

SPECIAL PERMIT APPLICATION

EXHIBIT 16-
GENERAL BOTANICAL SURVEY

***General Botanical Survey and Vertebrate Fauna Assessment,
Waikoloa Quarry
Waikoloa, South Kohala District, Island of Hawai‘i***

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July 2015

Introduction

This biological survey was prepared for West Hawaii Concrete, which leases land and operates a rock quarry on 219.990 acres of land at Waikoloa within TMK (3) 6-8-001:066 (Figure 1) (“the property”).¹ A Special Permit to allow for the operation of the quarry operation at the property was approved by the County of Hawaii Planning Commission in September 1992, and the Special Permit was issued by the State Land Use Commission in January 1993. West Hawaii Concrete has operated a rock quarry at the property since 1995. This survey was prepared as part of information for an amendment to the Special Permit to extend the life of the permit to run the quarrying operation to 2043 or longer, to add approval of West Hawaii Concrete’s composting operation to the Special Permit, and to enable processing and recycling of Portland cement concrete (PCC) and asphalt concrete pavement (ACP) on the site. According to the quarry operators, the top five feet of rock has been removed from 95% of the approximately 220-acre quarry property as part of quarrying activities, and very little natural surface exists. This is evident in aerial and ground photos of the property (Figures 2 and 3).

The objectives of the botanical component of this survey were to 1) describe the vegetation; 2) list all species encountered; 3) determine the likelihood of the presence of rare, threatened or endangered (T&E) plant species; and 4) identify the locations of any T&E individuals found. The area was surveyed by Ron Terry and Patrick Hart (résumés for whom are attached to the end of this report) in June 2015. Plant species were identified in the field and, as necessary, collected and keyed out in the laboratory. Special attention was given to the possible presence of any federally listed T&E plant species (USFWS 2015), although the habitat did not indicate a strong potential for their presence.

The survey also included a limited faunal survey restricted to providing a list of birds and introduced mammals, reptiles, or amphibians observed during the botanical survey. Also considered in this report is the general value of the habitat for native birds and the Hawaiian hoary bat. Not included in the survey were invertebrates or aquatic species or habitat.

¹ Since December 2008 the property has been owned by WQJ2008 Investment LLC and Ukumehame Quarry Company LP.

Vegetation Type and Influences

The geology of the property consists of Mauna Loa 'a'a lava flows of various ages between 1,500 and 3,000 years old (Wolfe and Morris 1996). These black, rugged, nearly unvegetated lava flows in Waikoloa and adjacent Pu'uana'hulu are known as the Kanikū lava flows. Elevations range from about 680 to 920 feet above sea level. The natural slope perpendicular to the sea (prior to grading) is on the order of 5 percent. Like most 'a'a flows, the surface is highly irregular, with local relief of more than 20 feet and steep slopes around boulders and rock outcrops. The area receives an average annual rainfall of about 10 inches (Giambelluca et al 2013).

The natural, pre-human vegetation of this part of the Kanikū Lava Flow was likely very sparse native herbs and grasses, perhaps including *pili* grass (*Heteropogon contortus*) and *ilima* (*Sida fallax*). The types of dry grasslands and shrublands described by Gagne and Cuddihy (1990) for other parts of low-elevation Waikoloa do not occur because soil has simply not had time to develop in this young substrate. Typical vegetation in older areas surrounding the Kanikū lava flow in which at least some soil has formed likely consisted of 'ilima and *pili* grass along with *kawelu* grass (*Eragrostis variabilis*) and vines such as *pā'ū-o-Hi'iaka* (*Jacquemontia ovalifolia*), with a perhaps diverse but fairly sparse cover of native dry-forest trees and shrubs including 'a'ali'i (*Dodonaea viscosa*), sandalwood or *iliahi* (*Santalum ellipticum*), *lama* (*Diospyros sandwicensis*), *wiliwili* (*Erythrina sandwicensis*) and *uhiuhi* (*Mezoneuron kawaiensis*).

Small remnants of now-endangered species such as *uhiuhi* and rare species such as *wiliwili* that were formerly fairly widely distributed still persist in some areas. Other endangered species such as red 'ilima (*Abutilon menziesii*) have been completely extirpated by cattle grazing and feral goat browsing.

Previous Surveys of the Property

Botanist Winona Char conducted several botanical surveys of the quarry site in 1992 as part of the original permitting documentation for the quarry (Char 1992 and 1992b). In a May 1992 survey, she found that fountain grass covered 30 to 50% of older lava flows, but less than 3% on younger lava flows, although it was still the dominant species. A few *kiawe* trees and indigo plants were present. The only natives were 'uhaloa (*Waltheria indica*) and the fern *iwa'iwa* (*Doryopteris decipiens*).

Although she made an intensive search for pololei fern (*Ophioglossum concinnum*), which at the time was considered endemic and a category 1 candidate endangered species, none were located. She noted that the plant might emerge after the first heavy downpour, after which it would likely quickly die off, with only its invisible underground rhizomes remaining until the next large rain. She then resurveyed the area after heavy rains in October 1992 associated with Hurricane Iniki. This time, she did find some ferns within a small gully in the pahoehoe, along with seedlings of a number of weeds not previously observed. Since that time, the *O. concinnum* has been included in species *O. polyphyllum*, an indigenous fern that is widespread around the world. Although cryptic, it

is locally abundant on a seasonal basis, and is no longer considered endangered or even rare (Palmer 2003).

Results: Vegetation

Our survey in 2015 was of a landscape that had been heavily scraped and quarried, but with a vegetation that did not differ markedly from that of 25 years ago. Vegetation over the property is still fairly sparse, as shown in Figures 2 and 3. It consists of two types:

1. Graded and actively used areas, with sparse vegetation of fountain grass (*Cenchrus setaceus*), a non-native, fire-promoting grass, and tree tobacco (*Nicotiana glauca*), a weed that springs up heavily in this part of the island when lava is disturbed. Very few other species are present. This occupies nearly all of the property.
2. Undisturbed areas, which vary from unvegetated to very sparse fountain grass.

Flora

The flora of the quarry as of June 2015 is extremely non-diverse. All plant species found on the property during the survey are listed in Table 1. Of the eight species detected, only two were native. There were a few individuals of the indigenous (native to the Hawaiian Islands and elsewhere) 'uhaloa and puakala (*Argemone glauca*). There were no endemic (found only in the Hawaiian Islands) plants. All other plants were weeds, and no rare or unusual plant species were present. The only tree present was the non-native *kiawe* (*Prosopis pallida*), of which we only observed four individuals. Given enough time without further disturbance, a larger variety of non-native weeds common in the Waikoloa area would undoubtedly begin to invade.

Threatened and Endangered Plant Species and Critical Habitat

No threatened or endangered plant species as listed by the U.S. Fish and Wildlife Service appear to be present on the property, nor are there uniquely valuable habitats. No existing or proposed federally designated critical habitat is present on the property.

Botanical Impacts and Recommended Mitigation Measures

The history of heavy, continuous disturbance coupled with the lowland context has resulted in a flora and vegetation on the property that has little value in terms of conserving native vegetation or threatened or endangered plant species. As such, no adverse botanical impacts on the property are expected as a result of the continuing and proposed uses.

Fauna

During the survey we observed five bird species, all of them common non-natives (see Table 2). Birds were generally sparse due to the sparse vegetation.

We would expect the migratory resident Golden Plover (*Pluvialis fulva*) to be present at least occasionally, as it is frequently seen in the area and throughout the State of Hawai'i during its residence here from August to April each year. The Golden Plover is not a threatened, endangered or candidate species. Similarly, the Short-eared Owl or *pueo* (*Asio flammeus sandwichensis*), which is an endemic (i.e., native and unique to Hawai'i), sub-species of this near cosmopolitan species, likely hunts in the area. It is unlikely that any native forest birds would make much use of the property because of the lack of forest within five miles.

Although they would likely never be seen, it is possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened Newell's Shearwater (*Puffinus auricularis newelli*) over-fly the property between the months of May and November. The Hawaiian Petrel was formerly common on the Island of Hawai'i. 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, as well as at the mid-to-high elevations of Hualālai. It has within recent historic times been reduced to relict breeding colonies located at high elevations on Mauna Loa and, possibly, Hualālai. Hawaiian Petrels were first listed as an endangered species by the USFWS in 1967 and by the State of Hawai'i in 1973.

Newell's Shearwaters were also once common on the Island of Hawai'i. This species breeds on Kaua'i, Hawai'i, and Moloka'i. Newell's Shearwater populations have dropped precipitously since the 1980s (Banko 1980, Day et al., 2003). This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. Newell's Shearwater was listed as a threatened species by the USFWS in 1975 and by the State of Hawai'i in 1973.

The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is considered another significant cause. 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. There is no suitable nesting habitat within or close to the property for either species.

Various mammals would be expected on the property, including feral goats (*Capra hircus*), small Indian mongoose (*Herpestes a. auro-punctatus*), mice (*Mus* spp.), rats (*Rattus* spp.), and perhaps feral cats (*Felis catus*). None of these alien mammals have conservation value and all are deleterious to native flora and fauna. During the survey, only goats were observed. Goat browsing on young, green fountain grass was evident, and it also appeared that goats may have been browsing on young tree tobacco leaves. Although tree tobacco is somewhat poisonous to goats, they are known to browse on it when little else is available (Green and Newell 1982).

Although not detected in the survey, which took place in daylight, the only native Hawaiian land mammal, the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), may also

be present in the general area, as it is present in many areas on the island of Hawai'i. They may forage for flying insects on the property on a seasonal basis. Bats roost in trees and very tall shrubs, only one of which was present on the property.

There are no native terrestrial reptiles or amphibians in Hawai'i. No reptiles and amphibians were detected during the survey, but it is likely that various geckoes (Family Gekkonidae) are present.

As discussed above, this report does not cover invertebrates, which a separate faunal specialist is studying because of the potential presence of the endangered Blackburn's sphinx moth, the larval stage of which is known to feed on tree tobacco.

Impacts and Mitigation Measures for Fauna

We offer the following recommendations in order to avoid impacts to endangered but widespread native birds and the Hawaiian hoary bat:

- To minimize impacts to the endangered Hawaiian hoary bat, we recommend that trees taller than 15 feet should not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). At the present time, only one such tree, a *kiawe*, appears to be present.
- If any activities incorporate outdoor lighting, they may attract endangered Hawaiian Petrels and Newell's Shearwaters, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of Hawaiian Petrels and Newell's Shearwaters by their interaction with outdoor lighting, we recommend no construction or unshielded equipment maintenance lighting after dark between the months of April and October. All permanent lighting should be shielded in strict conformance with the Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

Report Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Dry conditions can render almost undetectable plants that extended rainfall may later invigorate and make obvious. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. Although this survey was conducted in accordance with accepted practice, the findings of this survey should be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species. However, the property is not a likely habitat for rare, threatened or endangered plant or animal species.

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Figure 1. Property Map

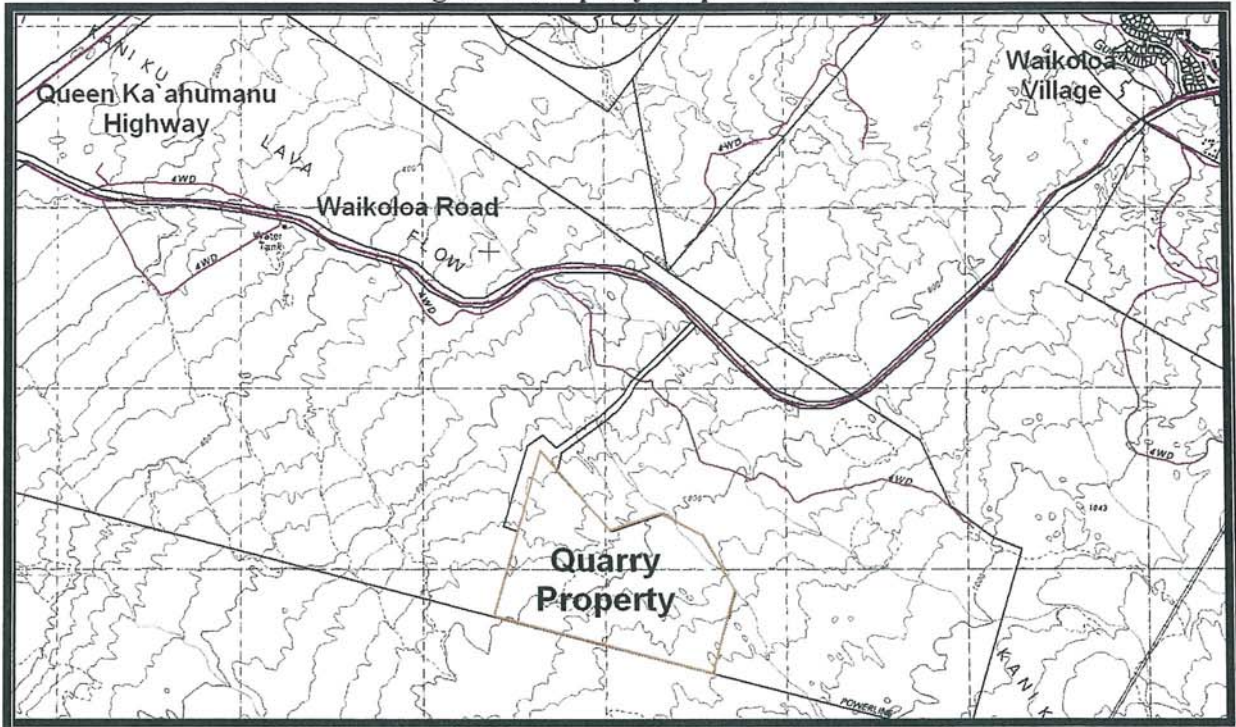


Figure 2. Aerial Image



Base Map © Google Earth

Figure 3. Property Photos



3a. Active Rock Crushing Area ▲ ▼ 3b. Typical Scraped Area

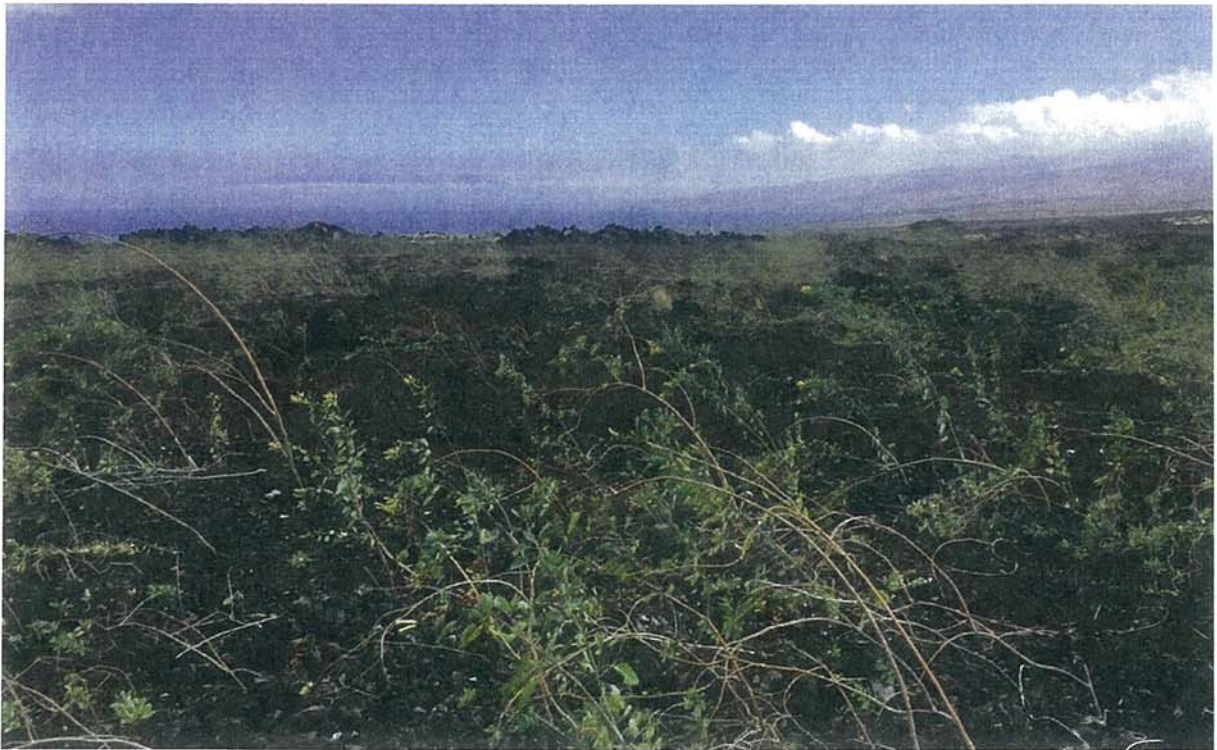


Figure 3. Property Vegetation Photos



3c. Landscape on Older Lava Flow Pre Quarry ▲
▼ 3d. Scraped Area Left, Natural Surface Right, Younger Lava Flow



Table 1. List of Plant Species Detected at Waikoloa Quarry

Scientific Name	Family	Common Name	Life Form	Status*
<i>Argemone glauca</i>	Papaveraceae	Pua kala	Herb	I
<i>Calotropis gigantea</i>	Asclepiadaceae	Crown flower	Shrub	A
<i>Cenchrus setaceus</i>	Poaceae	Fountain grass	Herb	A
<i>Nicotiana glauca</i>	Solanaceae	Tree tobacco	Shrub	A
<i>Prosopis pallida</i>	Fabaceae	Kiawe	Tree	A
<i>Senna occidentalis</i>	Fabaceae	Coffee senna	Herb	A
<i>Waltheria indica</i>	Malvaceae	'Uhaloa	Herb	I
<i>Verbascum thapsus</i>	Scrophulariaceae	Mullein	Herb	A

A = alien, E = endemic, I = indigenous, End = Federal and State listed Endangered Species
 Several plants were either sterile or unidentifiable, including a non-native composite.

Table 2. Bird Species Observed at Waikoloa Quarry

Scientific name	Common name	Status
<i>Acridotheres tristis</i>	Common Myna	Alien Resident
<i>Alauda arvensis</i>	Eurasian Skylark	Alien Resident
<i>Carpodacus mexicanus</i>	House Finch	Alien Resident
<i>Serinus mozambicus</i>	Yellow-Fronted Canary	Alien Resident
<i>Zenaida macroura</i>	Mourning Dove	Alien Resident

BIOGRAPHICAL SKETCH

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2005- present	Assistant/Associate Professor, Department of Biology, University of Hawaii at Hilo
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2001	Lecturer, Department of Zoology, University of Hawaii, Manoa
2000-2001	Lecturer, Department of Biology, University of Hawaii, Hilo
1993-1999	Research Assistant, Department of Zoology, University of Hawaii, Manoa
1991-1993	Teaching Assistant, Department of Zoology, University of Hawaii, Manoa
1992	Instructor, School for Field Studies
1989-1990	Volunteer, United States Peace Corps

RECENT PUBLICATIONS (last five years)

Wu, J. X., D. M. Delparte, and P. J. Hart. 2014. Movement patterns of a native and non-native frugivore in Hawaii and implications for seed dispersal. *Biotropica* 46:175-182.

VanZandt, M., D. DelParte, P. Hart, F. Duvall, and J. Penniman. 2014. Nesting characteristics and habitat use of the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) on the Island of Lanai. *Waterbirds* 37:43-51.

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Sridhar, H., U. Srinivasan, R.A. Askins, J. Canales-Delgadillo, C. Chen, D. N. Ewert, G. A. Gale, E. Goodale, W. K. Gram, P. J. Hart, K. A. Hobson, R. L. Hutto, S. W. Kotagama, J. L. Knowlton, T. M. Lee, C. A. Munn, S. Nimnuan,

B. Z. Nizam, G. Peron, V. V. Robin, A. D. Rodewald, P. G. Rodewald, R. L. Thomson, P. Trivedi, S. L. Van Wilgenburg, and K. Shanker. 2012. Positive relationships between association strength and phenotypic similarity characterize the assembly of mixed-species bird flocks worldwide. *American Naturalist* 180:777-790.

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Samuel, M. D., P. H. F. Hobbelen, F. DeCastro, J. A. Ahumada, D. A. LaPointe, C. T. Atkinson, B. L. Woodworth, **P. J. Hart**, and D. C. Duffy. 2011. The dynamics, transmission, and population impacts of avian malaria in native Hawaiian birds: a modeling approach. *Ecological Applications* 21(8): 2960-2973.

Hart, P. J., B. L. Woodworth, R. Camp, K. Turner, K. McClure, K. Goodall, Henneman, C. Spiegel, J. LeBrun, E. Tweed, and M. Samuel. 2011. Bird and resource variability across an elevational gradient in Hawaii. *The Auk* 128:113-126.

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Flaspohler, D.J., C. Giardina, G.P. Asner, **P.J. Hart**, J. Price, C.K. Lyons*, and X. Castaneda*. 2009. Long-term effects of fragmentation and fragment properties on bird species richness in Hawaiian forests. *Biological Conservation* 143:280-288.

Gaudioso, J.M., D.A. LaPointe, and **P.J. Hart**. 2009. Knemidokoptic mange in Hawai'i Amakihi (*Hemignathus virens*) on the Island of Hawai'i. *Journal of Wildlife Disease* 45:497-501.

Eggert, L.S., L.A. Terwilliger, B.L. Woodworth, **P.J. Hart**, D. Palmer, and R.C. Fleischer. 2008. Genetic structure along an elevational gradient in Hawaiian Honeycreepers reveals contrasting evolutionary responses to avian malaria. *BMC Evolutionary Biology* 8:315.

14 TCBS GRADUATE STUDENTS MENTORED AS PRIMARY ADVISOR (INCLUDING 5 HAWAIIAN/ PACIFIC ISLANDERS) DURING LAST 5 YEARS AT UH HILO:

- Jackie Gaudioso, Bobby Hsu, Samuel Brooks, Chris Todd, Seth Judge, Stephan Kropidowski, Thomas Jones, Kainana Francisco, Christina Cornett, Tony Kovach, Ann Tanimoto, Joshua Pang-Ching, Tishanna Ben, James Akau

GRANTS RECEIVED (LAST FIVE YEARS)

Price, D.P., P.J. Hart, E. Stacy, and M. Takabayashi.. Understanding Biotic Response to Environmental Change in Tropical Ecosystems Through a Place-Based Context (\$4,999,999)

Hart, P. J., P. Banko, and A. Timmermann. 2013. UH Climate Science Center grant
Reconstructing pre-historic climate variability in Hawaii and the tropical Pacific (\$81,000)

Hart, P. J. 2012. National Park Service. Vegetation inventory and mapping support.
(\$270,000)

Hart, P. J. 2010. National Park Service. Landbird inventory and monitoring (\$300,426)

Price, D.P., P.J. Hart, E. Stacy, and M. Takabayashi. 2008. CREST center in tropical ecology and evolution in marine and terrestrial environments (\$4,999,995)

PROFESSIONAL ASSOCIATIONS

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<i>Flora & Fauna:</i>	Flora and Fauna Studies, Section 7 Consultation, Remote Sensing of Vegetation

RECENT BIOLOGICAL ASSESSMENT PROJECTS:

- Biological surveys/training sessions (8 to date) for Environet, Waikoloa Maneuver Area (2013-15)
- Biological surveys of County Open Space Properties (6 to date) (HI County P&R 2014-15)
- Botanical survey Kilauea-Kauai Proposed Bicycle Path (Private 2013)
- Ka'ū Forest Reserve Management Plan Environmental Assessment (DLNR 2012)
- Hilo Hillside Subdivision Section 7 ESA Consultation, FEMA (Private 2011)
- Monk Seal Recovery Facility Environmental Assessment (Marine Mammal Center 2011)
- Biocontrol of Strawberry Guava Environmental Assessment (U.S. Forest Service 2010)
- Kea'au Paho Highway Improvements Botany Report (SSFM/Dept. of Trans. 2010)
- Ha'ena State Park Biological Report (PBR Hawaii/DLNR 2009)
- La'i'ōpua Endangered Species Preserve Management Plan (DHHL 2008)
- Environmental Assessment for Hakalau Forest NWR, Kona Forest Unit (USFWS 2008)
- Waikoloa Makai Botany Report (SSFM 2008)
- Aina Haina Conservation District Parcel Botany Report (Private 2007)
- Mohouli Drainage Botany Report (SSFM 2006)
- La'aloa D-Bar Ranch Botany Report (Private 2005)
- Environmental Assessment for State Kahikinui Forest Restoration, Maui (DLNR 2004)
- Botanical Report for Koa Timber (2002)
- Flora and Fauna Reports, Cellular Towers (5 reports, 1998-2004)
- Flora and Fauna Reports, Parker Ranch Quarry Sites (6 reports, 1999-2004)

QUALIFICATIONS OF RON TERRY, PH.D.:

Ron Terry, Ph.D., earned a B.A. in Geography in 1980 from the University of Hawai'i at Hilo. Supported by a National Science Foundation grant, he earned a Ph.D. from Louisiana State University, also in Geography, in 1988. He was Assistant Professor of Geography at the University of Hawai'i at Hilo from 1987-1992. During his professorship he began his consulting business, and began full-time consulting in 1992. He remains an Affiliate Professor at UH-Hilo. He has been a board member of several State boards and commissions related to environmental management.