NEPA Action EA/EIS
Publication Form

Project Name: Management of Invasive Vegetation on Wake Island Airfield, Wake Atoll, Pacific Ocean (EA / FONSI)
Island: Wake Island
District: N/A
TMK: N/A (Wake Island)
Permits: NPDES Construction General Permit

Applicant or Proposing Agency:
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Status:
Publication Date: 11/23/19
Comment Period: 30-days
Deadline: 12/23/19
Transmit Comments to Sam Whitin via email: swhitin@eaest.com

Summary (Provide proposed action and purpose/need in less than 200 words)**:**

The proposed action, scheduled to occur between January and March 2020, includes the removal of ironwood from three areas on Wake Island Airfield (WIA) through various combinations of chainsaw, herbicide application, controlled burn, and/or removal by heavy equipment. Disposal would also be carried out by various methods including wood-chipper, controlled wood-pile burn, or in-situ controlled burn. Due to the unique challenges of performing work at this remote location, including transport of equipment and materials, and potential for equipment failure, the Preferred Alternative includes all feasible methods for ironwood removal and disposal. It is expected that one or more of the methods will be used.

The activity is needed to improve habitat for native species and reduce safety concerns in three regions adjacent to the active runway of WIA. Invasive ironwood trees crowd and shade out native vegetation, force low species richness and diversity, provide habitat for invasive rats, and present a hazard to flight operations due to ironwood presence within the 3,000-foot WIA clear zone adjacent to the taxiway, as mandated by AFI 32-7063 Air Installations Compatible Use Zones Program.

DRAFT
FINDING OF NO SIGNIFICANT IMPACT (FONSI)
Management of Invasive Vegetation on Wake Island Airfield
Wake Atoll, Pacific Ocean

In accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S. Code 4321 et seq.); the Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA, 40 Code of Federal Regulations (CFR) Parts 1500–1508; and USAF policy and procedures (32 CFR Part 989); an Environmental Assessment (EA) was prepared for management of invasive vegetation on Wake Island Airfield (WIA). The EA is incorporated by reference into this finding per 40 CFR 1508.13 and 40 CFR 1502.21.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to improve habitat for native species and reduce safety concerns in three regions adjacent to the active runway of Wake Island Airfield (WIA).

The Proposed Action is needed because invasive ironwood trees crowd and shade out native vegetation, force low species richness and diversity, provide habitat for invasive rats, and present a hazard to flight operations due to ironwood presence within the 3,000-foot (ft) WIA clear zone adjacent to the taxiway, as mandated by Air Force Instruction (AFI) 32-7063 *Air Installations Compatible Use Zones Program*.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Preferred Alternative

The Proposed Action will remove invasive ironwood trees from three areas on Wake Island, followed by out-planting of native vegetation in cleared areas.

Due to the unique challenges associated with performing work on a remote location such as WIA, the Preferred Alternative includes execution of ironwood removal and disposal under the various methods outlined within this document. Challenges include those associated with transport of equipment and materials to and from the island, as well as those associated with equipment repair in the event of failure. Due to these uncertainties, the Preferred Alternative outlines all feasible methods for removal, and it is expected that one or more of the methods outlined here will be used.

Under the Preferred Alternative, the shipment of personnel and equipment to WIA will occur on regularly scheduled transport operations. All equipment and materials that will be brought to Wake Island via vessel or aircraft will be inspected and washed down or treated (if necessary) before shipment to Wake Island. This process will be coordinated, documented, and approved through the 611th Civil Engineer Squadron (CES) Biosecurity Manager. All materials and/or equipment shipped via vessel to Wake Island will comply with the February 2019 "Wake Island Airfield Vessel Movement Biosecurity Requirements" and precautions will be taken to ensure that all activities comply with the 2015 Wake Island Biosecurity Management Plan.

Removal activities would be likely to occur between January and March 2020. The cleared areas will be maintained to ensure proper compliance within the WIA clear zones.

Removal Method: Chainsaw and Herbicide Application

Chainsaws may be used to cut and fell trees at their base without disturbing the subsurface. However, cutting can induce the sprouting of ironwood suckers, or shoots that grow from buds within the tree's root system, and thus systemic herbicide application is required for full ironwood destruction. Caution would be necessary in areas around utilities, power lines, buildings, and historic structures to ensure trees do not fall on nearby developed areas.

Removal by chainsaw and herbicide would be the only method utilized within a 15-ft buffer zone of all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

Excavator-mounted shears could also be utilized to avoid uprooting trees in areas with sufficient clearance for an excavator. It is assumed that there will be potential for rutting from heavy equipment regardless of removal via chainsaw or excavator-mounted shears due to the fact that dump trucks will be necessary to remove felled trunks from the area.

Herbicide application may be used as a method to prevent cut stumps from sprouting new suckers. The Florida Exotic Pest Plant Council recommends applying herbicide to the surface of ironwood stumps, noting that the herbicide application should be concentrated on the layer of tissue immediately inside the bark. Herbicides can also be applied using the hack and squirt (frill-girdle) method in which herbicide is applied to deep cuts in the bark of the tree. Care will be exercised to avoid non-target species.

In accordance with Department of Defense (DoD) Instruction 4150.07, herbicides must be applied by a DoD certified pesticide applicator or under direct supervision of a DoD certified pesticide applicator. Herbicide labels must be provided to confirm if they meet DoD requirements and it is preferred that materials already be on the DoD approved list.

Removal Method: Bulldozer or Similar Heavy Equipment

A bulldozer or similar heavy equipment may be used to uproot and fell trees. Use of a bulldozer would not require use of herbicide, though felled trunks would still require chipping or burning for disposal. Bulldozers would be required to keep the blade raised above the ground to minimize potential impacts to cultural resources and reduce likelihood of encountering/ disturbing unexploded ordnance (UXO). However, the process of tree uprooting itself would cause significant ground disturbance and could still disturb cultural resources, UXO, utilities, roads, transformers, generators, or other infrastructure. Due to this potential for disturbance, a bulldozer would not be used within a 15-ft buffer zone of all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

Disposal Method: Chipper

A chipper may be used to chip felled trees for use as mulch on WIA. Use of the chipper will also require associated use of a thumb-equipped excavator to feed felled trees into the chipper machine. Felled trees would be placed in the designated wood pile and burning/chipping area after removal for processing. Chipped wood could be used as mulch or composted.

Disposal Method: Burning

Woodpile burning may be used as a method to dispose of ironwood trees felled via chainsaw, excavator-mounted shears, bulldozer, or similar heavy equipment. Tree trunks and branches disposed of under this alternative will be placed in the designated wood pile and burning/chipping area and burned in coordination with airfield operations to ensure the associated plume does not interfere with scheduled flights.

Removal and Disposal Method: Controlled Burn

Controlled burning may be used as a method to remove and dispose of ironwood trees in-place and is most effective in dense stands with sufficient dry fuel on the ground. It is likely that getting a sustained fire capable of sufficiently burning live trees would prove difficult, however this method assumes that a fire can be started and sustained without the use of accelerants or other additional efforts to sustain the fire. Fires can be controlled by conducting burning of stands of trees along man-made or natural firebreaks such as roads or clearings. It is important that controlled burning be conducted during periods of favorable wind conditions to reduce the risk of fire spreading to infrastructure. If utilized, all controlled burn activities must be overseen by the Wake Island Fire Department. Controlled burns of ironwood are most effective when allowed to slowly smolder. Unless further subsurface UXO or munitions and explosives of concern (MEC) evaluations occur, controlled burns will only occur in areas where subterranean UXO and MEC sweeps have already been done. Controlled burning would not occur within a 15-ft buffer zone around all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

Native Vegetation Out-Planting

To the maximum extent practicable, felled ironwood will be chipped and spread across the disturbed areas. After disturbance, all areas where ironwood has been removed will be revegetated with an appropriate seed mix or native plantings, which will be conducted in a separate mobilization effort. The later mobilization is required to avoid any residual effect from the herbicides used to terminate the invasive Ironwood trees and allow time to propagate the plantings. The U.S. Fish and Wildlife Service (USFWS) will be assisting with the selection and propagation of the native plantings.

No Action Alternative

Under the No Action Alternative, ironwood trees would not be removed, and the trees would continue to hinder the propagation of native plant species and provide ideal habitat for invasive

rats. The trees would also remain in the WIA clear zones, directly adjacent to the runway, thereby representing a potential hazard to flight operations.

SUMMARY OF FINDINGS

Comparison of Environmental Consequences

Resource Area	Preferred Alternative	No Action Alternative
Air Installation Compatible Use Zone/Land Use	Short-term, direct, minor, adverse Long-term, direct and indirect, major, beneficial	None – No change
Air Quality	Short-term, direct, moderate, adverse Long-term, indirect, minor, adverse	None – No change
Water Resources	***Surface Water:*** Short-term, indirect, minor, adverse ***Groundwater:*** Short-term, indirect, minor, adverse Long-term, indirect, minor, beneficial ***Wetlands:*** Short-term, direct and indirect, moderate, adverse Long-term, indirect, moderate, beneficial	***Surface Water:*** None – No change ***Groundwater and Wetlands:*** Long-term, indirect, minor, adverse
Safety and Occupational Health	Short-term, direct, moderate, adverse Long-term, indirect, moderate, beneficial	Long-term, indirect, moderate, adverse
Hazardous Materials and Wastes	Short-term, indirect, minor, negligible	None – No change
Biological Resources	***Vegetation:*** Short-term, direct, minor, adverse Long-term, direct, major, beneficial ***Wildlife:*** Short-term, indirect, minor, adverse Long-term, indirect, major, beneficial ***Threatened and Endangered Species:*** Short-term, indirect, minor, adverse Long-term, indirect, major, beneficial	None – No change
Cultural Resources	Short-term, direct, moderate, adverse Long-term, direct, moderate, beneficial and adverse	Long-term, indirect, minor, adverse
Geological and Soil Resources	Short-term, indirect, minor, adverse Long-term, indirect, minor, adverse	None – No change
Socioeconomic Resources and Environmental Justice	None – No change	None – No change
Coastal Zone Management	None – No change	None – No change
Utilities and Infrastructure	Short-term, direct and indirect, minor, adverse	None – No Change

Unavoidable adverse effects would result from implementation of the Proposed Alternative. These effects are anticipated to be minor.

Finding of No Significant Impact

After careful review of the attached EA, I have concluded that the Proposed Action would not have a significant impact either by itself or cumulatively on the quality of the natural or human environment. Therefore, issuance of a FONSI is warranted, and an Environmental Impact Statement is not required. This analysis fulfills the requirements of NEPA and implementing

regulations promulgated by the CEQ. Accordingly, the requirements of the National Environmental Policy Act of 1969 and the CEQ, and CFR Title 32, Part 989, Environmental Impact Assessment Process, have been fulfilled, and an Environmental Impact Statement is not necessary and will not be prepared.

[SIGNATURE] **[Date]**

NAME
TITLE

Attachment: Final Environmental Assessment

[***Preparer's Note***: This FONSI will be signed after the public and regulatory comment and review period and final governmental review and analysis.]

Draft Final

ENVIRONMENTAL ASSESSMENT FOR MANAGEMENT OF INVASIVE VEGETATION ON WAKE ISLAND AIRFIELD, WAKE ATOLL, PACIFIC OCEAN

PACIFIC AIR FORCES REGIONAL SUPPORT CENTER
611TH CIVIL ENGINEER SQUADRON
NATURAL RESOURCES PROGRAM
Joint Base Elmendorf-Richardson, Alaska

PREPARED FOR THE 611TH CIVIL ENGINEER SQUADRON
ON BEHALF OF THE UNIVERSITY OF GUAM
BY EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

NOVEMBER 2019

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/m^3	Microgram per cubic meter
AFOSH	Air Force Occupational and Environmental Safety, Fire Protection, and Health
AICUZ	Air Installation Compatible Use Zone
AQCR	Air quality control region
BASH	Bird/Wildlife Aircraft Strike Hazard
BCC	Bird of Conservation Concern
BEZ	Bird Exclusion Zone
BMP	Best management practice
BRA	Bird Reduction Area
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CES	Civil Engineer Squadron
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	Decibel(s)
DBH	Diameter at breast height
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOI	Department of the Interior
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
ft	Foot (feet)
GHG	Greenhouse gas
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IUCN	International Union for Conservation of Nature
JP-5	Grade 5 jet propulsion fuel
MBTA	Migratory Bird Treaty Act
MDA	Missile Defense Agency
MEC	Munitions and explosives of concern

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
$PM_{2.5}$	Particulate matter equal to or less than 2.5 microns in diameter
PM_{10}	Particulate matter equal to or less than 10 microns in diameter
ppm	Part per million
PRSC	Pacific Air Forces Regional Support Center
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
SHPO	State Historic Preservation Office
SSPP	Strategic Sustainability Performance Plan
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USAMDC	U.S. Army Space and Missile Defense Command
USASMDC	U.S. Army Space and Missile Defense Command
USFWS	U.S. Fish and Wildlife Service
UXO	Unexploded ordnance
WIA	Wake Island Airfield
WWII	World War II

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EXECUTIVE SUMMARY

INTRODUCTION

The Pacific Air Forces Regional Support Center (PRSC) 611 Civil Engineer Squadron (611th CES) Natural Resources Program is addressing issues surrounding invasive vegetation management at Wake Island Airfield, (WIA), Wake Atoll (Figure 1). Invasive vegetation management, specifically, physical removal of ironwood trees (*Casuarina equisetifolia*), is critical to helping WIA and CES meet the objectives of the Integrated Natural Resources Management Plan (INRMP), the Sikes Act, Executive Order (EO) 13112 *Exotic and Invasive Species,* Department of Defense Instructions (DoDI) 4715.03 *Natural Resources Conservation*, DoDI 4150.07 *Pest Management*, Air Force Instruction (AFI) 32-1053 *Integrated Pest Management*, and AFI 32-7604 *Integrated Natural Resources Management* and will help WIA meet its ongoing goals for invasive Polynesian rat (*Rattus exulans*) eradication by removing preferred rat habitat. Removal of ironwood is also an integral component of safe flight operations at WIA because the trees are encroaching past U.S. Air Force safety setbacks for woody vegetation relative to an active runway.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to improve habitat for native species and reduce safety concerns in three regions adjacent to the active runway of WIA (Figure 2). The Proposed Action is needed because invasive ironwood trees crowd and shade out native vegetation, force low species richness and diversity, provide habitat for invasive rats, and present a hazard to flight operations due to ironwood presence within the 3,000-foot WIA clear zone adjacent to the taxiway, as mandated by AFI 32-7063 *Air Installations Compatible Use Zones Program* (Figures 3, 4, and 5; PRSC 2017).

The Proposed Action is in alignment with the objectives of WIA's INRMP, approved in accordance with the Sikes Act, 16 U.S. Code 670(a)(1), which requires WIA to "protect native species and discourage non-native, invasive species" and "implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan" (PRSC 2017). The Proposed Action also helps WIA meet the goals outlined by EO 13112, DoDI 4715.03, DoDI 4150.07, AFI 32-1053, and AFI 32-7604, as discussed in Section 1.1.

DESCRIPTION OF THE ALTERNATIVES

Preferred Alternative—The Preferred Alternative includes the removal of ironwood in three areas of WIA through various combinations of chainsaw cutting, herbicide application, controlled burning and/or removal through use of heavy equipment. Disposal would also be carried out by various methods including disposal via wood-chipper, controlled wood-pile burning or in-situ controlled burning. Due to the unique challenges associated with performing work on a remote location such as WIA, the Preferred Alternative includes execution of ironwood removal and disposal under various methods. The unique challenges include those

associated with transport of equipment and materials to and from the island, as well as those associated with equipment repair in the event of failure. Due to these uncertainties, the Preferred Alternative outlines all feasible methods for removal, and it is expected that one or more of the methods outlined here will be used.

Removal activities would be likely to occur between January and March 2020. The cleared areas will be maintained to ensure proper compliance within the WIA clear zones.

No Action Alternative—Under the No Action Alternative, ironwood trees would not be removed and the trees would continue to hinder the propagation of native plant species. The trees would remain in the WIA clear zones directly adjacent to the runway, thereby representing a potential hazard to flight operations.

Alternatives Not Meeting the Purpose and Need

Alternative 1

An alternative considered but eliminated from detailed analysis includes girdling (completely removing a ring of bark from the circumference of the trunk) and herbicide treatment of ironwood trees. This method will not meet the project's purpose and need because it leaves dead trees in place within the WIA clear zones and near the taxiway, and thus does not mitigate associated safety concerns, particularly minimizing the threat to human health and safety from a situation such as an aircraft bird strike. This method is also unsuitable in areas outside of the WIA clear zones and near the taxiway because it leaves trees in-place, which represents an uncontrolled fire hazard in proximity to existing structures, and will eventually generate a follow-on action to cut the trees to ensure they do not fall on infrastructure or represent a fire hazard. While proponents of this method may cite earlier University of Hawai‘i efforts that removed ironwood trees via girdling on Wilkes and Peale islands, these islands do not have consistent human occupation and are considered lower safety risk for impacts from fire or falling hazards to people and the built environment.

Alternative 2

Another alternative considered but eliminated from detailed analysis includes the disposal of felled ironwood trees via barging off WIA for disposal on the mainland. This method will not meet the project's purpose and need because the movement of trees represents a significant biosecurity risk to any area where the trees might be delivered. Because there is a wood-chipper on WIA which would put the trees to beneficial reuse, and burning is a viable disposal alternative, the relative impacts associated with barging trees off WIA are considered untenable.

SUMMARY OF ENVIRONMENTAL IMPACTS

Table ES-1 provides a brief summary and comparison of potential impacts under each alternative.

Table ES-1 Comparison of Environmental Consequences

Resource Area	Preferred Alternative	No Action Alternative
Air Installation Compatible Use Zone/Land Use	Short-term, direct, minor, adverse Long-term, direct and indirect, major, beneficial	None – No change
Air Quality	Short-term, direct, moderate, adverse Long-term, indirect, minor, adverse	None – No change
Water Resources	***Surface Water:*** Short-term, indirect, minor, adverse ***Groundwater:*** Short-term, indirect, minor, adverse Long-term, indirect, minor, beneficial ***Wetlands:*** Short-term, direct and indirect, moderate, adverse Long-term, indirect, moderate, beneficial	***Surface Water:*** None – No change ***Groundwater and Wetlands:*** Long-term, indirect, minor, adverse
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Biological Resources	***Vegetation:*** Short-term, direct, minor, adverse Long-term, direct, major, beneficial ***Wildlife:*** Short-term, indirect, minor, adverse Long-term, indirect, major, beneficial ***Threatened and Endangered Species:*** Short-term, indirect, minor, adverse Long-term, indirect, major, beneficial	None – No change
Cultural Resources	Short-term, direct, moderate, adverse Long-term, direct, moderate, beneficial and adverse	Long-term, indirect, minor, adverse
Geological and Soil Resources	Short-term, indirect, minor, adverse Long-term, indirect, minor, adverse	None – No change
Socioeconomic Resources and Environmental Justice	None – No change	None – No change
Coastal Zone Management	None – No change	None – No change
Utilities and Infrastructure	Short-term, direct and indirect, minor, adverse	None – No Change

Unavoidable adverse effects would result from implementation of the Proposed Action. These effects are anticipated to be minor.

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1. PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The Pacific Air Forces Regional Support Center (PRSC) 611 Civil Engineer Squadron (611th CES) Natural Resources Program is addressing issues surrounding invasive vegetation management at Wake Island Airfield, (WIA), Wake Atoll (Figure 1). Invasive vegetation management, specifically, physical removal of ironwood trees (*Casuarina equisetifolia*), is critical to helping WIA and CES meet the objectives of the Integrated Natural Resources Management Plan (INRMP), the Sikes Act, Executive Order (EO) 13112 *Exotic and Invasive Species,* Department of Defense Instructions (DoDI) 4715.03 *Natural Resources Conservation*, DoDI 4150.07 *Pest Management*, Air Force Instruction (AFI) 32-1053 *Integrated Pest Management*, and AFI 32-7604 *Integrated Natural Resources Management* and will help WIA meet its ongoing goals for invasive Polynesian rat (*Rattus exulans*) eradication by removing preferred rat habitat. Removal of ironwood is also an integral component of safe flight operations at WIA because the trees are encroaching past U.S. Air Force (USAF) safety setbacks for woody vegetation relative to an active runway.

1.2 PROJECT LOCATION

WIA is approximately 2,300 miles southwest of Honolulu and 1,600 miles east of Guam. Wake Island is part of the Wake Atoll, located at 19° 17´ N and 166° 37´ E. It is composed of a lagoon with three coral islands (Peale, Wake, and Wilkes; Figure 1) in a wishbone formation, all built upon an underwater volcano. The total land area of the three islands is 7.12 square kilometers or 1,759 acres. Wilkes Island and Peale Island are uninhabited. Most of Wake Island's infrastructure (dining hall, recreational buildings, residential buildings, etc.) is located on the northern portion of the island. Typical access to WIA is gained only with prior approval and by aircraft on a flight out of Joint Base Pearl Harbor-Hickam on Oahu, Hawai'i.

The proposed project will occur in three distinct regions of Wake Island (Figure 2):

- Project Area 1: South of the Runway (Figure 3)
- Project Area 2: Lagoon/Pipeline (Figure 4)
- Project Area 3: VORTAC Area (Figure 5).

1.3 HISTORY AND BACKGROUND

The PRSC-managed installation functions in support of contingency deployments, serves as an emergency landing facility, provides fuel storage, and supports the needs of the Department of Defense (DoD). In 1962 EO 11048 designated the Secretary of the Interior responsible for all executive, legislative, and judicial authority necessary for the administration of the atoll. The civil administration of the atoll was then handed to the USAF through a 1972 Memoranda of Agreement between USAF and the Department of the Interior (DOI). To this day PRSC manages the atoll according to the terms and conditions of that 1972 Agreement, with one new caveat—the establishment of the surrounding waters of the Pacific Remote Islands Marine National Monument on 6 January 2009 by Presidential Proclamation 8336. Authority is

delegated to DOI and managed by DOI as a unit of the U.S. National Wildlife Refuge System; however, Secretary of the Interior Order 3284 maintains civil administration of emergent land on the atoll with USAF.

Ironwood has been documented on Wake Atoll since at least 1959, with specific events such as the 1970s "family tree planting days", which were held on the atoll to set out young ironwood trees (U.S. Army Space and Strategic Defense Command 1994). In the years since, ironwood has crowded out native vegetation. Recent ironwood management activities have occurred over four separate events between December 2016 and February 2018. Management activities, overseen by the University of Hawai'i, took place on Wake, Peale, and Wilkes islands. These activities utilized an herbicide treatment, which included the application of Garlon 4 Ultra, mixed with blue dye and diesel at a ratio of 1:4 Garlon sprayed on cut trees (cut stump method) or injected in those that had been frilled (frill-girdle method). Seedlings and saplings were also removed by the root. Overall, 71.8 acres of ironwood were treated, with a mortality rate over 95 percent (Gilardi 2017; Gilardi and Duffy 2018). The area anticipated for clearing during the 2019 effort is depicted in Figures 2, 3, 4, and 5.

1.4 PURPOSE, NEED, AND DECISION TO BE MADE FOR THE PROPOSED ACTION

1.4.1 Purpose

The purpose of the Proposed Action is to improve habitat for native species and reduce safety concerns in three regions adjacent to the active runway of WIA (Figure 2).

1.4.2 Need

The Proposed Action is needed because invasive ironwood trees crowd and shade out native vegetation, force low species richness and diversity, provide habitat for invasive rats, and present a hazard to flight operations due to ironwood presence within the 3,000-foot (ft) WIA clear zone adjacent to the taxiway, as mandated by AFI 32-7063 *Air Installations Compatible Use Zones Program* (Figures 3, 4, and 5; PRSC 2017).

The Proposed Action is in alignment with the objectives of WIA's INRMP, approved in accordance with the Sikes Act, 16 U.S. Code 670(a)(1), which requires WIA to "protect native species and discourage non-native, invasive species" and "implement nuisance and non-native species management actions presented in the Biological Control, Survey, and Management Plan" (PRSC 2017). As discussed in Section 1.1, the Proposed Action also helps WIA meet the goals outlined by EO 13112, DoDI 4715.03, DoDI 4150.07, AFI 32-1053, and AFI 32-7604.

1.4.3 Decision to be Made

The decision to be made is the selection of an alternative for PRSC to support the proposed action, which includes removal of invasive ironwood trees from three areas on Wake Island (Figures 2, 3, 4, and 5), and out-plant native vegetation where clearing will take place, and preparation of an associated Finding of No Significant Impact (FONSI). The alternatives involve

the No Action Alternative, which leaves invasive ironwood trees in place on Wake Atoll, or the Preferred Alternative, which uses a combination of removal and disposal methods to reduce invasive ironwood tree populations on Wake Atoll.

1.5 SUMMARY OF KEY ENVIRONMENTAL QUALITY COMPLIANCE REQUIREMENTS

1.5.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is a federal statute requiring the identification and analysis of potential environmental impacts associated with proposed federal actions before those actions are taken. The intent of NEPA is to help decision-makers make well-informed decisions based on an understanding of the potential environmental consequences, and take actions to protect, restore, or enhance the environment. NEPA established the Council on Environmental Quality (CEQ), which was charged with the development of implementing regulations and ensuring federal agency compliance with NEPA.

The CEQ regulations mandate that all federal agencies use a prescribed structured approach to environmental impact analysis. This approach also requires federal agencies to use an interdisciplinary and systematic approach in their decision-making process. This process evaluates potential environmental consequences associated with a Proposed Action and considers alternative courses of action.

The regulations established by CEQ ensuring compliance with NEPA are contained in 40 Code of Federal Regulation (CFR) Parts 1500-1508. Those regulations dictate that an Environmental Assessment is prepared to provide evidence for determining whether to prepare a FONSI or an Environmental Impact Statement is needed. The Environmental Impact Analysis Process (32 CFR Part 989, as amended) outlines the process for implementing NEPA.

AFI 32-7061 (32 CFR Part 989) provides policy and procedures for DoD officials to review environmental considerations when evaluating major DoD actions. The directive requires DoD components to integrate the NEPA process during the initial planning stages of proposed DoD actions to ensure that planning and decisions reflect environmental values.

USAF Policy Directive 32-70 states that the USAF would comply with applicable federal, state, and local laws and regulations, including NEPA. The USAF implementing regulation for NEPA is AFI 32-7061.

Upon completion of the Environmental Assessment review and consultation process, the project sponsor, USAF, would determine whether the Proposed Action would result in significant impacts to environmental or other resources. If significant impacts are expected to result, the USAF would then be required to decide whether to move forward with the development of an Environmental Impact Statement or to abandon the Proposed Action altogether. If no significant impacts are expected, then the USAF can publish a FONSI and move forward with the Proposed Action as such.

1.6 COORDINATION FOR ENVIRONMENTAL PLANNING AND PUBLIC INVOLVEMENT

To ensure compliance with the National Historic Preservation Act (NHPA), the PRSC coordinated and consulted with the Alaska State Historic Preservation Office (SHPO). The PRSC, Cultural Resources Manager has begun consultation with the Alaska State Historic Preservation Office and anticipates a letter of concurrence the week of 5 Dec 2019.

The Draft Final EA and FONSI was filed with the State of Hawaii Office of Environmental Quality Control on 18 November 2019 was and made available for public review on 23 November 2019. Copies of the Draft Final EA and FONSI were also made available for review at the WIA's Detachment Headquarters in the Passenger Terminal. Public and agency comments will be provided in Appendix B after the review period is closed on 23 December 2019.

1.7 ORGANIZATION OF THIS DOCUMENT

This Environmental Assessment is organized into six chapters and includes two appendices as follows:

- ***Chapter 1*** provides the background information, project location, and purpose and need for the Proposed Action.
- ***Chapter 2*** contains a description of the Proposed Action and alternatives, including the No Action Alternative.
- ***Chapter 3*** contains a description of the environmental resources and baseline conditions that could potentially be affected by the Proposed Action and alternatives and will present an analysis of the potential environmental consequences of implementing the Proposed Action and the No Action Alternative.
- ***Chapter 4*** includes an analysis of the potential cumulative impacts at WIA.
- ***Chapter 5*** lists the preparers of this Environmental Assessment.
- ***Chapter 6*** lists the references used in the preparation of this document.
- ***Appendix A*** provides the site figures.
- ***Appendix B*** provides the correspondence record with the State Historic Preservation Office.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The following selection criteria were used to evaluate the Proposed Action and alternatives. Any alternative considered must: (1) fulfill the requirements of NEPA and (2) meet the proposed project's purpose and need, including removal of invasive ironwood and mitigation of associated safety concerns within the WIA clear zones (per AFI 32-7063 *Air Installations Compatible Use Zones Program,* vegetation that would unnecessarily attract birds, waterfowl, or other animals is specifically prohibited within the Clear Zone).

2.1 PROPOSED ACTION

The Proposed Action will remove invasive ironwood trees from three areas on Wake Island (Figures 2, 3, 4, and 5), and out-plant native vegetation where clearing will take place. Removal of invasive ironwood trees is currently being considered to support WIA and the 611th CES in meeting the objectives of their INRMP and EO 13112 *Exotic and Invasive Species*, DoDI 4715.03 *Natural Resources Conservation,* DoDI 4150.07 *Pest Management,* AFI 32-1053 *Integrated Pest Management,* and AFI 32-7604 *Integrated Natural Resources Management* and will help WIA meet its ongoing goals for invasive Polynesian rat (*Rattus exulans*) eradication by removing preferred rat habitat. Removal of ironwood is also an integral component of safe flight operations at WIA because the trees are encroaching past USAF safety setbacks for woody vegetation relative to an active runway. These activities will disturb vegetation and migratory bird roosting habitat and will result in minor impacts to wetlands. In addition, due to the historic nature of WIA, there are many historic features that contribute to the Wake Island Atoll National Historic Landmark in the project area.

Wetland impacts would be addressed in compliance with EO 11990, the Clean Water Act (CWA) and Honolulu, Fort Shafter, Hawai'i District of the U.S. Army Corps of Engineers (USACE), through their permit requirements. Impacts to threatened or endangered migratory birds protected under the Migratory Bird Treaty Act (MBTA) are not anticipated but would be addressed through consultation with the U.S. Fish and Wildlife Service (USFWS). Cultural resource impacts will be assessed in compliance with Section 106 of the National Historic Preservation Act (NHPA) to ensure any impacts to cultural resources are appropriately assessed by the Alaska State Historic Preservation Officer. There are no federally recognized tribes with connections to WIA.

Construction activities would generally involve ground disturbance by heavy construction equipment that could include wood-chippers, excavators, bulldozers, graders, wheel rollers, or dump trucks as well as handheld chainsaws. The disturbances would occur between designated staging areas and each of the three project sites. Equipment would be stored overnight either at the project sites or would be parked out of the way at the project staging area within Project Area 1 (Figure 3). Removal methods as described in Section 2.2 would be selected based on the needs of each specific area, and special precautions would be taken with regard to tree uprooting and direction of felling in areas around facilities, cultural resources (known or potential), and UXO (known or potential) to prevent disturbance, damage, or detonation. Any remaining ironwood stumps would be treated with herbicide to prevent regrowth as described in Section 2.2 and would be cleared in areas around facilities where they could become tripping or vehicle

hazards. After disturbance, the disrupted areas would be regraded and revegetated with an appropriate seed mix or native plantings to the maximum extent practicable. In areas of wetland disturbance, implementation of best management practices (BMPs) such as utilization of existing roadways to access project sites and application of herbicide that has been approved for use in and around wetlands will minimize any impacts to wetlands in the project area.

Due to the potential for unexploded ordinance (UXO) at the project sites, UXO safety personnel will be present onsite during all tree clearing operations. BMPs for UXO safety will be followed by all project personnel, which include having at least one UXO technician present during all ironwood clearing activities and requiring all project personnel to follow the direction of the UXO technician.

Similarly, due to the potential for cultural resources to be present at the project sites, one cultural resource expert will be present onsite during all tree clearing operations.

2.2 PREFERRED ALTERNATIVE

Due to the unique challenges associated with performing work on a remote location such as WIA, the Preferred Alternative includes execution of ironwood removal and disposal under the various methods outlined below. Challenges include those associated with transport of equipment and materials to and from the island, as well as those associated with equipment repair in the event of failure. Due to these uncertainties, the Preferred Alternative outlines all feasible methods for removal, and it is expected that one or more of the methods outlined here will be used.

Under the Preferred Alternative, the shipment of personnel and equipment to WIA will occur on regularly scheduled transport operations. All equipment and materials that will be brought to Wake Island via vessel or aircraft will be inspected and washed down or treated (if necessary) before shipment to Wake Island. This process will be coordinated, documented, and approved through the 611th CES Biosecurity Manager. All materials and/or equipment shipped via vessel to Wake Island will comply with the February 2019 "Wake Island Airfield Vessel Movement Biosecurity Requirements" (PRSC 2019) and precautions will be taken to ensure that all activities comply with the 2015 Wake Island Biosecurity Management Plan (PRSC 2015).

Removal activities would be likely to occur between January and March 2020. The cleared areas will be maintained to ensure proper compliance within the WIA clear zones.

Removal Method: Chainsaw and Herbicide Application

Chainsaws may be used to cut and fell trees at their base without disturbing the subsurface. However, cutting can induce the sprouting of ironwood suckers, or shoots that grow from buds within the tree's root system, and thus systemic herbicide application is required for full ironwood destruction. Caution would be necessary in areas around utilities, power lines, buildings, and historic structures to ensure trees do not fall on nearby developed areas.

Removal by chainsaw and herbicide would be the only method utilized within a 15-ft buffer zone of all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

Excavator-mounted shears could also be utilized to avoid uprooting trees in areas with sufficient clearance for an excavator. It is assumed that there will be potential for rutting from heavy equipment regardless of removal via chainsaw or excavator-mounted shears due to the fact that dump trucks will be necessary to remove felled trunks from the area.

Herbicide application may be used as a method to prevent cut stumps from sprouting new suckers (Global Invasive Species Database 2010). The Florida Exotic Pest Plant Council (2011) recommends applying a 50 percent aqueous solution of Garlon 3A or a 10–20 percent solution of Garlon 4 Ultra to the surface of ironwood stumps, noting that the herbicide application should be concentrated on the layer of tissue immediately inside the bark. The same herbicides at the same concentrations can be applied using the hack and squirt (frill-girdle) method in which herbicide is applied to deep cuts in the bark of the tree. For this method, cuts should be angled down to allow herbicide to pool. For smaller trees with a diameter at breast height (DBH) of up to 6 inches, herbicides containing triclopyr ester (such as Pathfinder II or Garlon 4) or a 10–20 percent solution of Garlon 4 Ultra in oil (diesel, mineral, or citrus oil) can be applied to the bark around the base of the tree. Spraying herbicides such as Garlon 3A or Garlon 4 Ultra in a 3–5 percent solution in water directly onto the leaves of ironwood can also be effective. Care should be taken to avoid non-target species (Pernas et al. 2013).

Triclopyr ester, or Garlon 4, is effective against woody plants such as ironwood, and provides relatively low residual control, being active in the soil for only about 46 days. However, it cannot be utilized near water as it can be toxic to fish. Garlon 3A, a form of triclopyr amine, is approved for use over water, and can be utilized in areas where there are sensitive aquatic receptors (PRSC 2017).

In accordance with DoDI 4150.07, herbicides must be applied by a DoD certified pesticide applicator or under direct supervision of a DoD certified pesticide applicator. Herbicide labels must be provided to confirm if they meet DoD requirements and it is preferred that materials already be on the DoD approved list.

There is not a requirement to maintain a CWA National Pollutant Discharge Elimination System (NPDES) permit to apply herbicides on Wake Island (PRSC 2017).

Removal Method: Bulldozer or Similar Heavy Equipment

A bulldozer or similar heavy equipment may be used to uproot and fell trees. Use of a bulldozer would not require use of herbicide, though felled trunks would still require chipping or burning for disposal. Bulldozers would be required to keep the blade raised above the ground to minimize potential impacts to cultural resources and reduce likelihood of encountering/ disturbing UXO. However, the process of tree uprooting itself would cause significant ground disturbance and could still disturb cultural resources, UXO, utilities, roads, transformers,

generators, or other infrastructure. Due to this potential for disturbance, a bulldozer would not be used within a 15-ft buffer zone of all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

Disposal Method: Chipper

A chipper may be used to chip felled trees for use as mulch on WIA. Use of the chipper will also require associated use of a thumb-equipped excavator to feed felled trees into the chipper machine. Felled trees would be placed in the designated wood pile and burning/chipping area (Figure 3) after removal for processing. Chipped wood could be used as mulch or composted.

Disposal Method: Burning

Woodpile burning may be used as a method to dispose of ironwood trees felled via chainsaw, excavator-mounted shears, bulldozer, or similar heavy equipment. Tree trunks and branches disposed of under this alternative will be placed in the designated wood pile and burning/chipping area (Figure 3) and burned in coordination with airfield operations to ensure the associated plume does not interfere with scheduled flights.

Removal and Disposal Method: Controlled Burn

Controlled burning may be used as a method to remove and dispose of ironwood trees in-place and is most effective in dense stands with sufficient dry fuel on the ground (Elfers 1988). It is likely that getting a sustained fire capable of sufficiently burning live trees would prove difficult, however this method assumes that a fire can be started and sustained without the use of accelerants or other additional efforts to sustain the fire. Fires can be controlled by conducting burning of stands of trees along man-made or natural firebreaks such as roads or clearings. It is important that controlled burning be conducted during periods of favorable wind conditions to reduce the risk of fire spreading to infrastructure. If utilized, all controlled burn activities must be overseen by the Wake Island Fire Department. Controlled burns of ironwood are most effective when allowed to slowly smolder (Morton 1980). Unless further subsurface UXO or munitions and explosives of concern (MEC) evaluations occur, controlled burns will only occur in areas where subterranean UXO and MEC sweeps have already been done. Controlled burning would not occur within a 15-ft buffer zone around all known cultural resources, buildings, hazardous material storage sites, and other sensitive resource areas.

2.3 NO ACTION ALTERNATIVE

CEQ regulations require consideration of the No Action Alternative for all Proposed Actions. The No Action Alternative serves as a baseline against which the impacts of the Proposed Action and other potential alternatives can be compared.

Under the No Action Alternative, ironwood trees would not be removed, and the trees would continue to hinder the propagation of native plant species and provide ideal habitat for invasive rats. The trees would also remain in the WIA clear zones, directly adjacent to the runway, thereby representing a potential hazard to flight operations.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

As the NEPA process progresses, removal and disposal methods outlined under the preferred alternative may be eliminated if they are identified not to meet the project's purpose and need or will be unable to avoid all non-mitigable adverse effects, including those to the environment, cultural resources, or the 611th CES mission.

An alternative considered but eliminated from detailed analysis includes girdling (completely removing a ring of bark from the circumference of the trunk) and herbicide treatment of ironwood trees. This method will not meet the project's purpose and need because it leaves dead trees in place within the WIA clear zones and near the taxiway, and thus does not mitigate associated safety concerns, particularly minimizing the threat to human health and safety from a situation such as an aircraft bird strike. This method is also unsuitable in areas outside of the WIA clear zones and near the taxiway because it leaves trees in-place, which represents an uncontrolled fire hazard, and will eventually generate a follow-on action to cut the trees to ensure they do not fall on infrastructure or represent a fire hazard. While proponents of this method may cite earlier University of Hawai'i efforts that removed ironwood trees via girdling on Wilkes and Peale islands, these islands do not have consistent human occupation and are considered lower risk for fire or falling hazards to people.

Another alternative considered but eliminated from detailed analysis includes the disposal of felled ironwood trees via barging off WIA for disposal on the mainland. This method will not meet the project's purpose and need because the movement of trees represents a significant biosecurity risk, as well as a significant negative environmental effect due to the major carbon footprint associated with barging multiple tons of trees across the ocean. Because there is a wood-chipper on WIA which would put the trees to beneficial reuse, and burning is a viable disposal alternative, the relative impacts associated with barging trees off WIA are considered untenable.

2.5 EFFECTS ANALYSIS OF INDEPENDENT REMOVAL AND DISPOSAL COMBINATIONS OF THE PREFERRED ALTERNATIVE

As discussed in Section 2.2, the unique challenges associated with performing work on a remote location such as WIA require that Preferred Alternative include execution of ironwood removal and disposal under various methods. To aid the reader in understanding the impacts of each removal and disposal combination, Table 2-1 has been developed.

Table 2-1 Relative Impacts of Various Removal and Disposal Alternatives

Removal/Disposal Alternative	Proposed Action: Remove Ironwood Trees in Three Areas of Wake Atoll and Dispose of Ironwood Trees	No Action Alternative
Removal: Chainsaw/Herbicide **Disposal:** Wood-Chipper	Removal of ironwood trees would occur with minimal ground disturbance, without uprooting, and disposal would have minimal air quality impacts. Removal via chainsaw/herbicide would not present a risk to	Same as current conditions.

Table 2-1 Relative Impacts of Various Removal and Disposal Alternatives

Removal/Disposal Alternative	Proposed Action: Remove Ironwood Trees in Three Areas of Wake Atoll and Dispose of Ironwood Trees	No Action Alternative
	unknown cultural resources, underground utilities, or hazardous materials/wastes, and would minimize impacts to biological resources. This removal method would not destabilize soil and risk erosion. Disposal of ironwood trees via wood-chipper would provide a beneficial reuse to the island as wood chips could be utilized for mulch and would not significantly impact air quality. Overall, this removal/ disposal method is the least disruptive, but most time-consuming.	
Removal: Chainsaw/Herbicide **Disposal:** Wood Pile Burning	Removal of ironwood trees would occur with minimal ground disturbance, without uprooting, and disposal would have moderate, adverse air quality impacts. Removal via chainsaw/herbicide would not present a risk to unknown cultural resources, underground utilities, buried UXO/MEC, or hazardous materials/wastes, and would minimize impacts to biological resources. This removal method would not destabilize soil and risk erosion. Disposal of ironwood trees via wood pile burning would have adverse air quality impacts, and would require scheduling around airfield operations; however, it would not represent a time-intensive disposal process. Overall, this removal/disposal method is not disruptive to sensitive ground resources but does cause greater emissions on disposal.	Same as current conditions.
Removal: Dozer/Heavy Equipment **Disposal:** Wood-Chipper	Removal of ironwood trees would occur with maximum ground disturbance with full uprooting, and disposal would have minimal air quality impacts. Removal via dozer/heavy equipment would present a risk to unknown cultural resources, underground utilities, and buried UXO/MEC, but would not impact hazardous materials/wastes and would minimize impacts to biological resources. Disposal of ironwood trees via wood-chipper would provide a beneficial reuse to the island as wood chips could be utilized for mulch and would not significantly impact air quality. Overall, this removal/disposal method is rapid in its ability to remove ironwood and poses a greater risk to unknown underground resources but does not cause significant air emissions on disposal.	Same as current conditions.
Removal: Dozer/Heavy Equipment **Disposal:** Wood Pile Burning	Removal of ironwood trees would occur with maximum ground disturbance with full uprooting, and disposal would have moderate, adverse air quality impacts. Removal via dozer/heavy equipment would present a risk to unknown cultural resources, underground utilities, and buried UXO/MEC, but would not impact hazardous materials/wastes and would minimize impacts to biological resources. Disposal of ironwood trees via wood pile burning would have adverse air quality impacts, and would	Same as current conditions.

Table 2-1 Relative Impacts of Various Removal and Disposal Alternatives

Removal/Disposal Alternative	Proposed Action: Remove Ironwood Trees in Three Areas of Wake Atoll and Dispose of Ironwood Trees	No Action Alternative
	require scheduling around airfield operations; however, it would not represent a time-intensive disposal process. Overall, this removal/disposal method is rapid in its ability to remove and dispose of ironwood but poses a greater risk to unknown underground resources and air quality on disposal.	
Removal: Controlled Burn **Disposal:** Controlled Burn	Removal of ironwood trees would occur with minimal ground disturbance, without uprooting, and disposal would have moderate, adverse air quality impacts. Removal via controlled burning would not present a risk to unknown cultural resources, underground utilities, or hazardous materials/wastes; however, it would pose greater risk to biological resources within the burn area and could only be conducted in areas where a complete UXO/MEC sweep has been completed. This removal method would not destabilize soil and risk erosion. Disposal of ironwood trees via controlled burning would have adverse air quality impacts and would require scheduling around airfield operations and in favorable wind conditions; however, it would not represent a time-intensive disposal process. Overall, this method of removal/disposal is rapid in its ability to both remove and dispose of ironwood; however, it would have adverse impacts on biological resources and can only be utilized in small areas where UXO/MEC sweeps have been completed.	Same as current conditions.

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3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

The affected environment reviews the environmental setting or general environmental conditions of the proposed project area. It describes the environmental baseline against which the environmental effects can be evaluated. In compliance with NEPA and other relevant regulations, only those resource areas considered potentially subject to impacts, and with potentially significant issues, are discussed below. This section includes discussions of noise, air quality, land use and recreation, geological resources, water resources, coastal zone management, biological resources, human health and safety, utilities and infrastructure, hazardous materials and wastes, socioeconomic resources and environmental justice, and cultural and visual resources.

The following sections present a description of the environmental resources and baseline conditions that could potentially be affected from implementing the Proposed Action. In addition, an analysis of the potential environmental consequences of implementing the Proposed Action, as well as the No Action Alternative, is also presented. In accordance with CEQ guidelines (40 CFR Part 1508.8), each alternative considered was evaluated for its potential effect on physical, biological, and socioeconomic resources.

The impact analyses consider the alternatives discussed in Chapter 2 that have been identified as reasonable for meeting the purpose and need for action. Those alternatives include:

Preferred Alternative—The Preferred Alternative includes the full removal and disposal of ironwood trees in Project Areas 1, 2, and 3. Under the Preferred Alternative, the shipment of personnel and equipment to WIA will occur on regularly scheduled transport operations, which will temporarily impact the number of people on-island as well as the type of equipment that is used in this remote location. Mitigation measures from the Wake Island Biosecurity Management Plan (PRSC 2015) will be taken, including that all equipment and materials brought to Wake Island via vessel or aircraft will be inspected and washed down or treated (if necessary) before shipment to Wake Island. Approval of the 611th CES Biosecurity Manager will be required for all shipment operations.

No Action Alternative—Under the No Action Alternative, ironwood trees would remain in Project Areas 1, 2, and 3. Under this alternative, the ironwood would continue to crowd and shade out native vegetation, force low species richness and diversity, and present a hazard to flight operations due to ironwood presence within the WIA clear zones and adjacent to the taxiway (Figures 3, 4, and 5; PRSC 2017).

The criteria below were used to analyze impacts on the resources. For the purposes of this report, the existing conditions are used as a baseline comparison for the Preferred Alternative or No Action Alternative impacts. Each impact discussion for each resource area in the Environmental Consequences section will begin with the following:

- No effects would be expected

- Minor adverse effects would be expected
- Minor beneficial effects would be expected
- Moderate adverse effects would be expected
- Moderate beneficial effects would be expected
- Major adverse effects would be expected
- Major beneficial effects would be expected
- Combination of the above (minor beneficial and minor adverse effects would be expected).

To further clarify the nature of the various impacts upon each resource in the Environmental Consequences section of this Draft Environmental Assessment, the following terms were used and are defined.

Short-Term or Long-Term—These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity, for a finite period, or only during the time required for construction or installation activities. Long-term impacts are those that are more likely to be persistent and chronic.

Direct or Indirect—A direct impact is caused by and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a Preferred Alternative and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a water body might include sediment-laden waters in the vicinity of the action, whereas an indirect impact of the same erosion might lead to lack of spawning and result in lowered reproduction rates of indigenous fish in nearby waters.

Negligible, Minor, Moderate, or Major—These relative terms are used to characterize the magnitude or intensity of an impact. Negligible impacts are generally those that might be perceptible but are at the lower level of detection. A minor effect is slight, but detectable. A moderate impact is readily apparent. A major impact is one that is severely adverse or exceptionally beneficial.

Adverse or Beneficial—An adverse impact is one having unfavorable or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.

3.1 AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE

3.1.1 Definition of the Resource

AFI 32-7063, *Air Installations Compatible Use Zones Program*, requires air force installations to develop, implement, and maintain an Air Installation Compatible Use Zone (AICUZ) program for each installation. This instruction promotes long-term compatible land use in the vicinity of air installations, promotes education and engagement with communities affected by military operations, and defines procedures where aircraft operations may affect public health, safety, and/or welfare or where certain uses or structures may obstruct the airspace, attract birds, create electromagnetic or thermal interference, or produce dust, smoke, steam, or light emissions that could impact a pilot's vision, or otherwise can be hazardous to or incompatible with aircraft operations. AICUZ programs also define areas of higher risk from aircraft accidents and high noise exposure and provides recommended land uses.

Land use generally refers to real property classifications that indicate either natural conditions or the types of human activity occurring on a parcel. Natural conditions of property can be described or categorized as unimproved, undeveloped, conservation or preservation area, and natural or scenic area. Descriptive terms often used include residential, commercial, industrial, agricultural, institutional, and recreational.

Sound is defined as a particular auditory effect produced by a given source. Noise and sound share the same physical aspects; however, noise is considered a disturbance while sound is defined as an auditory effect. Noise is typically defined as any sound that is undesirable because it interferes with communications, is intense enough to damage hearing, or is otherwise bothersome. Noise can be intermittent or continuous, steady or impulsive, and can involve any number of sources and frequencies. Human response to increased sound levels varies according to the source type, characteristics of the sound source, distance between source and receptor, receptor sensitivity, and time of day. Affected receptors can be specific, such as schools or hospitals, or broad, such as green space or wildlife reserves, in which occasional or persistent sensitivity to noise above ambient levels exists.

3.1.2 Existing Conditions

Wake Island has three distinct areas of activity: areas including the airfield, 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. Vacant areas are in places filled by grass, ironwood, or other vegetation. 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; fire station; gym; morale, welfare, and recreation buildings; single-family housing; and billeting (USAF 2012).

Wake Atoll also includes Wilkes Island and Peale Island, which support large numbers of resident and migratory seabirds and visiting winter resident shorebirds and waterfowl. As a

result, bird sanctuary has been established on Wilkes Island. Wilkes Island receives selective grounds maintenance and contains bulk fuel storage and there are no active facilities on Peale Island (PRSC 2017).

Wind and surf contribute to relatively high natural background sound levels on Wake Island. These background levels can mask the approach of vehicles and personnel are not always aware of aircraft landings. Roosting birds also contribute to relatively high natural background sound levels.

Anthropogenic sources of noise at Wake Island are from airfield operations and base maintenance activities. The most common military aircraft are C-17s. An Air Force C-5 is the noisiest aircraft that typically operates at Wake Island. It is estimated to generate A-weighted sound pressure levels of approximately 84 decibels (dB) at the base dispensary, 69 dB at the midpoint of Peale Island, and 95 dB at the midpoint of Wilkes Island. Hearing protection is required for personnel engaged in aircraft apron operations. Estimates of aircraft noise were developed using DoD Noise Exposure Model Version 6.1 (U.S. Army Space and Missile Defense Command [USASMDC] 1999). Infrequent missile launches are another noise source on Wake Island.

3.1.3 Environmental Consequences

Short-term, direct, minor, and adverse impacts to AICUZ/Land Use; and long-term, direct and indirect, major, and beneficial impacts to AICUZ/Land Use are expected from the Preferred Alternative.

The Preferred Alternative is expected to have minor, adverse, short-term impacts on AICUZ/Land Use. Removal of ironwood trees will involve an increase in use and transport of heavy equipment between the three project areas (Figures 3, 4, and 5). This will increase traffic on WIA roads associated with designated access routes (Figures 6, 7, and 8). Current traffic levels on WIA are considered sufficiently low as to deem this a minor negative impact to land use on the associated roadways. Should controlled burning be utilized as a disposal/removal method, fire department personnel would be present throughout the entire burn and impacts to adjacent AICUZ/Land Use would be short-term and minor. Burning would be timed so that associated smoke would not impact flight operations.

Minor and adverse effects to noise resources would be expected with the Preferred Alternative due to tree removal and disposal activities. These adverse effects would be short term and, following completion of ironwood removal, the noise levels would return to ambient levels. Noise that is typically associated with tree removal generally includes the movement of trucks, and operation of chainsaws, excavators, and chippers. For context, the sound of a heavy truck at 50 ft is approximately 75 dB. In comparison, a rating of 75 dB is louder than an average vacuum cleaner (approximately 70 dB at 3 ft), but quieter than a garbage disposal (approximately 80 dB at 3 ft). As such, construction noises are typically classified as “moderate” levels of noise. Typical noise levels of representative construction equipment that would be used for the Preferred Alternative are provided in Table 3-1.

All construction activities would be conducted during normal business hours (from approximately 7 a.m. to 5 p.m.), and all equipment would be outfitted with mufflers that would be in good working condition.

Table 3-1 Noise Levels of Representative Construction Equipment

Equipment	Noise Level (dB)
Backhoe[1]	80
Chain Saw[1]	85
Dozer[1]	85
Dump Truck[1]	84
Excavator[1]	85
Front End Loader[1]	80
Grader[1]	85
Wood-Chipper[2]	81

Noise levels are given at a distance of 50 ft from the source.
Source: [1]Construction Noise Handbook (Federal Highway Administration 2006).
[2]Noise – Supplemental Information (Howard County Maryland, no date).

During tree removal activities, the existing solid waste accumulation area (Figure 3) will be utilized as a space to pile the trunks of removed trees. The solid waste accumulation area would also be utilized to dispose of trees via burning and/or chipping. The burning of trees would also result in short-term negative impacts to airfield operations and land use due to the size of smoke plumes. These burning activities would be timed in coordination with WIA airfield operations to minimize land use impacts during scheduled flight times.

Tree removal will occur adjacent to one Installation Restoration Program site with land use controls in effect: OT013, Scrap Metal Pile No. 2/Dump Site (Figure 3; EA Engineering, Science, and Technology, Inc., PBC 2017). It is not anticipated that tree removal will occur within OT013. Should tree removal be deemed feasible within the area, project personnel will consult the installation Remedial Project Manager to ensure compliance with all land use control restrictions and monitoring, inspection, and reporting requirements. Restrictions outlined in the 2017 Land Use Control Management Plan for this site include, "No residential use of areas within Site OT013 that contain COC [contaminant of concern] concentrations above the residential RACGs [remedial action cleanup goals] for soil," and "No removal of site soil for uncontrolled use elsewhere," (EA Engineering, Science, and Technology, Inc., PBC 2017). Ironwood removal would not constitute residential use and coordination with the Remedial Project Manager would ensure that no removal/reuse of site soil would occur. Ingress and egress to the vehicle staging area (Figure 6) will occur along one edge of Site OT013; however, no ground-disturbing activities will occur as a result of driving on the existing roadway.

The Preferred Alternative is expected to have long-term, direct, major, and beneficial impacts to AICUZ/land use. The removal of ironwood trees in the WIA clear zones and adjacent to the taxiway will have major direct beneficial impacts to WIA airfield safety and, therefore, the use of the runway will be improved.

None of the three project areas or access routes are designated recreational facilities; therefore, recreational facilities will not be impacted. Project activities are not anticipated to alter land use

designations (Figure 9). Areas cleared of ironwood trees will remain open and will be revegetated with native plantings as practicable.

No Action Alternative

The No Action Alternative is expected to have short- and long-term, indirect, moderate, and adverse impacts to AICUZ/land use. Adverse impacts in both the short and long term are associated with the continued safety hazard posed by ironwood trees in proximity to the runway and WIA clear zones. Wake Island residents have also expressed frustration with the presence of nuisance invasive rats that prefer habitat within ironwood underbrush, which in turn has a negative impact on outdoor recreation activities (PRSC 2017).

3.2 AIR QUALITY

3.2.1 Definition of the Resource

In accordance with the Federal Clean Air Act (CAA) (42 U.S. Code 7409) requirements, the air quality in a given region or area is measured by the concentration of criteria pollutants in the atmosphere. The air quality in a region is a result of not only the types and quantities of atmospheric pollutants and pollutant sources in an area, but also surface topography, the size of the topological "air basin," and the prevailing meteorological conditions.

Ambient Air Quality Standards—Under the CAA, the U.S. Environmental Protection Agency (EPA) developed National Ambient Air Quality Standards (NAAQS) for pollutants that have been determined to affect human health and the environment. The NAAQS represent the maximum allowable concentrations for ozone measured as either volatile organic compounds or total nitrogen oxides, carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter (including particulate matter equal to or less than 10 microns in diameter [PM10] and particulate matter equal to or less than 2.5 microns in diameter [PM2.5]), and lead(40 CFR Part 50).

Table 3-2 National Ambient Air Quality Standards

Pollutant	Average Period	Federal Air Quality Standards			
		Primary Standard		Secondary Standard	
		Level	Statistic	Level	Statistic
Carbon Dioxide	8-hour	9 ppm	Maximum	None	
	1-hour	35 ppm	Maximum		
Lead	Rolling 3-month average	0.15 µg/m^3	Maximum	Same as Primary	
Nitrogen Dioxide	Annual	0.053 ppm	Arithmetic Mean	Same as Primary	
	1-hour	0.100 ppm	3-year average	None	
PM_{10}	24-hour	150 µg/m^3	Maximum	Same as Primary	
$PM_{2.5}$	Annual	12 µg/m^3	Annual Mean Averaged Over 3 Years	15 µg/m^3	Annual Mean Averaged Over 3 Years
	24-hour	35 µg/m^3	3-year average	Same as Primary	
Ozone	8-hour	0.070 ppm	3 year average	Same as Primary	
Sulfur Dioxide	3-hour	None		0.5 ppm	Maximum
	1-hour	0.075 ppm	3-year average	None	

NOTES: µg/m^3 = Microgram(s) per cubic meter.
ppm = Part(s) per million.

***Attainment versus Non-Attainment and General Conformity*—**EPA classifies the air quality in an air quality control region (AQCR), or in subareas of an AQCR, according to whether the concentrations of criteria pollutants in ambient air exceed the NAAQS. Areas within each AQCR are, therefore, designated as either "attainment," "non-attainment," "maintenance," or "unclassified" for each of the six criteria pollutants. Attainment means that the air quality within an AQCR is better than the NAAQS; non-attainment indicates that criteria pollutant levels exceed NAAQS; maintenance indicates that an area was previously designated non-attainment but is now meeting attainment; and an unclassified air quality designation by EPA means that there is not enough information to appropriately classify an AQCR, so the area is considered unclassified.

***Federal Prevention of Significant Deterioration*—**Federal Prevention of Significant Deterioration (PSD) regulations apply in attainment areas to a major stationary source, (i.e., source with the potential to emit 250 tons per year of any criteria pollutant), and a significant modification to a major stationary source (i.e., change that adds 15–40 tons per year to the facility's potential to emit depending on the pollutant). Additional PSD major source and significant modification thresholds apply for greenhouse gases (GHGs). PSD regulations can also apply to stationary sources if: (1) a proposed project is within 10 kilometers of national parks or wilderness areas (i.e., Class I Areas), and (2) regulated stationary source pollutant emissions would cause an increase in the 24-hour average concentration of any regulated pollutant in the Class I area of 1 microgram per cubic meter or more (40 CFR 52.21[b][23][iii]). A Class I area includes national parks larger than 6,000 acres, national wilderness areas and national memorial parks larger than 5,000 acres, and international parks. PSD regulations also define ambient air increments, limiting the allowable increases to any area's baseline air contaminant concentrations, based on the area's Class designation (40 CFR 52.21[c]).

***Greenhouse Gas Emissions*—**GHGs are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The most common GHGs emitted from natural processes and human activities include carbon dioxide, methane, and nitrous oxide. GHGs are primarily produced by the burning of fossil fuels and through industrial and biological processes. On 22 September 2009, EPA issued a final rule for mandatory GHG reporting from large GHG emissions sources in the United States. The purpose of the rule is to collect comprehensive and accurate data on carbon dioxide and other GHG emissions that can be used to inform future policy decisions. In general, the threshold for reporting is 25,000 metric tons or more of carbon dioxide equivalent emissions per year but excludes mobile source emissions. The first emissions report was due in 2011 for 2010 emissions.

EO 13514 was signed in October 2009 and requires agencies to set goals for reducing GHG emissions. One requirement within EO 13514 is the development and implementation of an agency Strategic Sustainability Performance Plan (SSPP) that prioritizes agency actions based on lifecycle return on investment. Each SSPP is required to identify, among other things, "agency activities, policies, plans, procedures, and practices" and "specific agency goals; a schedule, milestones, and approaches for achieving results; and quantifiable metrics" relevant to the implementation of EO 13514. On 26 August 2010, DoD released its SSPP to the public. This implementation plan describes specific actions DoD would take to achieve its individual GHG reduction targets, reduce long-term costs, and meet the full range of goals of the EO. All SSPPs segregate GHG emissions into three categories: Scope 1, Scope 2, and Scope 3 emissions. Scope 1 emissions are those directly occurring from sources that are owned or controlled by the agency. Scope 2 emissions are indirect emissions generated in the production of electricity, heat, or steam purchased by the agency. Scope 3 emissions are other indirect GHG emissions that result from agency activities but from sources that are not owned or directly controlled by the agency. The GHG goals in the DoD SSPP include reducing Scope 1 and Scope 2 GHG emissions by 34 percent by 2020, relative to Fiscal Year 2008 emissions; and reducing Scope 3 GHG emissions by 13.5 percent by 2020, relative to Fiscal Year 2008 emissions.

3.2.2 Existing Air Quality

3.2.2.1 Climate

The climate at WIA affects the dispersion of air pollutants and the resulting air quality. The climate is maritime and chiefly controlled by the easterly trade winds, which dominate the island throughout the year. The winds blow steadily every month of the year with very little variation. The yearly average wind speed is 22.2 kilometers (13.8 miles) per hour (Missile Defense Agency [MDA] 2007).

3.2.2.2 Conditions

Wake Island is within the jurisdiction of EPA Region 9. There are no ambient air quality monitoring data for Wake Island, and there are no evident air pollution problems because the strong trade winds quickly disperse any local emissions. Furthermore, because there are no other islands within several hundred miles of Wake Island, there are no nearby sources from which

Wake Island would receive air pollutants, and there are no nearby communities that could be affected by air pollutants from emissions generated at Wake Island (MDA 2007).

The principal pollutant emission sources are periodic firing of the power plant (a solar array has recently been constructed to provide up to 750 kilowatts of WIA's electricity), motor vehicles, aircraft operations, fuel storage tanks, open burning of trash at the base solid waste accumulation area, incinerator emissions, and infrequent rocket launches. None of the emission sources at Wake Island meet the threshold for Title V permitting under the CAA, and no ambient air quality standards have been exceeded (USASMDC 2000 as cited in USASMDC 2002).

3.2.3 Environmental Consequences

Preferred Alternative

Short-term, direct, moderate, and adverse impacts and long-term, indirect, minor, and adverse impacts to air quality are expected from the Preferred Alternative.

The Preferred Alternative is expected to result in moderate temporary adverse impacts to air quality followed by negligible long-term adverse impacts to air quality. During tree removal, air quality is expected to be temporarily impacted by dust and exhaust from the operation of heavy equipment. Burning of trees as part of a controlled burn or burn pile will emit particulate matter ($PM_{2.5}$), along with pollutants such as carbon monoxide and nitrogen oxides. The major local effects of controlled burning or a burn pile are visibility reduction and respiratory impairment near the fire. Controlled burning would increase particulate matter in the air, thus reducing atmospheric visibility. It would also reduce air quality by emitting carbon monoxide and hydrocarbons but would not violate air quality standards. Should controlled burning or a burn pile be utilized, informal consultation with EPA Region 9 would be required (USAF 2019).

The CAA does not require EPA to establish air quality standards for carbon dioxide emissions at this time. Ninety percent of the emissions from forest fires, akin to the proposed burning of ironwood trees, are carbon dioxide and water vapor (Mobley 1976). As an odorless and colorless nontoxic gas formed abundantly in nature by the decomposition of organic substances, it is exhaled by all living organisms during breathing and absorbed from the air by plants for use in photosynthesis. Carbon dioxide's only potential as a pollutant is as a contributor to the overall greenhouse effect that is causing a rise in the Earth's air temperatures; however, given the scale of this project and the challenges associated with modeling the effects on global climate, the quantity of carbon dioxide emitted is beyond the scope of this analysis.

Loss of carbon sequestration associated with the loss of trees was also considered. While calculations for individual trees were not completed for this assessment, the potential long-term impacts to air quality were considered to be *de minimus* because of the number of trees that are likely to be removed.

No Action Alternative

The No Action Alternative is not expected to affect air quality.

3.3 WATER RESOURCES

3.3.1 Surface Water

3.3.1.1 Definition of the Resource

Surface water resources generally consist of permanently or seasonally flooded water features including lakes, ponds, rivers, streams, and oceans.

3.3.1.2 Existing Conditions

Wake lagoon covers approximately 1.5 square miles. 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 about 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. There are also a number of brackish ponds on Wake Island near the southeasternmost portion of the lagoon.

Deep water surrounds the entire atoll. Inside the lagoon, the mean tide range is approximately 1.5 ft. Low tides have a stand of 2–3 hours (PRSC 2017). Tidal flow through the lagoon has been disrupted as the result of historical activities conducted at the atoll. The solid fill causeway connecting Wake Island 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 2008); the lagoon can no longer be qualitatively described in such a manner.

There are no surface water impoundments on Wake Atoll. There are localized areas where runoff is collected and conveyed.

3.3.1.3 Environmental Consequences

Preferred Alternative

Short-term, indirect, minor, and adverse impacts to surface water are expected from the Preferred Alternative.

The Preferred Alternative could result in short-term minor adverse effects to surface water. Herbicides utilized to treat cut stumps have the potential to run off into Wake lagoon, the brackish ponds, or the Pacific Ocean after heavy rainfall events, however use of water-safe herbicides such as Garlon 3A (Triclopyr amine) will be utilized in areas where herbicide is most likely to impact water resources (PRSC 2017). BMPs will be utilized to minimize the amount of herbicide applied to each stump to prevent excess herbicide runoff into surface water, and herbicide will not be applied before predicted rainfall events to ensure that it is absorbed by

ironwood stumps before a rainfall event occurs. As the area of trees to be removed will be over 1 acre, an NPDES Construction General Permit will be required. Should controlled burning or burn piles be utilized, ash from burning would run off into the ocean and negatively impact ocean water quality, but it is not anticipated that concentrations would be sufficiently high to have an impact on marine species.

No Action Alternative

The No Action Alternative is not expected to affect surface water resources.

3.3.2 Groundwater

3.3.2.1 Definition of the Resource

Groundwater resources consist of water located beneath the ground surface in soil pore space, bedrock fractures, and subterranean drainage (i.e., karst dissolution features).

3.3.2.2 Existing Conditions

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. Drinking water on the island is collected via well and treated at an on-island desalination plant (MDA 2015).

3.3.2.3 Environmental Consequences

Preferred Alternative

Short-term, indirect, minor, and adverse impacts to groundwater; and long-term, indirect, minor, and beneficial impacts to groundwater are expected from the Preferred Alternative.

The Preferred Alternative would result in short-term adverse impacts to groundwater. Herbicides utilized to treat cut stumps have the potential to run off treated stumps and infiltrate into groundwater. BMPs will be utilized to minimize the amount of herbicide applied to each stump to prevent excess herbicide runoff into groundwater, and herbicide will not be applied immediately before predicted rainfall events to ensure that it is absorbed by ironwood stumps before rainfall occurs. The Work Plan for the proposed action will include more specifics on water testing to ensure groundwater resources, and in turn drinking water, is not impacted by herbicide application.

The Preferred Alternative would likely result in long-term beneficial impacts to groundwater. The removal of ironwood trees would eliminate trees that currently uptake groundwater to

survive, making more water available to native flora. These impacts would be minor due to the poor quality of groundwater on WIA.

No Action Alternative

Long-term, indirect, minor, and adverse impacts to groundwater are expected from the No Action Alternative.

The No Action Alternative would likely result in long-term negative impacts to groundwater. The continued existence of invasive ironwood trees would continue to uptake groundwater that could be used by native flora.

3.3.3 Wetlands

3.3.3.1 Definition of the Resource

Wetlands and waters of the United States are defined within the CWA, as amended, and jurisdiction is addressed by EPA and USACE. These agencies assert jurisdiction over traditionally navigable waters, wetlands adjacent to navigable waters, non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-around or have continuous flow at least seasonally, and wetlands that directly abut such tributaries. Section 404 of the CWA regulates the discharge of dredge or fills into waters of the United States, including wetlands. Encroachment into waters of the United States and wetlands typically requires a permit from the state and the federal government.

3.3.3.2 Existing Conditions

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.

A Jurisdictional Determination was not obtained from USACE for the wetlands delineated by Hebshi and Patrick in 2007 (PRSC 2017). A Jurisdictional Determination establishes concurrence from USACE regarding the delineated boundaries and establishes whether the wetlands are regulated as Waters of the United States under the 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 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 EPA (40 CFR Part 230). Section 8.7.1 of the INRMP includes management actions that are necessary to update the 2007 wetland delineation and obtain a Jurisdictional Determination for the delineated areas from USACE Honolulu District (PRSC 2017).

3.3.3.3 Environmental Consequences

Preferred Alternative

Short-term, direct and indirect, moderate, and adverse impacts to wetlands; and long-term, indirect, moderate, and beneficial impacts to wetlands are expected from the Preferred Alternative.

The Preferred Alternative would result in short-term, moderate, adverse impacts to wetlands. Wetlands are present throughout portions of Project Area 2 and the Lagoon/Pipeline Area (Figure 4) and have the potential to be disturbed by heavy equipment and falling trees during ironwood removal activities. The implementation of BMPs, including accessing the project site via established roads and outside of wetland areas where practicable (Figure 7), will minimize adverse impacts to wetlands. Any herbicides used on ironwood stumps will be approved for use around wetlands, such as Garlon 3A. Wetlands adversely impacted by ironwood removal activities will be re-graded and re-vegetated with native flora to the extent practicable. As the area of trees to be removed will be over 1 acre, an NPDES Construction General Permit will be required. Coordination with the USACE Honolulu District would occur prior to commencing ironwood removal. Should controlled burning or burn piles be utilized, ash from burning would run off into wetlands and negatively impact wetland water quality, but it is not anticipated that concentrations would be sufficiently high to have an impact on freshwater or brackish species.

The Preferred Alternative would result in long-term, indirect, moderate, and beneficial impacts to wetlands. Clearing of invasive ironwood trees in Project Area 2 will help enable native flora to revegetate areas previously impacted by ironwood.

No Action Alternative

Long-term, indirect, minor, and adverse impacts to wetlands are expected from the No Action Alternative.

The No Action Alternative would likely result in long-term negative impacts to wetlands. The continued existence of invasive ironwood trees would continue to inhabit wetland areas that could be inhabited by wetland flora and fauna, and continued expansion of ironwood into these areas could result in conversion/recruitment of wetland habitat to upland conditions.

3.4 SAFETY AND OCCUPATIONAL HEALTH

3.4.1 Definition of the Resource

A safe environment is one in which there is no, or there is an optimally reduced, potential for death, serious bodily injury or illness, or property damage. Safety and Occupational Health addresses both workers' health and public safety during demolition activities.

Construction site safety is largely a matter of adherence to regulatory requirements imposed for the benefit of employees and implementation of operational practices that reduce risks of illness, injury, death, and property damage. The health and safety of onsite military and civilian workers are safeguarded by numerous DoD and USAF regulations designed to comply with standards issued by the Occupational Safety and Health Administration (OSHA) and EPA. These standards specify the amount and type of training required for industrial workers, the use of protective equipment and clothing, engineering controls, and maximum exposure limits for workplace stressors.

Safety and accident hazards can often be identified and reduced or eliminated. Necessary elements for an accident-prone situation or environment include the presence of the hazard itself together with the exposed (and possibly susceptible) population. The degree of exposure depends primarily on the proximity of the hazard to the population. Activities that can be hazardous include transportation, maintenance and repair activities, and the creation of extremely noisy environments. The proper operation, maintenance, and repair of vehicles and equipment carry important safety implications. Any facility or human use area with potential explosive or other rapid oxidation process creates unsafe environments for nearby populations. Extremely noisy environments can also mask verbal or mechanical warning signals such as sirens, bells, or horns.

The Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program (Secretary of the Air Force 1996) implements the Occupational Safety and Health Air Force Policy Directive (Secretary of the Air Force 1993) by outlining the AFOSH Program. The purpose of the AFOSH Program is to minimize loss of USAF resources and to protect USAF personnel from occupational deaths, injuries, or illnesses by managing risks. In conjunction with the USAF Mishap Prevention Program, these standards ensure all USAF workplaces meet federal safety and health requirements. This instruction applies to all USAF activities.

3.4.2 Existing Conditions

The primary existing hazards at Wake Island are associated with aircraft refueling and base infrastructure support. Typical hazards include the handling and use of hazardous materials, exposure to noise from aircraft operations, and physical safety associated with the use of heavy equipment and support operations. These hazards are managed and controlled through implementation of safety programs, procedures, and the use of safety equipment (U.S. Army Space and Missile Defense Command [USAMDC] 1999). Aircrafts and pilots are additionally exposed to hazards associated with potentially dangerous bird/animal wildlife strikes in the local flying area of WIA (PRSC 2016).

The missile range extending from Wake Island toward the U.S. Army Kwajalein Atoll is under the jurisdiction of the Ronald Regan Ballistic Missile Defense Test Site. In the event of a catastrophic event (e.g., natural disaster, hazardous materials spill, aircraft or missile mishap), Operations Plan 355-1, *Wake Island Disaster Preparedness Plan*, would be implemented (USAMDC 1999).

3.4.3 Environmental Consequences

Preferred Alternative

Short-term, direct, moderate, and adverse impacts are expected from the Proposed Action; and long-term, indirect, moderate, and beneficial impacts are expected from the Proposed Action.

During the demolition process, workers would likely be exposed to materials that may result in injury or ill health. As such, a Health and Safety Plan would be developed in accordance to regulations under OSHA. Project activities would include UXO technicians who would observe potential UXO hazards during ironwood removal. In the event that UXO is discovered during operations on the island, work will cease and explosive demolition crews will dispose of the munitions. All personnel working on or visiting the site would be required to wear the appropriate personal protective equipment. Nearby access routes and roads will be closed during work for passerby safety and action will be taken to control dust and or fugitive emissions during demolition. Should controlled burning be utilized as a disposal method, personnel from the fire department would oversee operations to prevent any risks to safety or occupational health on the island.

Transportation to and from Wake will occur during regularly scheduled rotator flights between Joint Base Pearl Harbor-Hickam on Oahu, Hawai‘i, and WIA, and transportation on-base will involve electric mules, bicycles, or gasoline or diesel-powered vehicles. Project personnel will be exposed to standard hazards associated with air and ground travel and will be expected to abide by all standard safety precautions.

The Preferred Alternative is expected to result in a long-term positive effect to human health and safety. Removal of ironwood trees would reduce hazards in the WIA clear zones and near the taxiway.

No Action Alternative

Long-term, indirect, moderate, and adverse impacts to human health and safety are expected from the No Action Alternative. The health and safety risks posed by the presence of ironwood within the WIA clear zones and near the taxiway would remain. However, since the ironwood trees would not be removed, there would be no potential threat to demolition crews.

3.5 HAZARDOUS MATERIALS AND WASTES

3.5.1 Definition of the Resource

A hazardous substance, pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (42 U.S. Code 9601(14)), is defined as, “any substance designated pursuant to Section 1321(b)(2)(A) of Title 33; any element, compound, mixture, solution, or substance designated pursuant to Section 9602 of this title; any hazardous substance having the characteristics identified under or listed pursuant to Section 3001 of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended (42 U.S. Code 6921); any toxic pollutant listed

under Section 1317(a) of Title 33; any hazardous air pollutant listed under Section 112 of the CAA; and any imminently hazardous chemical substance or mixture with respect to which the Administrator of the EPA has taken action pursuant to Section 2606 of Title 15. The term does not include petroleum, including crude oil or any fraction thereof, which is not otherwise specifically listed or designated as a hazardous substance; and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas)."

Hazardous materials are defined by 49 CFR Part 171.8 as "hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (49 CFR Part 172.101), and materials that meet the defining criteria for hazard classes and divisions" in 49 CFR Part 173. Transportation of hazardous materials is regulated by the U.S. Department of Transportation regulations within 49 CFR Parts 105–180.

RCRA defines a hazardous waste as "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

3.5.2 Existing Conditions

Hazardous Materials

Current fuel storage areas at Wake Atoll accommodate Grade 5 jet propulsion fuel (JP-5), which is used primarily for aircraft refueling and power plant generators (PRSC 2017). They also contain small quantities of lubricants, gasoline, and diesel stored in bulk for base operations and infrastructure support. These materials are transported by ship to WIA and transferred to the onsite storage facilities. Potential spills are managed and minimized through implementation of existing Spill Prevention, Control, and Countermeasures Plans (MDA 2007).

Hazardous Waste

There are several satellite accumulation points located around the installation where waste is temporarily stored. All hazardous waste is moved from the satellite accumulation sites to a main hazardous waste accumulation site to await transportation offsite via barge. All liquid wastes are stored on spill pallets. Types of wastes generated include small quantities of used solvents, paints, cleaning fluids, asbestos-containing materials (generated during building maintenance activities), and pesticides. Waste may be placed in DOT-E-9618-approved polyethylene overpack containers for added security until shipment for treatment or disposal. Hazardous waste shipments are normally consigned to the Wake Island supply barge for shipment to Hawai‘i. (USASMDC 2002).

3.5.3 Environmental Consequences

Preferred Alternative

Short-term, indirect, minor, and negligible impacts from hazardous materials and wastes are expected from the Preferred Alternative.

The Limit of Disturbance for Project Area 2, the lagoon/pipeline area, includes a hazmat storage facility. The Preferred Alternative will include removal of ironwood trees near this storage facility. A Health and Safety Plan for the project would include avoidance behaviors deemed necessary near the storage facility. All necessary precautions would be taken around areas containing hazardous materials and wastes to ensure that trees do not fall on infrastructure and that controlled burning does not near areas containing hazardous materials.

Herbicides, including those proposed for use in this project, are considered hazardous materials. Application of herbicides will be managed judiciously to ensure materials are used wisely in order to meet DoD pesticide-use reduction goals and will be approved by the installation Environmental Office. BMPs for safety using hazardous materials will be taken when applying herbicide to cut stumps including personal protective equipment, limiting application to avoid excess herbicide which can run off into the soil or water, and selecting the proper herbicide for each individual site. Herbicide will be stored in a safe location when not in use. Garlon 4 Ultra and/or Garlon 3A will be transported to WIA on regularly scheduled rotator flights and will comply with all safe shipping procedures.

The increased use and transport of heavy equipment will involve use of gasoline and diesel. All necessary documentation for purchase of fuel on-island will be provided to the Defense Logistics Agency in advance of field efforts.

No Action Alternative

The No Action Alternative is not expected to affect hazardous materials and wastes.

3.6 BIOLOGICAL RESOURCES

Wake Atoll is a biologically diverse group of islands that includes arthropods, small mammals, marine mammals, over 30 species of birds, and over 200 species of plants. A comprehensive review of biological resources is provided in the WIA INRMP and is not repeated here (PRSC 2017).

3.6.1 Vegetation

3.6.1.1 Definition of the Resource

Vegetation resources refer to the plant communities at any scale including grasses, herbs, forbs, shrubs, vines, and trees.

3.6.1.2 Existing Conditions

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 keep the island in a perpetual state of drought. An average annual rainfall of 35 inches provides little drought relief (Weatherbase 2015). 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, including the construction of WIA and associated American and Japanese fortifications and bombardment by American planes during World War II (WWII), has ravaged the landscape since the early 20th century. Common plant communities include tournefortia forest (native), cordia forest (native), pemphis scrub (native), ironwood forest (invasive), ruderal vegetation (primarily invasive), and mowed/maintained (primarily invasive) vegetation. Invasive rats, which enjoy habitat in invasive ironwood forests, are known to forage upon native plants (PRSC 2017).

Ironwood is an aggressive invasive plant that tends to crowd and shade out native vegetation. It also has allelopathic properties, preventing seed germination of other species. As a result, ironwood forests rapidly progress to monocultures characterized by low species richness and diversity. In January 2019, EA completed a field delineation of ironwood stands in the three project areas adjacent to the airfield (Figures 10, 11, and 12). The assessment included delineation of a perimeter for the ironwood stands, as well as an assessment of tree density and tree size assessment through the measurement of DBH and tree-counts within 100-ft-radius test plots.

Within Project Area 1, South of the Runway, trees tend to be more densely concentrated closer to the side of the island facing the southern Pacific Ocean, with smaller average DBHs. Stands closer to the runway exhibit lower density but higher DBHs (Figure 10).

Within Project Area 2, the lagoon/pipeline area, trees have uniformly small DBHs and are densely concentrated (Figure 11). Within Project Area 3, the VORTAC area, trees were not surveyed for DBH, but were qualitatively observed to be low density as compared with Project Areas 1 and 2 (Figure 12). Within Project Area 3, invasive haole koa (*Leucaena leucocephala*) was also observed.

3.6.1.3 Environmental Consequences

Preferred Alternative

Short-term, direct, minor, and adverse impacts to vegetation; and long-term, direct, major, and beneficial impacts to vegetation are expected from the Preferred Alternative.

The Preferred Alternative would result in short-term adverse impacts to vegetation. Off-road transport of heavy machinery including excavators, chippers, bulldozers, similar heavy equipment, and/or chainsaws could negatively impact small native plant communities. The use of herbicides on cut tree stumps has the potential to leach into the soil and negatively impact soil quality and thus habitat for vegetation. However, soil quality on Wake Island is already low due to the lack of essential nutrients and organic matter. Furthermore, observations from Peale and Wilkes islands, where herbicide was used to kill significant numbers of ironwood trees, demonstrate that native heliotrope (*Heliotropium procumbens* var. *depressum*) has still been able to regrow in the surrounding areas. Removal of invasive ironwood trees and invasive haole koa (as practicable) is not considered an adverse impact to vegetation in the short term or long term.

Should controlled burning be utilized as a method for disposal/removal, native vegetation within the burn area would be impacted. Impacts to native vegetation as a result of burning are considered minor as the areas selected for burning would be small and revegetated after removal/disposal.

The Preferred Alternative would result in long-term beneficial impacts to vegetation. Removal of invasive ironwood trees would create space on Wake Island for native plant communities to become re-established in areas previously dominated by ironwood, and would remove habitat for invasive rats, which prey upon native plants. Chipping ironwood trunks would produce mulch for gardens.

No Action Alternative

The No Action Alternative is not expected to affect vegetation at WIA.

3.6.2 Wildlife

3.6.2.1 Definition of the Resource

Wildlife resources refer to the animal communities that have been specifically observed or are considered likely to utilize the habitats that occur within the site. The wildlife community typically includes fish, amphibians, reptiles, birds, and mammals.

3.6.2.2 Existing Conditions

Wildlife on Wake Atoll is dominated by a diversity of seabirds, migratory shorebirds, and waterfowl. Wilkes and Peale islands support large numbers of resident and visiting seabirds and winter resident shorebirds and waterfowl. Resident birds are present all year and are known to breed at Wake Island. Visitor birds include those that are considered passage migrant and vagrants. Winter residents are present on Wake Island during the nonbreeding season. Prior to the presence of humans on Wake Atoll, the islands likely supported a diverse assemblage of seabirds and shorebirds. More than 30 species of resident, migrant, visitor, vagrant, accidental, and exotic birds have been observed on Wake Atoll, including seabirds, shorebirds, land birds, and water birds (PRSC 2017). All seabirds present on the island, except for red-tailed tropic birds (*Phaethon rubricauda*), black noddy (*Anous minutus)*, and brown noddy (*Anous stolidus)*,

are conspicuous nesters that lay their eggs in the open, either on bare ground or exposed in shrubs or small trees. Populations of Laysan and black-footed albatrosses (*Phoebastria immutabilis* and *Phoebastria nigripes*), either nascent or remnant, return to Wake Island each year in November for the courtship and nesting season (MDA 2007).

During the field delineation of ironwood stands detailed in Section 3.6.1.2, an informal assessment of bird activity was completed. The assessment merely involved documenting species noted in the area at the time of ironwood stand delineation. The presence of the following species was noted: black noddy (*Anous minutus)*, brown noddy (*Anous stolidus)*, white tern (*Gygis alba)*, and red-tailed tropicbird (*Phaethon rubricauda).* During the observation activity, there was active and periodic disturbance of bird species within the ironwood assessment area via pyrotechnics as part of the Bird/Wildlife Aircraft Strike Hazard (BASH) program. Other bird species were observed outside of the ironwood stands; however, these species were also harassed as part of the BASH program.

There are no indigenous mammals on Wake Atoll. Various species of rat have been residents of the island, and it currently has a large Polynesian rat (*Rattus exulans*) population despite eradication efforts conducted in May 2012 (Brown et al. 2013). Studies since the failed eradication effort have noted that rats on WIA regularly consume the fruits of ironwood trees and frequently take harbor in ironwood thatch (Teig 2013). A 2013 study recommended that ironwood tree and thatch removal would improve the success of future rat control efforts (USAF 2013).

Reptiles and amphibians present on WIA include various species of geckos and skinks, including the mourning gecko (*Lepidodactylus lugubris*), house gecko (*Hemidactylus frenatus*), and the azure-eyed skink (*Emoia cyanura*) (Bryan 1959; Fritts et al., no date). Green sea turtles (*Chelonia mydas*) are also present.

Invertebrates present on Wake Atoll include terrestrial strawberry hermit crabs (*Coenobita perlata*), and several other species of hermit crabs which occur in tidal pools. Two species of land crabs (*Geograpsus crinipes* and *Geograpsus* sp.) are also present, where they dig burrows in casuarina and tournefortia forests (PRSC 2017).

Marine resources include coral reefs off the coast of WIA, which are protected under EO 13089, *Coral Reef Protection*, which requires federal agencies to "identify their actions that may affect U.S. coral reef ecosystems; utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems" (MDA 2007). The lagoon supports a large population of fish and the surrounding reefs host a diverse assemblage of reef fish. Nearshore fish important for food and recreational purposes include peacock hind (*Cephalopholis argus*), bonefish (*Albula vulpes*), and jacks (Carangidae). Sharks are present (MDA 2007). Also present in the region are three Endangered Species Act (ESA)-listed coral species, *Acropora globiceps*, *Acropora retusa*, and *Acropora speciose*, of which *Acropora globiceps* and *Acropora retusa* have been confirmed in to exist in multiple locations along the southern portion of Wake Atoll (USFWS 2017).

Marine mammals are protected under the Marine Mammal Protection Act of 1972 and may occur in the open ocean area surrounding Wake Atoll and between Wake and Kwajalein Atolls. Marine mammals that may be present include several species of cetaceans: the blue whale (*Balaenoptera musculus*), the finback whale (*Balaenoptera physalus*), the humpback whale (*Megaptera novaeangliae*), Cuvier's beaked whale (*Ziphius cavirostris*), and the sperm whale (*Physeter catodon*). Bottlenose (*Tursiops truncatus*) and spinner dolphins (*Stenella longirostris*) may also be present around Wake Atoll. Hawaiian monk seals (*Monachus schauinslandi*) have also previously been sighted at Wake Island on occasion (MDA 2007).

3.6.2.3 Environmental Consequences

Preferred Alternative

Short-term, indirect, minor, and adverse impacts to wildlife; and long-term, indirect, major, and beneficial impacts to wildlife are expected from the Preferred Alternative.

The Preferred Alternative would result in short-term adverse impacts to wildlife. Off-road transport of heavy machinery including excavators, chippers, bulldozers, similar heavy equipment, and/or chainsaws could negatively impact roosting habitat for birds by displacement and disruption. Birds would be encouraged to exit areas of ironwood clearing before removal activities begin each day, though it is anticipated that birds would vacate the vicinity of the project due to the noise of heavy machinery. Active disturbance as part of the BASH program already occurs within the three project areas on a daily basis; therefore, the impacts of the Preferred Alternative are considered to be minor.

Displacement and disruption of hermit crabs and land crabs, especially *Geograpsus crinipes* and *Geograpsus* sp., that burrow in ironwood underbrush may occur. To minimize impacts to crabs, personnel from the 611th CES natural resources team will look for crabs prior to and during ironwood removal operations and will physically remove all crabs encountered during the proposed action.

The use of herbicides on cut tree stumps has the potential to leach into the soil and negatively impact wildlife habitat. However, observations from Peale and Wilkes islands, where herbicide was used to kill significant numbers of ironwood trees, demonstrate that many native and migratory birds still are able to nest in areas impacted by herbicide.

Burning of felled ironwoods would create a plume of smoke that would temporarily adversely affect wildlife; however, burning within the boundaries of the existing solid waste accumulation area is expected to minimize impacts in wildlife habitat. Removal of invasive ironwood, and thus removal of invasive rat habitat, is not considered an adverse impact to wildlife in the short term or long term.

Controlled burning would negatively impact hermit and land crabs. Similar to removal by heavy equipment, birds would be encouraged to exit areas of ironwood clearing before burning

activities take place. Adverse impacts to wildlife, including crabs, are considered minor due to the fact that controlled burning would only take place in very small areas of the island.

The Preferred Alternative would result in long-term beneficial impacts to wildlife. Removal of invasive ironwood trees would create open space on Wake Island for native plant communities to become re-established in areas previously dominated by ironwood and would remove invasive rat habitat.

The Preferred Alternative is not anticipated to impact marine mammals, coral reefs, fish, reptiles, or amphibians.

No Action Alternative

Long-term, indirect, minor, and adverse impacts to wildlife are expected from the No Action Alternative.

The No Action Alternative would result in long-term adverse impacts to wildlife. Sooty and gray-backed terns would not be able to nest on the ground surrounding the ironwood trees and invasive rats would continue to live within the ironwood thatch. Native vegetation, which provides beneficial impacts to wildlife, would continue to be hindered by the presence of invasive ironwood.

3.6.3 Threatened and Endangered Species and Species of Concern

3.6.3.1 Definition of the Resource

The ESA (16 U.S. Code 1531 et seq.) establishes a federal program to protect and recover imperiled species and the ecosystems upon which they depend. The ESA requires federal agencies, in consultation with USFWS, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is defined by the ESA as any species likely to become an endangered species in the foreseeable future. The ESA also prohibits any action that causes a take of any listed species. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to engage in any such conduct. Listed plants are not protected from take, although it is illegal to collect or maliciously harm them on federal land.

Critical habitat is designated if USFWS determines that the habitat is essential to the conservation of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must ensure that their activities do not adversely modify critical habitat to the point that it would no longer aid in the species' recovery. Areas that are currently unoccupied by the species, but which are needed for the species' recovery, are protected by the prohibition against adverse modification of critical habitat.

3.6.3.2 Existing Conditions

Federally listed threatened and endangered terrestrial biota on Wake Atoll are limited to migratory seabirds and shorebirds. 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 (PRSC 2017). These birds are classified as "migratory" and are protected under the MBTA (16 U.S. Code 703-712). Invasive rats, which enjoy habitat within invasive ironwood stands, are known to prey upon seabird eggs and chicks (PRSC 2017). Table 3-3 lists the migratory birds that have been documented on Wake Atoll by the 2017 INRMP and supporting studies, as well as their status (PRSC 2017). Species listed by USFWS as a Bird of Conservation Concern (BCC) (USFWS 2008) or by the International Union for Conservation of Nature (IUCN) (2015) as Vulnerable Near Threatened are also included in the table.

Table 3-3 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 querquedula	Garganey	MBTA
Asio flammeus	Short-eared owl	MBTA
Aythya fuligula	Tufted duck	MBTA
Branta hutchinsii leukopenia	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

Table 3-3 Migratory Birds Documented on Wake Atoll

Scientific Name	Common Name	Status
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 Vulnerable
Pluvialis dominica	Pacific golden plover	MBTA
Puffinus auricularis newelli	Newell's shearwater	MBTA, Federally Endangered
Puffinus griseus/tenuirostris	Sooty shearwater	MBTA
Puffinus nativitatis	Christmas shearwater	MBTA, BCC
Puffinus pacificus	Wedge-tailed shearwater	MBTA
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
Sources: Rauzon et al. 2008; IUCN 2015.		

Federally endangered and threatened species using marine habitats occur within the lagoon and waters surrounding Wake Atoll. Table 3-4 lists species of concern and their current federal status that have been documented on Wake Atoll in the 2017 INRMP and supporting studies. The federally threatened green sea turtle (*Chelonia mydas*) is frequently sighted (PRSC 2017).

Table 3-4 Wake Atoll Listed Species and Species of Concern

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

3.6.3.3 Environmental Consequences

Preferred Alternative

Short-term, indirect, minor, and adverse impacts to birds listed under the MBTA; and long-term, indirect, major, and beneficial impacts to birds listed under the MBTA are expected from the Preferred Alternative. No impacts to threatened or endangered species or critical habitat are expected from the Preferred Alternative.

The Preferred Alternative would result in short-term adverse impacts to birds listed under the MBTA, and while no incidental takes are anticipated, any incidental takes would not be in

violation of the MBTA, per the DOI Solicitor's Opinion M-37050, *The Migratory Bird Treaty Act Does Not Prohibit Incidental Take*, dated 22 December 2017. Off-road transport of heavy machinery including excavators, chippers, bulldozers, similar heavy equipment, and/or chainsaws could negatively impact roosting habitat for birds by displacement and disruption. Birds would be encouraged to exit areas of ironwood clearing before removal activities begin each day, though it is anticipated that birds would vacate the vicinity of the project due to the noise of heavy machinery. Active disturbance as part of the BASH program already occurs within the three project areas on a daily basis; therefore, the impacts of the Preferred Alternative are considered to be minor.

Burning of felled ironwoods or controlled burning would create a plume of smoke that would temporarily adversely affect birds; however, burning within the boundaries of the existing solid waste accumulation area is expected to minimize impacts. In the case of controlled burning, birds would be encouraged to vacate the area of the burn prior to the start of operations and no long-term impacts or takes would otherwise be expected.

The use of herbicides on cut tree stumps has the potential to leach into the soil and negatively impact wildlife habitat. However, observations from Peale and Wilkes islands, where herbicide was used to kill significant numbers of ironwood trees, demonstrate that birds listed under the MBTA are still able to nest in areas impacted by herbicide.

Project Areas 1 and 3 are located entirely within the USFWS permitted Bird Exclusion Zone (BEZ). Project Area 2 is located partially within the BEZ and the remainder is within the Bird Reduction Area (BRA). The BEZ was established by the USAF and the USFWS and is defined as 1,000 feet from the airfield centerline. The BRA is defined as an additional 1,250-foot buffer surrounding the BEZ (Figure 13). The Preferred Alternative would result in long-term beneficial impacts to seabirds of Wake Island by promoting nesting away from airfield activities, and the Preferred Alternative would also result in long-term beneficial impacts to the health and safety of passengers that utilize the airfield by minimizing birds that desire to nest within the surrounding vegetation. The Preferred Alternative would also remove habitat for invasive rats that are known to prey upon seabird eggs and chicks.

The Preferred Alternative is not anticipated to impact any federally listed marine species.

No Action Alternative

The No Action Alternative is not expected to affect threatened and endangered species at WIA.

3.7 CULTURAL RESOURCES

3.7.1 Definition of the Resource

As part of the process for compliance with NEPA, federal agencies are required to assess potential impacts on the human environment (40 CFR Part 1508.14). That analysis is generally conducted in terms of cultural resources, which includes a variety of resources that are defined by specific federal laws, regulations, EOs, and other requirements. Those include the National

Historic Preservation Act, Native American Graves Protection and Repatriation Act, Archaeological Resources Protection Act, American Indian Religious Freedom Act, and EO 13007, among other regulations. Cultural resources are subdivided into prehistoric resources, historic structures and resources, and traditional resources.

Prehistoric archaeological resources are defined as physical remnants of human activity that predate the advent of written records in a particular culture and geographic region. They include archaeological sites, structures, artifacts, and other evidence of prehistoric human behavior.

Historic resources consist of physical properties or locations postdating the advent of written records in a particular culture and geographic region. They include archaeological sites, buildings and structures, objects, artifacts, documents, and other evidence of human behavior. Historic resources also include locations associated with events that have made a significant contribution to history or that are associated with the lives of historically significant persons.

Under Section 106 of the National Historic Preservation Act, the federal agency official is charged with providing the Advisory Council on Historic Preservation and the State Historic Preservation Office an opportunity to comment on the effect of federal undertakings on historic properties. Federal agencies identify and evaluate historic properties listed or eligible for inclusion in the National Register of Historic Places within the Area of Potential Effect; determine effects of an undertaking on historic properties; and consult to avoid, minimize, or mitigate adverse effects on the historic properties in consultation with the State Historic Preservation Office and other parties including Native Tribes.

3.7.2 Existing Conditions

Despite its small area, Wake Atoll is full of significant cultural resources (Figure 14). These resources are mainly from WWII and form the Wake Island National Historic Landmark (NHL). No evidence of prehistoric cultural resources has been discovered on Wake Island. The remoteness of the island and the lack of fresh water sources other than rainfall, discouraged settlement by native Pacific populations, so there is little potential for prehistoric or traditional resources to be present. No unique paleontological or traditional use resources are known to exist on the island (Verhaaren and Kullen 2015).

Wake Island in its entirety was designated a National Historic Landmark in 1985 in order to preserve both the battlefield where important WWII events occurred, and Japanese and American structures from that period. Many of the Japanese structures were actually constructed with American labor. A group of 98 American prisoners of war were forced to build these defenses until mid-1943, when they were executed by the Japanese. These structures include several pillboxes, bunkers, and aircraft revetments. The Wake Island NHL nomination package defines the landmark's boundaries as "the outer edge of the reef that surrounds the Wake Island so as to include the reef, the three islands, and the lagoon, which includes a number of historic shipwrecks and possible other artifacts." The Pan American facilities and the U.S. Naval submarine and aircraft base, constructed prior to WWII, are also included in the NHL (Verhaaren and Kullen 2015).

Cultural resources surveys, primarily to record archaeological resources, have been conducted on Wake Atoll. The northwestern third of Peale Island and the entirety of Wilkes Island have been completely (100 percent) inventoried and all cultural resources recorded. The central portion and southeast end of Peale Island and the Peacock Point area of Wake Island have been inventoried. Much of the atoll remains to be surveyed (Verhaaren and Kullen 2015).

In 2007, buildings constructed since WWII (between 1946 and 1989) were evaluated for historical significance. Those dating to 1957 or earlier were evaluated using the National Register evaluation criteria. Those dating from 1958 or later were evaluated for exceptional importance under Criteria Consideration (G). Only two buildings were eligible for listing on the National Register of Historic Places including Building 1502 (the terminal) and Building 1601 (the control tower) (Verhaaren and Kullen 2015).

Human remains are occasionally encountered on Wake Atoll. Most of these remains are those of participants in the WWII battle and subsequent Japanese occupation of the atoll.

3.7.3 Environmental Consequences

Preferred Alternative

Short-term, direct, moderate, and adverse impacts to cultural resources; and long-term, direct, moderate, and beneficial and adverse impacts are possible from the Proposed Action.

Wake Atoll did not support an indigenous population, so the potential to encounter prehistoric resources is extremely low. The potential for historic archaeological resources is considered variable across Wake Island because the island saw extensive reuse by American forces and domestic airline personnel after the war. Prior to construction, a designated cultural/historical monitor would perform a cursory cultural resource survey of the area daily before any ground disturbance occurs to verify that no cultural resources are present.

Project Area 1, South of the Runway, contains more than 20 features that contribute to the NHL (Figure 15). These features include pillboxes, blockhouses, bunkers, and aircraft revetments. Tree felling and bulldozing could damage or destroy these features of the NHL resulting in long-term, direct, moderate, adverse effect to the NHL. These adverse impacts will be minimized or avoided by relocating and establishing a perimeter around the features where heavy equipment use and tree felling would not occur. Herbicide application would not cause ground disturbance and, therefore, would not result in adverse impacts to cultural resources. Ironwood removal within a 15-ft perimeter of known cultural resources will only occur via chainsaw and herbicide application, and could occur via excavator-mounted shears if sufficient clearance is available for the excavator.

There are no historic buildings or structures in Project Area 2, Lagoon/Pipeline, or Project Area 3, VORTAC Area identified for ironwood treatment (Figure 2). The areas to be used for chipping and burning would occur in previously disturbed areas and would not impact cultural resources. Chainsaw use and herbicide application would cause minimal to no ground

disturbance and, therefore, the likelihood of adverse impacts to cultural resources would be none to negligible.

Removal of the trees would also result in an indirect, beneficial effect to the NHL and its features by fulfilling the recommendation in the Integrated Cultural Resources Management Plan (ICRMP) (Verhaaren and Kullen 2015) to remove the vegetation which would allow for stabilization of the features.

In all three areas, uprooting trees with bulldozers or similar heavy equipment would cause substantial ground disturbance. This ground disturbance could unearth and expose archaeological resources and/or human remains. Per the requirements of the ICRMP (Verhaaren and Kullen 2015), excavation for construction, repair, or environmental restoration activities in close proximity to known cultural resources or in unsurveyed or undisturbed areas must be monitored by a qualified archaeologist (Section 5.2.4 of the ICRMP, Verhaaren and Kullen 2015). If intact archaeological remains are encountered, the activity would be halted in that area and the procedure for reporting unanticipated cultural resources (Leeper 2019) would be followed. If human remains are encountered, the activity would be halted and the procedure for unanticipated human remains (Section 5.2.2 of the ICRMP, Verhaaren and Kullen 2015) would be followed. This would result in short- and long-term, minor, adverse impacts to archaeological resources and human remains if discovered.

Controlled burning of trees is anticipated to cause less damage to cultural resources than uprooting trees with bulldozers or similar heavy equipment, but more damage than cutting trees with chainsaws and treating with herbicide. If utilized, controlled burning would encompass a small area of ironwood and would be short in duration, and therefore would not be expected to impact cultural resources significantly.

No Action Alternative

Long-term, indirect, minor, and adverse impacts to cultural resources are possible from the No Action Alternative.

Under the No Action Alternative, no activities associated with ironwood removal would take place and the trees would remain. There would be no direct adverse impact to cultural resources. There would continue to be indirect adverse impacts to cultural resources in Project Area 1, South of the Runway, because the trees would continue to degrade the concrete features.

3.8 GEOLOGICAL AND SOIL RESOURCES

3.8.1 Definition of the Resource

Geological resources consist of all bedrock and soil materials within the project area. Geologic factors such as soil stability and seismic properties influence the stability of structures. Soil, in general, refers to unconsolidated earthen materials overlying bedrock and other parent material. Soil structure, elasticity, strength, shrink-swell potential, and erodibility all determine the ability for the ground to support structures and facilities. Soils typically are described in terms of their

type, slope, physical characteristics, and relative compatibility or limitations with regard to particular construction activities and types of land use.

Topography consists of the physiographic, or surface, features of an area and is usually described with respect to elevation, slope, aspect, and landforms. Long-term geological, erosional, and depositional processes typically influence topographic relief.

3.8.2 Existing Conditions

Wake Island is part of a mid-Pacific Ocean atoll that formed when a volcano rose above the ocean surface, then subsided below the surface due to deflation of the underlying magma chamber. Slow volcanic island subsidence allowed coral reefs to form around the island and grow at a rate equal to that of the subsidence, forming a ring-shaped reef with a shallow central lagoon (USAMDC 1999).

The reef rock is formed entirely from the remains of marine organisms including reef corals, coralline algae, mollusks, echinoderms, foraminifera, and green sand-producing algae. These organisms secrete external skeletons of calcium and magnesium carbonates that, as they grow and die, are either cemented in place to form hard reef rock or erode and wash down slopes to accumulate as sediment deposits, particularly in the lagoon or on deep terraces downslope on the ocean side of reefs. The reefs are growing actively as a result of vigorous development and populations of corals, coralline algae, and large mollusks. Only the thin upper veneer of the reef structure is alive and growing, accreting over the remains of prior generations of reef organisms. Although coral reefs are unique because they build and advance wave-resistant structures in the face of persistent and severe wave and storm attack, the organisms that form the reefs are vulnerable to sedimentation, burial, and changes in circulation caused by human development activities (USAMDC 1999).

The land masses at Wake Island have formed by one or both of two processes: accumulation of reef debris deposited on the lagoon side of the reef by large waves and the lowering of sea levels during periods of global cooling. The island's building process by large storm-generated waves is evidenced on the south side of Wake Island by the burial of pill boxes constructed during WWII under sand, gravel, and cobble-sized pieces of reef debris. As a result of these building processes, atoll island soils are predominantly coarse-grained and almost exclusively composed of calcium carbonate. Therefore, they are of low fertility and lacking many of the nutrients required to support many plant species (USAMDC 1999).

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 (PRSC 2017).

Island building by wave-deposited reef debris also limits land elevation. The maximum

elevation on Wake Island is 6.4 meters (21 ft) above mean sea level, and the average elevation is only about 3 meters (10 ft) (USAMDC 1999).

3.8.3 Environmental Consequences

Preferred Alternative

Short- and long-term, indirect, minor, and adverse impacts to geological resources are expected from the Preferred Alternative.

The Preferred Alternative would likely result in short-term minor adverse effects to geological and soil resources. The potential removal of ironwood via bulldozer would result in uprooting of trees, which could destabilize surface-level soil and increase erosion if re-vegetation does not follow tree removal. All removal/disposal methods other than controlled burning are likely to cause some form of ground-rutting because dump trucks will be necessary to remove felled trunks from the location of felling, however the ground would be re-graded after ironwood removal activities are completed. Long-term impacts to soil quality could result from the use of herbicides on cut tree stumps have the potential to leach into the soil and negatively impact soil quality, however, the herbicides proposed for this project have relatively low residual control, being active in the soil for only about 46 days (PRSC 2017). Soil quality on Wake Island is already low due to the lack of essential nutrients and organic matter. Furthermore, observations from Peale and Wilkes islands, where herbicide was used to kill significant numbers of ironwood trees, demonstrate that native heliotrope has still been able to regrow in the surrounding areas. Burning of felled ironwood trees is not anticipated to alter geological resources as burning will occur within the boundary of the existing solid waste accumulation area.

No Action Alternative

The No Action Alternative is not expected to affect geological resources.

3.9 SOCIOECONOMIC RESOURCES AND ENVIRONMENTAL JUSTICE

3.9.1 Definition of the Resource

Socioeconomics—Socioeconomics is typically defined as the relationship between economies and social elements, such as population and economic activity. Factors that describe the socioeconomic resources represent a composite of several attributes. There are several factors that can be used as indicators of economic conditions for a geographic area, such as demographics, income, unemployment, poverty level, and employment.

Environmental Justice—EO 12898 pertains to environmental justice issues and relates to various socioeconomic groups and the disproportionate impacts that could be imposed on them. That EO requires that federal agencies' actions substantially affecting human health or the environment do not exclude persons, deny persons benefits, or subject persons to discrimination because of their race, color, or national origin. The EO was enacted to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income

with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Consideration of environmental justice concerns includes race, ethnicity, and the poverty status of populations in the vicinity of a Proposed Action.

3.9.2 Existing Conditions

The region of influence for Wake Island is limited to the island itself. Since the island is an isolated military installation, actions taken there have little effect on outside employment, population immigration, or local area expenditures. Therefore, key socioeconomic indicators concerned with effects of regional employment and income data were not examined.

The military and contractor personnel who work at Wake Island include Americans and Thai nationals. Island personnel live in billets constructed on the island, which are military controlled. Some individuals live in private structures throughout the island. There are no private homes, motels/hotels, or private retail businesses on the island. The economy on the island is dominated by the military installation. Government and contractor employment are the only contributor to the island economy (USAMDC 1999).

3.9.3 Environmental Consequences

Preferred Alternative

The Preferred Alternative is not expected to impact socioeconomic resources and environmental justice.

Ironwood removal activities would require up to eight temporary personnel on the island. These transient personnel would be housed in existing military-controlled billets, which are kept vacant for these types of activities. Consequently, no impact to housing and thus socioeconomic resources is anticipated.

No Action Alternative

The No Action Alternative is not expected to affect socioeconomic resources and environmental justice.

3.10 COASTAL ZONE MANAGEMENT

3.10.1 Definition of the Resource

The Coastal Zone Management Act (CZMA) (16 U.S. Code 1451 et seq.) declares a national policy to preserve, protect, develop, and, where possible, restore or enhance the resources of the Nation's coastal zone. The coastal zone generally refers to the coastal waters and the adjacent shorelines, including islands, transitional and intertidal areas, salt marshes, wetlands, and beaches, and includes the Great Lakes. The CZMA encourages states to exercise their full authority over the coastal zone through the development of land and water use programs in cooperation with federal and local governments. Development projects affecting land/or water

use, or natural resources of a coastal zone, must ensure the project is, to the maximum extent practicable, consistent with the state's coastal zone management program.

A federal agency may review their activities, other than development projects within the coastal zone, to identify *de minimis* activities, and request state agency concurrence that these *de minimis* activities should not be subject to further state review. *De minimis* activities are activities that are expected to have insignificant direct or indirect (cumulative and secondary) coastal effects and which the state agency concurs are *de minimis*. The state agency is required to provide for public participation under Section 306(d)(14) of the CZMA when reviewing the federal agency's *de minimis* activity request.

3.10.2 Existing Conditions

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 National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management (NOAA 2019). Furthermore, there is no formal coastal zone protection program, coastal zone barrier resources, or Coastal America program involvement for WIA.

3.10.3 Environmental Consequences

Preferred Alternative

The Preferred Alternative is not expected to affect coastal zone management at WIA.

Removal of ironwood trees via cutting will leave the tree roots in place, providing stabilization to the soil while new seeds or plantings are establishing. Should ironwood be removed via bulldozer or similar large equipment, other native species between the trees would remain in place, preventing significant erosion in coastal zones, and planting of additional native plants would occur shortly after removal to re-stabilize soil. If ironwood is removed via in situ burning, the areas to be burned would be sufficiently small so as not to pose a risk to the coastal zone or associated erosion.

The 611th CES will review and coordinate with NOAA to ensure installation actions are consistent with the policies and procedures of the CZMA.

No Action

The No Action Alternative is not expected to affect coastal zone management at WIA.

3.11 UTILITIES AND INFRASTRUCTURE

3.11.1 Definition of the Resource

Infrastructure consists of the systems and physical structures that enable a population in a specified area to function, to include utility lines. Infrastructure is wholly human-made, with a high correlation between the type and extent of infrastructure, and the degree to which an area is

characterized as "urban" or developed. The availability of infrastructure and its capacity to support growth are generally regarded as essential to the economic growth of an area. Utilities and infrastructure generally include water supply, storm drainage systems, sanitary sewer and wastewater systems, power supply, and solid waste management.

3.11.2 Existing Conditions

WIA infrastructure was designed for a much larger population than is currently present. In the 1970s, up to 1,600 personnel might have been on the island at a given time, while today the daily population consists of approximately 120 BOS contractor personnel comprised of Americans and Thai nationals and various other federal employees, with 5 to 20 transient persons on average, depending on mission scope and requirements (PRSC 2017).

Electrical power is supplied to WIA by an onsite power plant located at the west end of Wake Island. The power plant was rebuilt in 2009 and consists of three generators fueled by JP-5 stored in one large storage tank and three day tanks (PRSC 2017). Additional power is supplied by a recently installed solar array. Many areas on the island have shallow buried electrical lines.

Drinking water is generated on the island by a desalination plant. Brackish water is collected from a well. The potable water is stored in several large tanks and piped throughout the island via shallow buried water lines (MDA 2015).

WIA maintains separate storm and sanitary sewer systems. The stormwater system flows through pipes to the lagoon or ocean or runs from roads and other developed areas into the ocean, lagoon, or more likely, seep into the porous sandy ground. The sanitary sewer system discharges into a septic field located at the southern end of Wake Island (PRSC 2017).

Solid waste generated on the island is disposed in the island's solid waste accumulation area, located south of the WIA runway (Figure 3). All collected domestic/recycled waste is transported to this solid waste disposal site (PRSC 2017).

Transportation of personnel on Wake Island is primarily by gasoline and diesel vehicles, diesel mules, and bicycles. Diesel trucks, aircraft, machinery, maintenance equipment, and a bus are also utilized to support mission operations. This equipment requires extensive paved and unpaved roadways throughout WIA. There are no highways on WIA (PRSC 2017).

3.11.3 Environmental Consequences

Preferred Alternative

Short-term, direct and indirect, minor, and adverse impacts to utilities and infrastructure are expected from the Preferred Alternative.

During tree removal activities, the existing solid waste accumulation area (Figure 3) will be utilized as a space to pile the removed trees. The solid waste accumulation area would also be utilized to dispose of trees via burning and/or chipping. This use of the solid waste accumulation

area, in excess of its typical operations, would result in short-term, direct, minor and adverse impacts to routine solid waste accumulation area operations.

Controlled burning in small portions of the project areas may be utilized. Should this method be selected, precautions would be taken to ensure that burning would not occur too near Wake Island facilities or infrastructure, including buried utilities. The fire department would be onsite at all times to oversee burn operations.

Removal of ironwood trees will require increased use and transport of heavy equipment between the three project areas (Figures 3, 4, and 5). This will increase traffic on WIA roads associated with designated access routes (Figures 6, 7, and 8) and would cause excess wear and tear on WIA roads. These impacts to roads are expected to be short-term, indirect, minor, and adverse due to the anticipated duration of the Preferred Alternative.

No impacts to electrical power supplies, drinking water, storm sewers, or sanitary sewers are expected from the Preferred Alternative. Dig permits will be obtained prior to removal operations to ensure buried water or electrical lines are not impacted. Any unmarked utilities found during removal operations would be reported.

No Action Alternative

The No Action Alternative is not expected to affect utilities and infrastructure.

4. CUMULATIVE AND OTHER EFFECTS

4.1 CUMULATIVE EFFECTS

CEQ regulations stipulate that the cumulative effects analysis of an Environmental Assessment should consider the potential environmental effects resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency or person undertakes such other actions" (40 CFR Part 1508.7). CEQ guidance, in considering cumulative effects, affirms this requirement, stating that the first steps in assessing cumulative effects involve defining the scope for the other actions and their interrelationship with a Proposed Action. The scope must consider other projects that coincide with the location and timetable of a proposed action and other actions. Cumulative effects analyses must also evaluate the nature of interactions among these actions (CEQ 1997).

To identify cumulative effects, the analysis needs to address two questions:

1. Does a relationship exist such that affected resource areas of the Proposed Action or alternatives might interact with the affected resource areas or past, present, or reasonably foreseeable actions?

2. If such a relationship exists, does an Environmental Assessment or an Environmental Impact Statement reveal any potential significant impacts not identified when the Proposed Action is considered alone?

The scope of the cumulative effects analysis involves both timeframe and geographic extent in which effects could be expected to occur, and a description of what resources could potentially be cumulatively affected. For the purposes of this analysis, the temporal span of the Proposed Action is 1 year, which would encompass the ironwood removal period. For most resources, the spatial areas for consideration of cumulative effects are confined to Project Areas 1, 2, and 3, described in Section 1.2 and depicted on Figures 3, 4, and 5, though a larger area is considered for some resources (e.g., air quality).

4.1.1 Projects Identified for Potential Cumulative Effects

The only known project that is scheduled concurrently with the proposed ironwood removal operation is a runway repaving project. This project is scheduled to begin during the first quarter of 2020 and will involve considerable mobilization of equipment and personnel to Wake Island.

4.1.2 Cumulative Effects Analysis

As previously discussed, the only known project that is scheduled concurrently with the proposed ironwood removal operation is a runway repaving project. In conjunction with the Proposed Action, this will increase the total number of people on-island, including billeting needs, and will also increase traffic volumes. However, given the low year-round population of WIA and available billets, the impact of additional individuals on-island associated with these projects is anticipated to have a negligible impact on primary base operations.

The highest risk associated with the shipment of additional equipment and personnel to WIA is that of biosecurity. All actions associated with the Proposed Action will be performed in accordance with the Wake Island Biosecurity Management Plan (PRSC 2015).

4.2 UNAVOIDABLE ADVERSE EFFECTS

Unavoidable adverse effects would result from implementation of the Proposed Action. These effects are not anticipated to be significant.

Air Installation Compatible Use Zone/Land Use—The Proposed Action would result in temporary adverse impacts to AICUZ/Land Use resulting from the ironwood removal and disposal activities. Removal and disposal activities would be conducted using well-maintained and job-suitable machinery to minimize noise generation. Affects to traffic are expected to be minor, and given typical WIA traffic levels, are deemed minor. Following completion of removal and disposal activities, land use and noise levels would return to ambient levels.

***Air Quality*—**During the ironwood removal phase of the Proposed Action, the air quality in the project vicinity is expected to be temporarily adversely impacted by dust and exhaust from the heavy equipment. During the ironwood disposal phase of the Proposed Action, the air quality in the project vicinity is expected to be temporarily adversely impacted by smoke from the burning of ironwood trunks, controlled burning of ironwood in situ, and/or exhaust and particulates from chipping of the trunks. BMPs would be implemented during all project activities to minimize dust generation, and may include air monitoring, watering in areas where dust is considered an issue, and running equipment only when it is needed. Air monitoring would be conducted to monitor dust and smoke levels and other potential air quality impacts. Following completion of ironwood removal, the air quality would return to ambient levels.

***Water Resources*—**Under the Proposed Action, ironwood removal activities would result in temporary adverse impacts to water resources. Herbicides utilized to treat cut stumps have the potential to run off into Wake surface water and wetlands, or infiltrate into groundwater, however water-safe herbicides such as Garlon 3A will be utilized in areas of particular sensitivity. Heavy equipment and felling trees could result in wetland disturbance. Implementation of BMPs, such as accessing the project site via established roads outside of wetland areas or utilizing herbicides that have been approved for use in and around wetlands will minimize adverse impacts water resources. An NPDES construction general permit will also be required.

Safety and Occupational Health—During the ironwood removal phases of the Proposed Action, workers would likely be exposed to materials that may result in injury or ill health, including heavy machinery, pesticides, and fire. As such, a Health and Safety Plan would be developed in accordance to regulations under OSHA; Engineer Manual 385-1-1 (USACE 2014); and AFOSH. The potential for adverse impacts to human health and safety would be minimized by implementing engineering controls, administrative measures, and the use of personal protective equipment.

***Wildlife and Threatened and Endangered Species*—**Under the Proposed Action, ironwood removal activities would result in a temporary adverse impact to wildlife and birds listed under the MBTA. Ironwood removal would create a disturbance to wildlife that inhabits the area or its immediate vicinity. Following completion of the removal, replanting with native plant species would help wildlife quality return to pre-construction levels.

Cultural Resources—Under the Proposed Action, ironwood removal activities would have the potential for long-term adverse effects to cultural resources if bulldozers or similar heavy equipment are utilized. Should bulldozers or similar heavy equipment be selected for ironwood removal, activities would be monitored by a qualified archaeologist and activity would be halted if cultural resources are identified in the work area. Impacts to cultural resources can be mitigated in these areas by removing ironwood trees via chainsaw or excavator-mounted shears in areas where there is sufficient clearance for an excavator.

Geological and Soil Resources—Under the Proposed Action, ironwood removal activities, which include movement of heavy machinery, would result in minor soil disturbance. Bulldozing, or use of excavation equipment to support tree felling, may result in major soil disturbance. BMPs such as utilization of chainsaws for ironwood removal in sensitive areas would be implemented during removal to minimize environmental consequences resulting from ground-disturbing activities. Standard erosion control measures would also reduce environmental consequences related to these characteristics. Although unavoidable, effects on soil at WIA are not considered significant.

***Utilities and Infrastructure*—**Under the Proposed Action, ironwood removal activities would include stockpiling of felled trees in the solid waste accumulation area. This use of the solid waste accumulation area, in excess of its typical operations, would constitute an unavoidable adverse impact to that utility. In addition, the increased use and transport of heavy equipment between the three project areas will increase traffic on WIA roads and represent an unavoidable adverse impact.

4.3 COMPATIBILITY OF PROPOSED ACTION AND ALTERNATIVES WITH THE OBJECTIVES OF FEDERAL, REGIONAL, STATE, AND LOCAL LAND USE PLANS, POLICIES, AND CONTROLS

The Proposed Action would be consistent with existing and future uses. Ironwood removal activities would not interfere with applicable land use policies or objectives and would be consistent with the goals outlined in the WIA INRMP and ICRMP.

4.4 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term uses of the biophysical components of the human environment include direct impacts, typically associated with activities that occur over a period of less than 5 years. Long-term uses of the human environment generally include those impacts that occur over a period of more than 5 years, including the permanent loss of resources.

This Environmental Assessment identifies potential short-term, adverse effects on the natural environment as a result of ironwood removal activities. These potential adverse effects include impacts to air, land use and recreation, water, biological resources, human health and safety, utilities and infrastructure, hazardous materials and wastes, and cultural and visual resources.

4.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The government has not made any commitment of irreversible or irretrievable resources and will not do so until the environmental analysis has been completed.

5. LIST OF PREPARERS

This Environmental Assessment was prepared for the USAF by EA Engineering, Science, and Technology, Inc., PBC (EA Engineering), under contract to the University of Guam. The individuals who contributed to the preparation of this document are listed below.

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6. REFERENCES

Brown, D., W. Pitt, and B. Tershy. 2013. *Wake Atoll Rat Eradication Review*. Final Draft. 5 September.

Bryan, E.H. 1959. *Notes on the Geography and Natural History of Wake Island*. Atoll Research Bulletin No. 66. The Pacific Science Board, National Academy of Sciences, National Research Council, Washington, D.C. As referenced in USAF 2008.

Council on Environmental Quality (CEQ). 1997. *Considering Cumulative Effects under the National Environmental Policy Act.* Executive Office of the President of the United States. January.

EA Engineering, Science, and Technology Inc., PBC. 2017. *Land Use Control Management Plan Pacific Air Forces Regional Support Center Remote Installations*. December.

Elfers, S.C. 1988. *Element Stewardship Abstract for Casuarina equisetifolia*. December.

Federal Highway Administration. 2006. *Construction Noise Handbook.* http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/index.cfm. Accessed March 2019.

Florida Exotic Pest Plant Council. 2011. *Florida EPPC's 2011 Invasive Plant Species List*. https://www.fleppc.org/list/2011/index.htm.

Fritts, T.A., G.H. Rodda, and M.J. McCoid. No date. *Lizards of the Marianas. A Checklist and Key to the Amphibians and Reptiles of the Marianas*.

Gilardi, J. 2017. *Wake Atoll Ironwood Removal Project*. August.

Gilardi, J. and D. Duffy. 2018. *Wake Atoll Ironwood Removal Project*. March.

Global Invasive Species Database. 2010. *Casuarina equisetifolia*. http://www.issg.org/database/species/ecology.asp?si=365&fr=1&sts=sss&lang=EN. Accessed March 2019.

Hebshi, A. and T. Patrick. 2007. Wake Island Trip Report and annotated wetland GIS – February 2007.

Hirsh, H. and K. Rex. No date. *Wake Island and Pacific Remote Islands Marine National Monument Management.* NOAA. https://oceanexplorer.noaa.gov/okeanos/explorations/ex1606/background/monument-mgmt/welcome.html. Accessed June 2019.

Howard County Maryland. No date. Noise – Supplemental Information. https://cc.howardcountymd.gov/LinkClick.aspx?fileticket=CouEppb46vQ%3D&portalid=0. Accessed April 2019.

International Union for Conservation of Nature (IUCN). 2015. *The IUCN Red List of Threatened Species*. Version 2015.1. http://www.iucnredlist.org. Accessed March 2019.

Leeper, K. 2019. *Historic Property Discovery Procedures for 2019 Wake ICRMP*.

Missile Defense Agency (MDA). 2007. *Wake Island Supplemental Environmental Assessment*. February.

———. 2015. *Integrated Flight Tests at Wake Atoll Final Environmental Assessment*. May.

Mobley, H.E. 1976. *Southern Forestry Smoke Management Guidebook*. December.

Morton, Julia F. 1980. *The Australian pine or beefwood (*Casuarina equisetifolia L.*), an invasive "weed" tree in Florida.* In: Proceedings, Florida State Horticultural Society. 93:87–95.

National Oceanic and Atmospheric Administration (NOAA). 2019. *Protecting Coastal Communities*. https://coast.noaa.gov/. Accessed March 2019.

Pacific Air Forces Regional Support Center (PRSC). 2015. *Wake Island Biosecurity Management Plan. Edition 4.0.* June.

———. 2016. *Bird Aircraft Strike Hazard (BASH) Reduction Plan*. September.

———. 2017. *Integrated Natural Resources Management Plan*. April.

———. 2019. *Wake Island Airfield Vessel Movement Biosecurity Requirements*. February.

Pernas, T., G. Wheeler, K. Langeland, E. Golden, M. Purcell, J. Taylor, K. Brown, D.S. Taylor, and E. Allen. 2013. *Australian Pine Management Plan for Florida*. Florida Exotic Pest Plant Council. www.fleppc.org. Accessed March 2019.

Rauzon, M.J. Boyle, D. Everett, W.T. and Gilardi, J. (Rauzon et al.). 2008. *The status of the birds of Wake Atoll.* Atoll Research Bulletin No. 561. Smithsonian Institution, Washington, D.C.

Secretary of the Air Force. 1993. *Occupational Safety and Health.* Air Force Policy Directive 91-3. 27 September.

———. 1996. *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program.* Air Force Instruction 91-301. 1 June.

Teig, D. (Lieutenant Colonel United States Air Force). 2013. Trip Report – Wake Island. 29 March.

U.S. Air Force (USAF). 2008. *Integrated Natural Resources Management Plan for Wake Atoll.* Prepared by Argonne National Laboratory for Hickam Air Force Base, 15th Civil Engineering Squadron, Environmental Planning Element. September.

———. 2012. *Wake Island Lagoon Marine Organism Testing for Brodifacoum*. Memorandum for Record. 611 CES/CEAN. 16 July.

———. 2013. *Trip Report – Wake Island – Biological Assessment*. Memorandum for: 611 CES/CEAN. From: 757AS/DOS. Department of the Air Force, Youngstown Air Reserve Station, Aerial Spray Unit, Vienna, Ohio. June.

———. 2019. *Personal Communication Regarding Air Quality Monitoring on Wake Island*. May.

U.S. Army Corps of Engineers (USACE). 2014. *Safety and Health Requirements.* Manual No. 385-1-1. Washington, D.C. 30 November.

U.S. Army Space and Missile Defense Command (USASMDC). 1999. *Wake Island Launch Center Supplemental Environmental Assessment*. October.

———. 2002. *Theater High Altitude Area Defense Pacific Test Flights Environmental Assessment*. 20 December.

U.S. Army Space and Strategic Defense Command. 1994. *Wake Island Environmental Assessment.* January.

U.S. Fish and Wildlife Service (USFWS). 2008. *Birds of Conservation Concern*. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. December.

———. 2017. *Draft Report, Phase I Marine Benthic Habitat Characterization, Wake Atoll Coral Reef Ecosystem Survey*. Prepared by Kevin Foster, Anthony Montgomery, Adam Griesemer, and Douglas Fenner. April.

Verhaaren, B.T and D. Kullen. 2015. *Argonne National Laboratory Integrated Cultural Resources Management Plan October 2015 – September 2020 for Wake Island Airfield, 611th Civil Engineer Squadron, PACAF Regional Support Center Alaska.* May.

Weatherbase. 2015. *Peacock Point, Wake Island* . Monthly Weather Averages Summary. http://www.weatherbase.com/weather/weather.php3?s=912450. Accessed March 2019.

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Appendix A

Figures

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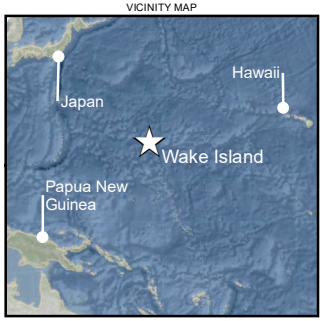
VICINITY MAP



Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Miles

Figure 1
Overview Map
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 1 OverviewMap.mxd jmorrissey

VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area

Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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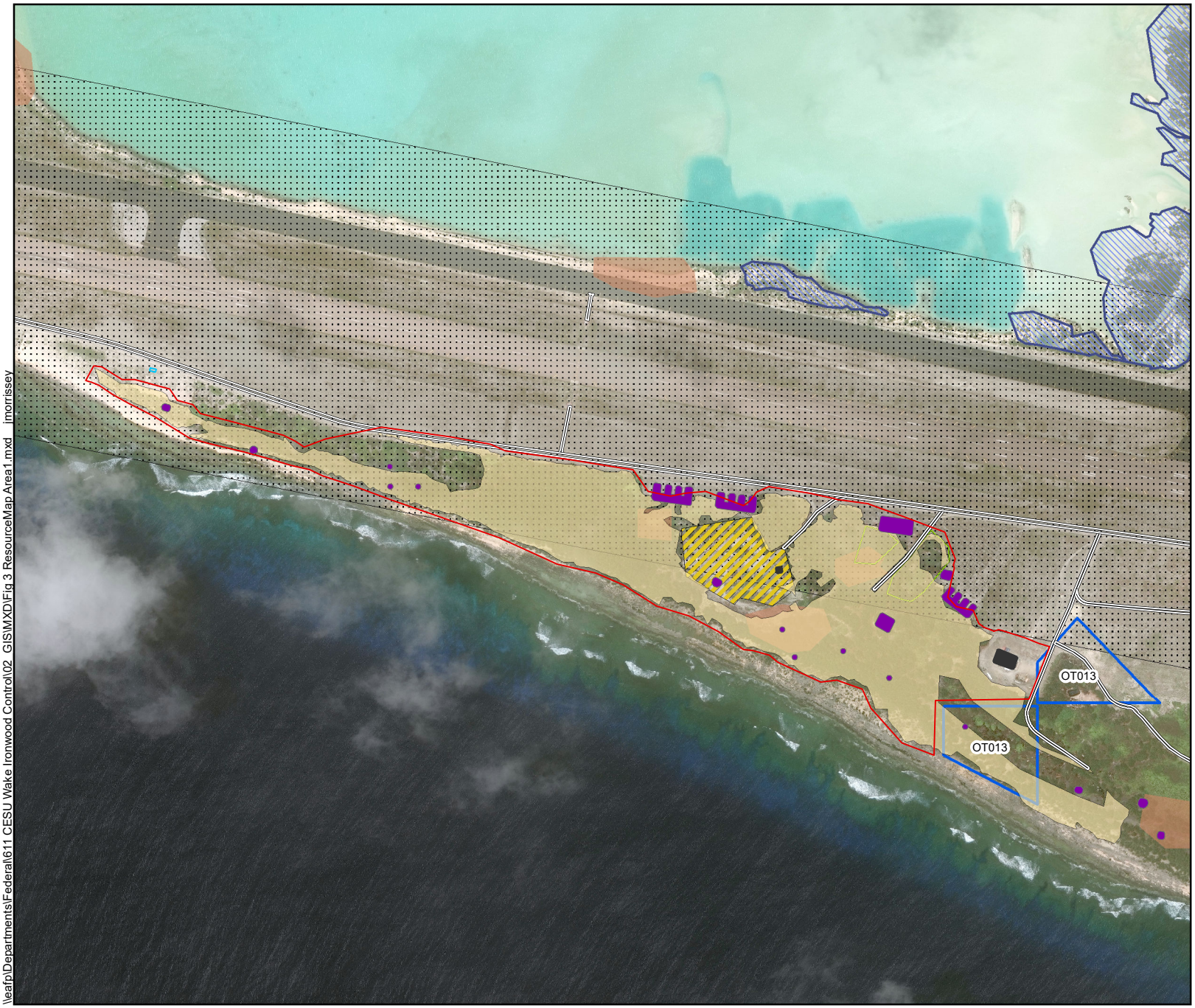
Figure 2
Wake Island Overview Map
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 2 WakeIslandOverview.mxd jmorrissey



VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood
- Clear Zone
- Installation Restoration Program
- ERP Site, LUC in Effect
- Buildings
- Cultural Resources Impact Minimization Area*
- Solid Waste Accumulation
- 2014 Nesting
- Wetlands
- Road
- Fence

*Area includes known sensitive cultural resources and 15 foot buffer

ERP - Environmental Restoration Program
LUC - Land Use Control

Map Date: 11/4/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 3
Site Resources
Project Area 1
South of the Runway
2019 Invasive
Vegetation Management
Wake Island

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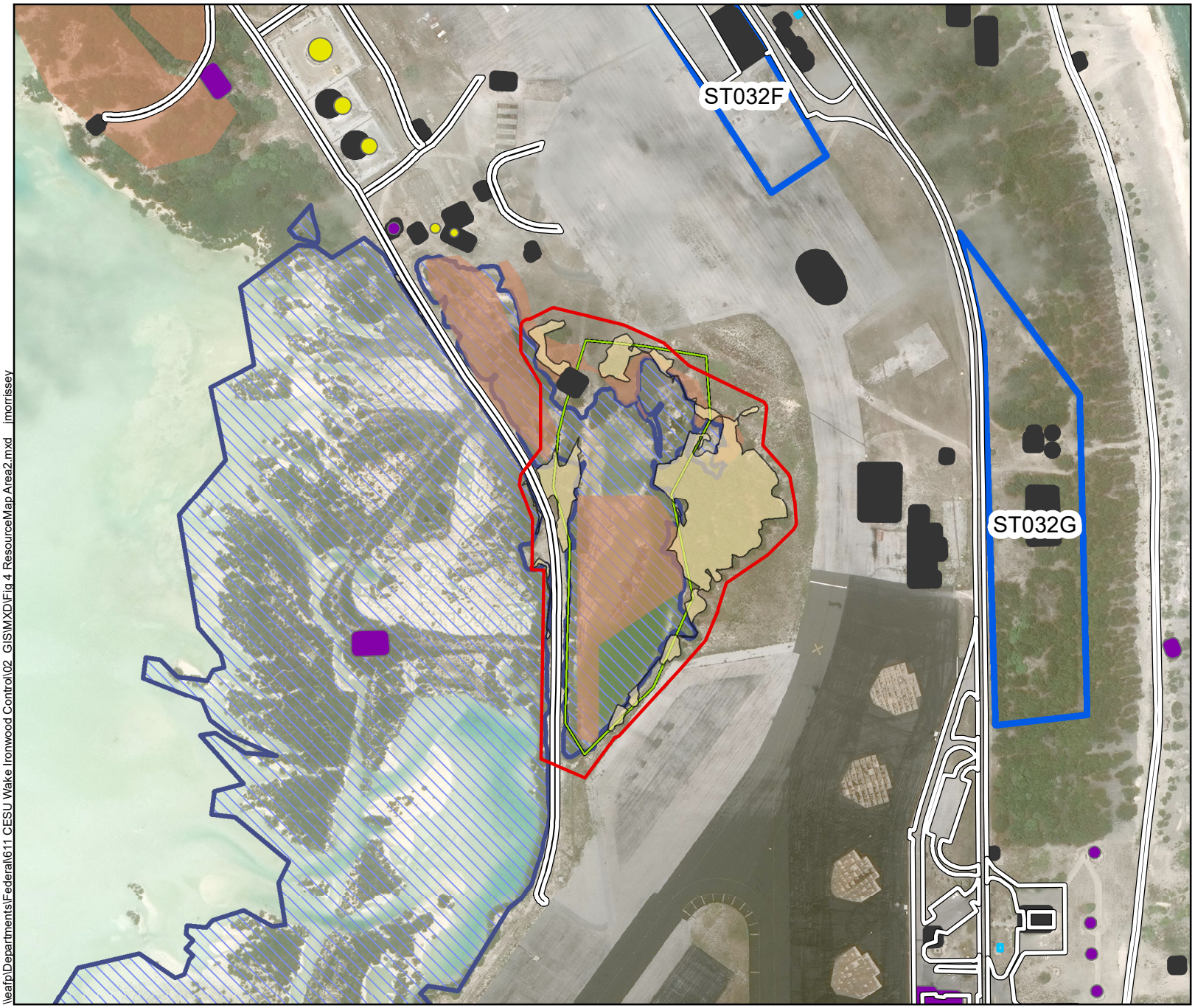

VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood
- Installation Restoration Program
- ERP Site, LUC in Effect
- Buildings
- Cultural Resources Impact Minimization Area*
- Fuel Tanks
- Hazmat Storage
- 2014 Nesting
- Wetlands
- Road
- Fence

*Area includes known sensitive cultural resources and 15 foot buffer

ERP - Environmental Restoration Program
LUC - Land Use Control

Map Date: 11/4/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 4
Site Resources
Project Area 2
Lagoon/Pipeline Area
2019 Invasive Vegetative Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 4 ResourceMap Area2.mxd jmorrissey

VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area
- Clear Zone
- Installation Restoration Program
- Buildings
- 2014 Nesting Areas
- Road

ERP - Environmental Restoration Program
LUC - Land Use Control

Map Date: 11/4/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 5
Site Resources
Project Area 3
VORTAC Area
2019 Invasive
Vegetation Management
Wake Island

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VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area
- Road
- Vehicle Staging Area
- Access Route

Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 6
Access Routes and Staging Area
Project Area 1
South of the Runway
2019 Invasive
Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 6-8 AccessRtMap.mxd jmorrissey

VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area
- Road
- Access Route

Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 7
Access Routes
Project Area 2
Lagoon/Pipeline Area
2019 Invasive
Vegetative Management
Wake Island

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VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area
- Road
- Access Route

Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Figure 8
Access Routes
Project Area 3
VORTAC Area
2019 Invasive Vegetation Management
Wake Island

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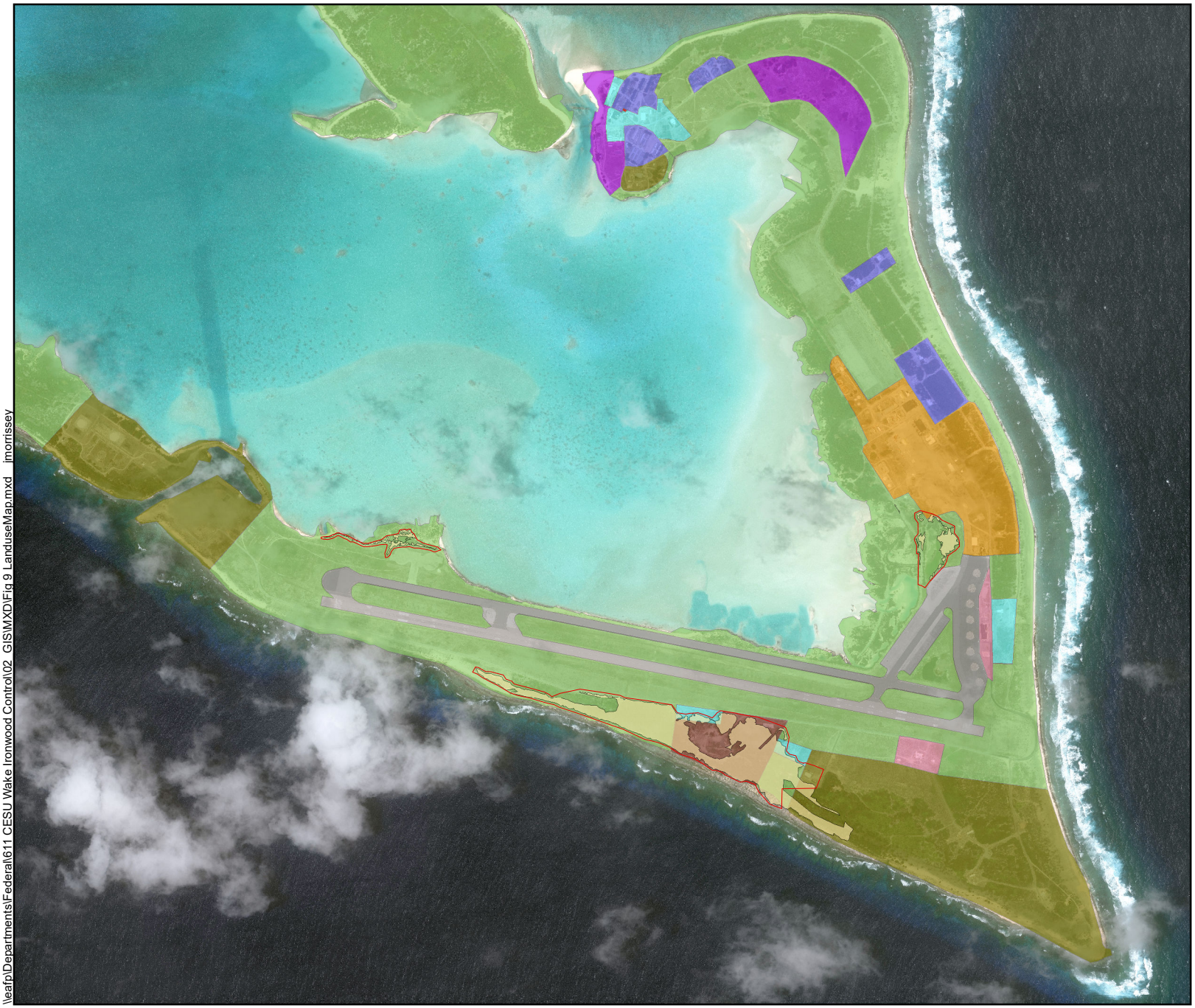

VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area

Land Use

- Administrative
- Airfield
- Community (Service)
- Housing
- Industrial
- Medical
- Open Space
- Primary Industrial
- Recreation
- Solid Waste Accumulation Area

Map Date: 11/4/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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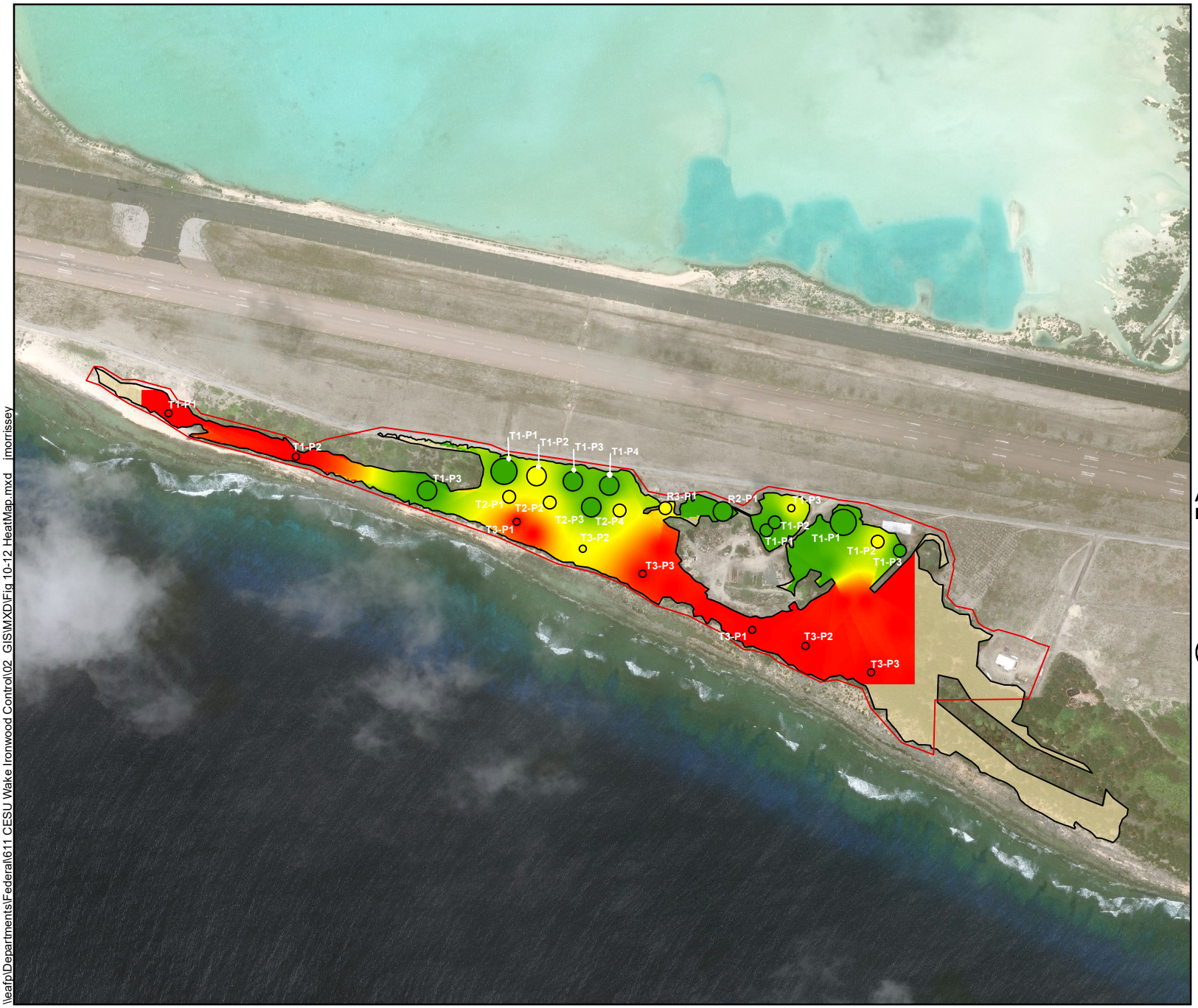
Figure 9
Land Use
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 9 LanduseMap.mxd jmorrissey



VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood Area (not surveyed)

Tree Density

- > 1000 Trees/Acre
- 500 - 1000 Trees/Acre
- < 500 Trees/Acre

Average Diameter Breast Height (DBH), inches

- < 4
- 5 - 6
- 7 - 9
- 10 - 14

Map Date: 6/21/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Feet

Figure 10
DBH and Tree Density
Project Area 1
South of the Runway
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 10-12 HeatMap.mxd jmorrissey

VICINITY MAP

Legend

Limit of Disturbance

Ironwood Removal Area

Tree Density

> 1000 Trees/Acre

500 - 1000 Trees/Acre

< 500 Trees/Acre

Average Diameter Breast Height (DBH), inches

< 4

5 - 6

7 - 9

10 - 14

Map Date: 5/28/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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Feet

Figure 11
DBH and Tree Density
Project Area 2
Lagoon/Pipeline Area
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 10-12 HeatMap.mxd imorrissey

VICINITY MAP

Legend

- Limit of Disturbance
- Ironwood Removal Area

Tree Density

- > 1000 Trees/Acre
- 500 - 1000 Trees/Acre
- < 500 Trees/Acre

Map Date: 5/28/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

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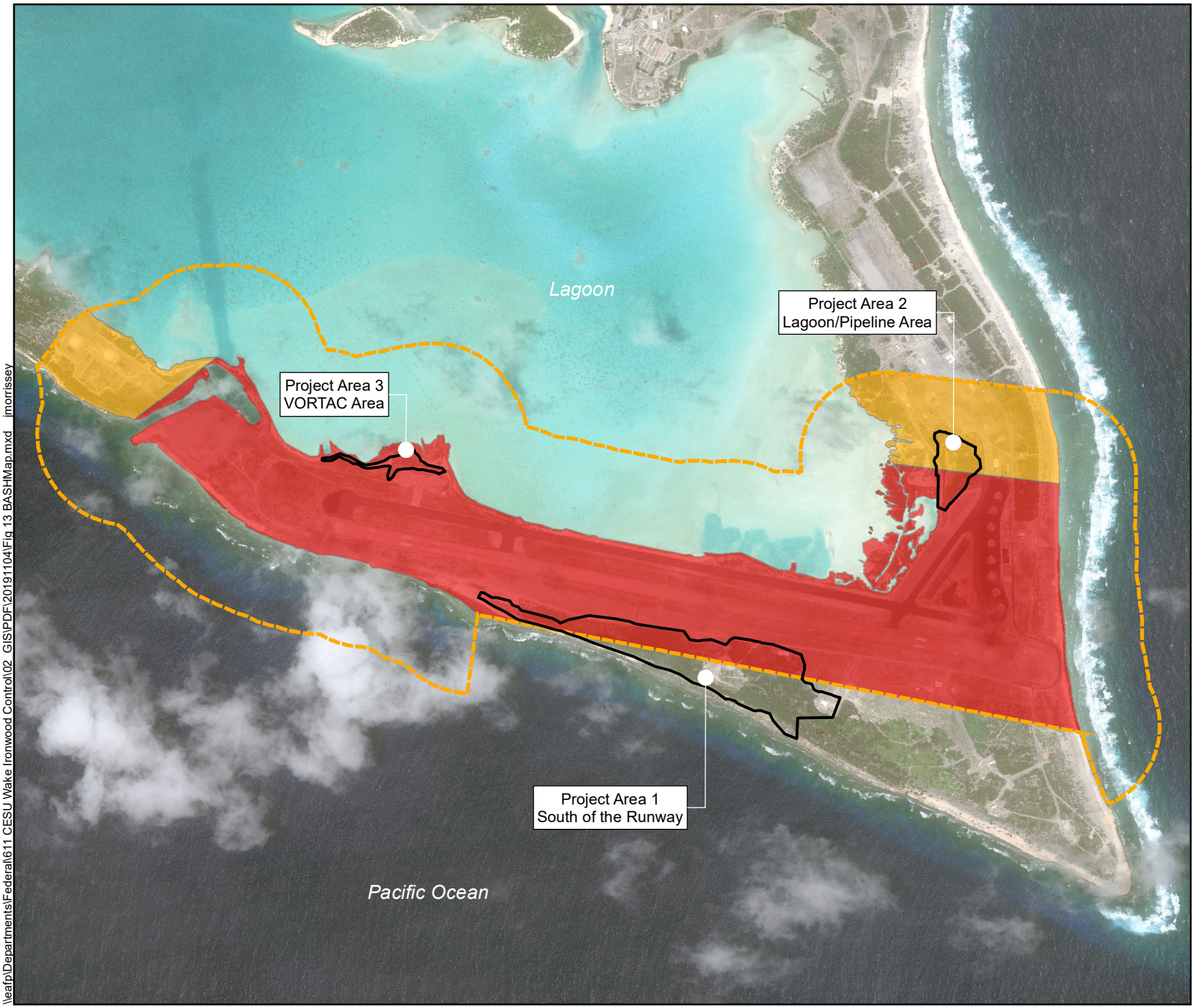
Feet

Figure 12
Tree Density
Project Area 3
VORTAC Area
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\MXD\Fig 10-12 HeatMap.mxd imorrissey



VICINITY MAP

Legend

- Limit of Disturbance
- BRA Boundary
- BRA
- BEZ

Key:

BRA = Bird Reduction Area
BEZ = Bird Exclusion Area

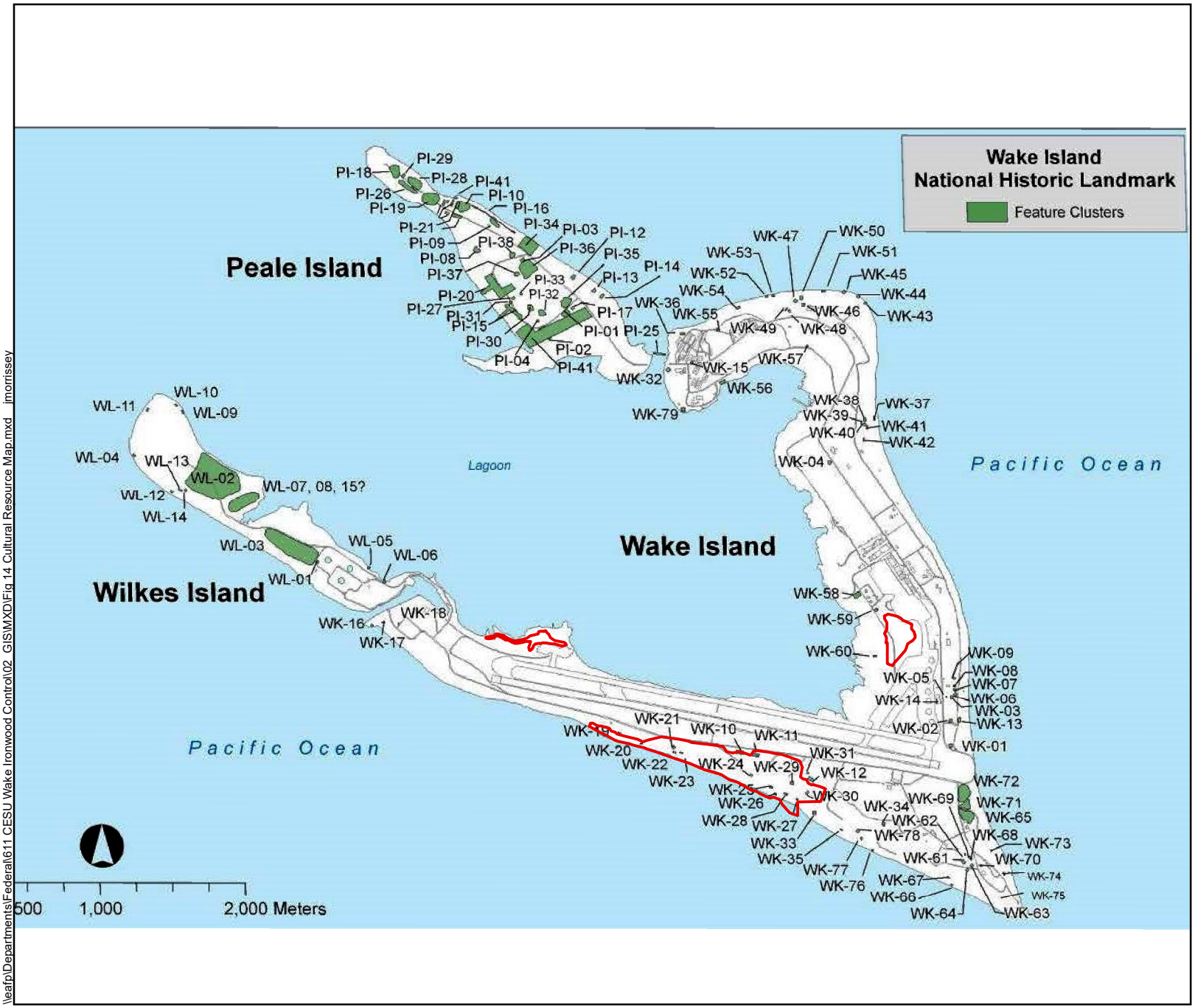
Map Date: 11/4/2019
Source: USAF 2014, PACAF 2016
Projection: WGS 1984 UTM Zone 58N Meter

N

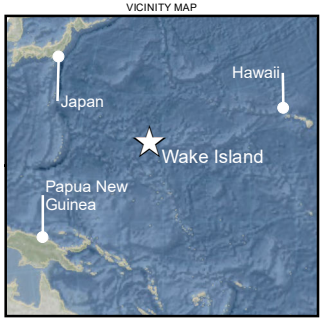
0 1,000 2,000
Feet

Figure 13
Bird Reduction and Bird Exclusion Areas
2019 Invasive Vegetation Management
Wake Island

\\eafp\Departments\Federal\611 CESU Wake Ironwood Control\02_GIS\PDF\20191104\Fig 13 BASHMap.mxd jmorrissey



VICINITY MAP



Legend

Limit of Disturbance

Map Date: 11/4/2019
Source: USAF, 2014, ESRI 2018
Projection: WGS_1984_UTM_Zone_58N

N

0 0.25 0.5
Miles

Figure 14
Cultural Resources as Mapped in 2015 ICRMP and Project LODs 2019 Invasive Vegetation Management
Wake Island

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VICINITY MAP

Legend

- Limit of Disturbance
- Mapped Ironwood
- Cultural Resources Impact Minimization Area*
- Road

*Area includes known sensitive cultural resources and 15 foot buffer

Map Date: 11/4/2019
Source: USAF, 2014, PACAF 2016
Projection: WGS_1984_UTM_Zone_58N

N

0 200 400
Feet

Figure 15
Cultural Resource Buffer Zones
Project Area 1
South of the Runway
2019 Invasive Vegetation Management
Wake Island

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Appendix B

State Historic Preservation Office Correspondence and Public and Agency Comments

[***Preparer's note:*** *Appendix will be populated in final draft of document.*]

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