APPENDIX C

U.S. FISH AND WILDLIFE SERVICE LETTER AND BIOLOGICAL SURVEY REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2010-I-0256

MAY 17 2010

Ms. Sara Ziff
United States Environmental Protection Agency
Region IX
75 Hawthorn Street
San Francisco, California 94105-3901

Subject: Informal Consultation for the Kapulena Well Project, EPA Grant 10-025, Hawaii

Dear Ms. Ziff:

We are in receipt of your letter dated April 8, 2010, describing the proposed construction of a new exploratory well at Kapulena, Hawaii (TMK [3] 4-7-002:035). In accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*), you requested our concurrence with your determination that this proposed well is not likely to adversely affect the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). We received your letter on April 12, 2010. On May 10, 2010, Jeff Zimpfer from our office asked you for an extension and we thank you for granting it to us. The project will occur in two phases. The first phase involves drilling an exploratory well. If the yield from the exploratory well is sufficient, the exploratory well will be converted to a production well. The project will involve upgrading the existing access way from the Honokaa-Waipio Road, a 26-foot (ft) (7.93 meter (m)) by 45-ft (13.8 m) control building, a water storage tank and associated infrastructure.

The Hawaiian hoary bat is a medium-sized (0.5-0.8 ounces; 14-22 grams), nocturnal, insectivorous bat. Hawaiian hoary bats roost and give birth solitarily in the foliage of trees, both exotic and native (Service 1998, p. iii). During the pupping season (May 15 and August 15), females carrying pups may be less able to rapidly vacate a roost site as the vegetation is cleared; additionally, adult female bats may leave their pups in the roost tree while they themselves forage, leaving young bats unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing vegetation between May 15 and August 15. Hawaiian hoary bats are most often observed foraging in open areas, near the edges of native forests, or over open water, although this may be due to the ease of detection in these habitats.

A minimal amount of vegetation clearing will result from the construction of this project. In addition, to minimize potential impacts to Hawaiian hoary bats, you agreed that woody vegetation taller than 15 (ft) (4.6 m) will not be cleared between April 15 and August 15. Therefore, based on the above avoidance and minimization measures, we concur with your

determination the proposed project may affect, but is not likely to adversely affect the Hawaiian hoary bat.

Unless the project description changes, or new information reveals that the proposed action may affect listed species or critical habitat in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary. If you have questions regarding this consultation, please contact Dr. Jeff Zimpfer, Fish and Wildlife Biologist, at 808-792-9400.

Sincerely,

for Loyal Mehrhoff
Field Supervisor

Reference

U.S. Fish and Wildlife Service. 1998. Recovery plan for the Hawaiian hoary bat (*Lasiurus cinereus semotus*). Department of the Interior, U.S. Fish and Wildlife Service, Portland, Oregon.

Biological Surveys Conducted on the Kapulena Production Well and Reservoir Site, Hāmākua District, Island of Hawai‘i.

Prepared by:

Reginald E. David
Rana Biological Consulting, Inc.
P.O. Box 1371
Kailua-Kona, Hawai‘i 96745

Prepared for:

Planning Solutions, Inc.
210 Ward Street
Suite 330, Ward Plaza
Honolulu, Hawaii 96814-4012

July 31, 2009

Table of Contents

Figures & Tables

Introduction

The County of Hawai‘i Department of Water Supply (DWS) proposes to drill an exploratory well and, if successful, convert the well to a potable water production well with a 0.3 million gallon storage tank on an approximately 0.63 acres of land that is identified as TMK: (4-7-02:29 and 4-7-02:35 (Figure 1). The project site in located in Kapulena, Hāmākua District, Island of Hawai‘i.

This report summarizes the findings of the botanical, avian and mammalian surveys that were conducted on the project site on July 27, 2009 as part of the environmental disclosure process. The primary purpose of the surveys was to determine if there were any botanical, avian or mammalian species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai‘i’s endangered species programs on, or within the immediate vicinity of the well and reservoir site. Federal and State of Hawai‘i listed species status follows species identified in the following referenced documents (Division of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2009).

Avian phylogenetic order and nomenclature follows *The American Ornithologists’ Union Check-list of North American Birds 7th Edition* (American Ornithologists’ Union 1998), and the 42nd through the 50th supplements to *Check-list of North American Birds* (American Ornithologists’ Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008, Chesser et al., 2009). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai‘i* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al., 1974).

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

General Project and Site Description

The roughly 0.63-acre site is located *mauka* of the Honoka‘a – Waipi‘o Road, State Route (240) at Kapulena, at an approximate elevation of 315 meters (1,033-feet) above sea level (Figure 1). DWS is proposing to drill an exploratory well and, if successful, convert the well to a potable water production well with a 0.3 million-gallon storage tank. Additionally, it is proposing to pave an approximately 90-meter (300-foot) access road. Electrical power and telephone service will be extended to the site from existing lines on Honoka‘a-Waipi‘o Road. A control building will be constructed on the site to house a chlorination system and control center. Water from the well will replace the surface water source of the abandoned Kukuihaele Spring.

The site is located on an active commercial macadamia nut (*Macadamia integrifolia*) orchard. As such the site has been highly modified by agricultural activities and almost no native vegetation remains on the property.

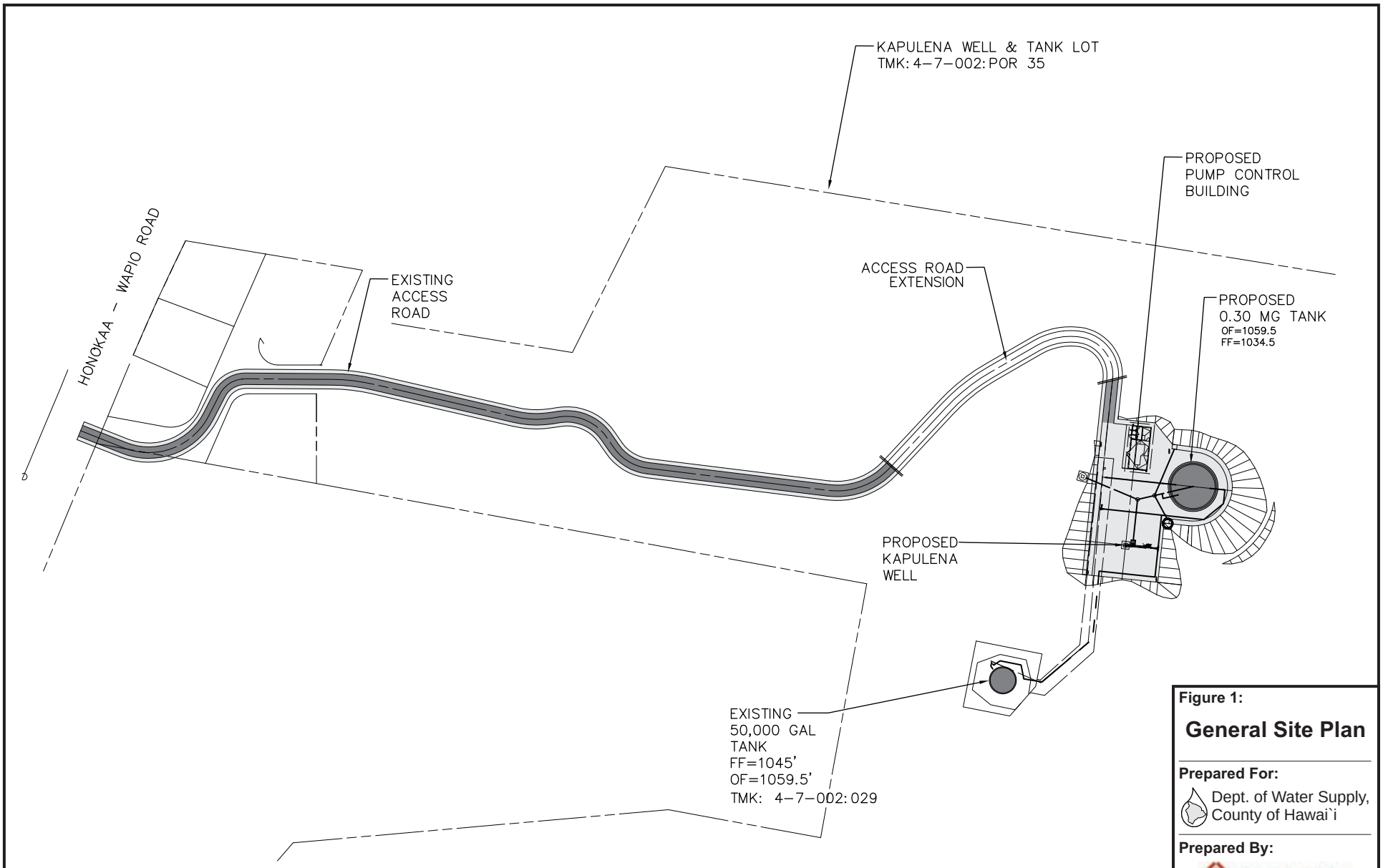

Figure 1:

General Site Plan

Prepared For:

Dept. of Water Supply, County of Hawai`i

Prepared By:

Source:

TNWRE

Project:

Kapulena Well & Reservoir

Figure 1 Site Plan 2009-07-31.cdr

Figure 2 – Kapulena well site, showing macadamia nut trees and sparse understory

Botanical Survey Methods

A reconnaissance level botanical survey was conducted within the site, primarily to characterize the vegetation present and to determine whether any botanical species currently listed or proposed for listing under either federal or State of Hawai‘i endangered species statutes were present on the site. A species list was kept of all species recorded; these data are presented in Table 1.

Botanical Survey Results

I recorded 59 species of plants on the site (Table 1). One species, *hāpu‘u* (*Cibotium chamissoi*) is endemic to the Hawaiian Islands and three others, *‘uhaloa* (*Waltheria indica*), *hala* (*Pandanus tectorius*) and manyspike flatsedge (*Cyperus polystachyos*) are indigenous to the islands. The remaining 56 species recorded are all considered to be alien, naturalized species. Three of these naturalized species *kukui* (*Aleurites moluccana*), *ki* (*Cordyline fruticosa*) and banana (*Mus x paradisiaca*), were introduced to the Hawaiian Islands prior to western contact. No species currently listed, or proposed for listing under either the federal or State of Hawai‘i endangered species statutes was recorded on the site.

Table 1 - Plants Recorded on the Kapulena Well Site

Scientific Name	*Common Name*	*ST*
FERNS & FERN ALLIES		
DICKSONIACEAE		
Cibotium chamissoi Kaulf.	*hāpu`u*	**E**
NEPHROLEPIDACEAE		
Nephrolepis multiflora (Roxburgh) Jarrett ex Morton	common sword fern	N
FLOWERING PLANTS		
DICOTYLEDONES		
ACANTHACEAE		
Thunbergia fragrans Roxb.	sweet clock vine	N
AMARANTHACEAE		
Altenanthera pungens Kunth	khaki weed	N
Amaranthus spinosa (L.) DC	spiny amaranth	N
ANACARDIACEAE		
Mangifera indica L.	mango	N
Schinus terebinthefolius Raddi	Christmas berry	N
APIACEAE		
Centella asiatica (L.) Urb	Asiatic pennywort	N
APOCYNACEAE		
Allamanda cathartica L.	golden trumpet	N
Plumeria rubra Willd. Ex Roem. &Schult.	Mexican plumeria	N
ARALIACEAE		
Schefflera actinophylla (Endl.) Harms	octopus tree	
ASPHODELACEAE		
Aloe vera (L.) Burn.	aloe	N
ASTERACEAE (COMPOSITAE)		
Bidens pilosa L.	beggar's-tick	N
Hypochoeris radicata L.	hairy cat's ear	N
Conyza bonariensis (L.) Cronq.	hairy horseweed	N
Emilia fosbergii Nicolson	Flora's paintbrush	N
Sonchus oleraceus L.	sow thistle	N
Sphagneticola trilobata (L.) Pruski	wedelia	N
Taraxacum officinale W.W. Weber ex Wigg.	common dandelion	N
Youngia japonica (L.) DC	oriental hawksbeard	N
BRASSICACEAE		
Lobularia maritime (L.) Desv.	sweet alyssum	N
CASUARINACEAE		
Casuarina equisetifoilia L.	ironwood	N

Table 1 Continued

Scientific Name	***Common Name***	***ST***
CECROPIACEAE		
Cecropia obtusifolia Bertol.	guarumo	N
EUPHORBIACEAE		
Aleurites moluccana (L.) Willd.	*kukui*	Pol
Chamaesyce hirta (L.)	garden spurge	N
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	N
Euphorbia heterophylla L.	*kaliko*	N
Ricinus communis L.	castor bean	N
FABACEAE		
Desmodium cf. *incanum* DC	Spanish clover	N
Melilotus alba Medik.	white sweet clover	N
Mimosa pudica L.	sensitive plant	N
LAURACEAE		
Persia Americana Mill	avocado	N
MALVACEAE		
Hibiscus rosa-sinensis L.	red hibiscus	N
Malvastrum coromandelianum (L.) Garcke	false mallow	N
MYRTACEAE		
Psidium cattleianum Sabine	strawberry guava	N
Psidium guajava L.	common guava	N
Syzygium cumini (L.) Skeels	Java plum	N
PRIMULACEAE		
Anagalis arvensis L.	scarlet pimpernel	N
PROTEACEAE		
Macadamia integrifolia Muell.	macadamia nut	
ROSACEAE		
Rubus rosifolius Sm.	Mauritius raspberry	N
STERCULIACEAE		
Waltheria indica L.	*‘uhaloa*	Ind
URTICACEAE		
Pilea microphylla L.	artillery plant	N
VERBENACEAE		
Stachytarpheta urticifolia (Salisb.) Sims	------	N
	MONOCOTYLEDONES	
AGAVACEAE		
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	Pol
Dracaena goldieana Masters & Moore	queen dracaena	N
PANDANACEAE		
Pandanus tectorius S. Parkinson ex Z	*hala*	Ind
CYPERACCEAE		
Cyperus polystachyos	manyspike flatsedge	Ind

Table 1 Continued

Scientific Name	***Common Name***	***ST***
MUSACEAE		
Musa x paradisiaca L.	banana	Pol
POACEAE (GRAMINEAE)		
Axonopus fisifolius (Raddi) Kuhlm.	carpet grass	N
Bambusa vulgaris Schrad. Ex Wendl.	common bamboo	N
Chloris radiata (L.) Sw.	radiate fingergrass	N
Heliconia bihai (L.) L	lobster claw heliconia	N
Melinus minutiflora P. Beauv.	molasses grass	N
Melinus rupens (Willd.) Zizka	Natal redtop	N
Saccaratum officinarum L.	Sugar cane	N
Sacciolepis indica (L.) Chase	Glenwood grass	N
Paspalum conjugatum Bergius	Hilo grass	N
Urochloa maxima (Jacq.) Webster	Guinea grass	N
ZINGIBERACEAE		
Alpinia purpurata (Vieill.) K. Schum	red ginger	N
Hedychium cornorarium Koenig	white ginger	N
Hedychium flavescens N. Carey ex Roscoe	yellow ginger	N

Key to table 1

ST	Status
E	Endemic – native and unique to the Hawaiian Islands
Ind	Indigenous – native to the Hawaiian Islands, but also found elsewhere naturally
N	Naturalized – an alien species now naturalized in the Hawaiian Islands
Pol	Polynesian introduction – a plant that was brought to the islands by the Polynesian settlers

Avian Survey Methods

A record was kept of all avian species detected while within the project site. Additionally, two eight-minute point counts were made at opposite ends of the property. Field observations were made using Leitz 10 X 42 binoculars, and by listening for vocalizations. Counts took place between 08:30 a.m. and 10:00 a.m., the peak of daily bird activity. Time not spent counting was used to search the study site for species and habitats that were not detected during count sessions.

Avian Survey Results

During the course of the avian survey I recorded 47 individual birds of nine separate species representing eight families (Table 2). One of the species recorded, Hawaiian Hawk (*Buteo solitarius*) is listed as an endangered species under both federal and state of Hawai‘i endangered species statutes. The remaining eight species recorded are considered to be alien to the Hawaiian Islands

Avian diversity and densities were relatively low, though in line with what one would expect in an active macadamia nut orchard. Two of the species recorded Hwamei (*Garrulax canorus*), and Northern Cardinal (*Cardinalis cardinalis*) accounted for 40.43 percent of the total number of birds recorded. Hwamei was the most frequently detected avian species.

Table 2 - Avian Species Detected at the Kapulena Well Site

Common Name	***Scientific Name***	***ST***	***RA***
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Meleagridinae - Turkeys		
Wild Turkey	*Meleagris gallopavo*	A	2.00
	FALCONIFORMES		
	ACCIPITRIDAE - Hawks, Kites, Eagles & Allies		
	Accipitrinae - Kites, Eagles & Hawks		
Hawaiian Hawk	*Buteo solitarius*	**EE**	1.00
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Zebra Dove	*Geopelia striata*	A	1.50
	PASSERIFORMES		
	TIMALIIDAE - Babblers		
Hwamei	*Garrulax canorus*	A	5.00
Red-billed Leiothrix	*Leiothrix lutea*	A	2.00
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	3.50
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	1.50
	CARDINALIDAE - Cardinals & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	4.50
	FRINGILLIDAE - Fringilline and Carduleline Finches & Allies		
	Carduelinae - Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	2.50

Key to table 2

ST Status

A Alien – Introduced to the Hawaiian Islands by humans

EE Endangered Endemic – Native and unique to the Island of Hawaii, also listed as endangered

RA Relative Abundance –Number of birds detected divided by the number of count stations (2)

Mammalian Survey Methods

All observations of mammalian species were of an incidental nature. With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *ʻōpeʻapeʻa* as it is known locally, all terrestrial mammals currently found on the Island of Hawaiʻi are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the study area.

Mammalian Survey Results

Evidence of two mammalian species was detected during the course of this survey. A lone small Indian mongoose (*Herpestes a. auropunctatus*) was seen within the site. Track, sign and scat of pigs (*Sus s. scrofa*), was encountered in numerous locations within the study site.

Discussion

Botanical Resources

A total of 61 species of plants was recorded on the site, four of which are native. All four of the native species recorded, *hāpuʻu, ʻuhaloa, hala* and manyspike flatsedge are relatively common species. The remaining species recorded are all considered to be alien to the Hawaiian Islands.

The site is located within an active macadamia nut orchard. The vegetation on the well and reservoir site is typical of that found in macadamia orchards, namely macadamia nut trees, with weedy ruderal species growing in the path and roadways. The vegetation is controlled by the regular application of herbicides, in this case Roundup © below the drip line of the trees, and by regular mowing elsewhere. This habitat is illustrated in Figure 2. The existing access road is maintained by mowing, and is bordered on both sides by an eclectic mix of ornamental plants, and fruit trees. The modification of the vegetation on the site will not affect any listed species, neither will it result in significant impacts to native vegetation within the greater Honokaʻa/Waipiō area.

Avian Resources

Avian diversity and densities were low, as is to be expected given the current habitat present on the site. All but one of the nine avian species detected during the course of this survey are considered to be alien to the Hawaiian Islands. The lone native species recorded, Hawaiian Hawk is listed as an endangered species under both federal and state of Hawaiʻi endangered species statutes.

<u>*Hawaiian Hawk.*</u> A single adult female dark phase Hawaiian Hawk flew into a macadamia nut tree adjacent to one of my count stations. On viewing the bird through binoculars it was found that the bird was banded. Inquiries to John Klavitter elicited the information that he and Mark Vekasy had banded the bird as an adult hatch year bird on “March 19, 1998, just outside Honokaʻa.”

Hawaiian Hawks are currently found in nearly all habitats on the island that still have some large tree components. They are regularly seen foraging in the general project area. Hawk densities are highest in mature, native species dominated forests, with grassy under-stories. This habitat, with high amounts of forest edge, supports large populations of game birds and the four species of introduced rodents known from the island, all of which are prey items for the hawk. Additionally, this type of habitat also provides numerous perches and nesting sites suitable for this species (Klavitter 2000).

The Hawaiian Hawk, or *ʻio*, is the only extant *falconiforme* in Hawaiʻi. It is currently endemic to the Island of Hawaiʻi. Sub-fossil remains indicate that it was also formerly found on Molokaʻi and Kauaʻi (Olson & James 1997). Several incidental unconfirmed sightings of this species exist from Kauaʻi (Dole 1879, Beaglehole, 1967) and Maui (Banko 1980c). This species was first mentioned in the western literature by Cook and King in 1784 and was scientifically described by Peale in 1848 from a specimen collected in "Kealakekua" (Medway 1981, Peale 1848).

Current population estimates based on John Klavitter's research extrapolates that there are currently 1,450 Hawaiian Hawks living in the wild. That number is, in his estimation, equal to or higher than the number present in pre-contact times (Klavitter 2000). The Hawaiian Hawk breeding season starts in late March, chicks hatch in May, and begin to fledge in July (Griffin et al. 1998). Although hawks use resources in most forest habitats they usually nest in *ʻōhiʻa* trees (*Metrosideros polymorpha*). Of 112 nests found during the 1998 and 1999 nesting seasons, 82 percent of the nests were located in *ʻōhi'a trees* (Klavitter 2000). There are no appropriate nesting trees present on the project site for this species. The USFWS published a proposed rule to delist the Hawaiian Hawk in the *Federal Register* on August 6, 2008. The proposal is still open (*Federal Register* 2008).

Hawaiian Petrel and Newell's Shearwaters. It is also possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*), or *uaʻu*, and the threatened Newell's Shearwater (*Puffinus auricularis newelli*), or *ʻaʻo*, over-fly the project area between the months of May and November (Banko 1980a, 1980b, Day et al. 2003a, Harrison 1990). There is no suitable nesting habitat within or close to the proposed project site for either of these pelagic seabird species.

Hawaiian Petrels were once common on the Island of Hawaiʻi (Wilson and Evans 1890–1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as at the mid to high elevations of Mount Hualālai. It has, within recent historic times, been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Mount Hualālai (Banko 1980a, Banko et al. 2001, Cooper and David 1995, Cooper et al. 1995, Day et al. 2003, Harrison 1990, Hue et al. 2001, Simons and Hodges 1998).

Newell's Shearwaters, another pelagic seabird species were formerly common on the Island of Hawaiʻi (Wilson and Evans 1890–1899). This species breeds on Kauaʻi, Hawaiʻi and Molokaʻi in extremely small numbers. Newell's Shearwater populations have dropped precipitously since the

1880s (Banko 1980b, Day et al., 2003b). This species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern.

Mammalian Resources

The findings of the mammalian survey are in keeping with the habitat present on the site, and the current management of the property.

Hawaiian hoary bat. Although, no Hawaiian hoary bats were detected during the course of this survey, it is probable that bats do occasionally use resources within the general project area. Hawaiian hoary bats are regularly seen in the general project area on a seasonal basis (David 2009). Unlike nocturnally flying seabirds, which sometimes collide with man-made structures, bats are uniquely adapted to avoid collision with most obstacles, man-made or natural. They navigate and locate their prey primarily by using ultrasonic echolocation, which is sensitive enough to allow them to locate and capture small volant insects at night.

Recent research on this species has shown that the species is present on the Island of Hawai‘i on a seasonal basis in almost all areas on the Island where dense vegetation and tree cover is present. The research also indicates that the bat is a human commensal species often associated with tree farms and other agricultural efforts. They are also attracted to outdoor lights which attract volant insects on which this species forages (Bonaccorso et al. 2004, 2007).

Although none of the four established alien rodents known from the Island of Hawai‘i were detected during the course of this survey it is probable that roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mice (*Mus musculus domesticus*), use resources on the project site as rodents are particularly fond of nuts.

Potential Impacts to Protected Species

Hawaiian Hawk

The principal potential impact that the development of the proposed well and reservoir poses to Hawaiian Hawks would be during the clearing and grubbing phase of the project that an active Hawaiian Hawk nest tree could potentially be removed. It is not expected that the development of the proposed well and reservoir will result in deleterious impacts to Hawaiian Hawks. This opinion reflects the fact that the trees that will need to be cleared to build this project are predominantly relatively short macadamia nut trees, a substrate that is not usually associated with Hawaiian Hawk nesting activity. Individual foraging hawks may be temporarily disturbed by construction activity. Such potential disturbance to foraging Hawaiian Hawks is not likely to be significant, as there are miles of suitable foraging habitat surrounding the very small project site.

Hawaiian Petrel and Newell's Shearwater

Development of this site as proposed could have the potential to adversely affect Hawaiian Petrels and Newell's Shearwaters only if it involved an increase in outdoor lighting. As no such lighting is planned, there appears to be no risk to these species.

Hawaiian Hoary Bat

The principal potential impact that the development of the proposed well and reservoir poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of vegetation within the project site may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season female carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally adult female bats sometimes leave their pups in the roost tree while they themselves forage. Very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing during the pupping season, between April 15 and August 15, the period in which bats are potentially at risk from vegetation clearing.

Conclusions

The modification of the current habitat on the Kapulena site is not expected to result in significant impacts to any botanical, avian or mammalian species currently listed as threatened, endangered or proposed for listing under either the Federal, or State of Hawai‘i endangered species programs. Furthermore, the development of the site is not expected to have a significant deleterious impact on native faunal resources found within the Hāmākua District.

Recommendations

While the risk that project-related activities could adversely affect Hawaiian bats is small, it is present if vegetation clearing is conducted during the pupping season. The risk to this protected species can be completely eliminated by avoiding such work between April 15 and August 15.

Glossary

Alien - Introduced to Hawai‘i by humans.
Commensal – Animals that share humans’ food and lodgings, such as rats and mice.
Diurnal – Daytime.
Endangered – Listed and protected under the ESA as an endangered species.
Endemic – Native and unique to the Hawaiian Islands.
Falconiforme – Diurnal birds of prey – 271 species worldwide.
Indigenous - Native to the Hawaiian Islands, but also found elsewhere naturally.
Mauka – Upslope, towards the mountains.
Naturalized – A plant or animal that has become established in an area that it is not indigenous to
Nocturnal – Nighttime, after dark.
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened - Listed and protected under the ESA as a threatened species.
Volant – Flying, capable of flight - as in flying insect.

ASL – Above mean sea level.
DWS – Hawai‘i County Department of Water Supply.
ESA – Endangered Species Act of 1973, as amended.
USFWS – U.S. Fish & Wildlife Service

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