

Chapter 2. Refuge Management Direction

2.1 Considerations in 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 the 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.

2.2 General Guidelines

To reduce the length and redundancy of the individual objective descriptions, common elements are presented below.

2.2.1 Implementation Subject to Funding Availability

Actions 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. Annual priorities will follow CCP guidelines, although funding initiatives, unforeseen management issues, and budgets may vary from year to year. The CCP will be reviewed every year and updated as necessary throughout its life.

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. The Service will continue to maintain regular discussions and partnership with the DLNR. Topics for discussion continue to be the endangered waterbirds at Keālia Pond NWR and surrounding private and public lands, and wildlife monitoring. Upon establishment as an overlay refuge, the Service will seek a collaborative effort with DLNR for consultation and assistance in continuing the seabird monitoring program and development of a native plant restoration plan.

2.2.3 Threatened and Endangered Species Protection and Recovery

Protection of threatened and endangered (T&E) species is common across all alternatives. It is Service policy to give priority consideration to the protection, enhancement, and recovery of T&E species on national wildlife refuges. The protection of federally listed species is mandated through 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 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.



Endangered 'alae ke'oke'o USFWS

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 (DOI) and the Service. 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 of 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 DOI 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's 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 Officer (SHPO) 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. The Fire Management Plan (Appendix G) provides detailed guidance for the suppression and use of prescribed fire. The plan outlines wildfire response and prescribed fire objectives, strategies, responsibilities, equipment and staffing; burn units; implementation; monitoring; and evaluation.

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 the Refuge purpose.

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 many of the same steps as this CCP including 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 will 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 will be needed on Refuge lands, the most specific (selective) chemical available for the target species will be used unless considerations of persistence or other environmental and/or biotic hazards will preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides

registered with the EPA in full compliance with the Federal Insecticide, Fungicide, and Rodenticide Act and as provided in regulations, orders, or permits issued by EPA, that it is registered for use in the State of Hawai‘i, may be applied on lands and waters under Refuge jurisdiction.

Environmental harm by pest species refers 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; 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 will be evaluated for potential effects to Refuge biological resources and environmental quality. Pesticide uses with appropriate and practical best management practices (BMP) for habitat management as well as facilities maintenance will be approved for use on Refuge lands where there likely will be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance 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 (e.g., mosquito-borne disease).

Although human nuisance is not discussed at length in the IPM policy, the Service is committed to continue to address nuisance species of nonnative midges when not in conflict with the Refuge purpose and within available funding. For more information on strategies related to control of pests, see Appendix E.

2.2.9 National Environmental Policy Act Compliance

Since this CCP is programmatic in many issue areas, it may not contain the necessary detail on every future action outlined to adequately present and evaluate all physical, biological and socioeconomic impacts. For example, “step-down” plans required for various management actions such as visitor services and transportation will be developed after publication of the CCP. Thus, before certain objectives or actions are implemented, a decision will be made in coordination with the Regional NEPA Coordinator on whether separate step-down NEPA compliance (categorical exclusions, environmental assessments, or an environmental impact statement) are needed.

2.2.10 Law Enforcement

Officers’ Responsibilities

Fish and wildlife law enforcement issues on lands and waters of the Keālia Pond NWR are under the jurisdiction of the Service Zone Officer based in Honolulu. The role of the Zone Officer is to conduct patrols 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 Resources 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 of 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 State Division of Conservation and Resources Enforcement (DOCARE), Maui Police Department, and the Sheriff Division of the State Department of Public Safety.

2.3 Summary of CCP Actions

Wildlife and Habitat Restoration efforts and increased water management capabilities are intended to achieve the maximum potential for enhancing and maintaining biological and ecological requirements for endangered waterbirds, and indirectly benefit wintering migratory waterbirds (Figure 2.1). The Refuge will plan and implement the physical alterations needed to maximize our ability to control water in the Main Pond and adjacent vegetated mudflats, significantly remove (or attain less than 10 percent cover) the most aggressive pest plants, and control larger areas of pickleweed on the flats. Physical restoration includes: construction of a water control structure at the N. Kīhei Rd. culvert, additional groundwater sources (wells) to maintain water on the flats, and reconfiguration of topography to hold water longer.

The increased capability to dewater and flood the Main Pond will enable the Refuge to use water level to control the three nuisance issues (spotted-winged midges, pest tilapia, and windblown sediment). Maintaining water coverage at 20-30 percent in the Main Pond December-February has resulted in a reduction of midges and lower abundance of tilapia. Flooding into the adjacent sedges and flats in March will provide habitat for breeding ‘alae ke‘oke‘o and a shorter midge season with a lower intensity/density of nuisance midges. Water level will be maintained until natural recession occurs for ae‘o breeding activity.

Molokini, after establishment as an overlay refuge, will be managed as a seabird colony with periodic visits to monitor the population status and trends. The monitoring will include three to six visits during seabird nesting season (March-November). In addition to maintaining consistent data collection for ‘ua‘u kani, the extra visits will allow us to begin an ‘ou monitoring program to determine the population parameters. After 3 years, the Refuge will evaluate the necessity to monitor annually and the potential to monitor every 2-3 years. In addition, we will initiate a native plant restoration plan, particularly ‘ihi (*Portulaca molokiniensis*) and a few other species found only

on that islet, with a minimum of two additional visits per year during the nonnesting season (December-February). These visits will also be used to monitor tree tobacco for 'ōka'i 'aiea. The potential for their presence on Molokini is high given that they are found on Maui and Kaho'olawe. Volunteers will assist with propagating plants in the Refuge's greenhouse and outplanting will be conducted by Federal and State biologists under a cooperative agreement with DLNR.

Climate change analyses for Keālia Pond NWR will be evaluated for applicability to management strategies. Refuge staff will participate in development of climate change assessment protocols.

Visitor Services. Visitor services will be expanded with the Refuge open on weekends and additional efforts made to provide vegetated barriers and/or blinds to provide better viewing opportunities and increase areas for wildlife viewing. Visitor services staff will provide educational programs and materials. Recruitment and training of volunteers to provide additional programs will increase.

2.4 Goals, Objectives, and Strategies

Goals and objectives are the unifying elements for successful, adaptive refuge management. They identify and focus management priorities, resolve issues, and link to refuge purposes, Service policy, and the Refuge System mission. A CCP describes management actions that help bring a refuge closer to its vision. A vision broadly reflects the refuge purposes, Refuge System mission and goals, other statutory requirements, and larger-scale plans as appropriate. Goals then define general targets in support of the vision, followed by objectives that direct effort into incremental and measurable steps toward achieving those goals. Finally, strategies identify specific tools and actions to accomplish objectives. Unless specifically stated, all objectives are applicable throughout the life of this plan.

The goals for Keālia Pond NWR are presented on the following pages, followed by one or more objectives that pertain to it. The goal order does not imply any priority. 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 strategies, a brief rationale generally describes how management strategies will be implemented to achieve the intended objectives. The rationale may also, where necessary, discuss means to minimize potential impacts to non-target species and habitats. It also provides further background information pertaining to the importance of an objective relative to legal mandates for managing units of the Refuge System, including refuge purpose, trust resource responsibilities (federally listed T&E species and migratory birds), and maintaining/restoring BIDEH.

Table 2.1 - Keālia Pond NWR Management Summary

Key Themes		Objectives	Scope of Management
HABITATS	Seasonal & Semi-permanent Wetland Habitat	1.1 Protect seasonal ponds	26 acres
		1.2 Protect vegetated flats	135 acres
		1.3 Protect open water	197 acres
		1.4 Protect coastal flats	60 acres
	Upland Habitat	2.1 Enhance shrub land	5 acres
		2.2 Protect buffer zone	75 acres
	Coastal Habitat	3.1 Protect and enhance coastal strand	3 acres
	Islet Habitat	4.1 Protect seabird nesting	19 acres
Scientific Data	5.1 Conduct inventory, monitoring, and research	Track nesting success; impacts of pest plants & animals; water quantity & quality; abundance of endangered waterbirds; monitor plants for ‘ōka‘i ‘aiea presence; monitor seabird nesting on Molokini; study most effective IPM strategies; and conduct research on ‘alae ke‘oke‘o intra- & inter-island dispersal patterns	
	5.2 Conduct scientific assessments	Assess watershed volume; assess water resources, assess bathymetric configurations; develop climate change assessment protocols; and evaluate SLAMM analyses	
Visitor Services	6.1 Provide opportunities for wildlife observation & photography	>12,000 visitors	
	6.2 Evaluate fishing program	Complete fishing CD; develop brochures; analyze fish	
	6.3 Expand interpretation and outreach	>10 programs annually	
Volunteers	6.4 Expand volunteer program	>75 volunteers	
Environmental Education	7.1 Expand EE partnerships	5-12 programs annually	
	7.2 Expand internship program	4-5 interns	

2.4.1 Goal 1.

Protect, maintain, and enhance seasonal wetland habitats to meet the life history needs of endangered Hawaiian waterbirds.

Objective 1.1: Protect, maintain, and enhance seasonal wetland habitat in constructed ponds.

Protect and maintain a mosaic of seasonal wetland habitat in Kanuimanu Ponds (20 acres) and Baitfish Ponds (6 acres) for the life history needs of ae‘o and ‘alae ke‘oke‘o with the following attributes:

- 75% of pond bottom composed of undulating, irregular topography that creates exposed, small, low islands with 4:1 slopes April-July for breeding ae‘o;
- A mosaic of mudflat (dry and saturated) and open water (<12 in.) interspersed with 30-60% cover of native emergent vegetation;
- Stable water level (1-2.5 ft. depth) in all ponds December-March for ‘alae ke‘oke‘o nesting;
- 1-4 in. open water depth, 6 in. maximum by September;
- Predation of <1% of ae‘o or ‘alae ke‘oke‘o occurring within this habitat per year;
- No tilapia present;
- <25% cover of pest plants (marsh fleabane, California bulrush, and California grass);
- Levees and slopes covered with 10-50% native groundcover vegetation with <4 in. height;
- Abundant nektonic and benthic invertebrates with densities of 480-720 invertebrates/yard²;
- ‘Alae ke‘oke‘o brood-rearing within 55 yds. of nesting habitat;
- Limited public access during ‘alae ke‘oke‘o nesting December-March; and
- Minimal human disturbance during ae‘o nesting season April-July.

Strategies for Achieving the Objective

Control pest plants using mowing, brush cutting, excavation, water level management, prescribed fire, and herbicides (see IPM, Appendix E)

Continue partial to complete closures to public access on levees to minimize disturbance to waterbirds, particularly during breeding season

Propagate and plant native species to establish natural vegetative cover on pond levees and slopes

Control tilapia with traps and nets, lowering water level, and/or drying the ponds August-September

Use IPM techniques to set back wetland succession and promote a mosaic of vegetation/open water to maximize territories for ‘alae ke‘oke‘o

Pulse water from brackish wells to inundate emergent vegetation for ‘alae ke‘oke‘o nesting (Nov.)

Maintain water cover at 70-80% to control pest plants November-December

Maintain stable water level of 1-2.5 ft. for ‘alae ke‘oke‘o January-April

Pulse water during draw down to promote abundance and availability of invertebrates

Slow drawdown of water to eliminate pest fish and promote invertebrate/algal and plant response

Allow water to recede in mid-April to trigger ae‘o nesting by May

Maintain 60-70% water coverage for breeding ae‘o

Allow periodic dewatering from August-October to recycle nutrients and promote invertebrate abundance and diversity

Maintain stable water level and/or pulse water slightly during ae‘o nesting

Control predators with live-traps, snap-traps, bait stations, and water level management

Control cattle egret colonies by removing roosting trees, and/or direct removal of individual birds

Add fill and compact levees to maintain integrity, prevent flooding and erosion

Use heavy equipment to reconfigure pond topography to increase water coverage

Rationale

Ae‘o require different loafing and foraging habitats during the breeding (April-August) and nonbreeding seasons. Recently hatched ae‘o require shallow water of less than 2 inches to forage. During the remainder of the year, fledglings through adults can forage in water as deep as 6 inches. Seasonally regulating water depth stimulates germination of beneficial plant species, controls pest plants, and provides a variety of macro-invertebrates for young and adult ae‘o to feed upon, thereby creating and maintaining maximized production and carrying capacity of the wetlands. A mosaic of open water and vegetation serves as microhabitat for ae‘o thermoregulation. Dewatering the pond during nonbreeding season is beneficial for recycling nutrients, removing pest fish, and allowing staff to perform IPM (herbicide and mechanical) treatments before flooding. This drying cycle enhances soil aeration and invertebrate productivity.

Breeding ae‘o require dry to unsaturated mudflat habitat for building nests. Prebreeding water drawdowns help dry the mudflats for nesting. Saturated mudflats can be used as nest sites, but result in ae‘o expending additional energy to build nests robust enough to counter the excess moisture. The drawdown is timed to coincide with minimal or no ‘alae ke‘oke‘o nesting or chick rearing, part of a cycle of wetting and drying of habitat to make it suitable to a greater number of birds throughout the year and increasing species diversity. Thus, ae‘o nesting habitat temporarily follows where ‘alae ke‘oke‘o habitat existed previously.

The target distance between nest site to vegetation and water is approximately 5-20 feet. These slow breeding season drawdown rates also stimulate ample numbers and diversity of invertebrates throughout the brood-rearing period, allowing adults with broods to establish feeding territories and reduce inter-brood conflicts that can result in injury or death to young chicks.

‘Alae ke‘oke‘o prefer stable water levels (1-2.5 feet depth) for nest building and brooding. To prepare ponds for nesting, water levels are maintained at a constant level to provide adequate sites that are secure from predation. Fluctuating water levels would require nesting adults to continually expend energy to build the nest up or be isolated on dry ground and subject to greater predation.

Ae‘o and ‘alae ke‘oke‘o are easily disturbed during their nesting seasons and will depart the nest when danger is perceived, leaving the nest, eggs, or young exposed to predators and the weather. Eggs can also be destroyed by prolonged exposure to high temperature, wind chill, and rain. Human disturbance must be minimized during the nesting period to reduce the risk of nest abandonment.

Nests, eggs, and young are vulnerable to a variety of predators including rats, mongooses, dogs, cats, cattle egrets, and ‘auku‘u (black-crowned night-heron). Predator control success is defined, in part, by an increase in ae‘o nest success. Nesting islands with surrounding water help protect ae‘o eggs and chicks from cats, mongooses, and rats. Predator control and control of pest fish species (tilapia) also improve habitat condition and increase nest success. The target of removing all tilapia from the constructed ponds is attainable as no outside sources contribute directly to them. These ponds will be filled from a groundwater well, precipitation, and possibly some upwelling and/or seepage.

Low vegetation on levees creates important habitat for ‘alae ke‘oke‘o as well as other species. Maintaining vegetation height of less than 4 inches provides foraging areas where ‘alae ke‘oke‘o can graze on short grass and feed on associated invertebrates. Levees are also used as loafing habitat by shorebirds. Planting of native vegetation along slopes prevents erosion and also provides additional habitat.

Objective 1.2: Protect , maintain, and enhance seasonal vegetated flats for foraging, loafing, and breeding.

Protect and maintain up to 135 acres of vegetated flats for all life history (foraging, loafing, breeding) requirements of ae‘o and ‘alae ke‘oke‘o with the following characteristics:

- A mosaic of flats and open water (<7 in., 1-4 in. optimal) interspersed with 30-60% cover of emergent vegetation and algae that provides seeds and green browse April-August;
- No California bulrush, mangrove, or California grass;
- Undulating, irregular bottom topography creating exposed non-saturated substrate (e.g., shoreline, islands) with gradual slopes;
- <50 ft. width of emergent vegetation along shorelines for nesting ‘alae ke‘oke‘o December-March;
- Predation of <3% of ae‘o or ‘alae ke‘oke‘o per year;
- No human disturbance during breeding season, minimal disturbance remainder of year; and
- Abundant epiphytic invertebrates (e.g., dragonflies) and aquatic benthic/nektonic macro invertebrates (density 480-720 invertebrates/yd²), crayfish, and small forage fish.

Strategies Applied to Achieve Objectives

Mow and rototill to open pickleweed-dominated north shoreline of the Main Pond
Use IPM strategies including mowing, brush cutting, excavation, water level management, prescribed fire, and herbicides
Propagate and plant native species in place of pest plants to provide nesting structure for ae‘o and visual obscurity for ‘alae ke‘oke‘o territories
Control predators with live-traps, snap-traps, bait stations, and water level management
Manipulate water levels to expose islands and mudflats for foraging waterbirds
Flood Main Pond into vegetated flats in March to provide nesting habitat for ‘alae ke‘oke‘o
Mow and rototill wetland habitat on the north side of N. Kīhei Rd. culvert to increase mudflats
Minimize human disturbance by installing fences and signs, particularly along the south side of the Main Pond (N. Kīhei Rd.) by 2013
Construct a water source in vicinity of the Baitfish Ponds to flood the vegetated flats by 2016
Construct low berms to extend hydroperiod and promote plant response by 2019
Install predator-proof fence around the wetland perimeter to decrease mammalian predator immigration from sugarcane fields by 2020

Rationale

Vegetated flats extend beyond the Main Pond (open water) around its perimeter. The flats located on the north side of the Main Pond are over 900 feet-wide in contrast to the south side flats that are narrow and less than 260 feet wide. A mosaic of flats and open water (<7 in., 1-4 in. optimal) interspersed with 30-60 percent cover of emergent vegetation and algae provides seeds and green browse for ‘alae ke‘oke‘o, maximizes visual barriers for ae‘o nest territories, and provides concealment and thermal cover April-August. The south side is susceptible to wind-generated waves and human trespassing; therefore, the north flats provide higher-quality habitat for waterbirds. A majority of the management activities to control pest plants occurs on the north side during late summer and fall.

The hydrology of shallow water habitats benefits breeding, resting, and loafing requirements for ae‘o and ‘alae ke‘oke‘o as long as dry areas adjacent to water and vegetation are available. A mosaic of vegetative cover created by mowing and rototilling shoreline vegetation provides thermoregulation cover for protection from inclement weather and pair bonding and brood-rearing habitat. Based on

experience in the Main Pond, a long-term transition to native wetland plants and nonnative waterbird forage plant species is anticipated. To keep birds from flying over the bridge to access the other side of the outlet, habitat enhancement on the north side of the N. Kīhei Rd. culvert will not be performed near the bridge, thus reducing the potential for road kill.

Predator control efforts increase prior to and during ae‘o breeding season around areas of high-density nesting. Due to their vulnerability in the vicinity of primary nesting area, partial to complete public access closures during ae‘o nesting/brood-rearing periods increases fledging success. With increased habitat restoration on the flats, management of water, and effective predator control, ae‘o nest success should increase.

Objective 1.3: Protect , maintain, and enhance open water habitat for waterbird life history requirements.

Protect and maintain up to 197 acres of open water habitat in Keālia Pond for all ae‘o and ‘alae ke‘oke‘o life history requirements year-round with the following characteristics:

- <50 ft. width of emergent vegetation along shoreline of vegetated flats;
- Open water with <12 in. depth over 30-40% of the pond during ae‘o breeding season (April-July)
- >80% reduction of tilapia;
- <720/yd² spotted-winged midge density;
- Predation of <3% ae‘o and/or ‘alae ke‘oke‘o occurring in this habitat per year;
- Abundant epiphytic invertebrates and benthic/nektonic macro invertebrates (density of 480-720 invertebrates/yd²), crayfish, and small forage fish; and
- No human disturbance.

Strategies Applied to Achieve Objectives

Continue partial to complete closure of Kanuimanu Ponds during breeding season, as needed

Control pest fish by deploying nets and traps to remove fish biomass when water recedes

Control windblown sediment by sheetflowing water through Well D water distribution line August-December

Control overabundance of spotted-winged midges with methoprene (no more than one treatment per year)

Use water control structures and well pump for water control for plant and invertebrate response and water manipulations

Control predators with live-traps, snap-traps, bait stations, and water level management

Control tilapia via chemical treatment to remnant water in the outlet in September

Construct a six-bay water control structure at N. Kīhei Rd. bridge to control water in the Main Pond by 2016

Control water in the Main Pond to maintain 30% cover December-February to control midges and tilapia

Flood Main Pond into vegetated flats in March to provide nesting habitat for ‘alae ke‘oke‘o

Rationale

Flooding and dewatering in the Main Pond is dependent on surface and groundwater; precipitation; and the natural recession April-July. Water management is performed August-December (or longer depending on the onset of winter rains) by direct pumping from brackish water wells.

The Main Pond is the primary source of nuisance issues (including spotted-winged midges, dead fish, and windblown sediment) for Refuge neighbors and yet this habitat is the most difficult to control. The abundance of spotted-winged midges varies from year to year but has occurred from mid-December to mid-April in most years. The highest abundance was approximately 96,000 larvae/yd². Based on monitoring and the level of complaints, we estimate 480-720 midge larvae/yd² is a level that is tolerable by neighbors yet provides sufficient forage for endangered and migratory waterbirds. The short-term control of spotted-winged midges has been an application of the insect growth regulator methoprene which has shown to decrease the adult nuisance. However, a natural long-term control is sought such as water manipulation to control midge density. When this control is established, methoprene will be used as a secondary option.

The presence of tilapia in the Main Pond is inevitable because the fish remain in the outlet where the deep channel retains water throughout the year. During rainstorms, tilapia from upstream irrigation reservoirs enter the Main Pond with stream flow. Long periods of flooded conditions result in the dispersal of fish from the outlet and the exponential increase in productivity, thus leading to overcrowded conditions resulting in a fish die-off when water level recedes to approximately 50 percent coverage. The Main Pond is allowed to dry September-December for regrowth of kaluhā (saltmarsh bulrush), breakdown of organic material, soil aeration, and dispersal of accumulated sediment.

When windblown sediment becomes a nuisance issue, water can be directed to the upper reaches of the Main Pond via the Well D water distribution line to sheet flow over extensively dry portions to hold down sediment. This will be performed after ae‘o breeding season September-December and after IPM treatments on pest plants along the vegetated edge has been completed.

In 2001, an in-depth study of the pond hydrology (quantity and quality) was initiated in addition to monitoring spotted-winged midges and tilapia abundance. Monitoring data from 2 years with low winter water level December-February resulted in midge numbers below nuisance level. Duplication of this water condition during key months (December-February) may be a long-term solution to controlling midges and tilapia. In most years, midge abundance was high when winter flooding was high (December-April). However, when water level was low and the salinity was high, the midge abundance was lower and not a nuisance to neighbors.

If water pumping capability is maximized and the water control structure at the N. Kīhei Rd. bridge is constructed, the ability to maintain low water conditions (20-30 percent coverage) from the time winter flooding occurs to end of February may be the solution to both controlling the abundance of midges and also the abundance of tilapia. The shallow, salty water conditions and disconnect from the pond outlet results in undesirable habitat for tilapia, thus their abundance will be controlled.

Objective 1.4: Protect , maintain, and enhance coastal flats for ae‘o life history needs.

Protect and maintain up to 60 acres of seasonal coastal flat habitat at Mā‘alaea Flats for all life history requirements of ae‘o throughout the year with the following characteristics:

- A mosaic of saturated and dry mudflats;
- Open water <7 in. depth;
- Documented predation level of <20% of ae‘o nests annually;
- No human disturbance within 109 yds. of breeding territories;
- Abundant invertebrates with densities of 480-720 invertebrates/yd²;
- <30% cover of vegetation to provide cover and protection from wind;
- <30% cover of pickleweed;
- 50-100 ft. width of vegetation along N. Kīhei Rd.; and
- Physical barriers to prevent vehicular access onto the coastal flats.

Strategies Applied to Achieve Objectives

Maintain recycled-plastic fence along N. Kīhei Rd. to prevent vehicular access onto the flats

Construct water source (well, pump, water distribution line) at Mā‘alaea Flats to maintain shallow water by 2014

Implement complete or partial closure of Boardwalk, if necessary to prevent nest abandonment and egg/chick loss

Control predators with live-traps, snap-traps, bait stations, and water level management

Map topography of the mudflats to identify areas to construct low berms for water retention by 2013

Use IPM strategies including mowing, brush cutting, excavation, water level management, prescribed fire, and herbicides to control pest plants

Propagate and plant native species in place of pest plants

Create low islands within the flats to diversify topography by 2016

Restore Mā‘alaea Flats wetland community to provide additional habitat away from the Boardwalk by 2013

Alter bathymetry to retain water longer on Mā‘alaea Flats by 2013

Plant native shrub buffer along highway to reduce opportunities for waterbirds flying low over road by 2014

Rationale

Mā‘alaea Flats is connected to the Main Pond outlet on the east side and receives ocean water during higher high tides on the west end of the 60-acre flats. Natural flooding December-March appears to be from high water levels in the Main Pond via the outlet. If the Refuge had the ability to maintain water on the flats, there will be an increase in ae‘o use throughout the year. An additional source of water will enable the Refuge to maintain shallow water until completion of the breeding season. In addition, low berms on the east side, adjacent to the outlet will retain water on the flats instead of draining into the Main Pond outlet, particularly when the sand plug is breached (naturally or by hand). Monitoring human activities is a continuous need because of the connection to the beach front. Signage and fencing is necessary to control human access and law enforcement is essential to prevent disturbance to birds even during Boardwalk closures.

2.4.2 Goal 2.

Expand protected species' habitat to promote their recovery.

Objective 2.1: Enhance shrub land habitat for endangered 'ōka'i 'aiea (Blackburn's sphinx moth).

Enhance plant community to provide habitat for the endangered 'ōka'i 'aiea with the following characteristics:

- 1-5 acres of dry to mesic shrub land and forest habitat;
- 60-80% native host plants including 'aiea, lama, hao, 'ohe, 'āla'a, 'a'ali'i, wiliwili, maiapilo, and naio;
- <40% pest groundcover plants and annual grasses;
- 10-30% tree tobacco; and
- Restrictions on public access to inhibit collection.

Strategies Applied to Achieve Objectives

Identify presence, location, and extent of plant species known to be used by 'ōka'i 'aiea

Monitor plants for evidence of 'ōka'i 'aiea activity (eggs, larvae, adults)

Use IPM techniques to remove pest plants (kiawe, marsh fleabane) around host species such as tree tobacco

Conserve native plants known to host 'ōka'i 'aiea, including lama, hao, 'ohe, 'āla'a, 'a'ali'i, wiliwili, maiapilo, and naio

Propagate and plant native host species

Rationale

The 'ōka'i 'aiea moth is currently found in association with topographically diverse landscapes that contain low to moderate levels of nonnative vegetation. Vegetation types that support 'ōka'i 'aiea include dry to mesic shrub land and forest from sea level to moderate elevations (USFWS 2003).

Impacts to the moth's habitat from urban and agricultural development, invasion by nonnative plant species, habitat fragmentation and degradation, increased wildfire frequency, ungulates, and direct impacts to the moth from nonnative parasites and insect predators have reduced the species' range.

Most common native plants that the moth use are lama trees, hao, 'ohe, 'āla'a trees, 'a'ali'i, wiliwili, and naio. The largest populations of 'ōka'i 'aiea on Maui and Hawai'i are associated with trees in the genus *Nothocestrum* (i.e., tree tobacco). The necessary biological requirements of 'ōka'i 'aiea larvae for foraging, sheltering, maturation, and dispersal are the two documented host plant species within the endemic *Nothocestrum* genus (*N. latifolium* and *N. breviflorum*) and the dry and mesic habitats between the elevations of sea level and 5,000 feet and receiving between 10-100 inches of annual precipitation which currently support or historically have supported these plants.

Although only a few 'ōka'i 'aiea have been reported at Keālia Pond, the Refuge has the potential to meet these requirements for both adult and larvae. A closely associated State wetland management area, Kanaha Pond, is identified as such habitat.

Objective 2.2: Expand Refuge boundary to maintain a buffer from upper watershed impacts.

Maintain 75 acres of upland habitat along the Refuge boundary to serve as a buffer from future land use changes and protect wetland habitat from upper watershed impacts (filter pollutants, suspended sediment, pest plant species from streams entering into the wetlands). Expand the Refuge boundary to incorporate additional wetland habitat and upland habitat for the benefit of protected species (ae‘o, ‘alae ke‘oke‘o, honu, honu ‘ea, and seabirds) and wetland integrity.

Strategies Applied to Achieve Objectives

Maintain 75 acres of upland habitat along the Refuge’s north boundary with forest, scrub-shrub, and grasses to minimize sedimentation from upper watershed

Acquire 9-34 acres of coastal wetlands at Mā‘alaea Flats from A&B to make the wetland a contiguous property

Acquire kūleana property (approximately 4 ac.) located along the Refuge’s southeast boundary

Acquire 5-7 acres of coastal dune habitat as a conservation easement, from Keālia Resort in North Kīhei to the Refuge’s western boundary at Mā‘alaea Flats

Evaluate the feasibility of expanding the Refuge’s north boundary (5-8 ac.) to incorporate additional upland habitat as buffer around the wetlands

Evaluate the feasibility of acquiring Keālia coastal dunes at Mā‘alaea Flats

Rationale

The north side of the Refuge is comprised of upland vegetation and shrub habitat which provides a buffer and filter for sheet-flow runoff into Keālia Pond (e.g., slows water and allows groundwater seepage, filters sediments and pollutants before entering the vegetated mudflats and open water). This area is dominated by dense stands of pest plant species (e.g., kiawe, ironwood, and koa haole). While native plants are desirable, the existing vegetation provides an adequate buffer to shield endangered waterbird habitats from urban disturbances. The remaining upland forest habitat beyond the Refuge boundary is minimal but will be evaluated for an additional buffer zone for the wetland.

Suspended sediments contained in stream-flows from the upper watershed primarily derive from sugarcane production and urban development and settle in the Refuge wetlands. Acquisition of 9-34 acres beyond the current boundary at Mā‘alaea Flats will effectively encompass the remaining wetland and peripheral buffer of forest/shrub habitat on north side and coastal dunes on the south side. A portion of this area is within the previously-approved Refuge boundary. We have initiated discussions with the land owners for specific land parcels adjacent to Mā‘alaea Flats and the Refuge’s southeast boundary and those will be the first priority for acquisition.

2.4.3 Goal 3.

Protect, restore, and manage coastal habitat for the benefit of nesting sea turtles, seabirds, and the integrity of the fragile ecosystem.

Objective 3.1: Restore and maintain coastal strand and dune habitat.

First restore and thereafter maintain 2-3 acres of the coastal strand and dune habitat for the benefit of nesting sea turtles (primarily honu ‘ea) and nesting seabirds (‘ua‘u kani), and also to provide a protective barrier to Mā‘alaea Flats. The coastal dune and beach strand habitat will be restored and maintained for the following characteristics:

- 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., ‘akulikuli and kīpūkai) on dunes;
- <25% of woody pest plant species (e.g., marsh fleabane, kiawe, and koa haole) in coastal strand;
- <25% cover of herbaceous pest plant species (e.g., saltbush) and grasses (buffel grass, swollen finger grass);
- Manage public use to reduce human disturbance during turtle nesting season; and
- Documented predation of no more than 1 seabird nest annually.

Strategies Applied to Achieve Objectives

Continue partnership with A&B with installation and maintenance of recycled-plastic fence along Keālia Beach to prevent erosion of sand dunes by vehicles

Resume Kokua Keālia project to restore native coastal plants to the dunes adjacent to the Boardwalk by 2012

Control predators with live-traps, snap-traps, bait stations, and water level management

Consult with State and/or County coastal engineers to identify climate change impacts and evaluate alternatives to enhancing coastal habitat

Coordinate with adjacent landowners for water source to irrigate plants during establishment phase, if necessary

Propagate native plants (‘akulikuli, pauhoehoe, ‘ākia, naupaka, nanea, ‘ōhelo kai) in Refuge greenhouse for outplanting

Install temporary sand fencing to facilitate restoration of impacted dunes

Use appropriate IPM techniques (chemical, mechanical, manual) that will not result in additional erosion to control pest plant species

Rationale

Coastal dune communities are important to several rare and endangered plant and potentially animal species. Coastal dunes are also fragile and easily altered by human activity. Coastal dune and beach strand habitat also provides important foraging and loafing habitat for migratory bird species such as the ‘ūlili (wandering tattler), kōlea (Pacific golden plover), hunakai (sanderling), and ‘akekeke (ruddy turnstone). Given the soil texture, relative position to the shoreline, and desirable plants species; the strand provides suitable subterranean burrow habitat for ‘ua‘u kani and ‘a‘o. This coastal habitat is also suitable for ‘ilio-holo-i-ka-uaua pupping and rearing and by honu ‘ea and honu for laying eggs and basking.

Restoration of coastal dunes not only promotes habitat quality, it also enhances visitors’ experience along the Keālia Coastal Boardwalk. Native species will be planted during the winter season to minimize the need to water during the establishment phase. Planting will not be performed when endangered birds are nesting. The dense vegetative growth of pest plants have provided an effective buffer between the ocean and Mā‘alaea Flats therefore, careful planning and scheduling is needed to ensure the integrity and stability of the beach and dunes is not impacted during control and replanting efforts.

This section of the coastal strand and dune system is located at a greater distance from human activity with fewer human impacts. The area is ideal for nesting sea turtles (no headlights or condominium lights) and seabirds, in addition to ae‘o and migratory shorebirds on the mudflats.

2.4.4 Goal 4.

Protect, restore, and maintain Molokini islet habitat for seabird nesting.

Objective 4.1: Restore and manage Molokini for seabirds.
Restore up to 19 acres on Molokini for breeding seabirds, primarily ‘ua‘u kani (wedge-tailed shearwater), and ‘ou (Bulwer’s petrel) with the following characteristics: <ul style="list-style-type: none"> • >30% native vegetation; • 50-80% ‘ua‘u kani fledging success; • No nonnative predators; • No public access onto the islet; • Researchers access on islet from April-early November only.
Strategies Applied to Achieve Objectives
Maintain Memorandum of Understanding with DLNR and revise if needed
Finalize Memorandum of Understanding with the U.S. Coast Guard
Establish quarantine protocols for agency access
Continue long-term seabird banding
Propagate and plant native species during nonbreeding season (December-February)
Conduct ‘ua‘u kani breeding bird survey

Rationale

Molokini is in the process to be established as an overlay refuge unit of Keālia Pond NWR. Public access on the island has been limited since the early 1900s due to the sensitivity of burrowing seabird nest sites. Due to this, the seabird habitat is intact and very successful. The potential for native plant restoration is high, even with the access logistics (boat transportation, terrain), because the Refuge has volunteers to propagate plants in the greenhouse and references to historic (1913) and recent botanical surveys are available to replicate native species including: ‘ihi, alena, nena, pili grass, pa‘u o hi‘iaka, nehe, ‘ōhelo kai, ‘akulikuli, ‘ilima, and uhaloa.

A cooperative agreement with DLNR is essential to retain the consistency of management efforts, transfer of information, and expertise.

2.4.5 Goal 5.

Gather scientific information in support of adaptive management decisions on the Refuge under Goals 1-4.

Objective 5.1: Conduct inventory, monitoring, and research to document progress and evaluate management strategies to guide management decisions.

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:

- Data collection techniques will 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;
- Studies will be designed to statistically detect early stages of habitat changes that would 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;
- Projects will adhere to scientifically defensible protocols for data collection, where available and applicable; and
- Annual and cumulative reports will be completed for all inventory, monitoring, and research activities to document results and provide comprehensive analyses.

Inventory, monitoring, and research – Keālia Pond
Inventory and monitor bird abundance with monthly census
Monitor breeding ‘alae ke‘oke‘o from December-April for reproductive success
Monitor breeding ae‘o from April-July for reproductive success
Monitor macroinvertebrate densities
Monitor mongoose and rat abundance with tracking tunnel surveys at least every 90 days
Monitor and document predation of waterbirds
Monitor banded ae‘o and ‘alae ke‘oke‘o
Monitor midge larvae by core sampling during high water conditions (December-April)
Monitor water quantity (surface water and groundwater)
Monitor water quality (abiotic parameters: pH, temperature, salinity, conductivity, turbidity, dissolved oxygen)
Maintain and monitor weather station
Monitor fish abundance
Monitor vegetation response to IPM techniques
Monitor waterbird response to IPM strategies by sampling treated and untreated habitat
Conduct study to determine the most effective IPM strategies to control California bulrush and other pest species
Research to determine invertebrate composition and relative abundance in vegetated mudflats and open water habitats
Determine invertebrate composition and relative abundance at Mā‘alaea Flats

Inventory, monitoring, and research – Keālia Pond (continued)
Monitor human activities along the coastal mudflats and dunes for potential effects that jeopardize the integrity of the area
Periodically (once per 10 years) collect/analyze soil samples for contaminants, including streamflow entry areas
Identify presence, location, and extent of plant species known to be used by ‘ōka‘i ‘aiea
Monitor plants for evidence of ‘ōka‘i ‘aiea activity (eggs, larvae, adults)
Conduct research on ‘alae ke‘oke‘o intra- and inter-island dispersal patterns
Conduct study to identify alternative methods to control tilapia (reduce catch per unit effort)
Analyze fish to ensure they are safe for human consumption in potential fishing program (through Department of Health (DOH))
Implement a pilot program to evaluate the impacts of a fishing program at the Main Pond
Inventory, monitoring, and research – Molokini
Contract a complete archaeological and cultural investigation for Molokini when acquired as overlay refuge
Determine the breeding population of ‘ou on Molokini
Monitor active nesting attempts by ‘ua‘u kani and ‘ou (February-March)
Monitor ‘ou breeding (March)
Monitor ‘ua‘u kani nest success and band chicks (October)
Monitor and document seabird predation
Conduct a vegetation survey for composition and relative abundance

Rationale

The Administration Act requires us to “... monitor the status and trends of fish, wildlife, and plants in each Refuge.” Surveys are used primarily to evaluate resource response to assess progress toward achieving Refuge management objectives derived from the Refuge System mission, Refuge purpose, and maintenance of BIDEH. Determining resource status and evaluating progress toward achieving objectives is essential to implementing adaptive management on DOI lands as required by policy (522 DM 1). Surveys will provide the best available scientific information to promote transparent decisionmaking processes for resource management over time on Refuge lands.

Inventory, monitoring, and research studies are essential to high-quality habitat and population management. Conducting censuses for endangered waterbirds and compiling data is critical to evaluate population status and measure progress towards goals. Similarly, other populations, habitat conditions and habitat management practices, including restoration efforts must be monitored to evaluate their status and effectiveness. Population trends can be used to evaluate habitat effectiveness and guide management actions. When Molokini is acquired as an overlay refuge, a cultural and archeological investigation will be contracted to obtain information about the human history of the islet. It will seek to answer various questions about the pre-contact activities of Native Hawaiians and their interactions with the natural resources surrounding the Islet.

Refuges must collect site-specific information and conduct defensible research to provide information for devising, guiding, and adapting management practices. Applied research on the Refuge will help address management issues and questions, in theory, will result in improved management decisions on both the Refuge and on a regional basis. The Refuge has always maintained a close working relationship with State and local agencies, and universities to advance the knowledge base of a variety of habitats and plant and wildlife species. We have been monitoring

environmental parameters (water, weather), vegetation, waterbirds, and invertebrates, to varying degrees, for the past 10 or more years and will continue to maintain consistent methodology in data collection. These data have provided baseline information for management planning to optimize habitat for endangered waterbirds, address nuisance issues, and evaluate adaptive management strategies.

The Refuge's location at the base of the watershed makes the wetlands vulnerable to impacts from upper land use activities. Periodic analyses of water and soils are a preventative measure to identify contaminants and trace elements, and changes in what is entering into the Refuge property. Some elements attach to soils but are not found in water, and vice versa; therefore, the need to sample both in order to gain a broader picture of upper watershed impacts. Although soils can retain contaminants over a period of time, water samples detect only one point in time but if collected during similar conditions (high water flow from streams), the data provides a sufficient index for long-term monitoring.

Opening the Refuge to a seasonal fishing program is in a discussion phase. A fishing program would primarily be a management activity but can be an opportunity to involve the public, with the stipulation that it does not negatively impact the endangered Hawaiian waterbirds. Time and additional staff would be needed to plan, complete policy requirements, and investigate logistics of operating a fishing program.

Objective 5.2: Conduct scientific assessments.

Conduct scientific assessments to provide baseline information to expand knowledge regarding the status of Refuge resources to better inform resource management decisions. These scientific assessments will contribute to the development of Refuge resource objectives and they will also be used to facilitate habitat restoration through selection of appropriate habitat management strategies based upon site-specific conditions. These assessments have the following attributes:

- Utilize accepted standards, where available, for completion of assessments; and
- Scale and accuracy of assessments are appropriate for development and implementation of Refuge habitat and wildlife management actions.

Strategies Applied to Achieve Objectives

Based on the topography of the Main Pond, evaluate the need to periodically excavate and reconfigure elevations to facilitate water management (flooding and dewatering capabilities)

Evaluate feasibility of using a pump at the pond outlet for water control (lowering water level)

Identify the quantity of water from the Pōhākea, Pale‘a‘ahu, and Waikapū streams that reach the Refuge

Conduct soil investigation to identify composition and profile and use data and hydrological processes information to reconfigure topography in order to retain water for foraging and nesting ae‘o

Evaluate the topography of Mā‘alaea Flats and identify methods to separate from outlet (berm and possible water control structure)

Collect and analyze soil (composition, profile) at Mā‘alaea Flats

Evaluate SLAMM Analyses for climate change planning

Conduct a biological assessment on Molokini (nonnative amphibians, invertebrates)

Rationale

Appropriate environmental assessments are necessary to determine resource status, promote learning, and evaluate progress toward achieving objectives whenever using adaptive management. These assessments will provide fundamental information about biotic (e.g., vegetation data layer) as well as abiotic processes and conditions (e.g., soils, topography) that are necessary to ensure that implementation of on-the-ground resource management achieve resource management objectives identified under Goals 1-4.

Three streams drain from 56 square miles of the West Maui Mountain watershed and 1 additional stream drains a portion of the Haleakalā watershed. These stream-flows are infrequent, unpredictable, and uncontrolled. Preliminary data exists on the amount of surface water these streams deliver, however, a comprehensive hydrological assessment is needed to determine the amount (acre-feet) of stream flow that is needed to maintain water level at a suitable depth to manage for ae‘o and ‘alae ke‘oke‘o throughout the year.

Changes in the upper watershed can have potential impacts to the Refuge in terms of water quality and quantity; therefore, a more accurate assessment on these parameters is needed to ensure water is available for endangered and migratory bird species. Water and sediment samples from streams were analyzed in 2003 and provide a baseline for future monitoring of water quality. The function as a settling basin has created the endangered waterbird habitat for which the Refuge was established and thus, should be retained as much as possible. If streamflow subsides in the future, the Refuge will need to pump water from the brackish water wells throughout the year to replicate natural conditions. This would not only be costly, but also difficult to achieve for such a large wetland.

Mā‘alaea Flats is partially flooded with water from the outlet when the Main Pond is full. This hydrological connection means that when the sandplug is breached (naturally or manually) water in the flats drains as well. This has a negative impact on waterbird foraging and nesting habitat on the flats. Planning, including evaluation of the elevational gradient and a new soil survey, is needed to identify methods to hold water on the flats and maintain the level for ae‘o foraging and nesting.

Molokini will be a new addition to the Refuge System and, although the islet is managed by DLNR, their activities are limited to monitoring ‘ua‘u kani nesting. A biological and vegetation assessment is needed prior to restoration planning initiation. There is a high potential to re-establish native plants and the capability of replicating the plant composition recorded in 1913. An inventory of invertebrates is needed to ensure nonnative species (e.g., big-headed ants and yellow crazy ants) will not negatively impact chick survival.

2.4.6 Goal 6.

Through quality wildlife-dependent recreation and learning opportunities, visitors understand and appreciate the unique wildlife and habitats of Keālia Pond NWR.

Objective 6.1: Provide opportunities for wildlife observation and photography.
Provide visitors with the opportunity for self-guided wildlife observation and photography to increase their knowledge and appreciation for wetland ecosystems and endangered species. <ul style="list-style-type: none"> • Focus on wetland ecology and the endangered waterbirds that rely upon these wetlands; • Provide viewing opportunities; and • Directly link opportunities to EE and interpretation programs.
Strategies Applied to Achieve Objectives
Maintain safe access on all trails and Keālia Coastal Boardwalk by performing periodic inspections and repairs
Install trail counter
Annually evaluate and implement a closure of the Keālia Coastal Boardwalk during ae‘o nesting season, if necessary
Monitor waterbird response to visitor use to minimize potential impacts to the species and adapt visitor use patterns
Complete the Complex brochure and bird species checklist
Coordinate with Hawai‘I Department of Transportation (HDOT) to establish a bus stop at the coastal Boardwalk between Mā‘alaea and Kīhei
Continue to accommodate recreational photographers visiting the Refuge and support existing agreements
Open Kanuimanu Ponds to the public on weekends
Develop and implement a Visitor Services Plan (VSP) by 2017
Evaluate the need, location, and logistics of photo blinds on/adjacent to Kanuimanu Pond levees
Evaluate the potential for fee program on the Refuge

Rationale

The Keālia Coastal Boardwalk is open year-round for visitors, but tours are only provided upon request. The parking area will only accommodate 12 vehicles, 2 disabled parking, and 2 buses; therefore, it may be advantageous to have the Boardwalk as one of the stops for public transportation when traveling from west (Lahaina) to east (Kīhei). As long as the period between stops is adequate, it may be a way to reach more people given the limited parking capacity.

Keālia Pond NWR has been more visible to the public since the opening of the Boardwalk. Visitor use will increase significantly when the new HQ/VC is opened to the public. The Refuge relies on static displays for self-guided visitation; however, additional opportunities for visitors and educational groups are expected in the future. The step-down VSP is intended to enhance visitors’ knowledge of the value of wetlands, offshore islands and the wildlife that depend on their existence, and Native Hawaiian traditional uses.

Keālia Pond NWR hosts hundreds of migratory waterfowl and shorebirds during winter months and receives most of its visitors during that same period. With increased water control capabilities, the Refuge will have some flexibility with attracting wetland birds into accessible areas for wildlife

observation. During the nesting seasons for endangered ‘ālae ke‘oke’o (December-May) and ae‘o (April-August), continuous evaluation of waterbird use is conducted so Refuge staff can allow access to visitors where birds remain undisturbed. Accessibility onto Kanuimanu Pond levees gives photographers an opportunity to photograph wetland bird species. The size of the Main Pond and background with the West Maui Mountains makes a scenic shot, particularly in the morning when the sun’s glare is low and the trade-winds are light.

Recreational photographers have provided the Refuge with bird photographs for brochures by means of SUP and the photographer’s approval to use his/her photographs. This has worked well in the past and benefits the Refuge. Recreational photographers can access general public use areas and are usually not identified upon check-in at the visitor contact station (HQ). Increased visitation will require more law enforcement presence to protect wildlife and minimize vandalism. As an example, the Keālia Coastal Boardwalk is the target of graffiti, destruction of property, trash dumping, and camping. Illegal access to areas not open to the public can have detrimental impacts on waterbirds and vegetation (e.g., additional introduction of pest species).

Public access onto Molokini is prohibited due to the sensitivity and geology of the islet. There are, however, tour boat companies that provide snorkeling/diving opportunities in the surrounding waters outside our jurisdiction. Access will be given to Federal and State biologists performing Refuge duties. The Refuge brochure will mention Molokini as part of the Refuge System. Special Use Permits to access other areas are issued on a case-by-case basis if compatible.

Objective 6.2: Evaluate feasibility of a recreational fishing program.
Investigate, research, and evaluate the compatibility of a seasonal fishing program as a management tool for controlling pest species (tilapia) by 2016.
Strategies Applied to Achieve Objectives
As part of the VSP, determine the compatibility of fishing at Keālia Pond
Prepare materials related to fish ecology in Keālia Pond, (i.e., fish identification, biology, and impacts of pest species)
Evaluate whether or not a fishing program is an effective management tool for removing biomass
Analyze fish for contaminants and human consumption (DOH)
Define the Refuge’s role and participation in the State Fishing Education Program

Rationale

The Refuge hosted the State Fishing Education Program (an annual public education event) from 1997-2002 at Kanuimanu Ponds. The intent of this objective is to evaluate the need (compared with other management strategies to remove tilapia), compatibility, and feasibility of conducting a controlled public fishing program. Other aspects that need to be considered are law enforcement, safety, operating requirements (staffing), and outreach to the public. For the latter, the potential for illegal fishing during “off-season” is a greater concern. A fishing program would primarily be a management activity but can be an opportunity to involve the public, with the stipulation that it does not negatively impact the endangered Hawaiian waterbirds and migratory birds. Time and staff will be needed to plan, complete policy requirements, and coordinate logistics of operating a fishing program.

Objective 6.3: Provide interpretation and outreach programs.

Expand the Refuge’s interpretation and outreach programs to foster appreciation and stewardship for wetland and cultural resources. Provide interpretive tours for visitors, birding groups, and other educational groups.

Strategies Applied to Achieve Objectives

Maintain high-quality, updated displays and signs for Keālia Coastal Boardwalk and trails to interpret the ecology, wildlife, and identification of wetland habitats and associated watersheds

Provide public presentations and interpretive tours on wetland ecology and wildlife, coastal habitats, and cultural history

Keep the Refuge Website updated on available opportunities and current projects

Provide public presentations and interpretive tours on wetland ecology and wildlife, coastal habitats, and cultural history

Prepare a pamphlet on Molokini for distribution to tour boat operators/companies

Incorporate Refuge opportunities and information into the Maui Visitors’ Bureau products

Participate in off-site programs including Earth Day, beach cleanups, watershed events, etc.

Provide information on the Refuge System to the public

Rationale

Interpretation is intended to create emotional and intellectual connections between the audience and the resource as well as provide opportunities for visitors to make their own connections to the resource. Outreach is two-way communication between the Service and the public to promote involvement with the Refuge, and influence attitudes and actions, with the goal of improving joint stewardship of our natural resources. We rely heavily on self-guided opportunities for visitors. This is especially true for the Keālia Coastal Boardwalk which is approximately 2 miles from the HQ/VC.

Offering special talks at the Boardwalk by volunteers will enhance visitors’ knowledge and understanding and encourage visitors to return. Volunteers may also assist with interpretation at Kanuimanu Ponds, particularly for school groups or to lead groups of birdwatchers. The new Keālia Pond HQ/VC is designed to prepare visitors for and enhance their experience on the Refuge.

Molokini is not accessible due to the sensitivity of the habitat and safety; however, informative materials and interpretation of the property will be given to Refuge visitors, tour boat operators, and others to develop awareness for seabird habitats.

We will increase outreach to direct more attention to the Refuge as an outdoor learning experience. Specialized tours could be developed to meet the needs of the public. This will increase the Refuge’s visibility as part of the community where people can explore the natural resources and gain a sense of stewardship in becoming involved with Refuge programs.

Objective 6.4: Expand volunteer opportunities and partnerships.
Expand the Refuge’s volunteer program to foster appreciation and stewardship for the wetland resources and assist with Refuge activities and facilities. Participate in partnerships and other collaborative efforts that provide ecosystem-based opportunities to facilitate Refuge objectives.
Strategies Applied to Achieve Objectives
Continue to support volunteerism through partnerships and community groups
Post available opportunities and current projects on Website
Continue partnerships with community organizations, County, State, and Federal agencies related to watersheds, wetland and coastal restoration, etc.
Establish a Friends group to promote and assist with the Refuge’s purpose and mission
Incorporate Refuge volunteer opportunities into State and County volunteer programs and Maui Visitors’ Bureau products
Recruit and train volunteers to assist with visitors and school groups, particularly during peak hours
Seek volunteers to offer special programs at the kiosks of the Keālia Coastal Boardwalk
Recruit and train volunteers to assist in the Refuge VC and provide introductory information to visitors

Rationale

Maui residents have a strong volunteer ethic and they are willing to help out if they know what is available to them. The Refuge’s volunteer opportunities need to be advertised and the Refuge will continue to participate in community events. With additional staffing, we will put more effort into recruiting volunteers for all programs (biological, habitat, visitor services, EE, and interpretation).

The value of the coastal dunes to sea turtles and native plants is interpreted in Boardwalk panels. The coastal dune restoration project involves Refuge volunteers and the community and helps to instill a sense of stewardship of the natural resources. Volunteers will be recruited and trained to operate the Keālia Pond VC and provide a point of contact to visitors at the Keālia Coastal Boardwalk. Operation of the new VC is highly dependent on a robust volunteer program given the current lack of permanent resources with which to staff it.

Establishment of a Friends group is a high priority for operating the visitor center and assistance with other programs on- and off-Refuge (sea turtle monitoring program or Dawn Patrol). Volunteers assisting with propagation and planting native plants will also be working in the greenhouse to propagate plants specifically for restoring habitat on Molokini.

2.4.7 Goal 7.

Provide students and teachers high-quality hands-on EE programs that foster a connection with nature and the Refuge.

Objective 7.1: Provide a high-quality EE program.
Expand EE programs that connect children with nature and focus on the functions of wetlands and coastal ecosystems as part of watersheds. Quality curriculum includes: <ul style="list-style-type: none"> • Supports national and State Department of Education (DOE) standards; • Provides interdisciplinary opportunities that link natural resources through all subject areas; • Incorporates the Refuge System mission and Refuge purpose; • Involves the local community, volunteers, future Friends group, and partners; • Involves hands-on learning opportunities and stewardship components; • Incorporates current conservation issues and concerns; and • Located both on- and off-Refuge.
Strategies Applied to Achieve Objectives
Issue SUPs to EE organizations to conduct programs on the Refuge
Participate in teachers’ workshops
Design/produce a pamphlet for Boardwalk interpretive panels
Develop site-specific curriculum materials for educators
Provide formal learning experiences on the Refuge that support teachers’ curricula and DOE requirements
Establish and train volunteer docents to greet students and oversee EE programs at the Keālia Coastal Boardwalk

Rationale

Keālia Pond NWR is one of three wetlands on Maui that provides hands-on opportunities for school children. Our proximity to schools and year-round access provides teachers, students, and other local education organizations an opportunity to study natural resource management and conservation issues in an outdoor setting. Hands-on experiences and exposure to wildlife career opportunities can help direct students into natural resource disciplines. Teachers may not have the time and resources to compile pre- and post-visit materials; therefore, the Refuge can provide packets geared for different age groups for teachers to incorporate the visit into their curriculum.

We rely on partner organizations to provide formal EE opportunities to students by establishing SUPs each year. Organizations include Hawai‘i Nature Center (conducting the wetland curriculum at the Refuge for 14 years), Maui Digital Bus (for 8 years), and individual teachers on their own. The new visitor services manager will be responsible for the EE program.

Refuge-specific EE programs should be developed for school groups. Development of all programs will include pre- and post-visit materials for the teachers use. Teachers workshops will be held annually to ensure DOE requirements are met. Volunteers will be recruited and trained to assist with the program. All EE programs will have a stewardship component where students will participate in a wetland restoration project. Currently, this includes hand removal of pest plants and outplanting native plants. Cultural resources, which provide data and places to educate about changes in wildlife populations and the landscapes they inhabit, as well as cultural knowledge about the traditional uses of plants and animals, will be incorporated into EE curricula and programs.

Programs for high school students included Baldwin High School (built nest platforms), Kīhei Charter School (comparison of pest plant controls), Lahainaluna High School (GIS), and Maui High School (GIS). Hands-on opportunities give students a chance to experience a biologist vocation and also provide another tool for investigating alternative management methods for the Refuge. Other opportunities will likely become apparent as the Refuge implements programs and receives feedback from teachers and educators.

Objective 7.2: Provide high-quality internship opportunities.
Expand the Refuge internship program for Maui’s students. Interns will be introduced to natural resource careers through hands-on work with, and training by, natural resource professionals to help develop a new generation of enthused and effective conservationists and ecologists.
Strategies Applied to Achieve Objectives
Collaborate with the University of Hawai‘i campuses (Maui, Hilo) to host interns receiving credit hours (i.e., Pacific Internship Programs for Exploring Science)
Develop an internship program for Kamehameha Schools in their Natural Resources Academy
Host AmeriCorps and Youth Conservation Corps students
Develop an internship program for public schools on Maui
Host Mainland and international interns
Explore the potential for housing on- or off-site

Rationale

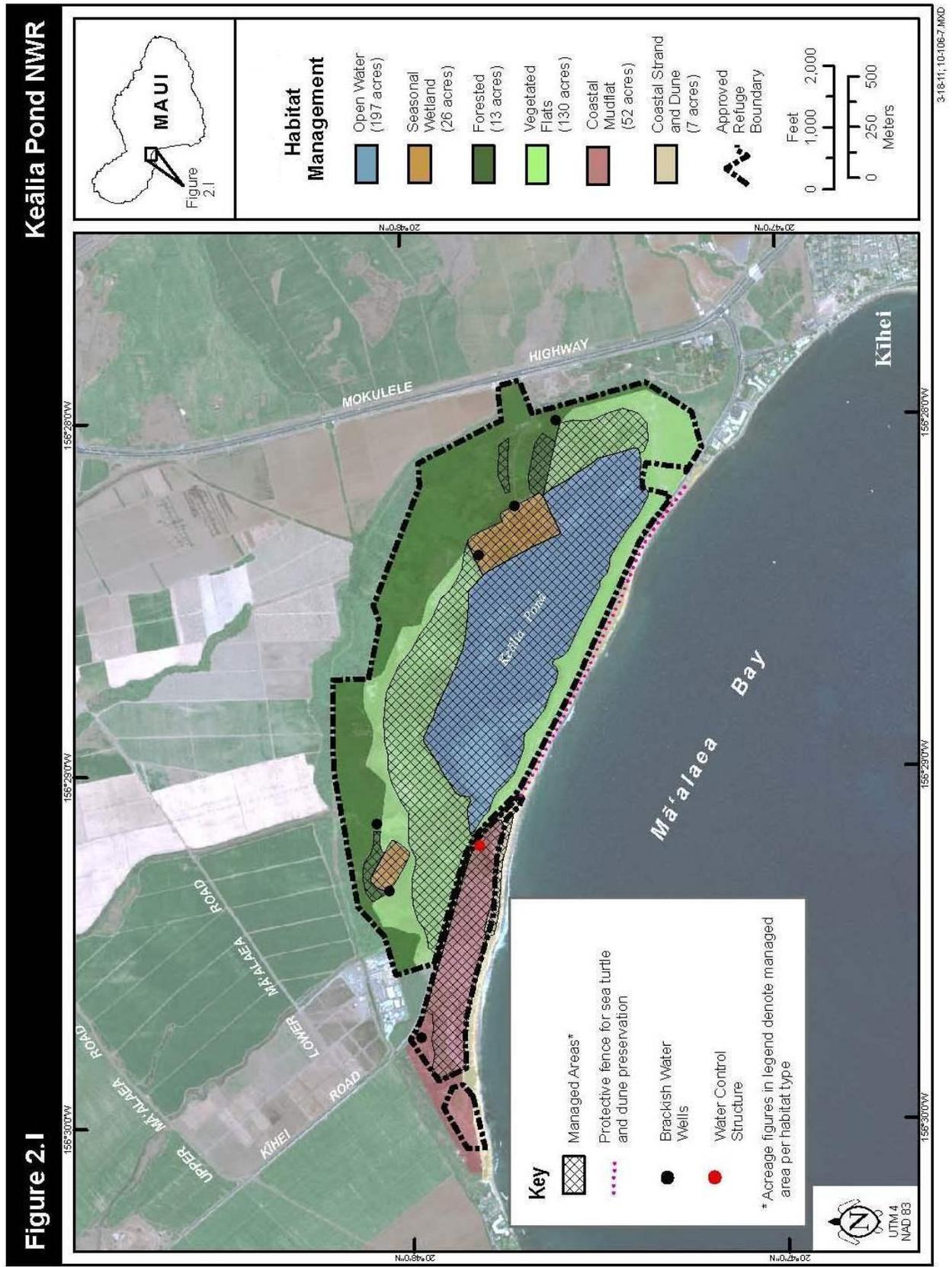
The Pacific Internship Programs for Exploring Science (PIPES) operates as an umbrella program for internship opportunities. Each summer all the PIPES student interns participate in a 4-day orientation and a 10-week internship program focusing on tropical ecology, evolution, natural resources management, and environmental education and outreach. Interns work on mentored research projects with mentors from university, Federal, State, and Counties agencies, as well as non-profit organizations.

The DOI is engaging young people across the country in conservation and energy efficiency projects on America’s public lands, to inspire and provide career pathways in natural resource occupations and related sciences, and to become better educated about the Nation’s ecosystems. Establishing an internship with Kamehameha Schools will benefit high school students but also recruit Native Hawaiians into environmental conservation fields. Interns play a vital role in helping the Refuge System in preserving a national network of lands and waters for the conservation and management of the fish, wildlife, and plants of the United States for the benefit of present and future generations. Most internships last between 12-20 weeks and offer opportunities to:

- Gain valuable hands-on natural resource management experience;
- Earn college credit; and
- Gain a working knowledge of the Service useful for future career decisions.

The Youth Conservation Corps (YCC) is a program for young adults who are between the ages of 15-18; where projects are conducted for 8-10 weeks during the summer. Environmental awareness is an integral aspect of the YCC program, with projects embracing both work and environmental learning goals. The participants spend most of their time in the outdoors. All participants are expected to gain an understanding and appreciation of the Nation’s environment and heritage equal to 1 full academic year of study.

Figure 2.1 –Habitat Management



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