number of factors (e.g., budget and manpower constraints, and wartime tasks). However, their importance to the proper management of the installations' natural resources cannot be understated. Therefore, the management actions presented in **Tables 10-1, 10-2,** and **10-3** should be modified as part of the annual review of this INRMP by the INRMP Working Group to ensure that these goals are continually emphasized and accomplished when practicable.

This INRMP reflects the commitment set forth by Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS to conserve, protect, and enhance the natural resources present on the installations. This INRMP is the final plan that will direct the natural resources management at the installations from FYs 2017 through 2021. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, conserve, and enhance the ecological integrity of the installations and the biological communities occurring on the installations. In addition, the natural resources management measures described in this Plan will protect the installations' ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Natural resources and land use management issues are not the only factors contributing to the development and implementation of the INRMP. Installation management and other seemingly unrelated issues affect the implementation of this Plan. It is of utmost importance to the implementation of this INRMP that installation personnel take "ownership" of the plan (i.e., individual or organizational primary responsibility to implement the INRMP), provide the necessary resources (i.e., personnel and equipment), and allocate the appropriate funding to enact the Plan. It is extremely important that an INRMP Working Group be established to aid in the continued development of and commitment to the implementation of this INRMP. The INRMP Working Group should be comprised of key installation personnel, and will assume an oversight role to ensure the effective implementation of this Plan. Top and middle level management representation, as well as representation from several individuals with day-to-day on-installation field experience, will provide the INRMP Working Group with the leadership and structure necessary for the successful implementation.

Any requirement for the obligation of funds for projects in this INRMP shall be subject to the availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable federal law.

Implementation of the actions and projects are guided by how budget priorities are assessed for environmental work on DOD installations. This is described in DODI 4715.03 on Environmental Conservation Programs, which implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DOD control.

The Office of Management and Budget considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, to be a high priority. However, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding. As such, these programs and projects have been placed into four priority-based categories: (0) day-to-day recurring projects, (1) high priority projects, (2) important projects, and (3) projects of lesser importance. The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer toward successfully achieving its goal. DODI 4715.03 defines recurring and non-recurring conservation requirements as follows:

Recurring and Non-Recurring Conservation Requirements
Priority 0: Recurring Natural Resources Conservation Management Requirements: a. Administrative, personnel, and other costs associated with managing the DOD Natural Resources Conservation Program that are necessary to meet applicable compliance requirements in federal, state, territorial and CNMI laws; regulations; EOs; and DOD policies, or in direct support of the military mission. b. DOD components shall give priority to recurring natural resources conservation management requirements associated with the operation of facilities, installations, and deployed weapons systems. These activities include day-to-day costs of sustaining an effective natural resources management program, and annual requirements, including manpower, training, supplies, permits, fees, testing and monitoring, sampling and analysis, reporting and recordkeeping, maintenance of natural resources conservation equipment, and compliance self-assessments.

Recurring and Non-Recurring Conservation Requirements
Priority 1 (High): Non-Recurring Natural Resources Management Requirements. Current Compliance. Includes installation projects and activities to support: a. Installations currently out of compliance (e.g., received an enforcement action from an authorized federal, state, territorial, or CNMI agency or local authority). b. Signed compliance agreement or consent order. c. Meeting requirements with applicable federal, state, territorial, regulations, standards, EOs, or DOD policies. d. Immediate and essential maintenance of operational integrity or military mission sustainment. e. Projects or activities that will be out of compliance if not implemented in the current program year including the following:
i. Environmental analyses for natural resources conservation projects, and monitoring and studies required to assess and mitigate potential impacts of the military mission on conservation resources. ii. Planning documentation, master plans, compatible development planning, and INRMPs. iii. Natural resources planning-level surveys. iv. Reasonable and prudent measures included in incidental take statements of Biological Opinions; biological assessments; surveys; monitoring; reporting of assessment results; or habitat protection for listed, at-risk, and candidate species so that proposed or continuing actions can be modified in consultation with the USFWS or NMFS. v. Mitigation to meet existing regulatory permit conditions or written agreements. vi. Nonpoint source pollution or watershed management studies or actions needed to meet compliance dates cited in approved state or territorial coastal non-point source pollution control plans, as required to meet consistency determinations consistent with Coastal Zone Management. vii. Wetlands delineations critical for the prevention of adverse impacts on wetlands, so that continuing actions can be modified to ensure mission continuity. viii. Compliance with missed deadlines established in DOD-executed agreements.

Recurring and Non-Recurring Conservation Requirements
Priority 2 (Medium): Non-Recurring Natural Resources Management Requirements. Maintenance Requirements. Includes those projects and activities needed to meet an established deadline beyond the current program year and maintain compliance. Examples include the following: a. Compliance with future deadlines. b. Conservation, GIS mapping, and data management to comply with federal, state, territorial, CNMI, and local regulations; EOs; and DOD policy. c. Efforts undertaken in accordance with non-deadline specific compliance requirements of leadership initiatives. d. Wetlands enhancement to minimize wetlands loss and enhance existing degraded wetlands. e. Conservation recommendations in biological opinions issued pursuant to the ESA.
Priority 3 (Low): Non-Recurring Natural Resources Management Requirements. Enhancement Actions Beyond Compliance. Includes those projects and activities that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required by law, regulation, or EO, and are not of an immediate nature. Examples include: a. Community outreach activities, such as International Migratory Bird Day, Earth Day, National Public Lands Day, Pollinator Week, and Arbor Day activities. b. Educational and public awareness projects, such as interpretive displays, oral histories, Watchable Wildlife areas, nature trails, wildlife checklists, and conservation teaching materials. c. Restoration or enhancement of natural resources when no specific compliance requirement dictates a course, or timing of action. d. Management and execution of volunteer and partnership programs.

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Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Natural Resources Program Management **INRMP Goal No. 1:** Update the INRMP when environmental or mission conditions change as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03.						
NRP-1	**Installation Management Plan Coordination** • Conduct an INRMP coordination meeting with installation organizations at the initiation of implementation and on an annual basis following the annual INRMP review.	2	Sikes Act, ESA	Annually	In House	NA
NRP-2	**Plan Update, INRMP, Annual Review (ST)** • Conduct annual review of the INRMP to assess the suggested management practices in terms of their appropriateness for current conditions at the installations. • Coordinate the annual review with USFWS and NOAA (tripartite coordination). • Ensure that the annual review is conducted allowing enough time to route changes through the regulatory agencies for their concurrence and signature. • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act DODI 4715.03	Annually	In House	NA
NRP-3	**Plan Update, INRMP, 5-Year Review (ST)** • Every 5 years determine if modification of the INRMP is necessary based on changes in environmental conditions or the mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03. • If it is determined that modification of the INRMP is necessary, complete the changes in house. • Coordinate review of modifications with USFWS and NOAA (tripartite coordination). • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act DODI 4715.03	5-Year	Contractor	YGFZOS18133

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Fish and Wildlife Resources **INRMP Goal No. 2:** Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment. **INRMP Goal No. 3:** Maintain partnerships with agencies involved in wildlife management and utilize expertise from agencies, if appropriate and cost effective, for implementation of INRMP projects.						
FWM-1	**Management, Species, Migratory Birds (ST)** • Conduct annual surveys to estimate numbers of breeding seabirds, migratory shorebirds, and waterfowl on Wake Atoll. • Collect data on species phenology to assist the BASH program in mitigating the risk of bird strikes. • Conduct acoustic and decoy attraction trials at Peale Island. • Perform pre-vegetation clearing surveys in order to document the absence or presence of MBTA resources.	2	MBTA	Annually	Contractor, USDA, USFWS, BOS Contractor	FA5000-13-C-0005-P00005
FWM-2	**Management, Species, Flora and Fauna (ST)** • Conduct follow-up biological surveys to the 2010 terrestrial vegetation, terrestrial arthropods, rats, and intertidal organisms Legacy Resource Management Program surveys. • Prepare a report presenting the results of the surveys and compare data with 2011 pre-rat eradication survey results.	2	MBTA, BASH	2017	USGS, Contractor, University	YGFZOS177788
FWM-3	**Management, Species, Strawberry Hermit Crab, Herpetofauna and Polynesian Rat (ST)** • Conduct a survey and population assessment of the strawberry hermit crab on Wake Atoll. • Conduct a herpetofauna survey on Wake Atoll. • Conduct Polynesian rat population survey on Wake Atoll.	2	Sikes Act, Fish and Wildlife Coordination Act	2018	USFWS	TBD
FWM-4	**Management, Species, Fish Population Survey (ST)** • Conduct lagoon and offshore surveys of fish populations, specifically those species most commonly targeted by on island residents.	2	Sikes Act, PP 8336	Annually	NOAA NMFS, University, USFWS	YGFZOS173456 YGFZOS183456 YGFZOS193456

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Outdoor Recreation and Public Access to Natural Resources **INRMP Goal No. 4:** Provide quality outdoor recreation experiences for civilian, active duty and contract work staff that do not deteriorate ecosystem integrity or the USAF mission.						
OR-1	**Outreach (ST)** • Coordinate the Outdoor Recreation Program on Wake Atoll. • Develop a bird identification tri-fold for distribution to Wake Atoll residents and visitors. • Include protection of corals and historic artifacts as components of the Outdoor Recreation Plan. • Include the assessment of opportunities to encourage coral development in recreational SCUBA diving activities. • Create a nature trail using existing roads and paths and develop a tri-fold for distribution to Wake Atoll residents and visitors describing various natural components along the trail(s). • Prohibit vehicle use on beaches unless for emergency or security reasons consistent with Section 11.3 of AFI 32-7064 (USAF 2014a).	2	Sikes Act	2015-2022	Contractor	YGFZOS151317 YGFZOS161317 YGFZOS171317 YGFZOS181317 YGFZOS191317 YGFZOS201317
OR-2	**Reports, Other, Annual Fishing Management Report (ST)** • Ensure personnel fishing on Wake Atoll are aware of and follow guidelines in Wake Island Operating Guidance. • Include information regarding the fishing program and associated requirements in the newcomers' orientation to Wake Atoll. • Gather quarterly fishing log sheets and prepare annual report for submission to USFWS (superintendent) • Monitor Atoll fishing activities to ensure compliance with the Wake Island Operating Guidance.	2	Sikes Act, Proclamation 8336	Annually	In House, BOS Contractor	FA5000-13-C-0005-P00005

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Conservation Law Enforcement **INRMP Goal No. 5:** Utilize law enforcement expertise from cooperating DOD and DOI agencies to monitor activities on Wake Atoll and educate installation personnel on restrictions applicable to the Atoll's resources.						
CLE-1	**Management, Conservation (ST)** • Continue enforcement of natural resources laws and regulations on Wake Atoll.	1	Sikes Act, MBTA, ESA, Sikes Act, Proclamation 8336	Ongoing	In House, USFWS	NA
Threatened and Endangered Species and Habitats **INRMP Goal No. 6:** Manage Wake Atoll using a regional ecosystem-based approach that manages sensitive species and their associated ecosystems while protecting the operational functionality of the sites missions.						
TE-1	**Management, Species, Pacific Threatened and Endangered Species (ST)** • Conduct annual sea turtle monitoring (green sea turtle, hawks bill sea turtles) for nests, crawls, and tracks in areas with potentially suitable nesting habitat on Wake Atoll. • If nesting is determined to be occurring on Wake Atoll, develop management actions to enhance habitat and minimize potential for adverse impacts to nesting areas. • Document sightings of sea turtles and monk seals at Wake Atoll. • Conduct annual scalloped hammerhead shark monitoring in waters surrounding Wake Atoll.	2	ESA, Sikes Act, Proclamation 8336	Annually	Contractor, NOAA NMFS, USFWS	YGFZOS167777 YGFZOS177777 YGFZOS187777 YGFZOS197777 YGFZOS207777
TE-2	**Management, Habitat, Coral Reef Ecosystems-Wake Atoll (ST)** • Conduct a survey and assessment of corals associated with Wake Atoll inside the lagoon and outer reef. • As a component of the coral reef survey and assessment, develop GIS-based imagery illustrating coral reef resources around Wake Atoll and within the lagoon.	2	INRMP Sikes Act ESA, MSA	2016	NOAA NMFS, USFWS	YGFZOS177777

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
TE-3	**Management, Species, Humphead Wrasse, and Bumphead Parrotfish (ST)** • Conduct a comprehensive survey to identify potential breeding habitat, juvenile nursery habitat and the status of juvenile humphead wrasse, bumphead parrotfish and scalloped hammerhead sharks in the surrounding waters of Wake Atoll. • Prepare a report presenting the results of the survey and an assessment of suitable breeding habitat, juvenile nursery habitat and the status of juvenile humphead wrasse, bumphead parrotfish and scalloped hammerhead sharks in the surrounding waters of Wake Atoll.	1	ESA, Sikes Act, Proclamation Act 8336	2018	NOAA NMFS, USFWS	YGFZOS17766
TE-8	**Management, Species, Giant Clams (ST)** • Conduct initial baseline surveys to identify potential habitat/nurseries for the giant clam within the near shore marine environment on Wake Atoll. Prior to the survey, information on the giant clam habitat and behavior should be collected from the USFWS, Hawai`i DLNR, and other giant clam experts. • Research appropriate and successful ocean based nursery techniques. • Contact aquaculture facilities raising giant clam larvae (spats) that would be available for ocean placement.	2	Sikes Act, Fish and Wildlife Coordination Act, Proclamation 8336	2017	Contractor, USFWS	TBD
Water Resources Protection **INRMP Goal No. 7:** Maintain healthy and stable soils by rehabilitating damaged areas in order to reduce sediment inputs into the watershed that degrade water quality. **INRMP Goal No. 8:** Minimize non-point source pollution of both surface and groundwater in the watershed through the implementation of BMPs.						
WRP-1	**Reports, Other, Stormwater Management Plan – Natural Resources Review (ST)** • Minimize potential for impacts the water resources associated with stormwater runoff and erosion and sedimentation.	2	CWA, Proclamation 8336	Ongoing	BOS Contractor	FA5000-13-C-0005-P00005

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
	• Minimize potential for impacts to water resources associated with accidental spills or leakage from vehicles or equipment. • Implement good housekeeping practices to minimize potential for impacts to water quality or habitat associated with trash and other installation debris and materials.					
Wetland Protection **INRMP Goal No. 9:** Comply with USACE regulations pertaining to wetlands.						
WP-1	**Monitor, Wetlands (ST)** • Update the 2007 wetland delineation conducted on Wake Atoll based on the 1987 USACE Wetlands Delineation Manual and the 2010 Draft Interim Regional Supplement to the USACE Wetland Delineation Manual: Hawai`i and Pacific Islands Region. • Obtain a Jurisdictional Determination from the Honolulu, Fort Shafter, Hawai`i District of USACE for the delineated wetlands. • Any actions that may impact wetlands or other aquatic sites at Wake Atoll must first be reviewed for adequacy in terms of compliance with the 10 April 2008 Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR 325-332) and USEPA (40 CFR Part 230). • Finish the filling of the engineered detention basin near the runway with demolition debris per approval by USACE and USEPA Region 9 and in accordance with recommendations for habitat modifications from the 2014 Wake BASH Assessment.	2	CWA, Proclamation 8336	2018	Contractor	YGFZOS175524
WP-3	**Outreach (ST)** • Educate facility personnel on the locations of wetlands and the need to avoid impacts to the habitats.	2	CWA, Sikes Act	Ongoing	In House	NA
WP-4	**Mitigation (ST)**	1	CWA, Sikes Act,	Ongoing	In House	NA

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
	• For each planned project at Wake Atoll, determine if jurisdictional wetlands would be impacted. • If impacts to wetlands would occur, prepare a mitigation plan for each project. • Submit the mitigation plan to the following agencies for review and comment: USACE, USEPA, USFWS, and NOAA-NMFS. • Execute wetland mitigation plan.		Proclamation 8336			

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Grounds Maintenance **INRMP Goal No. 10:** Maximize use of native plant species and avoid introduction of invasive, exotic species during re-vegetation activities.						
GM-1	**Plan Update, Other, Land Management Plan (ST)** • Update the Wake Atoll Land Management Plan to incorporate 2014 BASH Risk Assessment habitat modifications recommendations. • Coordinate with USFWS on the habitat modifications per the 2014 BASH Risk Assessment • Implement the grounds maintenance and land management goals identified in the updated Land Management Plan and in accordance with the INRMP and the 2014 BASH Risk Assessment Report. • Evaluate the potential to convert improved grounds on Wake Atoll to semi-improved grounds.	2	Sikes Act	2017	BOS Contractor	FA5000-13-C-0005-P00005
GM-2	**Management, Habitat, Native Species (ST)** • Use native plant species for revegetation and landscaping activities in accordance with the Land Management Plan, EO 13148 and Chapter 12 of AFI 32-7064 (USAF 2014a). • Develop a native plant nursery on Wake Atoll to provide plants for habitat enhancement, restoration, and landscaping activities. • Develop a central garden on Wake Atoll for growing vegetables and other plants.	2	EO13148, Sikes Act, EO13112	2017-2020	Contractor	YGFZOS171268 YGFZOS181268 YGFZOS191268 YGFZOS201268
Wildland Fire Management **INRMP Goal No. 11:** Support a Wildland Fire Management Program to protect high-value natural resources areas and operational facilities from catastrophic wildfire while conserving resources and military operational flexibility.						
WFM-1	**Plan, Update, Other, Wildland Fire Management Plan (ST)** • Develop a Wildland Fire Management Plan for Wake Atoll that addresses increases in forest cover and fuel supply. • Include in the Plan the conduct of pre-action surveys by a person with knowledge of Wake Atoll bird species and their nesting habits for wildland fire	2	Sikes Act, MBTA	2017	Contractor	TBD

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
	management actions that could result in bird take. Include implementation of management practices based on the pre-action surveys to avoid bird take.					

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Integrated Pest Management **INRMP Goal No. 12:** Develop and employ a systematic approach for onshore and offshore biosecurity, inclusive of rapid response.						
IPM-1	**Plan, Update, Other, IPM Plan (ST)** • Update the Wake Atoll IPM per recommendation from USDA-Wildlife Services. • Incorporate IPM practices into the management and control of pests.	2	Sikes Act, EO13112	Ongoing	BOS Contractor	FA5000-13-C-0005-P00005
IPM-2	**Management, Invasive Species, Flora and Fauna (ST)** • Develop a Long-Term Management Strategy for top invasive species at Wake Atoll that maps out measures to be implemented annually at each installation. • Implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.	2	Sikes Act, ESA, EO13112, MBTA	Annually	Contractor	YGFZOS161377 YGFZOS171377 YGFZOS181377 YGFZOS191377 YGFZOS201377
IPM-3	**Management, Invasive Species, Polynesian Rats (ST)** • Conduct follow-up rat eradication efforts based on lessons learned from the May 2012 eradication efforts and additional field research with USDA-Wildlife Services.	2	Sikes Act, ESA, EO13112, MBTA	Ongoing	USDA, USGS, USFWS, University, Contractor	YGFZOS161315 YGFZOS171315 YGFZOS181315 YGFZOS191315 YGFZOS201315
IPM-4	**Plan Update, Other, Biosecurity Management Plan (ST)** • Update the Wake Island Biosecurity Management Plan in accordance with recommendations from USAF-Pest Management Board, USDA, and USFWS. • Minimize potential for the inadvertent introduction of exotic and invasive species onto Wake Atoll associated with contingency, emergency, and supply operations. • Minimize potential for introduction of exotic and invasive species onto Wake Atoll by residents and visitors.	2	DOD-Foreign Clearance Guide ESA Sikes Act EO 13112 AFI 32-1053 AFI 32-7064, Proclamation 8336	Annually	In House	NA

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
IPM-5	**Management, Invasive Species, Flora and Fauna (ST)** • Conduct an assessment of the viability of implementing HACCP planning, or similar methods, as a tool for minimizing potential for introduction of exotic or invasive species onto Wake Atoll. • Ensure that the HACCP emphasizes targeting species with potential to have major impacts to the Atoll's biota and that are currently present on Hawai`i or Guam such as the brown tree snake, coconut rhinoceros beetle and little fire ant.	2	Sikes Act, Proclamation 8336	2017	Contractor	TBD
Bird/Aircraft Strike Hazard **INRMP Goal No. 13:** Implement the BASH Plan to lessen occurrences of bird aircraft strikes.						
BH-1	**Management, Species, Migratory Birds** • Conduct efficacy trials with trained canine(s) to assess the utility of the tool for reducing the attractive nature of cleared grounds.	2	Sikes Act, MBTA	2016	TBD	NA
BH-2	**Permit, Renewal, Migratory Bird Treaty Act - Depredation Permit (ST) and Plan Update, Other, Bird/Aircraft Strike Hazard Plan (ST)** • Update the 2013 BASH Plan for WIA in accordance with the 2014 BASH Risk Assessment • Coordinate with USFWS regarding habitation modifications in accordance with the 2014 Wake BASH Risk Assessment. • Conduct a review of the 2013 MBTA depredation permit to evaluate if the quantity of take needs is still meeting WIA needs. • Continue to assist the installation flight safety office and others in implementing BASH actions presented in the 2013 BASH Plan.	2	MBTA, Sikes Act	Annual	BOS Contractor	FA5000-13-C-0005-P00005
BH-3	**Survey, Other, MBTA/BASH Monitoring Protocols** • Design avian surveys and monitoring to provide useful information to Airfield managers regarding BASH based on 2014 recommendations from USDA-Wildlife Services.	2	MBTA, Sikes Act	Annual	BOS Contractor	FA5000-13-C-0005-P00005

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
BH-4	**Management, Habitat, Taxiway (ST)** • Monitor the persistence of avian species within the re-designed 2.97-acre stormwater detention basin at the east end of the Airfield between Taxiway A and E (Wetland 6) in accordance with the USACE waiver.	2	MBTA, Sikes Act	2016- 2017	BOS Contractor	FA5000-13-C-0005-P00005
Coastal Zone and Marine Resources **INRMP Goal No. 14:** Complete an assessment of shallow water coral reef systems and establish a long term index based monitoring program for coral reef health in areas of key importance to the USAF mission.						
CZ-1	**Inter-Agency Coordination, Management and Support** • Continue to work in coordination with the USFWS to meeting the goals of the Pacific Marine National Monument that surrounds Wake Atoll. • Continue to support marine rapid environmental assessment cruises conducted by NOAA and use information from the cruise reports, combined with information collected by WIA marine habitat surveys, to assess reef habitats and to identify and track trends that may indicate impacts from ongoing actions.	2	Sikes Act, Fish and Wildlife Coordination Act, MBTA, ESA, Proclamation 8336	Ongoing	In House	N/A
CZ-2	**Management, Habitat, Coral Reefs (ST)** • Coordinate with NOAA-NMFS to conduct an Essential Fish Habitat survey of waters and substrate around Wake Atoll every 3 years to identify areas where federally managed species spawn, breed, feed, and or grow to maturity. • Prepare a report presenting the results of the Essential Fish Habitat surveys.	1	Sikes Act, ESA, MSA, Proclamation 8336	2017	NOAA-NMFS Contractor	TBD
CZ-3	**Survey, Other, Coral Conservation and Outreach** • Ensure that recreational activities do not have adverse impacts on submerged lands and corals associated with Wake Atoll. • Support an update to the Wake Atoll Dive Plan. • Coordinate with NOAA-NMFS to develop a coral restoration project for the Wake Island Dive Club.	2	Sikes Act, ESA, Proclamation 8336	2017	In House NOAA-NMFS	YGFZOS157777

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
CZ-4	**Management, Habitat, Marina Channel Dredging (ST)** • Develop and model terrestrial and marine impacts associated with several different channel modification designs. • Utilize design alternatives that result in improved flow conditions in the Wake Atoll Lagoon. • Utilize modeling results to support NEPA analysis of proposed channel modification.	2	ESA, MSA, Proclamation 8336	2018	NOAA-NMFS Contractor	YGFZOS181268
CZ-5	**Survey, Other, Channel Markers Replacement** • Assess the viability of repairing/replacing the range markers for the entrance channel to the Wake Atoll Marina. Repair or replace the range markers if determined to be feasible.	2	CFR, Title 33, Subchapter C, Part 62.1(a) and (c), Proclamation 8336	2018	USCG, Contractor	TBD
Cultural Resources Protection **INRMP Goal No. 15:** Ensure that management actions prescribed in this INRMP are consistent with, and do not conflict with, management prescribed in the ICRMPs for Wake Atoll, Kōke`e AFS, and Mt. Ka`ala AFS.						
CRP-1	**Management, Cultural Sites, Wake Atoll** • Educate installation personnel and visitors on the occurrence of cultural resources on the facilities and actions required to avoid impacts to the resources. • Educate installation personnel and visitors on actions to be taken if previously undocumented cultural resources are discovered, or if unanticipated impacts occur to known resources. • Educate installation personnel and visitors on actions to be taken if human remains are discovered.	2	NHPA, AFI 32-7065, Sikes Act	Ongoing	In House	NA

Table 10-1. Summary of Wake Atoll Natural Resources Management Actions

Objective No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
GIS Management **INRMP Goal No. 16:** Collect, store, and maintain data about historical conditions, trends, and current status for critical indicators of ecological integrity and sustainability. Use GIS information as benchmarks for developing future natural resources management goals and objectives.						
GIS-1	**Maintenance, Environmental, Functional Data Layers and Mission Data Sets** • Continue use, development, and maintenance of GeoBase for natural resources management.	2	AFI 32-10112	Ongoing	In House	NA
Climate Change Management **INRMP Goal No. 17:** Develop an understanding of the potential impacts to natural resources associated with climate change. Develop strategies to address climate change impacts to natural resources.						
CC-1	**Survey, Other, Climate Change Vulnerability Assessment** • Conduct a climate change vulnerability assessment on Wake Atoll. • Consider and evaluate the results of the climate change vulnerability analysis conducted by NMFS in the Marine National Monuments as a component of the analysis of potential climate change effects on Wake Atoll.	2	DODI 4715.03, Sikes Act, Proclamation 8336	2018	Contractor	TBD

NOTES: NA = Not applicable.
ST = Standard Title.
TBD = To be determined.

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Natural Resources Program Management **INRMP Goal No. 1:** Update the INRMP when environmental or mission conditions change as required by the Sikes Act (16 U.S.C.670a) and DODI 4715.03.						
NRP-1	**Installation Management Plan Coordination** • Coordinate with installation operational and management organizations and stakeholders to ensure there is an understanding of management goals and actions developed in the INRMP. • Ensure that management actions developed in the INRMP are consistent with current management instructions and plans.	2	Sikes Act	Annually	In House	NA
NRP-2	**Plan Update, INRMP, Annual Review (ST)** • Conduct annual review of the INRMP to assess the suggested management practices in terms of their appropriateness for current conditions at the installations. • Coordinate the annual review with USFWS, NOAA, and Hawai`i DLNR. • Ensure that the annual review is conducted allowing enough time to route changes through the regulatory agencies for their concurrence and signature. • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act	Annually	In House	NA
NRP-3	**Plan Update, INRMP, 5-Year Review (ST)** • Every 5 years determine if modification of the INRMP is necessary based on changes in environmental conditions or the mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03. • If it is determined that modification of the INRMP is necessary, complete the changes in house. • Coordinate review of modifications with USFWS, NOAA, and Hawai`i DLNR (tripartite coordination). • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act, DODI 4715.03	5-Year	Contractor	YGFZOS18133

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Fish and Wildlife Resources **INRMP Goal No. 2:** Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment. **INRMP Goal No. 3:** Maintain partnerships with agencies involved in wildlife management and utilize expertise from agencies, if appropriate and cost effective, for implementation of INRMP projects.						
FWM-5	**Management, Species, Fauna (ST)** • Conduct wildlife surveys on Kōke`e AFS and Kōke`e MAS to determine avian, mammalian, herpetofauna and insect species and numbers on the installation. • Incorporate biological survey data into the INRMP as they are collected	2	MBTA, Sikes Act, ESA	2018	Contractor, USDA, USFWS	TBD
Conservation Law Enforcement **INRMP Goal No. 5:** Utilize law enforcement expertise from cooperating DOD and DOI agencies to monitor activities on Kōke`e AFS and Kōke`e MAS and educate installation personnel on restrictions applicable to the site's resources.						
CLE-1	**Law Enforcement, Natural Resources** • Continue enforcement of natural resources laws and regulations on Kōke`e AFS.	1	MBTA, ESA, USFWS – Refuge Use Permit, Sikes Act, Proclamation 8336.	Ongoing	In House	NA

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Threatened and Endangered Species and Habitats **INRMP Goal No. 6:** Manage Kōke`e AFS using a regional ecosystem-based approach that manages sensitive species and their associated ecosystems while protecting the operational functionality of the sites missions.						
TE-5	**Consultation, USFWS, Biological Opinion, Kōke`e AFS (ST)** • Maintain compliance with the 2017 Biological Opinion and Informal Consultation of the U.S. Fish and Wildlife Service for the Proposed Continuing Operations at Kōke´e Air Force Station and Microwave Antenna Site, Island of Kaua´i. • Continue to conduct outreach, as needed, to ensure that new installation personnel are aware of the importance of seabird fallout reduction. • Complete the Kōke`e Downed Bird Log (**Appendix Q**) for all downed, injured, or dead birds. The Kōke`e Downed Bird Log should be available for inclusion in the biannual report for the Continuing Operations of the Kōke`e AFS and Kōke`e MAS. • Support USFWS in the development of methods to increase the visibility of towers to minimize the impacts on listed species by sharing information gained from Kōke`e AFS and other installations, as applicable.	1	ESA, Sikes Act	2016	In House	NA
TE-6	**Management, Species, Hawai`ian Geese (ST)** • Regularly inspect garbage cans on Kōke`e AFS to ensure they remain secured from feral cats and rats. • Continue to conduct trapping and removal of feral cats from Kōke`e AFS as necessary. • Conduct outreach and education so that base personnel understand that the Hawai`ian geese should not be harassed or harmed and that they should not feed the geese or feral cats.	1	ESA, Sikes Act	Ongoing	Contractor, In House	YGFZOS158012
TE-7	**Management, Species, Hawai`ian Hoary Bats (ST)** • Install auditory bat recording devices at Kōke`e AFS. • Conduct nighttime auditory surveys of bat activity around Kōke`e AFS.	2	ESA, Sikes Act	2016	Contractor, University	YGFZOS167778 YGFZOS177778

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
	• Prepare a report presenting the results of the auditory survey.					

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Water Resources Protection **INRMP Goal No. 7:** Maintain healthy and stable soils by rehabilitating damaged areas in order to reduce sediment inputs into the watershed that degrade water quality. **INRMP Goal No. 8:** Minimize non-point source pollution of both surface and groundwater in the watershed through the implementation of BMPs.						
WRP-1	**Reports, Other, Stormwater Management Plan– Natural Resources Review (ST)** • Minimize potential for impacts the water resources associated with stormwater runoff and erosion and sedimentation. • Minimize potential for impacts to water resources associated with accidental spills or leakage from vehicles or equipment. • Implement good housekeeping practices to minimize potential for impacts to water quality or habitat associated with trash and other installation debris and materials.	2	CWA	Ongoing	In House, Contractor	NA
Grounds Maintenance **INRMP Goal No. 10:** Maximize use of native plant species and avoid introduction of invasive, exotic species during re-vegetation activities.						
GM-2	**Management, Habitat, Native Species (ST)** • Use native plant species for revegetation and landscaping activities in accordance with EO 13148 and Chapter 12 of AFI 32-7064 (USAF 2014a).	2	EO 13148, Sikes Act, EO13112	2018	In House, Contractor	NA
GM-3	**Management, Habitat, Flora (ST)** • Control grasses and other vegetation that are spreading out into gravel and paved areas on Kōke`e AFS.	2	EO 13148, Sikes Act, EO 13112	2018	In House, Contractor	NA
Wildland Fire Management **INRMP Goal No. 11:** Support a Wildland Fire Management Program to protect high-value natural resources areas and operational facilities from catastrophic wildfire while conserving resources and military operational flexibility.						
WFM-2	**Plan, Other, Wildland Fire Management Plan (ST)** • Ensure that plans are in place to address wildland fires at Kōke`e AFS. • Ensure that all installation personnel are aware of actions to be taken in response to wildland fires at the facilities.	2	MBTA, Sikes Act	Ongoing	In House, Contractor	NA

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Integrated Pest Management **INRMP Goal No. 12:** Develop and employ a systematic approach for onshore and offshore biosecurity, inclusive of rapid response.						
IPM-6	**Plan, Update, Other, IPM Plan (ST)** • If determined necessary, develop an installation specific IPM Plan for Kōke`e AFS based on USDA-Wildlife Services recommendations. • Incorporate IPM practices into the management and control of pests.	2	Sikes Act	Ongoing	In House	NA
IPM-7	**Management, Invasive Species, Flora and Fauna (ST)** • Develop a Long-Term Management Strategy for top invasive species at Koke'e AFS that maps out measures to be implemented annually at each installation. • Implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan for Kōke`e AFS.	2	Sikes Act, ESA, EO13112, MBTA	2016-2020	Contractor	TBD
Cultural Resources Protection **INRMP Goal No. 15:** Ensure that management actions prescribed in this INRMP are consistent with, and do not conflict with, management prescribed in the ICRMP for Kōke`e AFS.						
CRP-1	**Management, Cultural Sites, Kōke`e AFS** • Educate installation personnel and visitors on the occurrence of cultural resources on the facilities and actions required to avoid impacts to the resources. • Educate installation personnel and visitors on actions to be taken if previously undocumented cultural resources are discovered, or if unanticipated impacts occur to known resources.	2	NHPA, AFI 32-7065, Sikes Act	Ongoing	In House	NA
GIS Management Actions **INRMP Goal No. 16:** Collect, store, and maintain data about historical conditions, trends, and current status for critical indicators of ecological integrity and sustainability. Use GIS information as benchmarks for developing future natural resources management goals and objectives.						
GIS-1	**Maintenance, Environmental, Functional Data Layers and Mission Data Sets** • Continue use, development, and maintenance of GeoBase for natural resources management.	2	AFI 32-10112, Sikes Act	Ongoing	In House Contractor	NA

Table 10-2. Summary of Kōke`e Air Force Station and Kōke`e Microwave Antenna Station Natural Resources Management Actions

Project No.	Task(s)	Priority Level	Regulatory Driver	Execution Year	Recommended Agent	USAF Project Number
Climate Change Management Actions **INRMP Goal No. 17:** Develop an understanding of the potential impacts to natural resources associated with climate change. Develop strategies to address climate change impacts to natural resources.						
CC-1	**Survey, Other, Climate Change Vulnerability Assessment** • Conduct a climate change vulnerability assessment on Kōke`e AFS.	2	Sikes Act	2017	Contractor	TBD

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
Natural Resources Program Management **INRMP Goal No. 1:** Update the INRMP when environmental or mission conditions change as required by the Sikes Act (16 U.S.C.670a) and DODI 4715.03.						
NRP-1	**Installation Management Plan Coordination** • Coordinate with installation operational and management organizations and stakeholders to ensure there is an understanding of management goals and actions developed in the INRMP. • Ensure that management actions developed in the INRMP are consistent with current management instructions and plans.	2	Sikes Act	2015	In House	NA
NRP-2	**Plan Update, INRMP, Annual Review (ST)** • Conduct annual review of the INRMP to assess the suggested management practices in terms of their appropriateness for current conditions at the installations. • Coordinate the annual review with USFWS, NOAA, and Hawai`i DLNR (tripartite coordination). • Ensure that the annual review is conducted allowing enough time to route changes through the regulatory agencies for their concurrence and signature. • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act DODI 4715.03	Annually	In House	NA
NRP-3	**Plan Update, INRMP, 5-Year Review (ST)** • Every 5 years determine if modification of the INRMP is necessary based on changes in environmental conditions or the mission as required by the Sikes Act (16 U.S.C. 670a) and DODI 4715.03. • If it is determined that modification of the INRMP is necessary, complete the changes in house. • Coordinate review of modifications with USFWS, NOAA, and Hawai`i DLNR (tripartite coordination). • Ensure that all changes to the INRMP are updated accurately in E-Plan.	1	Sikes Act, DODI 4715.03	2018	Contractor	YGFZOS18133

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
Fish and Wildlife Resources **INRMP Goal No. 2:** Employ a systematic approach to managing wildlife resources, using a process that includes inventory, monitoring, modeling, management, and assessment. **INRMP Goal No. 3:** Maintain partnerships with agencies involved in wildlife management and utilize expertise from agencies, if appropriate, and cost effective, for implementation of INRMP projects.						
FWM-6	**Management, Species, Fauna (ST)** • Conduct surveys on Mt. Ka`ala to determine avian, mammalian, herpetofauna and insect species and numbers on the installation.	2	MBTA, Sikes Act, ESA	2017	Contractor, USFWS	TBD
Conservation Law Enforcement **INRMP Goal No. 5:** Utilize law enforcement expertise from cooperating DOD and DOI agencies to monitor activities on Mt. Ka`ala AFS and educate installation personnel on restrictions applicable to the site's resources.						
CLE-1	**Management, Conservation (ST)** • Continue enforcement of natural resources laws and regulations on Mt. Ka`ala AFS.	1	MBTA, ESA, USFWS – Refuge Use Permit, Sikes Act, Proclamation 8336.	Ongoing	In house	TBD
Threatened and Endangered Species and Habitats **INRMP Goal No. 6:** Manage Mt. Ka`ala AFS using a regional ecosystem-based approach that manages sensitive species and their associated ecosystems while protecting the operational functionality of the sites missions.						
TE-4	**Management, Species, Flora (ST)** • Conduct a follow up Federal and state listed threatened or endangered plant species survey on Mt. Ka`ala AFS and in managed/maintained areas around the perimeter fence. • If listed species are found, implement management actions necessary to avoid impacts to the species.	2	ESA, Sikes Act	2017	Contractor	TBD

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
Water Resources Protection **INRMP Goal No. 7:** Maintain healthy and stable soils by rehabilitating damaged areas in order to reduce sediment inputs into the watershed that degrade water quality. **INRMP Goal No. 8:** Minimize non-point source pollution of both surface and groundwater in the watershed through the implementation of BMPs.						
WRP-1	**Reports, Other, Stormwater Management Plan – Natural Resources Review (ST)** • Minimize potential for impacts the water resources associated with stormwater runoff and erosion and sedimentation. • Minimize potential for impacts to water resources associated with accidental spills or leakage from vehicles or equipment. • Implement good housekeeping practices to minimize potential for impacts to water quality or habitat associated with trash and other installation debris and materials.	2	CWA	Ongoing	In House, Contractor	TBD
Wetland Protection **INRMP Goal No. 9:** Comply with USACE and the Hawai`i Department of Health Clean Water Branch regulations pertaining to wetlands.						
WP-2	**Monitor, Wetlands (ST)** • Conduct a wetland and waters of the United States delineation at Mt. Ka`ala AFS based on the 1987 USACE Wetlands Delineation Manual and the 2010 Draft Interim Regional Supplement to the USACE Wetland Delineation Manual: Hawai`i and Pacific Islands Region. • Obtain a Jurisdictional Determination from the Honolulu, Fort Shafter, Hawai`i District of USACE for the delineated wetlands. • Any actions that may impact wetlands or other aquatic sites at Mt. Ka`ala AFS must first be reviewed for adequacy in terms of compliance with the 10 April 2008 Compensatory Mitigation for Losses of Aquatic Resources (USACE 33 CFR 325-332) and USEPA (40 CFR Part 230).	2	CWA, Sikes Act	2017	Contractor	TBD
WP-3	**Outreach (ST)** • Educate facility personnel on the locations of wetlands and the need to avoid impacts to the habitats.	2	CWA, Sikes Act	Ongoing	In House	NA

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
WP-4	**Mitigation (ST)** • For each planned project at Mt. Ka`ala AFS, determine if jurisdictional wetlands would be impacted. • If impacts to wetlands would occur, prepare a mitigation plan for each project. • Submit the mitigation plan to the following agencies for review and comment: USACE, USEPA, USFWS, and NOAA-NMFS. • Execute wetland mitigation plan.	1	CWA, Sikes Act	Ongoing	In House	NA
Grounds Maintenance **INRMP Goal No. 10:** Maximize use of native plant species and avoid introduction of invasive, exotic species during re-vegetation activities.						
GM-2	**Management, Habitat, Native Species (ST)** • Use regionally native plant species for revegetation and landscaping activities in accordance with EO 13148 and Chapter 12 of AFI 32-7064 (USAF 2014a).	2	Sikes Act	Ongoing	In House Contractor	NA
Wildland Fire Management **INRMP Goal No. 11:** Support a Wildland Fire Management Program to protect high-value natural resources areas and operational facilities from catastrophic wildfire while conserving resources and military operational flexibility.						
WFM-2	**Plan, Other, Wildland Fire Management Plan (ST)** • Ensure that plans are in place to address wildland fires at Mt. Ka`ala AFS. • Ensure that all installation personnel are aware of actions to be taken in response to wildland fires at the facilities.	2	MBTA, Sikes Act	Ongoing	In house, Contractor	NA

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
Integrated Pest Management **INRMP Goal No. 12:** Develop and employ a systematic approach for onshore and offshore biosecurity, inclusive of rapid response.						
IPM-1	**Plan, Update, Other, IPM Plan (ST)** • If determined necessary, develop an installation specific IPM Plan for Mt. Ka`ala AFS based on USDA-Wildlife Services recommendations. • Incorporate IPM practices into the management and control of pests.	2	Sikes Act	Ongoing	In House	NA
IPM-2	**Management, Invasive Species, Flora and fauna (ST)** • Develop a Long-Term Management Strategy for top invasive species at Mt. Ka'ala AFS which maps out measures to be implemented annually at each installation. • Implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan for Mt. Ka`ala AFS.	2	Sikes Act, ESA, EO13112, MBTA	2016-2020	Contractor	TBD
Cultural Resources Protection **INRMP Goal No. 15:** Ensure that management actions prescribed in this INRMP are consistent with, and do not conflict with, management prescribed in the ICRMP for Mt. Ka`ala AFS.						
CRP-1	**Management, Cultural Sites, Mt. Ka`ala AFS** • Educate installation personnel and visitors on the occurrence of cultural resources on the facilities and actions required to avoid impacts to the resources. • Educate installation personnel and visitors on actions to be taken if previously undocumented cultural resources are discovered, or if unanticipated impacts occur to known resources.	2	NHPA, AFI 32-7065, Sikes Act	Ongoing	In House	NA

Table 10-3. Summary of Mt. Ka`ala Air Force Station Natural Resources Management Actions

Project No.	Tasks and Management Goals	Priority Level	Regulatory Driver	Execution Year	Agent	USAF Project Number
GIS Management Actions **INRMP Goal No. 16:** Collect, store, and maintain data about historical conditions, trends, and current status for critical indicators of ecological integrity and sustainability. Use GIS information as benchmarks for developing future natural resources management goals and objectives.						
GIS-1	**Maintenance, Environmental, Functional Data Layers and Mission Data Sets** • Continue use, development, and maintenance of GeoBase for natural resources management.	2	AFI 32-10112, Sikes Act	Ongoing	In House, Contractor	N/A
Climate Change Management Actions **INRMP Goal No. 17:** Develop an understanding of the potential impacts to natural resources associated with climate change. Develop strategies to address climate change impacts to natural resources.						
CC-1	**Survey, Other, Climate Change Vulnerability Assessment** • Conduct a climate change vulnerability assessment on Mt. Ka`ala AFS.	2	Sikes Act	2016	Contractor	TBD

11. APPENDIXES

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12. ASSOCIATED AND COMPONENT PLANS

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