Appendix A

Biological Surveys of the
Island School Campus
Prepared by
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September 24, 2010

Biological Surveys of the Island School Campus
Tax Map Key: (4) 3-8-02: 16
Puhi, Island of Kaua'i.

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Introduction and Background

The Island School is an existing Pre-Kindergarten through Grade 12 private school located on an approximately 38.448-acre site in Puhi, Island of Kaua'i. The Island School site, identified as Tax Map Key: (4) 3-8-02: 16, is located adjacent to the northeast boundary of the University of Hawai'i's Kaua'i Community College campus (KCC). To meet increased enrollment projections, Island School has prepared a development master plan for the 38.448-acre campus, which includes new classrooms and other school facilities. This report describes the methods used and the results of the botanical, avian and mammalian surveys conducted on the subject property as part of the environmental disclosure process associated with the school; development master plan.

The primary purpose of the surveys was to determine if there are any botanical, avian or mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the study area. We were also asked to evaluate the potential impacts that the development of the project might pose to any sensitive or protected native botanical, avian or mammalian species, and to propose appropriate minimization and or mitigative measures that could be implemented to reduce or eliminate any such impacts. The federal and State of Hawai'i listed species status follows species identified in the following referenced documents, Department of Land and Natural Resources (DLNR) 1998, U. S. Fish & Wildlife Service (USFWS) 2005a, 2005b, 2010). Fieldwork was conducted on August 10 and 12, 2010.

The avian phylogenetic order and nomenclature used in this report follows the *AOU Check-List of North American Birds* (American Ornithologists' Union 1998), and the 42nd through the 51st supplements to the Check-List (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010). Mammal scientific names follow (Tomich 1986). Plant names follow (Palmer, 2003) for ferns, (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow (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 Site Description

The approximately 38.448 – acre site is mostly covered with the existing Island School campus which includes parking lots, paved driveways, school buildings and associated infrastructure. There are a series of sports fields to the north of the campus buildings as well as a garden, and a relatively small area of undeveloped land surrounding the north, east and southwestern edges of the site. The school is bordered to the west and south by the KCC campus (Figure 1).

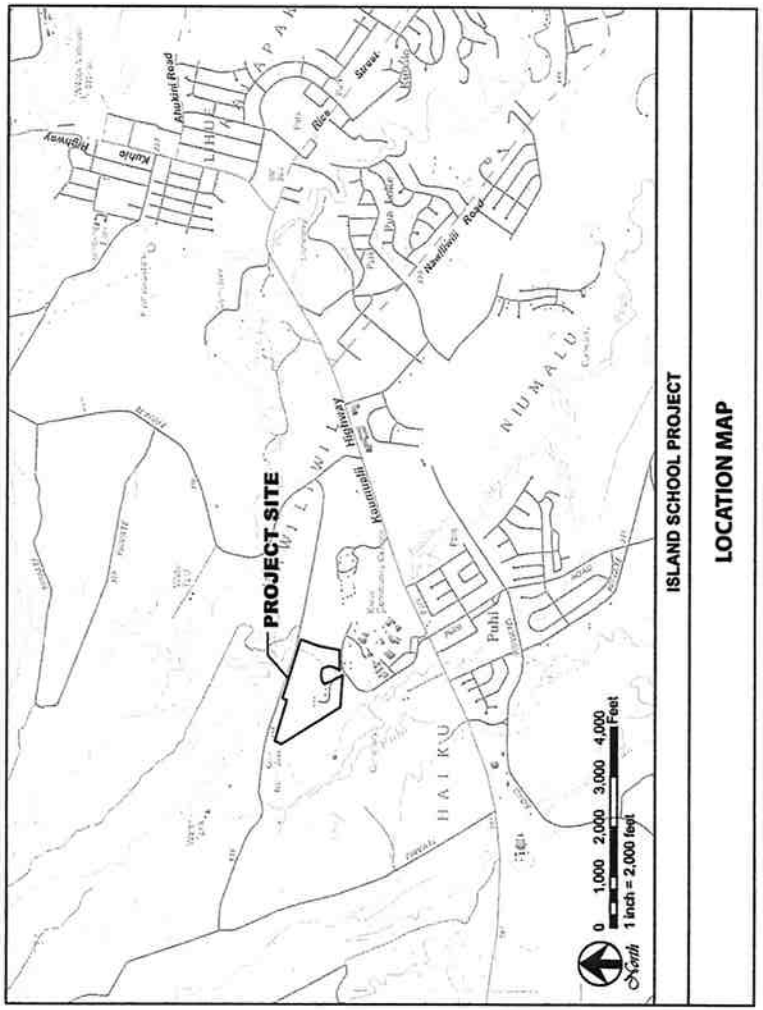

Figure 2 – Entrance to the Island School campus looking north from the front gate

Figure 3 – Soccer field looking south from northern end of campus towards school

Environments present within the survey area can be divided into two major types: school grounds with maintained ornamental plantings, and unmaintained areas of grasses, shrubs, and trees on previously disturbed ground. The former is reflected in Figures 2 and 3. Presumably, disturbed areas that are not presently maintained were once developed as agricultural fields.

Botanical Survey Methods

The botanical survey was undertaken on August 10, 2010. A pedestrian or wandering transect method was used, entailing the botanist covering the survey area on foot and noting plant species as they were encountered. As the survey progressed, notes were made on the relative abundances of each species (e.g., rare, common, abundant, etc.). Photographs were taken, or specimens collected for closer inspection, of plants not readily identified in the field. In a few cases (typically grasses), plants could not be identified due to a lack of flowering or fruiting at the time of the survey. Conditions with respect to the dry season appeared not to be adverse, as this windward area has experienced sufficient recent rainfall to support the natural vegetation on the site.

Botanical Survey Results

A plant checklist (Table 1) was compiled from field observations, with entries arranged alphabetically under plant family names (standard practice). Included in the list are scientific name, common name, and status (whether native or non-native) for each species observed during the survey. Qualitative estimates of plant abundance are included in column 4. These are coded in the table as explained in the Legend to Table 1 and apply to observations made during the present survey. For some species, a two-level system of abundance is used: the letter-number codes indicating species that have a limited distribution (e.g., found in only one small area of the property), but present there in numbers exceeding just a few individuals. For example, an abundance rating of "R" indicates a plant encountered only once or twice during the entire survey. An "R2" indicates a plant encountered in just one or two places, but with several to many individuals present where encountered. An "R3" would be a plant seldom encountered (i.e., rare), but locally abundant in at least one of the locations where it was encountered.

The project area supports two basic vegetation areas: 1) landscaping around the existing school buildings, roads, and other appurtenances such as athletic fields, and 2) minimally or unmaintained areas representing potential campus expansion areas. Abundance scale values in Table 1 are given only for the undeveloped areas. Species observed on the landscaped campus are marked in Table 1 with note (1). If an abundance value is given for a species indicated as occurring in the landscaped area, it occurred in both environments and the abundance given is for the undeveloped land only. Species associated only with aquatic areas (irrigation ditch and ponds) are indicated in Table 1 by note (2). For plant status, indigenous (**Ind**) and endemic (**End**) indicate native plants; naturalized (Nat), ornamental (Orn), and Polynesian introduced (Pol) indicate non-natives. The latter (so-called "canoe plants") were introduced to the Hawaiian Islands by Polynesian settlers prior

to 1778. A majority of the native species recorded is planted on the campus as ornamentals; thus, "status" reflects their relationship generally in the Hawaiian Islands and not their use in the present situation. This distinction is important, because some of the natives are rare, and at least three (*Brighamia insignis, Hibiscus brackenridgei,* and *H. clayi*) are listed species (USFWS, 2010). Subspecies of *Hibiscus waimeae* and *H. arnottianus* are also listed, although these subspecies are not found naturally on Kaua'i.

Table 1. Flora Recorded – The Island School, Puhi, Kaua'i

Species	*Common name*	*Status*	*Abundance*	*Notes*
	FUNGI			
AGARICACEAE				
Leucocoprinus fragilissimus (Ravenel) Pat.			R	
	FERNS and FERN ALLIES			
DENNSTAEDTIACEAE				
Microlepia strigosa (Thunb.) C. Presl.	*palapalai*	Ind	--	1
DICKSONIACEAE				
Cibotium sp.	*hāpu'u*	End	--	1
NEPHROLEPIDACEAE				
Nephrolepis cordifolia			--	1
Nephrolepis multiflora L.		Nat	A	1
POLYPODIACEAE				
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	*laua'e*	Nat	U3	1
Platycerium bifurcatum (Cav.) C. Chr.	common staghorn fern	Nat	--	1
PSILOTACEAE				
Psilotum nudum (L.) P. Beauv.	*moa*	Ind	R	
THELYPTERIDACEAE				
Christella dentata (Forssk.) Brownsey & Jermy	wood fern	Nat	U	
Christella parasitica (L.) H. Lév	wood fern	Nat	O2	
	FLOWERING PLANTS			
	DICOTYLEDONE			
ACANTHACEAE				
Graptophyllum pictum (L.) Griff.	caracature plant	Orn	--	1
Thunbergia fragrans Roxb.	sweet clockvine	Nat	U	
AMARANTHACEAE				
Amaranthus viridis L.	slender amaranth	Nat	--	1
Amaranthus spinosus L.	spiny amaranth	Nat	R	
ANACARDIACEAE				
Schinus terebinthifolius Raddi	Christmas berry	Nat	O	

Table 1 continued.

Species	*Common name*	*Status*	*Abundance*	*Notes*
ARALIACEAE				
Munroidendron racemosum (C. Forbes) Sherff	---	End	--	1
Schefflera actinophylla (Endl.) Harms	octopus or umbrella tree	Nat	O	1
Schefflera arboricola (Hayata) Merr.	dwarf umbrella tree	Orn	--	1
ASTERACEAE (COMPOSITAE)				
Ageratum conyzoides L.	*maile hohono*	Nat	O	
Bidens pilosa L.	*ki*	Nat	U2	1
Calyptocarpus vialis Less.	---	Nat	--	1
Conyza sp.	horseweed	Nat	O	1
Crassocephalum crepidiodes (Benth.) S. Moore	---	Nat	U	
Erigeron bellioides DC	fleabane	Nat	--	1
Partheniuim hysterophorus L.	false ragweed	Nat	O	
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	U	1
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	U2	
Sigesbeckia orientalis L.	sm. yellow crownbeard	Nat	R	
Sonchus oleraceus L.	sow thistle	Nat	U	
Sphagneticola triloba (L.) Pruski	wedelia	Nat	A	1
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat	U2	1
Tridax procumbens L.	coat buttons	Nat	--	1
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	--	1
Youngia japonica (L.) DC	oriental hawksbeard	Nat		1
BIGNONIACEAE				
Spathodea campanulata P. Beauv.	African-tulip tree	Nat	U	1
BORAGINACEAE				
Cordia sebastena L.	Geiger tree	Orn	--	1
Cordia subcordata Lam.	kou	Pol	--	1
Heliotropium procumbens Mill.	---	Nat	R	
CAMPANULACEAE				
Brighamia cf. insignis A. Gray	*'ōlulu*	End*	--	1,3
CARICACEAE				
Carica papaya L.	*papaya*	Nat	--	1
CARYOPHYLLACEAE				
Drymaria cordata (L.) Willd. ex Roem.	*pipili*	Nat	--	1
CASUARINACEAE				
Casuarina equisetifolia L.	ironwood	Nat	U1	
CLUSIACEAE				
Calophyllum inophyllum L.	*kamani*	Pol	--	1
CONVOLVULACEAE				1
Ipomoea batatas (L.) Lam.	*'uala*	Pol	--	1
Ipomoea obscura (L.) Ker-Gawl.	---	Nat	R	

Table 1 continued.

Species	Common name	Status	Abundance	Notes
Ipomoea triloba L.	little bell	Nat	U3	1
Merremia tuberosa (L.) Rendle	wood rose	Nat	U	
CUCURBITACEAE				
Cicurbita sp.	squash	Orn	R	3
EBENACEAE				
Diospyros sp.	*lama*	End	--	1,3
EUPHORBIACEAE				
Aleurites moluccana (L.) Willd.	*kukui*	Pol	--	1
Chamaesyce albomarginata (Torr.) & A. Gray) Small	rattlesnake weed	Nat	--	1
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat	U3	
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	Nat	--	1
Chamaesyce hyssopifolia (L.) Small	—	Nat	U	1
Codiaeum variegatum (L.) Blume	croton	Orn	--	1
Macaranga tanarius (L.) Müll. Arg	---	Nat	A	1
Phyllanthus debilis Klein ex Willd.	*niuri*	Nat	U2	1
Phyllanthus tenellus Roxb.	---	Nat	--	1
Ricinis communis L.	castor bean	Nat	--	1
FABACEAE				
Acacia confusa Merr.	Formosan *koa*	Nat	R	
Acacia koa A. Gray	*koa*	End	--	1
Alysicarpus vaginalis (L.) DC	Alyce clover	Nat	U	
Canavalia cathartica Thours	*maunaloa*	Nat	C	1
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	C	
Crotalaria incana L.	fuzzy rattlepod	Nat	U	
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	R2	
Desmodium incanum DC	Spanish clover	Nat	U	
Desmodium triflorum (L.) DC	—	Nat	C3	1
Desmodium sandwicense E. May	chili clover	Nat	R2	
Falcataria moluccana (Miq.) Barneby & Grimes	albizia	Nat	C	1
Indigofera hendecaphylla Jacq.	prostrate indigo	Nat	--	1
Indigofera suffruticosa Mill.	indigo	Nat	U2	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	U2	
Mimosa pudica L.	sensitive plant	Nat	C	1
Neonotonia wightii (Wight & Arnott) Lackey	glycine	Nat	U3	1,3
Samanea saman (Jacq.) Merr.	monkeypod	Nat	--	1
Senna occidentalis (L.) Link	coffee senna	Nat	R	3
GOODINACEAE				
Scaevola taccada (J. Gaert.) Roxb.	*naupaka kahakai*	Ind	--	1
LAMIACEAE				
Leonotis nepetifolia (L.) R.Br.	lion's ear	Nat	R2	

Table 1 continued.

Species	Common name	Status	Abundance	Notes
LAURACEAE				
Cinnamomum burmanni (Nees) Blume	Padang cassia	Nat	R	3
LYTHRACEAE				
Cuphea carthagenensis (Jacq.) J. F. Macbr.	Colombian waxweed	Nat	R	
MALVACEAE				
Hibiscus clayi Degener & Degener	—	End*	--	1
Hibiscus arnottianus A. Gray	*koki'o ke'okeo*	End	--	1
Hibiscus brackenridgei A. Gray	*m'ao hau hele*	End*	--	1
Hibiscus kokio Hilleb.	*koki'o 'ula'ula*	End	--	1
Hibiscus ovalifolius (Forssk.) Vahl	Rock's hibiscus	Orn	--	1
Hibiscus rosa-sinensis L. cultovars	Chinese hibiscus	Orn	--	1
Hibiscus waimeae A. Heller	*koki'o ke'oke'o*	End*	--	1
Sida acuta N.L. Burm.	—	Nat	U2	
Sida rhombifolia L.	Cuba jute	Nat	--	1
Sida spinosa L.	prickly sida	Nat	R	
Sida sp.			O	
Thespesia populnea (L.) Sol. ex Corrêa	*milo*	Ind	--	1
MORACEAE				
Artocarpus altilis (Z) Fosberg	*'ulu*; breadfruit	Pol	--	1
Ficus microcarpa L. fil.	Chinese banyan	Nat	--	1
MYOPORACEAE				
Bontia daphnoides L.	—	Orn	--	1
Myoporum sandwicense A. Gray	*naio*	Ind	--	1
MYRTACEAE				
Metrosideros polymorpha Gaud.	*'ōhi'a*	End	--	1
Psidium cattleianum Sabine	strawberry guava	Nat	U	
Psidium guajava L.	common guava	Nat	U	1
Rhodomyrtus tomentosa (Aiton) Hassk.	downy myrtle	Nat	O2	1
Syzygium cumini (L.) Skeels.	Java plum	Nat	O	1
ONAGRACEAE				
Ludwigia octovalvis (Jacq.) Raven	primrose willow	Nat	U2	2
OXALIDACEAE				
Oxalis corniculata L.	yellow wood sorrel	Pol	U	1
Oxalis corymbosa DC	pink wood sorrel	Nat	U	1,3
PASSIFLORACEAE				
Passiflora laurifolia L.	yellow granadilla	Nat	C	1
PITTOSPORACEAE				
Pittosporum sp.	*hō'awa*	End	--	1,3
PLANTAGINACEAE				
Plantago lanceolata L.	nrw-lvd plantain	Nat	U	1
Plantago major L.	brd-lvd plantain	Nat	--	1
POLYGALACEAE				
Polygala paniculata L.	bubblegum plant	Nat.	U2	

Table 1 continued.

Species	Common name	Status	Abundance	Notes
PROTEACEAE				
Grevillea robusta A. Cunn ex R.Br.	silk oak	Nat	R	
ROSACEAE				
Osteomeles anthyllidifolia (Sm.) Lindl.	*'ūlei*	Ind	--	1
RUBIACEAE				
Gardenia sp.	gardenia	Orn	--	1
Morinda citrifolia L.	*noni*	Pol	--	1
Paederia foetida L.	*maile pilau*	Nat	U	
Spermacoce assurgens Ruiz. & Pav.	buttonweed	Nat	O2	1
SAPINDACEAE				
Dodonaea viscosa Jacq.	*'a'ali'i*	Ind	--	1
SAPOTACEAE				
Chrysophyllum oliviforme L.	satin leaf	Nat	R	
SCROPHULARIACEAE				
Bacopa monnieri (L.) Pennell	*'ae'ae*	Ind	--	1
SOLANACEAE				
Solanum americanum P. Miller	*pōpolo*	Pol	R2	
Solanum lycopresicum var. carasiforme (Dunal) G. Spooner	cherry tomato	Nat	--	1
THYMELAEACEAE				
Wikstroemia uva-ursi A. Gray	*'akia*	End	--	1
URTICACEAE				
Pilea microphylla (L.) Liebm.	artillery plant	Nat	--	1
Pipturus albidus (Hook. & Arnott) A. Gray	*māmaki*	End	--	1
VERBINACEAE				
Lantana camara L.	lantana	Nat	R	
Stachytarpheta cayennensis (Rich.) Vahl	nettle-leaved vervain	Nat	U	
Verbena litoralis Kunth	*ōwi*	Nat	U2	1
Vitex rotundifolia L. fil.	*pōhinahina*	Ind	--	1
MONOCOTYLEDONES				
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki*	Pol	--	1
Cordyline fruticosa (L.) A. Chev.	ti cultivars	Orn	--	1
Pleomele cf. aurea (H. Mann) N.E. Brown	*hala pepe*	End	--	1,3
ARACEAE				
Colocasia esculenta L.	*kalo*	Pol	--	1
Philodendron bipinnatifidum Endl.	selloum	Orn	--	1
Syngonium sp.	nephthytis	Orn	R	
ARECACEAE				
Chamaedora sp.		Orn	--	1

Table 1 continued.

Species	Common name	Status	Abundance	Notes
Cocos nucifera L.	coconut palm	Nat	R	1
Dypsis decaryi (Jumelle) Beentje & Dransf.	Madagascar triangle palm	Orn	--	1
Dypsis lutescens (H. Wendl.) Beentje & Dransfield	golden-fruited palm	Orn	--	1
Latania loddigesii Mart.	blue latan palm	Orn	--	1
Pritchardia thurstonii F. Muell. & Drude	Fiji fan palm	Orn	--	1
Pritchardia sp.	—	End	--	1
Ptychosperma macarthurii (Veitch) J. D. Hook.	Macarthur palm	Orn		
COMMELINACEAE				
Commelina diffusa N. L. Burm.	dayflower	Nat	U	
CYPERACEAE				
Cyperus polystachyos Roth.	—	Ind	O	1
Cyperus sp.			R	2
Kyllinga brevifolia Rottb.	*kili'o'opu*	Nat	--	1
Kyllinga nemoralis (J.R. Forster & G. Forster) Dandy ex Hutchinson & Dalziel	*kili'o'opu*	Nat	--	1
LILIACEAE				
Chlorophytum comosum (Thunb.) Jacq.	spider plant	Orn	--	1
Ophipogon cf. jaburan (Sieb.) Loddiges	variagated mondo	Orn	--	1
Ophiopogon planiscapus Nakai	mondo grass	Orn	--	
MUSACEAE				
Musa hybrid	banana	Orn	--	1
ORCHIDACEAE				
Spathoglottis plicata Blume	Philippine ground orchid	Nat	U	--
PANDANACEAE				
Pandanus tectorius S. Parkinson ex Z	*hala*	Ind	U	1
POACEAE (GRAMINEAE)				
Axonopus compressus (Sw.) P.Beauv.	brd-lvd. carpetgrass	Nat	--	1
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	R2	
Coix lacryma-jobi L.	Job's tears	Nat	R1	2
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	U	1
Dactyloctenium aegyptium (L.) Willd.	beach wiregrass	Nat	R	1
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	Nat	U	1
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat	R	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	O2	1
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	U3	1
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.		Nat	--	1
Melinus minutiflora P. Beauv.	molasses grass	Nat	C3	1
Paspalum conjugatum Bergius	Hilo grass	Nat	A	1
Paspalum dilatatum Poir.	Dallis grass	Mat	--	1
Paspalum fimbriatum Kunth	fimbriate paspalum	Nat	U	1
Paspalum cf. *scrobiculatum* L.		Ind	R	
Paspalum sp.	indet.	Nat	--	1

Table 1 continued.

Species	*Common name*	*Status*	*Abundance*	*Notes*
Saccharum officinarum L.	sugar cane	Pol	R	
Sacciolepis indica (L.) Chase	Glenwood grass	Nat	O	
Setaria gracilis Kunth	yellow foxtail	Nat	R	
Sporobolis cf. *africanus* (Poir.) Robyns &Tournay	smutgrass	Nat	O3	1
Urochloa maxima (Jacq.) Webster	Guinea grass	Nat	A	1
Urochloa mutica (Forssk.) Nguyen	California grass	Nat	O3	1,2
ZYNGIBERACEAE				
Hedychium flavescens N. Carey ex Roscoe	yellow ginger	Orn	--	1
Zingiber zerumbet (L.) Sm.	*'awapuhi*	Pol	--	1

Legend to Table 1

Status = distributional status

- End. = endemic; native to Hawai'i and found naturally nowhere else.
- End* = species is listed as threatened or endangered (USFWS, 2010).
- Ind. = indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.
- Nat. = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
- Orn. = exotic, ornamental or cultivated crop; plant not naturalized (not well-established outside of cultivation).
- Pol. = Polynesian introduction; brought to the Hawaiian Islands before 1778.

Abundance = occurrence ratings for plants on property in August 2010

- R – Rare - only one or two plants seen.
- U - Uncommon - several to a dozen plants observed.
- O - Occasional - found regularly, but not abundant anywhere.
- C - Common - considered an important part of the vegetation and observed numerous times.
- A - Abundant - found in large numbers; may be locally dominant.
- AA - Abundant - very abundant and dominant; defining vegetation type.

Numbers (as in R3) offset occurrence ratings (1 – several plants; 2 – many plants; 3 – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone.

Notes:

<1> Developed campus (abundance, if given, relates to the presence on undeveloped land)
<2> Associated with water features (irrigation canals, ponds)
<3> Plant lacking flowers or fruit; identification uncertain.

In all, one mushroom, nine ferns and 167 species of flowering plants were recorded in the Island School survey area (Table 1). Considering only those flowering plants and ferns found outside the landscaped areas (95 species), only four are natives - 4 percent, all four are indigenous to the Hawaiian Islands and relatively common in the lowlands. No endemics were recorded except as part of the landscaping.

The vegetation found in the undeveloped parts of the property consists of mixed areas of moderately open to closed forest, shrubland, and grassland. Forest tends to predominate, with mostly mature macaranga (*Macaranga tanarius*) and albizia (*Falcataria moluccana*) trees. Other conspicuous but generally not numerous species are Christmas berry (*Schinus terebinthfolius*), octopus plant (*Schefflera actinophylla*), and Java plum (*Syzygium cuminii*). Ground cover and understory shrubs and vines varied considerably from place to place. Additional detail on the vegetation in this area is provided in David and Guinther (2010).

Avian Survey Methods

Four avian count stations spaced approximately equidistant from each other were sited within the campus. Eight-minute point counts were made at each station. Stations were each counted once. Field observations were made with the aid of Leica 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated in the early morning hours, the peak of daily bird activity. Additionally, we conducted two 30-minute time dependant waterbird counts at the reservoir which is located immediately adjacent to the entrance driveway but which is not included in this proposed project, but from which waterbirds wander onto the property as is evidenced by the recording of waterbirds in the middle of the road during avian point counts. Time not spent counting stations was used to search the rest of the site for species and habitats not detected during count sessions.

Avian Survey Results

A total of 221 individual birds of 22 species, representing 16 separate families, were recorded during station counts (Table 2). Three of the species recorded, Hawaiian Goose, or *Nēnē* (*Branta sandvicensis*), Common Moorhen (*Galinula chloropus sandvicensis*), and Hawaiian Coot (*Fulica alai*) are listed as endangered species under both Federal and State of Hawai'i endangered species statutes. One other species recorded, Pacific Golden-Plover (*Pluvialis fulva*), is an indigenous migratory shorebird species. And one other, Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*) is an indigenous resident breeding species. The remaining 17 species recorded are all considered to be alien to the Hawaiian Islands.

Avian diversity and densities were in keeping with the highly manicured nature of the bulk of the site, and it's location in the lowlands of the Island of Kaua'i. Three species, Chestnut Munia (*Lonchura atricapilla*), Zebra Dove (*Geopelia striata*), and Common Myna (*Acridotheris tristis*), accounted for slightly less than 52 percent of all birds recorded during station counts. The most commonly recorded species was Chestnut Munia, which accounted for slightly more than 21 percent of the total number of individual birds recorded. An average of 55 birds were detected per station count.

Table 2 - Avian Species Detected – Island School Campus

Common Name	*Scientific Name*	*ST*	*RA*
	ANSERIFORMES		
	ANATIDAE - Ducks, Geese & Swans		
	Anserinae - Geese & Swans		
Hawaiian Goose (Nēnē)	*Branta sandvicensis*	EE	2.00

Table 2 continued.

Common Name	Scientific Name	ST	RA
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Black Francolin	*Francolinus francolinus*	A	0.50
Red Junglefowl	*Gallus gallus*	A	4.25
	CICONIIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	1.75
Black-crowned Night-Heron	*Nycticorax nycticorax hoactli*	IR	0.25
	GRUIFORMES		
	RALLIDAE - Rails & Allies		
Common Moorhen	*Gallinula chloropus sandvicensis*	EE	0.5
Hawaiian Coot	*Fulica alai*	EE	0.5
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
	Charadriinae - Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	IM	0.25
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Rock Pigeon	*Columba livia*	A	0.25
Spotted Dove	*Streptopelia chinensis*	A	0.75
Zebra Dove	*Geopelia striata*	A	9.75
	PSITTACIFORMES		
	PSITTACIDAE - Lories Parakeets, Macaws & Parrots		
	Psittacinae - Typical Parrots		
Rose-ringed Parakeet	*Psittacula krameri*		0.25
	PASSERIFORMES		
	CETTIIDAE - Cettia Warblers & Allies		
Japanese Bush-Warbler	*Cettia diphone*	A	0.75
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	4.25
	TIMALIIDAE – Babblers		
Hwamei	*Garrulax canorus*	A	0.25
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	7.25
	EMBERIZIDAE – Emberizids		
Red-crested Cardinal	*Paroaria coronata*	A	1.75

Table 2 continued.

Common Name	Scientific Name	ST	RA
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	1.00
	FRINGILLIDAE – Fringilline And Cardueline Finches & Allies		
	Carduelinae – Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	2.75
	PASSERIDAE - Old World Sparrows		
House Sparrow	*Passer domesticus*	A	1.25
	ESTRILDIDAE – Estrildid Finches		
	Estrildinae – Estrildine Finches		
Nutmeg Mannikin	*Lonchura punctulata*	A	5.50
Chestnut Munia	*Lonchura atricapilla*	A	11.75

Key to Table 2.

ST	Status
EE	Endangered Endemic species -
A	Alien species – introduced to Hawai'i by humans, and have become established in the wild
IM	Indigenous Migratory species -
RA	Relative Abundance: Number of birds detected divided by the number of count stations (4)

During the time dependant waterbird counts we recorded three Common Moorhen, and three Hawaiian Coots. Both species were represented by a pair of adult birds and a sub-adult, indicating that successful nesting is occurring either at the pond or within one of the *'auwai's* that run through portions of this site and the adjacent Kaua'i Community College property.

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *'ōpe'ape'a* as it is known locally, all terrestrial mammals currently found on the Island of Kaua'i 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 project area.

Mammalian Survey Results

Three mammalian species were detected during the course of this survey. One dead cat (*Felis c. catus*) was encountered on the eastern side of the playing field. Tracks and sign of both dog (*Canis f. familiaris*) and pig (*Sus s. scrofa*) were observed in several locations within the study area. The endangered Hawaiian hoary bat was not seen during the course of this survey.

No mammalian species protected or proposed for protection under either the federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR 1998, USFWS 2005a, 2005b, 2010).

Discussion

Botanical Resources

The proposed expansion area for Island School is devoid of botanical resources that would merit special concern. All species are common to lowland windward Kaua'i, nearly exclusively non-native, and not requiring or deserving of preservation on this property. Landscaping after completion of project building plans would hold more promise for creating valuable botanical resources than the present weedy growth. The two most common trees, macaranga and albizia, are fast growing species that do not make good landscaping trees, particularly in park and school ground settings, because of their tendency to shed large branches in moderately strong winds.

Avian Resources

The findings of the avian survey are consistent with the location of the property, and the habitat present on the site. Additionally, the findings are consistent with at least one other avian survey conducted on the Kaua'i Community College campus, which is located immediately adjacent to the Island School site (David and Guinther 2010).

Five of the 22 avian species detected during the course of this survey, Hawaiian Goose, or Nēnē, Common Moorhen, Hawaiian Coot, Pacific Golden-Plover and Black-crowned Night-Heron are native species. Nēnē, Common Moorhen and Hawaiian Coot are listed as endangered species under both the state and federal endangered species statutes. We recorded a total of eight separate Nēnē, and three each Common Moorhen and Hawaiian Coot on the site. The Nēnē population on Kaua'i is increasing at a fairly rapid pace, and is likely that if this increase continues that human - Nēnē interactions will continue to rise on the Island over time. Common Moorhen and Hawaiian Coot are relatively abundant and wide spread on the Island of Kaua'i. They can be found in association with just about any kind of standing or running water no matter how ephemeral in nature. We also recorded one Pacific Golden-Plover during station counts. This species is an indigenous migratory shorebird species that nests in the high Arctic during the late spring and summer months, returning to Hawai'i and the Tropical Pacific to spend the fall and winter months each year. They usually leave Hawai'i for their trip back to the Arctic in late April or the very early part of May each year. The remaining 17 avian species detected during this survey are all considered to be alien to the Hawaiian Islands (Table 2).

Although not detected during this survey, it is probable that the Hawaiian endemic sub-species of the Short-eared Owl, or Pueo (*Asio flammeus sandwichensis*) use resources in the

general project area, as they are regularly seen foraging over open fields in the low-to-mid elevation areas on the Island (David 2010).

Two other species not detected during this survey, Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*) have been recorded over-flying the project site between April and the end of November each year (David 1995, Morgan *et al.*, 2003, 2004, David and Planning Solutions 2008). Additionally, the Save Our Shearwaters Program has recovered both species from the general project area on an annual basis over the past three decades (Morgan *et al.*, 2003, 2004, David and Planning Solutions 2008, DLNR, Division of Forestry and Wildlife (DOFAW) 2009).

The petrel is listed as endangered, and the shearwater as threatened under both federal and State of Hawai'i endangered species statutes. The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley *et al.*, 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961, Telfer 1979, Sincock 1981, Reed *et al.*, 1985, Telfer *et al.*, 1987, Cooper and Day 1994, 1998, Podolsky *et al.*, 1998, Ainley *et al.*, 2001).

There are no nesting colonies nor appropriate nesting habitat for either of these listed seabird species within or close to the school site. The closest currently active Newell's Shearwater colony is located above Kalāheo, which is located approximately 9.5-kilometers southwest of the site (David *et al.*, 2002). The closest known Hawaiian Petrel nesting colonies are located at the back of Limahuli, Wainiha, Lumaha'i, and probably Hanalei Valleys (David *et al.*, 2002, DOFAW 2009).

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the habitat currently present on the site. Although no Hawaiian hoary bats were detected during the course of this survey, bats have been recorded within the general project area, on a regular basis (David 2010). Hawaiian hoary bats are widely distributed in the lowland areas on the Island of Kaua'i, and have been documented in and around almost all areas that still have some dense vegetation (Tomich 1986, USFWS 1998, David 2010).

Although no rodents were detected during the course of this survey, it is likely that the four established alien *muridae* fund on Kaua'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use various resources found within the general project

area. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependant on them.

Potential Impacts to Protected Species

Botanical Resources

No plant species currently listed as endangered, threatened, or proposed for listing under either the federal or the State of Hawai'i's endangered species programs were recorded as growing naturally on the Island School property. Several listed species observed were ornamentals in a Hawaiian native plant garden. Therefore, it is not expected that proposed expansion of the campus will result in deleterious impacts to any plant species currently listed as endangered, threatened, or proposed for listing under either federal or State of Hawai'i endangered species statutes (DLNR 1998, USFWS 2005, 2010).

Nēnē

The principal potential impacts that the additional development of the site poses to Nēnē is during the construction phase of the project, and following build-out by the increased number of humans and associated school activities. Although Nēnē on Kaua'i tend to show a remarkable disregard of human activity, fatalities have occurred on construction sites, along roads, and numerous nests have failed due to human disturbance and as a direct result of predators taking eggs and goslings (David 2010, Ebbin Moser + Skaggs, and Rana Biological Consulting, Inc. 2010).

Hawaiian Petrel and Newell's Shearwater

The principal potential impact that the development of the site poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by outdoor lighting associated with possible night-time construction activity, and following build-out with exterior lighting associated with the structures and appurtenances that are built on the property.

Hawaiian Hoary Bat

The principal potential impact that the further development of the site poses to Hawaiian hoary bats is during the clearing and grubbing phases of the project. Areas that currently have dense vegetation are likely used to some degree by roosting bats; normally it is not thought that the availability of roosting habitat is a limiting factor in this species survival (Bonaccorso 2009). The principal threat that clearing potential roosting habitat poses to this species is between May and July when female bats may be carrying pups and potentialialy may not be able to flee vegetation clearing activity quickly enough to avoid harm (Bonaccorso 2005, 2007, 2009).

Following build-out of the project, lighting associated with the school, and landscaping vegetation will likely attract volant insects to the site, which in turn will provide bats with additional foraging opportunities.

Critical Habitat

There is no federally delineated Critical Habitat present on the school site or adjacent to the property. Thus the further development of the school will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under State law.

Recommendations

- Since it is likely that endangered Nēnē will use resources on the site, and both Newell's Shearwaters and Hawaiian Petrels may fallout onto the site during the construction phase of the project, we recommend that an endangered species awareness program be developed which includes general information on the endangered species act and protected species, specific restrictions that will be in force on the job site to project endangered species, and a set of protocols on who, and how job site personnel will respond to any downed or injured endangered species that may occur on the site. All construction personnel should be required to be familiar with the program; it's guidelines, restrictions and protocols that will need to be followed. Similar programs have been developed and are being used at several construction project sites, and resorts on the Island of Kaua'i.

- If construction activity is planned to occur during the Nēnē nesting season, which typically runs from October through March on Kaua'i, the project site should be surveyed by a qualified biologist before the onset of the construction, to determine if any active Nēnē nesting activity is occurring on the site.

- If active Nēnē nesting does occur while construction is ongoing, it may be advisable to have a Nēnē monitor on site during such activity to ensure that no harm befalls the birds.

- If nighttime work will be required in conjunction with the construction of the project, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer *et al.* 1987).

- It is also recommended that all exterior lighting associated with the operation of the proposed facility be shielded so as to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed *et al.* 1985, Telfer *et al.* 1987).

- It is recommended that if heavy vegetation on the periphery of the existing developed school site needs to be cleared, that clearing not occur between May 15 and July 15, when bats may be carrying young (pups) and potentially could be placed at risk by such clearing.

Glossary

Alien – Introduced to Hawai'i by humans
'Auwai – irrigation flume usually left over from sugar cultivation days
Commensal – Animals that share human food and lodgings, such as rats, mice cats and dogs.
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species
Endemic – Native to the Hawaiian Islands and unique to Hawai'i
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
muridae – Rodents, including rats, mice and voles, one of the most diverse family of mammals.
Nēnē - Hawaiian Goose (*Branta sandvicenis*) and endangered endemic species
Naturalized – A plant or animal that has become established in an area that it is not indigenous to
Nocturnal – Night-time, after dark
Ornamental – Usually referring to a a plant or tree grown for its attractive appearance, usually a non-native species
'Ōpe'ape'a – Endemic endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*)
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Phylogenetic – The evolutionary order that organisms are taxonomically arranged by
Threatened – Listed and protected under the ESA as a threatened species
Volant – Flying, capable of flight - as in flying insect.

DLNR – Hawai'i State Department of Land & Natural Resources
DOFAW – Division of Forestry and Wildlife
ESA – Federal Endangered Species Act of 1973, as amended
USFWS – United State Fish & Wildlife Service

Literature Cited

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *in*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22: Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. (Pg. 108-123).

American Ornithologist's Union. 1998. *Check-list of North American Birds.* 7th edition. AOU. Washington D.C. 829pp.

_____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 119:897-906.

_____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 120:923-931.

_____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 121:985-995.

_____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 122:1031-1031.

_____. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds.* Auk 123:926-936.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007 Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 124:1109-1115.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2008 Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 125:758-768.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 126:1-10.

_____. 2010. Fifty-first supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 127:726-744.

Bonaccorso, F. J., C. M. Todd and, A. C. Miles. 2005. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. 1 September 2004 to 31 August 2005.

_____. 2007. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. April 1, 2007.

Bonaccorso, F. J., M. Corresen, and C, Pinzari 2009. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. February 4, 2009.

Cooper, B. A and R. H. Day. 1994. Kauai endangered seabird study. Volume 1: Interactions of Dark-rumped Petrels and Newell's Shearwaters with utility structures on Kauai, Hawaii: Final Report, TR-105847-V1, Electric Power Research Institute, Palo Alto, California.

_____. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newell's Shearwaters at Power Lines on Kauai. Colonial Waterbirds, 21 (1): 11-19.

David, R. E. 2010. Unpublished field notes – Kaua'i, 1980 - 2010.

David, R. E., R. H. Day, and B. A. Cooper 2002. Results of Newell's Shearwater Surveys at the Kaluahonu, Moalepe and Anahola Memorial Colonies, Island of Kaua'i, Hawai'i, July 2002. Prepared for Planning Solutions, Inc., and Kaua'i Electric.

David, R. E., and Planning Solutions 2008. 2007 Save Our Shearwaters Program End of Year Report: Prepared for: Kaua'i Island Utility Cooperative & The Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife.

David, R. E. and E. Guinther 2010. Biological Surveys of the Univeristy of Hawaii, Kauai Community College Campus, Tax Map Key: (4) 3-4-7: 3-04-07:01, 02, and 06 Puhi, Island of Kaua'i. Prepared for Wilson Okamoto Corporation and the State of Hawai'i, University of Hawaii, Kauai Community College.

Department of Land and Natural Resources (DLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawai'i. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Division of Forestry & Wildlife (DOFAW) 2009. Unpublished Seabird Survey Data.

Ebin, Moser + Skaggs LLP, and Rana Biological Consulting, Inc. 2010. Kaua'i Lagoons Habitat Conservation Plan. Prepared for: Kauai Lagoons, LLC & Mori Golf (Kauai), LLC.

Hadley, T. H. 1961. Shearwater calamity on Kauai. Elepaio 21:60.

Morgan, C., P. White, and R. E. David. 2003. Habitat Conservation Plan: Kaua'i Island Utility Cooperative: Working Paper No. 2 - Data Analysis: Interpreting the Save Our Shearwaters Bird Recovery Database (1979-2002) for Habitat Conservation Planning. Prepared for: Kaua'i Island Utility Cooperative.

Morgan, C., P. White, and R. E. David. 2004 Habitat Conservation Plan: Kaua'i Island Utility Cooperative: Data Report and Analysis: Save Our Shearwaters Bird Program 2003 Update. Prepared for: Kaua'i Island Utility Cooperative.

Palmer, D. D. 2003. *Hawai'i's ferns and fern allies*. University of Hawaii Press, Honolulu. 324 pp.

Podolsky, R., D.G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. "Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i". Colonial Waterbirds 21:20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. Auk 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell ' s Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildlife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places*. Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. 'Elepaio 39:71

Telfer, T. C. , J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. Wildlife Society Bulletin 15:406-413.

Tomich, P.Q. 1986. *Mammals in Hawaii*. Bishop Museum Press. Honolulu, Hawaii. 37 pp.

U.S. Fish & Wildlife Service (USFWS) 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

_____. 1998. Recovery Plan for the Hawaiian Hoary Bat. U.S. Fish & Wildlife Service, Portland, Oregon.

_____. 2005a. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

_____. 2005b. 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

U.S. Fish & Wildlife Service (USFWS). 2010. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do

Wagner, W.L., D.R Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i.* University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawai'i,* pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.