



A honu hatchling scoots its way to the sea Mike Silbernagle/USFWS

Chapter 2. Refuge Management Direction

2.1 Considerations in the Design of the CCP

In thinking through appropriate actions for this long-term conservation plan, the planning team reviewed and considered a variety of resource, social, economic, and organizational aspects important for managing the Refuge. As is appropriate for a national wildlife refuge, resource considerations were fundamental in developing this CCP. House Report 105-106 accompanying the Improvement Act states “. . .the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first.”

Local, State, and Federal agencies and elected officials were contacted by the planning team to ascertain priorities and problems as perceived by others. The team also contacted Refuge users, nonprofit groups, and community organizations to ensure that their comments and ideas were considered during CCP development. Details of public participation can be found Appendix I.

2.2 General Guidelines

General guidelines for implementing the CCP follow. To reduce the length and redundancy of the descriptions for individual strategies, common features are presented below.

2.2.1 Implementation Subject to Funding Availability

Action strategies will be implemented over a period of 15 years as funding becomes available. Routine maintenance, repair, replacement, and improvement of existing facilities will continue, also dependent on funding.

2.2.2 Interagency Coordination and Collaboration

Ecosystem planning efforts discussed in Chapter 1, Section 1.6 involve collaboration among Federal, State, and local agencies toward mutual goals.

2.2.3 Threatened and Endangered Species Protection and Recovery

Protection of threatened and endangered species is common across all alternatives. It is Service policy to give priority consideration to the protection, enhancement, and recovery of these species on national wildlife refuges. The protection of federally listed species is mandated through the Endangered Species Act of 1973 (ESA). Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. To ensure adequate protection, the Refuge is required to review all activities, programs, and projects occurring on lands and waters of the Refuge to determine if they may affect listed species. If the determination is that an action may adversely affect an endangered species, then the Refuge conducts a formal review, known as a consultation, to identify those effects and means to mitigate those effects. Completed consultations are included in Appendix K.

2.2.4 Historic and Cultural Resource Protection

Cultural resources on Refuge lands receive protection and consideration in accordance with Federal cultural resources laws, Executive orders, and regulations, as well as policies and procedures established by the Department of the Interior and the Service. Although the presence of cultural resources, including historic properties, does not preclude a Federal activity, the Refuge will seek to identify and protect cultural resources whenever possible. Refuge management actions will support the State of Hawai‘i’s vision statement “to promote the use and conservation of historic and cultural resources for the education, inspiration, pleasure and enrichment of the public in a spirit of stewardship and trusteeship for future generations” (State Historic Preservation Plan 2010-2014).

The Native American Graves Protection and Repatriation Act (NAGPRA) is a Federal law passed in 1990 that provides a process for museums and Federal agencies to return certain Native American cultural items (human remains, funerary objects, sacred objects, or objects of cultural patrimony) to lineal descendants, and culturally affiliated Indian tribes and Native Hawaiian organizations. A Native Hawaiian organization includes any organization that: (a) serves and represents the interests of Native Hawaiians, (b) has as a primary and stated purpose the provision of services to Native Hawaiians, and (c) has expertise in Native Hawaiian Affairs, and includes the Office of Hawaiian Affairs and Hui Malama I Na Kupuna ‘O Hawai‘i Nei. The Department of the Interior has interpreted this definition to also include the Hawaiian island burial councils and various ‘ohana (extended families).

During early planning of any projects, the Refuge will provide the Service Regional Historic Preservation Officer (RHPO) a description and location of all projects and activities that affect ground and structures, including project requests from third parties. Information will also include any alternatives being considered. The RHPO will analyze these undertakings for potential to affect historic properties and enter into consultation with the State Historic Preservation Division and other parties as appropriate. The Refuge will also ask the public and local government officials to identify

any cultural resource impact concerns. This notification is generally done in conjunction with the review required by NEPA or Service regulations on compatibility of uses.

2.2.5 Fire Management

The suppression of wildfires and the use of prescribed or controlled fire are a long-standing part of resource protection, public safety, and habitat management on national wildlife refuges. In 2003, a Fire Management Plan that incorporated NEPA compliance was approved for the Refuge and provides detailed guidance for the suppression and use of prescribed fire. That plan's actions and effects are incorporated through reference in this CCP. The plan outlines wildfire response and prescribed fire objectives, strategies, responsibilities, equipment and staffing; burn units; implementation; monitoring; and evaluation. The complete Fire Management Plan is available at the Complex office in Hale'iwa (USFWS 2003).

2.2.6 Participation in Planning and Review of Regional Development Activities

The Service will actively participate in planning and studies for ongoing and future industrial and urban development, contamination, and other potential concerns that may affect the Refuge's wildlife resources and habitats. The Service will continue to cultivate working relationships with pertinent State and Federal agencies to stay abreast of current and potential developments and will utilize effective outreach tools and technologies and EE as needed to raise awareness of the Refuge's resources. The Refuge will participate in local community initiatives to protect, steward, and enhance natural landscapes and wildlife habitat. We will continue to identify and pursue new opportunities for land acquisition that will benefit Refuge purposes.

2.2.7 Adaptive Management

Based upon 522 Departmental Manual (DM) 1 (Adaptive Management Implementation policy), Refuge staff shall utilize adaptive management for conserving, protecting, and, where appropriate, restoring lands and resources. Within 43 CFR 46.30, adaptive management is defined as a system of management practices based upon clearly identified outcomes, where monitoring evaluates whether management actions are achieving desired results (objectives). The recently published DOI Adaptive Management Technical Guide also defines adaptive management as a decision process that "promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood."

Adaptive management accounts for the fact that complete knowledge about fish, wildlife, plants, habitats, and the ecological processes supporting them may be lacking. The role of natural variability contributing to ecological resilience also is recognized as an important principle of adaptive management. It is not a "trial and error" process, but rather emphasizes learning while doing based upon available scientific information and best professional judgment considering site-specific biotic and abiotic factors on Refuge lands. Adaptive management results in effective monitoring and evaluation of the CCP.

Part of measuring the success of and adaptively managing the Refuge also includes the formal 15-year revision of the CCP. The revision will be initiated by the Service and will involve a

comprehensive review of management plans and research; working closely with partners; and engaging the public.

2.2.8 Integrated Pest Management

In accordance with DOI policy 517 DM 1 and Service policy 569 FW 1, an integrated pest management (IPM) approach will be utilized, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on Refuge lands. The IPM would involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to nontarget species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide would be needed on Refuge lands, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the Environmental Protection Agency (EPA) in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and as provided in regulations, orders, or permits issued by EPA may be applied on lands and waters under Refuge jurisdiction.

Environmental harm by pest species would refer to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors, including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and/or altered ecological processes. Environmental harm may be a result of direct effects of pests on native species, including preying and feeding on them; causing or vectoring diseases; preventing them from reproducing or killing their young; outcompeting them for food, nutrients, light, nest sites, or other vital resources; or hybridizing with them so frequently that within a few generations, few if any truly native individuals remain. Environmental harm also can be the result of an indirect effect of pest species. For example, decreased waterfowl use may result from pest plant infestations reducing the availability and/or abundance of native wetland plants that provide forage during the winter.

Throughout the life of the CCP, most proposed pesticide uses on Refuge lands would be evaluated for potential effects to Refuge biological resources and environmental quality. Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as facilities maintenance would be approved for use on Refuge lands where there likely would be only minor, temporary, and localized effects to species and environmental quality based upon nonexceedance of threshold values in chemical profiles. However, pesticides may be used on Refuge lands where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety. For more information on strategies related to control of pests, see Appendix E.

2.2.9 Law Enforcement

Officers' Responsibilities

Fish and wildlife law enforcement issues on lands and waters of the James Campbell NWR are under the jurisdiction of the Service Zone Officer based in Honolulu. The role of the Zone Officer is to conduct and document law enforcement incidents and coordinate and/or meet with all refuge project leaders, law enforcement supervisors, and refuge officers. The Hawaiian and Pacific Islands Zone Officer is highly mobile and is frequently deployed temporarily to various areas throughout the State

of Hawai‘i and across the Pacific Region. The need for a dedicated Refuge Officer for the Complex has been identified in the Implementation Plan (Appendix C).

Officers’ Authority

The Zone and Refuge Officers are primarily responsible for enforcing refuge and wildlife laws, including but not limited to:

- Administration Act;
- The Lacey Act;
- Archaeological Resource Protection Act;
- Endangered Species Act;
- Migratory Bird Treaty Act; and
- Marine Mammal Protection Act.

Zone and Refuge Officers are also empowered to enforce all criminal laws, including traffic violations, drugs, and warrants for arrest as they relate to trespass, hunting, fishing, and the taking wildlife on Federal lands, and in some instances boating safety related to refuge lands and waters. Service Officers work joint patrols and coordinate with the Department of Land and Natural Resources-Division of Conservation and Enforcement (DLNR-DOCARE), Honolulu Police Department (HPD), and the Sheriff Division of the State Department of Public Safety.

2.2.10 Permanent Full-time Staffing Additions

This CCP proposes adding 13 new permanent full-time (PFT) positions to the staff of the Complex: a Deputy Project Leader, Supervisory Park Ranger, Wildlife Refuge Specialist, Wildlife Biologist, Refuge Law Enforcement Officer, Environmental Education Specialist, Park Ranger, Facility Manager, 3 Maintenance Workers, and 2 Biological Technicians. All staffing additions are subject to regional approval and allocation of additional base funding.

2.2.11 Summary of CCP Actions

Intensive management of threatened and endangered waterbird species and their habitat at the Ki‘i and Punamanō Units of the Refuge will continue to focus on protection and successful nesting as part of the Statewide effort to implement the Hawaiian Waterbird Recovery Plan. A Visitor Services Plan (VSP) will be developed to identify, evaluate, and select sites for infrastructure such as a headquarters/visitor center/ EE (HQ/VC/EE) facility needed to fully implement a safe and compatible program for the public (to include roads, parking areas, trails, overlooks, etc.). The VSP will identify any new special regulations needed to protect sensitive wildlife resources, the fragile coastline, and the visiting public. The Refuge will cooperate with other agencies and the Kahuku community to develop, evaluate, and implement feasible projects to reduce projected flooding impacts in the local area; and both current aquaculture leases will remain in effect until 2023 at which time, by prior agreement, they will expire.

All wetlands, coastal dunes/strand and scrub/shrub habitats will be restored and managed. Trial use of predator-proof fencing will be initiated on selected dune and/or wetland sites to protect nesting seabirds and waterbirds. Abandoned aquaculture facilities will be cleaned up. If we determine that the Service does not currently have management authority for the shoreline adjacent to the Refuge coastline, we will pursue an Executive Order from the Governor of Hawai‘i for jurisdiction to help fulfill the Refuge purpose and ensure compatibility of uses.

Table 2.1 James Campbell NWR Management Summary

Key Themes		Objectives	Habitat Restoration
HABITATS	Intensively Managed Wetland	1.1 Ae‘o loafing & foraging	90-115 ac
		1.2 Ae‘o breeding	20 ac
		1.3 ‘Alae ke‘oke‘o & ‘alae ‘ula loafing & foraging	<59 ac
		1.4 ‘Alae ke‘oke‘o & ‘alae ‘ula breeding	<30 ac
	Natural Wetland	1.5 ‘Alae ke‘oke‘o & ‘alae ‘ula life-history	32-51 ac
	Remnant Wetland	1.6 Waterbirds & migratory birds	25-67 ac
	Coastal Strand/Dune	3.1 Restore, protect, and manage coastal strand	100-185 ac
		3.2 Improve seabird nesting site on runway	20-28 ac
Scrub/Shrub Habitat	2.3 Restore scrub/shrub	<312 ac	
Strategies			
Expansion Lands	2.1 Complete land acquisition	Coordination/cooperation with James Campbell Co., Regional Office, and Washington Office	
	2.2 Plan & construct Refuge facilities	Design/build new HQ/VC/EE facility, maintenance shop, bunkhouse & greenhouse	
Scientific Data	4.1 Conduct inventory and monitoring	Track nesting success; impacts of pest plants & animals; and movements of endangered waterbirds. Initiate data collection volunteer program	
	4.2 Facilitate research & scientific assessments	Form research partnerships and develop climate change assessment protocols	
Visitor Services	5.1 Provide EE	Up to 6,000 students with construction & staffing of EE facility	
	5.2 Offer new visitor opportunities, primarily wildlife observation and photography	5,000 visitors annually along coastline & Ki‘i; up to 210,000 w/ construction & staffing of VC	
Cultural & Historic Resources	6.1 Enhance awareness, protection, & appreciation	Consult Native Hawaiian & historical societies to develop interpretive materials; NAGPRA training for staff; develop maps for avoidance of known sites	
Flood Damage Reduction	7.1 Support feasible flood damage reduction efforts for Kahuku	Cooperate in planning process; maintain Walkerville Unit as potential flood damage reduction project area	

2.3 James Campbell NWR Management

Goals and objectives are the unifying elements for successful, adaptive refuge management. They identify and focus management priorities and link to refuge purpose(s), Service policy, and the Refuge System mission. The goals for the James Campbell NWR are presented on the following pages. Some objectives pertain to multiple goals and have simply been placed in the most reasonable spot. Similarly, some strategies pertain to multiple objectives and for clarity these strategies are listed under each relevant objective. Following the goals, objectives, and strategies, a brief rationale is provided that describes how management strategies will be implemented to achieve the intended objectives.



Ae'o ohana Laura Beauregard/USFWS

2.3.1 Goal 1.

Protect and manage seasonal wetland habitats to meet the life-history needs of endangered waterbirds to promote their recovery.

Objective 1.1. Intensively manage for ae'o loafing and foraging habitat.

Manage seasonal wetland habitat for loafing and foraging ae'o throughout the year on approximately 115 ac of the Ki'i Unit with the following characteristics:

- Open water (1-6 in) and mudflat (saturated and dry) interspersed with 30-60% cover of emergent vegetation (e.g., cattail), grasses (e.g., sprangletop, knot-grass, millet), and sedges (e.g., saltmarsh bulrush, *Fimbristylis* sp.) providing a mosaic;
- Less than 25% cover of pest plants including marsh fleabane, *Batis*, California bulrush, and California grass;
- Sufficient benthic and nektonic macroinvertebrates and small fish to provide forage on a rotational basis for up to 200 ae'o;
- No cats or dogs; and
- Documented predation below 10 individual ae'o per year.

Strategies Applied to Achieve Objective

Drawdown in specified impoundments from approximately March-July (control fish and promote invertebrates/algal growth, plant response)

Flood after vegetation treatment (mowing, tilling, herbicide, prescribed fire) to promote foraging

Pulse water to promote abundance and availability of invertebrates thrice monthly

Eliminate cattle egret roost trees

Fencing, live-trapping, snap-traps, shooting, and bait stations to reduce predation

Control pest plants using: herbicide application, prescribed fire, mowing, rototilling, disking, and brush cutting

Strategies Applied to Achieve Objective

Create openings (interspersion) in dense vegetation

Monitor predator abundance (i.e., track tunnels) to evaluate effectiveness of predator control efforts

Rationale: Ae‘o require different loafing and foraging habitats during the breeding (late February-July) and nonbreeding seasons. Recently hatched ae‘o (<14 days old) require shallow water of less than 2 inches to forage. During the remainder of the year fledgling and adult ae‘o can forage in water as deep as 6 inches.

Seasonally regulating water depth stimulates germination of desirable and beneficial plant species, controls undesirable plants, and provides a variety of macroinvertebrates for young and adult ae‘o to feed on, thereby creating and maintaining maximized production and carrying capacity of the wetlands. In addition to providing forage, seasonally regulated water depths provide a mosaic of open water and vegetation as microhabitat for ae‘o thermoregulation and cover during inclement weather.

Mowing, prescribed fire, herbicide application, rototilling, and disking are all suitable techniques for creating the desired mosaic of vegetation, open water, and mudflats by opening dense contiguous patches of *Batis*, California grass, marsh fleabane, California bulrush, water hyssop, or cattail. These management techniques also benefit a variety of other wetland-dependent species including koloa maoli, ‘alae ke‘oke‘o, ‘alae ‘ula, wintering waterfowl (dabbling ducks), and shorebirds.

Objective 1.2. Intensively manage wetland habitat for ae‘o breeding.

Provide seasonal wetland habitat for breeding ae‘o from February-July on 20 acres of the Ki‘i Unit with the following characteristics:

- Open water (<3 in) and mudflat (saturated and unsaturated) with <25% cover of emergents, grasses, and sedges providing a mosaic;
- Undulating, irregular bottom topography creating unsaturated mudflats with gradual slopes during drawdown for nesting adjacent to foraging habitat;
- Predation limited to no more than five documented events per year;
- Less than 25% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, and California grass; and
- Benthic and nektonic macro-invertebrates and small fish with densities of 400-600 invertebrates/yd².

Strategies Applied to Achieve Objective

Flood for prebreeding (as a follow-up to mowing/rototilling, etc. to create nesting habitat)

Slow drawdown rate (control fish and promote invertebrates/algal growth, plant response)

Pulse water weekly to promote invertebrates for broods

Control predators with fencing, live-trapping, snap-traps, and bait stations

Control pest plants with herbicide application, prescribed fire, mowing, disking, and brush cutting

Restricted public use (seasonal closures) and limited Refuge staff presence only at a level necessary to conduct monitoring and water management, under normal circumstance, 1-3 visits per week

Monitor predator abundance to evaluate success of control efforts

Rationale: Breeding ae‘o require dry to unsaturated mudflat habitat for building nests. Pre-breeding water level drawdowns help establish drier mudflats. Although saturated mudflats can be used as nest sites, adult ae‘o expend more energy building nests robust enough to counter the excess moisture. Initiation of the drawdown is timed to coincide with minimal or no ‘alae ke‘oke‘o nesting or chick rearing. This timing method is part of an overall cycle of wetting and drying of habitat, making it suitable to a greater number of birds throughout the year and increasing species diversity. Thus, ae‘o nesting habitat temporally follows where ‘alae ke‘oke‘o habitat existed previously.

Declining water levels increase areas of suitable nesting habitat. Ae‘o breeding season water drawdowns maximize the number of nests that an area can support. The target distance between nest site to vegetation and water is 0-20 feet. Slow drawdown rates also stimulate ample numbers and diversity of invertebrates throughout the brood rearing period, allowing adult ae‘o with broods to establish feeding territories and reduce inter-brood conflicts that can result in injury or death to young chicks.

Ae‘o are very easily disturbed during the nesting season. Since they nest in the open on exposed mudflats they evolved behaviors to help protect nests and young. One behavior of the adult is to depart the nest when perceived danger is detected, leaving the nest, eggs, or young exposed to ground or avian predators and the weather. Eggs can also be destroyed by prolonged exposure to high temperature, wind chill, and rain, all of which occur frequently in Hawai‘i. Human disturbance must be minimized during the nesting period to reduce the risk of nest abandonment. Thus, public access is generally closed during this time.

Objective 1.3. Intensively manage seasonal wetland habitat for ‘alae ke‘oke‘o and ‘alae ‘ula loafing and foraging.

Provide seasonal wetland habitat for loafing/foraging ‘alae ke‘oke‘o and ‘alae ‘ula throughout the year on approximately 50 ac of seasonal wetlands and 9 ac of associated dikes at Ki‘i with the following characteristics:

- Mudflat (dry and saturated) and open water (<1-18 in) interspersed with 30-60% cover of tall (3-8 ft) emergent vegetation, grasses, and sedges that provide seed and green browse and a mosaic of concealment cover, open water, and thermal cover;
- <25% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, and California grass;
- Adjacent short (<4 in), grassy uplands (especially dikes) for foraging;
- Interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
- Predation levels of no more than five individual ‘alae ke‘oke‘o and one ‘alae ‘ula per year;
- *Tilapia* numbers maintained at a level promoting algal growth and other desirable plants such as *Ruppia maritima* as forage; and
- Abundant epiphytic invertebrates (i.e., dragonflies), crayfish, and aquatic benthic/nektonic macroinvertebrates to support up to 200 ‘alae ke‘oke‘o and 100 ‘alae ‘ula on a seasonal basis.

Strategies Applied to Achieve Objective

Extended hydroperiod to promote epiphytic invertebrates

Flood after vegetation treatment (mowing, tilling, etc.) to promote foraging

Slow drawdown rate (control fish and promote invertebrates/algal growth, plant response)

<i>Strategies Applied to Achieve Objective</i>
Control pest plants using: herbicide application, prescribed fire, mowing, rototilling, disking, and brush cutting
Fencing, live-trapping, snap-traps and bait stations to reduce predation

Rationale: While ‘alae ke‘oke‘o and ‘alae ‘ula occupy similar loafing and foraging habitat, there are differences between the species’ needs. ‘Alae ke‘oke‘o use earlier successional stages of wetland habitat with a greater open water to vegetation ratio. They also typically occupy deeper water than ‘alae ‘ula. ‘Alae ‘ula prefer late successional stages comprised of dense, robust vegetation with greater seclusion. ‘Alae ke‘oke‘o spend more time loafing in a flock on open water and dikes, whereas ‘alae ‘ula are more solitary and occupy areas around the base of robust emergent vegetation or dikes. ‘Alae ‘ula use open water primarily as a corridor between areas of suitable habitat.

Ki‘i ponds A and E contain a high percentage of *Batis* which provides habitat for ‘alae ‘ula, while other ponds are managed for other species. The mosaic of open water and dense vegetation provides areas for thermoregulation and cover and increases habitat diversity. Mowing, disking, prescribed fire, herbicide application, and rototilling are all techniques suitable to open dense contiguous patches of *Batis*, California grass, marsh fleabane, California bulrush, water hyssop, or cattail-dominated areas. These techniques also return nutrients to the wetland ecosystem and benefit a variety of other water-related species including koloa maoli, wintering waterfowl, and shorebirds.

Objective 1.4. Intensively manage seasonal wetland habitat for ‘alae ‘ula and ‘alae ke‘oke‘o breeding.

Provide seasonal wetland habitat for breeding ‘alae ‘ula and ‘alae ke‘oke‘o throughout the year on approximately 30 ac on Ki‘i with the following characteristics:

- Mudflat (dry and saturated) and open water (<1-18 in) interspersed with 30-60% cover of tall (3-8 ft) emergent vegetation, grasses, and sedges that provide seed and green browse and a mosaic of concealment cover, open water, and thermal cover;
- Less than 25% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, and California grass;
- Interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
- Predation of no more than five individual ‘alae ke‘oke‘o and one ‘alae ‘ula per year;
- *Tilapia* numbers constrained to a low level, promoting algal growth and other desirable plants such as *Ruppia maritima* as forage;
- Abundant epiphytic invertebrates (e.g., dragonflies), crayfish, and aquatic benthic/nektonic macroinvertebrates to support up 200 ‘alae ke‘oke‘o and 100 ‘alae ‘ula on a seasonal basis;
- Brood rearing in close proximity to nesting habitat; and
- Stable water levels during laying and incubation.

<i>Strategies Applied to Achieve Objective</i>
Extended hydroperiod to promote epiphytic invertebrates
Flood to sufficiently inundate emergent vegetation
Slow drawdown rate (control fish and promote invertebrates/algal growth, plant response)

<i>Strategies Applied to Achieve Objective</i>
Fencing, live-trapping, snap-traps, and bait stations to reduce predation
Control pest plants using herbicide application, prescribed fire mowing, rototilling, brush cutting, disking
Mowing, rototilling, brush cutting, and/or prescribed fire to create openings in dense vegetation
Maintain stable water levels during laying and incubation
Partial to complete public closure to minimize human disturbance
Monitor predator abundance to evaluate effectiveness of predator control efforts

Rationale: ‘Alae ke‘oke‘o and ‘alae ‘ula prefer stable water levels for nest building and nesting. When preparing an impoundment for ‘alae ke‘oke‘o and ‘alae ‘ula nesting, water levels are raised to a depth of 8-15 inches and maintained at a constant level to provide adequate nest sites that are secure from predation. Fluctuating water levels are not desirable, requiring nesting adults to continually build the nest up or have it isolated on dry ground and subject to greater predation. During brood rearing periods, however, water levels are pulsed infrequently to provide physical barriers between brood territories and provide greater access to macroinvertebrates that are eaten by adults in breeding condition and also fed to developing chicks. These invertebrates are an important protein source for proper development.

The amount of vegetative cover in an impoundment varies with the duration between habitat management actions. As succession from open water to a more vegetation-dominated wetland occurs, it favors different species. ‘Alae ke‘oke‘o are adept at nesting in a more open setting where there is approximately 30 percent cover of emergent vegetation. ‘Alae ‘ula prefer a more vegetated system with about 60 percent cover.

Because of rapid and year-long plant growth in Hawai‘i, habitat manipulation generally requires removal of all or nearly all vegetation (generally every 2-3 years) from a managed wetland impoundment to increase the time before follow-up management actions are needed. In the habitat preparation phase, dewatering followed by mowing, tilling, and herbicide application are used to achieve the mosaic. During the managing phase when water is in the impoundment, water level manipulation helps to create the desired percentage of vegetation and interspersed. Each impoundment can be managed independently in this manner, varying the habitat to meet wildlife needs.



Habitat manipulation Mike Silbernagle/USFWS

Ample food supply is important to build and maintain a healthy breeding population at a given site. Pest fish, such as *Tilapia* spp., are known to compete for food eaten by ‘alae ke‘oke‘o and ‘alae ‘ula. They also degrade water quality, which can affect invertebrate densities and plant growth. During habitat manipulation, slow drawdowns of water levels are used to concentrate undesirable fish and ultimately remove them from the environment. Following their death during dewatering, the remains are allowed to dry and decompose naturally or are tilled into the soil, increasing soil nutrients that aid in promoting invertebrate and plant response. Avian botulism is a concern so evidence of botulism

poisoning is closely monitored for during this fish decomposition period.

‘Alae ke‘oke‘o and ‘alae ‘ula are less susceptible to disturbance during nesting compared with ae‘o and this relates to their nest location, nesting habitat, and response to disturbance. Since ‘alae ke‘oke‘o and ‘alae ‘ula nest in open water or dense vegetation with concealment, their response to disturbance is to remain motionless on the nest. As a result, public use is limited during the ‘alae ke‘oke‘o and ‘alae ‘ula nesting season. Most of the time it is difficult to see a nest even at a relatively close distance.

Recognizing public tours and educational programs are important, there is a need to restrict access for such activities in areas where nesting and brood rearing is concentrated. The locations of nest are monitored and visitors either directed away from the areas or led quickly through the area to minimize human disturbance.

Objective 1.5: Manage natural wetland habitat for ‘alae ke‘oke‘o and ‘alae ‘ula.

Provide and manage up to 51 ac of natural wetland habitat of the Punamanō Unit to meet all life-history needs of ‘alae ke‘oke‘o and ‘alae ‘ula throughout the year with the following characteristics:

- Mudflat (dry and saturated) and open water (<1-18 in) interspersed with 30-60% cover of tall (3-8 ft.) emergents, grasses, and sedges that provide a mosaic of concealment cover, open water, and thermal cover;
- Less than 40% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, California grass, Christmas berry, and koa haole;
- Adjacent short (<3 in), grassy uplands for foraging;
- Predation levels of no more than five ‘alae ke‘oke‘o and one ‘alae ‘ula per year.

Strategies Applied to Achieve Objective

Fencing, live-trapping, snap-traps and bait stations to reduce predation

Control pest plants using: herbicide application, prescribed fire, mowing, rototilling, disking, and brush cutting

In selected sites, investigate and implement, if feasible, installation of small water control structures to partially restore water level management capability and increase habitat diversity

Monitor predator abundance to evaluate effectiveness of predator control efforts

Rationale: Currently, with no water control structures, intensive water management capabilities are lacking at the Punamanō Unit. Therefore, the timing, duration, and water level cannot be managed. Natural weather patterns and subsurface ground water movement control the hydrology of the unit.

Maintenance (nonbreeding) habitat is created, maintained, or enhanced mostly at the wetland/upland interface because mowing, tilling, and other mechanisms can be undertaken to control vegetation. Access to these areas is limited and most work here must be accomplished by hand. Mudflat habitat is only available along portions of the wetland perimeter. Presence, absence, and amount of mudflat are dependent on natural fluctuating water level. Natural undulating vegetation edges only create limited areas for thermoregulation.

Breeding habitat for ‘alae ke‘oke‘o and ‘alae ‘ula is restricted to centrally located stands of emergent vegetation. Vegetation control in the wetland occurs infrequently due to unavailability of adequate

equipment (e.g., aquatic weed cutters and excavators) on a regular basis. As a result, lower numbers of ‘alae ke‘oke‘o and ‘alae ‘ula are supported here than in intensively managed wetland units. Nesting is confined to bulrush stands on this unit. Macro- and other invertebrates are produced, but competitive fish such as *Tilapia* are not controlled and likely reduce food availability for endangered ‘alae ke‘oke‘o and ‘alae ‘ula.

Mowing, prescribed fire, herbicide application, and rototilling are all tools that are available to open wetland shoreline areas of *Batis*, California grass, marsh fleabane, Christmas berry, and koa haole. Chipping can reduce the removed material that cannot be disposed of by techniques identified above. This will speed recovery of the area by reducing the time necessary for natural decomposition to occur. Controlling these species promotes a mosaic of wetland fringe and upland vegetation, open water, and mudflats as suitable habitat for ‘alae ke‘oke‘o and ‘alae ‘ula. Small pieces of herbaceous plant material created from mowing and other techniques also become available to ‘alae ke‘oke‘o and ‘alae ‘ula for nest construction.

A 16-acre wetland site (currently unmanaged) in the southeast corner of the Punamanō Unit, adjacent to Nudist Camp Road, has been partially drained by small lateral surface ditches since the early 1900s. This area will be investigated to determine if the installation of small water control structures in these lateral ditches may partially restore historic water levels and provide a minimal amount of water management capability that will increase overall wetland habitat diversity in this unit, benefitting both ‘alae ke‘oke‘o and ‘alae ‘ula.

Objective 1.6. Manage remnant wetland habitat within acquisition area for the benefit of endangered waterbirds and migratory birds.

Once acquired, protect and maintain approximately 69 ac of remnant seasonal wetlands within the acquisition boundary for James Campbell NWR expansion to meet these characteristics:

- Mudflat (dry and saturated) and open water (<1-18 in) interspersed with 30-60% cover of tall (3-8 ft) emergent grasses and sedges that provide a mosaic of concealment cover, open water, and thermal cover;
- Less than 40% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, California grass, Christmas berry, and koa haole;
- No ironwood or kiawe;
- Interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
- Documented predation of no more than five ae‘o per year; and
- Limited/controlled public use to minimize disturbance.

Strategies Applied to Achieve Objective

Fencing, live-trapping, snap-traps and bait stations to reduce predation

Control pest plants using: herbicide application, prescribed fire, mowing, rototilling, disking, and brush cutting

Create desirable mosaic of openings in vegetation by mowing, rototilling, disking or prescribed fire

Monitor predator abundance to evaluate effectiveness of predator control efforts

Rationale: Once acquired, Service management of semi-permanent and temporary wetlands within the approved boundary will involve controlling undesirable vegetation and, where feasible, limited water level management. Major alteration of the landscape is not required to enhance and maintain wetlands capable of supporting waterbirds because in most areas soils and hydrology are still functioning in a relatively natural manner. Maintenance (nonbreeding) habitat may be created, maintained, or enhanced in suitable and accessible wetland/upland interface where mowing, tilling and other mechanisms can be undertaken to control vegetation.

Lower numbers of ‘alae ke‘oke‘o and ‘alae ‘ula will be supported here than in an intensively managed wetland. Nesting will be confined to emergent stands. Macro- and other invertebrates are produced, but competitive fish such as *Tilapia* are not controlled and they likely reduce food for endangered ‘alae ke‘oke‘o and ‘alae ‘ula. Life-history needs of endangered waterbirds will be met in at least part of the area throughout the year under this objective. Other benefiting species include the koloa maoli and a variety of migratory wintering waterfowl, primarily dabbling ducks such as koloa māpu (northern pintail), koloa mohā (northern shoveler), and green-winged teal. Several shorebird species will also benefit including ‘akekeke, kolea, and ‘ū‘lili.

Selected sites will be investigated for the feasibility of installing small water control structures to partially provide water level management capability in these remnant degraded wetlands. In addition, several existing groundwater wells on the acquisition area have been used in the past for commercial aquaculture operations. These wells, as well as surface water runoff, may also be used to partially provide water level management capabilities. This limited capability may improve the control of pest species and increase habitat diversity.

Objective 1.7. Manage aquaculture ponds, in voluntary cooperation with lessees, for waterbirds and shorebirds.

Enhance, protect and manage up to 242 ac. (currently under lease until 2023) to meet these characteristics:

- Mudflat (dry and saturated) and open water (<1-18 in) interspersed with 30-60% cover of tall (3-8 ft) emergent grasses and sedges that provide a mosaic of concealment cover, open water, and thermal cover;
- Less than 40% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, California grass, Christmas berry, and koa haole;
- No ironwood or kiawe;
- Interspersed vegetation with sufficient edge providing visual barriers to maximize territories available for breeding;
- Documented predation level of no more than 10 ‘alae ke‘oke‘o and 4 ‘alae ‘ula per year; and
- Limited/controlled public use to minimize disturbance.

Strategies Applied to Achieve Objective

Passively manage aquaculture ponds in voluntary cooperation with lessees through water level management

Conduct aquaculture ponds assessment and develop a restoration plan

Fencing, live-trapping, snap-traps and bait stations to reduce predation

Control pest plants with herbicide application, mowing, rototilling, disking, and brush cutting

Rationale: Aquaculture ponds are currently under lease with the Service on 242 acres of the Refuge. These leases are scheduled to expire in 2023, when they will permanently revert to Refuge management. Lessees may relinquish their leases prior to 2023 on a voluntary basis, or leases may be terminated if lessees fail to meet the conditions of the leases. Under current aquaculture operations, many of the ponds may be idle for extended periods of time (months to years). These idle ponds have potentially high habitat value for endangered waterbirds and migratory birds. With relatively little active management, primarily water level management (raising and lowering water levels at desirable intervals), the additional wetland habitat can benefit these species. This provides an opportunity for voluntary cooperative management strategies between the lessees and the Refuge.

When the leases expire and/or when the ponds revert to Refuge management, they will be evaluated for more active and long-term management strategies. This process will begin with a comprehensive water management and resource analysis planned for 2018-2020.

Objective 1.8. Provide wetland habitats to meet the life-history needs of koloa maoli.

Enhance, protect and manage up to 50 acres to meet these characteristics:

- Mudflat and open water containing an approximately 50:50 ratio of emergent plants to open water, with an irregular shoreline;
- Less than 40% cover of pest plants including marsh fleabane, *Batis*, water hyssop, California bulrush, California grass, Christmas berry, and koa haole;
- Abundant small invertebrates such as aquatic insects, snails and crustaceans (400-600 invertebrates/yd²);
- No introduced aquatic vertebrates; and
- Limited/controlled public use to minimize disturbance.

Strategies Applied to Achieve Objective

Support inter-agency efforts to promote the recovery of pure koloa maoli

Monitor, research, and survey koloa maoli population

Pulse water to promote abundance and availability of invertebrates thrice monthly

Control pest plants using: herbicide application, prescribed fire, mowing, rototilling, disking, and brush cutting

Rationale: The koloa maoli is an endangered waterfowl endemic to the Hawaiian Islands. Koloa maoli eat primarily small invertebrates such as aquatic insects, snails, and crustaceans. They also eat freshwater limu (algae) and seeds of grasses, sedges, and other plants. They sometimes graze on grasses and legumes similar to geese. Pest fish (mosquito fish and *Tilapia*) compete with koloa maoli for food. Koloa maoli are more likely to use wetlands farther (more than 600 yds) from houses, larger (0.75 ac) wetlands, and those surrounded by more wetlands area (2.5 ac) (Uyehara et al. 2007).

The Draft Revised Recovery Plan for Hawaiian Waterbirds lists the koloa maoli as having a high potential for recovery and a high degree of threat due to hybridization with mallard ducks, the greatest threat to this species' continued existence. Although birds on O'ahu and Maui are thought to be primarily koloa-mallard hybrids, three pure koloa maoli were found at James Campbell NWR during a genetic testing survey in 2008. In addition to hybridization concerns, other hazards exist for koloa maoli. Known predators of eggs and ducklings include mongooses, cattle egrets, cats, dogs,

and possibly rats and Samoan crabs. ‘Auku‘u and bullfrogs have been observed to take ducklings. Avian diseases are another threat to koloa maoli with outbreaks of avian botulism occurring annually throughout the State. Habitat improvements combined with feral mallard control may reduce extinction threats to koloa maoli (Uyehara et al 2008).

2.6.2 Goal 2.

Complete acquisition of the James Campbell NWR expansion to restore, protect and manage habitats according to Refuge purposes and to meet Refuge staff facility needs.

Objective 2.1. Complete the James Campbell National Wildlife Refuge Expansion Act land acquisition process.
Complete acquisition of lands identified in the Expansion Act by December 2013.
<i>Strategies Applied to Achieve Objective</i>
Continue close coordination/cooperation with James Campbell Company, Regional Office, and Washington Office to complete terms of purchase agreement
Monitor transfer of State Water Use Permit to meet time restrictions for administrative transfer
Identify/pursue new opportunities for land acquisition that will serve/benefit Refuge purpose
Pursue acquisition from willing sellers of small land inholdings within the Refuge boundary to complete/consolidate Refuge lands
If needed, pursue Executive Order from the State of Hawai‘i for jurisdiction to manage shoreline adjacent to Refuge to protect wildlife and standardize public use regulations

Rationale: The James Campbell NWR Expansion Act of 2005 authorized the expansion of the Refuge to 1,100 acres. The purchase agreement between the Service and James Campbell Company has a sunset clause that mandates the acquisition be completed by December 2013. Funding has been obligated to complete the purchase and as of August 2011, Parcels 1 and 4 (see Figure 3-2) have been purchased and are now part of the Refuge. Parcels 2 and 3 remain to be purchased.

Management jurisdiction for the new property boundary along the shoreline is under review, subject to the Service solicitor’s opinion. If we determine that the Service does not currently have management authority for the shoreline adjacent to the Refuge, we will pursue an Executive Order from the Governor of Hawai‘i for jurisdiction to help fulfill the Refuge purpose and eliminate conflicting uses or regulations. Under State law, when a compelling need or benefit may be met, an Executive Order signed by the Governor may be issued to transfer management responsibility of the State shoreline corridor to the adjoining landowner, in this case the Refuge. This action, if approved and agreed upon by the State, would consolidate management and protection of highly valuable and sensitive coastal resources along this unique portion of coastline.

Water rights owned by James Campbell Company will be transferred to the Refuge upon sale. State Water Commission regulations allow for administrative transfer of water use permits if application is made within 60 days of land transfer. Administrative transfer precludes the need to apply for new water use permits on existing permitted wells.

Other lands adjacent to or in the vicinity of the Refuge with potential high value and benefit to the Refuge may be identified and become available for purchase. In these cases, Service procedures and policies, including NEPA compliance and willing seller policy, would be followed to pursue acquisition of these potential additional lands.

Objective 2.2. Develop site plans and construct new Refuge facilities.

By the year 2014, identify suitable sites for complex headquarters, visitor center, and EE (HQ/VC/EE), and other Refuge facilities. Develop plans for and construct HQ/VC/EE facility with the following attributes:

- Leadership in Energy & Environmental Design certified;
- Energy efficient – in operation and in construction;
- Resource efficient – in operation and in construction;
- Non-polluting – in operation and production;
- Accessible – to provide equal use of the built environment for all people;
- Native plantings – landscape uses native plants adapted to O‘ahu’s north shore; and
- Local building materials – to minimize the energy embedded in their transportation.

Strategies Applied to Achieve Objective

Develop site plans for areas to be managed as administrative lands

Acquire approval and funding for Design/Build of new HQ/VC/EE facility

Evaluate and construct, if feasible, a new Complex maintenance facility at a more desirable location (higher elevation, less harsh coastal environment, improved access) than current location

Evaluate and implement, if feasible, restoration of existing residential home on Parcel 4 to provide adequate temporary housing for volunteers, interns, or researchers; or pursue location and construction of a standardized bunkhouse facility

Construct greenhouse for native plant propagation

Rationale: Acquisition of new land will provide opportunities to develop major Refuge facilities that will benefit the public and staff such as a HQ/VC/EE to serve the Complex. Suitable site characteristics include consideration of public road access, proximity to utilities, and ground elevation. For nearly 20 years, Refuge staff have worked out of a leased office space in Hale‘iwa, 20 miles from the Refuge. This location does not serve the staff or the public well. A HQ/VC/EE constructed on the Refuge would be a tremendous boost to the visibility and image of the Service and could serve an estimated 210,000 visitors annually and up to 6,000 students.

The current location of the Complex maintenance facility is undersized and is exposed to harsh marine coastal winds that are highly corrosive to equipment due to salt spray. When fully acquired, sites on the expansion lands will be evaluated to determine their feasibility for a new maintenance facility that would better serve the growing management needs of the Complex and offer greater protection from harsh coastal conditions. A new bunkhouse would provide onsite, affordable temporary housing for volunteers, researchers, or interns thereby greatly enhancing the ability of these persons to conduct work on the Refuge. New facilities will be designed and built to improve performance in metrics such as energy savings, water efficiency, CO₂ emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

2.6.3 Goal 3.

Restore and protect coastal strand/dune habitat and upland scrub/shrub to provide safe refuge for endangered ‘Īlio-holo-i-ka-uaua and threatened honu, as well as provide habitat for seabirds, shorebirds, and migratory birds.

Objective 3.1. Restore, protect, and manage coastal strand/dune habitat.

Restore, protect, and manage a mosaic of up to 200 acres of terrestrial habitat consisting of approximately 140 acres of coastal dune/strand, and up to 60 acres of adjacent coastal scrub/shrub to promote nesting and roosting habitat for 6 seabird species, as well as protected habitat for honu and ‘Īlio-holo-i-ka-uaua. Coastal strand/dune habitat characteristics should be:

- Patchy distribution of low growing (2-8 ft), native woody species (e.g., ‘ilima, naupaka kahakai, pilo, wiliwili, naio, hala) as a mosaic;
- 30-40% cover of native grasses (e.g., ‘āki‘aki) and herbaceous vegetation (e.g., Mau‘u, Pōhuehue) on dunes;
- Less than 10% of woody pest plant species (e.g., marsh fleabane, mangrove, Christmas berry, and koa haole);
- No ironwood or kiawe;
- Less than 15% cover of herbaceous pest plant species;
- Predation limited to no more than six seabirds per year; and
- Restricted public use to protect fragile dunes habitat, particularly native plants; and to minimize human disturbance to ‘Īlio-holo-i-ka-uaua, honu, seabirds, shorebirds, and other migratory birds.

Strategies Applied to Achieve Objective

Remove marine debris

Periodic mowing and brush-cutting to allow for breeze flow and pathways from dune crest

Propagation and planting of native plant species

Control pest plants with herbicide application, prescribed fire, mechanical removal, and brush cutting

Predator control methods for pigs, cats, and dogs include trapping, fencing, and shooting

Support volunteers and organizations to protect wildlife and inform public along shoreline

Predator control methods for rodents and mongooses include bait stations, trapping, and fencing

Fencing to limit human disturbance

Test use of predator-proof fencing to exclude all mammals; implement on a larger scale if feasible

For nesting seabirds, minimize human disturbance until colony is well established; then provide appropriate viewing platforms or blinds for the public

Refuge coastline closed to public use at night to protect nesting honu and seabirds

Temporary or seasonal public closures in the Refuge-owned shoreline as necessary to protect nesting honu or pupping ‘Īlio-holo-i-ka-uaua

Rationale: Intact vegetative coastal dune communities are extremely rare throughout the main Hawaiian Islands and important to several rare and endangered animal and plant species. Coastal dune and associated beach strand habitat are used by endangered ‘Ōlio-holo-i-ka-uaua and threatened honu for hauling out, basking, and pupping or nesting respectively. This habitat also provides important foraging and loafing areas for migratory bird species such as the kioea, kōlea, and ‘akekeke. Soil texture, relative position to the shoreline, and desirable plant species provide suitable subterranean nest burrow habitat for ‘ua‘u kani and ‘a‘o (Newell’s shearwater).

The Refuge coastline is at the northeast tip of the island where it is highly susceptible to accumulation of marine debris due to ocean currents and prevailing northeast wind. Honu, ‘Ōlio-holo-i-ka-uaua, and sea birds may be severely injured and even die after entanglement with fishing lines, fragments of trawl netting or plastic packing straps. Seabirds caught in this debris may lose their ability to move quickly through the water, reducing their ability to catch prey and avoid predators; or they may suffer constricted circulation, leading to asphyxiation and death. Fishing line, nets, and ropes cut into the skin of ‘Ōlio-holo-i-ka-uaua or honu, leading to infection or painful amputation of flippers or tails. Honu frequently eat plastic bags, confusing them with jellyfish, their common prey. Seabirds eat polystyrene balls and plastic buoys, confusing them with fish eggs and crustaceans. Beach clean-ups at the Refuge are scheduled two to four times annually, depending on the availability of volunteers.

Coastal dunes are fragile and easily altered by human activity. Livestock grazing and off-road-vehicle (ORV) use was and is occurring, having an impact on the substrate and vegetative community. Observed changes include “blowouts” in the dunes and the occurrence of pest plant species that likely came in with livestock food or mud tracked in with ORVs. These activities will be suspended as the land is acquired by the Refuge.

Six seabird species were selected for priority management because of their habitat preferences at other nesting sites in Hawai‘i that resemble the conditions at the Refuge, the proximity of possible sources of colonizing birds, examples of previous restoration attempts at other sites that were successful, and their relatively higher resistance to small mammals such as mice that may be impossible to control in the early stages of colony restoration. In order of feasibility of attraction and establishment, the species are mōlī, ‘ua‘u kani, koa‘e‘ula, ‘a, ka‘upu, and Christmas shearwater. Other species including the ESA-listed ‘a‘o, the ‘ou, and many of the tropical terns will more likely be attracted and successfully nest here once other seabirds are already established. Removal of woody pest plants to maintain breeze flow is critical to aid in thermoregulation of nesting adults and pre-fledgling seabirds. During periods of high temperatures, seabirds depend on airflow to help maintain normal body temperature. Parents have to remain on the nest during incubation, making departure from the area infeasible because mortality of the developing embryo could occur. Sea breeze/air flow is also an important component to taking-off because of wing loading. Much like aircraft, seabirds tend to take off into the wind because it assists them in getting airborne more quickly with less energy expenditure.

Low intensity management on beach and dunes will include fencing, spot treatment of pest plants, and minimizing predation. For each species, the restoration methods can include manipulating the vegetation community; providing a mammal-free area; employing attraction techniques such as sound recordings, decoys, and mirrors to take advantage of the highly social nature of nesting seabirds; or actively translocating animals at the appropriate age, rearing them on site and releasing them in the hope that they will return at breeding age to the new colony. This final method has been

recently successfully employed with short-tailed albatrosses in Japan and has also been used with fluttering shearwaters in New Zealand and Atlantic puffins in Maine. Existing habitat for each of the species suggested already exists in the approved acquisition site. Additional nest sites could be provided for koa‘e ‘ula and ‘ua‘u kani by using slabs of concrete building material to create shelters and by building wooden nest site structures above the ground for ‘ā (Rauzon 1999).

Predators such as rats, mongooses, cats, and dogs are the primary limiting factor to restoring and maintaining a seabird community. Predator control provides the opportunity for seabirds to recolonize important nesting habitat. Benefits will also be realized for wintering and resident shorebirds on areas managed for seabirds. Removal of pest species and increased loafing and foraging habitat will allow the Refuge to support a larger number of shorebirds, many coming from thousands of miles away.

Objective 3.2. Improve potential seabird nesting site on abandoned Kahuku airfield runway.

Restore, manage, and protect approximately 28 acres of abandoned runway to promote nesting habitat with the following characteristics:

- Patchy distribution of low growing (2-8 ft) naupaka kahakai as a mosaic;
- Less than 10% of woody pest plant species (e.g., marsh fleabane, mangrove, Christmas berry, and koa haole);
- No ironwood or kiawe;
- Less than 15% cover of herbaceous pest plant species;
- Breeze flow corridors to aid in thermoregulation;
- Predation limited to no more than six seabirds per year; and
- Restricted public use to minimize human disturbance to nesting seabirds.

Strategies Applied to Achieve Objective

Remove and control invasive woody growth on and along perimeter (aprons) of runway using a variety of techniques including cutting, mowing, grubbing, prescribed fire, and herbicide application

Implement control methods for nonnative predators including trapping, baiting, fencing, and shooting

Test use of predator-proof fencing to exclude all mammals; implement on a larger scale if feasible

Monitor seabird activity to determine future management actions

Monitor encroachment of pest species

Engage in attraction of birds using visual cues such as decoys, mirrors, and/or recorded calls of desired species

Rationale: A short distance inland from the dunes, the abandoned World War II Kahuku runway could provide potential nesting habitat to albatross and other seabirds, similar to that found on abandoned runways at Midway Atoll, Tern Island, and other remote Pacific Islands. Mōlī, in particular, frequently and heavily use flat, open sites with low or interspersed vegetation for nesting. These conditions exist at several former military runways at several sites around the Pacific. The Kahuku runway is ideally located just a few hundred yards inland from the coast and downwind of the prevailing trade winds.

After years of inactivity, vegetation has encroached on much of the remaining Kahuku runway. The

aprons of the runway proper, constructed primarily of compacted crushed coral, are largely covered with koa haole, kiawe, *Pluchea*, and ironwood. The runway was constructed of a light asphalt mix and has been invaded by pest vegetation to a lesser extent. Where small portions of the original runway remain open, native vegetation such as pōhuehue has become established. This low-growing plant is suitable for nesting habitat and will continue to be promoted. Sufficient airflow (breeze and wind) is a fundamental component of a suitable mōlī nesting site. Mōlī adults and chicks depend heavily on airflow to help regulate their body temperatures to help with takeoff and flight at inland sites. Removal of the existing dense woody pest vegetation along the runway will help to significantly restore a natural airflow over the site.

Control of nonnative predators is essential to the establishment and success of any seabird colony on the main Hawaiian Islands. Several attempts by mōlī to individually colonize nearby coastal habitat over the past few decades have almost always resulted in the eggs, chicks, or adults being killed by predators, generally believed to be dogs.

As rising sea levels begin to negatively impact important seabird nesting sites in more vulnerable remote Pacific islands, nesting sites on the main Hawaiian Islands (which are generally higher in elevation) will become increasingly important. Unfortunately, suitable potential nesting sites in the main Hawaiian Islands are very uncommon due to loss of habitat and impacts from pest species. Potential nesting sites such as the abandoned Kahuku runway may take on significantly more importance in future decades.

Over the 15-year timeframe of this CCP, the use and benefits of the runway habitat for seabirds will be monitored and evaluated. The kioea, another important migratory bird species, is regularly observed using the remaining open portions of the runway for foraging and resting. This species will also benefit from the proposed management of the runway.

The few species of seabirds that successfully nest in very limited areas on the Island of O‘ahu are a reflection of the devastating impacts from predators, including rats, mongooses, cats, dogs, and pigs. These pest species are the primary limiting factor to reestablishing and maintaining a successful nesting seabird community. Despite predator control programs, predation can still be a serious problem. One management strategy to reduce or eliminate the damage would be to include predator enclosure fences and eradicate pests from within the fenced areas. Control and management of pest vegetation and predators provides an opportunity for seabirds to recolonize important nesting habitat.



Mōlī pair watches over chick USFWS

Objective 3.3. Restore scrub/shrub habitat within expanded boundary.

Develop restoration plans for up to 312 acres of scrub/shrub habitat considering the following:

- Native plants consistent with historic scrub/shrub habitats;
- Sparsely vegetated geological formations (e.g., coral outcrops) with potential to support nesting seabirds; and
- Cover plants within 30 yds of wetlands to support life history needs of waterbirds.

Strategies Applied to Achieve Objective

Conduct surveys and studies to determine desirable native vegetation community based on local site conditions including soil type, elevation, groundwater table and proximity to shore

Use IPM techniques to control/eradicate pest plants

Work with the Bishop Museum and other partners to determine the historic plant communities

Develop/implement restoration program, to include outplanting of native species

Determine the feasibility of establishing populations of the endangered ‘Ewa hinahina and ‘akoko.

Develop/implement plans to conduct major cleanup of abandoned aquaculture facilities and restore to natural conditions or other approved uses (i.e., visitor use facilities)

Rationale: This area in the new Refuge boundary has not previously been managed by the Service. Much of the scrub/shrub habitat occurs over an exposed coral shelf substrate. This habitat is limited on O‘ahu and supports several threatened or endangered plants. The extent of this coral substrate on the Refuge might be important for future restoration and recovery efforts for one or more of these species.

One of the most significant influences leading to the degradation and loss of native Hawaiian habitats has been the relentless influx of pest plants, many of these highly invasive. The Refuge plans to work with partners to restore a viable natural native plant community through removal of pest plants and outplanting of native plants that were part of the historic vegetative community. Plans to construct a greenhouse in Objective 2.2 will enhance the Refuge’s ability to promote native plant propagation for use on the Refuge.

2.6.4 Goal 4.

Collect scientific information necessary to support adaptive management decisions.

Objective 4.1. Conduct inventory, monitoring, and research to document progress and evaluate management strategies to guide management decisions.

Throughout the life of the CCP, conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public-use activities to facilitate adaptive management. These surveys contribute to the enhancement, protection, use, preservation, and management of wildlife populations and their habitats on- and off-refuge lands. Specifically, they can be used to evaluate achievement of resource management objectives identified in this CCP. These surveys have the following attributes:

<ul style="list-style-type: none"> • Data collection techniques would have zero to minimal animal mortality or disturbance and zero to minimal habitat destruction; • Collect minimum number of samples (i.e., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements for identification and/or experimentation in order to minimize long-term or cumulative impacts; • Use proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, to minimize the potential spread or introduction of pest species; and • Projects will adhere to scientifically defensible protocols for data collection, where available and applicable.
<i>Strategies Applied to Achieve Objective</i>
Continue to encourage Refuge staff to publish in peer-reviewed scientific journals and attend professional society and agency-sponsored meetings/conferences
Require researchers to use regionally comparable field methods where feasible and appropriate
Establish and develop partnerships with other agencies, organizations and universities to pursue joint research projects
By 2020, in a comprehensive water resources and management plan, collect and synthesize the following information: hydrology (seasonal water levels, wet and dry cycles, groundwater resources), water chemistry, soils, and geomorphology
By 2013 complete baseline hydro-geomorphic study of entire refuge landscape (project currently funded and scheduled to begin 2011)
Utilize trained volunteers, where feasible, to conduct surveys and collect data to reduce workload on refuge staff
Investigate and monitor the impacts of pest plants and animals on Refuge landscapes
Investigate movements of endangered waterbirds (e.g., inter- and intra-island movement)
Determine survival and predation rates of endangered waterbirds
Develop GIS layer of pest species and update on a quarterly basis
Develop GIS layer of Refuge vegetation and update on an annual basis
Develop climate change monitoring protocols

Rationale: Monitoring projects on Refuge islands enhance scientific understanding of the ecosystems and lead to better management. Long-term monitoring efforts are extremely valuable in terms of the information provided and in adaptive management techniques. Human use issues are likely to increase in terms of pressures on the Refuge resources due to developing local and regional markets. This may lead to additional and new types of human impacts. This is likely to present management challenges, which can be approached with proactive applied research projects and long-term monitoring efforts. Communication of monitoring and research findings is the responsibility of the Service. Presentation of results and ideas helps foster the understanding and respect for Refuge management actions. Dissemination of scientific information also leads to conservation of natural resources through understanding and informed management decisions. Research presentation also provides a forum for research and management improvement through peer-review.

Refuge scientists will also be encouraged to include research findings in public interpretive programs. Information on the location of extremely fragile natural resources or those subject to vandalism will not be included in final studies and reports for public distribution. Modification of

databases and methods to be comparable and compatible to other research is a cost-effective way to conduct comprehensive Refuge research. Being able to compare Refuge data with other local, regional, and even global data will help guide ecosystem management priorities for Refuge resources. It will also promote the Service’s ecosystem approach to resource management, as well as enhance worldwide scientific connection and understanding.

A study initiated in 2011, *Temporal and Spatial Pattern of Sea-level Rise Impacts to Coastal Wetlands and Other Ecosystems*, will provide timely models for assessment of ecosystem vulnerability within the Refuge. Stakeholder workshops will be used to assess needs and define gaps to identify and design final products with place-based solutions.

During the period 2018-2020, a comprehensive water resources and water management plan is scheduled to be developed for the entire Refuge. This time period represents an optimum schedule for this plan for a number of reasons. Foremost is that the major milestone will be reached in 2023 when the long-term leases of the aquaculture ponds will expire and full management responsibility for these ponds will return to the Refuge. This event will have major implications across the Refuge landscape and habitat management programs. By initiating planning in 2018, we will be able to evaluate and incorporate the most recent data on a number of issues including global climate change and sea level rise, and the most up-to-date status of endangered waterbirds. A plan completed by 2020 would provide Refuge staff critical and timely information needed to make decisions about major projects related to taking over management of the aquaculture ponds which could have Refuge-wide implications and enter these projects into database needs in time to be considered by the 2023 budget cycle. A hydro-geomorphic study planned for completion by 2013 may provide much of the groundwork and provide much of the baseline information for this 2020 comprehensive plan.

2.6.5 Goal 5.

Provide wildlife-dependent public use and educational opportunities to enhance public understanding and appreciation of the natural resources of James Campbell NWR and the National Wildlife Refuge System.

Objective 5.1. Provide a quality environmental education program.

Provide a quality EE program based on Refuge and endangered species recovery management programs, with specific learning objectives and diverse opportunities with the following attributes:

- Increases public awareness and knowledge of environmental issues;
- Meets State standards for learning;
- Provides motivation to improve or maintain environmental quality;
- Imparts skills to identify and help resolve environmental challenges; and
- With construction/staffing of an EE center, accommodates a year-round program that serves up to 6,000 students per year.

Strategies Applied to Achieve Objective

Develop a VSP within 5 years that identifies details of the Refuge EE program and evaluates EE facility needs, including construction of an EE center

Promote the Refuge and the EE program with teachers during the development of the VSP

<i>Strategies Applied to Achieve Objective</i>
Continue current seasonal program (October 15-February 28) at Ki'i Unit
Seek additional partnerships and teacher volunteers for providing additional EE opportunities annually
Hire a permanent-full time EE specialist
Phase-in seasonal program around Punamanō Unit as facilities are developed through the VSP (with gradual reduction at Ki'i Unit)
Designate EE sites where students can participate in independent study
Develop curricula for the EE program and provide support and resources for Refuge volunteers
Expand and encourage other local schools such as Sunset Beach Elementary, Lā'ie Elementary, Kahuku Elementary, and Hau'ula Elementary to participate in educational programs
Develop "teach the teacher" programs and Refuge-specific instructor training
Develop grant proposals to strengthen outreach and education partnerships
Participate in the Smaller Learning Communities Program at Kahuku schools

Rationale: Environmental education does not advocate a particular viewpoint or course of action. Rather, it teaches individuals how to weigh various sides of an issue through critical thinking and it enhances their own problem-solving and decision-making skills. It is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action. It focuses on:

- Awareness and sensitivity about the environment and environmental challenges;
- Knowledge and understanding about the environment and environmental challenges;
- Attitude concern for the environment and help to maintain environmental quality;
- Skills to mitigate the environmental problems; and
- Participation for exercising existing knowledge and environmental related programs.



Ki'i kiosk Laura Beauregard/USFWS

Land acquisition will expand the land base of natural resources, providing greater opportunities for year-round EE programs at James Campbell NWR. The Refuge is in a unique position to offer local education agencies, teachers, and students an opportunity to study endangered species, natural resource management, conservation issues, and cultural resources in an outdoor setting.

The Refuge currently serves 1,500 students and teachers annually. We could accommodate up to 3,000 students annually with no change in the current program. State budget issues during the 2009-2010

school year resulted in teacher furloughs, 4-day school weeks, and reduced fieldtrip funding. These issues negatively impacted the ability of teachers to bring their students to the Refuge. We estimate that the Refuge could accommodate up to 6,000 on-site each year if: (1) an education staff was available to run the program full-time; (2) educators were trained and could be recruited to utilize the Refuge during all months of the school year; and (3) the proposed EE facility is funded and constructed.

Objective 5.2. Offer visitors outdoor recreation opportunities to enjoy, discover, and encourage support for James Campbell NWR.

Provide meaningful, enjoyable outdoor experiences for people of all ages (including wildlife observation, photography, interpretation, and fishing) that connect them with nature and foster a conservation ethic. By 2016, develop a VSP and associated NEPA document to identify locations, facilities, and regulations needed to provide year-round opportunities with the following attributes:

- High-quality wildlife-oriented visitor experiences;
- Accessible to individuals with disabilities;
- Safe environment and facilities for visitors; and
- Visitor access to ocean shoreline is provided.

Strategies Applied to Achieve Objective

Conduct docent-led tours at Ki‘i Unit

Develop a VSP within 5 years that identifies new visitor facilities and features, to include self-guided interpretive trails

Conduct docent-led tours at Punamanō Unit, when facilities are developed through VSP

Provide specific information for shoreline access, including ‘Īlio-holo-i-ka-uaua and honu closure information in cooperation with other agencies (NOAA and State)

Hire a Refuge Officer

Develop new interpretative materials (brochures, kiosk panels, species lists)

Rationale: We see our work resulting in all visitors and local communities gaining a greater connection with nature, sense of place, respect for their environment, and a lifelong interest in and participation in the conservation, protection, and enhancement of wildlife, plants and their habitats.

A VSP will be developed to ensure: (1) opportunities exist to view wildlife in their habitat and in a natural setting; (2) observation opportunities promote public understanding of Refuge resources and its role in managing and protecting those resources; (3) observations occur in places with the least amount of disturbance to wildlife; (4) facilities are safe, fully accessible, and available to a broad spectrum of the public; (5) viewing opportunities are tied to interpretive and educational opportunities; and (6) observers have minimal conflict with other visitors or Refuge operations. Features of the VSP could address the following projects:

- Develop self-guided interpretive boardwalk with observation towers, kiosks, and spur trails for photographers and beach access (access across the Refuge will remain closed until VSP is approved and necessary infrastructure is completed);
- Design kiosks for roadside pull-offs, trail heads, and visitor contact station; and
- Work with the Hawai‘i Department of Transportation and Federal Highway Administration to plan and fund safe pull-offs along Kamehameha Highway along boundary of James Campbell NWR.

The Refuge is considered by many to be one of the best areas in Hawai‘i to view endangered waterbirds. High-quality wildlife viewing will continue and be expanded on the Refuge through the development and maintenance of trails, boardwalks, and observation sites (i.e., elevated viewing platforms).

Four species of endangered Hawaiian waterbirds are present year-round at Ki'i Unit, which currently provides the visiting public with quality viewing opportunities. Ae'ō are highly susceptible to disturbance during their nesting season, whereas the other endangered waterbirds are more tolerant. Consequently, docent-led interpretative tours of Ki'i wetlands are conducted only during the ae'ō nonbreeding season (October -February). During the interim between present conditions and the development of lands within the expansion boundary, these tours will be continued. As part of the VSP, we plan to develop self-guided tours in other areas of the Refuge. Once they are in place, docent-led tours will be conducted at greatly reduced frequency at Ki'i.

Refuge law enforcement officers are responsible for upholding Federal laws and regulations that protect natural resources, the public, and employees. The expansion lands come with new challenges for law enforcement on the Refuge. A dedicated Refuge Officer is needed to protect Refuge visitors and employees from disturbance or harm by others; to assist visitors in understanding Refuge laws, regulations, and the reasons for them; to enhance the management and protection of natural resources; and to obtain compliance with laws and regulations necessary for the proper administration, management, and protection of the Refuge.

2.6.6 Goal 6.

Protect historic and cultural resources for the benefit of present and future generations.

Objective 6.1. Enhance awareness, protection, and appreciation of historic and cultural resources.

Throughout the life of this plan, increase monitoring, protection, and appreciation of all cultural resources and historic sites on the Refuge. Promote conservation of historic and cultural resources for the education, inspiration, and enrichment of the public in a spirit of stewardship and trusteeship for future generations.

Strategies Applied to Achieve Objective

Comply with Section 106 of the National Historic Preservation Act (NHPA) when conducting ground-disturbing activities

Develop and maintain liaison with Native Hawaiian organizations

Consult with Native Hawaiian groups, historical societies, and other preservation partners to identify types of historic and cultural resource information appropriate for public interpretation

Train all field personnel in Native American Grave Protection and Repatriation Act (NAGPRA) protocol and procedures for handling inadvertent discoveries of human remains and cultural artifacts

Develop a Refuge GIS layer for cultural resource sites (for use in management decisions, with sensitive information protected)

Develop a GIS layer for World War II remnants on Refuge lands

Rationale: The NAGPRA is a Federal law that provides, in part, a process for Federal agencies to transfer custody and control of certain cultural items (human remains, funerary objects, sacred objects, and objects of cultural patrimony) removed from federal lands to lineal descendants, Indian tribes, and

Native Hawaiian organizations. Native Hawaiians believe that the mana or spiritual essence and power of a person reside in the bones, their iwi. Unmarked Native Hawaiian burial sites have been exposed in the coastal strand/dunes area of the Refuge but can be encountered almost anywhere. Care of inadvertently discovered iwi kupuna (ancient bones) is an important issue for Native Hawaiians and the entire community in Hawai'i. The Service has the responsibility to care for the iwi kupuna with utmost respect for Hawaiian protocol and the recognized lineal descendants and culturally affiliated Native Hawaiian organizations. Strict protocols come into force whenever human skeletal remains are encountered inadvertently, through maintenance activities or through natural erosion.

When remains are encountered, all work in the immediate area is stopped, and the police as well as the Coroner-Medical Examiner are notified. If the remains appear to be under 50 years in age, a possible homicide victim, or missing person, the local police secure the scene and investigate. If the remains appear to be over 50 years in age since death and interment, a qualified archaeologist then examines the burial context to assist in determining whether they may be iwi kupuna. If they are iwi kupuna, the Service, in consultation with recognized descendants or Native Hawaiian organizations, determines whether the burial can safely remain in place where discovered or whether relocation may be needed. The key to protecting cultural resources is promoting knowledge of and appreciation for the resources. Currently, information on known cultural sites is not easily accessible to Refuge field staff responsible for the maintenance operations. Recognizing that sensitive information should be protected, knowledge of specific areas to avoid would be helpful to field staff engaging in maintenance activities around the Refuge. James Campbell NWR had a cultural resource overview completed by the National Park Service in 2005. However, a comprehensive access-protected GIS-based database is needed. The Zone Officer has received training in cultural resource law, but continuing education and coordination with State officers is needed for more staff.

Polynesian settlement, Hawaiian legends, agricultural activities, and World War II fortifications are all part of the rich history within the Refuge, and it is appropriate to share these stories with the public. The Refuge could achieve a higher level of interpretation by partnering with Native Hawaiians and groups interested in local history. Protection of historic and cultural resources will be incorporated in the VSP.



Kahuku Airfield, August 20, 1942 DOD archives

2.6.7 Goal 7.

Assist partner agencies and local community with planning and implementing flood damage reduction measures for the Town of Kahuku.

Objective 7.1. Support flood damage reduction efforts for Kahuku.

Maintain floodwater storage function of Refuge expansion lands (when fully acquired) and support approved watershed flood damage reduction projects.

Strategies Applied to Achieve Objective

Maintain 73-acre Walkerville Unit (when fully acquired) as potential flood damage reduction project area by removing existing encroaching woody vegetation, as feasible, and periodic disking or mowing to prevent further encroachment and allow more free-flowing water

Participate in community and government planning efforts to reduce flood damages in Kahuku that may utilize portions of Refuge expansion lands

Regularly maintain Refuge ditches

Evaluate Refuge infrastructure for flood damage reduction mitigation opportunities

Rationale: Local flooding following major rainfall is an important concern for the local Kahuku community. Past flooding has damaged homes and businesses and closed local roads and highways. Portions of the Refuge expansion lands lie within the floodplain and floodway adjacent to the town of Kahuku and Hospital Ditch, a vital local drainage. These lands already flood following heavy rain and runoff but have been identified as a site where engineered (controlled) flooding may offer some opportunity for flood damage reduction in the surrounding area. As identified in studies by the U.S. Army Corps of Engineers (USACE), flooding in the local area has many causes and contributing factors. Future projects will likely not completely solve this problem but may help to mitigate (reduce) damages under certain conditions.

The James Campbell Expansion Act of 2005 did include a “finding” supporting the Act that, in addition to other identified management priorities, the purchase of new Refuge lands “is necessary to reduce flood damage following heavy rainfall to residences, businesses, and public buildings in the town of Kahuku.” The intent of the original language was to support projects that were being evaluated at that time by USACE as part of the Kahuku Watershed Feasibility Study. This study, completed in 2006, did not identify any comprehensive flood control or flood damage mitigation projects which would meet Federal cost/benefit requirements for USACE funding. Consequently, no flood damage reduction features were approved or funded as a result of this study.

Due to low elevations throughout the coastal plain, including the Refuge, and the general long-term nature of drainage and flood damage reduction projects, future proposed projects will need to incorporate and evaluate the effects of global climate change and associated sea level rise (SLR). As of the date of this Plan the most recent scientific models predict a SLR of approximately 1 foot by the year 2050 along the Hawaiian coastlines. In addition, although average annual rainfall totals for Hawai‘i are expected to decline due to climate change, individual severe storm events with increased local rainfall totals are expected to increase.

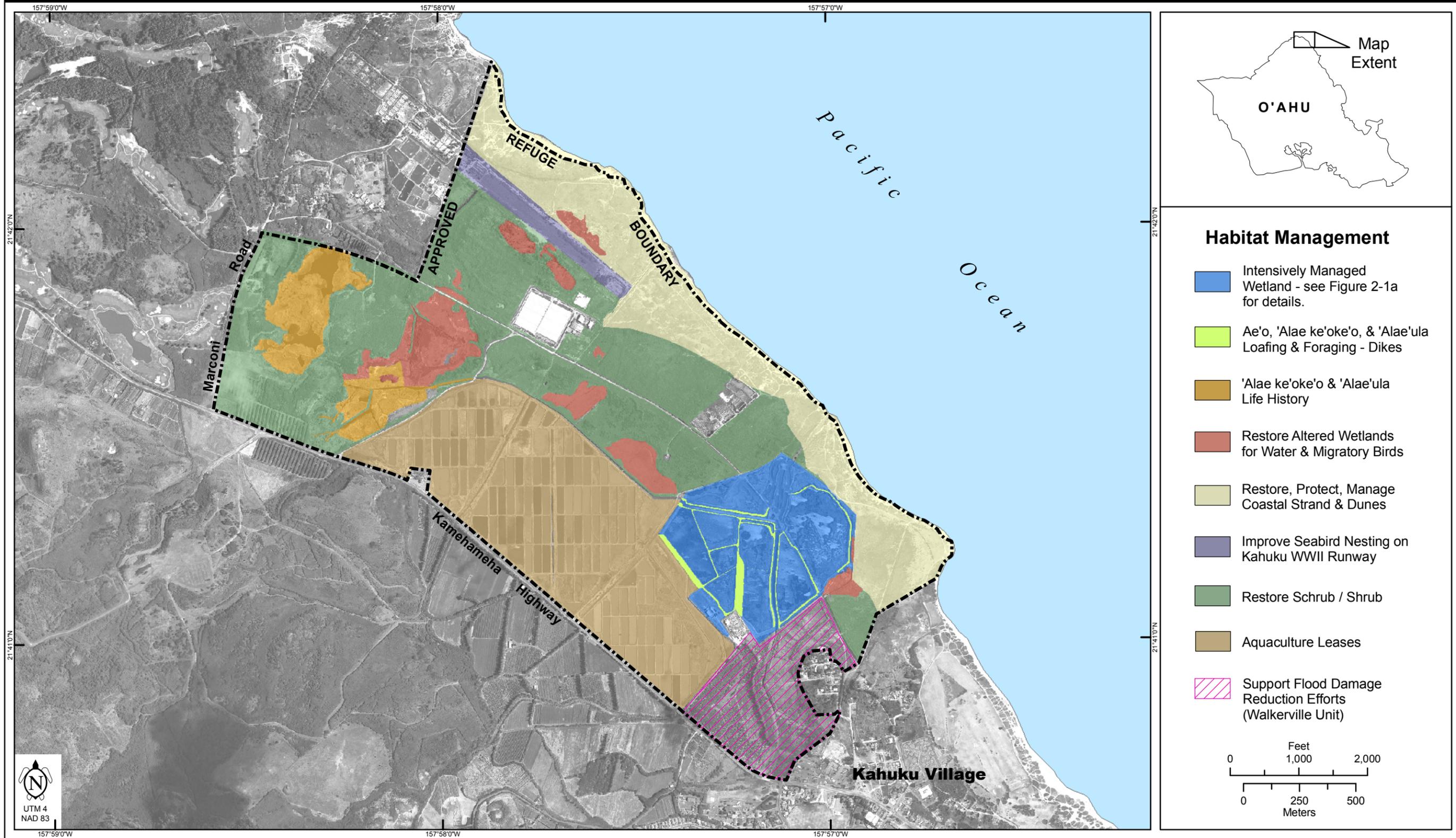
The proposed Walkerville Unit may be a suitable location for potential flood damage reduction projects because of its proximity to Kahuku and major drainage ditches; its relatively low-lying elevation; and its lower overall potential wildlife value compared to other Refuge expansion lands. This parcel is comprised primarily of former agricultural lands that have been idle for several years. As a result, much of the area is heavily encroached by woody pest vegetation which can hamper the flow of floodwater. Planned disking and mowing will prevent further encroachment and can be seasonally timed to provide short vegetation or open ground which can benefit some species of endangered or migratory birds.

This designation of the Walkerville Unit for flood damage reduction project(s) is intended only as an interim measure until final decisions regarding such projects are made. Other adjoining Refuge expansion lands (primarily makai) may also be considered in future flood damage reduction projects and are not excluded.

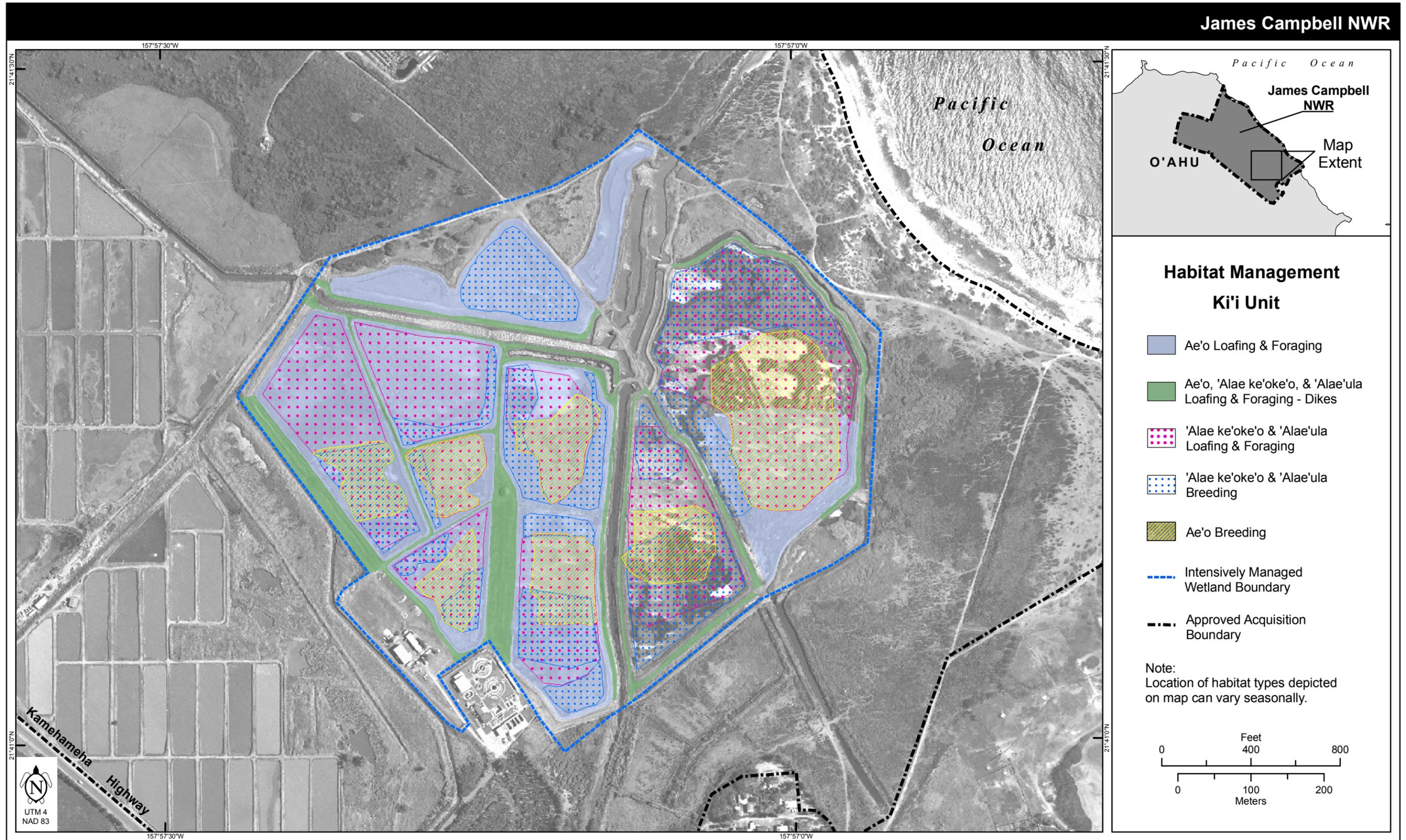
The Refuge will continue to participate and cooperate in community and agency efforts to address flood damage reduction for the local area. Any future proposed projects which would involve and/or impact Refuge lands would be subject to full engineering, environmental, regulatory review and compliance by the Service and other responsible agencies. We will continue to evaluate our infrastructure on the Refuge, particularly on newly acquired lands, to determine if further changes can be made to help mitigate flood damages.

[As of September 2011, the parcel of land containing the proposed Walkerville Unit has not been acquired by the Service.]

James Campbell NWR



8-29-11; 10-053-20.MXD



8-29-11; 10-053-19.MXD

