Kaheawa Wind Power
Habitat Conservation Plan
Annual Report: FY 2018

Kaheawa Wind Power, LLC
3000 Honoapi`ilani Highway
Wailuku, Hawai`i 96768

August, 2018

ITL 08 and ITP TE118901-0

I certify that to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate and complete.

Hawai'i HCP Manager
Terraform Power, LLC

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Executive Summary

Kaheawa Wind Power, LLC (KWPI) has been implementing a Habitat Conservation Plan (HCP) since approval in January 2006. The HCP supports the Federal Incidental Take Permit TE-118901-0 and State of Hawai'i Incidental Take License ITL-08. KWPI was commissioned to begin operating on June 22, 2006. Species covered under the HCP include the Hawaiian petrel (HAPE), Newell's shearwater (NESH), Hawaiian goose (nēnē), and Hawaiian hoary bat (bat). This report is for the State of Hawai'i fiscal year (FY) 2018, July 1, 2017 through June 30, 2018.

In FY2018 the downed wildlife search area consisted of graded roads and wind turbine generator (WTG) graded pads found within a 70-meter radius circle centered on each turbine. Teresa Gajate has been contracted since October 2015 to conduct canine assisted searching with her dog Makalani. Staff HCP biologists visually searched when Ms. Gajate was not available. Visual searches were 5.8% of the all KWPI WTG searches in FY2018. The search interval mean and standard deviation (SD) in days was 7.0 (SD = 0.22). The FY2018 search area density weighted proportion (DWP) of the predicted total fall distribution is approximately 38.2%, 25.6% and 57.3% for the nēnē, seabirds and bat, respectively.

One adult bat and one adult nēnē fatality attributed to WTG collision were observed within the search area on formal searches during FY 2018. No other adults of covered species were found outside of the search area or incidental to formal searches. Four nēnē goslings were also found dead within the search area but were not considered takes attributed to wind site operations. Twenty-three nēnē, six HAPE, and eight bats have been observed within the search areas and included in the total take estimated since the permit period began in 2006. Since operations began six goslings found were not attributed to wind turbine operations and three bats, one adult nēnē and one HAPE were found but considered either outside the search area or incidental to formal searches. NESH have not been found at KWPI since operations began.

The total estimated direct take as adults at the 80% credibility level for KWPI HCP covered species is 37 nēnē, 12 HAPE and 23 bats. Unobserved direct take as adults therefore is 14 nēnē, six HAPE and 15 bats. Indirect take (IDT) converted to adult take is two, three, and five for the nēnē, HAPE and bat, respectively. Total estimated take in FY2018 therefore is 39, 15 and 28 for the nēnē, HAPE and bat, respectively. The total estimated take as adults reported in the FY2017 HCP annual report was 36, 16 and 31 for nēnē, HAPE and bat, respectively. Between the FY2017 and FY2018 reports two bats found in 2008 and 2011 were re-assessed to be incidental to formal searches when SEEF results were less than 75% and one HAPE found in 2012 was re-assessed to have been outside of the formal search area. The 20-year permit term take projections calculated at the end of FY2018 for the nēnē, HAPE and bat are 59, 24 and 42 adults, respectively. Lost future productivity as fledglings accrued for nēnē and HAPE is 8.7 and 10.2, respectively.

Independent contractor Kristin Mack has conducted searcher efficiency (SEEF) trials at KWPI since October 2015. The FY2018 SEEF results for large, medium, and small size carcasses was 100% (N = 14), 100% (N = 11), 95.4% (N = 44), respectively. Four 28-day carcass retention (CARE) trials, each conducted quarterly, used four large, four medium, and 20 small size carcasses. The FY2018 CARE mean and standard deviation (SD) in days for large, medium, and small carcasses were 28.0 (SD = 0), 28.0 (SD = 0) and 14.9 (SD = 11.3), respectively.

Wildlife Acoustics SM2BAT+™ bat detectors with one SMX-U1™ microphone each recorded nightly bat detections at all nine WTG associated ground locations at KWPI during 5.4% of total detector nights (162 of 2989). The overall rate for KWPI in FY2017 was 5.1%. Feeding buzzes were detected on three nights in FY2018. Bats were detected in every month of the year at ground height detectors with peak per cent nights with detections in August (9%), September (14%), December (8%) and May (9%) and at WTG 10 (9%).

A total of 45 site personnel and 67 off-site MECO employees received Wildlife Education and Observation Program trainings in FY 2018.

Vegetation management of the search plots at KWPI for FY 2018 treated 13 acres of total search plot area using hand-held weed whackers and herbicide.

Seabird mitigation for baseline estimated take continues at the Makamaka'ole seabird enclosures and

includes trapping and monitoring for potential predators, maintenance of enclosure fences, erosion control and monitoring seabird activity within the Makamaka'ole Stream drainage area and near artificial burrows within the enclosures. HCP required alternative seabird mitigation site surveys in East Maui were completed in FY 2016. Additional HAPE nesting colony assessment and predator control on Lāna'i Island has been funded and arranged with the USFWS and Pūlama Lāna'i to mitigate for the loss of productivity accrued from HAPE estimated take not yet mitigated for. No seabird fledglings have been produced to date.

Nēnē mitigation contracted to DOFAW for Tier 1 (baseline) estimated take continued at the Haleakala Ranch nēnē pen with 47 fledglings produced through FY 2018. Nēnē fledgling production for FY2018 was one.

Mitigation for Tier 1 (baseline) estimated bat take was completed in 2008. Mitigation for Tier 2 (higher) estimated bat take has begun to be funded in FY 2017 quarter 2 and is bat ecological research on East Maui contracted to H.T. Harvey Ecological Consultants intended to better inform future bat habitat restoration and conservation. KWPI is also partially funding bat ecological research on Hawai'i Island contracted to the US Geological Survey Hawaiian hoary bat research group. Forty-seven nēnē fledglings have been produced at the Haleakala Ranch pen through FY 2018.

KWPI provided DOFAW and USFWS abbreviated quarterly summary reports for FY 2018 quarters 1-3 and met periodically with these agencies. The Endangered Species Recovery Committee reviewed the FY 2017 annual HCP report on January 24, 2018.

Introduction

In June 2006 Kaheawa Wind Power, LLC (KWPI) began operating the island of Maui's first commercial wind energy generation facility in the Kaheawa Pastures area of West Maui. The State Board of Land and Natural Resources approved a Conservation District Use Permit (CDUP) for the facility, which is situated on state conservation lands, in January 2003.

In fulfillment of the Endangered Species Act and Chapter 195-D, Hawai`i Revised Statutes, KWPI developed a project-specific Habitat Conservation Plan (HCP) in cooperation with the U.S Fish and Wildlife Service (USFWS), the Department of Land and Natural Resources- Division of Forestry and Wildlife (DOFAW) ("the agencies") and the Hawai`i Endangered Species Recovery Committee (ESRC). Upon final approval of the HCP, the federal Incidental Take Permit (ITP #TE-118901-0) and state Incidental Take License (ITL# 08) were issued in January 2006, each with a duration of twenty years. The ITP and ITL cover four federally-listed and endangered species: the Hawaiian petrel or 'ua'u or HAPE (*Pterodroma sandwichensis*), Newell's shearwater or 'a'o or NESH (*Puffinus newelli*), Hawaiian goose or nēnē (*Branta sandvicensis*), and the Hawaiian hoary bat or 'ope'ape'a or bat (*Lasiurus cinereus semotus*).

KWPI has previously submitted annual HCP progress reports for FY 2007 through FY 2017 to the agencies (Kaheawa Wind Power 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 and 2017). This report summarizes HCP related activities for KWPI during the State of Hawai`i fiscal year (FY) 2018 (July 1, 2017 through June 30, 2018).

Downed Wildlife Monitoring

KWPI biologists have implemented a year-round intensive monitoring program to document downed (i.e., injured or dead) wildlife incidents on the project site involving HCP-listed and non-listed species since operations began June 2006. Fatality monitoring plots were reduced in area on October 1, 2010, after receiving approval from the agencies, from the initial intensive weekly monitoring on 180 meter (m) by 200m plots centered on each wind turbine generator (WTG) to 73m circular plots centered on each WTG, except where steep slopes prohibited visual searching. At the March 31, 2015 ESRC meeting, after review of monitoring data for KWPI, members agreed to "encourage the applicant to work with the statistical experts and researchers to develop an alternative more efficient and focused monitoring strategy which still meets the committees expressed preference for continuation of annual monitoring".

Beginning in April 2015 with agreement from the agencies, the area searched weekly included only the graded roads and WTG pads found within a 70m radius circle centered on each WTG (Figure 1).

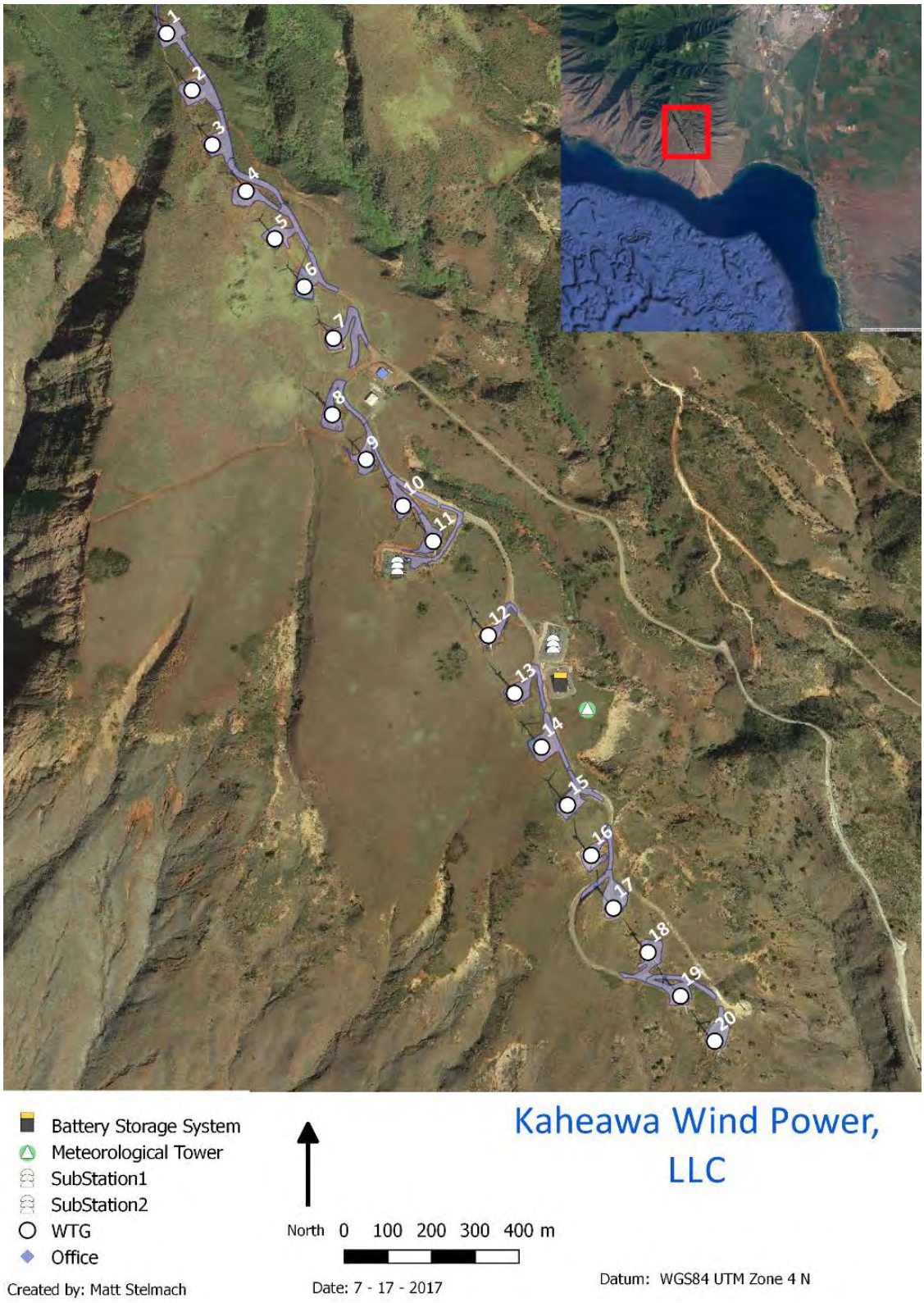

Figure 1. KWPI WTG, building and site utility locations.

Search Area Density Weighted Proportion of the Predicted Fall Distribution

The density weighted proportion (DWP) of the predicted total fall distribution is one of the measured variables used to estimate the total take for each HCP listed species (see Estimated Adjusted Take). The DWP has also been called the density weighted area (DWA). The FY 2018 search area DWP of the predicted total fall distribution for the nēnē, seabirds and bat is approximately 38.2%, 25.6% and 57.3% for the nēnē, seabirds and bat, respectively (Appendix 1).

More birds or bats are expected to and do fall closer to the WTG and the distribution of fatalities is not uniform, becoming less dense per acre as distance increases from the WTG. To determine the DWP as distance increases the 70m circle around the WTG is divided into six circular adjacent bands and the 71-100m area into three 10m radius bands. The first, closest band encompasses the area from the WTG out to 20m radius and each band farther from the WTG has a 10m radius. The total area in square meters is calculated for each band. The portion of the total area in each band that was searched (roads and pads) was determined using ARCGIS (Appendix 1). The product of the portion of area searched per band and the predicted fatality distribution per band are determined for each band for each carcass size class (large, medium and small) and the results summed for all bands to derive the DWP of the entire fall distribution of each carcass size class searched (Appendix 1). The fall distribution is assumed to be uniform around the turbine.

Nēnē

The DWP of the predicted total fall distribution between 0 and 70m radius was calculated for all 32 observed nēnē fatalities from turbine strikes at KWP I and Kaheawa Wind Power II (KWP II). To account for hypothetical takes that would have been expected, based on the ballistics modelling of Hull and Muir (2010) for large birds around "small" turbines, but not observed, six individuals (approximately 20% of the observed nēnē) were added to create the fall distribution between 70m and 100m. The KWP I and KWP II nacelle heights are 68m and 72m, respectively, and the maximum height of the rotor swept zones are 90m and 100m, respectively. These are considered small turbines by Hull and Muir (2010). Since the heights at KWPI and KWPII are similar, all the observed nēnē take from both sites has been used in creating the observed fall distribution.

The entire 70m circle centered on each WTG is modeled to include 84.2% of all nēnē carcasses expected to fall from turbine strikes (Figure 2). The Hull and Muir (2010) ballistics model for large size birds at small size turbines is shown in Figure 2 for comparison. The reduced area of graded roads and pads within 70m radius circles searched in FY2018 is estimated to encompass 38.2% of all potential nēnē fatalities (Appendix 1).

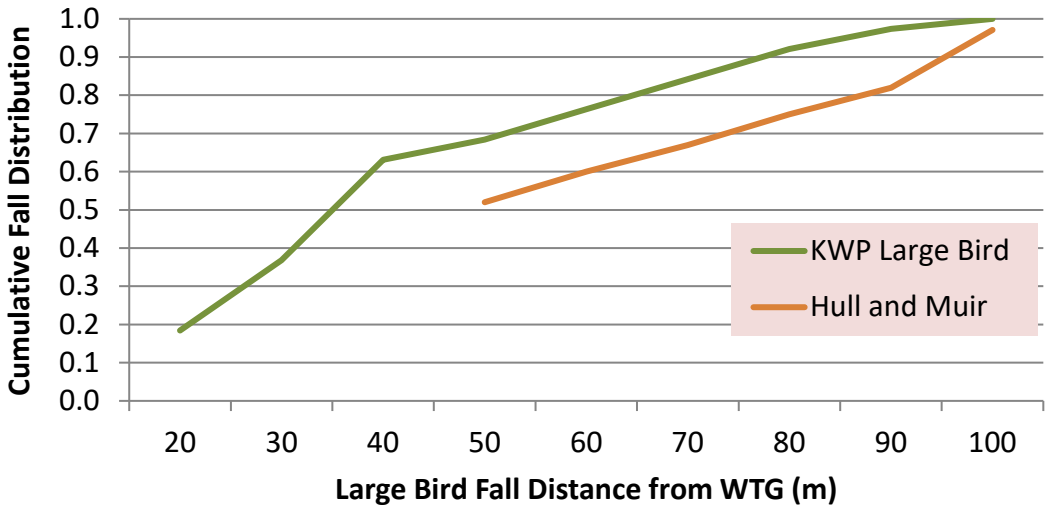

Figure 2. The cumulative fall distribution of nēnē by distance from WTG at KWP and KWPII compared to the ballistics model of Hull and Muir (2010) for large bird/small height turbines.

Hawaiian Petrel and Newell's Shearwater

The DWP of the predicted total fall distribution between 0 and 70m radius was calculated for all 28 observed seabird fatalities from turbine strikes at KWP I and KWP II found within 70m of the WTGs. The observed seabirds included only HAPEs, white-tailed tropicbirds and wedge-tailed shearwaters (WTSHs); i.e. the "fast-flying" birds. Game-birds, owls and great frigatebirds were not considered to be "fast-flying". To account for hypothetical takes that would have been expected, based on the ballistics modelling of Hull and Muir (2010) for medium birds around "small" turbines, but not observed, six individuals (approximately 20% of the observed seabirds) were added to create the fall distribution between 70m and 100m.

The entire 70m circle centered on each WTG is modeled to include 82.4% of all seabird carcasses expected to fall from turbine strikes (Figure 3). The Hull and Muir (2010) ballistics model for medium size birds at medium sized turbines is shown in Figure 3 for comparison. The model data for medium birds at small turbines is not easily extracted from Hull and Muir (2010) but would be expected to show more birds falling closer to turbines (skewed left of the distribution line in Figure 3). The reduced area of graded roads and pads within 70m radius circles searched in FY2018 is estimated to encompass 25.6% of all potential seabird fatalities (Appendix 1).

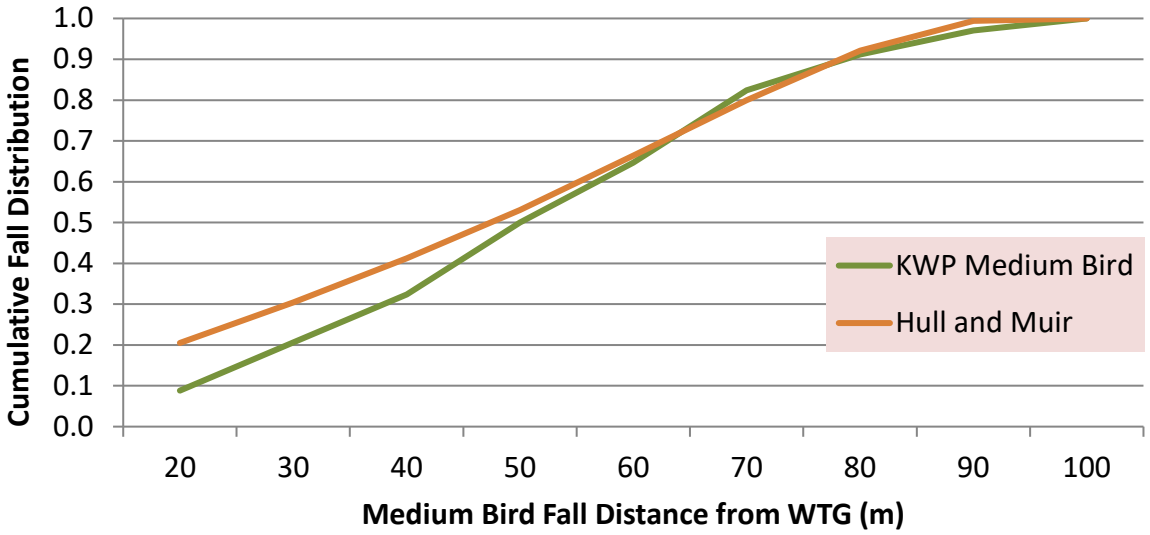

Figure 3. The cumulative fall distribution of medium sized fast-flying birds by distance from WTG at KWP and KWPII compared to the ballistics model of Hull and Muir (2010) for medium bird/*medium* height turbines.

Hawaiian Hoary Bat

The DWP of the predicted total fall distribution was calculated using all 14 observed bat fatalities from turbine strikes at KWP I and KWP II. Hull and Muir (2010) modelled that only 1% of bats would be expected to fall beyond 50m.

A 70m radius circle centered on each WTG is modeled to include 100% of all bat carcasses expected to fall from turbine strikes (Figure 4). The Hull and Muir (2010) ballistics model for bats at small size turbines is shown in Figure 4 for comparison. The reduced area of graded roads and pads within 70m radius circles searched in FY2018 is estimated to encompass 57.3% of all bat fatalities (Appendix 1).

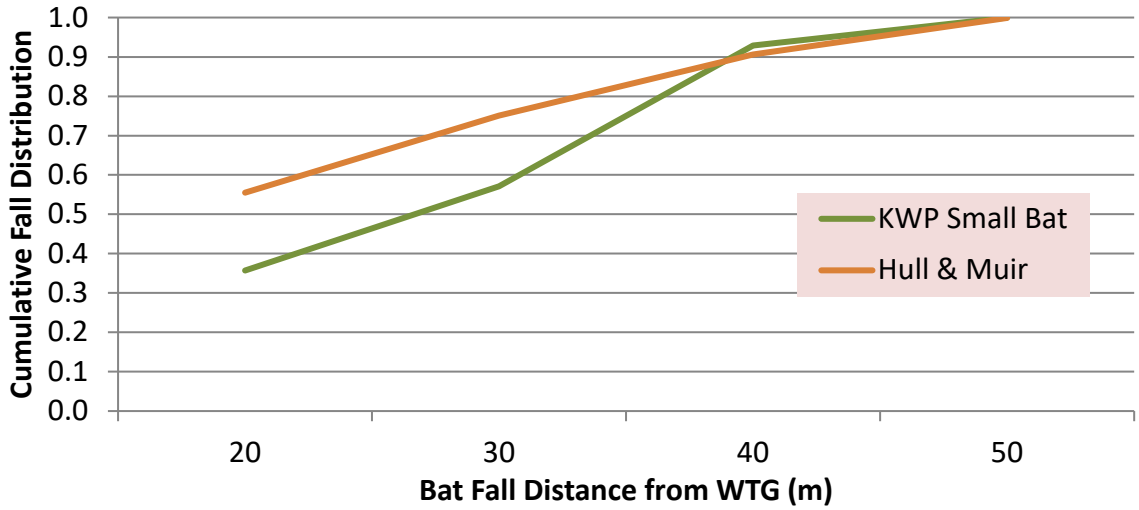

Figure 4. The cumulative fall distribution of bats by distance from WTGs at KWP and KWP II compared to the ballistics model of Hull and Muir (2010) for bats/small height turbines.

Search Interval

The FY2018 search interval mean and standard deviation (SD) in days for KWPI downed wildlife monitoring was 7.0 (SD = 0.22) (Appendix 2). For the safety of the HCP staff, monitoring is halted during periods when wind speeds are reported higher than 15 meters per second (m/s). During FY 2018 no monitoring schedule interruptions occurred.

Teresa Gajate and her canine Makalani provided canine-assisted searching in FY2018. Canine-assisted searching was the primary search method, with visual searching by HCP staff when canine- assisted searching was not available. In FY2018 only 5.8% of searches were visually conducted by humans (Appendix 2).

Canine Interactions with Wildlife

Special precautions have been taken to eliminate any potential canine interaction with wildlife. The handler has been directed to immediately retrieve Makalani if nēnē were observed and to temporarily skip searching WTGs if nēnē were present within the WTG search area or vicinity. Skipped WTGs were preferentially searched later the same day or the next day with either canine assistance or visual search. Canine searches were postponed or skipped in favor of visual searches if nēnē were present at the turbine or if WTG repairs were necessary. Nēnē presence halted no WTG searches. No canine wildlife interactions were observed.

Downed Wildlife Incidents

Appendix 3 summarizes all downed wildlife incidents documented at KWPI during FY 2018 including non-listed species incidents. One adult bat and one adult nēnē fatality attributed to WTG collision were observed within the search area on formal searches during FY2018 (Appendices 4 and 5). Four nēnē goslings were also found dead within the search area but were not considered takes attributed to wind site operations (Appendices 6, 7, 8 and 9). No other adults of covered species were found outside of the search area or incidental to formal searches. After finding a dead gosling in the spill containment receptacle at KWPII WTG 6 wire-mesh ramps were subsequently installed in each spill containment receptacle and the receptacles drained of rain water more often. Since operations began in 2006, 23 nēnē, six HAPE, and eight bats have been observed within the search areas and included in the total take estimated. Since operations began six goslings found dead were not attributed to wind turbine operations while three bats, one adult nēnē and one HAPE were found dead but considered either outside the search area or incidental to formal searches. NESH have not been found at KWPI since operations began.

Migratory Species Treaty Act (MBTA) protected species found include three Hawaiian short-eared owls (also a Hawai`i state “species of concern”) (Appendices 10, 11 and 12). The Hawaiian short-eared owl found on August 15, 2017 was alive but injured and first spotted at 7:28 AM on the access road between KWPI and KWPII. DOFAW came and collected the bird at 9:15 AM. All incidents were reported to the agencies within 24 hours and downed wildlife incident reports submitted within three days of each discovery.

Searcher Efficiency Trials

In FY 2018, independent contractor Kristin Mack (the SEEF proctor) conducted searcher efficiency (SEEF) trials. The SEEF proctor used randomly selected points within the reduced search area for SEEF locations. The schedule for placing carcasses was pre-determined for each week and unavailable to HCP staff and the canine handler. HCP staff would inform the SEEF proctor of the planned weekly search schedule to ensure SEEFs were put out for scheduled search days. At the end of each search day HCP staff would communicate to the SEEF proctor what was found. If any SEEF carcasses were missed a different HCP staff member (typically the HCP

manager) would attempt to recover the carcass and report to the SEEF proctor if the carcass was still present. If the carcass was not found that carcass trial would be considered lost and not included in SEEF results.

The FY2018 SEEF results for large, medium, and small size carcasses was 100% (N = 14), 100% (N = 11), 95.4% (N = 44), respectively (Table 1, Appendix 13). The two small SEEF's were missed by human searchers.

Table 1. SEEF results for KWPI during FY 2018.

Carcass Size	Result (%)	Trials
Large	100.0	14
Medium	100.0	11
Small	95.4	44

Carcass Retention Trials

Carcass retention (CARE) trials are used to estimate how long a carcass remains detectable to searchers before complete removal or obscuring by scavengers or weather conditions (wind blowing a carcass out of a search area). Trials proctored were conducted using Rhode Island Red crossed chickens as surrogates for nēnē, WTSHs for HAPE and NESH, and commercially produced rats for bats. The chickens were from Maui farmers. WTSH carcasses were fledglings and adults found dead by the public and delivered to Sea Life Park on Oahu or collected by DOFAW on Maui. Rat carcasses were purchased from Layne Laboratories, Inc. in California, a pet food company. These rats are brown and/or black and are the Layne Laboratory "Small Colored" size category (approximately 11.4 cm in body length not including the tail) and have been chosen to mimic the body size of Hawaiian hoary bats. The HCP listed species are not available to use in CARE trials. Our state and federal wildlife collection permits for WTSH use for KWPI are numbers WL 15-05 and MB24151B-0, respectively, through 2016, and WL18-09 and MB22098C-0, respectively, during 2017 and 2018. Any take of MBTA species is also reported annually through these permits.

In FY2018 four 28-day carcass retention (CARE) trials, one per quarter, used a total of four large, four medium, and 20 small size carcasses (Appendix 14). The CARE mean and standard deviation (SD) in days for large, medium, and small carcasses were 28.0 (SD = 0), 28.0 (SD = 0) and 14.9 (SD = 11.3), respectively (Table 2).

Table 2. Carcass retention trial results at KWPI during FY 2018.

Carcass Size	Count	Mean Retention (days)	SD (days)
Large	4	28	0
Medium	4	28	0
Small	20	14.9	11.3

Scavenger Trapping

We initiated scavenger trapping near the WTGs in August 2015 in response to a decreasing average persistence during CARE trials. Trapping is intended to decrease scavenging of any downed wildlife and may

improve nēnē fledgling survival and nesting success. All traps were designed to minimize inadvertent interaction with nēnē.

Trapping in FY 2018 included 12 DOC200™ or DOC250™ body grip kill traps and eight cage live traps (Figure 5). During FY 2018, 25 mongooses, four cats and two rats were caught using the approved trapping protocol and monitoring frequency. No non-target animals were trapped. Beginning in January 2018 trapping was discontinued to determine if decreasing CARE average retention for rat carcasses was being affected by constant availability of scavenger food sources. The CARE trial average persistence time for rat carcass trials in quarters three and four at KWPI increased noticeably after trapping ceased (Appendix 14).

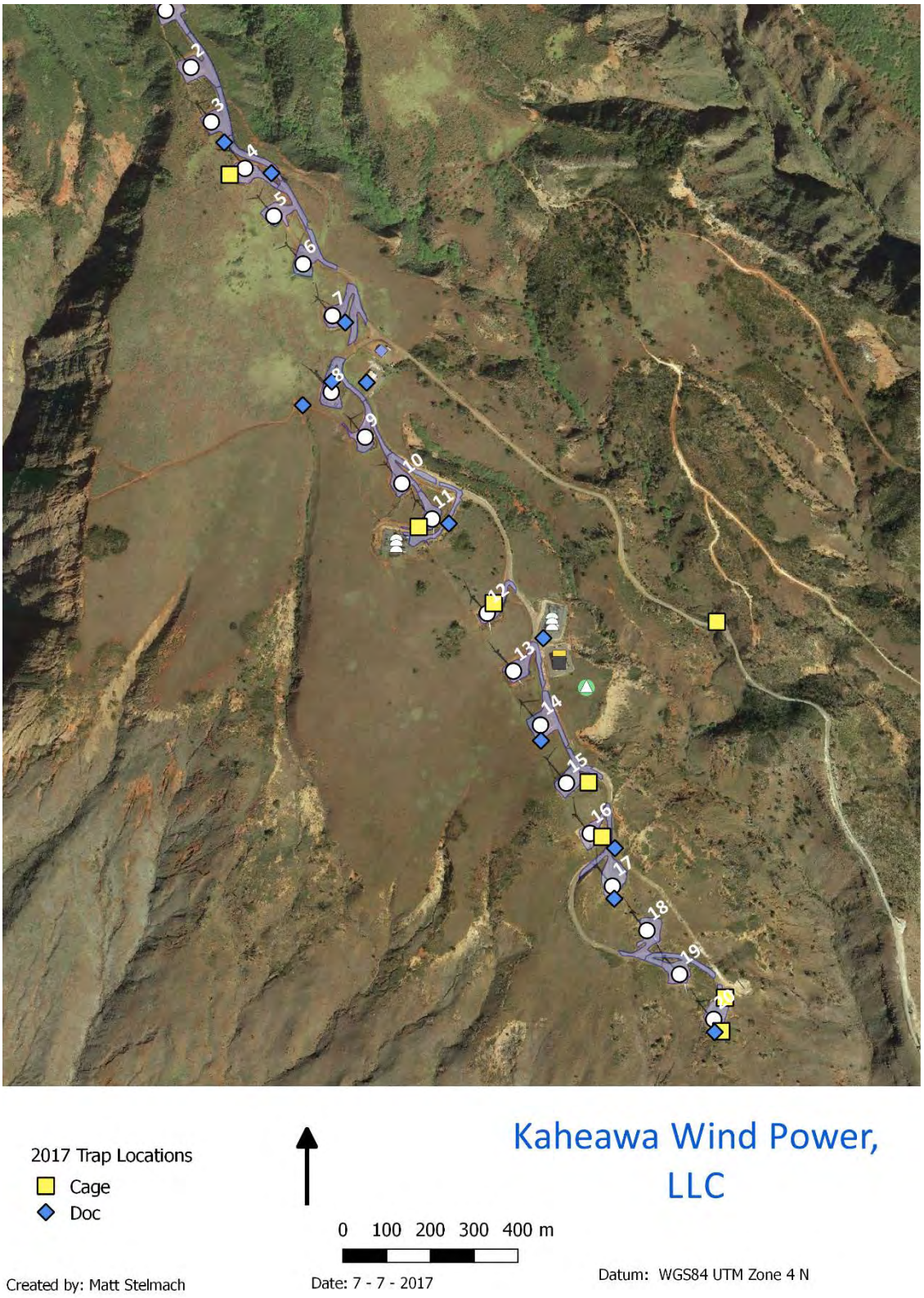

Figure 5. Location of KWPI predator traps during FY 2018.

Estimating Adjusted Take

The estimators used in this report were developed by the USGS (Huso *et al.* 2015 and Dalthorp *et al.* 2017) and have been recommended by the agencies. The USGS Evidence of Absence estimator's output is a value that represents the number of fatalities that has not likely been exceeded during the survey period. Values can be generated for varying levels of "credibility" (confidence) and expressed as a percentage (e.g., 50%, 80%, etc.). The higher the desired level of credibility the more conservative (higher) the estimated value. At the request of the agencies, the more conservative 80% credibility level is reported.

A stipulation of the estimator model is that only fatalities observed within the designated search area are included in the take estimation. Fatalities observed outside of the designated search area or incidental to searches are considered in the estimation calculation to have already been represented in the un-searched portion of the total expected fatality distribution. Beginning in FY 2018 the USFWS provided a formal protocol to determine whether a downed wildlife incidentally found in the formal search area should be included in the same way that observed fatalities found in search areas during formal searches are included (Appendix 15).

One adult bat and one adult nēnē fatality attributed to WTG collision were observed within the search area on formal searches during FY 2018. No other adults of covered species were found outside of the search area or incidental to formal searches. Four nēnē goslings were also found dead within the search area but were not considered takes attributed to wind site operations. The total estimated direct take at the 80% credibility level for KWPI HCP covered species is 37, 12 and 23 adults for the nēnē, HAPE and bat, respectively (Appendix 16, 17 and 18). Unobserved direct take as adults therefore is 14 nēnē, six HAPE and 15 bats (Appendix 16, 17 and 18) . Indirect take (IDT) converted to adult take is two, three, and five for the nēnē, HAPE and bat, respectively. Observed direct take (ODT) is the only take that has been documented and confirmed at the site. However, for the purposes of estimating potential take for permitting and mitigation, the Evidence of Absence estimator calculates additional take that may have occurred but that was not observed. This unobserved direct take (UDT) attempts to account for fatalities that may have fallen outside of search plots, were missed by searchers within search plots, or were removed by scavengers or environmental factors such as high winds.

In addition to ODT and UDT, indirect take (IDT) is estimated separately for ODT and UDT and is the possible or known take of offspring that have been negatively affected by the direct take of their parents. Both parents of nēnē and the seabird species exhibit equal responsibility for care of young until fledging while only the female bat cares for their offspring. All four HCP covered species have seasonal breeding periods as described in the KWPI HCP and the point during the breeding season when an adult is taken determines to what extent the offspring is affected (i.e. the chance of survival of an offspring without one or both parents may vary).

IDT for nēnē and HAPE are detailed in Appendix 19 and 20 and depends on what time of year the adult take was observed. Total IDT (for ODT and UDT) for nēnē and for HAPE is 2.41 and 8.52 fledglings, respectively. IDT converted to adult take for nēnē is two (rounded up, 2.41 x 0.512 = 1.23), and assumes three years from fledging to adulthood at an annual survival rate of 0.8 (0.512 after three years). IDT converted to adult take for HAPE is three, rounded up (8.52 x 0.3 = 2.56), and assumes five years from fledging to adulthood and a 0.3 survival rate from fledgling to adult.

The total estimated nēnē take (direct plus indirect take) at the 80% credibility level is not more than 39 adults. Baseline take level according to the KWPI HCP is 60 nēnē. Thirty-nine nēnē is 65% of the baseline take level. The total estimated HAPE take at the 80% credibility level is not more than 15 adults. Baseline take level is 25 individuals. Fifteen HAPE is 60% of the baseline take level.

Accrued lost productivity as fledglings for nēnē is 8.7 (Appendix 19) and for HAPE is 10.2 (Appendix 20). Accrued lost productivity for a given year is determined by adding adult estimated take accumulated from all previous years (not yet mitigated for) and multiplying that adult total by 0.1 for nēnē and 0.15 for HAPE as proscribed in the KWPI HCP. Each year's lost productivity is accumulated until estimated adult take is mitigated for.

The six nēnē fatalities that were observed at KWPI before calendar year 2011 are not included in the lost

productivity assessment (May 20, 2014 agency meeting notes) since the pen intended for mitigation was not available to introduce nēnē goslings prior to 2011.

IDT estimated from bat ODT is calculated for adult female bats or bats of unknown sex (conservatively assumed to be female), found between April 1 and September 15, the bat breeding season designated by the agencies (Appendix 21). Any ODT of adult female or sex unknown bats found during the breeding season are assumed to have dependent young and a loss of 1.8 juveniles is calculated per female or unknown sex ODT (2 pups per female X 0.9 survival rate to weaning per pup = 1.8 juveniles). For KWPI two female bats and four bats whose sex has not yet been determined were found within the search area during the breeding period through FY 2018. Thus, the IDT from the six ODT found during the breeding season would 10.8 juveniles (6 x 1.8 = 10.8). The sex of all bats found during the breeding period will be determined in FY 2019 and IDT from ODT recalculated.

IDT estimated from bat UDT assumes 50% of the UDT would be female and that for each female there is an average probability that she would be pregnant or lactating for three months in a year. Bats fly through the project area throughout the year and the probability of an individual female bat having dependent young during a 12-month period is assumed to be 25% (three out of 12 months). The average period of dependence is determined considering that Hawaiian hoary bats have one brood a year, and that hoary bats in North America have an average 56-day gestation period followed by parental care to weaning averaging 34 days or approximately three months for gestation and parental care (Hayssen *et al* 1993, Hayes and Wiles 2013, and NatureServe 2015 for *Lasiuris cinereus*). There is not enough information for hoary bats from Hawai`i to determine the gestation and pre-weaning dependent period. Consequently, IDT is assessed to bats lost from female UDT at the rate of 0.225 juveniles/adult female bat (0.5 x 0.25 x 1.8 = 0.225). The IDT for the UDT considering the direct take estimate at the 80% credibility level is 3.38 juveniles (23 estimated – 8 observed = 15 unobserved x 0.225 = 3.38) (Appendix 21).

The estimated rate of survival of young to reproductive age (the next year after birth) assumed from available data is 0.30 (extrapolated from little and big brown bats (*Myotis lucifugus* and *Eptesicus fuscus*; Humphrey 1982, Humphrey and Cope 1976). Bat total IDT of 14.18 (10.8 + 3.38 = 14.6) converts to 4.25 or five adults, rounded up (14.18 x 0.3 = 4.25) (Appendix 21). The total estimated bat take at the 80% credibility level is not more than 28 adults. The baseline take limit of 20 bats has been mitigated for. The higher take limit (and total permitted take) is 50 bats or 30 more than the baseline take limit. Eight bats more than the baseline level of 20 bats (28-20 = 8) is 27% of the higher take limit of 30 bats (8/30 = 0.27).

Permit Term Projected Estimated Take

The permit term projected take estimates are calculated using the EoA (v. 2.06) software. Although the permit term is for 20 years, operations began approximately 6 months after the permit was issued. Therefore, the estimated take is projected for only 19.5 years. The projections assume that search conditions (SEEF, CARE, search interval, search area, etc.) in the remaining years of the permit term are like the most recent year of operations. As more years of data from operations are added to the projection calculation the projected take may decrease when compared to the permit term projections made in earlier years because the variation assumed for conditions in future years is replaced with actual variation for conditions recorded, assuming no unusual variations in conditions and take occur in future years. If additional minimization techniques are implemented ***and they successfully reduce the take rate*** the projected take will decrease as years pass and may be considerably less than projections made prior to implementation of additional minimization techniques.

The permit term take projections calculated at the end of FY2018, including direct and indirect take, for the nēnē, HAPE and bat are 60, 23 and 42 adults, respectively (Appendices 22, 23 and 24). The permit limits currently for nēnē, HAPE and bat are 60 (Baseline), 38 (Higher) and 50 (Higher) adults, respectively.

Hawaiian Hoary Bat Monitoring

To better understand variations in bat activity specifically near the ground close to the WTGs, we have operated nine Wildlife Acoustics SM2BAT+™ ultrasonic bat detectors with one SMX-U1™ microphone (mic) since October 2013 throughout KWPI. Prior to October 2013 Titley Anabat™ detectors had been deployed around the site near WTGs beginning in 2008 (KWP 2013). The detector mics are mounted at 6.5 meters' height. Eight are placed near the WTGs and one is placed near a gulch edge (WTG 3); each mic is positioned horizontally, pointing SW (away from the prevailing NE trade winds).

Detectors recorded bat activity at all nine ground locations during 5.4% of detector nights (162 of 2989) with the highest level at WTG 10 (9%) (Table 3). Bats were detected in every month of the year with peaks of nights with detections in August (9%), September (14%), December (8%) and May (9%) near the ground (Figure 6). Feeding buzzes were detected on three nights, two at WTG 10 in September and May and one at WTG 15 in August. A bat was detected at the most WTGs in one night at four different locations on August 1 and 8, September 4, December 12 and May 5. Bat activity occurred throughout the night in a slightly left-skewed normal distribution peaking at 2200h, with very few detections after 0300h (Figure 7). Bat activity assessment at nacelle height locations ended in December 2017.

Table 3. Hawaiian hoary bat nights with detections and total detection nights by WTG at KWPI in FY 2018.

WTG	Nights	Detections	Rate
1	363	12	0.03
3	315	18	0.06
5	357	21	0.06
8	352	17	0.05
10	350	32	0.09
13	283	17	0.06
15	244	10	0.04
16	365	19	0.05
20	360	16	0.04
	2989	**162**	**0.054**

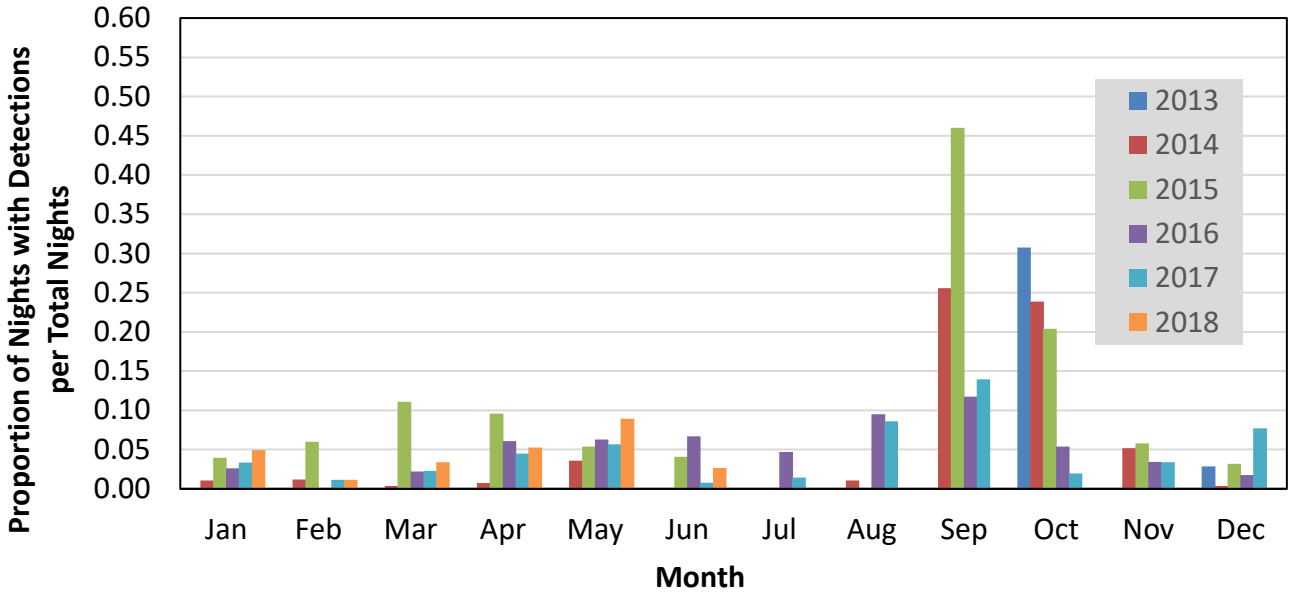

Figure 6. Bat nightly presence at KWPI by month in FY 2013 through 2018.

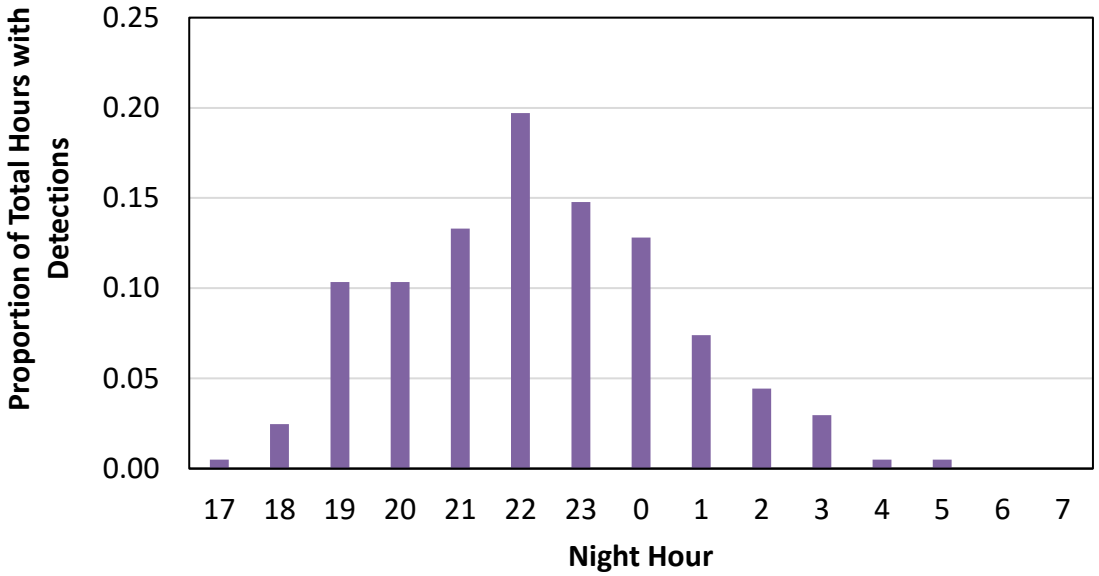

Figure 7. Hours with Detections at KWPI in FY 2018 (n = 203).

Wildlife Education and Observation Program

The wildlife education and observation program (WEOP) helps to ensure the safety and well-being of native wildlife in work areas and along site access roadways. The training provides useful information to assist staff, contractors, and visitors to be able to conduct their business in a manner consistent with the requirements of the HCP, CDUP, land use agreements and applicable laws. Records of wildlife observations by WEOP-trained staff are also used by the HCP program to identify the patterns of wildlife use of the site.

WEOP trainings were given to 45 personnel who were on-site regularly for two days or more and 67 MECO

employees off-site. The personnel were trained to identify covered and non-covered species of wildlife that may be found on-site and what protocol to follow, as determined in the HCP, when a downed wildlife is found. The trainees were also made aware of driving conditions and received instruction on how to drive and act around wildlife.

Vegetation Management

The HCP team manages ground cover at a low stature that will improve monitoring efficiency and minimize impacts to native plants without compromising soil stability. An overall site vegetation management plan was approved via letter from DOFAW dated November 15, 2010. Prior to 2010 no vegetation management was authorized. Nēnē nesting season restricts vegetation management activities within the search plots to only occur from April 1 through October 31. In November 2016, Stephanie Franklin of DOFAW-Maui verbally approved using hand management tools (spray packs and weed whackers) during nesting season if activity was within the current search area and did not disturb wildlife. In March 2017, Stephanie Franklin of DOFAW-Maui verbally approved the removal of Christmasberry (*Schinus terebinthifolius*) within 70m of the turbines to reduce potential nēnē nesting habitat near to the WTGs.

Treatment of the search plot areas for the FY 2018 was conducted in September. Primary vegetation management involve herbicide application and weed whackers. Approximately 13 acres were treated with glyphosate-based herbicide in FY 2018; this area consisted of roads and pads primarily within the search area.

Mitigation

Hawaiian Hoary Bat-Research

Considering the more conservative estimate using the 80% credibility level the estimated total take is 28 adult bats. Mitigation for the baseline take of 20 bats was funded in 2006 and completed. Thirty additional take has been authorized through a minor amendment approved by USFWS in October 2015 and DOFAW in January 2016. A mitigation project that will account for take of 15 of the higher take of 30 bats began May 2017 (KWPI 2017) and is Hawaiian hoary bat ecological research in East Maui contracted to H.T. Harvey Ecological Consultants. The contract total cost is $750,000 to be funded by mid-2019. KWPI will also partially fund another Hawaiian hoary bat ecological research project on Hawai'i Island contracted to the U.S. Geological Survey Hawaiian hoary bat research group that began in FY 2018 (KWPII 2017). KWPI contribution to this contract will be $750,000 by mid-2021 and account for take of the remaining 15 bats of the amended total.

East Maui Seabird Survey

In the unlikely event the initial five-year mitigation targets at Makamaka'ole for the NESH would not be met, surveys of East Maui for potential additional mitigation sites were funded and completed in September 2015 (KWP 2016). These surveys evaluated potential colony locations, estimated the numbers of birds present, assessed predator activity, and provided for management feasibility assessment.

Hawaiian Petrel and Newell's Shearwater- Makamaka'ole

Figure 8. Two completed enclosures on the Makamaka'ole Seabird Mitigation site in northern West Maui (Enclosure B is left and Enclosure A is right).

Weekly site visits to Makamaka'ole, now by the contractor Aloha Environmental Services, LLC, continue and focus on predator trapping and tracking, ongoing maintenance of both enclosures, artificial burrow checks, and game camera operation (Figure 8). The annual calendar year report to Hawai'i Division of Forestry and the Natural Area Reserve System for 2017 which spans the entire 2017 nesting season is included as Appendix 18. Monitoring checklists recorded via IForm™ have been created to ensure consistent oversight. These checklists include sound system battery checks, game camera operation and download, burrow checks for erosion damage, signs of bird activity (visual, scent, and game camera) and ongoing perimeter checks of fences and culverts. The Victor™ rat snap kill traps, DOC 200™ body grip kill traps (all encased in bird-safe boxes), and cage live traps are routinely maintained. Experimentation with bait and trap types have been ongoing.

The enclosures have shown to be an effective but not impermeable barrier to rats (Table 4).

Table 4. Makamaka'ole trapping data by species and location for FY 2018.

Trap Location	Trap Type	Quantity Deployed	Number Caught
Outside A	Cage	1	0
	Victor Rat Snap	13	53 rats, 4 mice, 3 mongooses
	DOC 200 Body Grip	13	27 mongooses, 4 rats
Inside A	Victor Rat Snap	10	10 rats, 13 mice
	Cage	1	0
	DOC 200 Body Grip	4	2 rats
Outside B	Cage	1	0
	Victor Rat Snap	10	20 rats, 1 mouse
	DOC 200 Body Grip	5	19 mongooses, 9 rats
Inside B	Victor Rat Snap	10	4 rats, 4 mice
	Cage	1	0
	DOC 200 Body Grip	5	0

This year we saw an average of 7 rats per enclosure (N = 14). This translates to an average ingress rate of one rat every 45-50 days. Ingress tend to be clustered and appear to have been related to breaches in the enclosure associated with heavy rain events and temporary fence or culvert degradation.

Ten tracking tunnels inside each enclosure have been inked and baited in November, January and May to assess small mammal activity (Table 5). Since January 24, 2014 no mongoose have been detected or trapped inside either enclosure. On January 7, 2015, we received our approved protocol to continue using Diphacinone bait blocks (KWP 2015). Twenty-five and 22 bait stations using Diphacinone bait blocks are currently deployed inside enclosure A and enclosure B, respectively. Bait stations within both enclosures continue to be checked biweekly, and re-baited as needed.

Table 5. Makamaka'ole rodent presence/absence summary, as the number of tracking tunnels with paw prints out of 10 total tunnels deployed.

	November 2017		January 2017		May 2018	
	% Enclosure A	% Enclosure B	% Enclosure A	% Enclosure B	% Enclosure A	% Enclosure B
Mouse/Rat	0	60	30	0	20	0
Mongoose	0	0	0	0	0	0

Barn owl control contracted to DOFAW began at night in March 2017 and continued through September 2017. Through the 2017 calendar year nesting season DOFAW contractors removed three barn owls during 25 night visits. Terraform Power continues to renew its USFWS depredation permit (MB 19697C-0) and has obtained a DOFAW wildlife control permit (WCM 18-43) to continue barn owl control with Aloha Environmental Services, LLC.

Erosion inside and outside of enclosures continues to be monitored closely. Specially fabricated hydrologic flumes are still attached to the outflow sections of two culverts at enclosure A. These flumes direct water away from the enclosure, preventing erosion directly outside of the culvert tube and at the fence line. 'Uki

(*Machaerina augustifolia*), propagated by Maui Native Nursery were out-planted around the approved irrigation ditches dug in December 2017 to stabilize soil in the disturbed areas. As specified by the NARs permit, regular herbiciding and weeding without motorized tools occurred each quarter. Target species for removal were *Clidemia hirta*, *Tibouchina spp*., *Melinus minutiflora* and *Psidium spp.*

Acoustic attraction systems broadcast social calls year-round at night. Additional HAPE calls recorded from Waikamoi, Maui in 2015 were added to enclosure B and NESH calls recorded on Kaua'i from Pohakea in Hono O Nā Pali as well as from Upper Limahuli were added to enclosure A. After a brief period when calls were mixed in both enclosures, the enclosures contain only HAPE calls in enclosure B and NESH calls in enclosure A. KWP Biologists have been periodic night surveys to ensure the sound systems work correctly and to monitor bird activity in the area.

Since our first sighting during the 2015 calendar year breeding season on June 22, 2015 three species of seabird, HAPE, NESH, and Bulwer's petrel (BUPE, *Bulweria bulwerii*), have frequented burrows within both enclosures between the months of March and October. Generally NESH and BUPE nesting activity in 2018 has been like the 2017 season. Unfortunately, in 2018 no HAPE have been photographed on the ground in either enclosure. HAPE activity on the ground also decreased considerably during the 2017 calendar year nesting season compared to 2016.

The first bird activity for 2018 recorded on March 26 was a NESH exiting burrow 26A (enclosure A) (Table 6). Since the first sighting of 2018 the same two burrows that showed the most activity in 2017 also have been showing the most activity again in 2018 (26A, and 43A) (Figure 9 and 10). The first activity inside enclosure B this season on May 4 was a Bulwer's petrel entering burrow 50B (Table 7). Since May 4 there have been visits from both Bulwer's petrel and NESH at three burrows and one natural area near burrow 22B named the "Uluhe" burrow (Figure 11, 12, 13 and 14).

	26A				**43A**			**50A**
	2017		2018		2017		2018	2017
Month	Photo Nights (nights w/2 birds)	Egg [1]	Photo Nights	Egg [1]	Photo Nights (nights w/2 birds)	Egg [1]	Photo Nights	Photo Nights
Mar			3					
Apr			16				10	
May	12		6	1	8		1	
Jun	14 (2)		11		6		15 [2]	
Jul	25 (10)		17	egg			19	
Aug	23 (2)	egg			28 (2)	egg		1
Sep	18				13			
Oct								
Nov		egg						
	[1] collected				[2] NESH with egg "stuck" to brood patch			

Table 6. Nights per month NESH photographed at burrows 26A, 43A and 50A in calendar years 2017 and 2018. NESH eggs collected in 2017 and FY2018.

Figure 9. Two NESH at burrow 26A entrance (with NESH decoy in background) inside enclosure A on April 19, 2018.

Figure 10. A NESH in burrow 43A on July 2, 2018

Table 7. Nights per month NESH photographed at burrows 22B, 50B, 42B and the "Uluhe" burrow near to 22B in calendar years 2017 and 2018. BUPE egg collected in 2017 and none in 2018 (so far).

	22B					50B				Uluhe			42B		
	2017			2018		2017		2018		2017		2018	2017	2018	
	NESH	BUPE	HAPE	NESH	BUPE	NESH	BUPE	NESH	BUPE	NESH	HAPE	NESH	BUPE	BUPE	NESH
	Photo Nights (nights w/2 NESH), Egg = collected														
Mar															
Apr				1?					2			1			
May	1	2		12 (4)	1			3	2			4		5	1
Jun	7 (1)	3		20 (12)				5	1			6			
Jul	7 (1)		1	10 (5)		3	1	3		15	4	2			
Aug	16	Egg	6							9	9		1		
Sep	11		2							1	1				
Oct															
Nov															

Figure 11. A BUPE in front of burrow entrance 42B inside enclosure B on May 4, 2018.

Figure 12. Two NESH near the burrow entrance for 22B inside enclosure B on May 31, 2018.

Figure 13. A NESH in front of burrow 50B on July 3, 2018.

Figure 14. A NESH in the "Uluhe" burrow in enclosure B on July 4, 2018.

Nēnē – Haleakala Ranch Pen

As part of KWPI nēnē mitigation, the Haleakala Ranch pen was paid for in 2008 by KWPI and constructed three years later by DOFAW. Nēnē have been trans-located from Kaua`i to the Haleakala Ranch pen since 2011. Forty-seven nēnē fledglings have been produced from KWPI funded mitigation at the Haleakala Ranch pen through FY 2018. Fledgling production for FY2018 was one. Nēnē lost productivity and total indirect take (8.7 and two, respectively; 11 total) through FY 2018 is completely mitigated for with these 47 fledglings. If all lost productivity and indirect take are accounted for by the number fledglings produced in each year, then the remaining fledgling "surplus" (47-11 = 36 fledglings) will be considered to survive to adult age three years later at a rate of 0.8 per year (0.512 for three years). The adults survived from the surplus fledglings then reduces each current year's adult estimated take and reduces the subsequent lost productivity that will accrue from that adult estimated take. After accounting for lost productivity and indirect take, the remaining accrued fledglings would also mitigate for approximately nine adult nēnē (of the 39 total estimated through FY2018) (Appendix 19).

The agencies have agreed that KWPI will not accrue lost productivity for nēnē take that occurred prior to calendar year 2011, when the pen was constructed. Six nēnē fatalities were documented at KWPI prior to January 1, 2011.

Adaptive Management

KWPI began implementing low wind speed curtailment (LWSC) at all WTGs up to wind speeds of 5.0 m/s on July 29, 2014. LWSC is expected to reduce bat take as explained in the KWPII HCP. Curtailment was increased to 5.5 m/s on August 4, 2014 in response to take occurring at KWPI and KWPII. Curtailment will continue to be in effect from sunset to sunrise, annually, from February 15 through December 15. KWPI continues site-wide bat activity assessment after the initial required three-year period.

Agency Visits and Reporting

During FY 2018, KWPI attended meetings with agencies to discuss a variety of topics related to HCP implementation. Abbreviated summary reports for FY 2018 quarters 1-3 were provided to USFWS and DOFAW. The Endangered Species Recovery Committee reviewed the FY 2018 annual HCP report on January 24, 2018.

Expenditures

The total KWPI HCP related expenditures in FY 2018 is $648,552 (Table 8).

Table 8. Expenses by category for KWPI during FY 2018.

Category	Cost ($)
Permit Compliance	1,700
Bat Mitigation	553,117
Seabird Mitigation	21,265
Vegetation Management	300
Fatality Monitoring	30,170
Equipment and Supplies	1,000
Terraform Power Labor	41,000
Total Cost	**648,552**

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Appendices

Appendix 1. Density weighted proportion searched for Hawaiian goose, Hawaiian petrel and Hawaiian hoary bat at KWP I in FY 2018.

Radius Band (m)	Total Area ($m^{2)}$	Search Area (m^2)	Portion searched	Small Size Distribution	Small DWP	Medium Size Distribution	Medium DWP	Large Size Distribution	Large DWP
0-20	25120.0	24249.3	0.965	0.357	0.345	0.091	0.088	0.139	0.134
30	31400.0	18447.7	0.588	0.214	0.126	0.091	0.053	0.194	0.114
40	43960.0	11092.9	0.252	0.357	0.090	0.121	0.031	0.278	0.070
50	56520.0	9387.9	0.166	0.071	0.012	0.182	0.030	0.056	0.009
60	69080.0	9184.3	0.133	0.000	0.000	0.152	0.020	0.083	0.011
70	81640.0	10582.3	0.130	0.000	0.000	0.182	0.024	0.083	0.011
			Total	**1.000**	**0.573**	**0.818**	**0.246**	**0.833**	**0.350**

Appendix 2. Downed wildlife monitoring dates at KWPI during FY 2018.

		Turbine #																		
Search Date	**Search Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
27-Jun	Canine	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
28-Jun	Canine						1														
4-Jul	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11-Jul	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1
12-Jul	Canine																		1		
18-Jul	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25-Jul	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
26-Jul	Canine																				1
1-Aug	Canine		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2-Aug	Canine	1																			
8-Aug	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15-Aug	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22-Aug	**Visual**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30-Aug	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5-Sep	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12-Sep	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19-Sep	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
26-Sep	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3-Oct	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10-Oct	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17-Oct	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24-Oct	**Visual**	1	1	1	1	1	1	1	1	1	1	1	1								
24-Oct	**Visual**													1	1	1	1	1	1	1	1
31-Oct	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1
1-Nov	Canine														1						
7-Nov	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14-Nov	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21-Nov	Canine	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
22-Nov	Canine						1														
28-Nov	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5-Dec	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

12-Dec	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
19-Dec	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
26-Dec	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
2-Jan	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
9-Jan	Canine	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
10-Jan	Canine				1																	
16-Jan	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
23-Jan	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
30-Jan	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
6-Feb	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
13-Feb	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
20-Feb	**Visual**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
27-Feb	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
6-Mar	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
13-Mar	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
20-Mar	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
27-Mar	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
3-Apr	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
10-Apr	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
17-Apr	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
24-Apr	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
1-May	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
8-May	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
15-May	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
22-May	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
29-May	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5-Jun	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
12-Jun	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
19-Jun	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
26-Jun	Canine	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Intervals	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	**1040**
	Mean	6.98	7.00	7.00	7.00	7.00	6.98	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	**6.998**
	SD	0.24	0.20	0.20	0.28	0.20	0.31	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.28	0.20	0.20	0.20	0.28	0.20	0.28	**0.224**

Appendix 3. Downed Wildlife Found at KWPI in FY2018.

Discovery Date	Common Name	Age	Sex	Animal Condition	Search Type	Search/ Incidental	WTG	Distance	Bearing from	Ground Cover
25-Jul	Gray Francolin	Juvenile	Unknown	Dead	Canine	Search	16	28	178	Low vegetation
15-Aug	Hawaiian Hoary Bat	Adult	Unknown	Dead	Canine	Search	14	11	204	Dirt
15-Aug	Hawaiian Short-eared Owl	Adult	Unknown	Alive	Visual	Incidental	Other	400	303	Gravel
5-Sep	Gray Francolin	Adult	Unknown	Dead	Canine	Search	8	55	244	Medium grass
5-Sep	Hawaiian Short-eared Owl	Adult	Unknown	Dead	Canine	Search	8	43	226	Medium grass
27-Nov	Ring-Necked Pheasant	Adult	Male	Dead	Visual	Incidental	14	3	265	Gravel
28-Nov	Japanese White-eye	Adult	Unknown	Dead	Canine	Search	8	35	204	Bare
5-Dec	Hawaiian Goose	Adult	Unknown	Dead	Canine	Search	18	29	163	Bare
5-Dec	Japanese White-eye	Adult	Unknown	Dead	Canine	Search	13	5	335	Bare
26-Dec	Gray Francolin	Adult	Female	Dead	Canine	Search	8	20	60	Shrub
9-Jan	Hawaiian Goose	Juvenile	Unknown	Dead	Canine	Search	8	37	196	Medium shrubs
16-Jan	Hawaiian Goose	Juvenile	Unknown	Dead	Canine	Search	6	19	181	Bare
30-Jan	Hawaiian Goose	Juvenile	Unknown	Dead	Canine	Search	6	27	90	Short grass
30-Jan	Hawaiian Goose	Juvenile	Unknown	Dead	Canine	Search	8	43	10	Medium grass
3-Apr	Gray Francolin	Unknown	Unknown	Dead	Canine	Search	8	1	224	Rocks
24-Apr	Gray Francolin	Juvenile	Unknown	Dead	Canine	Search	18	5	180	Rocks
19-Jun	Hawaiian Short-eared Owl	Adult	Unknown	Dead	Canine	Search	2	24	290	Water

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) 8/15/2017

Observer Name: Teresa Gajate
Date of Incident: 8/15/2017
Date of Report: 8/15/2017
ID Number: 20170815_KWPI_T14_LACI
Species (Common Name): Hawaiian Hoary Bat
Age: Adult
Sex (if known): Unknown
Incidental or Routine Search: Search
Time Observed (HST): 11:20
Time initially Reported (HST): 11:28
Time Responders Arrive (HST): NA
General Location: 10.8m south of turbine 14 on pad
GPS Coordinates: Latitude:20.809835,
Longitude:-156.548294,
Altitude:707.5
WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed: 8/8/2017
Closest Structure (eg Turbine #): WTG 14
Distance to base of closest structure: 10.8 m
Bearing from base of closest structure (degrees): 204°
Ground Cover Type: Dirt
Wind Direction and Speed: NE 11 mph
Cloud Cover (%): 60 %
Cloud Deck : High
Precipitation: None
Temperature: 83 °F
Condition of Specimen: Bat found with multiple fractures to the left radius/ulna. Vespula, ants, and fly larvae present. Flesh eaten from face and abdomen. Hair tufts found near carcass
Probable Cause of Injuries: Proximity to turbine suggests collision with turbine.
Other Notes: No gender determination could be made from the available remains.

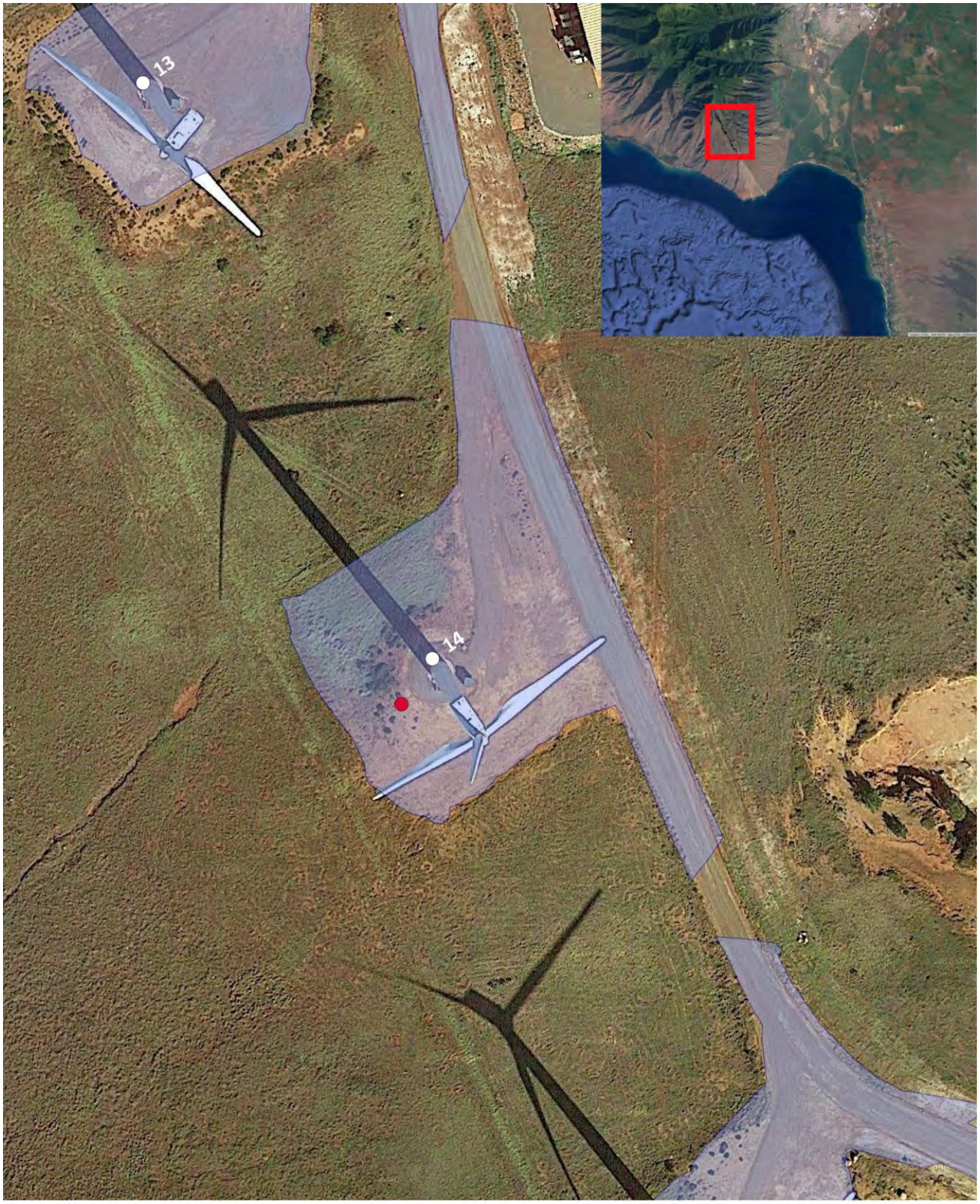
		Actions Taken
15-Aug-17	11:20	Teresa Gajate and Makalani locate a Hawaiian hoary bat fatality at KWP I turbine 14. Matt Stelmach notified.
15-Aug-17	11:28	Matt Stelmach arrives to confirm id. Stephanie Franklin notified via phone. Matt Stelmach instructed to collect specimen and record data. Data recorded and specimen collected.
15-Aug-17	13:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the Hawaiian hoary bat in reference to the turbine.

Figure 2. A photo of the Hawaiian hoary bat as found relative to a 6” tape measure.

Figure 3. A photo of the ventral side of the Hawaiian hoary bat.

Figure 4. A photo of the injury to the left wing of the bat. Also note the degradation of the carcass by insects evident through the removal of flesh on the left side of the skull and upper extremity.


13
14
Hawaiian Hoary Bat
Search Area
BESS
Met
Turbine
North
0 10 20 30 40 m
Project: Kaheawa Wind Power I
Created By: M. Stelmach
Date : 8/15/2017

Appendix 5. Hawaiian Goose Downed Wildlife Report at KWPI December 5, 2017.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Goose (*Branta sandvicensis*) 12/5/2017

Observer Name:	Teresa Gajate
Date of Incident:	12/5/2017
Date of Report:	12/5/2017
ID Number:	20171205_KWPI_T18_HAGO
Species (Common Name):	Hawaiian Goose
Age:	Adult
Sex (if known):	Unknown
Incidental or Routine Search:	Search
Time Observed (HST):	10:37
Time initially Reported (HST):	10:56
Time Responders Arrive (HST):	13:30
General Location:	28.8 m south of turbine on pad entrance
GPS Coordinates:	Latitude:20.805434, Longitude:-156.545927, Altitude:655.1 WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed:	11/28/2017
Closest Structure (eg Turbine #):	WTG 18
Distance to base of closest structure:	28.8 m
Bearing from base of closest structure (degrees):	163°
Ground Cover Type:	Bare
Wind Direction and Speed:	NE 16 mph
Cloud Cover (%):	20 %
Cloud Deck :	High
Precipitation:	None
Temperature:	72 °F
Condition of Specimen:	Adult nene, eyes absent, deep laceration through the abdomen left leg broken in multiple locations. Gut pile found 10 meters west
Probable Cause of Injuries:	Location and inuries suggest collision with the turbine
Other Notes:	

		Actions Taken
05-Dec-17	10:37	Teresa Gajate, Spencer Engler, and Makalani locate a Hawaiian goose downed wildlife incident. M Stelmach is notified.
05-Dec-17	10:56	Matt Stelmach arrives to confirm identity and collect data. Stephanie Franklin notified via phone.
05-Dec-17	13:30	Colton Loque from DOFAW arrives to collect the specimen.
05-Dec-17	15:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the Hawaiian goose relative to the turbine.

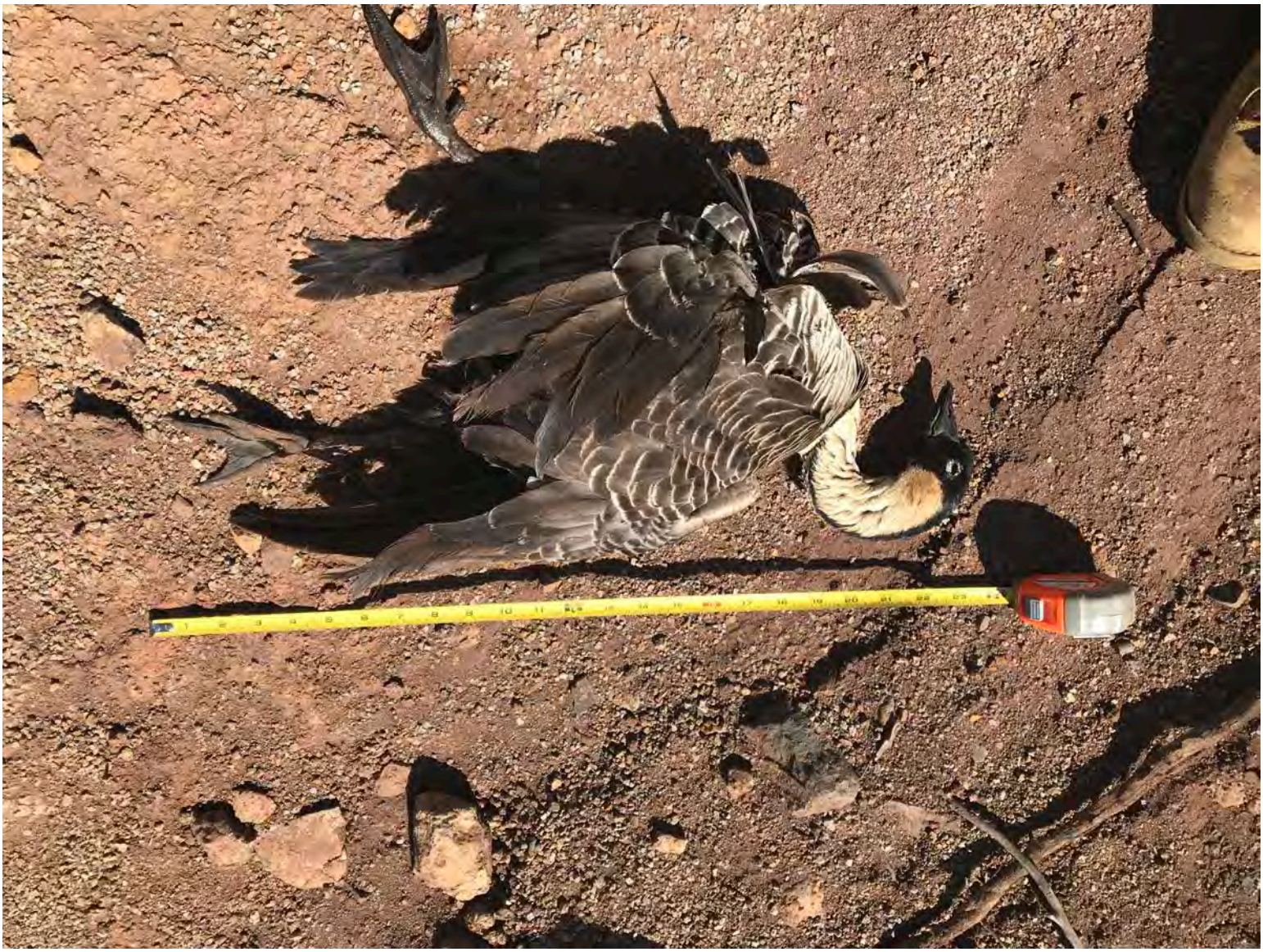


Figure 2. A photo of the Hawaiian goose as found relative to a 24” tape measure.

Figure 3. A photo of the injury to the abdomen of the Hawaiian goose.

Figure 4. A photo of the gut pile found west of the bird, relative to an 8” tape measure.


18
Gut Pile
19
Hawaiian Goose
Search Area
lorth
0 10 20 30 40 50 m
Project: Kaheawa Wind Power I
Created By: M. Stelmach
Date : 12/5/2017

Appendix 6. Hawaiian Goose Downed Wildlife Report at KWPI January 9, 2018.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Goose (*Branta sandvicensis*) 1/10/2018

Observer Name: Teresa Gajate
Date of Incident: 1/9/2018
Date of Report: 1/10/2018
ID Number: 20180109_KWPI_T08_HAGO
Species (Common Name): Hawaiian Goose
Age: Juvenile
Sex (if known): Unknown
Incidental or Routine Search: Search
Time Observed (HST): 13:05
Time initially Reported (HST): 13:36
Time Responders Arrive (HST): 14:20
General Location: 36.8m south of turbine 1m off pad under lantana
GPS Coordinates: Latitude:20.816601,
Longitude:-156.552861,
Altitude:850.4
WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed: 1/2/2018
Closest Structure (eg Turbine #): WTG 8
Distance to base of closest structure: 36.8 m
Bearing from base of closest structure (degrees): 196°
Ground Cover Type: Medium shrubs
Wind Direction and Speed: SW 2 mph
Cloud Cover (%): 50 %
Cloud Deck : High
Precipitation: None
Temperature: 78 °F
Condition of Specimen: Gosling nene found under dense brush. Body in good condition still pliable, eyes present and whole. Ants present. No injuries found on examination.
Probable Cause of Injuries: Unknown
Other Notes: Not fledged, Outside of search area

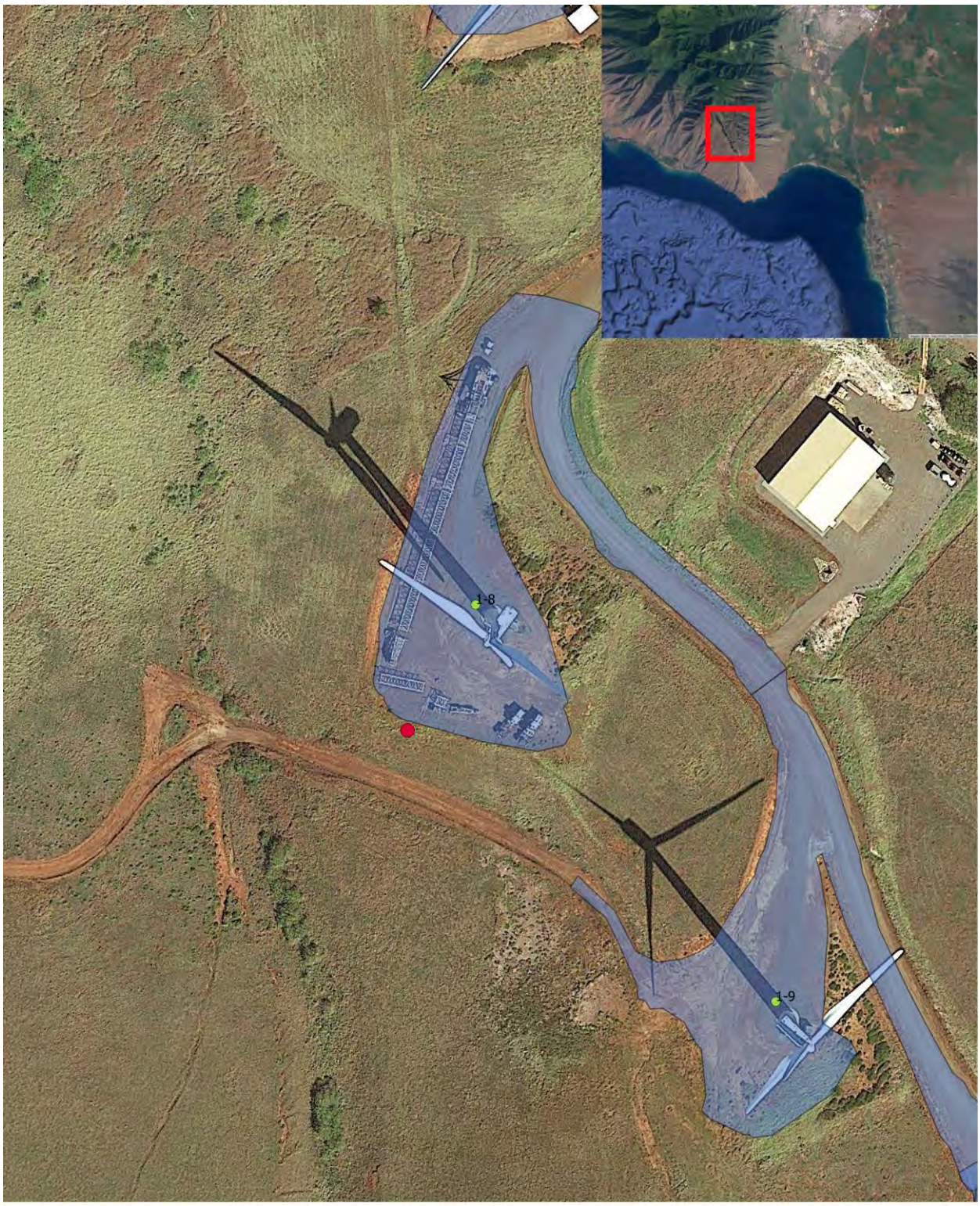
		Actions Taken
09-Jan-18	13:05	Teresa Gajate and Makalani located a dead nene gosling at KWP I turbine 8. Matt Stelmach and Mitch Craig notified.
09-Jan-18	13:36	Matt Stelmach arrives to confirm species ID. Stephanie Franklin notified via phone.
09-Jan-18	14:20	Colton Loque of DOFAW arrives to collect specimen
10-Jan-18	9:30	USFWS and DOFAW notified via email.

Figure 1. A photo of the hawaiian goose relative to the turbine. The gosling is underneath the vegetation below the flagging.

Figure 2. A photo of the Hawaiian goose gosling as found with an 8” tape measure for reference.

Figure 3. A photo of the Hawaiian goose gosling dorsal side.

Figure 4. A photo of the ventral side of the Hawaiian goose gosling.


1-8
1-9
Hawaiian Goose Gosling
Search Area
North
0 10 20 30 40 50 m
Project: Kaheawa Wind Power I
Created By: M. Stelmach
Date : 1/10/2018

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Goose (*Branta sandvicensis*) 1/16/2018

Observer Name:	Teresa Gajate
Date of Incident:	1/16/2018
Date of Report:	1/17/2018
ID Number:	20180116_KWPI_T06_HAGO
Species (Common Name):	Hawaiian Goose
Age:	Juvenile
Sex (if known):	Unknown
Incidental or Routine Search:	Search
Time Observed (HST):	13:13
Time initially Reported (HST):	13:26
Time Responders Arrive (HST):	14:30
General Location:	19.2m on bare ground
GPS Coordinates:	Latitude: 20.819373, Longitude: -156.553265, Altitude: 891.876 WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed:	1/9/2018
Closest Structure (eg Turbine #):	WTG 6
Distance to base of closest structure:	19.2 m
Bearing from base of closest structure (degrees):	181°
Ground Cover Type:	Bare
Wind Direction and Speed:	N 12 mph
Cloud Cover (%):	5 %
Cloud Deck:	High
Precipitation:	None
Temperature:	78 °F
Condition of Specimen:	Dead, fresh, no obvious signs of trauma, large maggots devouring internal organs
Probable Cause of Injuries:	Unknown
Other Notes:	

Actions Taken:

16-Jan-18	13:13	Teresa and Makalani find gosling
16-Jan-18	13:26	Contacted Stephanie Franklin, DOFAW rep sent to retrieve carcass
16-Jan-18	14:30	Laikea Mohikea from DOFAW arrives and retrieves carcass

Photo 1: Gosling as found, WTG 6 in the background.

Photo 2. Gosling as found.

Appendix 8. Hawaiian Goose Downed Wildlife Report at KWPI January 30, 2018.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Goose (*Branta sandvicensis*) 1/30/2018

Observer Name:	Teresa Gajate
Date of Incident:	1/30/2018
Date of Report:	1/31/2018
ID Number:	20180130_KWPI_T06_HAGO
Species (Common Name):	Hawaiian Goose
Age:	Juvenile
Sex (if known):	Unknown
Incidental or Routine Search:	Search
Time Observed (HST):	09:30
Time initially Reported (HST):	09:57
Time Responders Arrive (HST):	10:15
General Location:	Short grass 4 m from access road
GPS Coordinates:	Latitude: 20.819519, Longitude: -156.553039, Altitude: 892.3 m WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed:	1/23/2018
Closest Structure (eg Turbine #):	WTG 6
Distance to base of closest structure:	27 m
Bearing from base of closest structure (degrees):	90°
Ground Cover Type:	Short grass
Wind Direction and Speed:	S 10 mph
Cloud Cover (%):	100 %
Cloud Deck :	Low
Precipitation:	None
Temperature:	70 °F
Condition of Specimen:	Small gosling, down coming off, maggots, beetles
Probable Cause of Injuries:	Unknown
Other Notes:	Collected by Tracen Oania- DOFAW

Photo 1. Gosling as found near KWP I WTG 6.

Photo 2. Gosling location with WTG 6 in the background.

Appendix 9. Hawaiian Goose Downed Wildlife Report at KWPI January 30, 2018.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Goose (*Branta sandvicensis*) 1/30/2018

Observer Name:	Teresa Gajate
Date of Incident:	1/30/2018
Date of Report:	1/31/2018
ID Number:	20180130_KWPI_T08_HAGO
Species (Common Name):	Hawaiian Goose
Age:	Juvenile
Sex (if known):	Unknown
Incidental or Routine Search:	Search
Time Observed (HST):	09:57
Time initially Reported (HST):	09:57
Time Responders Arrive (HST):	10:15
General Location:	Medium grass 3m from access road, out of search area
GPS Coordinates:	Latitude: 20.817281, Longitude: -156.552598 Altitude: 851.0 m, WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed:	1/23/2018
Closest Structure (eg Turbine #):	WTG 8
Distance to base of closest structure:	43 m
Bearing from base of closest structure (degrees):	0°
Ground Cover Type:	Medium grass
Wind Direction and Speed:	S 10 mph
Cloud Cover (%):	100 %
Cloud Deck :	Low
Precipitation:	None
Temperature:	70 °F
Condition of Specimen:	Maggots, down easily pulls off, skull bones separated
Probable Cause of Injuries:	Unknown
Other Notes:	Collected by Tracen Oania-DOFAW

Photo 1. Gosling as found at KWP I WTG 8.

Photo 2. Gosling location with WTG 8 in background. Symbol points down to gosling.

Photo 3. Skull bones separated or cracked.

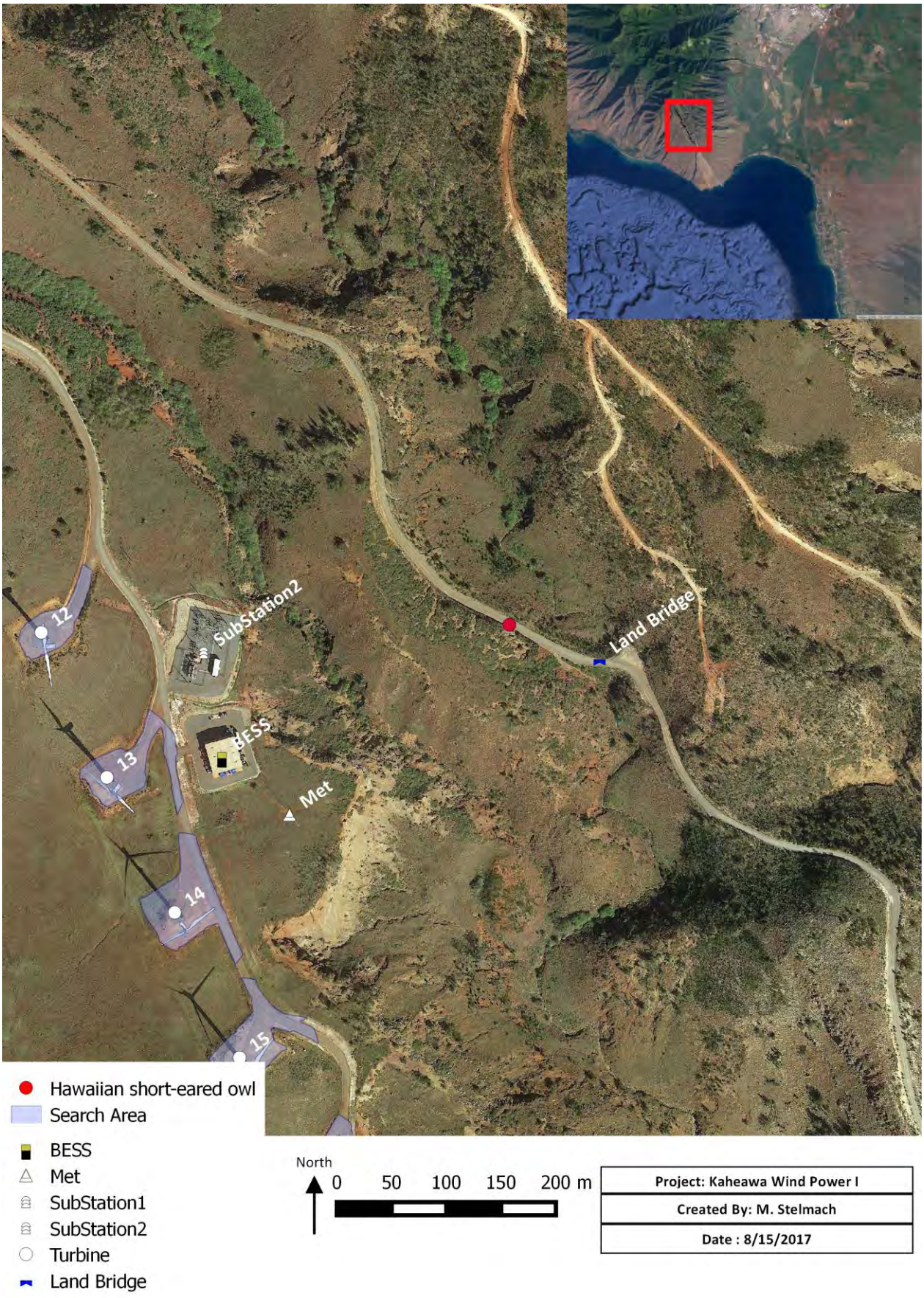
Appendix 10. Hawaiian Owl Downed Wildlife Report at KWPI August 15, 2017.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian short-eared owl (*Asio flammeus sandwichensis*) 8/15/2017

Observer Name: Matt Stelmach
Date of Incident: 8/15/2017
Date of Report: 8/15/2017
ID Number: 20170815_KWPII_LandBridge_SEOW
Species (Common Name): Hawaiian short-eared owl
Age: Adult
Sex (if known): Unknown
Incidental or Routine Search: Incidental
Time Observed (HST): 07:28
Time initially Reported (HST): 07:28
Time Responders Arrive (HST): 9:15 AM
General Location: 100m up road from land bridge
GPS Coordinates: Latitude:20.812301,
Longitude:-156.545232,
Altitude:691.7
WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed: N/A
Closest Structure (eg Turbine #): WTG Other
Distance to base of closest structure: 100 m
Bearing from base of closest structure (degrees): 303°
Ground Cover Type: Gravel
Wind Direction and Speed: NE 5 mph
Cloud Cover (%): 15 %
Cloud Deck : High
Precipitation: None
Temperature: 70 °F
Condition of Specimen: Pueo with a broken right wing found adjacent to road. Covered and brought to office. Open fracture on the right mid humerus. Good body fat.
Probable Cause of Injuries: Proximity to road suggests collision with vehicle.
Other Notes: Outside of search area. Efforts were made to minimize disturbance of the owl to reduce stress. Owl was disturbed by human presence and made efforts to fly. Minimal photos were taken and the owl was transferred to DOFAW custody for rehabilitation at 09:15

		Actions Taken
15-Aug-17	7:28	Matt Stelmach locates a pueo downed wildlife incident on the main road. Stephanie Franklin notified. Matt Stelmach directed
15-Aug-17	9:15	Sasha Smith arrives to collect the pueo.
15-Aug-17	10:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the owl as found.


12
SubStation2
Land Bridge
BESS
13
Met
14
15
Hawaiian short-eared owl
Search Area
BESS
Met
SubStation1
SubStation2
Turbine
Land Bridge
North
0
50
100
150
200 m
Project: Kaheawa Wind Power I
Created By: M. Stelmach
Date : 8/15/2017

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian short-eared owl *(Asio flammeus sandwichensis*) 9/5/2017

Observer Name: Teresa Gajate
Date of Incident: 9/5/2017
Date of Report: 9/5/2017
ID Number: 20170905_KWPI_T08_SEOW
Species (Common Name): Hawaiian short-eared owl
Age: Adult
Sex (if known): Unknown
Incidental or Routine Search: Search
Time Observed (HST): 12:49
Time initially Reported (HST): 12:59
Time Responders Arrive (HST): NA
General Location: 43m SW of turbine in medium grass
GPS Coordinates: Latitude:20.816775,
Longitude:-156.553068,
Altitude:847.4
WGS 84 Hawaii State Plane Zone 2
Date Last Surveyed: 8/29/2017
Closest Structure (eg Turbine #): WTG 8
Distance to base of closest structure: 43.2 m
Bearing from base of closest structure (degrees): 226°
Ground Cover Type: Medium grass
Wind Direction and Speed: S 1 mph
Cloud Cover (%): 40 %
Cloud Deck : High
Precipitation: None
Temperature: 85 °F
Condition of Specimen: Pueo body and right wing desiccated. Little flesh remains. No insects. Carcass scavenged. One leg found with body, one leg found 4m west.
Probable Cause of Injuries: Unknown
Other Notes: Outside of search area

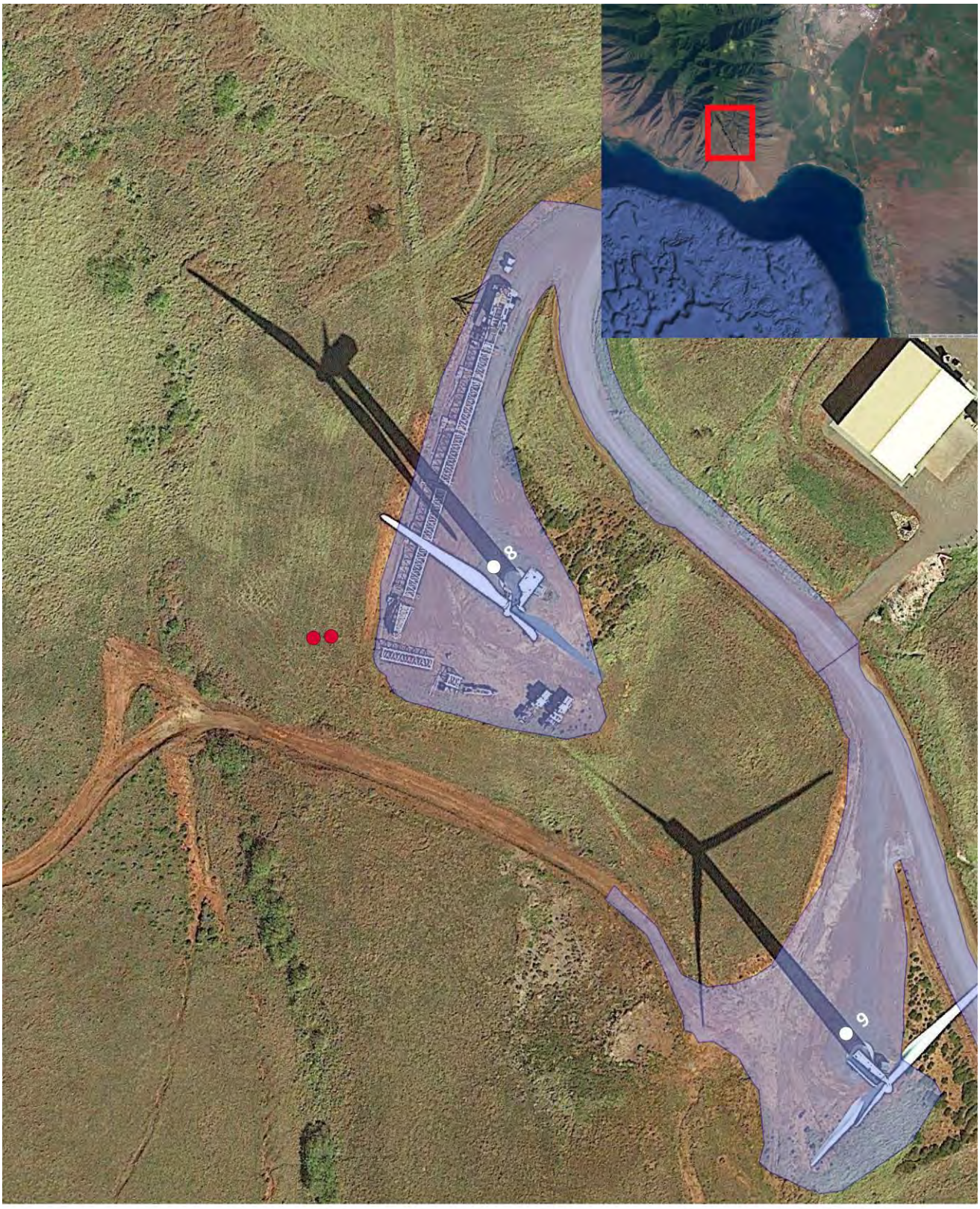
		Actions Taken
05-Sep-17	12:50	Teresa Gajate and Makalani locate a Hawaiian short-eared owl downed wildlife incident. Matt Stelmach notified.
05-Sep-17	12:54	Matt Stelmach arrives to confirm identity. DOFAW notified via phone. Matt Stelmach instructed to record data and collect carcass.
05-Sep-17	15:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the Hawaiian short-eared owl relative to the turbine.

Figure 2. A photo of the owl as found, relative to a 12” tape measure.

Figure 3. A photo of the dorsal side of the owl relative to a 12” tape measure.

Figure 4. A photo of the leg found 4m west of the body.



Hawaiian short-eared owl
Search Area

North
0 10 20 30 40 m

Project: Kaheawa Wind Power I
Created By: M. Stelmach
Date : 9/5/2017

Appendix 12. Hawaiian Owl Downed Wildlife Report at KWPI June 19, 2018.

Kaheawa Wind Power Phase I, LLC
Habitat Conservation Plan, Downed Wildlife Report
Hawaiian Owl (*Asio flammeus sandwichensis*) 6/19/2018

Observer Name: Teresa Gajate
Date of Incident: 6/19/2018
Date of Report: 6/21/2018
ID Number: 20180619_KWPI_T2_SEOW
Species (Common Name): *Asio flammeus sandwichensis* (Hawaiian Owl)
Age: Adult
Sex (if known): Unknown
Incidental or Routine Search: Search
Time Observed (HST): 08:10
Time initially Reported (HST): 08:42
Time Responders Arrive (HST): 6/21/2018 9:30 (DOFAW)
General Location: Nearest T2
GPS Coordinates: Latitude: 20.8237
Longitude: -156.5559
WGS84, Zone 4
Date Last Surveyed: 6/12/2018
Closest Structure (eg. Turbine #): T2
Distance to base of closest structure: 24m
Bearing from base of closest structure (degrees): 290°
Ground Cover Type: found in water container
Wind Direction and Speed: North 9 mph
Cloud Cover (%): 10
Cloud Deck: High
Precipitation: None
Temperature: 67 °F
Condition of Specimen: Dead, no obvious injuries
Probable Cause of Injuries: Drowning possible
Other Notes: Large water containers left from Maui Cultural Lands replanting efforts

Photo 1. Pueo as found.

Photo 2. Pueo in water tank with WTG 2 in background.

Appendix 13. SEEF trials at KWPI during FY 2018.

Trial date	WTG	Carcass type	Found	Searcher
1-Aug	16	Large Bird	1	K9
1-Aug	2	Large Bird	1	K9
29-Aug	2	Large Bird	1	K9
17-Oct	17	Large Bird	1	K9
24-Oct	13	Large Bird	1	Human
24-Oct	6	Large Bird	1	Human
14-Nov	1	Large Bird	1	K9
9-Jan	10	Large Bird	1	K9
9-Jan	12	Large Bird	1	K9
30-Jan	17	Large Bird	1	K9
13-Feb	18	Large Bird	1	K9
24-Apr	17	Large Bird	1	K9
1-May	13	Large Bird	1	K9
29-May	12	Large Bird	1	K9
1-Aug	16	Med Bird	1	K9
29-Aug	10	Med Bird	1	K9
29-Aug	6	Med Bird	1	K9
17-Oct	2	Med Bird	1	K9
24-Oct	20	Med Bird	1	Human
14-Nov	7	Med Bird	1	K9
9-Jan	8	Med Bird	1	K9
30-Jan	3	Med Bird	1	K9
30-Jan	11	Med Bird	1	K9
20-Feb	15	Med Bird	1	Human
29-May	19	Med Bird	1	K9

Trial date	WTG	Carcass type	Found	Searcher
1-Aug	14	Rat	1	K9
1-Aug	17	Rat	1	K9
1-Aug	2	Rat	1	K9
29-Aug	2	Rat	1	K9
17-Oct	10	Rat	1	K9
17-Oct	11	Rat	1	K9
17-Oct	2	Rat	1	K9
17-Oct	6	Rat	1	K9
17-Oct	8	Rat	1	K9
24-Oct	1	Rat	1	Human
24-Oct	2	Rat	0	Human
24-Oct	20	Rat	0	Human
24-Oct	8	Rat	1	Human
14-Nov	18	Rat	1	K9
14-Nov	2	Rat	1	K9
14-Nov	4	Rat	1	K9
14-Nov	6	Rat	1	K9
26-Dec	10	Rat	1	K9
26-Dec	10	Rat	1	K9
26-Dec	11	Rat	1	K9
26-Dec	14	Rat	1	K9
26-Dec	16	Rat	1	K9
9-Jan	11	Rat	1	K9
9-Jan	12	Rat	1	K9
9-Jan	17	Rat	1	K9
13-Feb	9	Rat	1	K9
20-Feb	19	Rat	1	Human
27-Mar	2	Rat	1	K9
27-Mar	7	Rat	1	K9
10-Apr	3	Rat	1	K9
10-Apr	4	Rat	1	K9
10-Apr	5	Rat	1	K9
10-Apr	15	Rat	1	K9
24-Apr	4	Rat	1	K9
24-Apr	7	Rat	1	K9
1-May	6	Rat	1	K9
1-May	8	Rat	1	K9
29-May	4	Rat	1	K9
29-May	17	Rat	1	K9
29-May	17	Rat	1	K9
29-May	18	Rat	1	K9
12-Jun	9	Rat	1	K9
12-Jun	10	Rat	1	K9
12-Jun	12	Rat	1	K9

Appendix 14. CARE AI-AL trial results at KWPI during FY 2018.

CARE AI FY2018		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Trial 7	
Carcass Type		Rat		Rat		Rat		Medium Bird		Large Bird		Rat		Rat	
WTG		4		5		6		7		8		11		18	
Vegetation		Bare													
Distance (m)		32		19		14		13		67		48		12	
Day	**Date**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**
0	31-Jul	P		P		P		P		P		P		P	
1	1-Aug	P		P		P		P		P	L	P	L	P	L
2	2-Aug	P	L	P	L	P	L,H	P	L	P		P		P	
3	3-Aug	P	A	P		P		P		P	A	P	H	P	H
4	4-Aug	P		**P**	H	**P**		P		P		P		P	
5	5-Aug	**P**	H	A		A		P		P	F	P		P	
6	6-Aug	A						P		P		P		P	M
7	7-Aug							P		P		P	M	P	
8	8-Aug							P	F	P		P		P	
9	9-Aug							P		P		P		P	
10	10-Aug							P	D	P		P	D	P	
11	11-Aug							P		P		P		P	
12	12-Aug							P		P		**P**		P	
13	13-Aug							P	M	P		A		P	
14	14-Aug							P		P				P	
21	21-Aug							P		P				P	A
28	28-Aug							**P**	S	**P**	S			**P**	M,D
Retention (days)		**5**		**4**		**4**		**28**		**28**		**12**		28	

A	ants	H	hair loss
B	body feathers	L	fly larvae
C	dirt covered	M	moved
D	desiccated	S	skeleton
F	feathers	W	wing feathers
Scav	Scavenged		

CARE AJ FY2018		**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**		**Trial 5**		**Trial 6**		**Trial 7**	
Carcass Type		Large Bird		Rat		Rat		Rat		Medium Bird		Rat		Rat	
WTG		1		2		3		5		8		11		15	
Vegetation		Bare													
Distance (m)		8		20		50		26		31		19		42	
Day	**Date**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**
0	10-Oct	P		P		P		P		P		P		P	
1	11-Oct	P	L	P		P		P		P		P		P	
2	12-Oct	P		**P**		**P**	A	**P**		P		P		P	L
3	13-Oct	P		A		A		A		P		P	A	P	A
4	14-Oct	P								P		P		P	H
5	15-Oct	P								P		P		P	
6	16-Oct	P								P		P		P	
7	17-Oct	P								P		P		**P**	
8	18-Oct	P								P		P	H	A	
9	19-Oct	P								P	D	P	S,D		
10	20-Oct	P								P		P			
11	21-Oct	P								P		P			
12	22-Oct	P								P		P			
13	23-Oct	P								P		P			
14	24-Oct	P								P		P			
21	31-Oct	P	F,S,D							P	F	P			
28	7-Nov	**P**								**P**		**P**			
Retention (days)		**28**		**2**		**2**		**2**		**28**		**28**		7	

CARE AK FY2018		Trial 1		Trial 2		Trial 3		Trial 4		Trial 5		Trial 6		Trial 7	
Carcass Type		Large Bird		Medium Bird		Rat		Rat		Rat		Rat		Rat	
WTG		2		4		5		9		9		17		17	
Vegetation		Short Grass		Bare											
Distance (m)		36		23		11		29		15		29		44	
Day	**Date**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**
0	13-Mar	P		P		P		P		P		P		P	
1	14-Mar	P		P		P		P		P		P		P	
2	15-Mar	P		P		P		P		P	L	P	L	P	
3	16-Mar	P		P		P	L	P	L	P		P		P	H
4	17-Mar	P	F,L	P	F,S,D	P		P		P	H,S,D	P	H,S	P	S,D
5	18-Mar	P		P		P	H	P	H	P		P	D	P	
6	19-Mar	P		P		P	S,D	P	S,D	P		**P**		P	
7	20-Mar	P		P		P		P		P		A		P	
8	21-Mar	P		P	L	P		P		P				P	
9	22-Mar	P		P		P		P		P				P	
10	23-Mar	P		P		P		P		P				P	
11	24-Mar	P		P		P		P		P				P	
12	25-Mar	P	S,D	P		P		P		P				P	
13	26-Mar	P		P		P		P		P				P	
14	27-Mar	P		P		P		P		P				P	
21	3-Apr	P		P		P		P		P				P	
28	10-Apr	**P**		**P**		**P**		**P**		**P**				P	
Retention (days)		**28**		**28**		**28**		**28**		**28**		**6**		**28**	

CARE AL FY2018		**Trial 1**		**Trial 2**		**Trial 3**		**Trial 4**		**Trial 5**		**Trial 6**		**Trial 7**	
Carcass Type		Rat		Large Bird		Rat		Rat		Medium Bird		Rat		Rat	
WTG		5		7		8		9		11		13		17	
Vegetation		Bare													
Distance (m)		23		7		25		30		38		8		6	
Day	**Date**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**	**P/A**	**Notes**
0	31-May	P		P		P		P		P		P		P	
1	1-Jun	P		P		P		P		P		P		P	
2	2-Jun	P		P		P		**P**		P		P		P	
3	3-Jun	P		P		P		A		P		P	L	P	
4	4-Jun	P	H,D	P	F,L	P	H			P		P	H	P	H
5	5-Jun	P		P		P				P	L	P	D	P	D
6	6-Jun	P	L	P		P	L			P		P		P	
7	7-Jun	P		P		P	D			P		P		P	
8	8-Jun	P		P		P				P		P		P	
9	9-Jun	P		P		P				P		P	M	P	
10	10-Jun	P		P	A	P				P		P		P	
11	11-Jun	P	S	P		P				P		P	S	P	
12	12-Jun	P		P		P				P		P		P	
13	13-Jun	P		P		P				P		P		P	
14	14-Jun	P		P	D	**P**				P		P		P	
21	21-Jun	**P**		P		A				P	SCAV,D	**P**		P	S
28	28-Jun	A		**P**	S					**P**		A		**P**	M
Retention (days)		**21**		**28**		**14**		**2**		**28**		**21**		28	

Wildlife agency standardized protocols for wildlife fatalities found outside the designated search area or discovered incidentally outside of a routine search

Evidence of Absence software (Dalthorp et al 2017; https://pubs.er.usgs.gov/publication/ds1055) utilizes the number of observed carcasses and the detection probability to produce a probability distribution of the number of fatalities that may have occurred based on imperfect detection. The number of carcasses entered as "Observed" assumes that the carcasses were found in the designated search area and during a routine search. In January 2018, the wildlife agencies discussed the need for establishing a standardized protocol for fatalities of protected wildlife species that are modeled with Evidence of Absence Ver. 2.0.6. but fail to meet the input criteria required by the model. Such exceptions may include carcasses found outside of the designated search area during a routine search, or carcasses incidentally discovered outside of a routine search day. "Rules" for treating these exceptions in the Evidence of Absence model should recognize and encumber the best science in order to maintain the validity of the software's output and not purposefully violate the basic mathematical assumptions that drive the model.

To best accommodate these types of Observed carcasses, the wildlife agencies provide the following standardized guidance. For the purposes of this guidance, assume the carcass found is of the species you are modeling.

Fatality found outside of the designated reduced search area

This situation would only apply to projects that have a carcass search area that has been reduced below where a carcass could potentially fall.

The Downed Wildlife Protocol and accompanying reporting procedures should be followed for carcasses found outside of the reduced routine search area. The carcass will be considered accounted for in the Unobserved take by the Evidence of Absence model. The report should clearly note the measured location of the carcass and relationship to the area searched in addition to the standard data required on the downed wildlife report. Measurements reported in meters will be based on distance from the turbine base or nearest structure. Such measurement should be conducted with a tape measure and with GPS. Project reports should also clearly identify the carcasses that fall in this category.

Fatality found outside of the designated "full" search area.

This situation would imply that the initial monitoring and search area based on turbine height and carcass size may have been undersized and will require expanding the area.

A designated "full" search area is expected to account for all carcasses. The lack of project specific data for small carcass sizes as resulted in the general adoption of the standards presented in Hull and Muir (2010). The wildlife agencies recommend an additional buffer zone of 20% be added to account for the wind effect on carcass fallout and uncertainty until adequate data is gathered for a site. The additional 20% buffer zone would need to be included in the routine searches. The buffer should be located on the down-wind side of the project if the wind is predominantly from one direction. The calculated area based on Hull and Muir plus the buffer area is designated as the "full" search area. Fatalities found during a routine search of the "full" search area (Hull & Muir predicted + 20% buffer zone) would be treated as an Observed fatality in the model.

If the carcass is found beyond this "full" monitoring area, the Downed Wildlife Protocol and accompanying reporting procedures should still be followed. In addition, the permittee should contact the appropriate wildlife agency personnel listed in the Downed Wildlife Protocol to discuss adjusting the size of the fall out area and if expanding the area searched is needed to account for all potential fallout.

Fatality found incidentally (not during a routine scheduled search) in the designated search area
The model takes into account the frequency of searches. If a carcass is found incidentally, then it must be determined if the carcass would have been found on the next routine search day and therefore counted as Observed, or if the carcass would have been missed or be gone on the next routine search and accounted for in the Unobserved portion of fatalities." The Hawaiian hoary bat carcasses are important to ongoing genetic research, so leaving the listed carcass in place is not in the best interest for the species. If a carcass is found incidentally, in the designated search area the Downed Wildlife Protocol and reporting should be followed. The report should clearly indicate who found the carcass, and under what circumstances (turbine maintenance, weeding, mowing, etc). The report should also indicate the method of determining how to categorize the carcass. The three methods are:

1) Permittee chooses to include the carcass as Observed in the model, regardless of searcher efficiency.

2) Wildlife agencies will include the carcass as Observed in the model when the documented detection probability is sufficiently high so as to reasonably assume the carcass would have been found on a subsequent scheduled search. Specifically, this method makes the assumption that the search efficiency and *k* value are such that there is a high probability that the carcass would have been found on a subsequent search. This method will be used for all large and medium carcasses found. This method will also be used for smaller carcasses when it is reasonable to assume the carcass or carcass trace would have been found on a subsequent search. The wildlife agencies will assume a carcass would have been found when the documented searcher efficiency ≥75% and *k* value ≥ 0.7.

In the case of small carcasses where the searcher efficiency is less than 75% (based on permittee's documented efficacy), a double-blind search with a replacement surrogate should be conducted to determine how the recovered carcass shall be categorized: Observed or Unobserved. That trial shall include the following criteria:

- **a.** The surrogate (typically a rat) should be identical to that used for search efficacy trials and similar in size to the carcass found.
- **b.** The surrogate carcass should be labeled as a surrogate for the specific carcass it is representing, and placed by a third party in the proximity of where the carcass that was recovered was found with label hidden.
- **c.** The placement of this carcass should be conducted by the same party responsible for placing carcasses for efficiency trials, whenever possible.

d. Under no circumstances should the searcher conducting the routine search, be the one placing the surrogate or have knowledge of the surrogate's location or the timing of the placement.

e. Routine fatality searches should be carried out following standard search procedures.

f. The outcome of the trial should be reported in the compliance report and include the date the surrogate was placed and the date the carcass was found. If the carcass was never found, the third party should check on the status of the carcass. If the carcass is still present, leave it in place for subsequent searches. Include this information in the compliance report.

g. If the surrogate was found, the original carcass should be reported as Observed. If the surrogate was not found, the original carcass should be reported as Unobserved.

Note: The wildlife agencies expect the permittee's to conduct thorough, fair, and impartial searches and not to purposefully conduct searches for carcasses outside of the scheduled routine fatality searches in an attempt to manipulate fatality documentation or calculation of take. The agencies also acknowledge the amount of effort it takes to conduct the thorough routine fatality searches and trials necessary to measure carcass retention and searcher efficiency. If a carcass is found outside of a routine search and a searcher efficiency trial is scheduled to be conducted within the next 30 days, it may be possible to include option 3 within that searcher efficiency trial. However, you must contact the wildlife agencies for approval.

Literature Cited

Dalthorp, Daniel, Huso, Manuela, and Dail, David, 2017, Evidence of absence (v2.0) software user guide: U.S. Geological Survey Data Series 1055, 109 p., https://doi.org/10.3133/ds1055.

Hull, C. L. and S. Muir (2010). Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model. Austalasian Journal of Environmental Management 17: 77-87.

Appendix 16. Fatality estimation input parameters and results for Hawaiian goose at KWPI through FY 2018.

								SEEF				
Period	**FY**	**Dates**		**Period length**	**% year (rho)**	**Search interval in days**	**Period searches - 1**	**Observed fatality (X)**	**Found**	**Placed**	**%**	**95%CI**	
1	FY06-08	1/1/2006	7/1/2008	912	2.50	9	100	2	16	22	0.73	0.522	0.877
2	FY09, FY10, part FY11	7/1/2008	11/15/2010	867	2.38	7	123	2					
3	FY11 part	11/16/2010	7/1/2011	227	0.62	7	31	5					
4	FY12	7/1/2011	7/1/2012	366	1.00	7	51	1	8	11	0.73	0.435	0.917
5	FY13	7/1/2012	6/30/2013	364	1.00	7	51	4	6	10	0.60	0.304	0.847
6	FY14	7/1/2013	6/30/2014	364	1.00	7	51	3	12	15	0.80	0.556	0.94
7	FY15	7/1/2014	6/30/2015	364	1.00	7	51	4	35	45	0.78	0.642	0.88
8	FY16	7/1/2015	6/30/2016	365	1.00	7	51	1	8	8	1	0.738	1
9	FY17Q1	7/1/2016	9/30/2016	91	0.25	7	12	0	11	11	1	0.8	1
10	FY17Q2-4	10/1/2016	6/30/2017	272	0.75	7	38	1 + 1*	11	11	1	0.8	1
11	FY18	7/1/2017	6/30/2018	364	1.00	7	51	0	14	14	1	0.783	1

	CARE							K	DWA	g			B		
Period	**Distr.**	**Scale**	**95% CI for scale**		**r**	**r lwr**	**r upr**	**l r**			**g**	**min**	**max**	**Ba**	**Bb**	**M***
1	EXP	580	71	4741	0.992	0.952	0.999	9	1	0.95	0.923	0.871	0.962	120.759	10.138	**2**
2								7	1	0.95	0.928	0.885	0.961	162.466	12.600	**5**
3								7	1	0.7*	0.678	0.646	0.708	581.813	276.801	**11**
4								7	1	0.7*	0.678	0.633	0.72	299.380	142.504	**13**
5	EXP	2430	111	254000	0.999	0.969	1	7	1	0.7*	0.666	0.58	0.748	79.751	39.926	**18**
6	EXP	2430	111	254000	0.923	0.793	0.973	7	1	0.7*	0.683	0.626	0.737	183.925	85.392	**23**
7	EXP	3960	181	390000	0.999	0.981	1	7	1	0.7*	0.691	0.658	0.722	548.693	245.857	**28**
8	EXP	3960	181	390000	0.999	0.981	0.999	7	1	0.288*	0.284	0.265	0.302	661.221	1670.615	**32**
9	EXP	3960	181	390000	0.999	0.981	0.999	7	1	0.288*	0.285	0.272	0.297	1437.106	3613.457	**32**
10	EXP	3960	181	390000	0.999	0.981	0.999	7	1	0.346*	0.341	0.324	0.359	931.839	1797.232	**35**
11	EXP	4930	226	469000	0.999	0.985	1	7	1	0.346*	0.344	0.336	0.352	4419.702	8438.369	**37**

Appendix 17. Fatality estimation input parameters and results for Hawaiian petrel at KWPI through FY 2018.

									SEEF				
Period	**FY**	**Dates**		**Period length**	**% year (rho)**	**Search interval**	**Period searches - 1**	**Observed fatality (X)**	**Found**	**Placed**	**%**	**95%CI**	
1	FY06-07	1/1/2006	6/30/2007	545	1.5	9	60	0	6	8	0.75	0.408	0.944
2	FY08	7/1/2007	6/30/2008	365	1	9	40	1	12	18	0.67	0.437	0.847
3	FY09	7/1/2008	6/30/2009	364	1	7	51	0	198	255	0.78	0.722	0.824
4	FY10	7/1/2009	6/30/2010	364	1	7	51	0	14	20	0.70	0.483	0.864
5	FY11a	7/1/2010	11/15/2010	137	0.38	7	19	0	15	21	0.71	0.503	0.871
6	FY11b	11/16/2010	6/30/2011	226	0.62	7	31	0					
7	FY12	7/1/2011	6/30/2012	365	1	7	51	2	14	37	0.38	0.236	0.539
8	FY13	7/1/2012	6/30/2013	364	1	7	51	1*	6	10	0.60	0.304	0.847
9	FY14	7/1/2013	6/30/2014	364	1	7	51	1	34	44	0.77	0.634	0.877
10	FY15	7/1/2014	6/30/2015	364	1	7	51	2	49	71	0.69	0.577	0.788
11	FY16	7/1/2015	6/30/2016	365	1	7	51	0	7	7	1	0.708	1
12	FY17Q1	7/1/2016	9/30/2016	91	0.25	7	12	0	12	12	1	0.815	1
13	FY17Q2-4	10/1/2016	6/30/2017	272	0.75	7	38	0	12	12	1	0.815	1
14	FY2018	7/1/2017	6/30/2018	364	1	7	51	0	11	11	1	0.67	1

	CARE										**g**			**B**		
Period	**Distr.**	**Shape**	**Scale**	**95% CI for scale**		**r**	**r lwr**	**r upr**	**K**	**DWA**	**g**	**min**	**max**	**Ba**	**Bb**	**M***
1	EXP	0.0233	43	14.5	127.8	0.902	0.745	0.966	0.9	1	0.807	0.602	0.948	14.640	3.512	**0**
2	EXP	0.0233	43	14.5	127.8	0.902	0.745	0.966	0.9	1	0.786	0.593	0.928	16.780	4.580	**2**
3	LogN	0.6724	2.7	2.1	3.3	0.946	0.839	0.987	0.9	1	0.847	0.717	0.942	31.552	5.682	**2**
4	EXP	0.0177	56.7	16.3	197.2	0.941	0.813	0.982	0.9	1	0.861	0.706	0.963	22.061	3.566	**2**
5	EXP	0.0030	337.5	36.4	3133	0.99	0.91	0.999	0.9	1	0.939	0.848	0.99	37.522	2.438	**2**
6									0.9	0.75*	0.712	0.654	0.767	173.480	70.173	**2**
7	EXP	0.0110	91	17.1	484.4	0.962	0.82	0.993	0.9	0.75*	0.581	0.431	0.724	24.567	17.703	**5**
8	EXP	0.0110	91	17.1	484.4	0.962	0.82	0.993	0.9	0.75*	0.646	0.511	0.77	32.733	17.929	**5**
9	EXP	0.0054	184	39.9	847.7	0.981	0.917	0.996	0.9	0.75*	0.714	0.668	0.758	281.195	112.620	**6**
10	EXP	0.0171	58.7	15.0	229.8	0.943	0.799	0.985	0.9	0.75*	0.65	0.555	0.74	65.572	35.296	**10**
11	EXP	0.0038	264.5	27.5	2540	0.987	0.883	0.999	1*	0.204*	0.197	0.18	0.214	414.190	1689.740	**10**
12	EXP	0.0038	264.5	27.5	2540	0.987	0.883	0.999	1*	0.204*	0.198	0.183	0.212	587.750	2386.760	**11**
13	EXP	0.0038	264.5	27.5	2540	0.987	0.883	0.999	1*	0.246*	0.239	0.225	0.253	864.440	2690.800	**11**
14	EXP	0.0005	2020	92.1	413000	0.998	0.963	1	1*	0.246*	0.24	0.203	0.28	114.850	362.767	**12**

Appendix 18. Fatality estimation input parameters and results for Hawaiian hoary bat at KWPI through FY 2018.

										SEEF				
#	FY	LWSC	Dates		Period length	% year	Search interval	Period searches - 1	Observed fatality	Found	Placed	%	95%CI	
1	07	no	6/1/06	6/30/07	394	1.08	9	43	0	19	30	0.63	0.455	0.787
2	08	no	7/1/07	6/30/08	365	1.00	9	40	0					
3	09	no	7/1/08	6/30/09	364	1.00	7	51	0					
4	10	no	7/1/09	6/30/10	364	1.00	7	51	0	22	40	0.55	0.397	0.696
5	11	no	7/1/10	6/30/11	364	1.00	7	51	0	5	12	0.42	0.18	0.688
6	12	no	7/1/11	6/30/12	365	1.00	7	51	0					
7	13	no	7/1/12	6/30/13	364	1.00	7	51	2	5	15	0.33	0.14	0.584
8	14	no	7/1/13	6/30/14	364	1.00	7	51	4	47	79	0.59	0.485	0.698
9	15	5.5 m/s	7/1/14	6/30/15	364	1.00	7	51	0	27	65	0.42	0.301	0.537
10	16	5.5 m/s	7/1/15	6/30/16	365	1.00	7	51	0	35	37	0.95	0.838	0.989
11	17Q1	5.5 m/s	7/1/16	9/30/16	91	0.25	7	12	1	8	9	0.89	0.586	0.988
12	17Q2- Q4	5.5 m/s	10/1/16	6/30/17	272	0.75	7	38	0	29	33	0.88	0.737	0.958
13	18	5.5 m/s	7/1/17	6/30/18	364	1.00	7	51	1	42	44	0.95	0.862	0.99

	CARE											g			B		M*
#	Distr.	Shape	Scale	95% CI for scale		r	r lwr	r upr	lr	K	DWA	g	min	max	Ba	Bb	
1	EXP	0.1095	9.130	3.880	21.481	0.636	0.389	0.817	9	0.7	1	0.445	0.261	0.638	11.208	13.955	**1**
2	EXP	0.1095	9.130	3.880	21.481	0.636	0.389	0.817	9	0.7	1	0.443	0.258	0.636	11.064	13.936	**1**
3	EXP	0.1095	9.130	3.880	21.481	0.698	0.463	0.853	7	0.7	1	0.501	0.312	0.69	12.697	12.644	**1**
4	EXP	0.1095	9.130	3.880	21.481	0.698	0.463	0.853	7	0.7	1	0.45	0.272	0.634	12.367	15.140	**1**
5	LogN	5.6614	3.092	1.360	4.824	0.798	0.558	0.937	7	0.7	1	0.505	0.257	0.752	7.145	7.007	**1**
6	LogN	0.6313	1.696	1.144	2.247	0.714	0.516	0.871	7	0.7	1	0.345	0.149	0.574	6.089	11.555	**1**
7	LogN	0.3431	2.354	1.921	2.788	0.935	0.823	0.984	7	0.7	1	0.414	0.183	0.669	5.894	8.335	**7**
8	LogN	0.7229	1.768	1.177	2.359	0.731	0.53	0.883	7	0.7	1	0.484	0.332	0.638	19.227	20.472	**18**
9	LogN	0.4063	1.121	0.646	1.595	0.497	0.328	0.692	7	0.7	1	0.217	0.128	0.321	14.757	53.295	**19**
10	EXP	0.0279	35.853	17.612	72.986	0.908	0.825	0.954	7	1*	0.492*	0.44	0.408	0.472	407.897	520.143	**19**
11	EXP	0.0131	76.481	20.710	282.400	0.956	0.849	0.988	7	1*	0.492*	0.45	0.401	0.499	177.743	217.500	**21**
12	LogN	0.5034	3.095	2.648	3.541	0.988	0.955	0.998	7	1*	0.573*	0.549	0.52	0.578	631.103	518.616	**21**
13	LogN	2.4600	2.647	1.842	3.452	0.824	0.689	0.929	7	1*	0.573*	0.459	0.386	0.533	80.673	95.133	**23**

Appendix 19. Nēnē lost productivity and indirect take at KWPI through FY 2018.

							Years when loss of productivity is calculated[1]									
	Description	**2007**	**2008**	**2009**	**2010**	**2011**	**2011**	**2012**	**2013**	**2014**		**2015**		**2016**	**2017**	**2018**	**Total**
A	**Observed Take**	0	2	1	1	3	2	1	4	2	1	3	1	1	0	1	**23**
B	Estimated Take Multiplier (**37/23=1.565**)	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	
C	**Estimated Direct Take (A x B)**	0	3.22	1.61	1.61	4.83	3.22	1.61	6.44	3.22	1.61	4.83	1.61	1.61	0	1.61	**37**
D	Observed Indirect Take Multiplier (Season Defined)	0	0.09	0	0	0.09	0	0.09	0.09	0.09	0	0.09	0.04	0.09	0.04	0.09	
E	**Observed Indirect Take (C x D)**	0	0.18	0	0	0.27	0	0.09	0.36	0.18	0	0.27	0.04	0.09	0	0.09	**1.57**
F	**Unobserved Direct Take (C - A)**		1.22	0.61	0.61	1.83	1.22	0.61	2.44	1.22	0.61	1.83	0.61	0.61	0.00	0.61	
G	**Unobserved Indirect Take (F x 0.06)**		0.07	0.04	0.04	0.11	0.07	0.04	0.15	0.07	0.04	0.11	0.04	0.04	0.00	0.04	**0.84**
H	Accrued Adult Take (**Previous Year's Accrued C - M)** (beginning 1/1/2011**)**							3.35	4.98	11.64		16.08		18.93	17.19	15.18	
I	Lost Productivity from accrued adult take **(Current year's H x 0.1) Fledglings**							0.33	0.50	1.16		1.61		1.89	1.72	1.52	**8.74**
J	Indirect Take + Lost Productivity (**E + G + I**)-Total Current **Fledglings**							1.24	1.00	1.45		2.06		2.02	1.72	1.64	***11.15***
K	**Mitigation fledglings produced**							**2**	**8**	**8**		**6**		**8**	**14**	**0**	
L[1]	Net fledglings remain (**Current Year K - J)**)		-0.25	-0.04	-0.04	-0.45		**0.76**	**7.00**	**6.55**		**3.94**		**5.98**	**12.28**	**-1.64**	
M	Net adults 3 yrs later (**Three year's previous L x 0.512**)					-0.13		-0.02	-0.02	-0.23		**0.39**		**3.58**	**3.35**	**2.02**	***8.94***

[1] Prior to 1/1/2011 Indirect Take (E+G) is converted to adult take 2 years later (M) and added to current Accrued Adult Take (H)

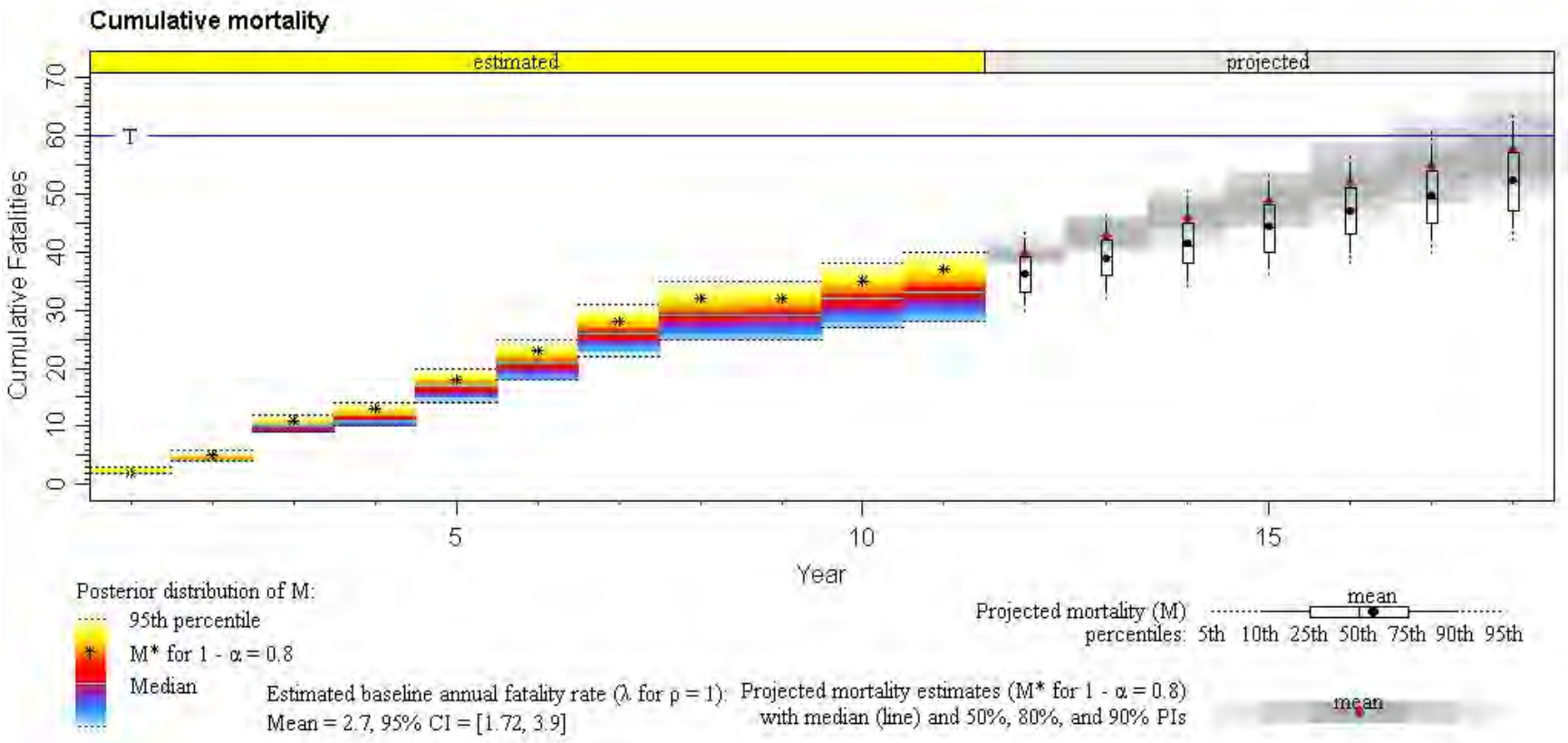
Appendix 20. HAPE lost productivity and indirect take at KWPI through FY 2018.

	Fiscal Year	2007	2008	2009	2010	2011	2012		2013	2014	2015		2016	2017	2018	Total
A	**Observed Take**	0	1	0	0	0	1	1	0	1	1	1	0	0	0	**6.00**
B	Estimated Take Multiplier (**12/6 = 2**)		2.00				2.00	2.00		2.00	2.00	2.00				
C	**Estimated Take (A x B)**		2.00				2.00	2.00		2.00	2.00	2.00				**12.00**
D	Observed Indirect Take Multiplier (**Season defined**)		0.66				0.66	0.50		0.89	0.89	0.66				
E	**Observed Indirect Take (A x D)**		0.66				0.66	0.50		0.89	0.89	0.66				**4.26**
F	Unobserved Direct Take (**C** - **A**)		1.00				1.00	1.00		1.00	1.00	1.00				**6.00**
G	**Unobserved Indirect Take (D x F)**		0.66				0.66	0.50		0.89	0.89	0.66				**4.26**
H	Accrued Adult Take (**Sum all previous year's C**)			2.00	2.00	2.00	2.00		6.00	6.00	8.00		12.00	12.00	12.00	
I	Accrued Adult Take Lost Productivity (**H x 0.15**)-Fledglings			0.30	0.30	0.30	0.30		0.90	0.90	1.20		1.80	1.80	1.80	**9.60**
J	Second Generation Adults: Indirect Take Survive to Adult accumulated and unmitigated (fifth year previous IDT **(E + G) *0.3**)								0.40	0.40	0.40		0.40	1.09	1.09	
K	Second Generation Adult Lost Productivity (accumulated **J x 0.15**)-Fledglings								0.06	0.06	0.06		0.06	0.16	0.16	**0.57**
											Total Lost Productivity					**10.17**
											Total Indirect Take					**8.52**

Appendix 21. Indirect take calculations for Hawaiian hoary bat at KWPI through FY 2018.

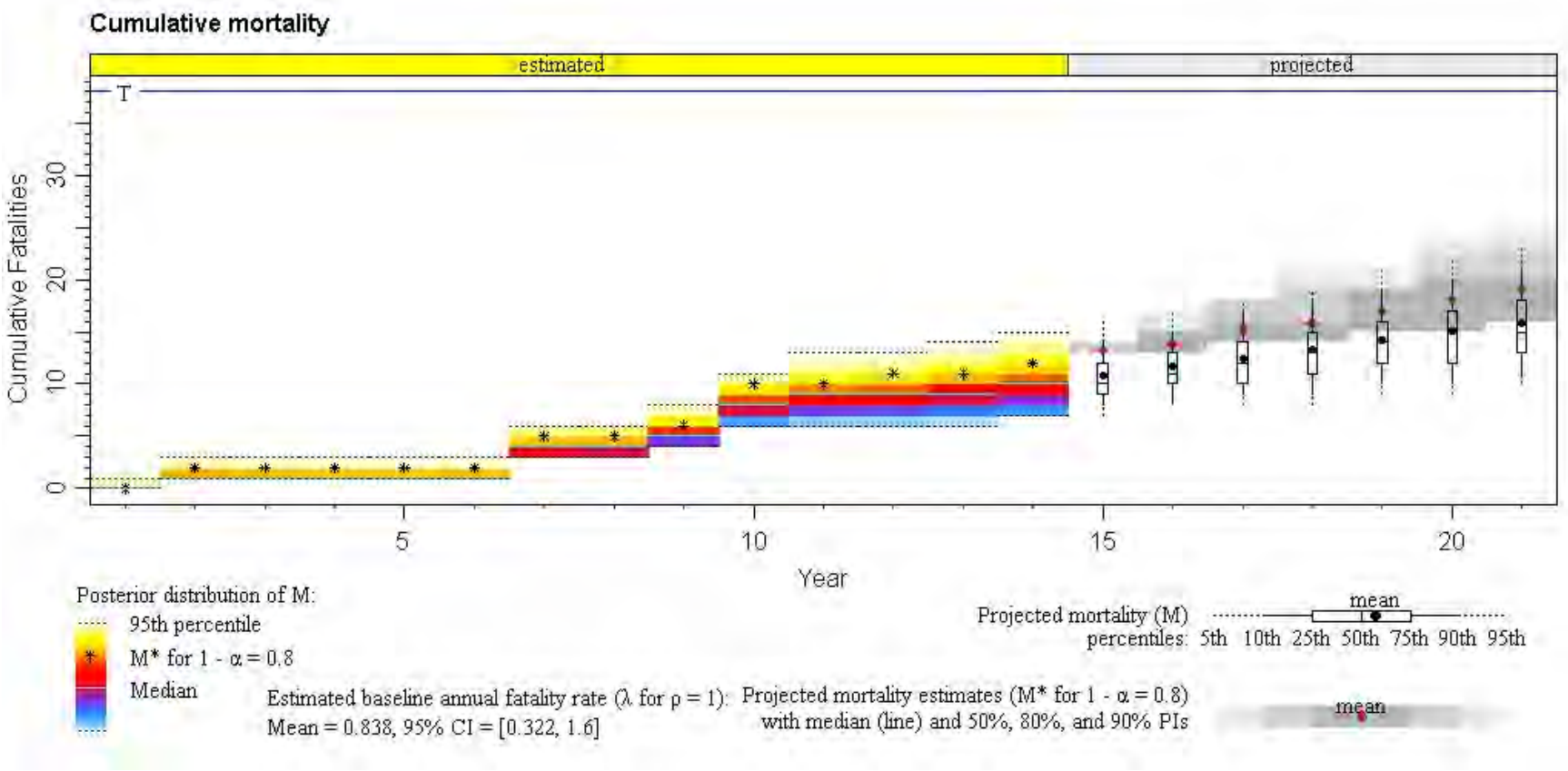
Component	Input	Value
A	Total Estimated Direct take	23
B	Observed direct take (ODT)	8
C	Unobserved direct take (UDT) (**A - B**)	15
D	ODT female or unknown during Apr 1- Sep 15 (2 female, 4 unknown)	6
E	Proportion of UDT that could be female and probability a female is pregnant or lactating (0.5 x 3/12)	0.125
F	Survival of twin pups to weaning (0.9 x 2 pups)	1.8
G	ODT IDT (**D x F**)	10.8
H	UDT IDT (**C x E x F**)	3.38
I	IDT total (**G + H**)	14.18
J	Survival of juvenile to adult	0.3
	IDT as adults (I x J)	4.25
	Total IDT rounded up	**5**

Appendix 22. Hawaiian Goose Projected Take.

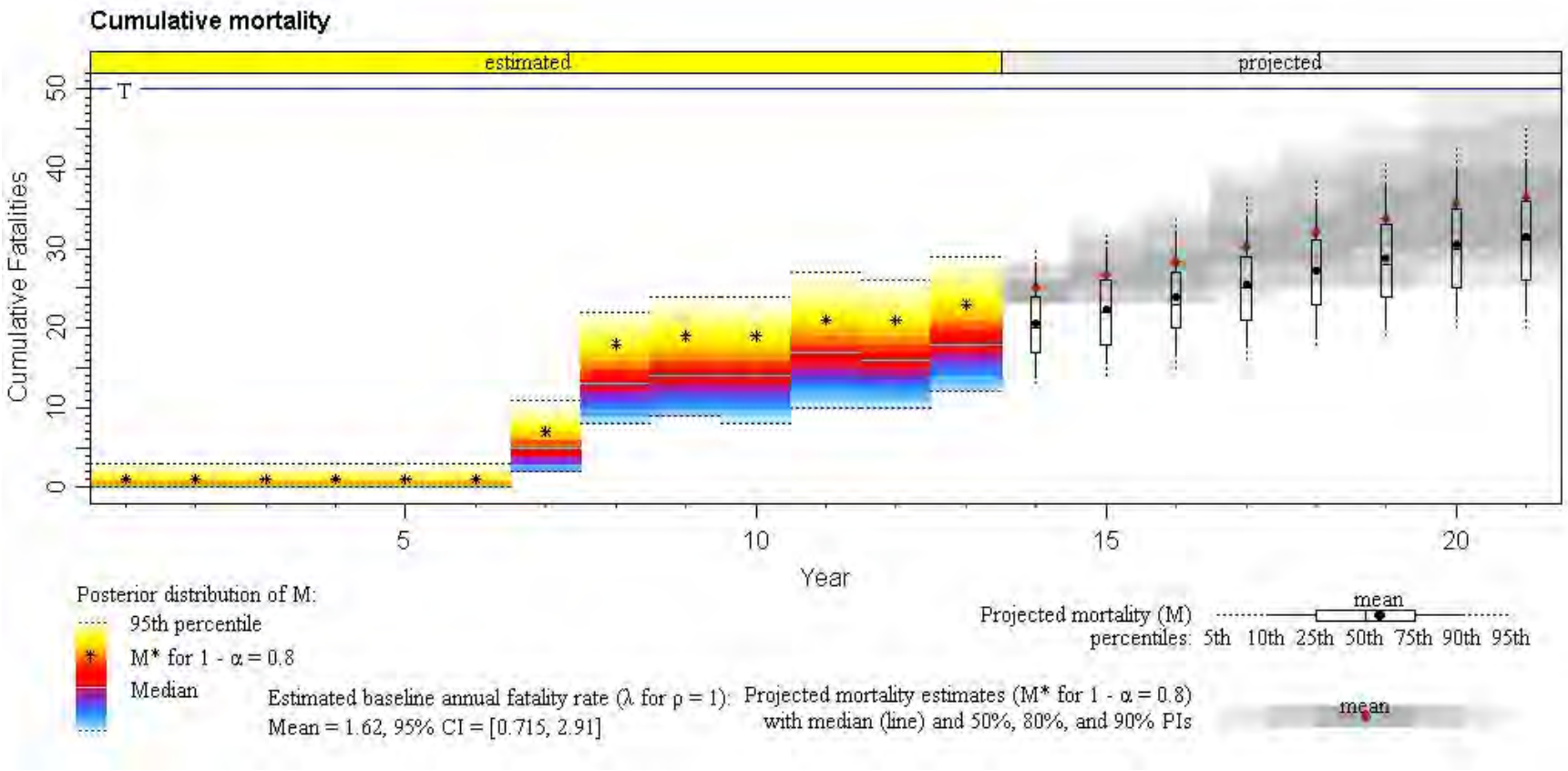


Note: The projected take displayed in Appendices 22, 23 and 24 represents *only the direct take* and does not include any additional indirect take. The number of years displayed in these Appendices represents the number of unique periods used in the projection, not necessarily the number of years. In each Appendix the length of time displayed equals 19.5 years, the expected time operating turbines through the 20-year permit. The direct take estimate at the 80% credibility level is presented as M*(symbol * and). The shaded gray bars are the probability intervals (PI) around the estimate at the 80% credibility level and do not represent any user chosen credibility level. The horizontal blue line (with a T) represents the baseline permitted take (including both direct and indirect take) for nēnē (Appendix 22) and the total permitted take for both HAPE and the Hawaiian hoary bat (Appendices 23 and 24).

Appendix 23. Hawaiian Petrel Projected Take



Appendix 24. Hawaiian Hoary Bat Projected Take.



Appendix 25. 2017 Special Use Permit Report and Renewal Request West Maui Natural Area Reserve: Kahakuloa Section West Maui Forest Reserve (Makamaka'ole Section – Enclosure B) Makamaka'ole Seabird Mitigation site.

2017 Special Use Permit Report and Renewal Request

West Maui Natural Area Reserve: Kahakuloa Section

West Maui Forest Reserve (Makamaka'ole Section – Enclosure B)

Makamaka'ole Seabird Mitigation site

This permit report and renewal request will update the Board of Land and Natural Resources or authorized representatives, on the accomplishments at Makamaka'ole for 2017 and review the requirements necessary to renew the NARS Special Use Permit and the DOFAW Special Use Permit.

Introduction

TerraForm Power LLC owns the Kaheawa Wind Power (KWPI and KWPII) facilities at Kaheawa Pastures, West Maui. In accordance with the State and Federally approved Habitat Conservation Plans (HCPs) for both projects, a final mitigation plan was approved on January 2012 to establish two artificial nest sites protected by separate predator resistant enclosures. The enclosed nesting sites are located across the northwestern edge of NARS land, the adjacent leased ranch area and a portion of the West Maui Forest Reserve (Figure 1 and 2). These nest sites are intended to attract Hawaiian petrels *(Pterodroma sandwichensis)* and Newell's shearwaters *(Puffinus newelli)* and provide a net conservation benefit to mitigate for the estimated take of both species at KWPI and KWPII.

Figure 1. Two completed enclosures on the Makamaka'ole Seabird Mitigation site (Enclosure B: left, Enclosure A: right).

On September 5, 2013 KWPI/KWPII completed construction of the two enclosures whose area encompasses approximately 7.9 acres. Both enclosures were constructed using guidelines established in collaboration with the NARS and DOFAW. Maui Feral Animal Removal Experts (FARE) constructed the enclosures with consultation from Steve Sawyer of EcoWorks Global.

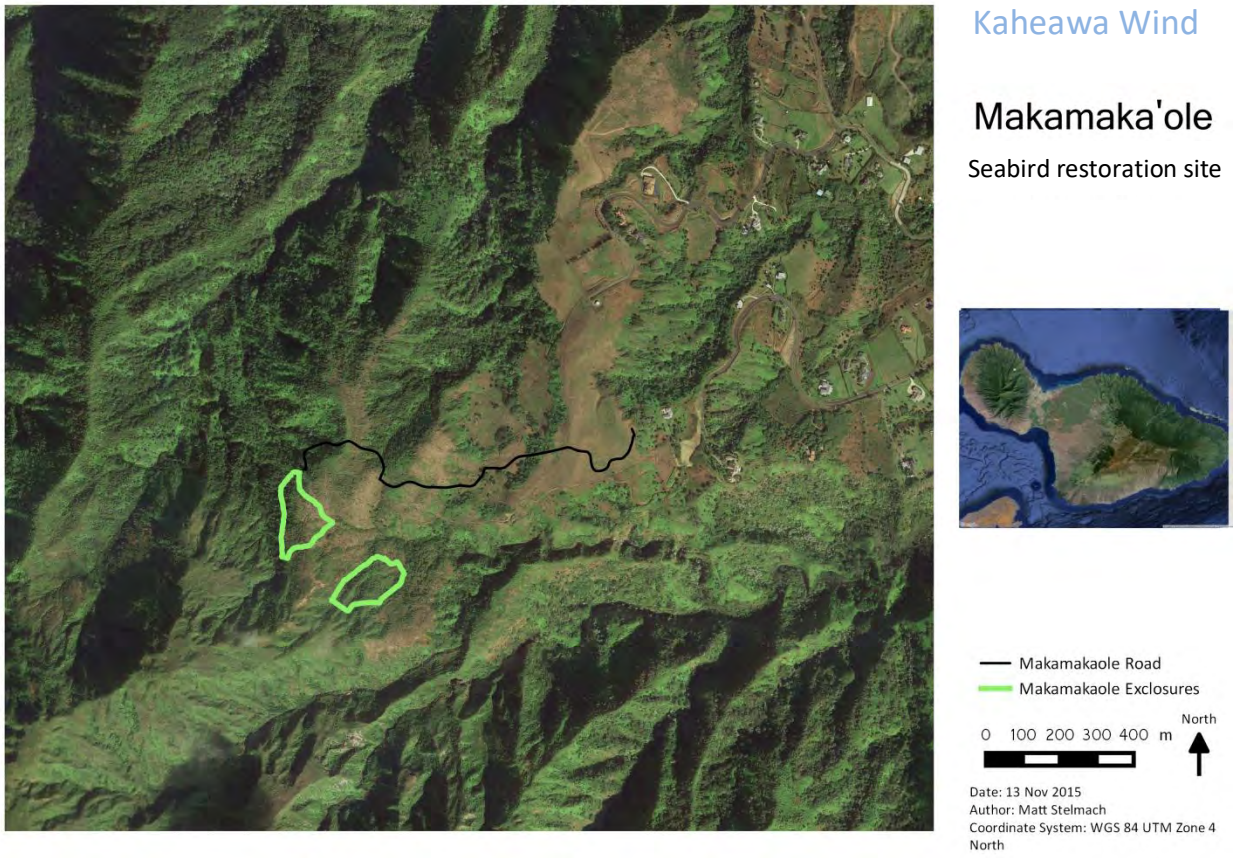


Figure 2. Map of the enclosures relative to the site access. Unit A is west and unit B is east.

Glossary of species names:

Common Name	Scientific name	Species Code
Bulwer's Petrel	*Bulweria bulwerii*	BUPE
Hawaiian Petrel	*Pterodroma sandwichensis*	HAPE
Newell's Shearwater	*Puffinus newelli*	NESH
ʻuki	*Machaerina angustifolia*	MACANG
'ohi'a	*Metrosideros polymorpha*	METPOL
Naupaka kuahiwi	*Scaveola gaudichaudiana*	SCAGAU
Manono	*Kadua affinis*	KADAFF
Kupukupu	*Nephrolepis cordifolia*	NEPCOR
Akia	*Wikstroemia uva-ursi*	WIKUVA
Hame	*Antidesma pulvinatum*	ANTPUL
Uluhe	*Dicranopteris linearis*	DICLIN
Strawberry Guava	*Psidium cattleyanum*	PSICAT
Guava	*Psidium guajava*	PSIGUA
Koster's Curse	*Clidemia hirta*	CLIHIR
Molasses Grass	*Melinis minutiflora*	MELMIN
Glory Bush	*Tibouchina urvilleana*	TIBURV
Wild Sage	*Lantana camara*	LANCAM
Branched Porterweed	*Stachytarpheta australis*	STAAUS

Table 1. A reference list of species of note for the Makamaka'ole Seabird Restoration site, with scientific names and species codes.

On February 24, 2016, Kaheawa Wind biologists met with Fern Duvall and Peter Landon of NARs. The meeting resulting in the following decisions by NARs:

1. Kaheawa Wind biologists could submit a water management plan to NARs for approval
2. Kaheawa Wind biologists Matt Stelmach and Spencer Engler are approved to conduct vegetation control within 1m of the fence before the birds return as an interim measure. NARs would like to see us come up with a long-term solution that would be low maintenance and effective. The primary concerns of NARs are:
    a. Continual disturbance of the vegetation, which allows non-native species to grow
    b. Damage to native species, specifically uluhe surrounding burrows.
3. NARs has approved the completion and removal of the following permit condition subject to the findings of an independent survey of the site:

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC take responsibility for the introduction of rye grass to the project area and must provide all measures to ensure that it does not become established within the NAR. The rye grass is expected to die out on its own, but Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC will continue to monitor it. If the rye grass persists, the removal will be the responsibility of Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC.

4. NARs approved the use of burrow covers as outlined in the 2016 Makamaka'ole annual report.
5. NARs suggested that alternative trapping methods may be approved on a case-by-case basis.

Results:

1. On March 1, 2017, Fern Duvall authorized the implementation of the KWP Makamaka'ole Ditching Proposal 20170227 (see Appendix A). We have implemented the plan and the attached photos show the results (See Figure 3):

Figure 3. A photo of the ditching from top (right) and bottom (left) after the ditching and outplanting.

2. Stainless chain-link to retrofit the fence is estimated to cost over $200,000. Adding the cost of labor to rebury the skirt makes this option too expensive. We request as a standard permit condition that quarterly vegetation maintenance includes weed whacking within 1m of the fence line and digging to rebury as necessary to maintain an effective barrier.
3. Kaheawa Wind contracted Starr Environmental to complete the vegetation survey of unit A (see Appendix B). No rye grass was found. NARs has approved the removal of this permit condition.
4. Burrow covers have been implemented on a limited basis to cover the active burrows. NARs suggested that alternative trapping methods may be approved on a case-by-case basis.
5. No alternate trap methods for mammals have been implemented.

*NARS Permit conditions appear in **BOLD GREEN** text.*

*DOFAW permit conditions appear in **BOLD BLUE** text.*

Kaheawa Wind responses will appear in plain text.

Seabird restoration:

NARS:

Besides conditions stipulated here, the permit holder will adhere to project specifications given in the permit application.

Access to monitor burrows that have been selected as nesting sites must be determined by consultation with experts on Kauai, Oahu and Maui (Andre Raine, Lindsay Young, and Jay Penniman, respectively).

In the predator-free enclosed area, biologists will establish artificial burrows with nesting material, and deploy them along with audio recordings that will specifically attract these species of seabirds.

Sea bird surveys will be conducted by qualified trained specialists familiar with NESH and HAPE nesting ecology.

Social Attraction and Artificial Burrows

Artificial burrows and species-specific song playback and decoys have been designed to encourage the Newell's shearwater and Hawaiian petrel to nest within predator-free enclosures. The playback system broadcasts pre-recorded songs of each species through external, weather resistant speakers (four speakers in A and two speakers in B). NESH songs in enclosure A and HAPE songs in enclosure B are broadcast daily from dusk until dawn. On October 27, 2015, NARS (Fern Duvall) approved year-round playback, as recommended by Steve Sawyer. Previously we broadcast songs from March through November. In 2016, at the suggestion of Steve Sawyer, we added song files provided by Maui Nui Seabird Restoration Project (MNSRP) to increase diversity to the playback with additional 'local dialect'.

Constructed nest boxes that measure 40cm x 50cm x 50cm and use 1.27cm marine-grade plywood have been fitted into carefully prepared excavations. Substrate removed during the excavation was used to fill in around the nest boxes and burrow passages. Artificial burrow entrances attached to the nest boxes are flexible, ribbed irrigation tubing (approximately 15cm diameter and 1.5 to 2m long) that allows the passage to include a 90º bend, a configuration found in naturally excavated petrel and shearwater burrows. The nest box lid enables easy inspection of the nest box and is even with or slightly above the ground level.

We placed all the burrows within 25m of the playback speakers and at higher elevations within the enclosures where vegetation is denser. Birds are expected to be most attracted to the immediate vicinity of the speakers as has occurred at other successful acoustic attraction projects. We have placed custom fabricated HAPE and NESH decoys to simulate adult birds resting or staging at nearby burrows (Figure 4).

Figure 4. NESH (left) and HAPE (right) decoys near burrow entrances.

In 2017, we recorded NESH, HAPE, and BUPE visitations to multiple burrows. Appendix B lists all game camera observations. The top two photos in Figure 5 show a NESH and a HAPE utilizing a burrow naturally created in nearby uluhe, and the bottom two photos show birds utilizing artificial burrows.

Figure 5. Game camera captures of seabird visitation over multiple nights in 2017.

Night Surveys

Appendix C lists monthly night survey observations. Night survey was conducted monthly to confirm activity as observed on the camera and get added clarity for bird activity. Birds of both species were observed circling over the enclosures and utilizing the nearby Makamaka'ole stream channel. Additionally, observation of barn owls was recorded to supplement the removal efforts.

Burrow Monitoring:

In 2017, we coordinated nest box assessment with the Maui Nui Seabird Restoration Project (MNSRP). On August 24th, MNSRP staff accompanied Kaheawa staff to scope and inspect all active nest boxes at Makamaka'ole. Burrows which did not have adults present and were known to have activity were opened. A total of four burrows were opened on August 24th, eggs were observed in three of the four burrows, with one burrow having a second egg. On November 9th, all burrows were examined for activity by Kaheawa Wind biologists and MNSBRP biologists. Results of all burrow monitoring can be found in Appendix D. This season three NESH eggs and one BUPE egg were recorded from Makamaka'ole. Full reports on collections can be found in Appendix E.

Acoustic Playback:

In 2015, NARS approved year-round song broadcasts that continued to be from 10 minutes after sunset to 10 minutes after sunrise. In February 2016, we received a call file from Jay Penniman, created by Jeff Schlueter of Conservation Metrics. The file is a mix of HAPE and NESH explained as "The HAPE sounds are pretty much all pulled from the 2015 recordings at SPID Waikamoi_9. The NESH sounds are from Kauai: some from Pohakea in Hono O Na Pali, and others from Upper Limahuli. We blended multiple clips together to get a higher density of calls and both species going at once."

We added these new acoustic playback recordings in February 2016 as every 5th sequence (i.e. four species-specific sequences of calls, then the mixed recording sequence). Throughout the breeding season, we observed and heard NESH responding to the vocalizations in the acoustic playback on night surveys. NESH also occupied burrows HAPE had visited in 2015.

In July 2016, there was a notable absence of HAPE circling above enclosure B (where HAPE only calls had been broadcast in previous years) during night surveys and ground based video recordings at burrows in enclosure B. we were unsure if the mixed sequence newly added could be interfering with HAPE attraction and therefore we removed the mixed calls from the acoustic playback in B in August 2016. Since August, the playback in enclosure B has only HAPE calls. Subsequently, we observed NESH circling the enclosure at A and on game cameras in A, while HAPE and NESH were observed circling at B.

Temperature:

NARS:

Temperature fluctuations inside of the burrow boxes must be reduced. This may take place after consultation with DOFAW-NARS staff and with MNSRP and Pacific Rim on workable suggestions that are not detrimental to the NAR site, and yet would allow nesting success.

In 2017 after consultation with NARS staff Fern Duvall and Peter Landon, approval was received to utilize the "Standard Box Cover" (as described in the 2016 report) as needed to maintain burrow temperatures. Box covers were installed on active burrows in A, all burrows in B have covers from 2016.

Figure 6. Final insulation box design in place over a burrow.

Easement:

DOFAW:

Because the State Forest Reserve is 'land locked', access through other land parcels (State Leased, subdivision and Natural Area Reserve) should be arranged between permittee and land/property managers, respectively.

We have contacted several land managers to formalize easements through the required access parcels including; Daniel Ornellas of the DLNR Land Division, Sunny Palmer of Commercial Properties of Maui Management Inc. representing the Maluhia Country Ranches Home Owners Association, and Kathleen Kensinger (the nearest neighbor to the state parcels). For private parcels, draft easements have been submitted to the homeowners for review, when the format has been approved we can finalize the agreements.

We have a "Meets and Bounds" legal description for the road through parcel TMK 231006003 shown in Figure 7. We continue to work with Daniel Ornellas to secure an easement for the parcels in question. We currently have verbal agreement with the land owners approving access to the site.

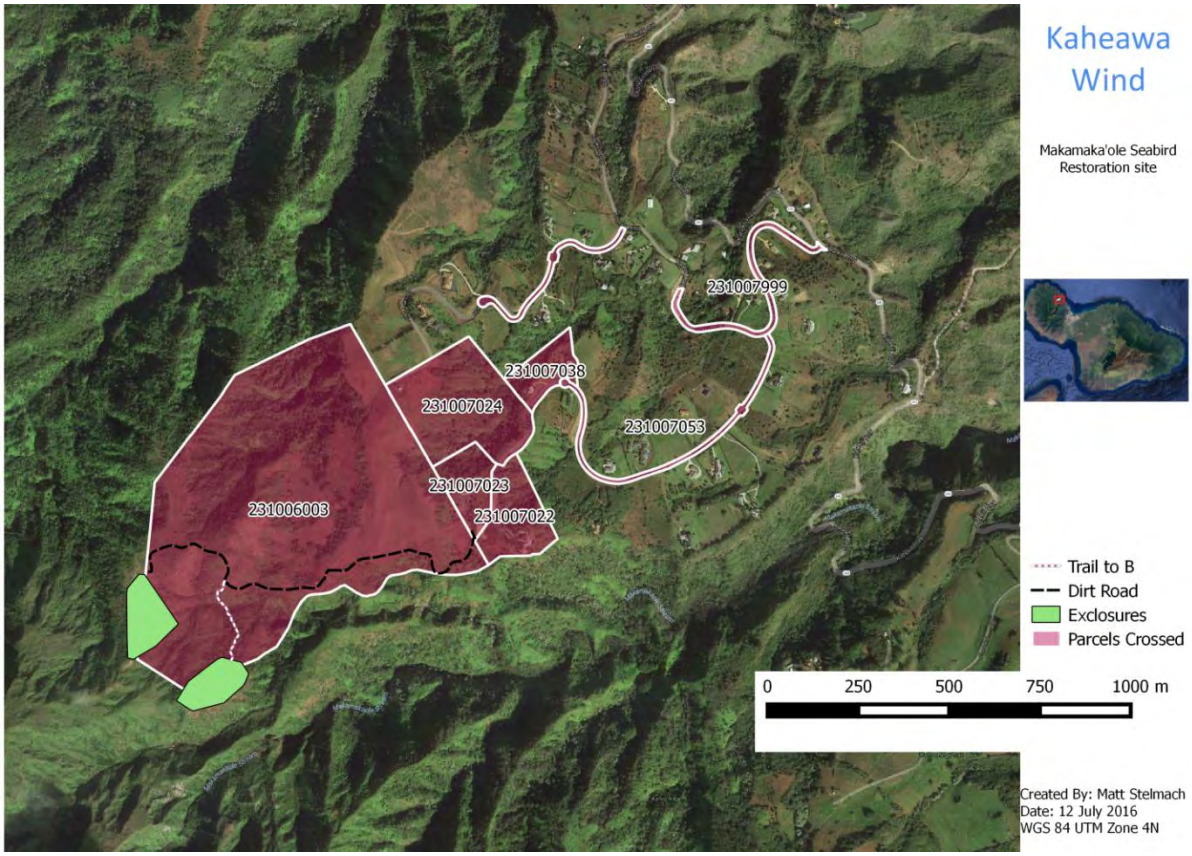


Figure 7. Parcels that must be crossed to access the Makamaka'ole Seabird Restoration site.

Vehicular Travel and Roadways:

NARS:

All vehicle traffic must stop at the NARS ungulate fence.

DOFAW:

Motor vehicles shall be used only on established roadways. Please carry a fire extinguisher and/or shovel in your vehicle while in State Forest Reserves. Vehicle catalytic converters have started wildland fires and you will be able to extinguish fires easily with these tools if fires are noticed early. Contact 911 if necessary. Please do not park in tall grass.

All vehicle traffic must stop at the NARS ungulate fence. Vehicular traffic prohibited to and from NARS ungulate fence to Enclosure B. Enclosure B may only be accessed on foot or by helicopter. A flight plan must be submitted and approved by the District Forest Manger Supervisor for all helicopter access into the State Forest Reserve.

All vehicle access stops at the NARS ungulate fence. Access to enclosure B is from the road via footpath.

Enclosure security:

NARS:

Doors to the two enclosures were revised so that they are more substantial than hinged plywood and can be self-locking. They will remain locked to protect decoy and acoustic equipment, nesting birds, and reduced the potential for ingress by predators.

DOFAW:

Doors to enclosure B will remain locked to protect decoy and acoustic equipment, nesting birds, and reduced the potential for ingress by predators. SunEdison will provide and maintain appropriate signs to create awareness for the project and identify contact person and/or number to gain access, if needed.

The doors to both enclosures have self-locking clasps and springs to ensure they remain closed. The doors are locked with padlocks and the combinations are changed regularly. When combinations are changed NARS and DOFAW staff are provided with updated combinations.

Predator control:

NARS:

Biologists will establish and maintain a predator control grid to initially remove all predators from inside the enclosures, utilizing traps specifically for each predator (mice, rats, mongoose, feral cats, dogs, barn owls) in the fenced areas. Traps used will be modified conibear-style and Doc-200 traps that will target cats and mongoose within the enclosure. These traps will be placed along landscape features such as ridgelines, near water sources, and in preferred microhabitats such as areas and tracks in which target species are most likely to travel, including a 100-meter buffer outside the enclosures.

The DOC-200 traps consist of spring-loaded clamps that are enclosed in wooden boxes with screen mesh sides; an animal must to pass through two successive small entry holes in order to access the bait and trap itself, thus discouraging non-target species (such as burrowing seabirds) from entering.

Conibear traps are body-grip traps that are not contained in a box, but are easily secured to a set point and also discourage non-target species. As an additional precaution, only snap traps and Doc-200 traps will be used during the nesting season inside the enclosures.

During the breeding season Doc-200 traps will be checked every week and maintained as necessary; Conibear traps will be checked daily. Signs alerting visitors entering the buffer areas to the presence of traps will be posted.

The locations for the 2017 traps are in Figure 8.

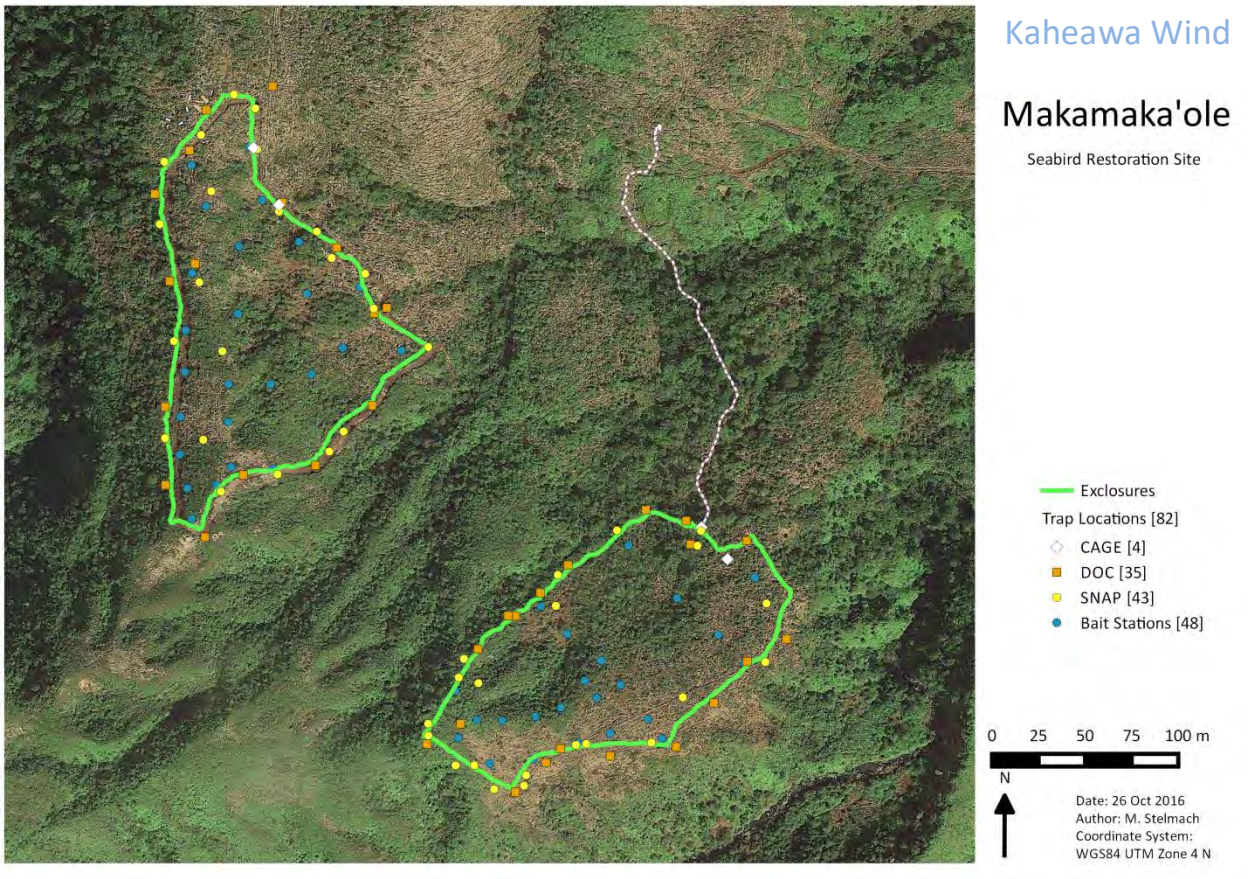


Figure 8. Locations of all predator control traps at the Makamaka'ole Seabird Restoration site (trap locations within 5m of actual location).

Trap Bait:

Peanut butter is the catchall bait for rats and mongoose. We have seen that it is an effective lure for these target species. However, the hot and humid climate at Makamaka'ole causes rapid molding of the bait, leading to an effective period of less than one week. Therefore, we have sought baits that will have a longer life.

Mustelids show a strong attraction to eggs. We have seen effective use of eggs for up to one month, with a peak attraction lasting up to two weeks. Some issues with longer bait life are non-target attraction of flies and ants.

We have communicated with Sean Moura who has been developing wax based baits. We tried bait he provided and modified his formulas to provide improved longevity. We tried a peanut butter based formula and a fish based formula. Each of these baits showed effective periods up to two weeks, with some blocks showing signs of chewing past two weeks. We have been pleased with this improvement and plan to continue to use wax baits (Table 2).

Trapping Summary			
Enclosure	**Inside/outside**	**Species**	**Count**
A	Inside	Mouse	9
		Rat	11
	Outside	Mongoose	31
		Mouse	7
		Rat	69
B	Inside	Mouse	2
		Rat	3
	Outside	Mongoose	18
		Mouse	1
		Rat	40

Table 2. Trapping success for 2017 by target and location.

We continue to deploy Ramik™ in trap boxes, checked bi-weekly, and changed as needed.

Tracking Tunnel Results:

In 2017, tracking tunnels were deployed inside enclosures, bi-monthly. Each enclosure contains 10 tracking tunnels. Tracking cards are deployed for three nights for mongoose and one night for rodents. The proportion of cards with activity can be found in Table 3.

Tracking Tunnel Summary								
Enclosure	**Species**	**1**	**3**	**5**	**6**	**7**	**9**	**11**
A	Mongoose	0	0	0	0.1	0	0	0
A	Rat	0	0	0	0.2	0	0.2	0
B	Mongoose	0	0	0	0	0	0	0
B	Rat	0	0	0	0	0	0	0

Table 3. Tracking tunnel activity by month for 2017.

Challenges:

Several issues have been challenging. Our goal continues to be exclusion of all predators and the fence does work as a strong deterrent. Nonetheless, the fence design is susceptible to erosion and soil movement and rats and mice can enter the smallest holes.

We continually improve the integrity of the fence. So far, we have:

1. Used rebar to stake down areas where the fencing skirt is exposed.
2. Used expansion foam to fill gaps formed in overlaps in the fence itself and around the culvert grates due to ground settling.
3. Repaired and replaced rusted hardware as needed.
4. Used a smoke machine to test holes found around the fence to determine if the holes dead end or create an opening to the exterior.

Despite these efforts we detected rodent activity inside of both enclosures. Our goal is to maintain the interior of the enclosures 100% rodent free.

We would like to modify the NARS permit condition to be "Weedeaters can be used quarterly within 1m of the fenceline. Only qualified staff trained in plant identification will be permitted to use weedeaters." We would use weedeaters along the fence line (within 1m of the fence on either side) of both enclosures and outside the breeding season (November 1 to March 31). Our goal is to expose the skirt to be able to look for holes caused by rodent digging and erosion. Weedeaters are a fast and effective tool, removing the above ground vegetation while leaving the roots to stabilize the soil. DOFAW has already given permission to use weedeaters to clear the fence line in enclosure B.

We also request permission to rebury the skirt as needed to ensure that our fence line is secure. Currently the erosion along the fence line is our greatest concern, however rats can dig up to 3m tunnels which would be more than sufficient to get underneath the skirt. DOFAW has already given permission to rebury the skirt as needed to maintain the predator exclusion integrity.

We will continue to investigate the feasibility of additional trap types such as those outlined below:

- Drowning traps with bird exclusion: https://www.youtube.com/watch?v=D47P1TgZ7ZE
- Goodnature A24 traps: http://www.goodnature.co.nz/products/rat-stoat/
- Box/cage traps
- Nooski ring traps: http://www.nooski.com/
- Ka Mate traps: http://www.kamatetraps.com/trap-introduction.html

In summary, we are seeking permission to:

1. **Use weedeaters adjacent to the fence within the NAR,**
2. **Rebury the skirt along both enclosure fences.**

Barn Owl Control:

In 2016, Kaheawa Wind and the DLNR-DOFAW signed a Memorandum of Understanding to control barn owls at Makamaka'ole. While the combination of fencing and trapping has proven a strong deterrent to rats, cats, and mongoose, seabirds are still susceptible to avian predators. Dr. Andre Raine of the Kauai Endangered Seabird Recovery Project has documented barn owls preying on multiple seabird species. Barn owls are present at Makamaka'ole and therefore pose a threat to both Hawaiian petrel and Newell's shearwater. DOFAW and Kaheawa Wind Biologists remove barn owls from the site to reduce the risk to our target restoration species. Our federal Migratory Bird Depredation permit MB19697C-1 allows all control work.

TERP provided funding to DOFAW in January 2017 and control work began in March 2017. In 42 nights of control attempts three owls were removed. Control methods involved placing visual lures (mice in cages) on T posts at various locations around a clear vantage point. Acoustic lures of mouse

distress calls proved to be effective at attracting owls in to control personnel. The control location was just off the trail to B where there is a clear view of the gulch and both enclosures.

We observed that owls frequent the gulch areas between and below the enclosures and follow this habitat feature to Makamaka'ole stream. Owls were most visible on clear nights with available moonlight. With clouds or no moon, it was difficult to spot owls. Additionally, ambient light from Kahului to the east made observation to the east difficult on moonless nights.

KWP staff set up two trial locations for trapping owls. One was just north of enclosure A and one was between the enclosures. Traps were constructed out of plywood and baited with visual and acoustic lures. Visual lures used were three live mice in a small cage, as well as a predator lure made by IcoTec. An acoustic lure was also used to play mouse and/or rat distress calls. In 28 nights of trapping, no owls were captured.

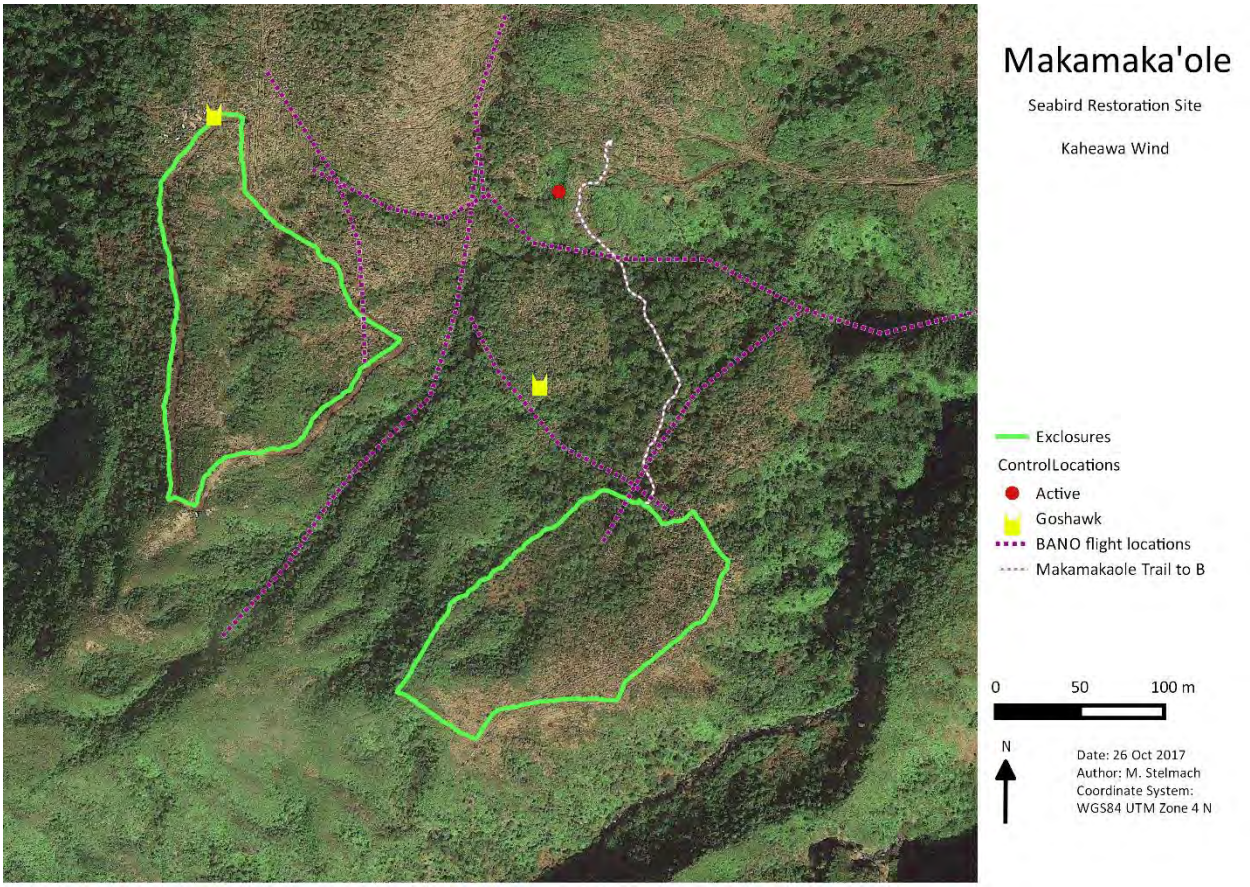


Figure 9. The map above shows approximate owl flight patterns and control locations.

Figure 10. The Swedish goshawk trap design is pictured above. Two doors close when downward pressure is applied to the central bar. Speakers below the trap broadcast an acoustic lure and caged mice inside the trap provide a visual lure.

Native Vegetation:

NARS:

Native plant species will continue to be propagated and will be used instead of non-native alternatives for future disturbance areas. Current disturbance areas will also be restored with native plant species where possible (I.e., fence scar, areas where excavator caused damage). A minimum of 500 native plants are to be planted during 2016.

Permit holder removed traps and listening stations from areas with uluhe [DICLIN] vegetation in 2015. No further disturbances will occur in the native uluhe areas or other native vegetation areas.

In areas where ground may be exposed, temporary erosion control mesh and/or low-statured non-invasive ground cover (preferably native species) will be used to fill in the cleared areas and stabilize the soils. Recommendations for appropriate species will be reviewed and approved by NARS staff prior to planting.

DOFAW:

SunEdison LLC must receive prior approval from the District Forest Management Supervisor for all outplanting projects. An outplanting plan consisting of plant species, number of plants, seed source, and location of planting sites must be submitted to the District Forest Management Supervisor.

Following the guidance of DOFAW and NARS and the 2011 Botanical Survey (Starr, 2011) we have prioritized the species in Table 4 for outplanting:

Hawaiian Name	Scientific Name
Maile	*Alyxia oliviformis*
Hame	*Antidesma playtyphyllum*
Kanawao	*Broussaisia arguta*
Uki	*Machaerina angustifolia*
Kupukupu	*Nephrolepis exatata*
Uluhe	*Dicranopteris linearis*
Kawau	*Ilex anomala*
Ieie	*Freycinetia arborea*
Kopiko	*Psychotria mariniana*
Naupaka kuahiwi	*Scaevola chammisoniana*
Hoi kuahiwi	*Smilax melastomifolia*
Ohe mauka	*Tetraplasandra hawaiensis*
Akia	*Wikstroemia oahuensis*
Ohia	*Metrosideros polymorpha*
Manono	*Kadua affinis*

Table 4. Priority outplanting species.

In 2017, we planted species according to need and availability of seed collected from approved sources (Table 5).

Enclosure	Plant Species	Sum
A	*Machaerina angustifolia*	289
Total		289

Table 5. Native outplantings throughout 2017.

Non-native vegetation:

NARS:

Permit holder will control weed recruitment in disturbance areas. Regular herbiciding and weeding without motorized tools must occur once every 3 months. Weeding and herbiciding must occur in areas along the fence corridor inside and outside the enclosures, within the enclosures and to all disturbed areas that were created by First Wind (SunEdison). Weeds to target are clidemia [CLIHIR], tibuchina [TIBURV], Molasses grass [MELMIN], and guava [PSICAT and PSIGUA].

DOFAW:

SunEdison LLC to control weed recruitment (mechanical and chemical) within disturbance areas (fence corridor, re-aligned ungulate fence corridor, access routes to and from Enclosure B, and burrow sites) and maintain zero tolerance for weed species.

We conducted quarterly weed removal (Table 6).

Makamaka'ole Weed Control			
Application Date	**Product Applied**	**Target Species**	**Enclosure**
19 January	Honcho	PSICAT	A
2 February	Honcho	PSICAT	A, B
3 February	Honcho	PSICAT	B
18 May	Honcho	PSICAT, TIBLON, CLIHIR	B
25 May	Honcho	PSICAT, TIBLON, CLIHIR	A
11 August	Honcho	TIBLON, CLIHIR, MELMIN	A, B
14 December	Honcho	TIBLON, CLIHIR, MELMIN	A, B

Table 6. Non-native plant management actions taken in 2017.

NARS:

First Wind (SunEdison) takes responsibility for the introduction of rye grass to the project area and must provide all measures to ensure that it does not become established within the NAR. The rye grass is expected to die out on its own, but First Wind (SunEdison) will continue to monitor it. If the rye grass persists, the removal will be the responsibility of First Wind (SunEdison).

We had used out planting of annual rye grass to stabilize soils exposed by fence construction and to prevent erosion. We had planted rye grass plantings along the exterior of the fence lines to provide short-term cover. We monitor for rye grass during regular fence checks and it is no longer detectable. No other control measures are required for the rye grass to be extirpated from the site.

Following our discussion on February 22nd, we contracted Starr Environmental to conduct a vegetation survey of the Makamaka'ole seabird restoration site. The target species was rye grass with additional instruction to monitor for additional new species which may have been introduced with the rye grass. I have attached a copy of the report (Appendix F) produced which states:

"No annual rye grass (*Lolium multiflorum*) was observed at or near the site. There is the possibility that seeds could exist in the soil and someday germinate, but we did not currently find this short-lived species in the areas surveyed."

We would like to remove page 2 paragraph 5 from the Special Use Permit which states:

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC take responsibility for the introduction of rye grass to the project area and must provide all measures to ensure that it does not become established within the NAR. The rye grass is expected to die out on its own, but Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC will continue to monitor it. If the rye grass persists, the removal will be the responsibility of Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC.

Approval for this request was received on November 9, 2017 from Fern Duvall (Appendix G).

NARS:

Precautions will be taken to prevent introduction of plants or animals not naturally present in the area. Should an infestation develop that is directly or indirectly attributable to the project, the permit holder is responsible for eradication by methods to be specified by NARS – whether it occurs during or up to 10 years after the permit period. Permit Holder is responsible for ensuring that all clothing and gear is cleaned before entering any Natural Area Reserve.

DOFAW:

All equipment and work gear (hiking boots, clothing, etc.) will be cleaned at an off-site location (TBD) prior to entry of Forest Reserve to prevent the spreading of noxious weeds.

Cleaning procedures will include both high-pressure air and power washing. Additional inspections will be conducted by permittee and if deemed necessary, agency representative.

Kaheawa Wind staff use dedicated equipment, for use solely at Makamaka'ole to prevent the introduction of non-native species to the project site. Visitors are provided with the following instructions:

> "The site we are visiting is a sensitive ecological area and a Natural Area Reserve. We will be responsible for any introduced non-native species, which is potentially very costly. **Please use a brush to scrub your boots, remove the laces and brush any seed out from under the tongue to help us prevent the spread of pest species.** This also applies to clothes; washed clothes should be sufficient to prevent seed transfer."

In addition, Kaheawa staff received and implements BMPs provided by Lance DeSilva on 9/1/2016 for preventing the spread of Rapid Ohia Death.

Disturbance of vegetation and soils:

NARS:

Disturbance of vegetation and wildlife will be avoided as much as possible. Do not leave trails. With the exception of the enclosures being installed to protect nesting bird activities may not impede public access, where allowed.

Hand clippers will be used around entrances to bird burrows. Weedeaters are not allowed.

The remaining 18 bird burrows were installed within enclosure A in 2015. Any future ground disturbances must be approved by DOFAW-NARS staff.

DOFAW:

SunEdison LLC must receive prior approval from the District Forest Management Supervisor (in consultation with District Wildlife Manager) to install any additional bird burrows in Enclosure B during this permit period.

Each enclosure contains 50 burrows, the last of which were installed in 2015. No new burrows were installed in 2017. No additional burrows are currently planned. No weedeaters are used in burrow maintenance.

NARS:

Culverts in Enclosure A will continue to be monitored for effectiveness and necessity and may need to be modified, reduced in size, or restored based on the findings and recommendations of DOFAW staff. First Wind (SunEdison) will continue to maintain flumes and other infrastructure to ensure water or debris is not washing into the ungulate fence. Any ditching or water diversion action to take place must be approved by DOFAW-NARS staff.

Concrete will be allowed only to patch existing concrete forms for culverts. Retention basins will not be paved.

Culvert repairs are continuous and ongoing. To better target our efforts, we used a fog machine to detect holes that connect around the culverts. We used foam gap filler around the grates to ensure that all gaps were sealed. We made patches to holes as needed, and the retention basins remain unpaved. Photos of each of the culverts are shown in Figure 11. Flumes for each culvert are in place and are monitored regularly.

Figure 11. Current condition of various culverts inside enclosures A and B.

DOFAW:

Disturbance of vegetation and wildlife will be avoided as much as possible. Do not leave trails. Except for the enclosures being installed to protect nesting birds, activities may not impede public access, where allowed.

Potentially sensitive botanical, wildlife, or archeological features will be avoided.

In areas where ground may be exposed, temporary erosion control mesh and/or non-invasive ground cover will be maintained in areas to stabilize soils. Recommendations for appropriate species will be reviewed and approved by the District Forest Management Supervisor prior to outplanting.

NARS:

Potentially sensitive botanical, wildlife, or archaeological features will be avoided.

Kaheawa Wind staff, volunteers, and contractors use existing trails. We made no alterations of infrastructure that would affect botanical, wildlife, or archeological features. Erosion control measures implemented include outplanting (see Outplanting), water bar installation, and trials for non-invasive erosion control such as drip erosion prevention.

Photo points:

NARS:

Permit Holder established permanent photo points (four corners and one at the entrance of the enclosure) to show the condition of the enclosure per year.

Annual photo points were collected 10/26/2017, and can be seen in Figure 12 and 13.

Enclosure A:

Figure 12. Clockwise from upper left: Mauka west, Mauka east, Makai east, Makai west.

Enclosure B:

Figure 13. Clockwise from upper left: Entrance, Mauka west, Makai east, Mauka east.

Fire prevention, spill prevention, and liability:

DOFAW:

Permittee shall be liable for any wildfires due to his/her negligence. As a minimum, a shovel and fire extinguisher shall be on at least one vehicle while conducting this activity.

Permittee will be responsible for any damages to any improvements in the area, including existing county water lines, fences, and gates, poles and telephone lines.

All Trucks that visit the site are equipped with a fire extinguisher and a shovel.

DOFAW:

Permittee will adhere to Standard EPA prevention, safety, and spill containment protocol.

All staff follows standard EPA prevention, safety and spill containment protocol. All pesticides used on site are diluted, and only day use quantities are brought. All chemicals are transported inside secondary containment. Records for pesticide application are kept at 3000 Honoapiilani Hwy, Wailuku HI 96793.

Hours of activity:

DOFAW:

Per approved US Fish & Wildlife Depredation Permit #MB69469B-0, permittee is authorized to take twenty-five (25) barn owls as a management tool to protect threatened and endangered species. The depredation permit expires on January 31, 2017.

Hunting, open fires and littering are prohibited.

No overnight camping shall occur in the West Maui State Forest Reserve.

Permittee shall conduct fence and site repair work during daylight hours only. All other data collection/monitoring work may be permitted through all hours of the day.

Permittee shall minimize damage to the soil. Permittee shall minimize damage to the existing vegetation, with special care to the surrounding trees and adhere to all Best Management Practices.

KWP staff communicates scheduled tasks with DOFAW and NARS. All fencing activity is conducted during daylight hours. No overnight camping occurs in the project area. Planned barn owl control actions will occur after dark.

Communication:

NARS:

No work or site establishment may be done without prior approval of NARS Staff.

While the permit holder bears ultimate responsibility for carrying out this project under the terms of the permit, the following personnel may be directly or indirectly involved at some time in the predator control, social attraction, and long-term maintenance and monitoring: First Wind (Sun Edison): Mr. Dave Cowan, Mr. Mitch Craig; DOFAW: Dr. Scott Fretz, Dr. Fern Duvall, Mr. Lance DeSilva, Mr. Peter Landon; SWCA Consultants: Mr. Jaap Eijzenga, Dr. Ling Ong; Pacific Rim Conservation : Dr. Eric Vanderwerf, Dr. Lindsay Young; National Tropical botanical Garden: Mr. Ken Wood. Additional personnel may be added to the project as needed.

DOFAW:

To avoid conflict with other DOFAW programs, our office will be provided with at least two weeks notice of dates of planned helicopter activities within the State Forest Reserves via email to Lance.K.Desilva@hawaii.gov.

Kaheawa Wind staff notified NARS and DOFAW of planned activities.

NARS:

(A) A field report will be submitted within 5 weeks of the project's completion. (b) Results of the project, as published or unpublished reports, also will be submitted. (c) The reports will identify the Natural Area reserve as a project site and acknowledge the special use permit approved by the NARS Commission.

This report constitutes the annual report and permit renewal request.

Status of Permits and Authorizations

All the lands involved are in the Conservation District, and a Site Plan Approval for the project was issued by the DLNR/OCCL on January 11, 2012. The NARS requires issuance of a Special Use Permit while DOFAW must approve the project and issue an Access Permit that would enable the project to be implemented within the West Maui Forest Reserve. The initial NARS Special Use Permit was received on December 17, 2012 and is renewed annually. The current NARS Special Use Permit was issued for the period of February 17, 2017 to February 16, 2018. DLNR Forestry Access Permit was issued on December 10, 2012 and is also renewed annually. The current DLNR Forestry Access Permit was issued for the period of March 1, 2017 to February 28, 2018.

This project may span several years or even decades. Should the project be terminated or otherwise determined no longer practical or warranted, the fence and artificial nesting burrow materials would be removed and the disturbed areas stabilized in accordance with recommendations and guidance approved by the NARS and DOFAW.

Summary

This project promotes important conservation for both species and increases their potential for recovery in the West Maui ecosystem. In addition, this project also promotes public outreach and education.

Kaheawa Wind biologists, consultants, and collaborators will take all practical measures and follow prescribed protocols and procedures when working in the Natural Area Reserve and State Forest Reserve lands to minimize damage to natural, geological, or cultural resources. While temporary impacts occurred during clearing for fence construction and installation of artificial burrows, the areas disturbed are recovering.

Our staff controls the ingress of unwanted invasive species and minimizes the effect of erosion. Kaheawa Wind biologists continue to coordinate with DOFAW, Maui NARS, and USFWS personnel on the scope of the project.

Summary of proposed activities in the West Maui Kahakuloa Section and West Maui Forest Reserve:

Kaheawa Wind will continue to maintain the following protocols:

1. Social attraction of Hawaiian petrel and Newell's shearwater with acoustic playback and decoys.
2. Maintenance of artificial burrows to promote colony establishment.
3. Continued out planting of plants as needed to maintain soil stability.
4. Continued monitoring to evaluate the success of colony establishment.
5. Maintenance of the vertebrate predator exclusion fence.
6. Maintain the vertebrate pest control grid for rats, mongoose, and cats. Control methods include snap traps, DOC200 traps, Cage traps (outside only), and Diphacinone bait stations (inside only).
7. Maintain a barn owl control program using trapping and lethal control.

Kaheawa Wind also requests permission for the following actions:

1. Interested collaborators, colleagues, and/or volunteers not specifically listed here to participate in permitted activities when accompanied by at least one of the primary project personnel.
2. Rebury the skirt as needed to ensure that our fence line is secure.
3. Use weedeaters within 1m of the fence line while outside of the breeding season (November – March) at both enclosures.
4. ***Please note TerraForm Power, LLC owns KWP I and KWP II. We would like the permits in the name of TerraForm Power, LLC in 2017.***

Project Personnel:

Kaheawa Wind, Operations:
Spencer Engler
Mitch Craig

Collaborators:
DLNR/DOFAW
DLNR/NARS
USFWS
Maui Nui Seabird Restoration Project
Steve Sawyer

For any questions, comments, or concerns regarding this report please contact:

Mitch Craig
Kaheawa Wind I & II
HCP Manager
3000 Honopiilani Hwy
Wailuku, HI 96793
MCraig@TerraForm.com
Mobile: 808-633-3723

Literature Cited:

2006 Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan

2011 Kaheawa Wind Power II Wind Energy Generation Facility, Habitat Conservation Plan

2012 Seabird Mitigation Plan for Kaheawa Wind Power Wind Energy Generation Facility and Kaheawa Wind Power II Wind Energy Generation Facility.

Appendix A. KWP Makamaka'ole Ditching Proposal.

Kaheawa Wind Power

Makamaka'ole Seabird Restoration Site

Kahakuloa Section of the West Maui Natural Area Reserve

Ditching proposal:

The Makamaka`ole Seabird restoration site provides two mammalian predator exclosures to establish breeding colonies of Hawaiian petrel (HAPE) and Newell's shearwater (NESH). Each exclosure protects 50 artificial nest boxes. Acoustic song broadcasts attract HAPE and NESH to the site. The site was operational in September 2013, first seabirds visited in 2014 and activity increased in 2015 and 2016. Figure 1 shows both exclosures and the land management responsible for oversight within each area.

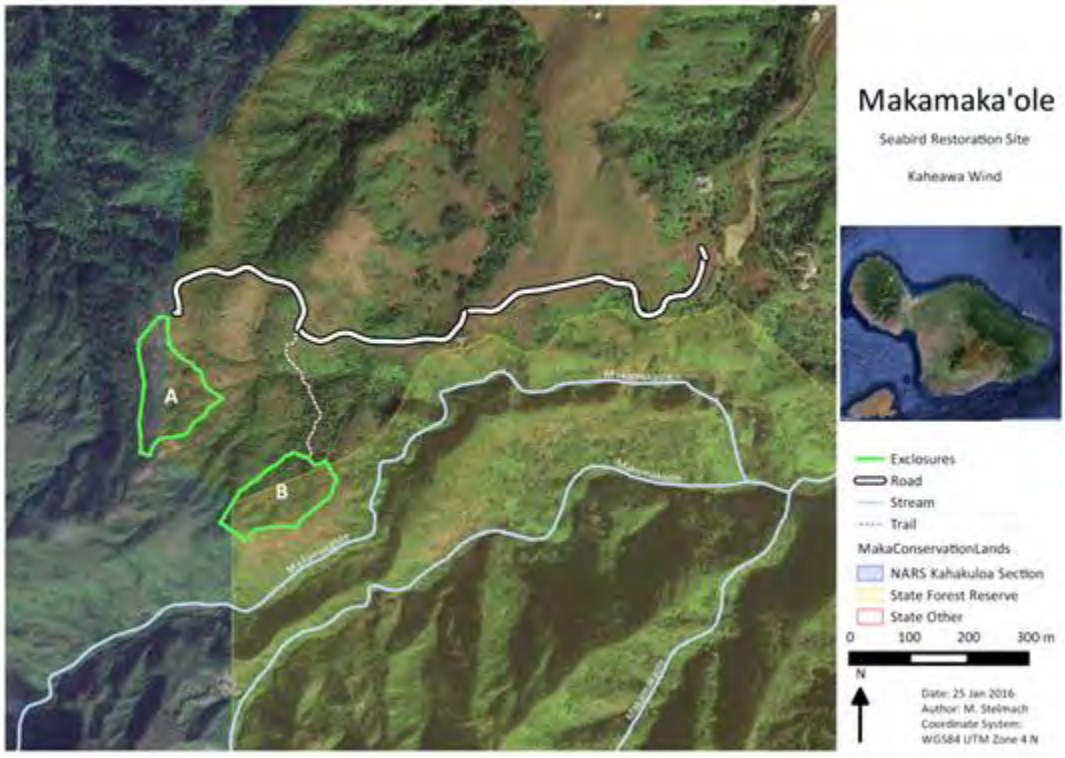


Figure 1. Two exclosures at Makamaka'ole are shown in relation to the Makamaka'ole stream bed and overlaid on land ownership.

The predator proof fences protect nesting seabirds from known predators, rats, cats and mongoose (Jamie K. Reaser, 2007; Duffy, 2010). To achieve total predator exclusion, we use a variety of traps inside and outside the exclosures and conduct tracking tunnel monitoring to assess results of trapping. Regular monitoring revealed rodent activity inside enclosure A for several months in 2016. Rodent ingress could be under, thru, or over the fence. We believe predator ingress is under and through the fence.

The exclosures are on the windward side of West Maui and receive intermittent heavy rains that cause erosion under the fences. Culverts were installed with the initial fence construction; however other drainage pathways are not captured by these culverts leading to erosion under the fence.

We propose to dig a 20m long ditch at culvert two and a 34m ditch at culvert three (Figure 2). The ditches will be no larger than 30cm wide x 30cm deep, and constructed with hand shovels (not machinery). The ditches will divert excess water to the culverts. This will minimize erosion under the fence.

The ditches would be in areas free of native species, and dominated by broomsedge (*Andropogon virginicus*) and molasses grass (*Melinis minutiflora*) (Figures 3-6). We will outplant the ditching sites with native species to provide a net benefit to the NAR and minimize disturbance.

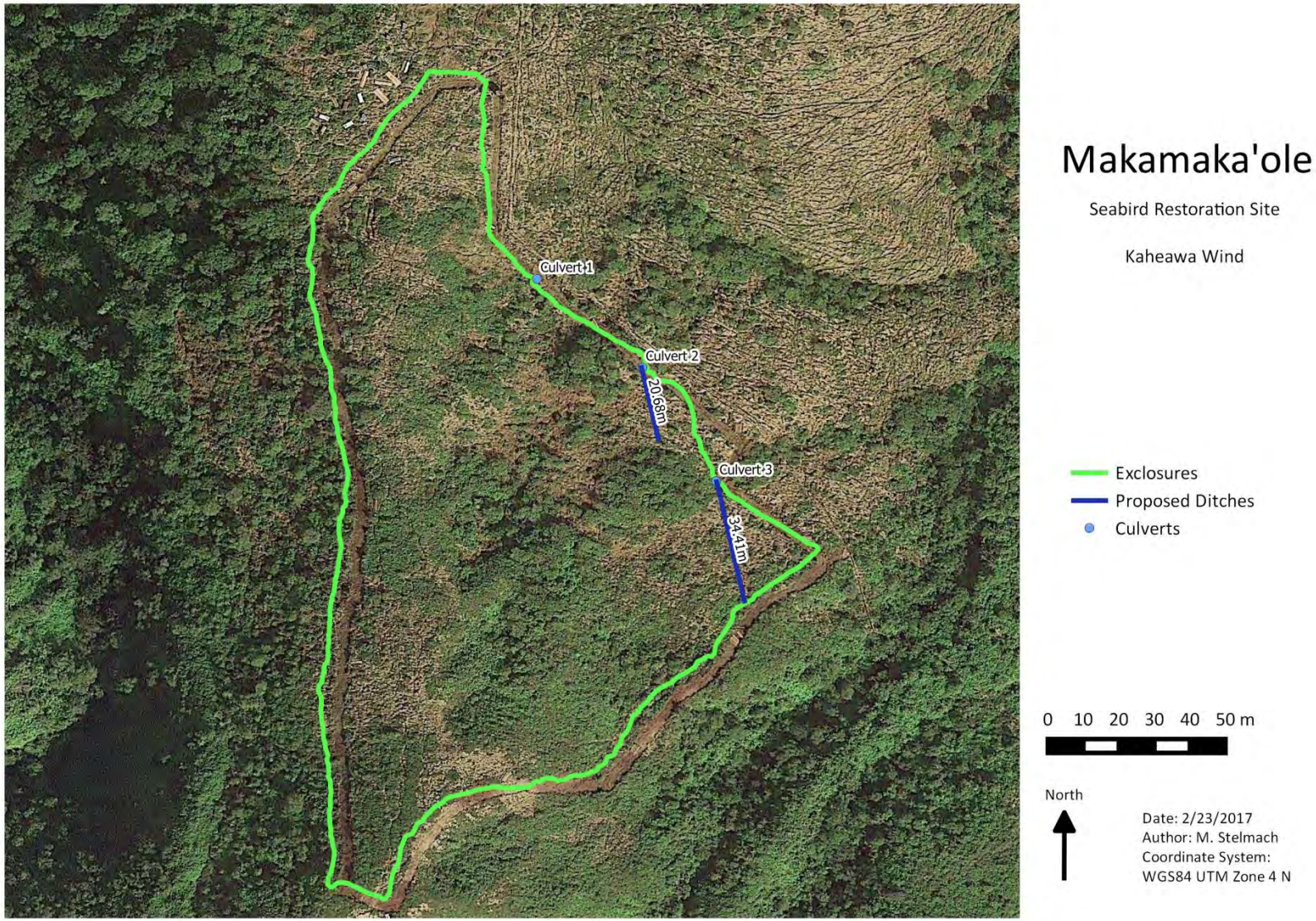


Figure 2. Proposed ditch locations are shown in blue at the second and third culverts.

Figure 3. A photo from the bottom of the proposed ditch at culvert 2 looking mauka. The predominant vegetation is broomsedge.

Figure 4. A photo from the top of the proposed ditch location at culvert 2.

Figure 5. A photo from the bottom of the proposed ditch at culvert 3. The dominant vegetation is broomsedge.

Figure 6. A photo from the top of the proposed ditch at culvert 3.

We met with NARs staff; Fern Duvall and Peter Landon on February 22, 2017 to discuss options for reducing erosion and predator ingress. This proposal is to construct an unlined ditch within the exclosure at the locations outlined in Figures 2-6. Final ditch locations and lengths may vary subject to on site needs and protection of native species. A diagram of a cross section of the hill slope with the proposed ditch design is shown in Figure 7.

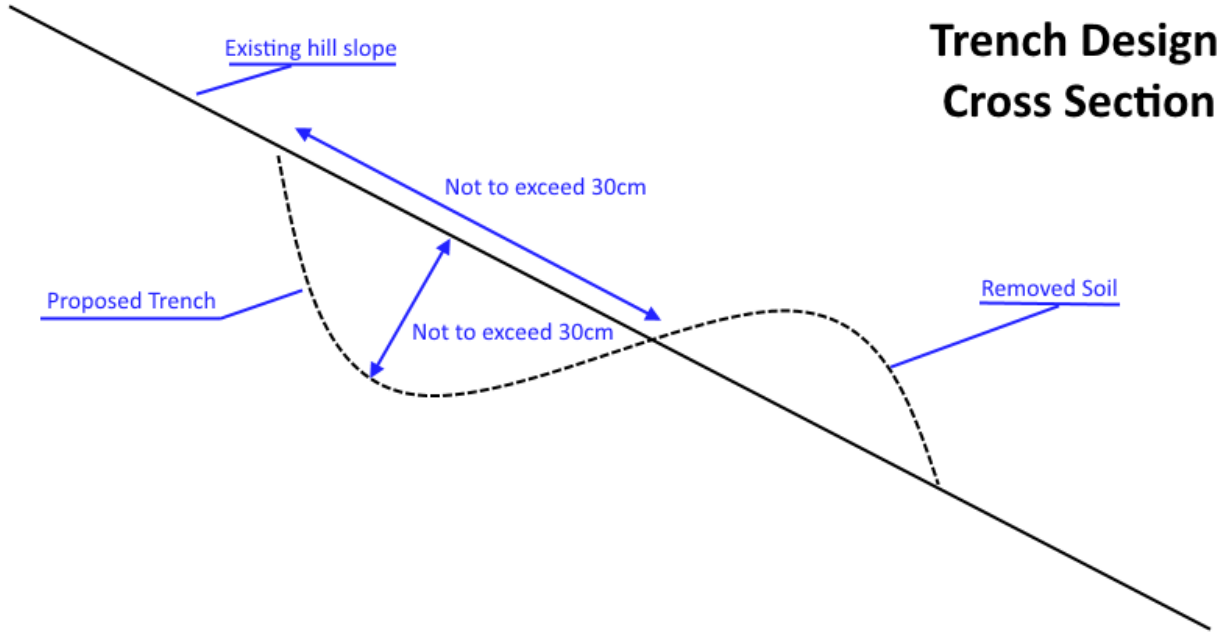


Figure 7. A cross section of the ditch design.

Literature Cited

Duffy, D. (2010). Changing Seabird Management in Hawai'i: From Exploitation through Management to Restoration. *Waterbirds*, 33(2): 193-207.

Reaser J.K., (2007). Ecological and socioeconomic impacts of invasive alien species in island ecosystems. *Environmental Conservation*, 34(2):1-14.

Appendix B. 2016 Seabird Activity at Makamaka'ole Seabird Mitigation Site.

Date	Enclosure	Burrow	Species	Notes
11-May	A	43A	**NESH**	entered burrow/ **A first sighting of the year**
12-May	A	43A	NESH	entered burrow
13-May	A	43A	NESH	entered burrow
14-May	A	43A	NESH	entered burrow
15-May	A	43A	NESH	entered burrow/scouting
15-May	A	26A	NESH	entered burrow/scouting
16-May	A	43A	NESH	entered burrow
17-May	A	43A	NESH	entered burrow/scouting
17-May	A	26A	NESH	entered burrow/scouting
18-May	A	26A	NESH	scouting
19-May	A	26A	NESH	entered burrow/scouting
20-May	A	26A	NESH	entered burrow/nest material collection
21-May	A	26A	NESH	entered burrow/nest material collection
21-May	B	22B	**BUPE**	entered burrow/**B first sighting of the year**
22-May	A	26A	NESH	entered burrow/nest material collection
23-May	A	26A	NESH	entered burrow/nest material collection
23-May	B	22B	BUPE	scouting
24-May	A	26A	NESH	entered burrow/nest material collection
25-May	A	43A	NESH	entered burrow/nest material collection
25-May	A	26A	NESH	entered burrow/nest material collection
26-May	B	22B	NESH	entered burrow
1-Jun	A	26A	NESH	scouting
2-Jun	A	26A	NESH	entered burrow/nest material collection
3-Jun	B	22B	BUPE	entered burrow
6-Jun	A	26A	**HAPE**	scouting
14-Jun	B	22B	NESH	scouting
15-Jun	B	22B	NESH	scouting
19-Jun	B	22B	NESH	scouting
20-Jun	A	26A	NESH	scouting/entered burrow
21-Jun	A	26A	NESH	entered burrow/ nest material collection
22-Jun	A	26A	NESH	entered burrow/ nest material collection
23-Jun	A	26A	NESH	nest material collection/**two birds**
24-Jun	A	26A	NESH	scouting/entered burrow
25-Jun	A	26A	NESH	scouting/entered burrow
25-Jun	B	22B	NESH/BUPE	scouting/entered burrow
26-Jun	A	26A	NESH	scouting/entered burrow
27-Jun	A	26A	NESH	scouting/entered burrow
28-Jun	A	26A	NESH	scouting/entered burrow

28-Jun	B	22B	NESH	scouting
29-Jun	A	26A	NESH	scouting/entered burrow
30-Jun	B	22B	NESH	entered burrow
30-Jun	A	26A	NESH	scouting/entered burrow
1-Jul	A	26A	NESH	scouting
1-Jul	B	22B	NESH	scouting
2-Jul	A	26A	NESH	scouting
3-Jul	A	26A	NESH	scouting/entered burrow
3-Jul	B	22B	NESH	scouting
4-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
4-Jul	B	22B	NESH	entered burrow
5-Jul	A	26A	NESH	scouting/entered burrow
5-Jul	B	22B	NESH	scouting/entered burrow
6-Jul	A	26A	NESH	scouting/entered burrow
7-Jul	A	26A	NESH	scouting/entered burrow
8-Jul	A	26A	NESH	scouting/entered burrow
9-Jul	A	26A	NESH	scouting/entered burrow
10-Jul	A	26A	NESH	scouting/entered burrow/**two birds**
10-Jul	B	22B	NESH	scouting/entered burrow/ **two birds**
11-Jul	A	26A	NESH	scouting/entered burrow/**two birds**
12-Jul	A	26A	NESH	scouting/entered burrow/**two birds**
12-Jul	B	22B	NESH	scouting
13-Jul	A	26A	NESH	scouting/entered burrow
13-Jul	B	22B	HAPE	fly-by
14-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
15-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
16-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
17-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
18-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
19-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
20-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
21-Jul	A	26A	NESH	scouting/entered burrow/ **two birds**
21-Jul	B	22B	NESH	scouting/nest material collection
27-Jul	A	26A	NESH	scouting/entered burrow
28-Jul	A	26A	NESH	scouting/entered burrow
29-Jul	A	26A	NESH	scouting/entered burrow
29-Jul	B	22B	Unk.	fly-by
30-Jul	A	26A	NESH	scouting/entered burrow/**two birds**
31-Jul	A	26A	NESH	entered burrow/nest material collection
1-Aug	A	26A	NESH	scouting/nest material collection
1-Aug	B	Uluhe 1	NESH	nest material collection

2-Aug	A	26A	NESH	scouting
2-Aug	B	Uluhe 1	NESH	scouting
3-Aug	A	26A	NESH	scouting/entered burrow
3-Aug	B	Uluhe 1	NESH	nest material collection
4-Aug	A	26A	NESH	scouting/entered burrow
4-Aug	A	43A	NESH	entered burrow/**two birds**
4-Aug	B	Uluhe 1	HAPE	scouting
4-Aug	B	Uluhe 1	NESH	nest material collection
4-Aug	B	22B	NESH	scouting
5-Aug	A	26A	NESH	scouting/entered borrow/**two birds**
5-Aug	A	43A	NESH	scouting/entered borrow/**two birds**
5-Aug	B	22B	NESH	scouting
5-Aug	B	Uluhe 1	HAPE	nest material collection
5-Aug	B	Uluhe 1	NESH	nest material collection
6-Aug	A	26A	NESH	entered burrow
6-Aug	B	22B	NESH	scouting
6-Aug	B	Uluhe 1	NESH	nest material collection
7-Aug	A	26A	NESH	scouting/entered burrow
7-Aug	A	43A	NESH	entered burrow
7-Aug	B	Uluhe 1	HAPE	nest material collection
7-Aug	B	Uluhe 1	NESH	nest material collection
8-Aug	B	22B	HAPE	scouting
8-Aug	B	Uluhe 1	HAPE	nest material collection
9-Aug	A	43A	NESH	entered burrow
9-Aug	B	22B	NESH	entered burrow
10-Aug	A	43A	NESH	entered burrow
10-Aug	A	42B	BUPE	nest material collection
10-Aug	B	22B	NESH	entered burrow, nest material collection
11-Aug	A	43A	NESH	entered burrow
11-Aug	B	22B	NESH	entered burrow, nest material collection
12-Aug	A	26A	NESH	scouting/entered burrow
12-Aug	A	43A	NESH	entered burrow/**two birds**
12-Aug	B	Uluhe 1	NESH	nest material collection
13-Aug	A	26A	NESH	entered burrow/nest material collection/ **two birds**
13-Aug	A	43A	NESH	entered burrow
14-Aug	A	26A	NESH	entered burrow/nest material collection
14-Aug	A	43A	NESH	entered burrow
15-Aug	A	26A	NESH	entered burrow/nest material collection
15-Aug	A	43A	NESH	entered burrow/**two birds**
16-Aug	A	26A	NESH	entered burrow/nest material collection
16-Aug	A	43A	NESH	entered burrow/nest material collection

17-Aug	A	26A	NESH	entered burrow/nest material collection
17-Aug	A	43A	NESH	entered burrow
18-Aug	A	26A	NESH	entered burrow/nest material collection
18-Aug	A	43A	NESH	entered burrow
18-Aug	B	22B	NESH	entered burrow
19-Aug	A	26A	NESH	entered burrow/nest material collection
19-Aug	A	43A	NESH	entered burrow
19-Aug	B	22B	NESH	entered burrow, nest material collection
20-Aug	A	26A	NESH	entered burrow
20-Aug	B	22B	NESH	entered burrow, nest material collection
21-Aug	B	22B	HAPE	entered burrow, scouting
22-Aug	B	22B	HAPE	scouting
22-Aug	B	22B	NESH	entered burrow, nest material collection
22-Aug	B	Uluhe 1	HAPE	nest material collection
23-Aug	A	26A	NESH	entered burrow
23-Aug	B	22B	HAPE	scouting, nest material collection
23-Aug	B	Uluhe 1	HAPE	nest material collection
24-Aug	A	26A	NESH	entered burrow
24-Aug	B	Uluhe 1	HAPE	nest material collection
25-Aug	A	26A	NESH	entered burrow/nest material collection
25-Aug	B	Uluhe 1	HAPE	nest material collection
25-Aug	B	Uluhe 1	NESH	nest material collection
26-Aug	A	26A	NESH	entered burrow/nest material collection
26-Aug	B	Uluhe 1	NESH	nest material collection
27-Aug	A	26A	NESH	entered burrow
27-Aug	B	Uluhe 1	HAPE	nest material collection
28-Aug	A	26A	NESH	entered burrow/**two birds**
28-Aug	B	Uluhe 1	HAPE	nest material collection
30-Aug	B	Uluhe 1	NESH	nest material collection
31-Aug	A	26A	NESH	entered burrow
31-Aug	A	50A	NESH	scouting
1-Sep	A	26A	NESH	scouting
1-Sep	A	43A	NESH	entered burrow
2-Sep	A	26A	NESH	entered burrow
2-Sep	A	43A	NESH	entered burrow
3-Sep	A	26A	NESH	scouting
3-Sep	A	43A	NESH	entered burrow
4-Sep	A	43A	NESH	entered burrow
5-Sep	A	43A	NESH	entered burrow
6-Sep	A	26A	NESH	entered burrow/scouting
6-Sep	A	43A	NESH	entered burrow

7-Sep	A	43A	NESH	entered burrow
8-Sep	A	43A	NESH	entered burrow
9-Sep	B	22B	NESH	entered burrow
9-Sep	A	26A	NESH	scouting
9-Sep	A	43A	NESH	entered burrow
10-Sep	B	22B	NESH	entered burrow/nest material collection
10-Sep	A	26A	NESH	scouting
10-Sep	A	43A	NESH	entered burrow
11-Sep	B	22B	NESH	entered burrow/nest material collection
11-Sep	A	26A	NESH	scouting
11-Sep	A	43A	NESH	entered burrow
12-Sep	B	22B	NESH	entered burrow/nest material collection
12-Sep	A	26A	NESH	entered burrow/scouting
12-Sep	A	43A	NESH	entered burrow
13-Sep	A	26A	NESH	entered burrow/scouting
15-Sep	A	26A	NESH	entered burrow
15-Sep	A	43A	NESH	entered burrow
16-Sep	A	26A	NESH	scouting
17-Sep	A	26A	NESH	scouting
18-Sep	B	22B	NESH	entered burrow
18-Sep	B	22B	HAPE	entered burrow/nest material collection
18-Sep	B	Uluhe 1	HAPE	scouting
18-Sep	A	26A	NESH	entered burrow/scouting
19-Sep	B	22B	NESH	entered burrow/nest material collection
19-Sep	B	Uluhe 1	HAPE	nest material collection
19-Sep	A	26A	NESH	entered burrow/scouting
20-Sep	B	22B	NESH	entered burrow/nest material collection
20-Sep	A	26A	NESH	entered burrow/scouting
21-Sep	B	22B	NESH	entered burrow/nest material collection
21-Sep	A	26A	NESH	entered burrow/scouting
22-Sep	B	22B	NESH	entered burrow/nest material collection
22-Sep	A	26A	NESH	entered burrow/scouting
22-Sep	B	Uluhe 1	NESH	entered burrow
23-Sep	B	22B	NESH	entered burrow/nest material collection
23-Sep	A	26A	NESH	entered burrow/scouting
24-Sep	B	22B	NESH	entered burrow/nest material collection
24-Sep	A	26A	NESH	entered burrow/nest material collection
25-Sep	B	22B	NESH	entered burrow
25-Sep	A	26A	NESH	entered burrow
29-Sep	A	26A	NESH	scouting
30-Sep	A	26A	NESH	scouting

Appendix C. Visual and Auditory Survey Results.

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
30-Mar-16	17:40	19:30	Road High point	18:15	Barn Owl	1	Transit	
30-Mar-16	17:40	19:30	Road High point	18:20	Barn Owl	1	Circling	
30-Mar-16	17:40	19:30	Road High point	19:40	Hawaiian Petrel	1	Transit	Maybe 2?
20-Apr-16	17:50	20:00	Unit B Mauka	19:20	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:25	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:30	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:35	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:40	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:45	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:50	Hawaiian Petrel	1	Transit	
20-Apr-16	17:50	20:00	Unit B Mauka	19:55	Newell's shearwater	1	Transit	
16-May-16	17:30	20:15	Unit B Mauka	19:20	Newell's shearwater	1	Transit	
16-May-16	17:30	20:15	Unit B Mauka	19:27	Newell's shearwater	2	Transit	Clear view!
16-May-16	17:30	20:15	Unit B Mauka	19:30	Newell's shearwater	2	Transit	Hear calls, cloud cover low
16-May-16	17:30	20:15	Unit B Mauka	19:38	Newell's shearwater	2	Transit	Calls overhead
16-May-16	17:30	20:15	Unit B Mauka	19:41	Newell's shearwater	4	Circling	Circling in Makamaka'ole
16-May-16	17:30	20:15	Unit B Mauka	19:46	Newell's shearwater	1	Transit	Flies directly above burrows
16-May-16	17:30	20:15	Unit B Mauka	19:49	Newell's shearwater	3	Circling	Observed directly overhead

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
16-May-16	17:30	20:15	Unit B Mauka	19:52	Hawaiian Petrel	2	Transit	Fly within 5m of observation point
16-May-16	17:30	20:15	Unit B Mauka	19:52	Newell's shearwater	1	Transit	Fly within 5m of observation point
16-May-16	17:30	20:15	Unit B Mauka	19:54	Newell's shearwater	1	Transit	Calls from Stream
16-May-16	17:30	20:15	Unit B Mauka	20:05	Newell's shearwater	1	Transit	
20-Jun-16	18:20	20:30	Unit B Mauka	19:41	Newell's shearwater	1	Transit	
20-Jun-16	18:20	20:30	Unit B Mauka	19:46	Newell's shearwater	1	Transit	
20-Jun-16	18:20	20:30	Unit B Mauka	19:50	Newell's shearwater	1	Transit	
20-Jun-16	18:20	20:30	Unit B Mauka	19:53	Newell's shearwater	2	Transit	
20-Jun-16	18:20	20:30	Unit B Mauka	19:55	Newell's shearwater	2	Circling	
20-Jun-16	18:20	20:30	Unit B Mauka	19:56	Newell's shearwater	1	Circling	
20-Jun-16	18:20	20:30	Unit B Mauka	19:59	Newell's shearwater	2	Circling	1953-2030 NESH Calling back to sound system and circling burrow area aggressively
20-Jun-16	18:20	20:30	Unit B Mauka	20:30	Barn Owl	1	Transit	Barn owl flushed from roost on fence post inside of enclosure B as we were packing out.
20-Jul-16	18:17	21:00	Unit B Makai	19:00		4	Transit	4 Unknown birds fly overhead
20-Jul-16	18:17	21:00	Unit B Makai	19:38	Newell's shearwater	1	Transit	
20-Jul-16	18:17	21:00	Unit B Makai	19:46	Newell's shearwater	1	Circling	
20-Jul-16	18:17	21:00	Unit B Makai	19:50	Newell's shearwater	1	Circling	
20-Jul-16	18:17	21:00	Unit B Makai	19:56	Newell's shearwater	2	Circling	

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
20-Jul-16	18:17	21:00	Unit B Makai	20:06	Newell's shearwater	2	Circling	
20-Jul-16	18:17	21:00	Unit B Makai	20:10	Newell's shearwater	2	Courtship	2 NESH circling together
20-Jul-16	18:17	21:00	Unit B Makai	20:20	Newell's shearwater	1	Courtship	
20-Jul-16	18:17	21:00	Unit B Makai	20:26	Newell's shearwater	1	Ground Call	call from what sounded like inside burrow entrance 22B
20-Jul-16	18:17	21:00	Unit B Makai	20:33	Newell's shearwater	1	Other (notes)	NESH seen landing in thick Uluhe west of speaker and burrow 22B
10-Aug-16	18:30	21:00	Unit B Mauka	19:20	Newell's shearwater	1	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	19:20	Hawaiian Petrel	2	Transit	
10-Aug-16	18:30	21:00	Unit B Mauka	19:25	Hawaiian Petrel	2	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	19:33	Hawaiian Petrel	2	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	19:38	Hawaiian Petrel	2	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	19:42	Newell's shearwater	2	Transit	
10-Aug-16	18:30	21:00	Unit B Mauka	19:47	Newell's shearwater	2	Transit	
10-Aug-16	18:30	21:00	Unit B Mauka	19:50	Newell's shearwater	2	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	19:55	Hawaiian Petrel		Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	20:00	Barn Owl	2	Transit	loud screech from below
10-Aug-16	18:30	21:00	Unit B Mauka	20:07	Newell's shearwater	1	Circling	
10-Aug-16	18:30	21:00	Unit B Mauka	20:14	Newell's shearwater	1	Ground Call	Landed
19-Sep-16	17:30	19:30	Unit B Mauka	19:00	Newell's shearwater	1	Circling	

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
19-Sep-16	17:30	19:30	Unit B Mauka	19:07	Newell's shearwater	1	Circling	Observed
30-Mar-17	17:30	20:29	Top of B	19:27	Hawaiian Petrel	1	Transit	Call only (50% confidence)
04-May-17	18:00	21:00	Top of B	19:53	Hawaiian Petrel	2		
04-May-17	18:00	21:00	Top of B	19:45	Hawaiian Petrel	2		
04-May-17	18:00	21:00	Top of B	19:39	Hawaiian Petrel	2		
04-May-17	18:00	21:00	Top of B	19:29	Hawaiian Petrel	2		
04-May-17	18:00	21:00	Top of B	19:25	Hawaiian Petrel	1		
25-May-17	17:30	21:00	Observation platform	20:09	Hawaiian Petrel	1	Circling	Calls
25-May-17	17:30	21:00	Observation platform	19:56	Newell's shearwater	2	Circling	Circling and calling over A
25-May-17	17:30	21:00	Observation platform	19:43	Newell's shearwater	2	Transit	Continued calls
25-May-17	17:30	21:00	Observation platform	19:35	Hawaiian Petrel	1	Transit	Heard in gulch
25-May-17	17:30	21:00	Observation platform	19:34	Newell's shearwater	2	Circling	Flew past platform
25-May-17	17:30	21:00	Observation platform	19:29	Hawaiian Petrel	2	Circling	
25-May-17	17:30	21:00	Observation platform	19:21	Newell's shearwater	2	Circling	
15-Jun-17	17:30	21:00	Road	18:31	Newell's shearwater	1	Transit	Heard before sound systems turned on above B. Heard from truck by road
20-Jul-17	16:28	20:54	Unit B Mauka	20:10	Barn Owl	1	Circling	Circling above enclosure A below burrows
20-Jul-17	16:28	20:54	Unit B Mauka	20:03	Newell's shearwater	1	Transit	Auditory
20-Jul-17	16:28	20:54	Unit B Mauka	20:00	Newell's shearwater	1	Transit	Auditory

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
20-Jul-17	16:28	20:54	Unit B Mauka	19:57	Newell's shearwater	1	Circling	Landed in front of burrow 50b after circling
20-Jul-17	16:28	20:54	Unit B Mauka	19:48	Newell's shearwater	1	Circling	Circling and calling for minutes
20-Jul-17	16:28	20:54	Unit B Mauka	19:46		1	Transit	Unknown spp
20-Jul-17	16:28	20:54	Unit B Mauka	19:40	Newell's shearwater	1	Transit	Auditory
20-Jul-17	16:28	20:54	Unit B Mauka	19:28	Newell's shearwater	1	Transit	Still light, observed without NVG
26-Jul-17	17:00	21:30	Gulch/entrance of A	20:20	Barn Owl	1	Circling	John Neisman shots fired. Owl seen flying east after shot, no signs of shot contact
26-Jul-17	17:00	21:30	Gulch/entrance of A	19:55	Barn Owl	1		Heard screech from down in gulch
26-Jul-17	17:00	21:30	Gulch/entrance of A	20:10	Barn Owl	1	Circling	Seen again above bottom of A then flew further pasts A towards Kahakaloa
26-Jul-17	17:00	21:30	Gulch/entrance of A	19:50	Barn Owl	1	Transit	Came in from A side, saw him too late to make a shot, flew back over towards A entrance
29-Aug-17	17:20	20:21	Gulch	19:40	Newell's shearwater	1	Transit	Newell's call directly behind us near road. Very load
27-Aug-17	17:00	20:30	Gulch	19:50	Barn Owl	1	Circling	Seen perched behind us in tree at 50 meters. Came flying down to the speaker and light was put on him. Angle was bad for the shot with spotters in the line of fire. No shots taken.
27-Aug-17	17:00	20:30	Gulch	19:40	Barn Owl	1	Transit	Seen between enclosures perched on a fence post

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
22-Aug-17	18:00	21:19	Gulch	20:20	Barn Owl	1	Circling	Barn owl came right in onto the mouse cage from between two enclosures. Spotlighted when came within 20 yards and shooters fired multiple rounds. Birds wing was injured and went down across gulch. John and John went to retrieve bird and found it at 8:30pm.
22-Aug-17	18:00	21:19	Gulch	20:10	Barn Owl	1	Circling	Barn owl came up from behind and came within 5 meters from my head. Spotlighted but there was no clear shot with spotters in between shooters and bird
22-Aug-17	18:00	21:19	Gulch	8:00	Barn Owl	2	Circling	Two barn owls together diving in and out of tall grass between the two enclosures.
22-Aug-17	18:00	21:19	Gulch	19:30	Barn Owl	1	Transit	Flew over mice from 3oclock to 9oclock. Many rounds fired but none took down owl
16-Aug-17	17:00	21:30	Gulch	19:40	Barn Owl	1	Transit	
16-Aug-17	17:00	21:30	Gulch	19:37	Newell's shearwater	2	Circling	Call only
16-Aug-17	18:57	20:27	A door	20:45	Barn Owl	1	Transit	Flew in close behind us from bottom of A then up to the road out of site. Did not see in time to get a light on it or a shot off
16-Aug-17	18:57	20:27	A door	19:45	Barn Owl	1	Transit	Heard screech and saw owl flying song bottom of A towards B. Never

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
								came closer than 100 yards
15-Aug-17	17:00	21:03	Gulch	20:20	Barn Owl	1	Transit	Came from behind and flew over us. Was late to shine with light and by the time it was spotted it was 40 yards away. Shots fired but bird did not go down.
15-Aug-17	17:00	21:03	Gulch	19:38	Barn Owl	1	Transit	Owl spotted with night vision coming from road side behind us, headed towards enclosure A. Beamed with spotlight as when it flew in front at 20 yards. Shots fired, owl went down into gulch. Could not find owl after hunt was complete.
10-Aug-17	19:01	20:30	Top of B	19:56	Newell's shearwater	1		Call
10-Aug-17	19:01	20:30	Top of B	19:44	Hawaiian Petrel	1		Call only
10-Aug-17	19:01	20:30	Top of B	19:42	Newell's shearwater	1	Circling	Call only
10-Aug-17	19:01	20:30	Top of B	19:37	Newell's shearwater	2		Call only. Not seen
10-Aug-17	19:01	20:30	Top of B	19:33	Newell's shearwater	1		Call only not observed
10-Aug-17	18:30		Top of A between upper and lower burrows	20:15	Barn Owl	2	Circling	Two barn owls seen circling at corner edge of enclosure A. One screeched and dive bombed the other.
10-Aug-17	19:01	20:30	Top of B	20:00	Barn Owl	1		Barn owl flying out of grass inside of B, gulch.
08-Aug-17	17:00	20:03	Gulch	19:25	Barn Owl	1	Circling	Owl flew in from between enclosure down to mice and

Night Survey 2017								
Survey Date	**Start Time**	**End Time**	**Sub-Location**	**Time**	**Common Name**	**Count**	**Behavior**	**Notes**
								speaker set up within 20 yards of shooters. Three shooters stations above speaker and mice. All three shooters took shots and owl fell into gulch to the right. Owl recovered.
06-Aug-17	17:00	21:45	Gulch	9:00	Barn Owl	1	Transit	Saw flying along lower section of enclosure B. Last sighting of the night. Saw owl 5 times more between first sighting and last. All were between enclosures or below about 100 yards away.
06-Aug-17	17:00	21:45	Gulch	19:51	Barn Owl	1	Circling	Below and between enclosures. Heading east. First sighting
18-Sep-17	18:03	19:36	Top of B	19:10	Newell's shearwater	1	Circling	Circling A
18-Sep-17	18:03	19:36	Top of B	19:07	Hawaiian Petrel	1	Circling	No calls
18-Sep-17	18:03	19:36	Top of B	19:16	Newell's shearwater	2	Transit	Two heard calling to each other from Makamakaole
11-Sep-17	18:48	21:00	Between A and B	19:40	Barn Owl	1	Transit	
17-Sep-17	17:30	20:15	Gulch	19:35	Barn Owl	1	Circling	BANO flew in and perched within 20 yards behind us. Took off as I flashed with beam light, Neisman took 3 shots as it flew away northwest but owl never went down. @7:35PM
17-Oct-17	18:00	19:45	Top of B	19:22	Barn Owl	1		Call
17-Oct-17	18:00	19:45	Top of B	19:05	Barn Owl	1		Call

Appendix D. Visual Burrow Inspection

Burrow Monitoring										
ID	Burrow #	Check Date	Enclosure	Toothpick Activity	Feathers	Chick	Nest Material	Other Activity	Ants	Notes
101	43	8/24/2017	A	False	True	False	True	True	False	NESH Egg
102	26	8/24/2017	A	False	True	False	True	True	False	NESH Egg
103	50	8/24/2017	A	False	True	False	True	True	False	Fresh poop
104	22	8/24/2017	B	False	True	False	True	True	False	BUPE Egg
105	1	11/9/2017	A	False	False	False	False	False	True	
106	2	11/9/2017	A	False	False	False	False	False	True	
107	3	11/9/2017	A	False	True	False	False	False	True	Ants, Feathers
108	4	11/9/2017	A	False	False	False	False	False	False	wall rot
109	5	11/9/2017	A	False	False	False	False	False	True	moisture
110	6	11/9/2017	A	False	False	False	False	False	True	
111	7	11/9/2017	A	False	False	False	False	False	False	none
112	8	11/9/2017	A	False	False	False	False	False	False	moisture
113	9	11/9/2017	A	False	False	False	False	False	False	none
114	10	11/9/2017	A	False	True	False	False	False	True	ants, feathers
115	11	11/9/2017	A	False	True	False	False	False	True	
116	12	11/9/2017	A	False	False	False	False	False	False	none
117	13	11/9/2017	A	False	False	False	False	False	False	none
118	14	11/9/2017	A	False	True	False	False	False	False	Feather
119	15	11/9/2017	A	False	True	False	False	False	True	moisture
120	16	11/9/2017	A	False	False	False	False	False	True	none
121	17	11/9/2017	A	False	False	False	False	False	False	none
122	18	11/9/2017	A	False	False	False	False	False	False	moisture
123	19	11/9/2017	A	False	False	False	False	False	False	T6, moisture
124	20	11/9/2017	A	False	False	False	False	False	True	moisture
125	21	11/9/2017	A	False	False	False	False	False	False	moisture
126	22	11/9/2017	A	False	False	False	False	False	False	moisture, 70F thermometer
127	23	11/9/2017	A	False	False	False	False	True	False	moisture, temp 20C, dead mouse
128	24	11/9/2017	A	False	False	False	False	False	True	ants

Burrow Monitoring										
ID	Burrow #	Check Date	Enclosure	Toothpick Activity	Feathers	Chick	Nest Material	Other Activity	Ants	Notes
129	25	11/9/2017	A	False	True	False	False	False	False	Moisture
130	26	11/9/2017	A	False	True	False	True	False	False	Egg collection
131	27	11/9/2017	A	False	False	False	False	False	False	T5
132	28	11/9/2017	A	False	False	False	False	False	False	T4
133	29	11/9/2017	A	False	False	False	False	False	False	moisture
134	30	11/9/2017	A	False	False	False	False	False	False	None
135	31	11/9/2017	A	False	False	False	False	False	True	Moisture
136	32	11/9/2017	A	False	False	False	False	False	False	None
137	33	11/9/2017	A	False	False	False	False	False	False	moisture
138	34	11/9/2017	A	False	False	False	False	False	False	moisture
139	35	11/9/2017	A	False	False	False	False	False	False	New lid
140	36	11/9/2017	A	False	False	False	False	False	False	None
141	37	11/9/2017	A	False	False	False	False	False	True	Ants, T3
142	38	11/9/2017	A	False	False	False	False	False	False	Moisture
143	39	11/9/2017	A	False	False	False	False	False	False	Needs lid
144	40	11/9/2017	A	False	False	False	False	False	False	new lid
145	41	11/9/2017	A	False	False	False	False	False	False	None
146	42	11/9/2017	A	False	False	False	False	False	True	ants
147	43	11/9/2017	A	False	True	False	True	False	False	Feathers, nest material
148	44	11/9/2017	A	False	False	False	False	False	False	None
149	45	11/9/2017	A	False	False	False	False	False	False	Perlite, T1
150	46	11/9/2017	A	False	False	False	False	False	False	moisture, new lid
151	47	11/9/2017	A	False	False	False	False	False	True	T2
152	48	11/9/2017	A	False	False	False	False	False	True	
153	49	11/9/2017	A	False	False	False	False	False	False	Needs screws and repair box
154	50	11/9/2017	A	False	False	False	False	False	False	Moisture
155	1	11/9/2017	B	False	False	False	False	False	False	None
156	2	11/9/2017	B	False	False	False	False	False	False	None
157	3	11/9/2017	B	False	False	False	False	False	False	None
158	4	11/9/2017	B	False	False	False	False	True	True	Mouse poop
159	5	11/9/2017	B	False	False	False	False	False	False	None
160	6	11/9/2017	B	False	False	False	False	False	False	Moisture

Burrow Monitoring										
ID	Burrow #	Check Date	Enclosure	Toothpick Activity	Feathers	Chick	Nest Material	Other Activity	Ants	Notes
161	7	11/9/2017	B	False	False	False	False	False	False	none
162	8	11/9/2017	B	False	False	False	False	False	False	mouse poop
163	9	11/9/2017	B	False	False	False	False	False	False	None
164	10	11/9/2017	B	False	False	False	False	False	False	none
165	11	11/9/2017	B	False	False	False	False	False	False	Moisture
166	12	11/9/2017	B	False	False	False	False	False	False	Moisture
167	13	11/9/2017	B	False	False	False	False	False	False	Moisture
168	14	11/9/2017	B	False	False	False	False	False	False	Moisture
169	15	11/9/2017	B	False	False	False	False	False	False	Dead mouse
170	16	11/9/2017	B	False	False	False	False	False	False	None
171	17	11/9/2017	B	False	False	False	False	False	False	None
172	18	11/9/2017	B	False	False	False	False	False	True	
173	19	11/9/2017	B	False	False	False	False	False	False	none
174	20	11/9/2017	B	False	False	False	False	False	False	none
175	21	11/9/2017	B	False	False	False	False	False	False	none
176	22	11/9/2017	B	False	True	False	True	False	False	previously active
177	23	11/9/2017	B	False	False	False	False	False	False	none
178	24	11/9/2017	B	False	False	False	False	False	False	none
179	25	11/9/2017	B	False	False	False	False	False	False	none
180	26	11/9/2017	B	False	False	False	False	False	False	none
181	27	11/9/2017	B	False	False	False	False	False	False	none
182	28	11/9/2017	B	False	False	False	False	False	False	None
183	29	11/9/2017	B	False	False	False	False	False	False	Needs tag
184	30	11/9/2017	B	False	False	False	False	False	False	Moisture
185	31	11/9/2017	B	False	False	False	False	False	False	None
186	32	11/9/2017	B	False	False	False	False	False	False	Moisture
187	33	11/9/2017	B	False	False	False	False	False	False	mouse poop on top, moisture
188	34	11/9/2017	B	False	False	False	False	False	False	None
189	35	11/9/2017	B	False	False	False	False	False	False	Moisture
190	36	11/9/2017	B	False	False	False	False	False	False	none
191	37	11/9/2017	B	False	False	False	False	False	False	rodent activity on top
192	38	11/9/2017	B	False	False	False	False	False	False	none

Burrow Monitoring										
ID	Burrow #	Check Date	Enclosure	Toothpick Activity	Feathers	Chick	Nest Material	Other Activity	Ants	Notes
193	39	11/9/2017	B	False	False	False	False	False	False	none
194	40	11/9/2017	B	False	False	False	False	False	False	none
195	41	11/9/2017	B	False	False	False	False	False	False	none
196	42	11/9/2017	B	False	True	False	True	False	False	wasps
197	43	11/9/2017	B	False	False	False	False	False	False	rodent material on roof
198	44	11/9/2017	B	False	False	False	False	False	False	none
199	45	11/9/2017	B	False	False	False	False	False	False	None
200	46	11/9/2017	B	False	False	False	False	False	False	None
201	47	11/9/2017	B	False	False	False	False	False	True	Needs new lid
202	48	11/9/2017	B	False	False	False	False	False	False	none
203	49	11/9/2017	B	False	False	False	False	False	False	None
204	50	11/9/2017	B	False	True	False	True	False	False	needs tag

Appendix E. Endangered and MBTA protected species collections reports:

Endangered Species Collection

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC

Makamaka'ole Seabird Restoration Site

ID
1

Collector Name
Matt Stelmach

Collector Affiliation
TerraForm

Species	CollectionDate	CollectionTime
Newell's shearwater	7/27/2017	14:00

Life Stage
Egg

Location Found
Latitude: 20.9558401596, Longitude: -156.5525280998

Observations
An egg was located outside of burrow 43A at the Makamaka'ole Seabird Restoration site. Burrow 43A has been recorded as active with a Newell's shearwater. The egg had a significant odor as well as fly larvae present. Feathers were attached to the egg.

Notifications
USFWS and DOFAW notified via email

Notes

Actions Taken

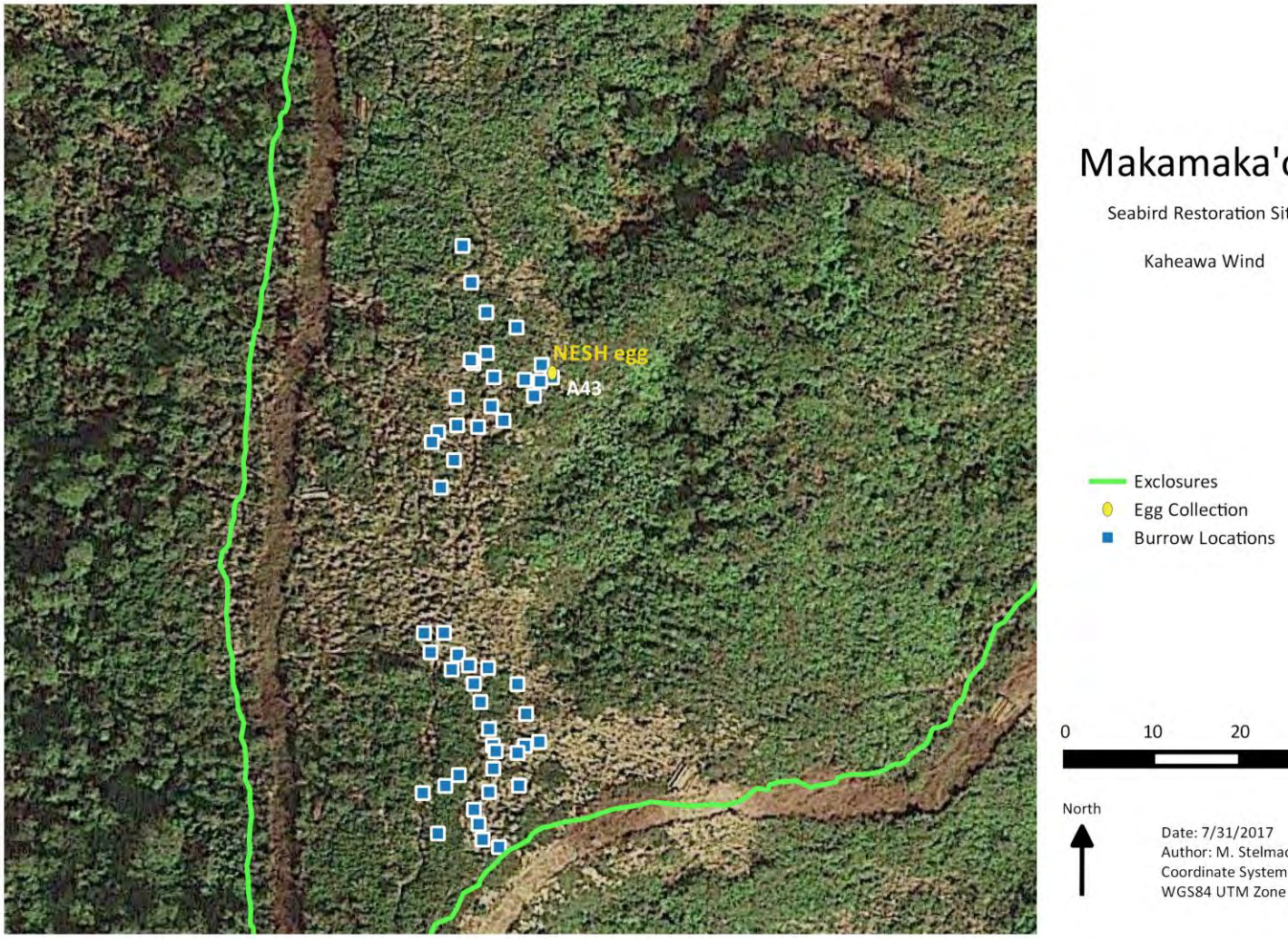
7/27/2017	11:00	Spencer Engler locates an egg outside of burrow 43A at Makamaka'ole. M. Stelmach notified.
7/27/2017	14:00	M. Stelmach arrives on site to collect the specimen and record data. Burrow scope verification that NESH is inside the burrow.
7/27/2017	15:00	Egg returned to KWP for refrigerated storage.
7/28/2017	11:10	USFWS and DOFAW Notified via email.
8/3/2017	10:00	Egg contents examined by Fern Duvall of DLNR - NARS. "The egg, clear white colored, was intact except for multiple hairline fractures. It was candled: Aircell space showed desiccation of the egg had begun; the yolk still moved freely inside the coagulating albumen, no blood vessels apparent. It may have been outside the burrow for several days causing the water loss. It was not weighed due to desiccation status. The egg dimensions 61.43 mm x 39.04 mm clearly place it as a NESH egg. Egg was opened on the side, to preserve egg shell for BPBM accession, to view the yolk surface. It was clearly an egg with early stage embryo visible (10.5X magnification picture taken – attached). It indicated the female had mated and egg fertilization was successful. The egg may not have been incubated, or for only a couple days max. The shell fragments removed and the dark feather were also retained for the museum. It is possible that the egg was inadvertently knocked out of the burrow by the birds, or competitor birds. No evidence of rodent biting of the egg. The shell and feather and fragments will be dried out and sent to Bishop Museum as accession from Matt Stelmach. NARs retains possession of the egg for transfer to Bishop Museum.

Figure 1. A photo of the egg as found relative to the burrow.

Figure 2. A close-up photo of the egg as found.

Figure 3. A photo of the egg with backlighting on 28 July 2017.

Figure 4. A photo of the contents of the egg under 10.5x magnification, taken by Fern Duval during egg examination. Shape and coloration of the embryo indicate early fertilization.



For additional information or questions please contact:

Matt Stelmach
Kaheawa Wind
HCP Manager
808-294-9239
MStelmach@terraform.com

Figure 5. Map of location where egg was found.

Endangered Species Collection

Thursday, August 24, 2017

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC

Makamaka'ole Seabird Restoration Site

ID
2

Collector Name
Matt Stelmach

Collector Affiliation
TerraForm

Species	Collection Date	Collection Time
Newell's shearwater	8/24/2017	8:30

Life Stage
Egg

Location Found
Latitude: 20.9558401596, Longitude: -156.5525280998

Observations
An egg was located inside of burrow 43A. The egg was located near the burrow entrance the egg was cracked and caked with blood and feathers. No contents remained inside the egg.

Notifications
USFWS and DOFAW notified via email

Notes
This is the second egg collected from this burrow this season, the first egg was recorded on 7/20/2017.

Actions Taken

8/24/2017	8:30	Matt Stelmach, Spencer Engler, Jay Penniman, Jenny Learned, and Che Frausto were on site to monitor burrows at Makamaka'ole. After scoping burrow 43A and finding no bird present, the burrow was opened. A partially crushed egg was located inside the burrow near the entrance. Photos were taken and the egg was collected.
8/24/2017	12:30	The egg shell was transported to KWP for refrigerated storage.
8/24/2017	17:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the egg as found relative to a Leatherman. Approximate length of 2”.

For additional information or questions please contact:
Matt Stelmach
Kaheawa Wind
HCP Manager
808-294-9239
MStelmach@terraform.com

Figure 2. Map of location where egg was found.

MBTA Species Collection

Thursday, August 24, 2017

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC

Makamaka'ole Seabird Restoration Site

ID
3

Collector Name
Matt Stelmach

Collector Affiliation
TerraForm

Species	Collection Date	Collection Time
Bulwer's Petrel	8/24/2017	9:30

Life Stage
Egg

Location Found
Latitude: 20.95406500, Longitude: -156.55129700

Observations
An egg was located inside of burrow 50B. The burrow was recorded as having Bulwer's petrel activity and contained feathers consistent with BUPE. The egg was located against the Makai wall of the burrow. It was crushed with no egg contents remaining.

Notifications
USFWS and DOFAW notified via email

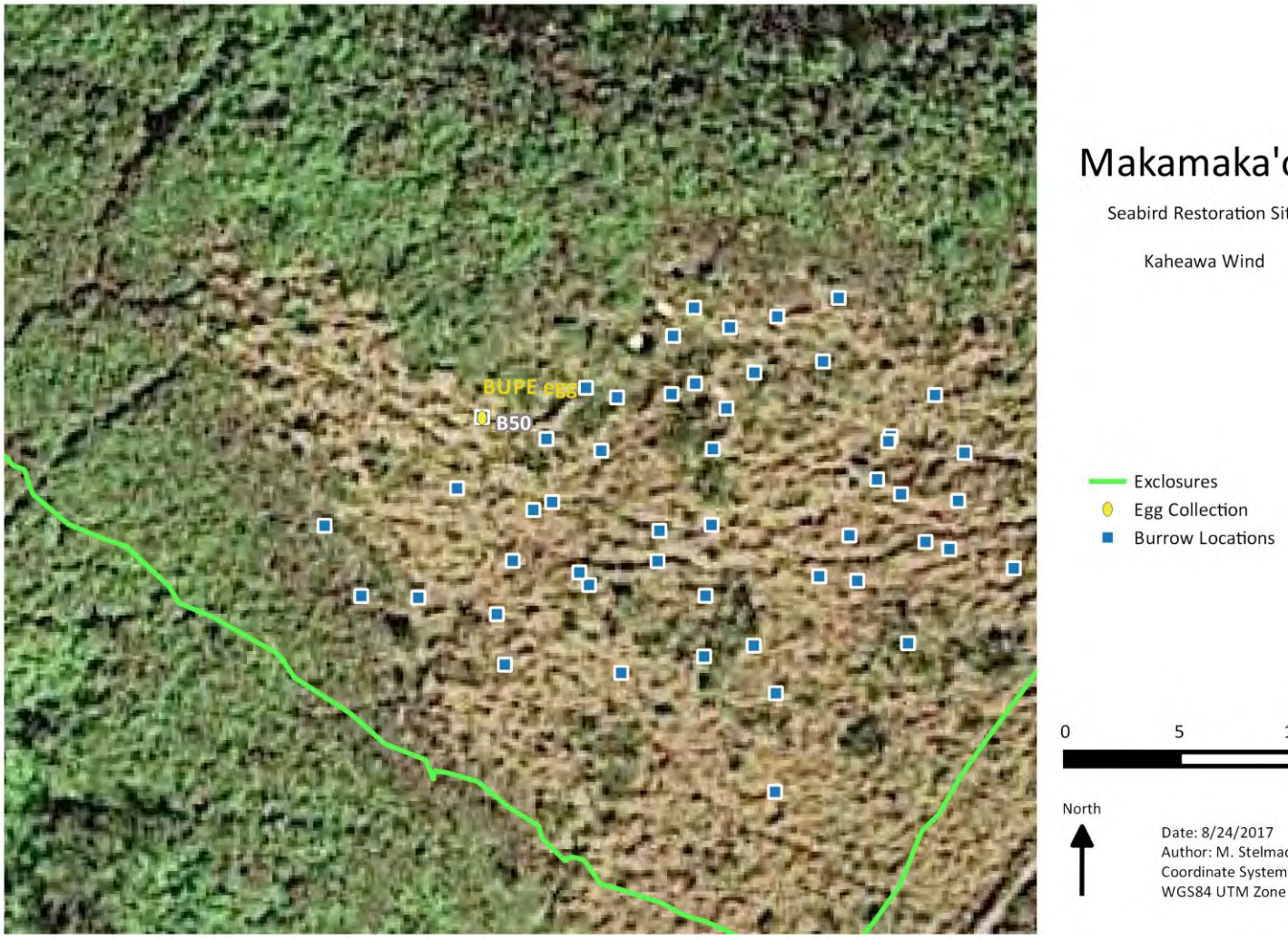
Actions Taken

8/24/2017	9:30	Matt Stelmach, Spencer Engler, Jay Penniman, Jenny Learned, and Che Frausto were on site to monitor burrows at Makamaka'ole. After scoping burrow 50B and finding no bird present, the burrow was opened. A partially crushed egg was located inside the burrow near the makai wall. Photos were taken and the egg was collected.
8/24/2017	12:30	The egg shell was transported to KWP for refrigerated storage.
8/24/2017	17:00	USFWS and DOFAW notified via email.

Figure 1. A photo of the burrow as found, the BUPE egg can be seen in the lower right. Several small black feathers suggest BUPE occupancy. Mauka/West is toward the top of the photo.

Figure 2. A photo of the egg with the rule markings on a Leatherman for scale. Egg length of approximately 1”.

Figure 3. A photo of the underside of the egg as found.



For additional information or questions please contact:
Matt Stelmach
Kaheawa Wind
HCP Manager
808-294-9239
MStelmach@terraform.com

Figure 4. Map of location where egg was found.

Endangered Species Collection

Thursday, November 09, 2017

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC

Makamaka'ole Seabird Restoration Site

ID
4

Collector Name
Matt Stelmach

Collector Affiliation
TerraForm

Species	Collection Date	Collection Time
Newell's shearwater	11/9/2017	10:06

Life Stage
Egg

Location Found
Latitude: 20.95555700, Longitude: -156.55268100

Observations
An egg was located inside the burrow of 26A.The burrow was recorded as having Bulwer's petrel activity and contained feathers consistent with NESH. The egg was buried inside the nest material. The egg was intact with a solid mass inside. This egg was previously noted on 8/24 but not collected to minimize disturbance to an active burrow.

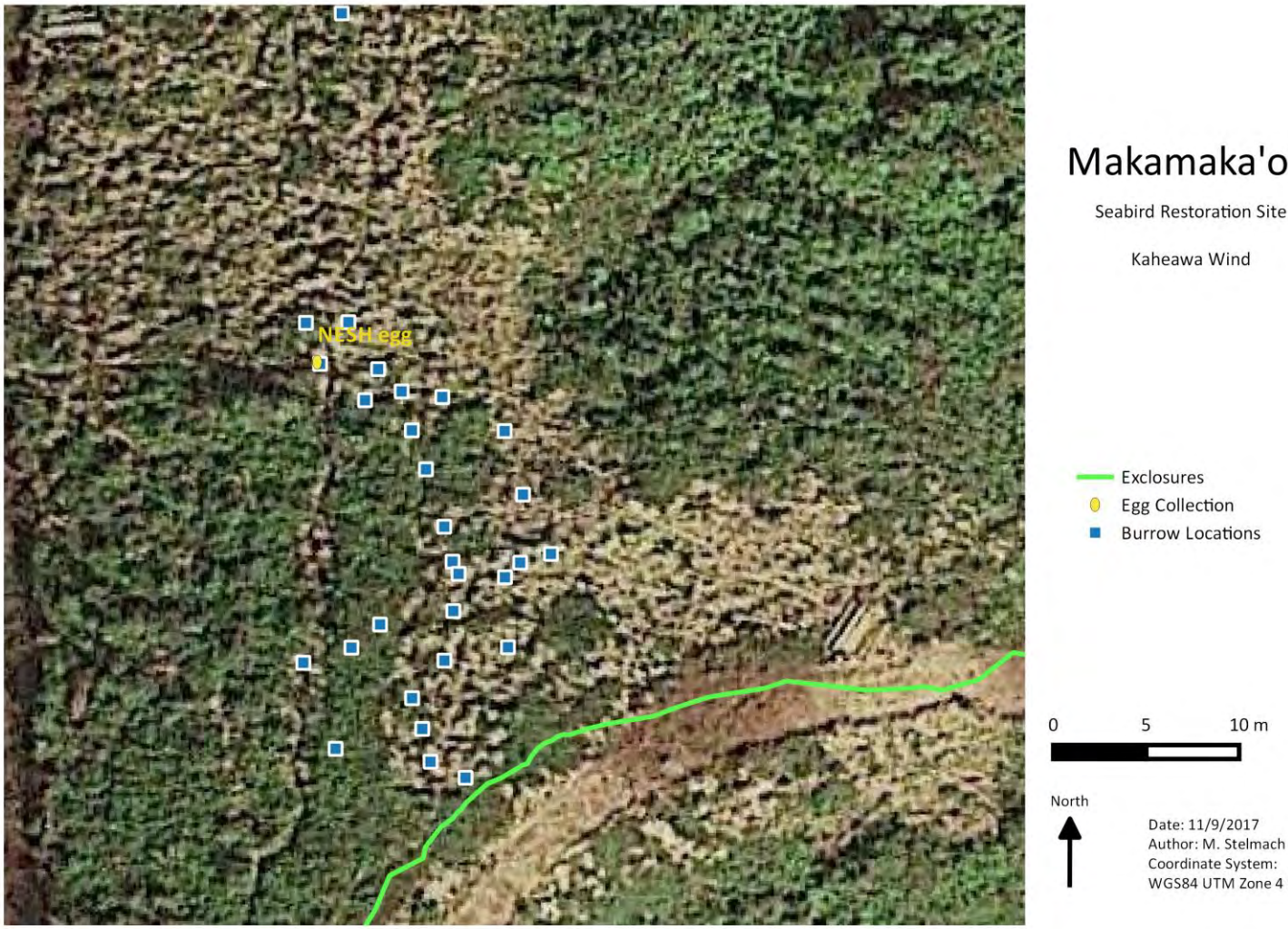
Notifications
USFWS and DOFAW notified via email

Actions Taken

11/9/2017	10:06	M. Stelmach, S. Engler, M. Craig and representatives from MNSBRP were on site to check burrow contents at the Makamaka'ole Seabird Restoration site. Burrow A26 was opened to check contents and the egg was
11/9/2017	14:49	The egg was transported to KWP for freezer storage.
11/9/2017	15:30	USFWS and DOFAW notified via email.

Figure 1. A photo of the egg as found inside burrow A26.

Figure 2. A photo of the Newell's shearwater egg after it was extracted. An 8" Leatherman is provided for reference.



For additional information or questions please contact:
Matt Stelmach
Kaheawa Wind
HCP Manager
808-294-9239
MStelmach@terraform.com

Figure 3. Map of location where egg was found.

BOTANICAL SURVEY

MAKAMAKA'OLE PREDATOR-FREE ENDANGERED SEABIRD ENCLOSURE UNIT A

KAHAKULOA, MAUI

Prepared by:
FOREST & KIM STARR
STARR ENVIRONMENTAL

Prepared for:
KAHEAWA WIND

JULY 2017

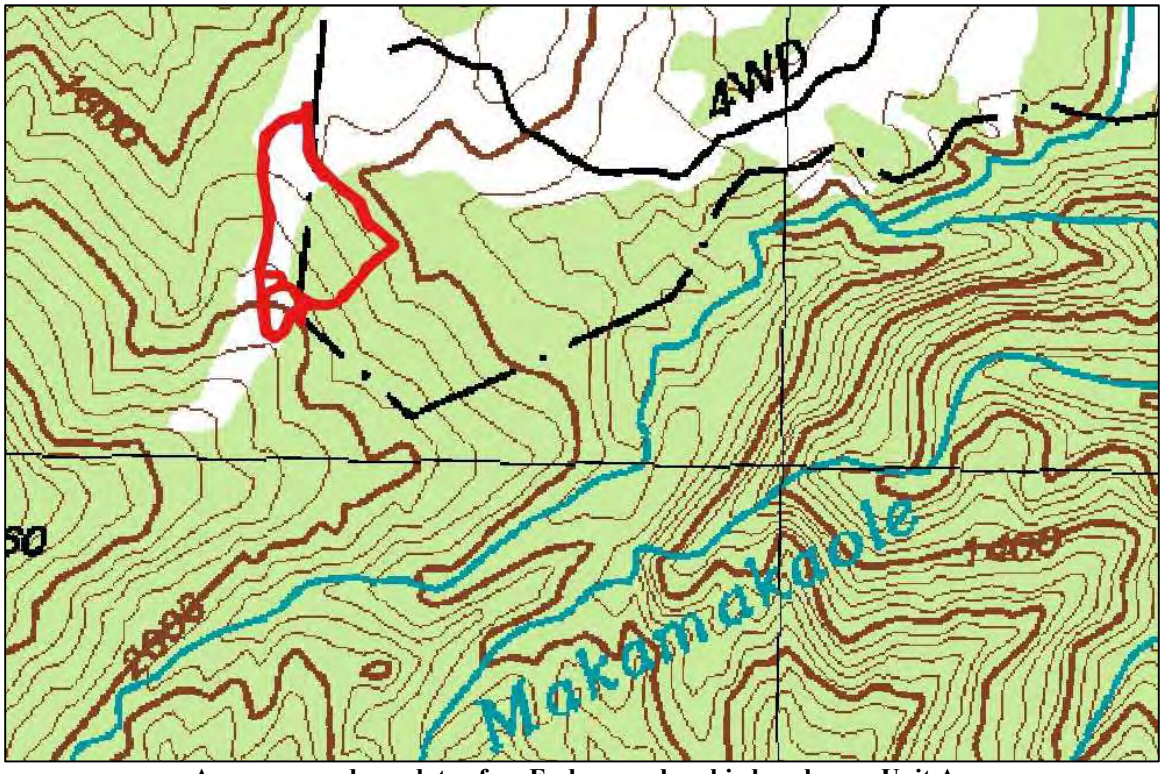
BOTANICAL SURVEY
MAKAMAKA'OLE PREDATOR-FREE
ENDANGERED SEABIRD ENCLOSURE A
KAHAKULOA, MAUI

INTRODUCTION

The Makamakaʻole Predator-free Endangered Seabird Enclosures project is situated on about 10 acres of land in Kahakuloa, West Maui on TMK parcels 231006001 and 231006003. The site is on land owned by the State of Hawaii, and is partly within both the West Maui Natural Area Reserve and the West Maui Forest Reserve. Two fenced enclosures in the area were constructed to exclude predators and benefit Endangered native ground nesting seabirds. This botanical survey was undertaken to determine if annual rye grass (*Lolium multiflorum*) or any new weeds were established at the western enclosure (Unit A), which encompasses about 2 hectares.

SITE DESCRIPTION

The site is comprised of mostly open ridges, located in a transition zone between predominantly native vegetation mauka and pasturelands makai. The vegetation is a mix of mesic to wet grasslands, shrublands and forest, with the ridges mostly open non-native grasses and sedges and the gullies and less disturbed areas predominantly native plants.



Area surveyed, predator free Endangered seabird enclosure Unit A.

BIOLOGICAL HISTORY

The area was once diverse native mesic to wet forest. Over the past two centuries, grazing, fire, and invasion by non-native species has converted much of the native plant cover into aggressive non-native pasture and wet forest weeds. Despite this, many native plants persist on the site, especially in gullies. Recently, two predator-free enclosures were constructed, which resulted in some ground disturbance. Annual rye grass (*Lolium multiflorum*) and native plants were planted at the site to help stem the erosion. The site is currently actively managed, including regular predator control.

SURVEY OBJECTIVES

The objectives of the survey were to:

- Provide a list of vascular plant species present.
- Determine the presence or absence of annual rye grass (*Lolium multiflorum*).
- Survey for new weed species in the target area.

SURVEY METHODS

A walk-through botanical survey method was used following the fenceline and a few main trails through predator proof seabird restoration enclosure Unit A and adjacent land. To minimize disturbance, the entire unit was not intensively surveyed, just the inside and outside of the fenceline, nearby areas, and a few main trails. Notes were made on plant species, distribution and abundance. The site was surveyed on July 27, 2017.

Surveying plants within enclosure Unit A.

RESULTS & DISCUSSION

ANNUAL RYGRASS

No annual rye grass (*Lolium multiflorum*) was observed at or near the site. There is the possibility that seeds could exist in the soil and someday germinate, but we did not currently find this short-lived species in the areas surveyed.

Annual rye grass (*Lolium multiflorum*) seeded in Kula Forest Reserve after 2007 fire.

Annual rye grass (*Lolium multiflorum*) seedhead, Kula Forest Reserve.

NEW NON-NATIVE PLANTS

Eight new non-native plant species were observed that were not observed in 2011.

- *Elephantopis mollis* (Soft elephant's foot)
- *Emilia* sp. (Pualele)
- *Erechtites valerianifolia* (Fireweed)
- *Juncus planifolius* (Broadleaf rush)
- *Mimosa pudica* (Sensitive plant)
- *Nephrolepis multiflora* (Sword fern)
- *Polygala paniculata* (Root beer plant)
- *Rhynchospora caduca* (Anglestem beaksedge)

All of these are common non-native weeds known from the general area that appeared in areas of disturbance, mostly along the fenceline and where weed control had recently occurred. Some of these could have been overlooked in 2011, but most of the new species were not apparent in nearby less disturbed vegetation.

It seems likely that many of these species will go away in areas of the site where the disturbance from construction is done and the areas are revegetating. Over time, more aggressive species will likely fill in the area, inhibiting these disturbance species that require more bare soil. However, a subset will likely continue to persist in areas where disturbance will continue, such as along trails and where weed control is done.

Most of the species should be of no concern to the seabirds. However, the thorny vines of *Mimosa pudica* (Sensitive plant) could possibly present a hazard for the birds and may warrant keeping an eye on and possibly controlling. It appears sensitive plant seeds were in the soil and germinated as disturbance and control measures occurred, as it was only found in recently disturbed areas, and mostly in areas where herbicide work had been done. It is hoped that as disturbance declines the sensitive plant will also decline, but if over time that appears to not be the case, it may warrant looking at different control techniques that could help keep this thorny species from covering more of the site.

***Mimosa pudica* (Sensitive plant)**

NEW NATIVE PLANTS

Two new native plant species were encountered that were not observed in 2011.

- *Paspalum scrobiculatum* (Ricegrass)
- *Scaevola gaudichaudii* (Naupaka kuahiwi)

Paspalum scrobiculatum (Ricegrass) was along trails and prefers disturbed open sites. This questionably indigenous grass was likely in the general area and took advantage of the soil disturbances.

What appears to be a young *Scaevola gaudichaudii* (Naupaka kuahiwi) was observed near a culvert along the makai boundary. It was apparently planted to help revegetate the area. Generally found in drier areas, it was suggested perhaps this naupaka may have been originally destined for plantings at the Kaheawa Wind Farm above Maalaea, and somehow made its way to the Makamaka'ole plantings. Assuming it wasn't collected from material nearby, and it is indeed what we think it is, it could be left to see how it does, or it could be removed to keep the native genetics more locally sourced.

What appears to be a young *Scaevola gaudichaudii* (Naupaka kuahiwi).

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999) and updates.

For each species, the following information is provided:

- Scientific name
- Common English or Hawaiian name.
- Bio-geographical status. The following symbols are used:
    - Endemic = Native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
    - Indigenous = Native to the Hawaiian Islands and also to one or more other geographic area(s).
    - Non-native = All those plants brought to the islands intentionally or accidentally after western contact.
- Abundance of each species within the project area:
    - Dominant = Forming a major part of the vegetation within the project area.
    - Common = Widely scattered throughout the area or locally abundant within a portion of it.
    - Occasional = Scattered sparsely throughout the area or occurring in a few small patches.
    - Rare = Only a few isolated individuals within the project area.

PLANT SPECIES LIST

Scientific Name	Common Name	Status	Abundance
Ageratum conyzoides	Maile honohono	Non-native	Occasional
Andropogon virginicus	Broomsedge	Non-native	Dominant
Arundina graminifolia	Bamboo orchid	Non-native	Occasional
Axonopus fissifolius	Narrow-leaved carpetgrass	Non-native	Common
Blechnum appendiculatum	Blechnum	Non-native	Occasional
Bobea elatior	Ahakea	Endemic	Rare
Centella asiatica	Asiatic pennywort	Non-native	Occasional
Christella dentata	Downy wood fern	Non-native	Rare
Cibotium glaucum	Hapuu pulu	Endemic	Occasional
Clidemia hirta	Koster's curse	Non-native	Occasional
Conyza bonariensis	Hairy horseweed	Non-native	Rare
Coprosma pubens	Pilo	Endemic	Rare
Cuphea carthagenensis	Colombian cuphea	Non-native	Occasional
Dicranopteris linearis	Uluhe	Indigenous	Dominant
Diplopterygium pinnatum	Uluhe lau nui	Endemic	Occasional
Elaphoglossum crassifolium	Laukahi nunui	Endemic	Rare
Elephantopis mollis	Soft elephant's foot	Non-native	Rare
Emilia sp.	Pualele	Non-native	Rare
Erechtites valerianifolia	Fireweed	Non-native	Occasional
Fimbristylis dichotoma	Fimbristylis	Indigenous	Dominant
Ilex anomala	Kawau	Indigenous	Rare
Juncus planifolius	Broadleaf rush	Non-native	Rare
Kadua affinis	Manono	Endemic	Occasional
Lycopodiella cernua	Wawaeiole	Indigenous	Occasional
Machaerina angustifolia	Uki	Indigenous	Occasional
Machaerina mariscoides subsp. *meyenii*	Uki	Endemic	Occasional
Melinis minutiflora	Molasses grass	Non-native	Common
Metrosideros polymorpha	Ohia	Endemic	Common
Mimosa pudica	Sensitive plant	Non-native	Occasional
Nephrolepis exaltata subsp. *hawaiiensis*	Kupukupu	Endemic	Rare
Nephrolepis multiflora	Sword fern	Non-native	Occasional
Odontosoria chinensis	Palaa	Indigenous	Occasional
Paspalum conjugatum	Hilo grass	Non-native	Common
Paspalum dilatatum	Dallis grass	Non-native	Occasional
Paspalum scrobiculatum	Ricegrass	Indigenous?	Common
Pluchea carolinensis	Sour bush	Non-native	Rare
Polygala paniculata	Root beer plant	Non-native	Occasional
Psidium cattleianum	Strawberry guava	Non-native	Occasional
Psidium guajava	Guava	Non-native	Rare

Scientific Name	Common Name	Status	Abundance
Psychotria mariniana	Kopiko	Endemic	Occasional
Rhynchospora caduca	Anglestem beaksedge	Non-native	Common
Sacciolepis indica	Glenwood grass	Non-native	Common
Sadleria sp.	Amau	Endemic	Rare
Scaevola chammisoniana	Naupaka kuahiwi	Endemic	Occasional
Scaevola gaudichaudii	Naupaka kuahiwi	Endemic	Rare
Setaria parviflora	Yellow foxtail	Non-native	Occasional
Smilax melastomifolia	Hoi kuahiwi	Endemic	Rare
Spathoglottis plicata	Philippine ground orchid	Non-native	Occasional
Stachytarpheta cayennensis	Vervain	Non-native	Occasional
Syzygium cumini	Java plum	Non-native	Occasional
Tibouchina herbacea	Cane tibouchina	Non-native	Common
Triumfetta semitriloba	Sacremento bur	Non-native	Rare
Wikstroemia oahuensis var. *oahuensis*	Akia kuahiwi	Endemic	Rare

REFERENCES

Starr, F. and K. Starr. 2011. Botanical Survey for The Makamaka'ole Predator-Free Endangered Seabird Enclosures, Kahakuloa, Maui, HI.

Wagner, W. L., D.R. Herbst, and S. H. Sohmer. 1999. Manual of the Flowering Plants of Hawaii. Univ. of Hawaii Press and Bishop Museum Press, Honolulu, HI.

Makamaka'ole Predator-Free Endangered Seabird Enclosure Unit A.

Appendix G. Email approval for the removal of permit conditions from NARs SUP.

From: Duvall, Fern P [mailto:fern.p.duvall@hawaii.gov]
Sent: Thursday, November 09, 2017 7:41 AM
To: Matthew Stelmach (TERP) <mstelmach@terraform.com>
Cc: Mitchell Craig (TERP) <MCraig@terraform.com>
Subject: RE: Makamaka'ole Special Use Permit

Matt:

I'm so sorry about my untimely response – this simply got buried among my other work items.

Answers:

Yes to the requested changes you requested in the permit renewal. Thanks for the Starr report of their findings – and yes, removing the section on the rye grass is appropriate based on the findings.

Me ke aloha mai Maui-Nui

Fern

_____

Dr. Fern P. Duvall II

Native Ecosystems Protection and Management - Maui Nui Program Manager

Department of Land and Natural Resources

Division of Forestry and Wildlife

1955 main Street, Room 301

Wailuku, HI 96793

Phone: (808) 873-3502, Fax: (808) 984-8114

Web Page: http://dlnr.hawaii.gov/dofaw/

Email: fern.p.duvall@hawaii.gov

From: Matthew Stelmach (TERP) [mailto:mstelmach@terraform.com]
Sent: Monday, October 30, 2017 11:31 AM
To: Duvall, Fern P <fern.p.duvall@hawaii.gov>
Cc: Mitchell Craig (TERP) <MCraig@terraform.com>
Subject: RE: Makamaka'ole Special Use Permit

Hi Fern,

I haven't heard back on this item. Can you let me know if this was received?

Thank you,

Matt Stelmach

Kaheawa Wind

HCP Manager

Office: 1.808.463.3005

Mobile: 1.808.294.9239

Email: mstelmach@TerraForm.com

Kaheawa Wind

3000 Honoapiilani Hwy

Wailuku, HI 96793

From: Matthew Stelmach (TERP)
Sent: Wednesday, September 20, 2017 8:58 AM
To: Duvall, Fern P <fern.p.duvall@hawaii.gov>
Cc: Mitchell Craig (TERP) <MCraig@terraform.com>
Subject: Makamaka'ole Special Use Permit

Hi Fern,

In the process of our permit review last year our legal team had a few requests for alterations to the permit. We would like to make two alterations to the permit conditions as follows:

Changes to the NARs permit condition as follows (page 2 paragraph 4):

Permit holder will control weed recruitment in disturbance areas through regular herbiciding and weeding without motorized tools which must occur once every 3 months.

Following our discussion Feb 22nd, we have conducted a vegetation survey of the Makamaka'ole seabird restoration site surveyed by Starr Environmental. The target species was rye grass with additional instruction to monitor for additional new species which may have been introduced with the rye grass. I have attached a copy of the report produced which states:

"No annual rye grass (*Lolium multiflorum*) was observed at or near the site. There is the possibility that seeds could exist in the soil and someday germinate, but we did not currently find this short-lived species in the areas surveyed."

We would like to remove page 2 paragraph 5 which states:

Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC take responsibility for the introduction of rye grass to the project area and must provide all measures to ensure that it does not become established within the NAR. The rye grass is expected to die out on its own, but Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC will continue to monitor it. If the rye grass persists, the removal will be the responsibility of Kaheawa Wind Power, LLC and Kaheawa Wind Power II, LLC.

Please let me know if there is any additional information I can provide.