Auwahi Wind Farm Habitat Conservation Plan FY 2018 Annual Report

Incidental Take Permit TE64153A-0/ Incidental Take License ITL-17

Submitted To:

Sempra Renewables

Auwahi Wind

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Acronyms and Abbreviations

DKIST	Daniel K. Inouye Solar Telescope
DLNR	Hawaii Department of land and Natural Resources
DOFAW	DLNR Division of Forestry and Wildlife
EA	Environmental Assessment
EIS	Environmental Impact Statement
EoA	Evidence of Absence
ESRC	Endangered Species Recovery Committee
FMP	Fire Management Plan
FY	Fiscal Year
HCP	Habitat Conservation Plan
HNP	Haleakala National Park
ITL	incidental take license
ITP	incidental take permit
LHWRP	Leeward Haleakalā Watershed Restoration Project
MBTA	Migratory Bird Treaty Act
MOU	memorandum of understanding
NPS	National Park Service
PCMM	post-construction mortality monitoring
PMA	Petrel Management Area
Project	21-megawatt Auwahi Wind Farm Project
Tetra Tech	Tetra Tech, Inc.
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 Introduction

In January 2012, Auwahi Wind Energy, LLC (Auwahi Wind) finalized a Habitat Conservation Plan (HCP) for the construction and operation of the 21-megawatt Auwahi Wind Farm Project (Project) in east Maui, Hawaii (Tetra Tech 2012a). The HCP was developed to obtain incidental take permit (ITP) number TE64153A-0 from the U.S. Fish and Wildlife Service (USFWS), and incidental take license (ITL) number ITL-17 from the Hawaii Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), both of which authorize incidental take for the Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Blackburn's sphinx moth (*Manduca blackburni*), collectively Covered Species. DOFAW issued the ITL on February 9, 2012, and USFWS issued the ITP on February 24, 2012, each with a term of 25 years.

This report provides a summary of monitoring and mitigation activities that have occurred during Fiscal Year (FY) 2018 (from July 1, 2017 to June 30, 2018). The following subsections provide an overview of post-construction mortality monitoring (PCMM) and mitigation activities, address other required annual reporting items as identified in the HCP, review an annual work plan for the upcoming year, and detail annual cost expenditures as required under the ITP/ITL. The status of Auwahi Wind's permit conditions in FY 2018 are summarized in Table 1-1. Detailed reports providing updates on Hawaiian petrel mitigation, Hawaiian hoary bat research being conducted by the U.S. Geological Survey (USGS), and Blackburn's sphinx moth mitigation efforts continued by Leeward Haleakalā Watershed Restoration Partnership are included as attachments to this report. Completion of the Hawaiian goose mitigation was documented in the FY 2013 HCP annual report (Tetra Tech 2013).

Table 1-1. Summary of compliance status FY 2018.

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
PCMM at the Project				
Project biologist	HCP, Section 4.2.1 and 7.1.1	To be on-staff during Project operations	In compliance; ongoing	Project biologist has been on staff since project began operations in December 2012.
PCMM	HCP, Section 7.1.1 & PCMM Plan	Intensive monitoring will occur years 1, 2, 7, 12, 17, and 22 (total of 6 years, includes carcass removal and searcher efficiency trials)	In compliance; ongoing	Monitoring commenced in December 2012 and is ongoing. PCMM results for FY 2018 are provided in Section 2 of this report.
Wildlife education and incidental reporting program	HCP, Section 7.11	Prior to and throughout operations	In compliance; ongoing	A wildlife education and incidental reporting program was initiated during construction and is ongoing. Four fatalities were reported via this program in FY 2018. Wildlife education and reporting protocol training was provided to 135 contractors in FY 2018.
Notify DLNR and the USFWS whenever a species protected by the Migratory Bird Treaty Act (MBTA) or a listed species is found dead or injured, or if there are observations of seabirds attracted to construction lighting	ITP Conditions L(i)	Via telephone within 24 hours and in a written report within five calendar days	In compliance; ongoing	Eight fatalities were listed species and six fatalities were MBTA in FY 2018. Table 2-3 lists all fatalities.
Report to DLNR of any mortalities, injuries, or disease related to the Covered Species	ITP Condition L(iv)	Within 3 days		
Table summarizing fatalities documented during PCMM	ITP Condition L(iv)	Semi-annually	In compliance; ongoing	Semi-annual table submitted to USFWS/DOFAW January 4, 2018 Fatalities documented during FY 2018; provided in Section 2 of this report, Table 2-3.
Semi-annual progress report	ITP Condition L(ii)	Annually in February	In compliance; ongoing	Semi-annual progress report submitted to USFWS/DOFAW April 2018. The next semi-annual progress report will be submitted in February 2019.

Table 1-1. Summary of Compliance Status FY 2018 (continued).

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
Hawaiian Hoary Bat Mitigation				
Conservation easement for the Waihou Mitigation Area (Tier 1 mitigation)	HCP, Section 6.2.1	Within 210 days of ITP/ITL issuance or the initiation of vertical construction of the turbines, whichever comes sooner; easement extension granted by DOFAW	In compliance; completed	Recorded conservation easement with the Hawaiian Islands Land Trust to preserve the Waihou Mitigation Area in perpetuity on December 18, 2012.
Install new ungulate-proof fencing or retrofit cattle fencing around the Waihou Mitigation Area (Tier 1 mitigation)	HCP, Section 6.2.1	Initiate within first year of permit issuance and complete within two years of permit issuance (February 9, 2014)	In compliance; completed	Installation complete September 2013.
Remove ungulates from within Waihou Mitigation Area fence line (Tier 1 mitigation)	HCP, Section 6.2.1	Initiate after ungulate proof fence is completed	In compliance; completed	Ungulates removed in March of 2014. Quarterly fence inspections continue to ensure fence stability and area remains ungulate free.
Conduct vegetative restoration activities, including removal of invasive species and native reforestation (Tier 1 mitigation)	HCP, Section 6.2.1, Table 6-3	Initiate after ungulate proof fence is completed	In compliance; ongoing	Semi-annual removal of target invasive species conducted and a total of 41 acres of native trees and shrubs out-planted. Ongoing maintenance.
Acoustic monitoring at the wind farm (Tier 1 mitigation)	HCP, Table 6-2	Years 1 and 2 of operation	In compliance; completed	Initiated July 2013, completed in December 2015. Results provided in FY 2016 HCP annual report (Sempra Energy 2016).
Hawaiian hoary bat research plan (Tier 2 mitigation)	HCP, Section 6.2.2	Draft research plan submitted to USFWS/DOFAW within 1 year of issuance of ITP; finalize within 2 years of ITP issuance and before the start of the study.	In compliance; ongoing	Final plan submitted in cooperation with USGS to USFWS/DOFAW in February 2014. Plan approved by USFWS/DOFAW in March 2014. Plan implemented March 2015.
Hawaiian hoary bat research continued (Tier 3 mitigation)	HCP, Section 6.2.3	Use research in Tier 2 to evaluate appropriate mitigation – additional area for bat habitat restoration or conduct additional research.	In compliance, ongoing	Final Tier 2 & 3 field work completed in March 2017. USGS progress report submitted in FY 2017. Data analysis and final report to be completed in FY 2019.
Predator control at the Kahikinui Petrel Management Area (Tier 1 mitigation)	HCP, Section 6.3.5; Petrel Management Plan	Auwahi Wind will begin predator control within the first year of operation	In compliance; ongoing	Full implementation of predator control in February 2014. Results from 2017 provided in Attachment 2.

Table 1-1. Summary of Compliance Status FY 2018 (continued).

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
Hawaiian Petrel Mitigation				
Petrel burrow surveys (Tier 1 mitigation)	HCP, Section 6.3.6, Table 6-6	Burrow monitoring will occur annually for first 3 years; an additional 5 years of monitoring will occur at certain points during the life of the mitigation	In compliance; ongoing	Conducted petrel burrow surveys 2012 – 2017; 2018 burrow surveys started in March and will continue through November 2017. Results from 2018 provided in Attachment 2.
Blackburn's Sphinx Moth Mitigation				
Funding to Leeward Haleakalā Watershed Restoration Project (LHWRP) to restore 6 acres of dryland forest in the Auwahi Forest Restoration Project	HCP, Sections 4.2.3 & 6.5.1, Table 6-2	First payment to LHWRP within 30 days of obtaining permit and remainder of funds paid within 3 months	In compliance; ongoing	Full payment to LHWRP on April 17, 2012. A letter from LHWRP summarizing status of restoration is provided in Attachment 4.
Hawaiian Goose Mitigation				
Research or management funding ($25K) provided to Haleakalā National Park Service (NPS)	HCP, Section 6.4, Table 6-2	Within 60 days of obtaining permit	In compliance; completed	Full payment to NPS April 17, 2012. A letter from the NPS summarizing the status and use of funds is provided in FY 2013 HCP annual report (Tetra Tech 2013) with updates in section 3.4.
Red ʻIlima (*Abutilon menziesii*) Mitigation				
ʻUlupalakua Ranch will plant 10 red ʻilima from its on-going conservation efforts. Report plant survival (3 years)	HCP, Section 4.2.3	After construction/site restoration is complete	In compliance; completed	Plants propagated at the ʻUlupalakua Ranch nursery in 2013. They were successfully out-planted and are thriving. Plant survival reported in Section 3.5.
Fire Management Plan (FMP)				
Implementation of FMP associated with lands owned by ʻUlupalakua Ranch	HCP, Section 4.2.4; Fire Management Plan	Education of employees, fuel reduction in high priority areas via grazing, firebreaks in high priority areas, and construction/availability of a water source to fire department	In compliance; ongoing	Annual review and management of FMP with ʻUlupalakua Ranch, ongoing employee, training, water source (site well) available to fire department. Irrigation system installed in FY 2017 and FMP updated in FY 2018. Vegetation control for fuel reduction conducted monthly through contractor. Landing zone and staging area for firefighting efforts maintained in FY 2018.

2.0 Post-Construction Mortality Monitoring

Auwahi Wind's HCP lays out a long-term monitoring approach consisting of two years of intensive monitoring followed by interim years of less intensive but systematic monitoring. Post-construction mortality monitoring was initiated in December 2012. During the commissioning period (December through mid-January) heavy construction equipment and operations in the near vicinity of the turbines limited the searching to pads and roads. Beginning January 25, 2013, standardized carcass searches beneath all eight turbines and the met tower, carcass persistence trials, and searcher efficiency trials began following the schedule and methods outlined in detail in the FY 2013 HCP annual report (Tetra Tech 2013). December 2014 marked the end of intensive monitoring across the entire plot. From January 2015 to January 2018, Auwahi Wind conducted systematic searches across pads and roads at a 3- to 4-day interval. On January 22, 2018, Auwahi Wind began systematic searching of roads and pads using a canine search team at a weekly interval.

A Migratory Bird Special Purpose Utility permit (Permit No. MB92518A-0) for handling migratory bird carcasses was issued by USFWS on December 10, 2012. A renewal permit was submitted and issued by the USFWS on April 1, 2018. A State Protected Wildlife Permit (Permit No. WL17-08) for handling native bird and bat carcasses was reissued by DOFAW on April 6, 2018.

The summary of trial data for each section in 2.0 is for the fiscal year (July-June) and not the period of take analysis. Take analysis is typically conducted on a calendar year or if there are changes to the search protocol, as discussed in section 2.1.

Table 2-1. Post-construction mortality monitoring summary, FY 2018.

Variable	Systematic (July 2017 – June 2018)
Study Metrics for Fatality Estimates	
Total number of Project turbines	8[1]
Number of turbines searched	8[1]
Sample plot size	Pads and roads within 100-meter (328-foot) radius of turbine
Met tower search plot size	10 meters (33 feet) around the base of the met tower
Search interval	4 days (July 2017 – January 2018); 7 days (January – June 2018)
Fatalities of Covered Species	
Hawaiian Petrel	
Number of fatalities documented	1 incidental
Indirect take	0.63 juveniles
Hawaiian Goose	
Number of fatalities documented	0
Indirect take	0
Hawaiian Hoary Bat	
Number of fatalities documented	4 + 3 incidental
Indirect take	~0-1 adult equivalent (indirect take will be officially calculated based on genetic results beginning with the FY 2019 annual report)
Fatalities of Other Species[2]	
Fatalities found during searches	12
Fatalities found incidentally	11

[1]One turbine was not operational and not searched, as it poses no risk to wildlife, from July 1, 2017 through March 17, 2017
[2]Includes three MBTA species fatalities

2.1 Systematic Carcass Searches

USFWS/DOFAW agreed on December 12, 2014, that Auwahi Wind could begin systematic searches in January 2015. Systematic searches were conducted along all pads and roads within a 100-meter (328-foot) radius of turbines July 1, 2017 – June 30, 2018. Linear transects, spaced approximately 6 meters (20 feet) apart, were established within each search area for visual searches, with searchers scanning out to 3 meters (10 feet) on each side of the transects. The search area size and configuration varied among turbine pads. Based on carcass distributions compiled by Tetra Tech, Inc. (Tetra Tech) from 25 publicly-available studies, the areas searched at the Project represented a total of 56 percent of the large-bird distribution and 76 percent of the bat distribution, which are consistent with results based on a theoretical carcass distribution model (Hull and Muir 2010). Searches were conducted at 4-day intervals from June 2017 to January 2018. In January 2018, Teresa Gajate and Makalani (canine search team) began conducting weekly searches of roads and pads (Table 2-2). The search interval was lengthened in response to canine search team availability and searcher efficiency.

Table 2-2. Average search interval between standardized carcass searches at the Auwahi Wind Project, FY 2018.

Month	Average Search Interval (days)[1]
July	4
August	4
September	4
October	4
November	4
December	4
January	4-7
February	7
March	7
April	7
May	7
June	7

[1]Includes all operational turbines and meteorological tower

Twenty-three fatalities were documented in FY 2018; Thirteen of these fatalities were documented during systematic carcass searches (Table 2-3). Five fatalities recorded were species covered under the Migratory Bird Treaty Act (MBTA): two great frigatebirds (*Fregata minor*), one barn owl (*Tyto alba*), one skylark (*Alauda arvensis)*, and one Pacific golden plover (*Pluvialis fulva*). Eight fatalities were Covered Species: seven Hawaiian hoary bats and one Hawaiian petrel (*Pterodroma sandwichensis*). No fatalities have been observed at the met tower.

Table 2-3. Documented fatalities at the Auwahi Wind Project, including threatened and endangered (T&E) FY 2018.

Species	Legal Status[1]	Found Date	Location (Turbine)	Type of Detection
Hawaiian Hoary Bat	T&E	8/5/2017	3	Incidental
House Sparrow	None	8/9/2017	Substation	Incidental
Hawaiian Hoary Bat	T&E	8/28/2017	1	Systematic
Hawaiian Hoary Bat	T&E	9/1/2017	2	Incidental
Hawaiian Hoary Bat	T&E	9/5/2017	1	Systematic
Hawaiian Hoary Bat	T&E	9/13/2017	6	Systematic
Kolea - Pacific Golden Plover	MBTA	9/29/2017	8	Systematic
Gray Francolin	None	10/3/2017	3	Systematic
Skylark	MBTA	11/8/2017	Laydown Yard	Incidental
Zebra Dove	None	1/16/2018	3	Systematic
Barn owl	MBTA	1/16/2018	Laydown Yard	Incidental
House Sparrow	None	43119	6	Systematic
Great Frigatebird	MBTA	1/22/2018	7	Systematic
Spotted Dove	None	1/22/2018	8	Systematic
Hawaiian Hoary Bat	T&E	1/29/2018	1	Incidental
Gray Francolin	None	2/1/2018	Laydown Yard	Incidental
Zebra Dove	None	2/10/2018	1	Incidental
Spotted Dove	None	3/12/2018	7	Systematic
Hawaiian Hoary Bat	T&E	3/26/2018	6	Systematic
Great Frigatebird	MBTA	4/20/2018	7	Incidental
Common Myna	None	5/2/2018	Substation	Incidental
Common Myna	None	6/18/2018	1	Systematic
Hawaiian Petrel	T&E	6/25/2018	8	Incidental

[1]T&E = Protected under the Endangered Species Act as threatened or endangered species; MBTA = Protected under the Migratory Bird Treaty Act; None = Introduced species without legal protection.

2.2 Carcass Persistence Trials

Four carcass persistence trials were conducted during FY 2018, and are summarized together for each carcass size class in Table 2-4. Each trial had a minimum of four carcasses per size class. Zebra dove (*Geopelia striata*), Rock pigeons (*Columba livia*), and cattle egrets (*Bubulcus ibis*), were used as surrogates for large birds, and medium sized black rats (R*attus rattus*) were used as surrogates for bats.

Carcasses were placed at randomly generated points on turbine pads and roads within active search plots. Carcasses were checked daily until they were no longer detectable or the trial period was complete. Trial periods ranged from 21 to 48 days. Changes in carcass condition were tracked and documented with photos. A detailed description of field methods is included in Attachment 1 of the 2013 HCP annual report (Tetra Tech 2013). Estimates of carcass probability and 95 percent confidence intervals for each carcass category were calculated using the single class module of Evidence of Absence software (EoA; Dalthorp et al. 2017).

Auwahi Wind has continually implemented predator control on site since the fall of 2013. The probability that a carcass would persist until the next search slightly dropped in FY 2018 (Table 2-4). This could be due to the increased search interval with the canine search team. Similar to trials conducted in the other years of operation, all large birds persisted through the entire trial period resulting in a very high probability of persistence until the next search in FY 2018.

Table 2-4. Carcass persistence estimates for systematic searches at the Auwahi Wind Project, FY 2018.

Carcass Size Class	N	Probability of Carcass Persistence until Next Search	95 Percent Confidence Interval	Search Interval
Bats	13	0.807	[0.638, 0.944]	4
	20	0.752	[0.609, 0.883]	7
Large birds	10	0.934	[0,1]	4
	10	0.991	[0.921, 0.999]	7

2.3 Searcher Efficiency

Searcher efficiency trials were conducted during FY 2018. These trials incorporated the assessment of each member of the field staff and were conducted by the Project biologist (tester) on site. All trials were conducted so that the searchers being assessed had no prior knowledge of the trial; every fatality search day was treated as if it had the potential to be a searcher efficiency trial day. Twenty-seven searcher efficiency trial days occurred during FY 2018, consisting of 49 individual trials. Rock pigeons and cattle egrets were used as surrogates for large birds, and medium sized black rats and bat decoys were used as surrogates for bats.

For all trials, turbines were randomly selected. On each trial day, one to five carcasses were placed in the field. Carcasses were placed at randomly generated points within the selected turbines' search plots. All trial carcasses were retrieved by the end of each trial day. If a trial carcass was not found by searchers, the tester would go out to the location and attempt to retrieve the trial carcass. If not found by the searcher or the tester, the carcass was assumed to have been scavenged and thus unavailable to be found by searchers and omitted from the analysis. Estimates of searcher efficiency and 95 percent confidence intervals for each carcass category were calculated using the single class module of EoA (Dalthorp et al. 2017).

Searcher efficiency for large birds remained high (100 percent), and searcher efficiency for bats was estimated at 91 percent. Throughout FY 2018 fatality searches were restricted to pads and roads, where regularly scheduled vegetation management improves the detectability of trial carcasses and decreases the risk of injuries for the searchers.

Table 2-5. Searcher efficiency estimates for systematic searches at the Auwahi Wind Project, FY 2018.

Carcass Size Class	Search Method	Number Placed[1]	Number Found	Average Searcher Efficiency	95 Percent Confidence Interval	Overall Average Searcher Efficiency
Bats	Human	8	6	0.75	[0.408, 0.944]	0.91
	Canine	15	15	1	[0.848, 1]	
Large birds	Human	18	18	1	[0.871, 1]	1
	Canine	8	8	1	[0.738, 1]	

[1]Excludes carcasses that were placed in the field but removed by scavengers prior to the survey (i.e., were not available to be found by searchers or tester).

2.4 Take

2.4.1 Direct Take

To ensure an accurate measurement of take and verify compliance under the ITL/ITP, fatality rates are adjusted based on the PCMM results. During the 5½ years of monitoring at the Project (January 2013–June 2018), there were 22 fatalities of Covered Species (20 Hawaiian hoary bats and two Hawaiian petrels). To account for unobserved fatalities, statistical models or estimators are used for calculating fatality rates. Given the limitations of the available statistical tools when dealing with small sample sizes, Auwahi Wind and USFWS/DOFAW agreed to use the EoA software in a meeting on April 17, 2015. EoA software was developed to provide an estimate of the probability, with a user-defined level of credibility, that the number of fatalities has not exceeded a given threshold. An updated version was released in July 2017 (Dalthorp et al. 2017). Interpretation of model output presents a regulatory challenge with respect to determining whether or not a take limit has been reached or exceeded because the EoA does not produce an exact estimated number of fatalities (i.e., a point estimate of take).

The agreed upon approach uses two pieces of information produced by the EoA to evaluate the likelihood that the number of fatalities has reached or exceeded the take limit: 1) The "maximum likelihood value" or where the probability of number of fatalities is greatest; and 2) The one-sided confidence interval surrounding the "most likely value," based on a credibility level of 80 percent. The EoA user manual states "An M*[mortality estimate] based on a credibility level of $1-\alpha=0.5$ [50% credible level] is the most accurate" (page 31, Dalthorp et al. 2017). The use of the 80-percent credible level results in a higher take estimate with a greater certainty that the actual take will not exceed predicted take.

Auwahi Wind used the EoA software and ran the model with PCMM data collected over the past five-and-a-half years for bats and large birds (Table 2-6). Because the fiscal year does not coincide with Project's operational year, the observed fatalities, carcass persistence, searcher efficiency, and detection bias values in Table 2-6 represent values for operational years, with the period from January 1, 2018 through June 30, 2018 representing 2018 (year 6). Therefore, values differ from those reported for the full FY 2018 in the sections above. We estimated an upper limit for potential Project direct take using an 80-percent credibility level for bats and large birds (Attachment 1).

Table 2-6. Summary of PCMM data at the Auwahi Wind Project, from the start of the Project through June 2018 (FY 2013 – FY 2018).

Calendar Year	Curtailment (5 m/s)	Species	Number of Fatalities Detected	Proportion of Carcass Distribution Searched	Average Search Interval (days)	Probability of Persistence	Average Searcher Efficiency (%)	Detection bias[1]	Cumulative Direct Take Estimate[3]	Cumulative Indirect Take Estimate (Adult Equivalent)[4]
2013	No	Hawaiian Hoary bat	1	0.97	9	0.44	0.57	0.28	8	1 (0.47)
2014	No		4	0.94	5	0.75	0.52	0.55	16	1 (0.74)
2015	Yes		1	0.76	3	0.73	0.68	0.45	18	1 (0.74)
2016	Yes		7	0.76	3	0.76	0.76	0.55	34	4 (3.03)
2017[2]	Yes		3	0.76	3-4	0.879	0.667	0.56	39	5 (4.25)
2018[5]	Yes		1	0.76	4-7	0.768	1	0.52	41	5 (4.25)
Calendar Year	**Curtailment (5 m/s)**	**Species**	**Number of Fatalities Detected**	**Proportion of Carcass Distribution Searched**	**Average Search Interval (days)**	**Probability of Persistence**	**Average Searcher Efficiency (%)**	**Detection bias[1]**	**Cumulative Direct Take Estimate[3]**	**Cumulative Indirect Take Estimate (Juvenile)**
2013	No	Hawaiian Petrel	1	0.91	9	0.79	0.74	0.67	3	0.63
2014	No		0	0.91	5	0.98	0.75	0.84	2	0.63
2015	Yes		0	0.56	3	0.993	0.89	0.55	2	0.63
2016	Yes		0	0.56	3	0.96	0.96	0.48	3	0.63
2017	Yes		0	0.56	3-4	0.99	0.96	0.55	3	0.63
2018[5]	Yes		0	0.56	4-7	0.99	1	0.55	3	1.26

[1]Detection bias calculated using Evidence of Absence software (Dalthorp et al. 2017)
[2]Detection bias calculated using pooled data with custom search interval in single class module from Evidence of Absence software
[3]Calculation of direct take based on EoA for search periods (see Attachment 1)
[4]Calculation of indirect take based on USFWS guidance on the calculation of indirect take 2016. Take estimate subjects to change pending genetic analysis of observed fatalities. Calculations based on search periods (see Attachment 1). The actual value is presented in parentheses and the value rounded up to the nearest whole number is presented first.
[5]Calendar year 2018 includes the dates from January 1 through June 30

Based on the 17 bat fatalities detected during five-and-a-half years of surveys and 3 incidental carcasses found in 2017-2018, it is most likely that 34 direct take of bats have occurred (Figure 1). It can be asserted with 80 percent certainty that the number of direct take ranged from 20 to 41 over this survey period (Attachment 1). Auwahi Wind is 80 percent certain that no more than 41 direct take have occurred.

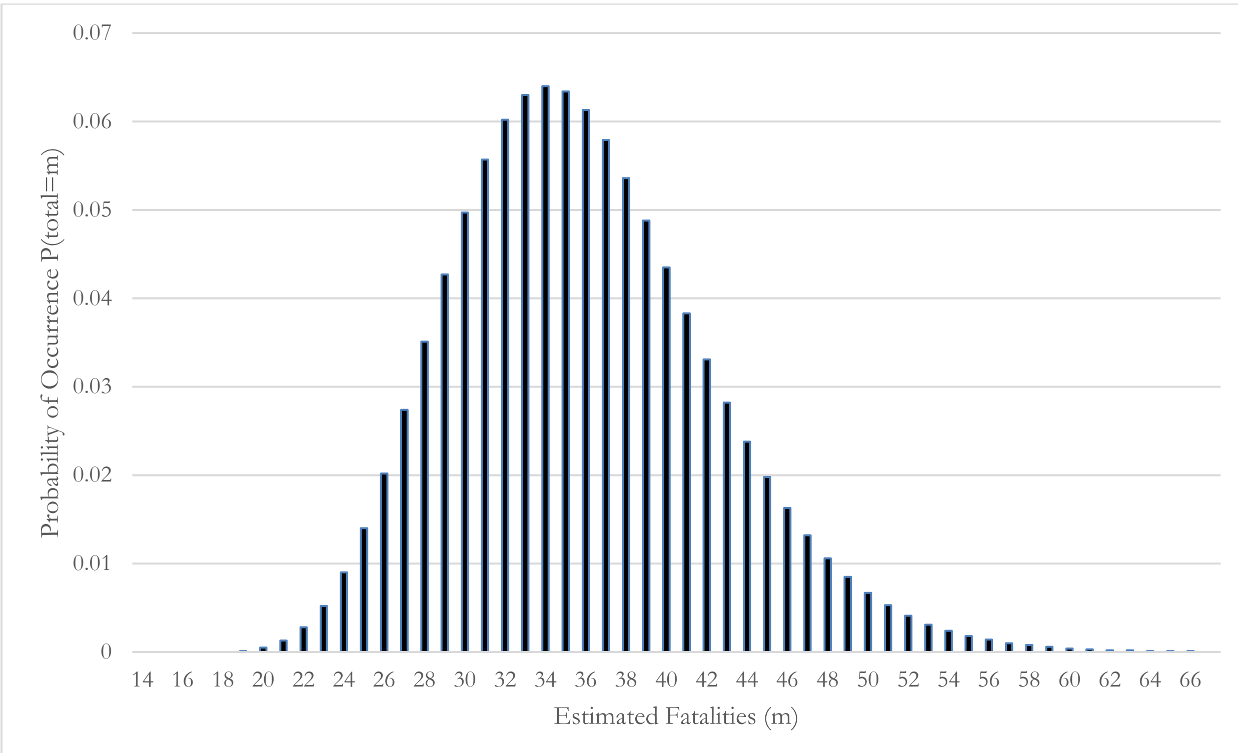

Figure 1. **Posterior probability distribution for Hawaiian hoary bats using the Evidence of Absence software (Dalthorp et al. 2017).**

Based on the 1 Hawaiian petrel fatality detected during five-and-a-half years of surveys and one incidental carcass detected in 2018, it is most likely that 2 direct take of petrels has occurred (Figure 2). Bias correction trials from Year 3 were derived from Year 2 trials conducted in the Year 3 search areas (pads and roads). It can be asserted with 80 percent certainty that the number of fatalities ranged from 2 to 3 over this survey period (Attachment 1). Auwahi Wind is 80 percent certain that no more than three direct take have occurred.

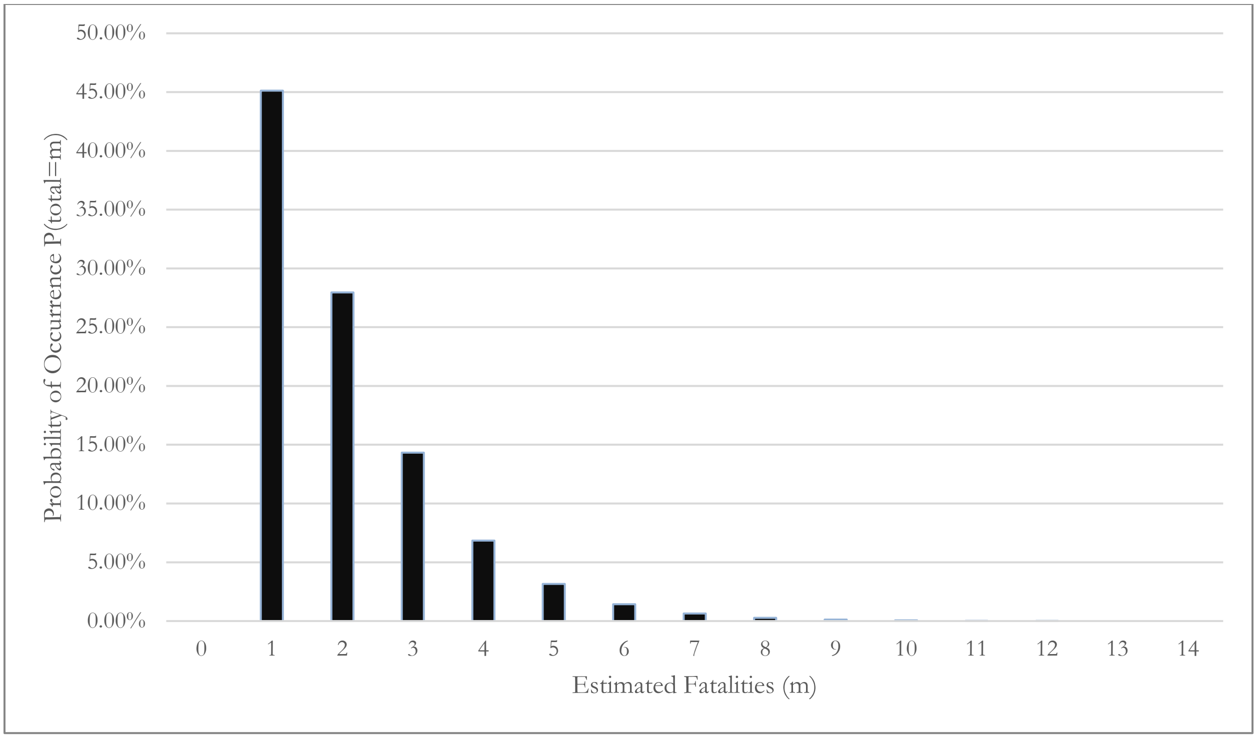

Figure 2. Posterior probability distribution for Hawaiian petrels using the Evidence of Absence software (Dalthorp et al. 2017).

2.4.2 Indirect Take

It is assumed that take of an adult bird or bat during the breeding season may result in the indirect loss of a dependent young. Thus, for every seabird or bat carcass detected during the breeding season, modifiers are applied to estimate indirect take to account for the likelihood that a given adult is reproductively active, the likelihood that the loss of a reproductively active adult results in the loss of its young, and average reproductive success (Auwahi Wind HCP, Section 5.2).

Hawaiian Hoary Bat:

Section 7.1.2 of the approved HCP outlines the reporting process for accounting for indirect take of bat carcasses detected during the breeding season. There have been two confirmed female bat fatalities during the breeding period at Auwahi Wind. Six fatalities were observed during the period when females may be pregnant or supporting dependent young (April 1 – September 15). The sex is unknown for each of these fatalities, but tissue samples have been submitted for genetic testing. Should genetic testing indicate any of these fatalities was a female, Auwahi Wind will reevaluate the potential for the collision-related fatalities to have resulted in indirect take and immediately report results following Section 7.1.2.

The USFWS provided guidance (October 1, 2016) proposing a new standardized process for estimating direct and indirect observed take in the absence of verified gender information in new HCP's and HCP Amendments. At the request of USFWS and DOFAW, this report has utilized the proposed (October 2016) USFWS methodology as an exercise to provide an interim indication of indirect take pending the results of genetic testing. The indirect take exercise for the Project is calculated as the sum of indirect take resulting from the following components of direct take:

- Observed adult female take occurring during the pup dependency period (April 1 – September 15);
- Observed take of unknown sex expected to be female during the pup dependency period; and
- Unobserved take expected to be female and occurring during the pup dependency period.

This exercise in calculating an interim value of indirect take was based on the October 2016 USFWS guidance as follows:

- The average number of pups attributed to a female that survive to weaning is assumed to be 1.8;
- The sex ratio of bats taken through unobserved direct take is assumed to be 50 percent female, unless there is substantial evidence (10 or more bats) to indicate a different sex ratio;
- The assessment of indirect take to a modeled unobserved direct take accounts for the fact that it is not known when the unobserved fatality may have occurred. The period of time from pregnancy to end of pup dependency for any individual bat is estimated to be 3 months. Thus, the probability of taking a female bat that is pregnant or has dependent young is 25 percent; and
- The conversion of juveniles to adults is 1 juvenile to 0.3 adults.

Based on the above methodology, the exercise resulted in an interim estimate of indirect take for FY 2018 calculated as:

Total observed female take assumed to have dependent young (April 1 – September 15)

- 2 (Females observed in the breeding season) * 1.8 (pups per female) = 3.6 juveniles based on observed take

Total observed take of unknown sex assumed to have dependent young (April 1 – September 15) [1]

- 6 (take during breeding season) * 0.5 (assumed sex ratio) * 1.8 (pups per female) = 5.4 juveniles based on observed take.

Total unobserved take of unknown sex assumed to have dependent young (April 1 – September 15)

- (41 [80 percent upper credible limit] – 17 [observed direct take]) * 0.5 (assumed sex ratio) * 0.25 (proportion of calendar year females could be pregnant or have dependent pups) * 1.8 (pups per female) = 5.4 juveniles based on unobserved direct take.

Total Interim Estimate of Juvenile Indirect Take = 14.4 (3.6+ 5.4 + 5.4)

- Total Adult equivalents = 5 (14.4 * 0.3 rounded up to the nearest whole number)
- Total take estimate = 46 (41 direct + 5 indirect)

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[1] Auwahi Wind is awaiting genetic testing results to identify the sex of bat carcasses that were too decomposed to determine sex based on morphology. Indirect take will be adjusted when this information becomes available.

Hawaiian Petrel:

The one Hawaiian petrel observed on site during systematic monitoring was found September 23, 2013. One Hawaiian petrel was observed incidentally (outside of the search plot) on June 25, 2018. The detection of an adult Hawaiian Petrel recorded during the breeding season is assumed to result in the loss of one chick (Auwahi Wind HCP 2012). The average reproductive success for petrels on Maui has been previously measured at 63 percent (Simons and Hodge 1998). Thus, the indirect take associated with the adult Hawaiian Petrel fatality is equal to 1.26 juveniles (the final assessment of indirect take at the end of the permit term will round up to the nearest whole number).

Total observed take assumed to have dependent young (May 1 – September 30)

- 2 (individuals observed in the breeding season) * 0.63 (average reproductive success) = 1.26 chicks based on observed take

Total Interim Take Estimate

- Total indirect take estimate = 2 (1.26 chicks, rounded up to the nearest whole number)
- Total take estimate = 3 adults and 2 chicks

Conversion to adult equivalents

- Total adult equivalents from indirect take = 1 (1.26 chicks * 0.3 surviving to adulthood rounded up to the nearest whole number)
- Total take estimate in adult equivalents = 4 adults (3 direct + 1 indirect)

2.5 Wildlife Education and Incidental Reporting

Auwahi Wind continues to implement a wildlife education and incidental reporting program for contractors, Project staff members, and other ʻUlupalakua Ranch staff who are on site regularly. This annual training enables staff to identify the Covered Species that may occur in the Project area, record observations of these species, and take appropriate steps for documenting and reporting any species encountered during the operation of the Project. Auwahi Wind trained 135 contractors and new staff in FY 2018, and one covered fatality was reported by a construction worker. The wildlife education program has expanded over the past year to include visits by educational groups and outreach events within the community as exemplified in Attachment 10.

3.0 Mitigation

3.1 Hawaiian Petrel Mitigation

Results from the 2017 petrel breeding season are summarized below and fully described in Attachment 2. Beginning August 2013, implementation of the predator control strategy was applied within Kahikinui Petrel Management Area (Kahikinui PMA). This includes predator assessments using tracking tunnels, grid spaced traps targeting areas within a 200-meter (656-foot) buffer of Hawaiian petrel nesting burrows, and deployment of game cameras to monitor for Hawaiian petrel and predator activity. Results of the 2018 breeding season and predator control will be included and summarized in the FY 2019 HCP annual report.

3.1.1 Petrel Burrow Monitoring

Petrel burrows within Kahikinui PMA continued to be monitored during the 2017 breeding season to obtain an estimate of the number of active petrel burrows and reproductive (fledging) success. As in previous years, the monitoring protocol followed methods used by the National Park Service (NPS, NPS 2012) and was supplemented with game cameras. Burrows were checked every two weeks from April –November. All burrows were monitored during each check April – July; after July only active burrows were monitored. Four new burrows located in 2017 were marked, mapped, and added to the monitoring dataset. In the 2017 breeding season, 70 petrel burrows were monitored, 31 showed signs of activity sometime during the breeding season. Consistent activity through the breeding season was seen at 29 burrows. By the end of the breeding season 9 burrows had successfully fledged a chick and one additional burrow probably fledged a chick; no burrows were confirmed to have failed. The number of burrows known to have fledged a chick/number of active burrows within the management area was 34 percent. We cannot confirm that all active burrows were occupied by breeding birds; according to Simons (1985) 66 – 75 percent of the Hawaiian petrel burrows determined to be active contained eggs. The percentage of chicks fledged per confirmed eggs laid within the PMA was 100 percent. The reproductive success values of 34 and 100 percent represent the difference between using only those burrows confirmed to have eggs laid (i.e., burrows classified as successful, probably successful or failed = 10/10 = 100 percent) and assuming all active burrows had eggs laid (i.e., also including burrows classified as occupied by a non-breeder = 10/29 = 34 percent).

3.1.2 Predator Control

Auwahi Wind worked with Island Conservation and Tetra Tech to develop a predator control strategy for Kahikinui PMA based on site-specific conditions and Island Conservation's expertise. The Petrel Monitoring Reports from 2014, 2015, and 2016 present the results of predator control implemented during those breeding seasons. Burrow monitoring prior to predator control was conducted in 2013. In the 2017 breeding season, Auwahi Wind continued to deploy tracking tunnels to assess rodent and mongoose activity across the entire 324-hectare (801-acre) Kahikinui PMA at the start and halfway through the breeding season. The 1-day tracking index was 2.7 percent for rodents in February. There was a decrease from 2.7 to 1.6 percent (3 of 187) in the tracking index for rodents in August. No mongoose were initially detected in February along any of the transects, with the 3-day tracking index of 0 percent. Halfway through the trapping season in August, 1 mongoose was detected along transect 3.

The predator control grid was operational for 34 weeks between March and mid-November (see Attachment 2, Sections 2.4 and 3.4). Predator control efforts removed 30 targeted mammalian predators from Kahikinui PMA, including 16 mice and 14 rats. All traps were checked and baited every two weeks. Baits were alternated between trap checks. Auwahi Wind has continued to provide support (e.g., training, deployment, monitoring) to the Maui Nui Seabird Recovery Project and Haleakala NPS relevant to loaned traps used for predator control in the adjacent Kahikinui Natural Area Reserve and Haleakala National Park (HNP). These traps removed an additional 3 predators, all feral cats, including 1 pregnant female. Support was provided related to loaned traps to the Kahoolawe Island Reserve Commission, Terraform, Molokai Land Trust and the Maui Forest Bird Recovery Project. The loaned traps within the Waikamoi management area removed a total of 7 predators.

3.1.3 Benefits

Auwahi Wind has measured reproductive success of Hawaiian petrels within Kahikinui PMA for the past six years as well as predator activity for the past five years. In accordance with assumptions in the HCP, predator control conducted by Auwahi Wind is anticipated to have had a positive effect on the reproductive success of Hawaiian petrels within Kahikinui PMA, and may also have reduced predation in adjacent areas managed by NPS (Haleakalā National Park), Maui Nui Seabird Recovery Project (State of Hawaii Kahikinui Natural Area Reserve), Leeward Haleakalā Watershed Partnership (State of Hawaii Department of Hawaiian Homelands) and the National Science Foundation - Daniel K. Inouye Solar Telescope (DKIST). Ongoing monitoring continues to benefit the petrel colony by providing new information on the extent of the colony, reproductive success, and fledging activity, which were previously unknown. Over the course of six years, 16 new burrows have been located, adding to the original 54 burrows located with extensive surveys in 2012 for a total of 70 burrows observed in 2017. Deployment of Reconyx cameras have also given the scientific community unique insight into the activity and exact fledging dates of Hawaiian petrels within the East Maui population.

The number of burrows existing within the Kahikinui PMA colony is not consistently at the level needed to ensure that the success criteria for Tier 1 mitigation under the HCP are met. The original HCP included a demographic model which assumed an average of 33 active burrows and a reproductive success rate of 60 percent with predator trapping (see Table 6-4 in the original HCP); however, on average there have been 29 active burrows monitored each year between 2013–2017 (ranging from 25 to 33) and an average reproductive success rate of approximately 29 percent using the conservatively low value (see Attachment 2). Therefore, the assumed benefit of predator control based on the available number of active burrows in the Kahikinui PMA is not sufficient to produce enough adult petrels, based on estimated population growth, to offset the amount of authorized petrel take under the ITP. Therefore, Auwahi Wind proposes to continue petrel mitigation efforts at the Kahikinui PMA in the 2018 breeding season, and then transition mitigation efforts (monitoring and predator control) to the adjacent DKIST site in 2019 to overtake the management of that site. Such a transition was identified as a potential adaptive management option within the Auwahi Wind's approved HCP if the mitigation efforts at the Kahikinui PMA colony were insufficient to provide the necessary benefit (Tetra Tech 2012a). Given the large number of burrows (359) and reported reproductive success at the DKIST site (10 – 41 percent; Attachment 2), predator control is expected to produce enough petrels to meet Tier 1 mitigation success criteria by the end of the permit term. See Attachment 2 for additional detail.

3.2 Hawaiian Hoary Bat Mitigation and Monitoring

Implementation of Tier 1 – 3 bat mitigation is on-going at the Waihou Mitigation Area, located on ʻUluplalakua Ranch. Tier 1 mitigation consists of the restoration of native forest on approximately 130 acres of pastureland in the Waihou Mitigation Area, specifically the Puʻu Makua parcel (including installation of an ungulate proof fence, ungulate removal and native reforestation). This parcel was placed into a conservation easement held by the Hawaiian Islands Land Trust on December 18, 2012 and will be protected in perpetuity. Tier 2 mitigation consists of funding Hawaiian hoary bat research to contribute to the overall knowledge of the Hawaiian hoary bat on Maui. Tier 3 mitigation expands on the bat research approved for Tier 2. All tiers of mitigation have been funded and are being implemented in accordance with mitigation plans approved by USFWS and DOFAW.

Auwahi Wind also installed two ground-based detectors (Wildlife Acoustics SM2-XBat) at the Project site and collected acoustic data for the first two and one-half years of operations. Methods and results of this study are presented in the FY 2016 HCP annual report (Sempra Energy 2016).

3.2.1 Tier 1 Mitigation

Auwahi Wind is in its fourth year of habitat restoration efforts at the 53-hectare (130 acre) Pu'u Makua mitigation site. The habitat restoration included ungulate fence installation, ungulate removal, invasive plant species removal, and plantings of native trees and shrubs. The status of each major activity is summarized below. The ungulate fence, installed in 2013, is in good condition. The 2.4-meter (8-foot) tall ungulate exclusion fence surrounding the parcel was inspected quarterly in FY 2018, and the parcel remains ungulate-free.

Biannual vegetation management activities continued in FY 2018 to maintain control of the target invasive species- tropical ash (*Fraxinus uhdei*), bocconia (*Bocconia frutescens*), black wattle (*Acacia mearnsii*), and Monterey pine (*Pinus radiata*) - coverages well below the required 50 percent success criteria. Follow-up management within the plots has begun to focus on the removal and suppression of non-targeted invasive species such as non-native grass and blackberry (*Rubus argutus*).

Auwahi Wind completed extensive native tree out-planting in FY 2016, with over 13,000 plants on over 40 acres of open pasture within the Puʻu Makua site (Auwahi Wind 2016). Out-planted trees were predominately koa (*Acacia koa*), ʻōhiʻa lehua (*Metrosideros polymorpha*), and māmane (*Sophora chrysophylla*). Some specialty native plants were mixed into out-planting efforts to create more diversity within plots. These specialty plants included māmaki (*Pipturus albidus*), kāwaʻu (*Ilex anomala*), halapepe (*Chrysodracon auwahiensis*), ʻōhelo (*Vaccinium reticulatum*), and ʻōhe mauka (*Polyscias hawaiensis*). Follow-up management within the plots continued in FY 2018, and included replacing lost out-planted native trees with new native plants starting in May 2017.

In April 2018, Auwahi Wind continued vegetation monitoring (Year 3 of monitoring with baseline conditions established in 2014 and 2015), with the objectives of assessing the effectiveness of invasive species removal and out-planting management activities. The follow-up survey used the same methods as the original baseline monitoring (Tetra Tech 2014). Results are summarized here and discussed in greater detail in the Hawaiian Hoary Bat Tier 1 Pu'u Makua Mitigation Summary in Attachment 3. For FY 2018 (Year 3) monitoring of percent vegetative cover along all transects showed an overall percent cover of native woody vegetation of 24.2 percent, and non-native vegetation of 9.6 percent (excluding kikuyu grass). Auwahi Wind has exceeded the interim Success Criteria for Year 3 (FY 2018). The target for out-plantings survival for Year 3 was set at 75 percent alive; given that all lost trees are replaced 100 percent of planted native plants are alive. The target for non-native plant cover for Year 3 was set at less than 75 percent; non-native cover in FY 2018 was 9.6 percent.

The restoration of the mitigation site has also been adaptively managed due to the implementation of the project ahead of the proposed timeline. Auwahi Wind has created suitable bat habitat as part of Tier 1 mitigation with the fence construction, native plant restoration, target species removal, and bat monitoring. Bat habitat enhancements and additional work has continued at Pu'u Makua with the addition of a diversity of native Hawaiian plants and adding Blackberry to the list of target species to control within the management unit.

3.2.2 Tier 2 and 3 Mitigation

Auwahi Wind worked with Tetra Tech and Dr. Frank Bonaccorso from USGS to develop a research project combining radio telemetry and acoustic monitoring. The goal of this study is to contribute to the knowledge of the Hawaiian hoary bat on Maui and also to track the success of restoration efforts in the Waihou Mitigation Area. The Tier 2 research plan was approved by USFWS/DOFAW in March 2014 (Sempra Energy 2014). The Tier 3 research plan expanded the sampling and scope of the approved Tier 2 research plan. The final Tier 2 – 3 research plan was approved in May 2016. This combined research plan includes acoustic monitoring (2015 – 2018), seasonal radio telemetry (2016 – 2017) with two additional phases of radio-telemetry to be completed and timed based on results from on-going acoustic monitoring efforts, an insect prey base study (2016), and a food habit assessment (2016 – 2017).

Auwahi Wind began implementing the approved Tier 2 research plan in March of 2015. The Tier 2 research plan study includes acoustic monitoring, used to establish a baseline of seasonal occupancy for bats within the mitigation area and to focus subsequent mist-netting and radio-telemetry efforts. Six acoustic detectors have been operational within the Puʻu Makua parcel (four within fence) and surrounding areas (two outside fence) since March of 2015. Acoustic data cards are collected every 3 – 6 months.

Auwahi Wind began implementing the approved Tier 3 research plan in October of 2016; however, as a result of significant electromagnetic interference from radio towers, the Tier 3 bat mitigation study was adaptively managed in consultation with USFWS and DOFAW to focus on insect prey base and food habitat assessment objectives that do not rely on telemetry information (Attachment 3). As part of this adaptive management, additional acoustic monitoring is being performed and the level of effort and periods of performance for other elements have been extended. Adaptive management measures to the research component include:

1) Increase in the staff effort devoted to nights of mist-netting at Pu'u Makua and outlying areas within ʻUlupalakua Ranch, to capture bats for genetic sampling and fecal collection.
2) Add a second season of insect prey base sampling at the Waihou Mitigation area and mist net sites, where only a single season was previously planned/budgeted.
3) Increase the number of insect prey species (up to 150 insect samples) that will be bar-coded for a larger library to match with insect fecal pellets in a dietary study.[2]
4) Additional items may be added to the scope of work if field time and funds allow:
    a. Adding acoustic detectors at other various locations on Ulupalakua Ranch lands.
    b. Adding insect prey base sampling at the Project to include additional site and additional species sampled.

Research objectives for Tier 2 and 3 mitigation completed in FY 2018 are summarized by USGS in Attachment 3. Within FY 2018, this adaptive management included: one acoustic detector was deployed at the ponds within the mitigation area (April 2017), one acoustic detector was placed at an anchaline pond along the shoreline of the Project area (June 2017), and two detectors were set up in Wiliwili (*Erythrina*

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[2] This effort is distinct from the USGS proposal currently accepted by the ESRC, although the analysis will be conducted in parallel.

sandwicensis) mixed native dryland forest grazing pastures at Auwahi Wind Farm site (June 2017). At the end of the field work, the telemetry equipment was donated to USGS for conducting current Hawaiian hoary bat research.

3.2.3 Benefits

Completion of the fence, removal of ungulates, and habitat restoration will benefit the Hawaiian hoary bat through the creation and protection of roosting and foraging habitat. Acoustic monitoring at the Project provides site-specific information on activity patterns and could be used in conjunction with other monitoring projects to acquire an island-wide understanding of Hawaiian hoary bat activity on Maui. Research has been identified as an important recovery action under the Hawaiian hoary bat recovery plan (USFWS 1998), and as an HCP mitigation action in the Endangered Species Recovery Committee (ESRC) Bat Guidance (DOFAW 2015). Tier 2 and 3 mitigation research plan funds bat research whose results will contribute to closing important gaps in the understanding of the species. Specifically, Auwahi Wind's research will fill in gaps in our knowledge of Hawaiian hoary bat diet, prey availability, and plant/prey associations. The results of this data should improve our understanding of how to manage habitat to benefit the Hawaiian hoary bat. Initial research has already identified pasture and water features that are being used for foraging by the Hawaiian hoary bat, and developing a nuanced understanding of how such features support the bat's life history requirements will be an important step in improving Hawaiian hoary bat mitigation efforts.

3.3 Blackburn's Sphinx Moth

As stated in the 2012 HCP annual report (Tetra Tech 2012b), Auwahi Wind developed a Memorandum of Understanding (MOU) and made a one-time payment of $144,000 to the Leeward Haleakalā Watershed Restoration Project on April 17, 2012, to restore 6 acres of dryland forest at the Auwahi Forest Restoration Project. A letter from the Auwahi Forest Restoration Project providing an update on use of funding during FY 2018 is provided in Attachment 5, which includes the location and description of habitat. A total of 1,086 of the proposed 1,500 ʻaiea (*Nothocestrum latifolium*) have been out-planted into 4.5 hectares (11 acres). Auwahi Forest Restoration Project is committed to fulfilling their MOU obligations over the next year, although they have continued to express concern over ʻaiea seed production.

3.4 Hawaiian Goose

As stated in the 2012 annual report, Auwahi Wind provided a one-time payment on April 17, 2012, of $25,000 to the NPS for use in building a Hawaiian goose rescue pen and predator fence to support egg, gosling, and adult rescue efforts in Haleakala National Park. Since construction of the pen, 10 goslings have been raised and released from the pen between years 2011 and 2016 (one in 2011, five in 2013 and four in 2016). One adult was rehabilitated and released in 2011.

3.5 Red ʻIlima

Auwahi Wind has fulfilled its HCP requirement to out-plant 10 Red ʻilima on ʻUlupalakua Ranch to offset potential Project impacts. Plants were propagated at the ʻUlupalakua Ranch nursery in 2013. Cuttings and propagation material was collected from a wild plant near turbine 6. The wild plant died but over 50 plants grown at the nursery from propagation material have been successfully outplanted and are thriving. In FY 18, 37 additional Red Ilima were planted in the newly constructed 1 acre ungulate free fenced site at the base of Puu Hokukano, of which 3 died. This fenced restoration site has provided a valuable source of native dryland forest propagation material from established native outplantings and helps with species identification serving as an outdoor classroom of the native vegetation that is currently and historically found in the area.

4.0 Adaptive Management

4.1 Minimization

Under adaptive management, Auwahi Wind has made the following changes to improve minimization measures at the wind facility:

- Auwahi Wind voluntarily implemented low wind speed curtailment on February 5, 2015, turbine blades are now feathered below a cut-in speed of 5 meters/second, from one hour before sunset until one hour after sunrise, year-round;
- Beginning in June 2018, Auwahi Wind incorporated thermal imagery paired with acoustic monitoring to gather data on the wildlife interactions with the turbines:
    - Initiated a year-long acoustic study of bat activity at the nacelles, and
    - Performing thermal imagery studies at the turbines included in the acoustic survey during the high-risk months, August through October, to validate the findings of the acoustic survey, inform raised cut-in speed strategy and optimize placement of potential deterrent technologies; and.
- To further minimize negative hazards associated with operating turbines at low wind speeds, Auwahi Wind will implement a raised cut-in speed of 6.9 m/s, with feathering, nightly during the high-risk months of August through October, for evaluation purposes.

4.2 Post-Construction Mortality Monitoring

Under adaptive management, Auwahi Wind has made the following changes to improve post-construction mortality monitoring:

- Under the recommendation of USFWS/DOFAW, Auwahi Wind continues to implement scavenger control at the site. Predator traps are deployed across all turbine search plots and are used year-round to remove scavengers and increase carcass persistence. Carcass persistence has increased across the site as a result;
- Beginning in January 2015, Auwahi Wind implemented quarterly vegetation management on pads and roads to increase visibility during fatality searches. Vegetation is cut back and maintained at 50 – 100 mm (2 – 4 inches) along pads and roads year-round. These efforts have increased the detectability of carcass surrogates during searcher efficiency trials. Monthly vegetation management efforts were initiated in March of 2017;
- Beginning in January 2015, Auwahi Wind switched to systematic searching of pads and roads within a 100-meter buffer of the turbine. Searcher efficiency and carcass persistence trials continue within this area to better refine fatality estimations for the life of the Project;
- Auwahi Wind continues to work with USFWS/DOFAW on interpreting EoA outputs, given the limitations of using probability distributions to interpret an exact estimated number of fatalities (i.e., a point estimate of take);

- Beginning in January 2018, Auwahi Wind incorporated the use of a canine search team into post-construction mortality monitoring to increase searcher efficiency on site;
- In an effort to identify threats to Hawaiian hoary bats, necropsies were requested of 2 carcasses found near the turbines. A histopathology is being performed by USGS to identify any other factors contributing to bat fatalities. No necropsies have been performed on carcasses found at wind farm sites on Maui although USGS provided data for fatalities that were found in homeowner yards and an instance of cat predation; and
- From January 2018-February 2018, a carcass persistence trial was conducted for 48 days, or twice the amount of past trials, to be consistent with almost the doubling of search intervals. The canine search team was also incorporated into the checks and in some cases was able to extend persistence by finding moved/scavenged carcasses.

4.3 Blackburn's Sphinx Moth Avoidance and Minimization

Auwahi Wind continues to implement avoidance and minimization measures for the Blackburn's sphinx moth. Monthly surveys continue to be conducted for Blackburn's Sphinx moth and manual removal of tree tobacco (*Nicotiana glauca*) has been completed, in addition to translocating any Blackburn's sphinx moth larvae and eggs found on tree tobacco at the Project (USFWS/DOFAW email instructions February 7, 2014). Areas within 33 feet of roadsides and edges of turbine pads are targeted because they may present a hazard for the moth, due to exposure to dust, possible trampling, and increased chance of collisions with vehicles. Through continued maintenance on-site there has been a decrease in plants within hazard areas. During FY 2018, 92 plants were removed from the Project with most plants observed to be in the immature vegetative state. In FY 2018, four larvae were detected during visual surveys of tree tobacco (Attachment 6). Tree tobacco established in the area around turbine 4 while it was shut down and off-limits for safety concerns most of the year. In collaboration with Ulupalakua Ranch, Auwahi Wind created a one acre protected dryland forest restoration site. Larvae can be translocated from removed tree tobacco within the Project area to tree tobacco near the dryland forest in hopes that the area can support a population of translocated larvae among the reintroduced native plants.

5.0 Changed or Unforseen Circumstances

The Project has seen higher than expected take of the Hawaiian hoary bat at its facility in the first 6 years of operations. On February 25, 2015, Auwahi Wind met with USFWS/ DOFAW to discuss its pursuit of a major amendment to their joint ITL/ITP. Auwahi Wind has been actively engaged with USFWS, DOFAW, and the ESRC to finalize an Amendment to the Auwahi Wind HCP. Drafts of the Auwahi Wind HCP Amendment have been submitted to the agencies on: March 22, 2017, and July 13, 2018. The proposed major amendment will be limited exclusively to address take of the federally listed Hawaiian hoary bat, incidental to activities associated with the operation, maintenance, and decommissioning of the Project. The amendment process is currently under way and several drafts have been circulated between USFWS and DOFAW field offices. The amendment is expected to be approved in FY 2019. Timeline of amendment process is per below:

- February 25, 2015, Auwahi Wind met with the USFWS and DOFAW to discuss Auwahi's intent to pursue a major amendment of its HCP and ITP/ITL.

- March 24, 2015, Auwahi Wind confirmed via letter to the agencies of its intent to pursue a major Amendment.
- October 16, 2015, Auwahi Wind met with the agencies to discuss the major components of the HCP Amendment, including total requested take, mitigation strategy and mitigation tier triggers.
- March 7, 2016 Auwahi Wind submitted a Supplemental Environmental Assessment (EA) outline to USFWS for review and comment.
- March 17, 2016 Auwahi Wind submitted a first draft of the HCP Amendment to both agencies for review and comment.
- May 4, 2016 Auwahi met with the USFWS and DOFAW to discuss the comments and receive further clarification and guidance.
- June 29, 2016 Auwahi submitted a second draft HCP Amendment to the USFWS and DOFAW for review and comment.
- July 1, 2016 Auwahi submitted a draft Supplemental EA to the USFWS.
- July 31, 2016, Auwahi received comments from the USFWS and DOFAW on the second draft of the HCP Amendment, and comments from the USFWS on the draft Supplemental EA.
- July 22, 2016, Auwahi requested via email that DOFAW concur with Auwahi counsel who determined that no supplemental Chapter 343 environmental review was required under the statutes and applicable case law.
- August 11, 2016, Auwahi Wind submitted a third draft submitted to USFWS/DOFAW.
- August 31, 2016, the USFWS requested that Auwahi reassess the take request contained in the draft Amendment based on the unexpected cluster of four bat fatalities identified during monitoring in June – August (three additional fatalities occurred in September) 2016.
- October 31, 2016, Auwahi presented a revised take authorization request to the USFWS and DOFAW.
- December 8, 2016 Auwahi brought the ESRC and USGS model developers into the discussion. Auwahi briefed the ESRC on its forthcoming HCP Amendment, including the revised take authorization request.
- January 20, 2017 Auwahi met with the USFWS, DOFAW and USGS statisticians to discuss the post-construction monitoring results to date and the associated take estimates developed by Auwahi.
- February 23, 2017 Auwahi sent the USFWS and DOFAW a detailed write-up of its take analysis methodology and an explanation of its take authorization request and asked the agencies to provide similar justification for their recommendations.
- March 22, 2017 Auwahi sent the USFWS and DOFAW a fourth draft of the HCP Amendment.
- March 29, 2017 Auwahi sent the USFWS a second draft of the Supplemental EA.
- Mid-May 2017 Auwahi received comments from the USFWS and DOFAW on the third draft of the HCP Amendment, but no comments from the USFWS on the second draft of the Supplemental EA and no formal response from DOFAW on the Chapter 343 question.
- June 16, 2017 USFWS informed Auwahi by email that USFWS changed its position regarding NEPA, and that the USFWS would now require a full Environmental Impact Statement (EIS) rather than a Supplemental EA.

- June 29, 2017 USFWS provided revised written guidance regarding appropriate types of Hawaiian hoary bat mitigation, and limitations on the use of mitigation tiers.
- July 10, 2017 Auwahi and the agencies met to discuss the USFWS' change of position, and the new and much longer timeline that would be necessary for a Supplemental EIS.
- August 4, 2017, the State Attorney General's office sent a letter on behalf of DOFAW to Maui County, explaining for the first time why DOFAW believed it could require a Chapter 343 Supplement EIS for the HCP Amendment, and sought Maui County's input.
- August 24, 2017, Maui County responded that it would defer to DOFAW's decision regarding the need for an Supplement EIS, since the County's permits were not likely to be impacted by the HCP Amendment.
- October 9, 2017 Auwahi Wind submitted the Fourth draft HCP Amendment to USFWS and DOFAW.
- January 2018, Auwahi received comments on the Fourth draft HCP Amendment from USFWS and DOFAW.
- March 20, 2018, Meet with USFWS and DOFAW to request a group meeting with the Regional Office to obtain consistency in guidance and any updates to guidance for mitigation. USFWS declined Auwahi's request.
- May 1, 2018 Auwahi Wind met with USFWS to discuss significant revisions to the HCP amendment based on agency comments including revising to 3 tiers, detailed adaptive management strategy, and mitigation. USFWS informed Auwahi Wind that research was not recommended as mitigation for future tiers, it should be considered a low mitigation priority for Tier 4. USFWS stated that an updated HCP must be submitted by June 30, 2018 but that additional edits could be made through the end of August/early September 2018.
- May 21, 2018 Auwahi Wind met with USFWS and DOFAW to discuss its plan to take estimates, the biological basis of tiers, and triggering for subsequent tiers.
- May 25, 2018 Auwahi Wind met with USFWS and DOFAW to discuss Tier 4 mitigation. Based on USFWS recommendations, Auwahi changed their Tier 4 mitigation from research to land protection.
- FY 2018 ended June 30, 2018.

6.0 Annual Workplan and Schedule

A work plan for FY 2019 is provided in Attachment 5. This work plan identifies major monitoring and mitigation activities and their associated timelines.

7.0 Cost Expenditures and Budget

A summary of HCP-related expenditures for FY 2018 is provided in Attachment 8. This summary lists costs (including staff labor) that Auwahi Wind has expended toward fulfilling the terms of the HCP in FY 2018, as well as cumulatively, and compares them against the budgeted amounts specified in Appendix 8 of the HCP.

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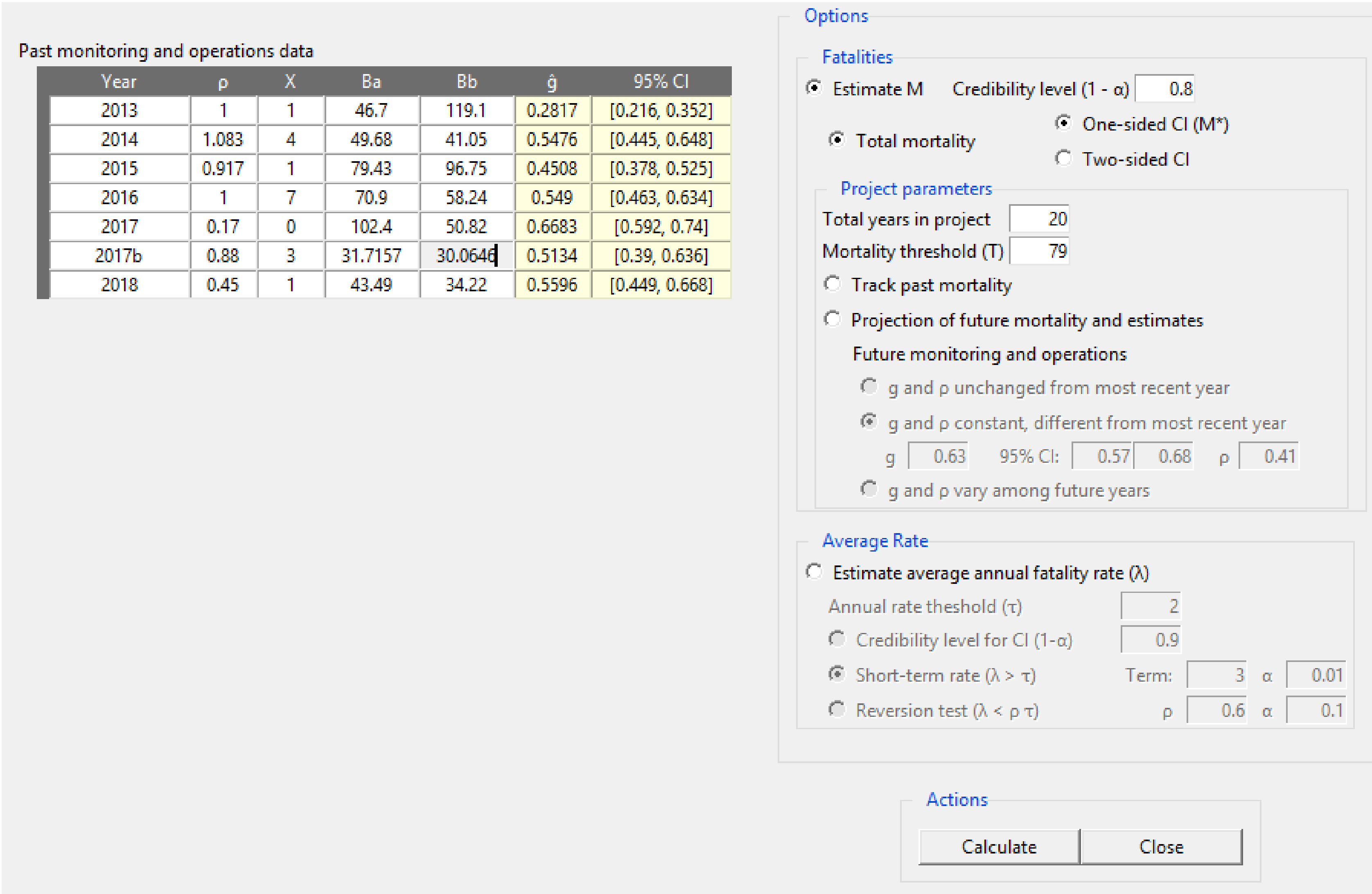
Attachment 1

Evidence of Absence Software Inputs and Outputs – Fatality Estimatio

Attachment 1 -Evidence of Absence Software Inputs and Outputs – Fatality Estimation



Past monitoring and operations data

Year	ρ	X	Ba	Bb	ĝ	95% CI
2013	1	1	46.7	119.1	0.2817	[0.216, 0.352]
2014	1.083	4	49.68	41.05	0.5476	[0.445, 0.648]
2015	0.917	1	79.43	96.75	0.4508	[0.378, 0.525]
2016	1	7	70.9	58.24	0.549	[0.463, 0.634]
2017	0.17	0	102.4	50.82	0.6683	[0.592, 0.74]
2017b	0.88	3	31.7157	30.0646	0.5134	[0.39, 0.636]
2018	0.45	1	43.49	34.22	0.5596	[0.449, 0.668]

Figure 1. Evidence of Absence software input for Hawiian hoary bats multi-year analysis (Dalthorp et al. 2017).

```
Summary statistics for total mortality through 7 years
-------------------------------------
Results
M* = 41 for 1 - a = 0.8, i.e., P(M <= 41) >= 80%

Estimated overall detection probability: g = 0.483, 95% CI = [0.445, 0.52]
   Ba = 324.54, Bb = 347.94

Estimated baseline fatality rate: lambda = 6.609, 95% CI = [3.86, 10.1]


Test of assumed relative weights (rho) and potential bias              Fitted rho
Assumed rho     95% CI
      1     [0.064, 1.921]
   1.08     [0.396, 2.274]
  0.917     [0.036, 1.251]
      1     [0.760, 3.117]
   0.17     [0.000, 0.567]
   0.88     [0.240, 2.039]
   0.45     [0.026, 1.069]

p = 0.41451 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 1.032

Posterior distribution of M
m      p(M = m) p(M > m)
0       0.0000   1.0000
...
19      0.0001   0.9998
20      0.0005   0.9993
21      0.0013   0.9981
22      0.0028   0.9953
23      0.0052   0.9901
24      0.0090   0.9811
25      0.0140   0.9671
26      0.0202   0.9468
27      0.0274   0.9194
28      0.0351   0.8843
29      0.0427   0.8416
30      0.0497   0.7919
31      0.0557   0.7362
32      0.0602   0.6760
33      0.0630   0.6130
34      0.0640   0.5490
35      0.0634   0.4856
36      0.0613   0.4243
37      0.0579   0.3664
38      0.0536   0.3128
39      0.0488   0.2640
40      0.0435   0.2205
41      0.0383   0.1822
...
================================================================================
Input
Year (or period) rel_wt  X    Ba     Bb   ghat    95% CI
2013             1.000   1   46.7  119.1 0.282 [0.216, 0.352]
2014             1.083   4  49.68  41.05 0.548 [0.445, 0.648]
2015             0.917   1  79.43  96.75 0.451 [0.378, 0.525]
2016             1.000   7   70.9  58.24 0.549 [0.463, 0.634]
2017             0.170   0  102.4  50.82 0.668 [0.592, 0.740]
2017b            0.880   3  31.72  30.06 0.513 [0.390, 0.636]
2018             0.450   1  43.49  34.22 0.560 [0.449, 0.668]
```

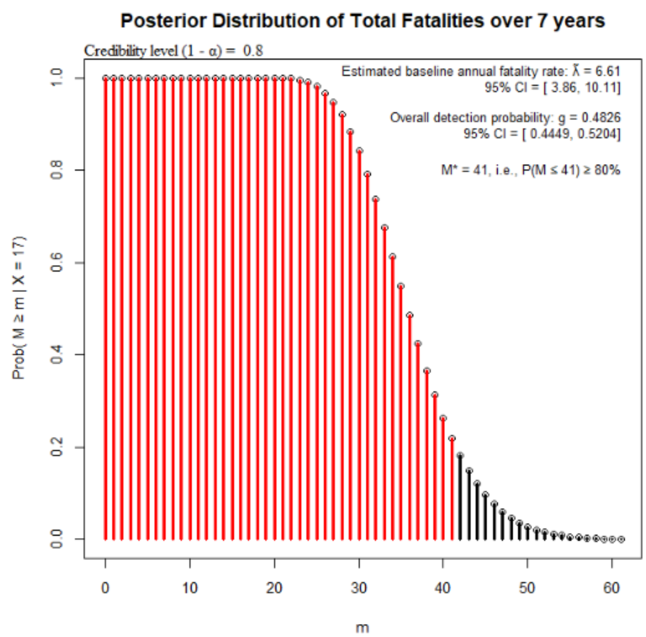
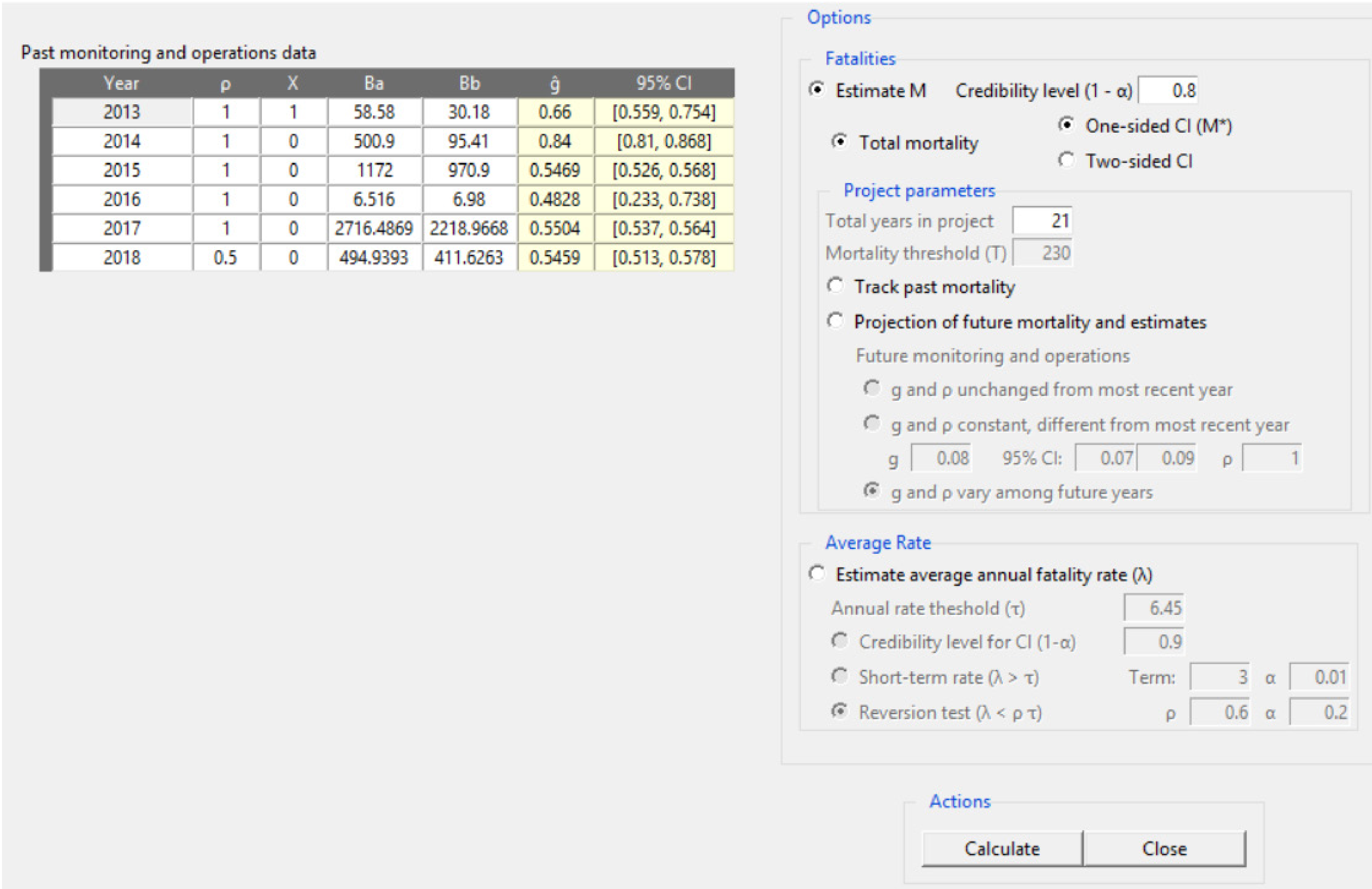


Figure 2. Evidence of Absence software output for Hawiian hoary bats multi-year analysis (Dalthorp et al. 2017).

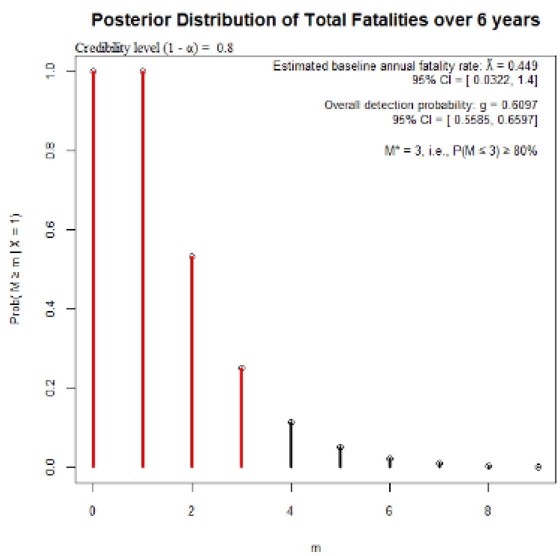


Past monitoring and operations data

Year	ρ	X	Ba	Bb	ĝ	95% CI
2013	1	1	58.58	30.18	0.66	[0.559, 0.754]
2014	1	0	500.9	95.41	0.84	[0.81, 0.868]
2015	1	0	1172	970.9	0.5469	[0.526, 0.568]
2016	1	0	6.516	6.98	0.4828	[0.233, 0.738]
2017	1	0	2716.4869	2218.9668	0.5504	[0.537, 0.564]
2018	0.5	0	494.9393	411.6263	0.5459	[0.513, 0.578]

Figure 3. Evidence of Absence software output for Hawiian petrels multi-year analysis (Dalthorp et al. 2017).

```
Summary statistics for total mortality through 6 years
-----------------------------------
Results
M* = 3 for 1 - a = 0.8, i.e., P(M <= 3) >= 80%

Estimated overall detection probability: g = 0.61, 95% CI = [0.558, 0.66]
   Ba = 216.82, Bb = 138.82

Estimated baseline fatality rate: lambda = 0.4485, 95% CI = [0.0322, 1.4]


Test of assumed relative weights (rho) and potential bias              Fitted rho
Assumed rho      95% CI
      1      [0.226, 4.409]
      1      [0.002, 2.339]
      1      [0.004, 2.883]
      1      [0.007, 3.612]
      1      [0.006, 3.374]
    0.5      [0.005, 3.063]

p = 0.66219 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 0.982

Posterior distribution of M
m      p(M = m)  p(M > m)
0       0.0000    1.0000
1       0.4681    0.5319
2       0.2796    0.2522
3       0.1383    0.1140
4       0.0638    0.0502
5       0.0284    0.0218
6       0.0124    0.0094
7       0.0054    0.0040
8       0.0023    0.0017
9       0.0010    0.0007
10      0.0004    0.0003
11      0.0002    0.0001
12      0.0001    0.0000
13      0.0000    0.0000
14      0.0000    0.0000
=====================================                                          ===
```




```
Input
Year (or period) rel_wt  X    Ba     Bb   ghat     95% CI
2013              1.000  1  58.58  30.18 0.660 [0.559, 0.754]
2014              1.000  0  500.9  95.41 0.840 [0.810, 0.868]
2015              1.000  0   1172  970.9 0.547 [0.526, 0.568]
2016              1.000  0  6.516   6.98 0.483 [0.233, 0.738]
2017              1.000  0   2716   2219 0.550 [0.537, 0.564]
2018              0.500  0  494.9  411.6 0.546 [0.513, 0.578]
```

Figure 4. Evidence of Absence software output for Hawiian petrels multi-year analysis (Dalthorp et al. 2017).

Attachment 2
Kahikinui Management Area Hawaiian Petrel Monitoring Report

Auwahi Wind Energy Project
2017 Auwahi Wind Energy Hawaiian Petrel Report

Submitted To:

Sempra® Renewables

Auwahi Wind

Prepared By:

TETRA TECH

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August 31, 2018

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1.0 Introduction

1.1 Background

In December 2012, Auwahi Wind Energy, LLC (Auwahi Wind) began commercial operations of the Auwahi Wind Farm (Project) in east Maui, Hawaii, consisting of eight 3-megawatt wind turbines. To address potential endangered species impacts associated with the Project, Auwahi Wind developed a Habitat Conservation Plan (HCP), which was finalized in January 2012 (Tetra Tech 2012a). Based on the anticipated take levels provided in the HCP, Auwahi Wind obtained an incidental take license (ITL) from the Hawaii Department of Land and Natural Resources (DLNR) on February 9, 2012, and an incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS) on February 24, 2012. To address the reporting requirements under the HCP for Hawaiian petrels (*Pterodroma sandwichensis*; petrels), this report summarizes the petrel management activities executed in 2017 within the Auwahi Wind Kahikinui Petrel Management Area (Kahikinui PMA).

As proposed in the Auwahi Wind HCP, take and mitigation are accounted for in tiers such that each subsequent tier has a higher take level and a correspondingly higher level of mitigation. For the initial tier (Tier 1), Auwahi Wind committed to mitigating potential impacts to petrels by implementing predator control within Kahikinui PMA to increase the survival and reproductive success of Hawaiian petrels. Tier 1 mitigation requires predator control at 33 active burrows (see the HCP for additional details). Petrel management activities will be considered successful if (1) predator control is successfully implemented and (2) mitigation efforts result in an increase in reproduction that offsets authorized take, as outlined in the Hawaiian Petrel Management Plan (Management Plan; Tetra Tech 2012b), approved by USFWS and the DLNR/Division of Fish and Wildlife (DOFAW).

A full predator control strategy for Kahikinui PMA was developed in partnership with Tetra Tech, Inc. and Island Conservation (Island Conservation and Tetra Tech, Inc 2013). The predator control strategy continues to focus on controlling feral cats, mongooses and rodents within the entire Kahikinui PMA.

1.2 Kahikinui PMA

Kahikinui PMA is located on the Department of Hawaiian Homelands (DHHL) portion of the Kahikinui Forest Reserve (Figure 1). The management area consists of approximately 356 hectares (ha) with petrel burrows scattered throughout. A 25-year License Agreement (License No. 772) was approved by the DHHL Commission on April 23, 2012, identifying Auwahi Wind as the responsible party for the management of petrels within Kahikinui Forest Reserve. Petrel surveys were conducted in 2011 and 2012 by Tetra Tech, Inc. (Tetra Tech), to locate active burrows within the Kahikinui PMA. Survey methods and results were outlined in the 2012 Hawaiian Petrel Report (Tetra Tech 2013).

Kahikinui PMA is located on a south-facing slope along the southwestern flank of Haleakala crater. The elevation within Kahikinui PMA ranges from 2,560 to 2,972 meters above sea level. The area is subject to rapidly changing weather conditions and fluctuating temperatures. There are no roads or trails, the terrain is rocky, and the substrate varies from volcanic cinder to large rock outcrops, including numerous gullies. The slopes are very rugged and steep in some sections and often consist of loose, sharp rock. A large cinder field occurs in the center of Kahikinui PMA. Vegetation is denser at the lower elevations than the higher elevations and consists mostly of native shrubs, primarily pukiawe (*Styphelia tameiameiae)* and ohelo (*Vaccinium reticulatum*).

A small population of the endangered Native Hawaiian Silversword (*Argyroxiphium sandwicense* ssp. *macrocephalum*) plant exists at the upper elevation.

1.3 Objectives of 2017

As in previous years, the objectives of the 2017 management season were to continue petrel burrow monitoring to assess the number of active burrows in Kahikinui PMA, determine petrel reproductive success, and continue implementation of the predator control strategy. These objectives were met using four main tactics:

1. Burrow checks conducted at known burrows to estimate the number of active burrows and their reproductive success.
2. Deployment of game cameras at active burrows to further document activity of petrels and any predation events.
3. A comprehensive predator assessment conducted across Kahikinui PMA prior to implementation of predator control (February) and in August (halfway through the year), using 1-day and 3-day tracking tunnel indices for rodents and mongooses, respectively.
4. Continuation of the predator control strategy that included the deployment of traps, and evaluation of trap effectiveness and placement.

2.0 Methods

2.1 Burrow Activity and Reproductive Success

Burrow checks were conducted every two weeks from April to November 2017 (the chick rearing and fledgling period). During each survey, trained surveyors checked the status of known petrel burrows and opportunistically searched nearby suitable habitat for additional burrows. Any new burrows located in 2017 were marked, mapped, and added to the monitoring dataset. All known burrows were monitored using the "toothpick method" (NPS 2012 and Tetra Tech 2013) during each check through July, after which only active burrows were monitored (Figure 2). Burrows were classified into one of six categories of seasonal status based on the activity pattern observed during the burrow checks and from game cameras (Section 2.2; Table 1). The seasonal status of each burrow determined if it was included in the reproductive success calculations. For all calculations of reproductive success, it was assumed there was a maximum of one egg or fledgling per burrow, and burrows categorized as prospecting or seasonally inactive were excluded.

Two metrics of reproductive success were utilized to allow for direct comparisons between previous monitoring years at Kahikinui PMA and other local petrel studies:

1. **Percent Chicks Fledged per Active Burrow**—This metric is represented by Equation 1 below, and calculates the reproductive success from all burrows which were consistently active during the egg-laying season.

Equation 1

$$\frac{\#\ \text{Successful} + \#\ \text{Probably Successful}}{\#\ \text{Successful} + \#\ \text{Probably Successful} + \#\ \text{Failed} + \#\ \text{Occupied by Non-breeder/Failed}}$$

2. **Percent Chicks Fledged per Eggs Laid**—This metric is represented by two values, one derived with assumptions providing a minimum value (Low; Equation 2 below) and a second derived with assumptions providing a maximum value (High; Equation 3 below).

Equation 2

Low Value

$$\frac{\#\ \text{Successful} + \#\ \text{Probably Successful}}{\#\ \text{Successful} + \#\ \text{Probably Successful} + \#\ \text{Failed} + \#\ \text{Occupied by Non-breeder/Failed}}$$

Equation 3

High Value

$$\frac{\#\ \text{Successful} + \#\ \text{Probably Successful}}{\#\ \text{Successful} + \#\ \text{Probably Successful} + \#\ \text{Failed}}$$

The trend in the percent chicks fledged per active burrow across the 6 years of monitoring (2012–2017) was investigated using a chi-square test. The result of the chi-square test was used to indicate if there was a relationship between reproductive success and the implementation of predator control. The percentage of chicks fledged per eggs laid was used to compare reproductive success across the five monitoring seasons for which the entire season was monitored (2013–2017).

2.2 Game Camera Monitoring

Reconyx Hyperfire™ cameras have been used since 2012 to provide supplemental information on burrow activity and reproductive success. All cameras were upgraded in 2017 with lithium batteries. Cameras were installed at active burrows, simultaneously being monitored with the toothpick method. Each camera was maintained at a given burrow until evidence of petrel activity ceased, and then was moved to other burrows with indications of recent petrel activity. Active burrow visitation by goats, cats, rodents, and mongooses was also recorded and guided targeted predator control efforts throughout the season.

2.3 Tracking Tunnels

Tracking tunnels were used to monitor the presence and distribution of small mammals (rodents and mongooses) within Kahikinui PMA (Brown et al. 1996, Blackwell et al. 2002, Gillies and Williams 2007, Speedy et al. 2007) in February and August 2017. This method provided an indicator of relative abundance of small mammals prior to implementing predator control and halfway through the season under active predator control. Tracking tunnel and transect spacing methodology are described in the Auwahi Wind Energy 2013 Hawaiian Petrel Report (Auwahi Wind Energy LLC 2014). Small mammal relative abundance (i.e., activity index) was calculated as the mean percentage of tunnels with tracks of the target species per transect (Gillies and Williams 2007). Although feral cats have been documented to pass through tracking tunnels, no tracking tunnels within the Kahikinui PMA have recorded cat tracks.

2.4 Predator Control

The predator control strategy was initiated in March 2017, and informed by the results of the February tracking tunnel study. A combination of five trap types were used which included 18 Belisle body grip traps, 49 DOC250 kill traps, 44 Goodnature A24 self-loader kill traps, 14 Victor foothold traps (equipped with OMNI M2M remote sensor technology) and 39 KaMate traps. Of 164 traps, 158 were placed within a 200-meter buffer of the petrel burrows using gridded spacing (Island Conservation and Tetra Tech 2013; Figure 3). Although designed to control mongooses, the DOC250 traps also have the ability to trap rodents. The Goodnature traps and DOC250 traps were each spaced at 150-meter intervals. All trap types, excluding footholds, were housed in wooden boxes or plastic coverings to reduce the risk of seabird bycatch. Foothold traps were placed seasonally, approximately 3 to 5 meters apart, and clustered in areas where cat activity was documented or believed to occur (fence lines, pathways, etc.). OMNI M2M sensors, attached to footholds, were successful in providing remote trap information.

The trapping grid was operational by March 23, 2017 (Figure 3). All traps were visually checked by Auwahi Wind technicians, every 2 weeks from March to late November. Belisle body grip traps were baited primarily with beef hotdogs; bait types within DOC250 traps were rotated every check between tuna/sardines, peanut butter, beef hotdogs, and a variety of other items such as catnip, baby food, and wax bait; Goodnature traps were baited with cinnamon or peanut butter; foothold traps were baited primarily with tuna/sardines and fish oils; and KaMate traps were primarily baited with macadamia nuts.

3.0 Results

3.1 Burrow Activity and Reproductive Success

During the 2017 breeding season, bi-weekly visits to monitor burrow activity began on April 5, 2017, and ended on November 15, 2017, at which time all of the burrows had ceased to be active. Game camera deployment preceded the burrow visits, with most cameras deployed at burrows by February 15, 2017 (Table 3). A total of 70 burrows were monitored within the Kahikinui PMA (66 initially located prior to the 2017 season and 4 burrows located during 2017 surveys).

Thirty-one (44 percent) of the 70 burrows were active during the 2017 breeding season, and 39 burrows (56 percent) were seasonally inactive (Figure 2; Table 2). Of the 31 active burrows, 29 were consistently active and were used to calculate reproductive success for Kahikinui PMA in 2017. The majority (46 percent) of the consistently active burrows occurred in Unit 1. Ten of the consistently active burrows showed reproductive sign; nine successfully produced a fledgling and one was probably successful, but the camera angle did not capture images of a chick (both fresh chick down and egg shell were noted). None of the burrows with reproductive sign showed evidence of depredation. The remaining 19 burrows that were consistently active either failed or were occupied by a non-breeder. The cause of nest failures/abandonment is unclear but 76 percent of all burrows showed sign of trampling by goats (Figure 2). There were no clear documented signs of depredation or reproductive sign observed at these 19 burrows, either by the biologist monitoring the burrows or captured on game cameras stationed at the burrows.

Reproductive success in 2017 was between 34 and 100 percent. Based on the survey findings, eggs were assumed to have been laid in 10 to 29 of the consistently active burrows; the range represents the difference between using only those nests where Hawaiian Petrel chicks were confirmed versus assuming all consistently active nests had eggs laid. The percentage of chicks fledged per active burrow within the Kahikinui PMA was 34 percent (Figure 4). The percentage of chicks fledged per confirmed eggs laid was 100 percent. There was no significant difference in reproductive success in the 6 years of monitoring (χ^2=2.928, *df* =10 *P*=0.983), using the conservatively low value for reproductive success.

3.2 Game Camera Monitoring

Game cameras were deployed at 36 burrows in 2017 (Table 3). Game cameras confirmed activity at 29 of the 70 burrows, documented the successful fledging of nine chicks, and the probable fledging of an additional chick. Successful fledging was recorded between October 18 and November 8, 2017 (Table 3). Game cameras recorded three separate instances of a feral cat investigating a burrow in 2017 (Figure 5). The first two visits occurred in Unit 3 and the last visit occurred in Unit 1 (Figure 2). One visit occurred before the breeding season. This cat was recorded on February 20, 2017 at burrow 58, prior to when the adult first arrived in March 3, 2017. Burrow 58 continued to be active after the cat visit but seasonally was determined to be Occupied by Non-Breeder/Failed. The second cat was recorded investigating burrow 55 on March 20, 2017, just after the burrow started to have activity (March 3, 2017). There were no clear signs of depredation at burrow 55, the burrow continued to be active after the cat visit but seasonally was determined to be Occupied by Non-Breeder/Failed. The third cat was recorded at burrow 42 on October 20, 2017 while a chick was present. This was a small cat, perhaps a kitten, that appeared to have entered the burrow to escape the rain. At the time the kitten visited the burrow there was one chick inside, this burrow successfully fledged a chick at the end of the season.

Game cameras also captured visitation by goats at the entrances of both Successful and Occupied by Non-Breeder/Failed burrows. Goats were detected by cameras at burrows most frequently in April and in August (Figure 6). Goats were observed at burrows within all four units (Figure 2), and 76 percent of all burrows showed sign of trampling by goats. No mongoose were detected by game cameras in 2017.

3.3 Tracking Tunnels

In February, rodents (mouse) were detected along three of the eight transects (Figure 7), using the 1-day rodent index. The 1-day tracking index was 2.7 percent (5 of 187, mean percentage of tunnels with tracks) for rodents in February. Halfway through the trapping season in August, rodents were detected along one transect. There was a decrease from 2.7 to 1.6 percent (3 of 187) in the tracking index for rodents in August.

No mongooses were initially detected in February along any of the transects, with the 3-day tracking index of zero percent. Halfway through the trapping season in August, 1 mongoose was detected along transect 3 (2.1 percent, 1 of 47).

Investigating the activity index across the entire management period (Fall of 2013 – Fall of 2017), there do not appear to be any noticeable trends. The overall activity trend for both rodents and mongoose is low across the site and across all monitoring periods. Mongoose activity has stayed below Fall 2013 levels since the Fall of 2015 (Figure 8).

3.4 Predator Control

The predator control grid was operational for 34 weeks between March and mid-November. Predator control efforts removed 30 targeted mammalian predators from Kahikinui PMA, including 16 mice and 14 rats. Animals removed per month ranged from zero to five (Figure 9). No incidental captures were documented. Predator removal was greatest in Unit 2 (14 animals removed) compared to Units 2, 3 and 4 (5 to 6 animals removed; Figure 3).

Auwahi Wind has continued to provide support (e.g., training, deployment, monitoring) to the Maui Nui Seabird Recovery Project and Haleakala National Park Service (NPS) relevant to loaned traps used for predator control in the adjacent Kahikinui Natural Area Reserve and Haleakala National Park (HNP). These traps removed an additional three predators, all feral cats, including one pregnant female. Support was provided in 2017 related to a loaned trap sensor to the Kahoolawe Island Reserve Commission and Terraform. Reporting of traps was confirmed in the Makamakaole Hawaiian Petrel social attraction site and on Kahoolawe island. Molokai Land Trust and the Maui Forest Bird Recovery Project also tested out loaned traps and removed a total of seven predators from their Waikamoi management area. Pohakuloa Training Area is currently testing the trap sensors around their Band Rumped Storm Petrel management area. Posters were presented at the Hawaii Conservation Conference and the Predator Forum (Attachment 9 of the Annual Report). Demonstrations were given at each of the Hawaii and Maui island predator forums.

4.0 Discussion

4.1 Reproductive Success

Throughout 2017, 31 burrows showed signs of activity at some point during the breeding season. Since monitoring began in 2012, we have seen a regular seasonal decline in active burrows in the month of September. The number of active burrows in August has dropped between 4 and 16 burrows by September depending on the year. According to Simons et al. (1985), both failed breeders and non-breeders typically leave the colony in September. Without confirmation of an egg in the burrow, it is challenging to determine what percentage of the burrows failed or simply contained juvenile non-breeders. This results in large confidence intervals surrounding reported reproductive success percentages (e.g., a difference of 47 percent from average low to average high value).

We have seen an increase of 16 in the total number of burrows reported in the management area from 2012 to 2017. However, the increase in burrows within the colony has not resulted in an increase in the number of active burrows in each year. This may be a result of an increase in younger/non-breeding birds investigating the site, which can increase the denominator in the calculation of reproductive success where actual breeding status is uncertain. The number of active burrows has remained relatively constant throughout the 6 years of monitoring (28 to 33 active burrows), suggesting the Kahikinui PMA may be saturated under current habitat conditions. This may be particularly true in Unit 1 which contains the largest proportion of consistently active burrows (46 percent; Figure 2).

We have not seen a significant increase in the reproductive success within the management area since predator control implementation, but there has been a mostly positive trend (Figure 4) since 2014 when predator control was fully implemented at Kahikinui PMA. Similarly, the adjacent Daniel K. Inouye Solar Telescope (DKIST) mitigation site has reported low reproductive success (10 to 41 percent), although this represents a 78 percent increase in the number of chicks fledged per active burrow since the predator control program was implemented at the site (Chen et al. 2018).

The Kahikinui PMA and DKIST sites appear to have low reproductive success compared with historic values from the nearby HNP (42 to 61 percent chicks fledged per active burrow; Natividad 1994). More current reproductive success data from HNP is needed for a valid comparison; however, recent data has not been available from NPS. Previous annual reports have discussed alternative explanations for the lower reproductive success, including:

- Individual fitness may be correlated with population density (Brown et al. 1990, Danchin and Wagner 1997, Stokes and Boersma 2000, Schreiber and Burger 2001), and Kahikinui PMA has a lower density of burrows across the management area than does Haleakala and DKIST;
- Kahikinui PMA may be an example of a population of younger/non-breeding birds predominantly investigating the site, as seen with the mass exodus of potentially non-breeding birds every September. The increase in non-breeders during the first few years will keep the reproductive success low until the first generation reaches breeding age; and
- Pressures occurring away from the colony (i.e., at-sea), where changes in climate and fisheries may have an impact on prey abundance and foraging efficiency.

4.2 Predator Control and Interpreting Predator Assessments

The overall decrease in rodent and mongoose activity, using tracking tunnels, has corresponded with a decrease in rodent and mongooses removed with trapping efforts. In the spring of 2014, we saw a spike in mongoose activity (Figure 8). Over the next year and a half of targeted predator control, eight mongooses were removed from the management area and surrounding area, with efforts either directly or indirectly supported by Auwahi Wind. By the fall of 2015, we did not detect any mongooses on the tracking tunnels and the activity levels have remained low in the subsequent years. No mongoose have been detected at tracking tunnels in Unit 1, and this is the unit with the highest concentration of active burrows (Figure 2).

Rodent activity appears to have seasonal pulses, based on the tracking tunnel and trapping results (Figure 8). We typically see pulses in rodent activity within the management area in the fall (September – November), and this generally coincides with an increase in trapping of mice over that same time period. Goodnature traps have proven successful at removing rodents when this occurs, with up to four carcasses found underneath one trap at one check.

No cats were caught during trapping at Kahikinui PMA in 2017 (Figure 8); however, three cats were trapped in neighboring management areas by partners using foothold traps with remote sensor technology, provided by Auwahi Wind. One of the three cats trapped was likely the same individual observed near burrow 42 based on the unique markings of the cat and the capture of the cat shortly after being observed at burrow 42. This individual was detected by a game camera at a burrow in a neighboring project and came into contact with a bird in a burrow twice before it was caught with Auwahi Wind staff assistance in a foothold trap with OMNI sensor. No cats were subsequently observed on game cameras for the remainder of the breeding season in the neighboring project. Coordinating predator control with neighboring projects based on game camera monitoring helped guide Auwahi Wind's efforts to remove this cat before it killed any of the chicks in the Kahikinui PMA. Detections of cats by game cameras in Kahikinui PMA were similar to previous years (Figure 5) despite removal by trapping. This suggests the site may experience a stable rate of immigration of new individuals to replace those removed by trapping.

4.3 Proposed Transition to DKIST Site

The number of known burrows within the Kahikinui PMA has not been consistently at the level needed to ensure that the current success criteria for Tier 1 mitigation under the HCP will be met as currently written. Tier 1 mitigation is intended to compensate for the incidental take of 19 adults petrels and 7 chicks over 25 years. The Project HCP noted that in the event that mitigation benefits at the Kahikinui PMA were less than anticipated such that management of additional petrel burrows was needed to achieve the necessary mitigation benefit, Auwahi Wind would assume management of the petrel colony at the adjacent DKIST site, after mitigation under their HCP (ATST 2010) had been met. As of the 2017 breeding season, the DKIST site included 189 active petrel burrows surrounded by an ungulate exclusion fence (Chen at al. 2018). Auwahi Wind has proposed to assume management of the burrows at the DKIST site in 2019 and continue its implementation through 2033 (Year 20 of the permit term). A more complete discussion of acquiring the DKIST site was included in the 2016 Auwahi Wind Energy Hawaiian Petrel Report.

4.4 Summary and Recommendations For 2018

- Since completion of comprehensive surveys in 2012, there has been a net increase of 14 burrows within the breeding colony.

- The use of game cameras for 5 consecutive years has allowed Auwahi Wind to have a more definitive understanding of activity and breeding success within Kahikinui PMA.
- Game cameras have also led to a better understanding of predator activity and activity by goats near burrows.
- Predator assessments (tracking tunnels) 2013 – 2017 point toward a fluctuation in rodent and mongoose activity within the site, with generally low levels of activity. These assessments are also helpful in interpreting predator trapping results.
- Goodnature traps continue to be able to remove the highest number of predators within Kahikinui PMA, followed closely by KaMate traps.
- Auwahi Wind continues to investigate the effectiveness of OMNI M2M sensors for monitoring foothold traps within the management area.
- Auwahi Wind would like to take steps to assume management at the DKIST petrel management site in the 2019 breeding season.

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6.0 Tables and Figures

Table 1. Seasonal status categories of Hawaiian petrel burrows at the end of the breeding season, based on visit data and game camera data

<table>
<tr><th>Seasonal Status</th><th>Definition</th><th colspan="3">Categories for Assessing Reproductive Success</th></tr>
<tr><td>Successful</td><td>Chick fledged, indicated on a game camera, no signs of predation.</td><td rowspan="5">Active</td><td rowspan="4">Consistently Active</td><td rowspan="3">Breeding Activity</td></tr>
<tr><td>Probably Successful</td><td>Toothpick disturbance and reproductive sign[2] present at active burrow entrance in October and no sign of depredation.</td></tr>
<tr><td>Failed</td><td>Observed depredation, or reproductive sign observed but ceased before fledging period in October.</td></tr>
<tr><td>Occupied by Non-breeder/Failed</td><td>Initial signs of activity, no reproductive sign observed and activity ceased before the October fledging.</td><td>Excluded</td></tr>
<tr><td>Prospecting</td><td>Burrows that were visited by adults only occasionally during the start of the season (March – July).</td><td colspan="2">Excluded</td></tr>
<tr><td>Seasonally Inactive</td><td>No toothpick disturbance or activity sign[1] during any burrow checks.</td><td colspan="3">Excluded</td></tr>
</table>

[1] Activity sign includes: bird on camera, droppings, tracks, feathers, and odor

[2] Reproductive sign includes: egg, eggshell, chick down, chick

Table 2. Seasonal status of Hawaiian petrel burrows in 2017

<table>
<tr><th>Seasonal Status</th><th>No. of Burrows</th><th colspan="3">Categories for Assessing Reproductive Success</th></tr>
<tr><td>Successful</td><td>9</td><td rowspan="5">31 Active</td><td rowspan="4">29 Consistently Active</td><td rowspan="3">10 Breeding Activity</td></tr>
<tr><td>Probably Successful</td><td>1</td></tr>
<tr><td>Failed</td><td>0</td></tr>
<tr><td>Occupied by Non-breeder/Failed</td><td>19</td><td>Excluded</td></tr>
<tr><td>Prospecting</td><td>2</td><td colspan="2">Excluded</td></tr>
<tr><td>Seasonally Inactive</td><td>39</td><td colspan="3">Excluded</td></tr>
<tr><td>TOTAL</td><td>70</td><td colspan="3"></td></tr>
</table>

Table 3. Game camera Hawaiian petrel burrow monitoring summary, 2017

Burrow Number	Seasonal Status	Camera Deployment Date	Last Date of Activity	Successfully Fledged Date
6	Successful	15-Feb-17	26-Oct-17	26-Oct-17
15	Successful	15-Feb-17	26-Oct-17	26-Oct-17
32	Successful	15-Feb-17	18-Oct-17	18-Oct-17
33	Successful	15-Feb-17	03-Oct-17	19-Oct-17
42	Successful	15-Feb-17	17-Oct-17	17-Oct-17
52	Successful	15-Feb-17	06-Nov-17	06-Nov-17
59	Successful	15-Feb-17	08-Nov-17	08-Nov-17
62	Successful	15-Feb-17	27-Oct-17	27-Oct-17
68	Successful	28-Jun-17	29-Oct-17	29-Oct-17
1	Seasonally Inactive	31-May-17		
7	Seasonally Inactive	15-Feb-17		
16	Seasonally Inactive	19-Sep-17		
61	Seasonally Inactive	15-Feb-17		
65	Seasonally Inactive	15-Feb-17		
69	Prospecting	19-Apr-17	19-Apr-17	
71	Prospecting	12-Jun-17	28-Jun-17	
34	Probably Successful	15-Feb-17	07-Sep-17	
3	Occupied by Non-Breeder/Failed	15-Feb-17	30-Aug-17	
4	Occupied by Non-Breeder/Failed	15-Feb-17	24-Jul-17	
9	Occupied by Non-Breeder/Failed	15-Feb-17	25-Jul-17	
13	Occupied by Non-Breeder/Failed	15-Feb-17	28-Jul-17	
18	Occupied by Non-Breeder/Failed	31-May-17	25-Jul-17	
20	Occupied by Non-Breeder/Failed	15-Feb-17	01-Aug-17	
22	Occupied by Non-Breeder/Failed	15-Feb-17	04-Aug-17	
23	Occupied by Non-Breeder/Failed	15-Feb-17	01-Aug-17	
25	Occupied by Non-Breeder/Failed[1]	15-Feb-17	29-Aug-17	
31	Occupied by Non-Breeder/Failed	15-Feb-17	08-Aug-17	
39	Occupied by Non-Breeder/Failed	15-Feb-17	22-Aug-17	
51	Occupied by Non-Breeder/Failed	15-Feb-17	23-Aug-17	
54	Occupied by Non-Breeder/Failed	15-Feb-17	07-Sep-17	
55	Occupied by Non-Breeder/Failed	15-Feb-17	07-Aug-17	
58	Occupied by Non-Breeder/Failed	15-Feb-17	07-Sep-17	
63	Occupied by Non-Breeder/Failed	15-Feb-17	07-Sep-17	
67	Occupied by Non-Breeder/Failed	15-Feb-17	07-Aug-17	
70	Occupied by Non-Breeder/Failed	19-Apr-17	11-Jul-17	
72	Occupied by Non-Breeder/Failed	7-Aug-17	11-Jul-17 [2]	

[1] An egg (most likely from the previous breeding season) was found outside burrow on April 5, 2017.
[2] Informed by toothpick monitoring data

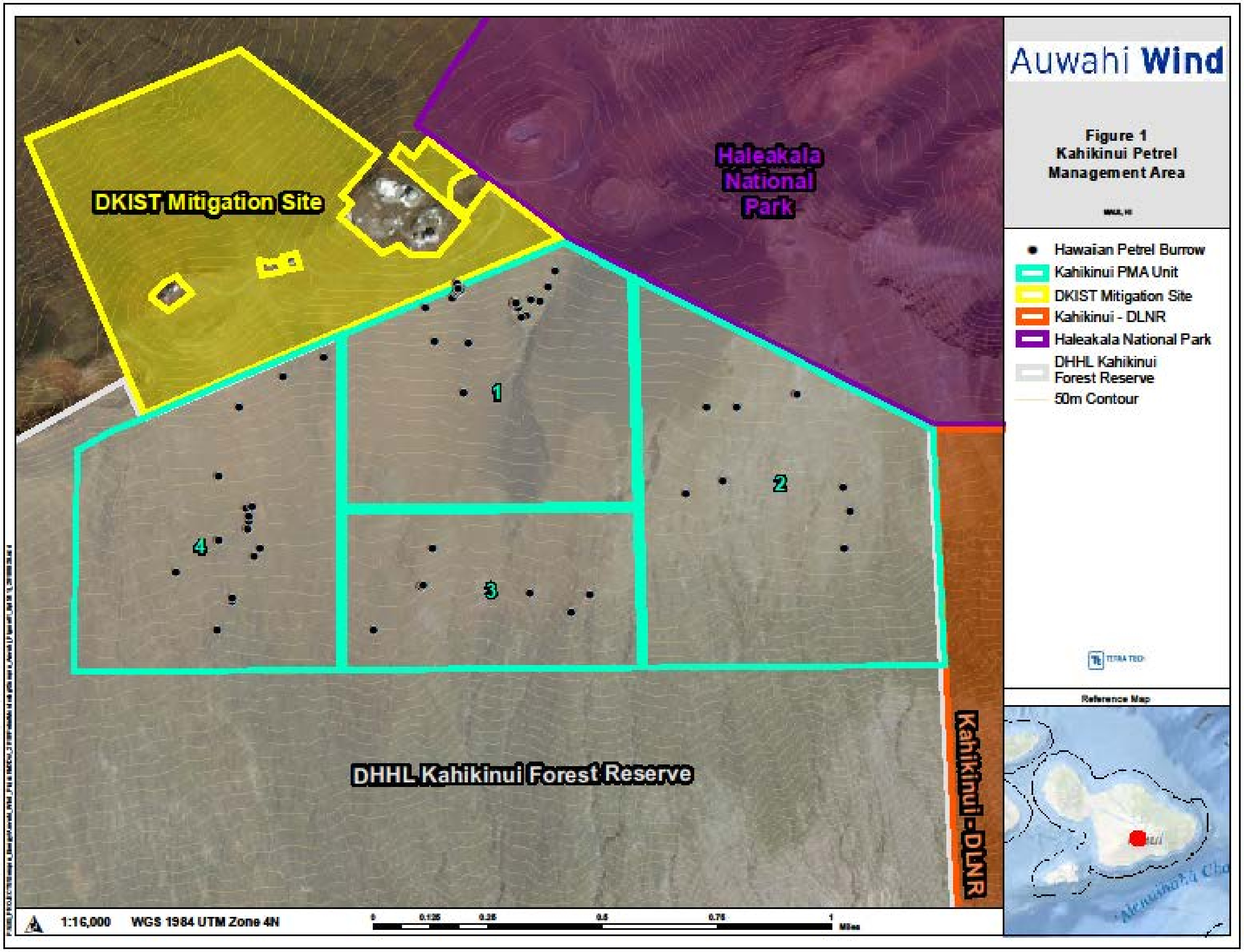

Figure 1. Auwahi Wind Kahikinui PMA

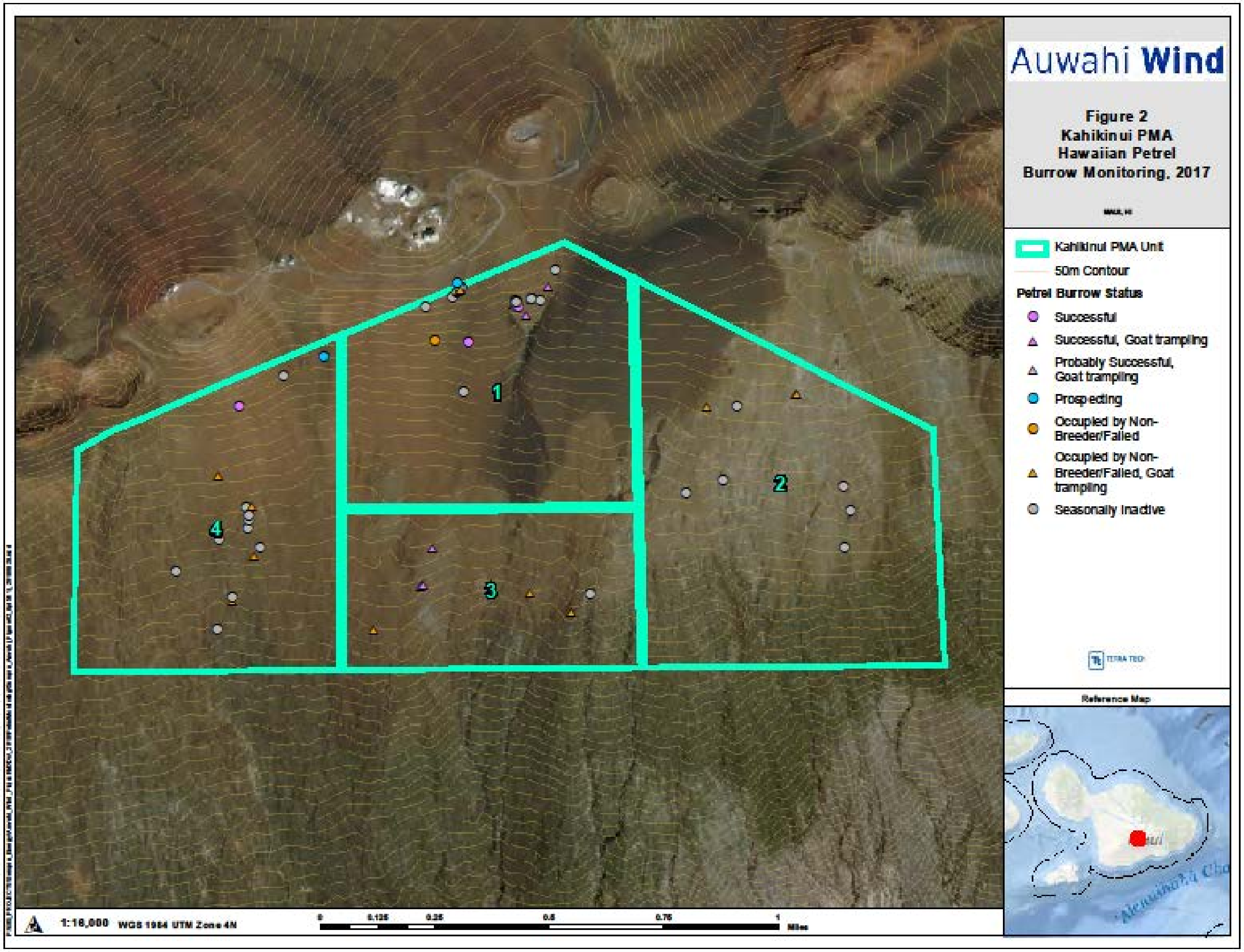

Figure 2. Petrel monitoring results at Kahikinui PMA, 2017

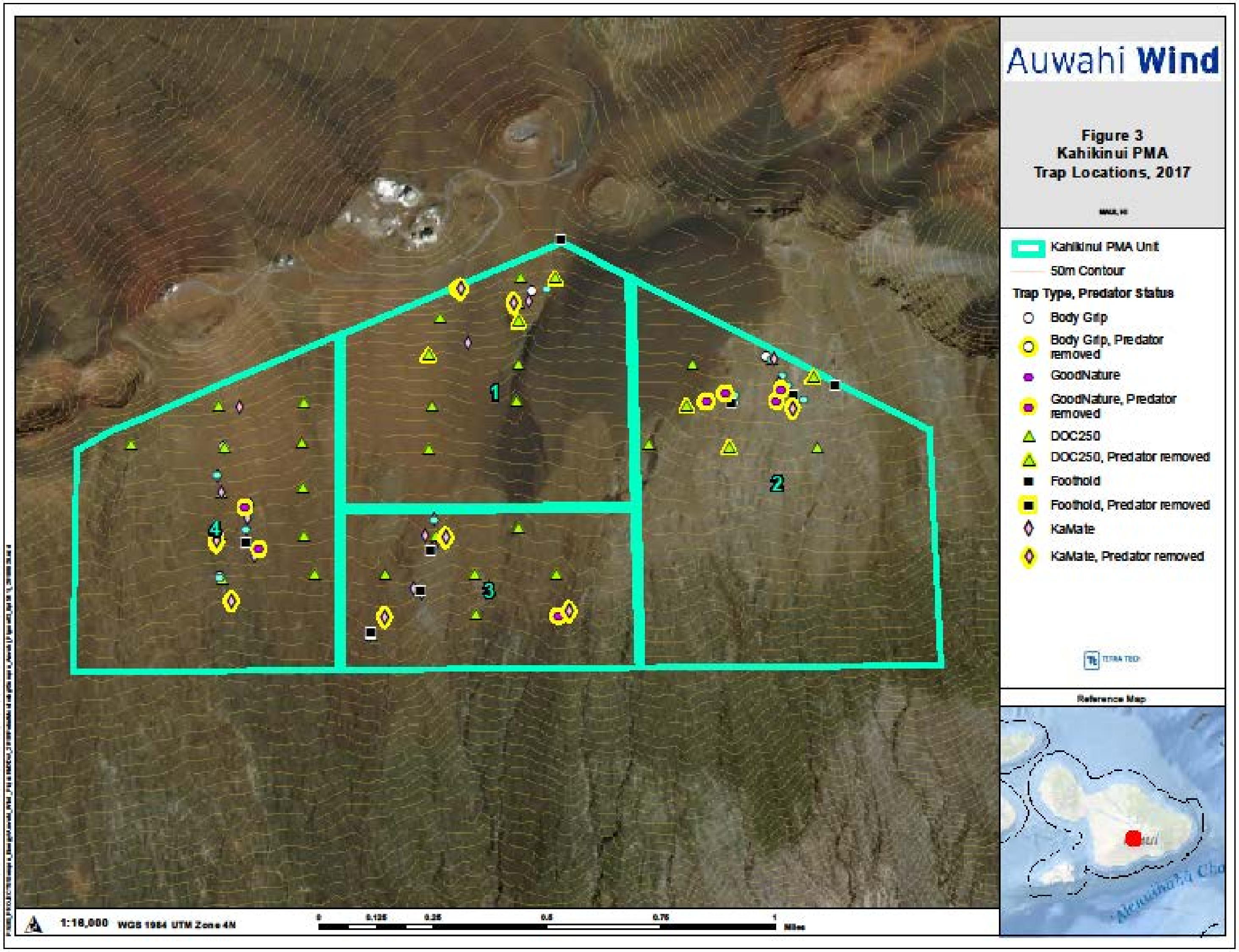

Figure 3. **Operational predator control grid within Kahikinui PMA, 2017**

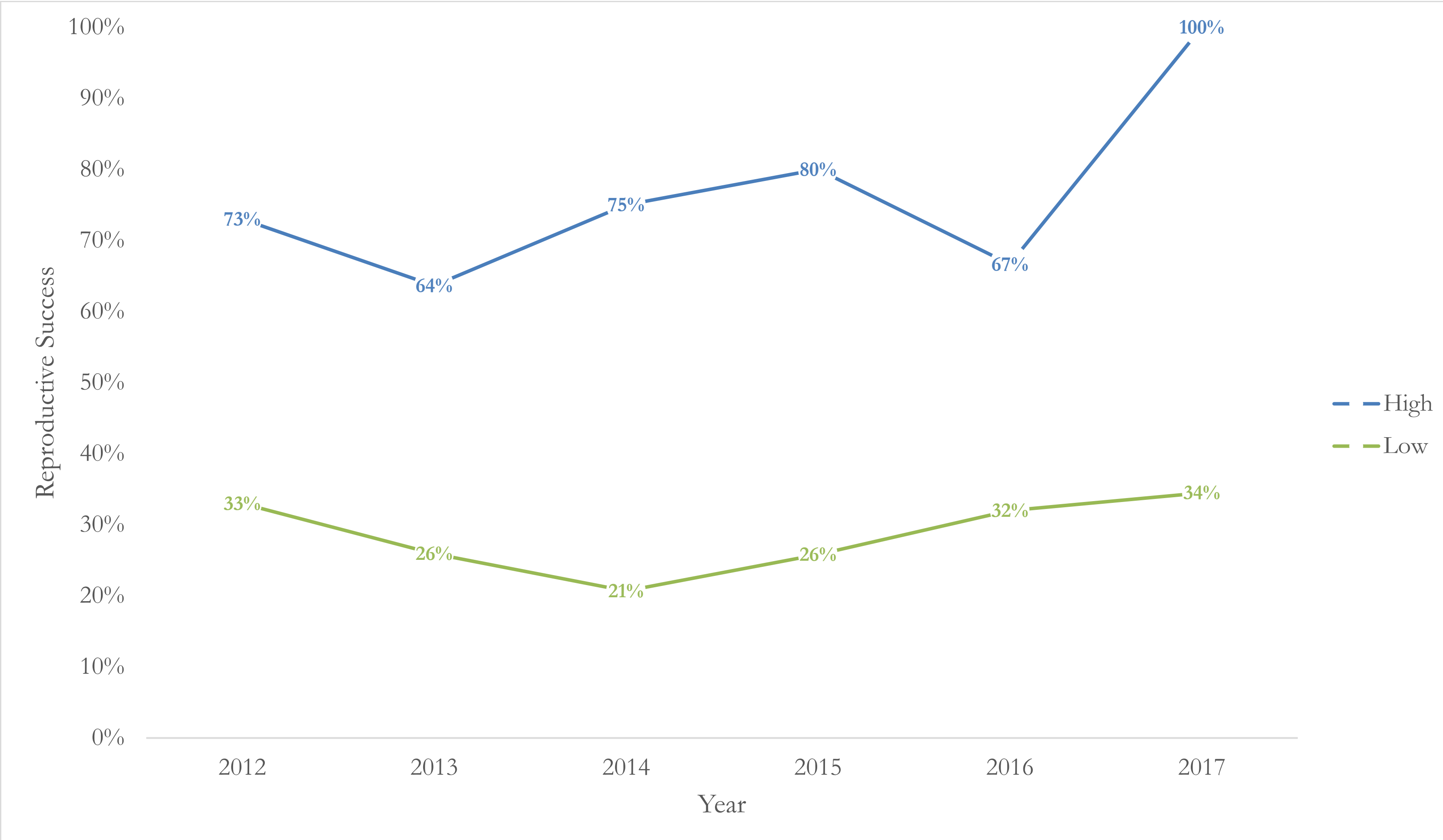

Figure 4. Reproductive success within Kahikinui PMA, 2012 – 2017. High assumes only those burrows with reproductive sign had breeding adults; and low assumes all consistently active burrows had breeding adults.

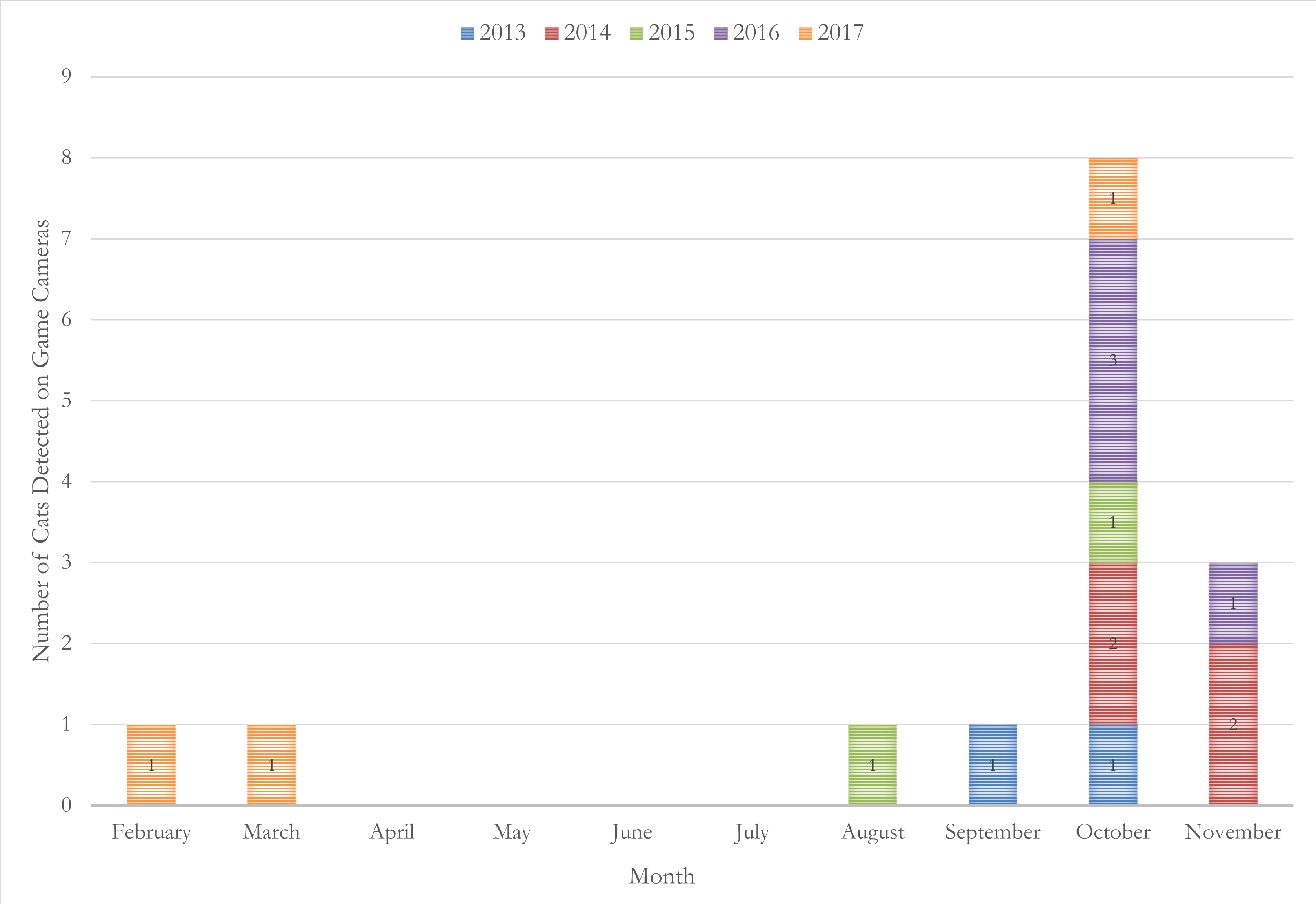

Figure 5. **Seasonal occurrence of cats detected at burrows by game cameras, 2013-2017**

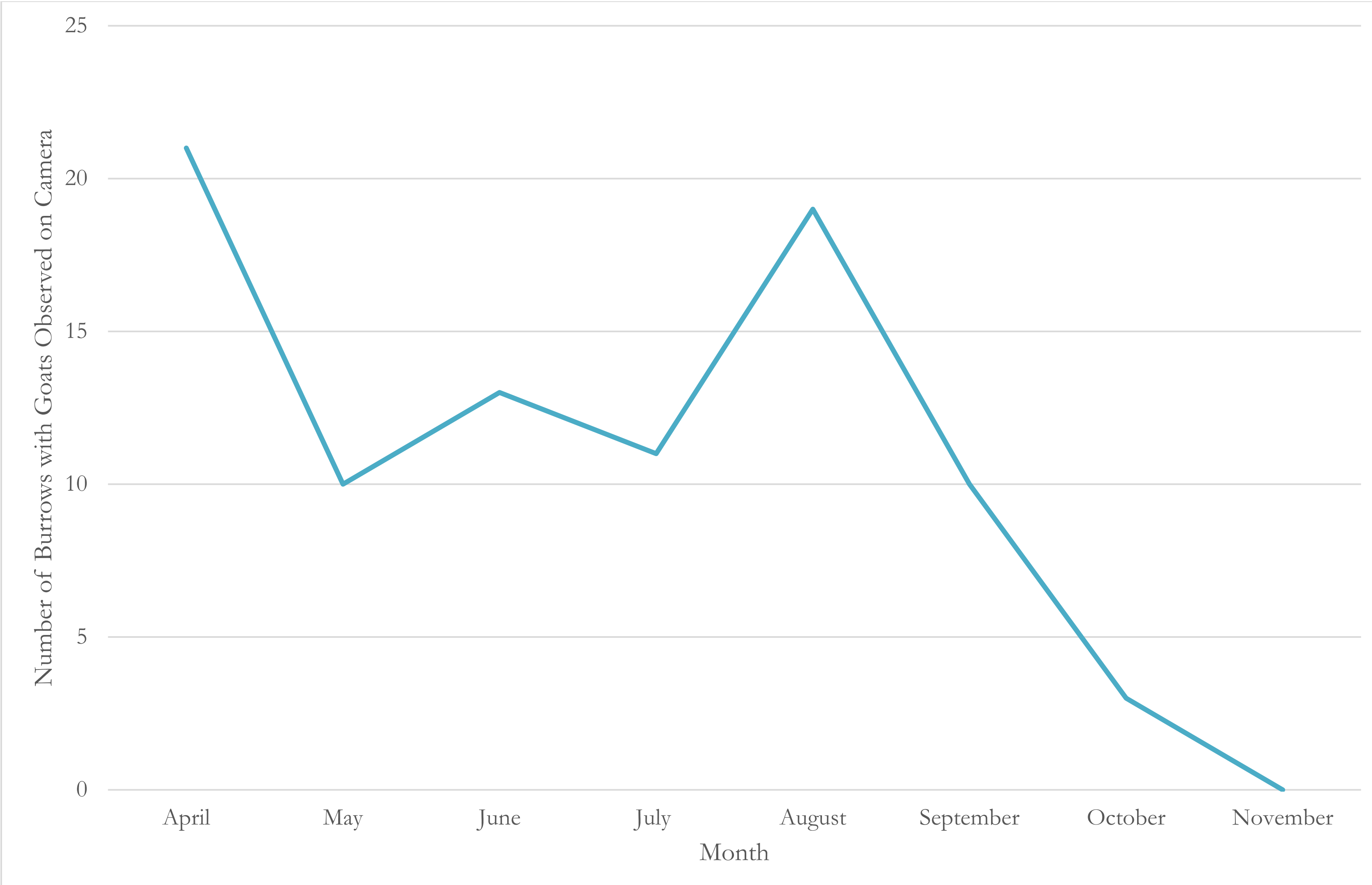

Figure 6. Seasonal occurrence of goats detected at burrows by game cameras, 2017

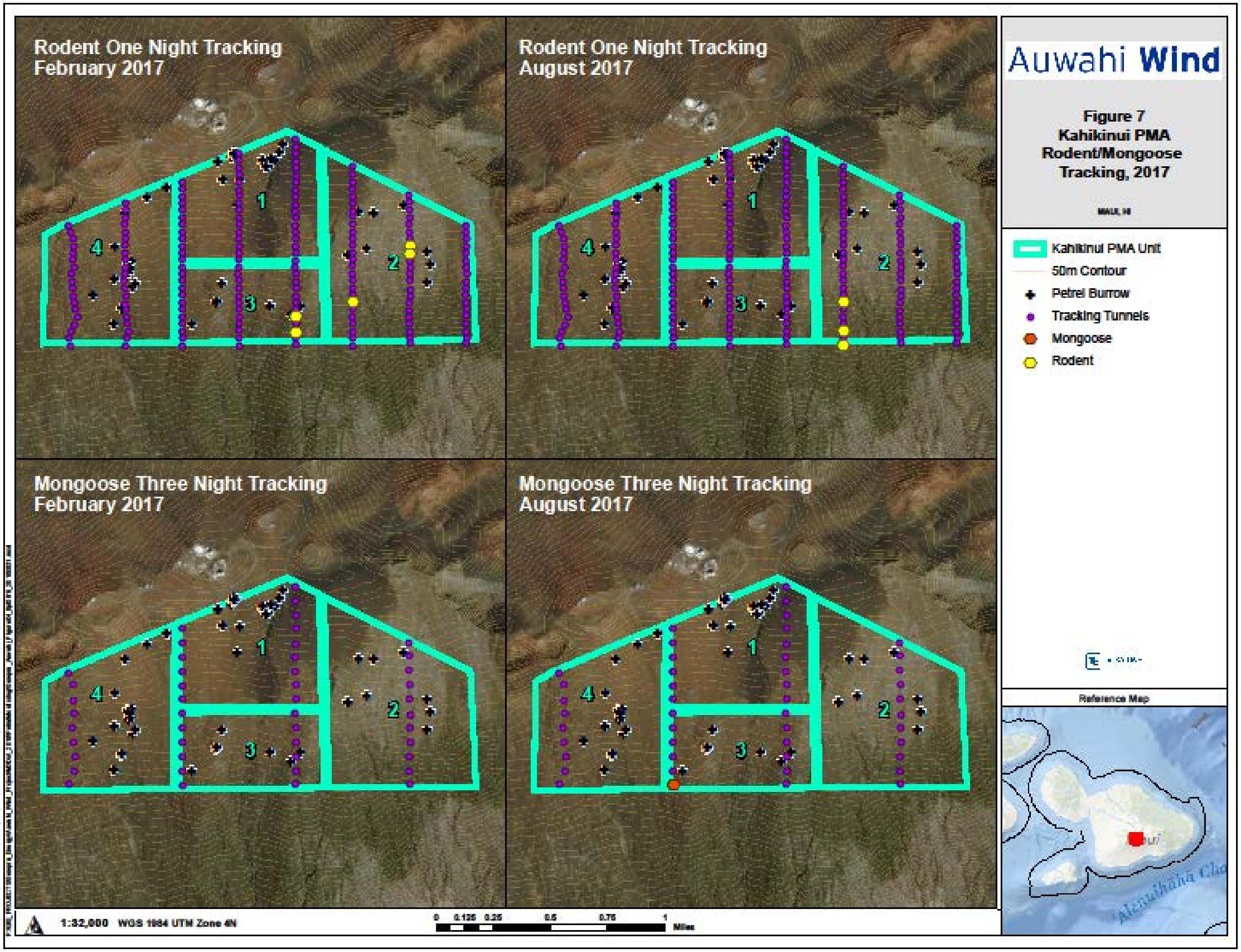

Figure 7. One/Three day tracking tunnel results Kahikinui PMA, February and August, 2017

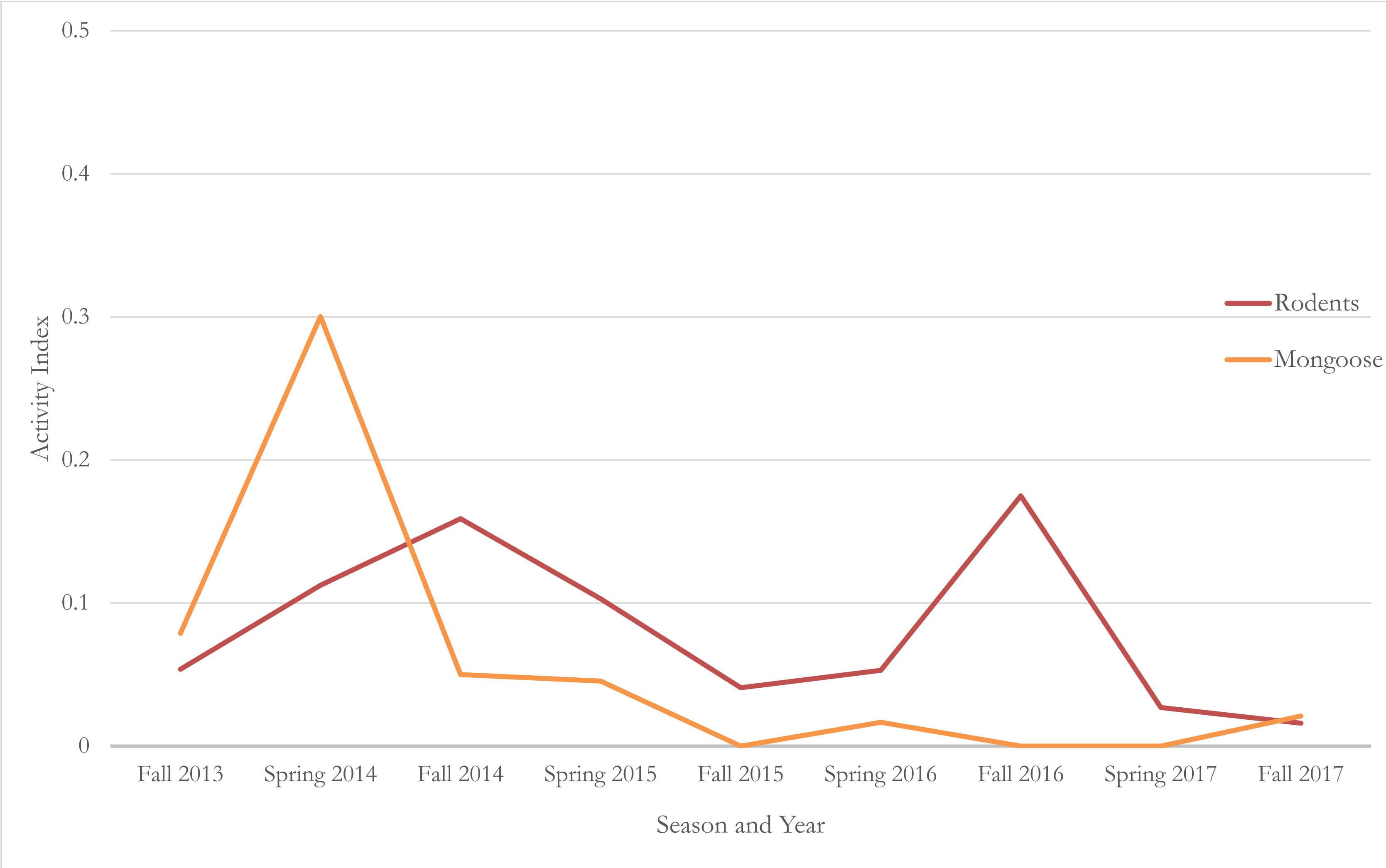

Figure 8. Summary of rodent and mongoose tracking tunnel results, 2013 – 2017

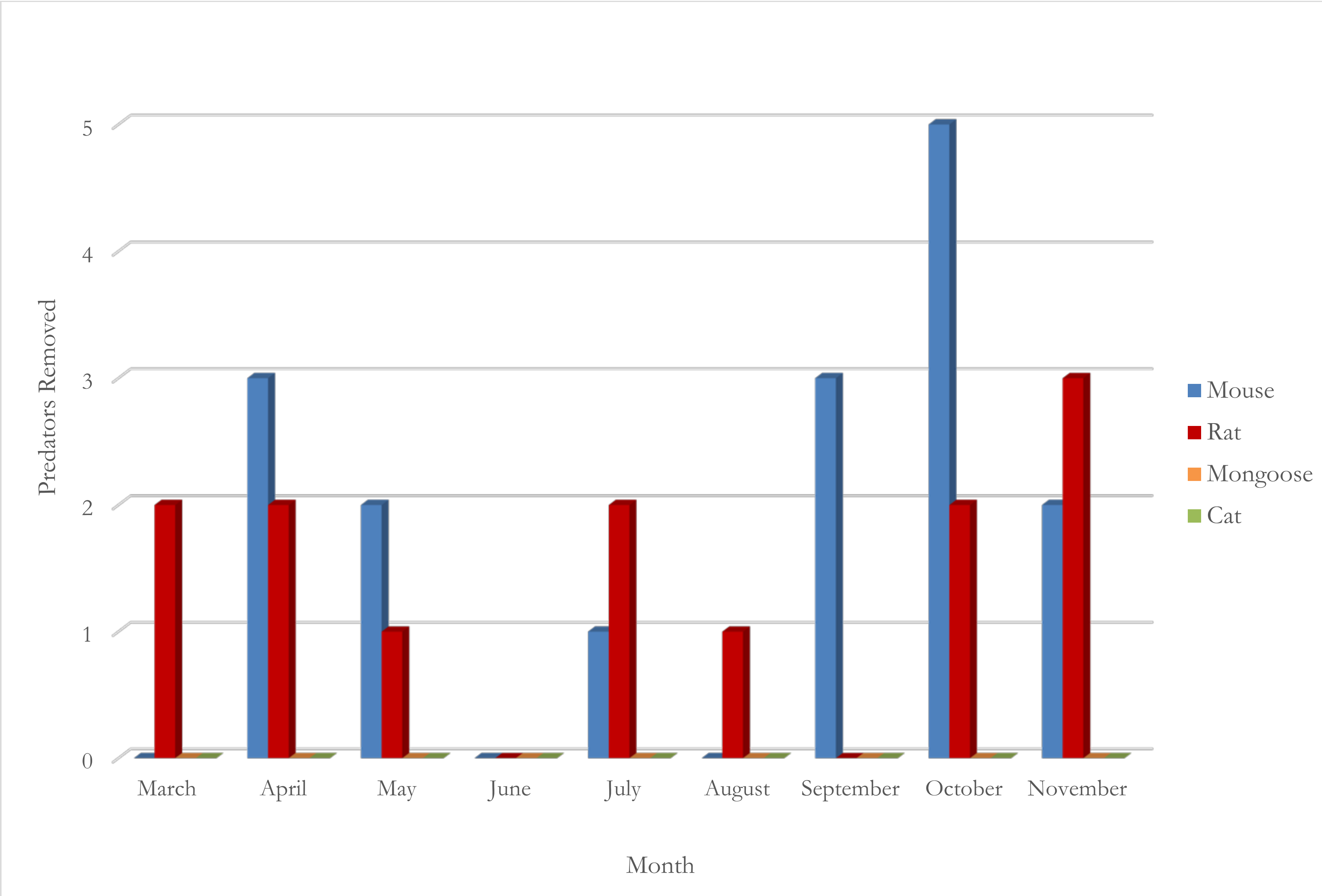

Figure 9. Monthly summary of predator trapping results, March – November, 2017

Attachment 3
Hawaiian Hoary Bat Tier 1 Summary

Auwahi Wind Energy Project

Hawaiian Hoary Bat Tier 1 Puʻu Makua Mitigation Summary Report FY 2018

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1.0 Introduction

In December 2012, Auwahi Wind Energy, LLC (Auwahi Wind) began commercial operations of the eight-turbine Auwahi Wind Farm (Project) on 'Ulupalakua Ranch in east Maui, Hawaii. To address potential endangered species impacts associated with the Project, Auwahi Wind developed a Habitat Conservation Plan (HCP), which was approved by the U.S. Fish and Wildlife Service (USFWS) and the Hawaii Department of Land and Natural Resources (DLNR)/Division of Forestry and Wildlife (DOFAW) in January 2012 (Tetra Tech 2012a). The HCP and associated incidental take permit (ITP) and incidental take license (ITL) identify the potential authorized incidental take of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), a federal- and state-listed endangered species, due to construction and operation of the Project.

Mitigation approved to provide a net benefit for potential Hawaiian hoary bat impacts includes protection and restoration of bat roosting and foraging habitat and implementing research activities within the Waihou mitigation area (Figure 1-1), located on 'Ulupalakua Ranch. As proposed in the HCP, bat take and mitigation are accounted for in tiers such that each tier has a higher take level and a correspondingly higher level of mitigation (see the HCP for additional details).

This report summarizes the activities implemented to date to fulfill the Tier 1 mitigation requirements, lists the criteria for assessing mitigation success, and presents the Fiscal Year (FY) 2018 results of vegetation monitoring used to measure the criteria.

2.0 Tier 1 Mitigation

For the Tier 1 mitigation, Auwahi Wind committed to mitigating impacts to bats by implementing habitat restoration measures in the Waihou Mitigation Area. The mitigation measures, as described in the approved Waihou Mitigation Area Management Plan (Tetra Tech 2012b), include:

- Establishing a conservation easement for an area within the Waihou Mitigation Area;
- Fencing and removal of ungulates from within the fence line in this area;
- Vegetation restoration within the fenced area (invasive plant species removal and planting pasture areas with native trees and shrubs); and
- Acoustic monitoring at the Auwahi wind farm site.

The mitigation measures have all been initiated and/or completed. The Pu'u Makua parcel in the southernmost portion of the Waihou Mitigation Area was placed into a conservation easement held by the Hawaiian Islands Land Trust on December 18, 2012, and will be protected in perpetuity (Tetra Tech 2013). As summarized in the following sections, ungulate control and vegetation restoration measures within the Pu'u Makua Parcel were initiated in 2013 following issuance of the ITP/ITL, and acoustic monitoring of bats was conducted at the wind farm from July 2013 through December 2015. Acoustic monitoring at the wind farm has also occurred during FY17 with USGS and Natural Power. Acoustic data will be collected in FY19 and will be compared along with thermal imagery data to monitor bat and wind turbine interactions.

2.1 Fencing and Removal of Ungulates

Auwahi Wind contracted Pacific Fencing to install an ungulate proof fence around the 130-acre Pu'u Makua parcel, which was completed in September 2013. In January 2014, F.A.R.E ungulate control was contracted to conduct extensive sweeps of the enclosed area and remove all ungulates found. The site was certified by F.A.R.E as ungulate free as of January 2014 and continues to be inspected quarterly to be maintained ungulate-free. For more details see Section 3.2.1 in the FY 2014 HCP Annual Report (Sempra Energy 2014).

2.2 Invasive Plant Species Removal

Following initial baseline vegetation monitoring of the Pu‘u Makua parcel in March 2014, Hawaii Vegetation Control was contracted to initiate biannual sweeps in April 2014 to remove primary invasive plant species within the fenced area including non-native grasses, blackberry (*Rubus argutus*), tropical ash (*Fraxinus uhdei*), bocconia (*Bocconia frutescens*), black wattle (*Acacia mearnsii*), and Monterey pine (*Pinus radiata*). Biannual sweeps continue, and vegetation management activities maintain target invasive species coverages below the 50 percent required. An estimated 257 hours were spent on invasive species removal in FY 2018. Actions for invasive species removal in FY 2018 included:

- Removal of invasive *Rubus* species, predominantly blackberry with some thimbleberry (*Rubus rosifolius*), from native forest-dominated areas and around outplanted natives;
- Removal of target invasive plants: pine (*Pinus sp.*) and black wattle;
- Removal of primary invasive plant species from fence line;
- Treat invasive species in grass pasture and native forest outplanted areas; and
- Assist Leeward Haleakala Watershed Partnership with coordination of an invasive pine removal trip attended by island conservationists from non-profit, state, and federal agencies. The work took place on state and private (Ulupalakua Ranch) lands along the eastern boundary of the Waihou Mitigation Area.

The non-native plant removal and outplanting has resulted in the koa leaf litter ground substrate reappearing in areas once dominated by grass pasture; it has also reduced the diversity of the invasive plant species tree canopy. For more details on invasive species plant removal activities, see Section 3.2.2 in the FY 2014 HCP Annual Report (Sempra Energy 2014), Section 3.2.1 in the FY 2015 HCP Annual Report (Sempra Energy 2015), Section 3.2.1 in the FY 2016 HCP Annual Report (Sempra Energy 2016), and Section 3.2.1 in the FY 2017 HCP Annual Report (Tetra Tech 2017).

2.3 Outplanting of Native Trees and Shrubs

A second baseline survey was conducted in February 2015, and native tree outplanting began in spring 2015. Outplanting was completed in FY 2016 with over 40 acres and more than 13,000 plants outplanted in open pasture within the Pu‘u Makua site (Sempra Energy 2016). Plants outplanted were predominately koa, ‘ōhi‘a, a‘ali‘i (*Dodonea viscosa*) and māmane (*Sophora chrysophylla*) with some specialty native plants mixed in. Follow-up management included additional native tree outplanting to replace dead plants. An estimated 478 hours were spent on outplanting in FY 2018. Restoration actions in FY 2018 included:

- Outplanting the following native species:
    - Koa (1,000 plantings), and

  - Other species (650 plantings) including: māmaki (*Pipturus albidus*), ʻuki (*Dianella sandwicensis*), pilo (*Coprosma sp.*), maile (*Alyxia stellate*), ōhā wai (*Clermontia arborescens*), ʻākia (*Wikstroemia sp.*), *Carex sp.*, lama (*Diospyros sp.*), wiliwili (*Erythrina sandwicensis*), hala pepe (*Chrysodracon halapepe*), naio (*Myoporum sp.*), naupaka (*Scaevola sp.*), māmane, alahe'e (*Psydrax odorata*), ʻohe makai (*Polyscias sandwicensis*), ʻōhiʻa (*Metrosideros polymorpha*), olopua (*Nestegis sandwicensis*), kōlea (*Myrsine lessertiana*);

- Conducting seed sow and seed ball trials;
- Continuing ongoing seed collection and seed storage at Maui Nui Botanical Garden. Auwahi Wind partnered with Maui Forest Bird Recovery project to collect ʻōhiʻa seeds at Pu'u Makua according to Laukahi: Hawaii Plant Conservation Network protocols. Other seeds collected included koa, kūkaenēnē (*Coprosma ernoideodes*), and ʻūlei (*Osteomeles anthyllidifolia*); and
- Offering two trips to volunteers to assist with plantings and visit the area.

For more details on outplanting activities, see Section 3.2.2 in the FY 2014 HCP Annual Report (Sempra Energy 2014), Section 3.2.1 in the FY 2015 HCP Annual Report (Sempra Energy 2015), Section 3.2.1 in the FY 2016 HCP Annual Report (Sempra Energy 2016), and Section 3.2.1 in the FY 2017 HCP Annual Report (Tetra Tech 2017).

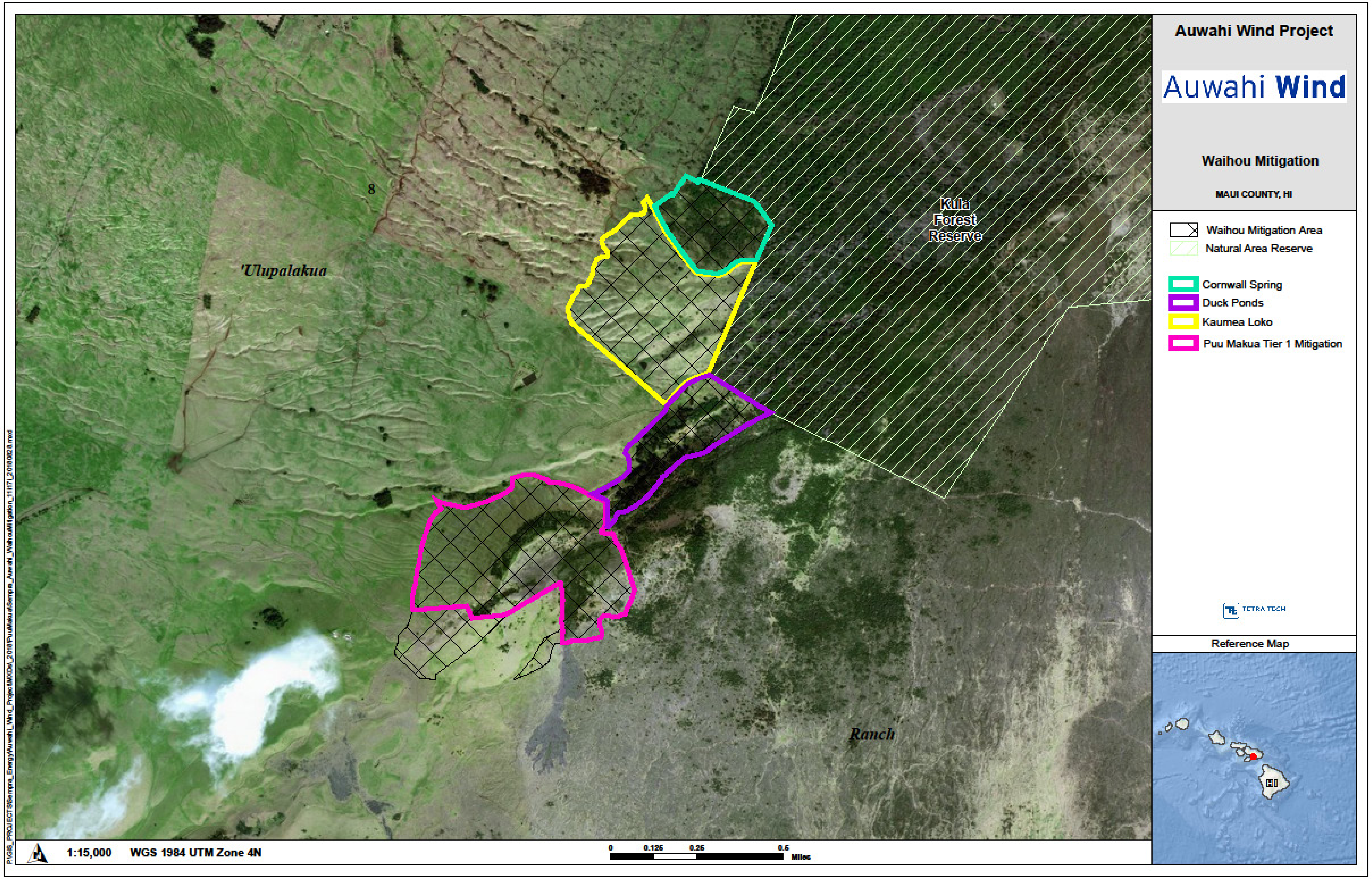

Figure 1-1. Waihou Mitigation

2.4 Acoustic Monitoring

Tier 2 and 3 mitigation activities included deployment of ultrasonic, full spectrum recorders across the Pu'u Makua parcel between March 2015 and March 2018 to record time-stamped Hawaiian hoary bat echolocation calls. The findings of this monitoring is summarized in Attachment 4 of the Auwahi Wind FY18 Annual Report.

3.0 Success Criteria

Tier 1 restoration efforts will be considered successful if 1) native trees and shrubs become established to create or enhance bat breeding and roosting habitat; and 2) non-native invasive plants within the Pu'u Makua parcel are reduced. To measure the success of habitat restoration efforts, periodic monitoring is being implemented by Auwahi Wind over the 25-year term of their ITP and ITL.

Long-term success criteria identified in the Project HCP as provided in Table 3-1 will be used to determine the overall success of Auwahi Wind's bat mitigation efforts.

Table 3-1. HCP Success Criteria for Vegetation Cover and Composition

Mitigation Objective	HCP Success Criteria1/	Method for Measuring Success Criteria
Protect the Pu'u Makua parcel from browsing and other disturbance by ungulates	After 6 years, mitigation fencing is complete and ungulates have been removed from within the fenced area, and over the 25-year permit term, the fence is maintained and the area is kept free of ungulates.	1) Visual observations of ungulates and ungulate sign (e.g., browse) within mitigation parcel and monitoring plots
Establish native tree and shrub cover to provide bat habitat	After 25 years, reforested areas within the Waihou Mitigation Area have greater than 50 percent cover dominated by native woody species.	2) Line-intercept and plot-based sampling of cover compared to baseline conditions 3) Permanent photo points
Reduce cover of non-native invasive plants	After 25 years, the cover of invasive species (excluding kikuyu grass [*Pennisetum clandestinum*]) in the Waihou Mitigation Area is less than 50 percent.	
1/ HCP success criteria apply to the Pu'u Makua parcel where restoration activities will be implemented.		

Interim success criteria are used by Auwahi Wind to evaluate progress toward meeting HCP success criteria and to help Auwahi Wind determine if and where remedial or management actions (e.g., additional plantings or invasive species control) or adaptive management might be necessary. The interim success criteria are based on survivorship of tree and shrub plantings, as well as percentage cover of native woody species. Table 3-2 provides interim success criteria/targets associated with specific monitoring years, which are measured through periodic vegetation monitoring described in Section 4.

Table 3-2. Vegetative Cover and Composition Interim Success Criteria for the Puʻu Makua Mitigation Area

Year	Interim Success Criteria/Targets	
	Tree and Shrub Cover[1/]	Invasive Species Cover[2/]
Year 1	90 percent alive	< 85 percent cover
Year 3	75 percent alive	< 75percent cover
Year 5	15 percent cover	< 65 percent cover
Year 10	25 percent cover	< 60 percent cover
Year 15	35 percent cover	< 55 percent cover
Year 20	45 percent cover	< 50 percent cover

1/ Applies to planted areas only
2/ Excluding kikuyu grass

4.0 Vegetation Monitoring Methods

The interim success criteria of outplanted native plants survivability and cover of native and non-native plants are determined using periodic line-intercept and plot surveys over the 25-year term of the HCP. The line-intercept method is used to estimate total vegetative cover, woody native cover, and non-native invasive cover. Transects for monitoring were selected from randomly generated locations. A count of planted trees and shrubs within plots is used to estimate tree survival per area during the first two monitoring years (Years 1 and 3 after planting), after which estimates of percent cover within plots will be used to assess plant establishment because it is usually difficult to differentiate planted trees and shrubs from volunteers a few years after outplanting. Percent cover within plots will be assessed starting in Year 5. The monitoring was designed to ensure that interim goals for outplanting are met so the Project is on track to meet overall goals for reforestation.

4.1 Monitoring Schedule

Monitoring was first conducted in 2014 and 2015 prior to planting to establish baseline conditions (Year 0), and then conducted in Years 1, 2, and 3 (April 2018) following planting and other management activities (Table 4-1). Periodic monitoring will continue in Years 5, 10, 15, and 20.

4.2 Transects and Plots

Ten permanent 100-meter baseline transects have been established within the Puʻu Makua parcel based on factors including 1) site accessibility to facilitate relocating transects in subsequent monitoring years, 2) to sample the range of vegetation categories present on the site, and 3) to capture the range of existing conditions and future management activities and planting intensities conducted throughout the mitigation area. Specifically, three baseline transects have been established within the Mixed Native/Pasture, three transects within the Native Forest, three within the Pasture, and two within the outplanted-vegetation types as shown in Figure 4-1.

Table 4-1. Timeline of Habitat Restoration Activities, Monitoring and Success Criteria Measurements

Year	Habitat Restoration Activities	Monitoring Schedule	Success Criteria Measured
2014	Fencing and ungulate removal; invasive species removal	Baseline (pre-outplanting, pre-invasive species removal)	Yes
2015	Fence inspection; invasive species removal; native tree outplanting	Baseline (pre-outplanting)	No
2016	Fence inspection; invasive species removal; native tree outplanting	Year 1 monitoring	Yes (Year 1 Criteria)
2017	Fence inspection; invasive species removal; native tree outplanting replacement	Year 2 monitoring	No
2018	Fence inspection; invasive species removal; native tree outplanting replacement	Year 3 monitoring	Yes (Year 3 Criteria)

Baseline transect origins (starting points) have been permanently marked and are oriented along a random bearing to adequately sample managed areas. Ten sub-transects, each 10 meters (33 feet) long, are placed randomly, perpendicular to, and at minimum 10 meters apart along the baseline transects. Vegetation composition and cover is measured along each 10-meter (33-foot) sub-transect by recording all vascular plant species intercepted by the line and recording the intercept distance of each species along the sub-transect in centimeters. This is done in 1-meter (3-foot) increments and then summed. Each species is classified as woody or non-woody, and as native or invasive. Bare ground, rock, or other non-vegetative substrate are also recorded.

Plot surveys during Years 1, 2, and 3 of monitoring after outplanting of native trees and shrubs are used to measure survival of planted trees within 27 plots that have been outplanted to determine the need for supplemental planting. A count of all plants within the entire planted plots are recorded. Survival data for planted trees and shrubs are intended to determine future maintenance needs and are not intended for use in establishing whether or not the site has met HCP success criteria. Likewise, during Year 5 and beyond, percent cover within the plots will be used to assess vegetation establishment and to determine future maintenance needs.

In addition, photographs are taken at the origin and the end of each baseline transect to document restoration progress. Photographs are taken annually from the same vantage point and in the same direction using a camera at an approximate height of between 4 feet 8 inches and 5 feet above ground level. In Years 10 and 20, vegetation cover will be assessed using aerial photographs to supplement other data collection methods.

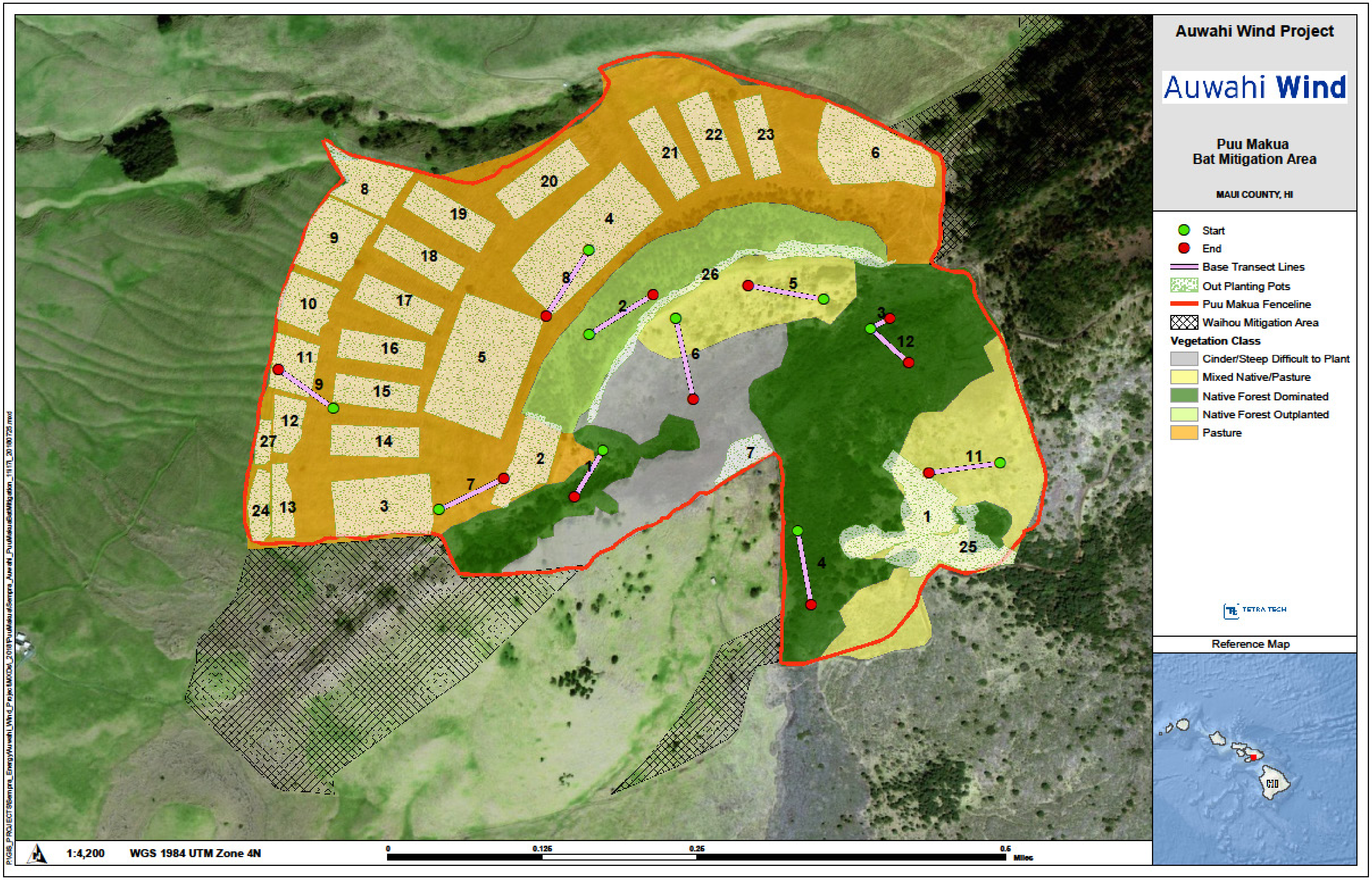

Figure 4-1. Pu‘u Makua Mitigation Area

4.3 Analysis

Percent cover estimates and 95 percent confidence interval are calculated for all baseline transects collectively and for each baseline transect individually so the Pu'u Makua parcel can be assessed while also allowing for specific areas to be identified that may require additional management. Total transect length is evaluated as:

Total Transect Length = # sub-transects X base transects X 1000cm/transect

Absolute cover is calculated by summing the intercept measurements of each vegetation type/group across all sub-transects, and then dividing by the total distance (length) covered by the sub-transects (e.g., percent cover that is vegetated). Relative cover is calculated as the percent of the total absolute cover comprised by each vegetation type/group (e.g., percent of woody vegetation that is native). To determine if the assessed percent cover has achieved the interim success criteria, statistical analysis is performed based on a one-sample proportion test, as described in the U.S. Environmental Protection Agency's Data Quality Assessment: Statistical Methods for Practitioners EPA QA/G-9S. The percent of live plantings (Years 1, 2, and 3) and percent cover (Year 5 and beyond) and a 95 percent confidence interval will be calculated separately for trees and shrubs, and for trees and shrubs combined.

5.0 Vegetation Monitoring Results

5.1 Survival

The February 2017 (Year 2 monitoring) count of planted trees and shrubs within survey plots showed an overall survival of 87 percent of the 13,651 originally outplanted native plants across all 27 plots (a total survival of 10,779 plants). Of the 27 total plots, 22 had greater than 90 percent plants alive. The remaining 5 plots had survival rates between 23 to 74 percent accounting for less than 15 percent of total outplantings. Outplanting to replace lost plants was initiated in May 2017 and continues to be undertaken (last outplanting in June 2018) targeting 100 percent survival of native plants in plots. 400 wilt (*Fusarium*) resistant Koa seedlings were used for most open pasture failed outplanting replacements purchased from Hawaii Agriculture Research Center and a variety of other native seedlings was purchased from native Nursery to replace and add diversity in the plots.

5.2 Cover

FY 2018 (Year 3) monitoring of percent vegetative cover along all transects showed an overall percent cover of native woody vegetation of 24.15 percent (Figure 5-1), and non-native vegetation of 9.56 percent (excluding kikuyu grass)[1]. While overall percent native woody coverage for Year 3 was not significantly different from the percent cover in the baseline survey year (One Sample Proportion test, ϱ= 0.220984), native plants have steadily increased in the outplanting plots in the pasture areas across survey years, as shown in Figure 5-2. Percent native woody coverages in Years 1-3 are significantly greater than the 15 percent cover success criteria for Year 5 success criteria (One Sample Proportion test, ϱ= 0.010441778), and targeted non-native vegetation cover across transects, which has consistently declined each survey year (Figure 5-3), remains well below the 75 percent cover success criteria for Year 3. Aerial photographs of the outplanting

[1] Interim success criteria have been analyzed using the maximum transect length bound the upper limit of vegetation per transect to obtain the total percent cover. Final analysis will incorporate the potential for overlap within transects. Initial analysis suggests this potential source of error accounts for less than 2 percent of vegetation cover within transects.

plots, as shown in Figure 5-4, document the restoration progress. In addition, Figure 5-5 shows Koa canopy starting to form on a baseline transect in an outplant plot in years 2015 (pre-outplant), and years 2017 and 2018 post-outplanting.

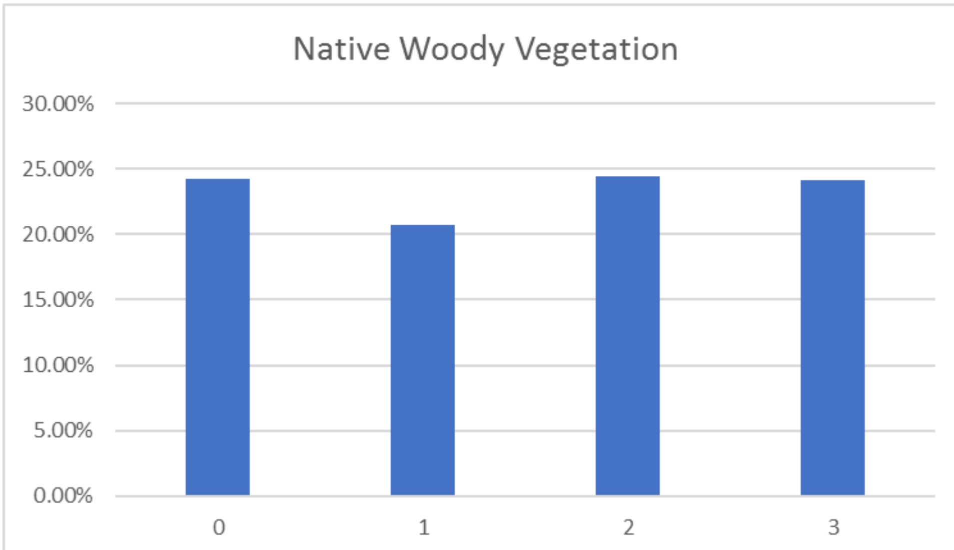

Figure 5-1. Percent Cover of Woody Native Plants Across Plots and Years

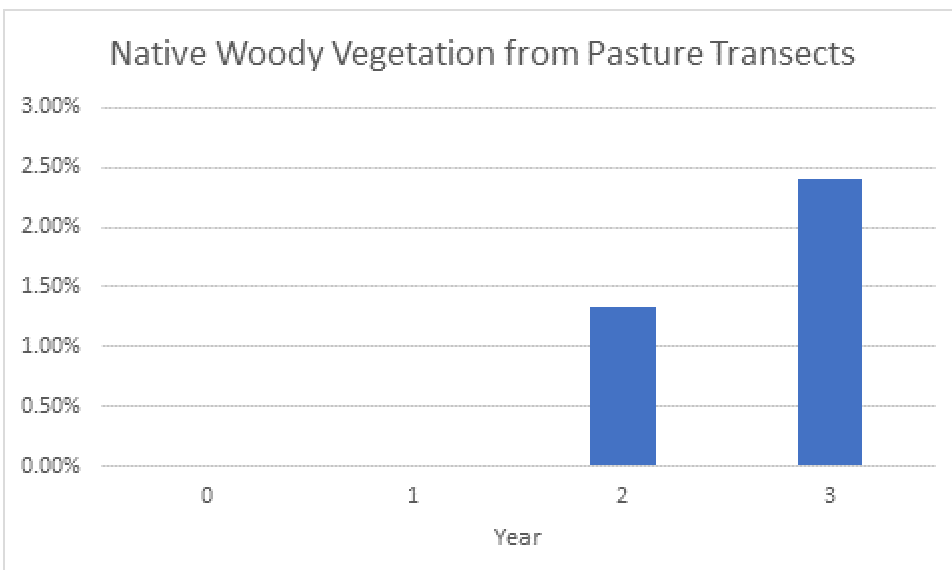

Figure 5-2. Percent Cover of Woody Native Plants in Pasture Plots Across Years

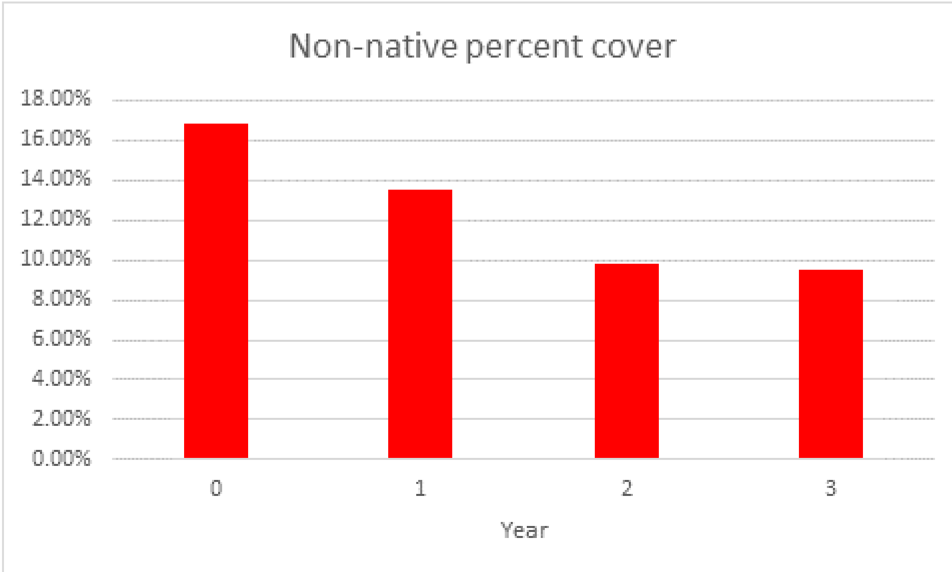

Figure 5-3. Percent Cover of Invasive Species Targeted for Removal Across Plots and Years

Figure 5-4. Aerial Image of Most Outplantings (image taken using a DJI inspire drone and shot in June 2018)

Figure 5-5. Photographs taken at the end of baseline transect number 8 in outplant plot in 2015 (pre-outplant), 2017 and 2018 showing formation of Koa canopy.

6.0 Discussion and Future Management

Auwahi Wind has exceeded the Interim Success Criteria established for Year 3 (FY 2018). The target for non-native plant cover for Year 3 was set at less than 75 percent; non-native cover in FY 2018 was 4.5 percent. The target for native species outplantings survival for Year 3 was set at 75 percent of plants being alive; there was 87 percent survival across plots for Year 2, and ongoing outplantings to replace lost plants (May 2017–June 2018) ensures that the interim and long-term mitigation targets are reached.

The lack of significant difference in percent native woody coverages for Year 3 compared to the baseline survey year may reflect the reduction in canopies of Koa impacted by Hurricane Iselle in August 2014 (Figure 6-1).

The Year 20 habitat restoration target is a native plant cover of 45 percent and a non-native plant species cover of less than 50 percent. To ensure that the interim targets continue to be met, and that long-term mitigation targets are reached, Auwahi Wind is committed to continue 1) vegetation restoration management activities including quarterly inspections to ensure the mitigation area remains free of ungulates, 2) biannual invasive species sweeps to remove target invasive plant species, and 3) native plant outplantings to replace native plants that have been lost post outplantings. In addition, Auwahi Wind is implementing adaptive management by removing prominent invasive plant species at the mitigation site that were not originally targeted, such as common blackberry (Figure 6-2); outplanting native plants where invasive species have been removed including adding plant diversity to control the understory-grasses; and participating in community-driven invasive removal activities such as pine removal along the Pu'u Makua boundary.

In conclusion, Auwahi Wind is in compliance with the Tier 1 mitigation requirement to offset the take of 6 bats through implementation of habitat restoration measures which have met interim success criteria. A total of 8 bats have been tagged and released from the area including 2pregnant females by USGS in 2017.

Figure 6-1. Koa Snapped at Base After Hurricane Iselle in 2014

Figure 6-2. Area Cleared of Invasive Blackberry Planted with Natives During Outreach Event

7.0 Literature Cited

Sempra Energy. 2014. Auwahi Wind Farm Project Habitat Conservation Plan FY 2014 Annual Report. Prepared for Auwahi Wind Energy, LLC. Maui, Maui County, HI.

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Tetra Tech. 2017. Auwahi Wind Farm Project Habitat Conservation Plan FY 2013 Annual Report. Prepared for Auwahi Wind Energy, LLC. Maui, Maui County, HI.

Attachment 4

Hawaiian Hoary Bat Tier 2 & 3 Research Summary

United States Department of the Interior
U. S. GEOLOGICAL SURVEY
PACIFIC ISLAND ECOSYSTEMS RESEARCH CENTER
PO Box 44, Bldg. 344
Hawaii National Park, Hawaii 96818

August 29, 2018

Mr. George Akau – Project Biologist
Auwahi Wind Energy
20100 Piilani Highway, PO Box 901364,
Kula, Hawaii 96790

Dear Mr. Akau,

This letter summarizes the USGS/HCSU bat research efforts at the Pu'u Makua Restoration Area June and July of 2017 (Phase 2 of Bat Research). Contained herein is a brief description of the study methods as well as preliminary and currently-available data available from acoustic monitoring, bat capture efforts, and evaluation of insect prey base and food habits. Figures and tables appear at the end of the document.

Data in this progress report has not been peer-reviewed and should be considered provisional and subject to revision. Due to its provisional nature, the information should not be publically released or distributed. We expect to submit an interpretive report for peer review by the end of December, 2018, and have a final approved report by March, 2019

The USGS looks forward to discussions with you and other stakeholders this research.

Respectfully

Gordon Tribble

Gordon Tribble
USGS PIERC Center Director

Summary of Field Research on the Hawaiian Hoary Bat at Pu'u Makua Restoration Area, Maui

Acoustic Monitoring

Song Meter SM2BAT+ ultrasonic recorders with high frequency microphones (Wildlife Acoustics, Inc., Concord, MA) and SD memory cards were deployed across a mitigation area, Pu'u Makua Restoration Area (**Figure 1**; hereafter Pu'u Makua) to record time-stamped Hawaiian hoary bat (*Lasiurus cinereus semotus*) echolocation calls. These ultrasonic, full spectrum recorders were programed to record continuously every night for up to three months. Detectors recorded from one hour prior to sunset until one hour after sunrise. The detectors were powered by batteries charged with solar energy panels. Station locations were chosen based on accessibility, safety, potential suitability of habitat for bat activity, and to provide widespread coverage.

During March 2015, we erected five stations within Pu'u Makua (Auw 1–5) and one outside the mitigation area at a site deemed potentially good for mist-net capture of bats (Auw 6), at an average elevation of 1,563 m asl. One additional monitoring station was erected on 18 April 2017 at Pond 1 (Auw7, **Figures 1 and 2**), one of four artificial ponds constructed for wetland bird habitat. Three additional acoustic monitoring stations (Auw 8–10) were erected 08–13 June 2018 at the Auwahi Wind facility. These stations spanned a lower elevation gradient (10-363 m asl) than Pu'u Makua and sampled bat activity at a wiliwili (*Erythrina sandwicensis*) grove adjacent to the O & M building and pads, open grass and kiawe (*Prosopis juliflora)* pasture, and an ephemeral anchialine pond on a'a lava flow close to the coast (**Figures 3 and 4**).

Acoustic recorders began recording data in March 2015 and data were downloaded from the memory cards approximately bimonthly through March 2018. Downloaded files were processed with Kaleidoscope (Ver.4.2.0, Wildlife Acoustics 2017) to filter ambient noise, and then checked for quality assurance. Acoustic detections were further categorized as "search calls" (single or multiple low repetition clicks) or "feeding buzzes" (rapidly repeating clicks characteristic of a prey attack by a bat). The software program Presence (Hines 2006, USGS) was used to calculate the "detectability" of bats at each monitoring location by month, and averaged for all sites per month. Detectability (p) represents the frequency of bat presence on a scale of 0 to 1, with 0 describing no bat activity and 1 representing acoustic activity by one or more bats every night of the survey period.

During 13–15 October 2016, we replaced the SMX-US microphones with newer-model SMX-U1 microphones. We operated side by side comparisons of the two microphone models over several weeks to standardize the number of pulses recorded from the two models. Initial results suggest that the SMX-U1 microphones have a higher sensitivity. Data from the two microphone models will be standardized for final analyses. Herein we present data from 13 October 2016 through 22 March, 2018 for all but 2 stations for which data processing is ongoing. Data from within the Pu'u Makua Restoration Area is presented separately from the wind facility area. Problems with sufficient battery power affected station Auw 1 during January-April 2017 (22% of sampling period inoperable) and stations Auw 3 and 9 in late February to March 2018 (5% and 22% of sampling period inoperable, respectively).

Bat activity was recorded at all ten detection stations from the onset of operation through March 2018 (**Table 1**). The number of files containing bat vocalizations varied among stations at Pu'u Makua; but bats were recorded at most stations on 50% or more of the nights surveyed each month (**Figure 5**). Only two stations recorded little to no bat activity during a month. Auw 4 during May 2017 and Auw 2 during November 2017. Stations Auw 2 and 3 had the greatest percentage of nights during which bats were recorded, while Auw 1 had the greatest number of echolocation pulses recorded (**Table 1**). The largest number of feeding buzzes were recorded at Auw 1 and 2, while Auw 1 and 4 had the most occurrences of multiple bats recorded simultaneously.

The three stations at the Auwahi Wind area recorded less bat activity than those at Pu'u Makua. No station in the Auwahi Wind area recorded more than 25% of nights in a month with bat presence. Auw 10, followed by Auw 9 had the largest number echolocation pulses. A single recording of a feeding buzz was documented at Auw 10, and one file contained presence of more than one bat at Auw 9.

At Pu'u Makua, high values of pooled mean monthly detectability were consistently observed from mid-October 2016 through mid-March 2018, except during April 2017 (**Figure 6)**. Monthly variation in detectability was similar from October 2017 to March 2018. High values of bat detectability are found in all months of sampling, except for March and April. Pooled mean monthly bat detectability from mid-June through mid-March in the area at Auwahi Wind was low, except for a small seasonal peak in September. August is when adults enter the volant population.

We concluded acoustic monitoring at the seven sites across the Pu'u Makua Restoration Area and three sites across the wind facility on 22 March 2018. Data analysis from Auwahi Wind area sites added in 2017 and the microphone comparison tests are in progress and will be included in the final report.

Bat Capture

Because bats were successfully captured in October and November of 2016 at Pond 1 (shown on map **Figure 1,** photograph **Figure 2**), we focused mist-netting efforts for 20 nights 08 June – 05 July 2017. Netting was conducted at Waihou over 18 nights in the clearing around station Auw 6 (Cabin site) and across artificial ponds at Pond 1 and Pond 2 sites (**Figure 1**). On two nights netting occurred in areas where bats had been observed at lower elevations within Pu'u Makua: near ranch headquarters in an open area behind the winery and over an open catchment tank in a pasture. Mist-nets were open a mean of 4.36 hrs/night between 6 pm and 1 am. An acoustic lure was deployed for 12 nights in the course of sampling. Broadcasting locally recorded hoary bat social calls attracted bats to nets on three of 16 nights of mist-netting at Pu'u Makua.

We deployed nets for 2,075.25 net-hours, representing an effort of 24 meters of net per night and 104 net-hours per night. Our bat capture efficiency rate was 0.0039 bats per net-hour effort.

Eight adult bats were captured in mist nets (**Figures 7 and 8**); 5 males and 3 females. Two female bats were pregnant, confirming presence of reproductive females at Pu'u Makua. Each bat was handled following the guidelines of the American Society of Mammologists and a University of Hawaii IACUC permit. Each bat was banded with a unique color-coded plastic band on the right forearm (**Table 2**). We recorded the sex, weight, forearm length and collected wing tissue (3 mm biopsy punch) and hair from all individuals. Fecal pellets were collected from five individuals for dietary analysis. There were no recaptures of marked bats during this effort.

Insect Prey Base Collection

The insect prey base for the Hawaiian hoary bat at the Pu'u Makua was sampled during 2016 and 2017 using malaise traps, UV light traps, and by shaking insects from vegetation over cloth sheet (**Figure 9**). We focused on surveying Lepidoptera (moths) and Coleoptera (beetles). Insects were collected near four acoustic detectors (**Figure 1**). Two malaise traps and two light traps were placed at each site; one of each trap type was placed adjacent to an acoustic detector. Representative insects collected using these methods were identified to finest taxonomic level possible from comparison to museum species and are held as a voucher collection at Kilauea Field Station.

While malaise and light traps were aimed to sample the general prey base at each site, sampling from vegetation was designed to identify Lepidoptera and Coleoptera associated with particular plant species. During 2017, Malaise traps operated continuously from 07 June through 03 July and were emptied of contents at approximately weekly intervals. Light traps were run from 7 to 10 pm during 20–23 June 2017. Insects were collected from vegetation on 20 June 2017. Rain prevented sampling vegetation during other days that staff were available. We sampled aalii (*Dodonaea viscosa*), unidentified grass, koa (*Acacia koa*), mamane (*Sophora chrysophylla*), black wattle (*Acacia mearnsii*), redwood (*Sequoia sempervirens*), and an unidentified species of pine. Caterpillars collected on these plants were conveyed to the lab and reared to the adult stage to facilitate identification. Genetic barcoding is expected to help identify some small but common Lepidoptera species not yet identified from our insect collections.

As a means to further assess potential Lepidoptera prey, the body lengths of all moths collected in malaise and light traps were measured and each individual was placed into three size classes: small (<10 mm), medium (10–15 mm) and large (>15 mm).

A total of 1,348 Lepidoptera in malaise traps and 683 Lepidoptera in light traps were collected during 2017. The relative abundance by family differed among sites and between sampling methods (**Figure 10**). In malaise traps, small moths within the superfamily Gelechoidea were most numerous (29.1%) followed by undetermined moths (26.9%) and Geometridae (24.3%). In contrast, Noctuidae (41.4%) dominated the catch in light traps, followed by undetermined moths (28.0%) and "other moths" (14.8%; mostly large-bodied Eribidae). In most cases, undetermined moths were primarily comprised of a wide variety of small moths that are very difficult to identify. Coleoptera were rarely collected in either trap type.

Moths collected in malaise traps were generally smaller than those collected in light traps (**Figure 11**). Overall, small moths comprised 69.8% of all moths in malaise traps while large moths made up 62.2% of all moths in light traps. For malaise traps, the size of moths at Puu 1 and 2 (**Figure 1**) were typically bigger compared to the other sites as large moths comprised 53.8% of all moths at that Puu 1 and 2. The overall preponderance of large moths at light traps was largely driven by results from Rest 1 and 2 sites (**Figure 1**), as large moths comprised 89.0% of all moths at that site, and more moths were collected at Rest 1 and 2 than the other three areas combined (354 vs. 329 moths). The large moth component at Rest 1 and 2 was dominated by Noctuidae and Erebidae.

Sampling from vegetation resulted in 41 Coleoptera representing three families and 52 Lepidoptera (caterpillars) from at least four families (**Table 3**). We found the greatest number of insects on aalii and koa (33 and 25 in 40 person-minutes of effort each, respectively). No

Coleoptera or Lepidoptera were collected on pine located by the pond during 20 person-minutes of collecting.

During 2017, we collected 37 caterpillars from six host plants and attempted to rear them to adults. Twenty-five of these caterpillars emerged as moths or were identifiable to genus while still in the caterpillar stage (**Table 4**). The non-native *Amorbia emigratella* (Tortricidae) was the most common moth species and was reared from aalii (9 individuals) and redwood (5 individuals). Two native moths, *Udara blackburni* (2 individuals) and *Scotorythra* sp. (4 individuals), were collected from black wattle. Because we did not have a source of fresh black wattle foliage to feed these caterpillars, we used koa as a replacement food plant during the later stages of caterpillar development. Six of the seven caterpillars collected on black wattle survived to adulthood; the seventh individual was parasitized by a wasp and died during the caterpillar stage.

Food Habit Assessment

Seventy-one insects collected on or near our study sites were preserved for barcoding. These insects represent a range of taxa and body sizes and include 63 Lepidoptera (from at least eight families), five Coleoptera (four families), one Diptera, and two Heteroptera (two families). The Diptera and one of the Coleoptera were collected from cow dung in the pasture below the study area. The insects preserved for barcoding, while a subset of the entire dataset, include many of the most common species and should represent much of the potential bat prey base.

Sixty-seven insect morphotypes were processed for genetic barcoding of the COI marker. Insects were first identified to family; one to three legs were removed from moths, while for some smaller flies and beetles, the whole body was used for DNA extraction. Arthropod DNA was extracted and polymerase chain reaction methods were used to amplify a 657 bp region of the COI gene for barcoding. Fifty-four samples produced quality consensus sequences after Sanger method sequencing. Of these fifty-four samples; forty-six from Lepidoptera, four from Coleoptera, two from Diptera, and 2 from Hemiptera were compared to similar COI barcodes by family and genus using the Blast search feature and a minimum 90% matching threshold in GenBank’s online database (**Table 5**).

Fecal samples were collected from 5 hoary bats (3 M, 2 F) and DNA was extracted for genetic dietary analysis in 2018. Meta-barcoding of fecal contents was performed through a service contract at the University of Tennessee at Knoxville. Sequences were assembled on an Illumina platform for COI and 16s genetic markers. A dietary bioinformatics analysis for locally captured bats, comparing insect prey found within fecal DNA to the Pu’u Makua insect barcode library, is forthcoming and will be included in the final report.

Summary of progress towards research objectives

Both bat presence and foraging activity was documented within the Pu’u Makua Restoration Area and surrounding Waihou vicinity at all seven monitoring stations, as well as the three additional stations in the vicinity of the Auwahi Wind facilities. There was very high bat activity and slight seasonal variation in the pooled samples of detectability from all the Pu’u Makua sampling stations. A lower level of bat activity but a stronger signal of season variation was documented in the pooled samples of detectability from the sampling stations in the Auwahi Wind vicinity. Acoustic data reported here is not directly compared to the previous report due to the difference in microphone model. The higher sensitivity in newer microphones has increased the detectability (p) values for bats, and data will be standardized for the final report.

We captured bats of both sexes, including pregnant females, during the summer mist netting period. Capturing additional bats at game ponds outside of the Pu'u Makua Restoration Area increased the number of fecal pellets available for prey composition analysis and should improve understanding of dietary preferences.

Insect prey base was sampled for a second season using malaise and light traps, as well as repeated vegetation sampling of restoration area plantings. From initial evaluation of the insect community, a Lepidopteran and Coleopteran prey base for bats currently exists in the Waihou vicinity, and within the Pu'u Makua Restoration Area. We collected samples from malaise traps from the Auwahi Wind facility and ranch sites, but project funding and time did not allow for analyses of these samples.

Additional processing of acoustic data will include: total bat call file counts, number of nights foraging was detected, occurrence of multiple bats recorded in one file, presence of social calls, and timing of echolocation activity during the night.

Additionally, we will complete:

- Analysis of bat recordings from stations Auw 6 and 7.
- Data standardization between microphone types.
- Analysis of trends in bat activity (foraging events) across monitoring stations will be compared over the three-year sampling period, and examined in relationship to potential patterns in insect prey availability and type.

Metabarcoding analysis of fecal pellets and comparison to insect prey base barcodes will include:

- Diet composition, prey types, families and species
- Native vs non-native diet items
- Differences in diet by sex and season
- Comparison of diet items in fecal material to local insect barcode library

Figures

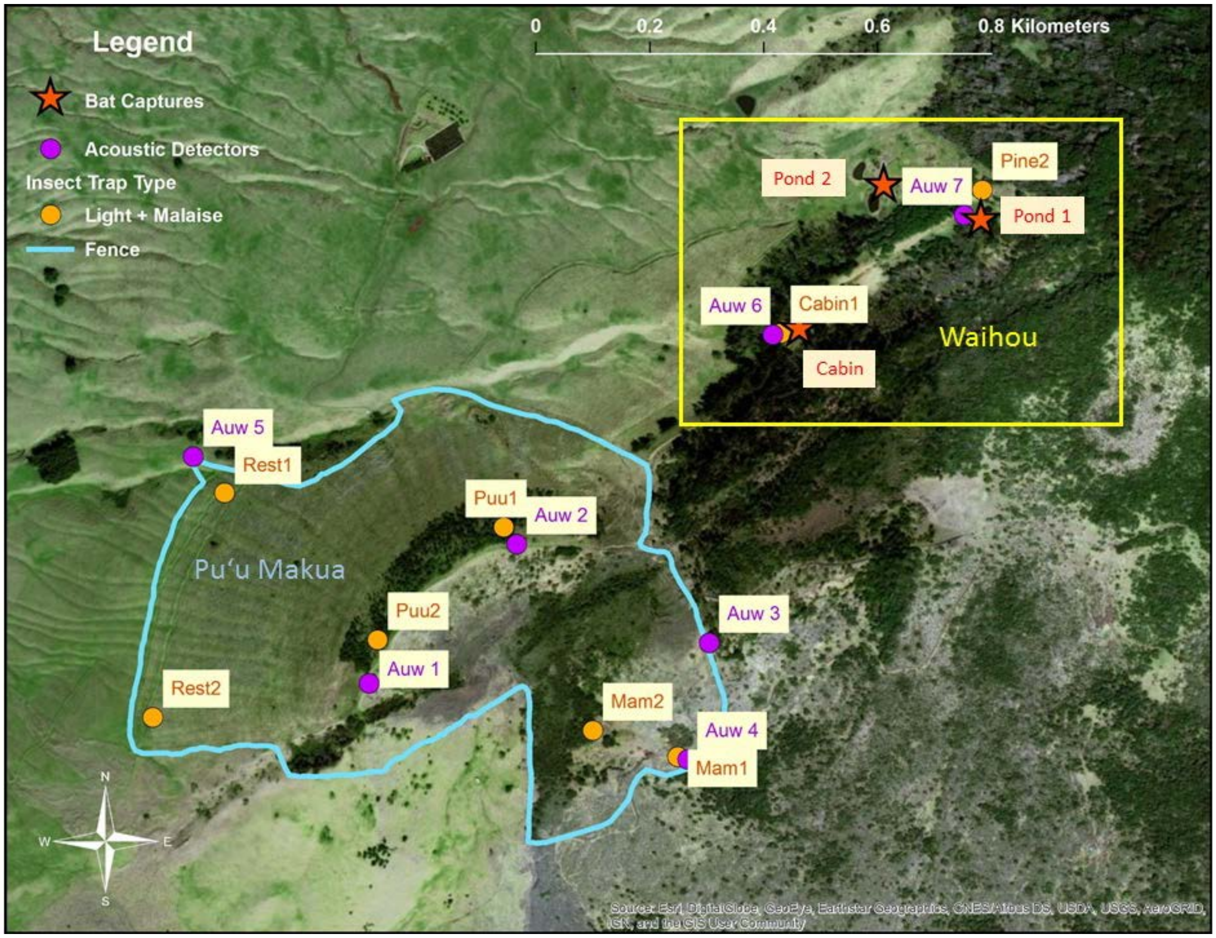


Figure 1. Map of the fenced Pu'u Makua Restoration Area (inside blue fence line) and Waihou vicinity (yellow box) showing seven acoustic recording stations (purple dots Auw 1 through Auw 7), eight paired light and malaise traps (orange dots labeled with site code), and locations of live bat captures from mist netting (red stars).

Figure 2. Bat monitoring station Auw5 in the Pu'u Makua Restoration Area (left). Bat monitoring station Auw 7 next to Pond 1.

Figure 3. Map of Auwahi Wind facility and vicinity showing three acoustic recording stations (purple dots Auw 8 through Auw 10), and one paired malaise trap (orange dot). Auwahi Wind facility turbines are located in green box.

Figure 4. Bat monitoring stations Auw8, Auw9, and Auw10 at Auwahi Wind facility and surrounding habitats.

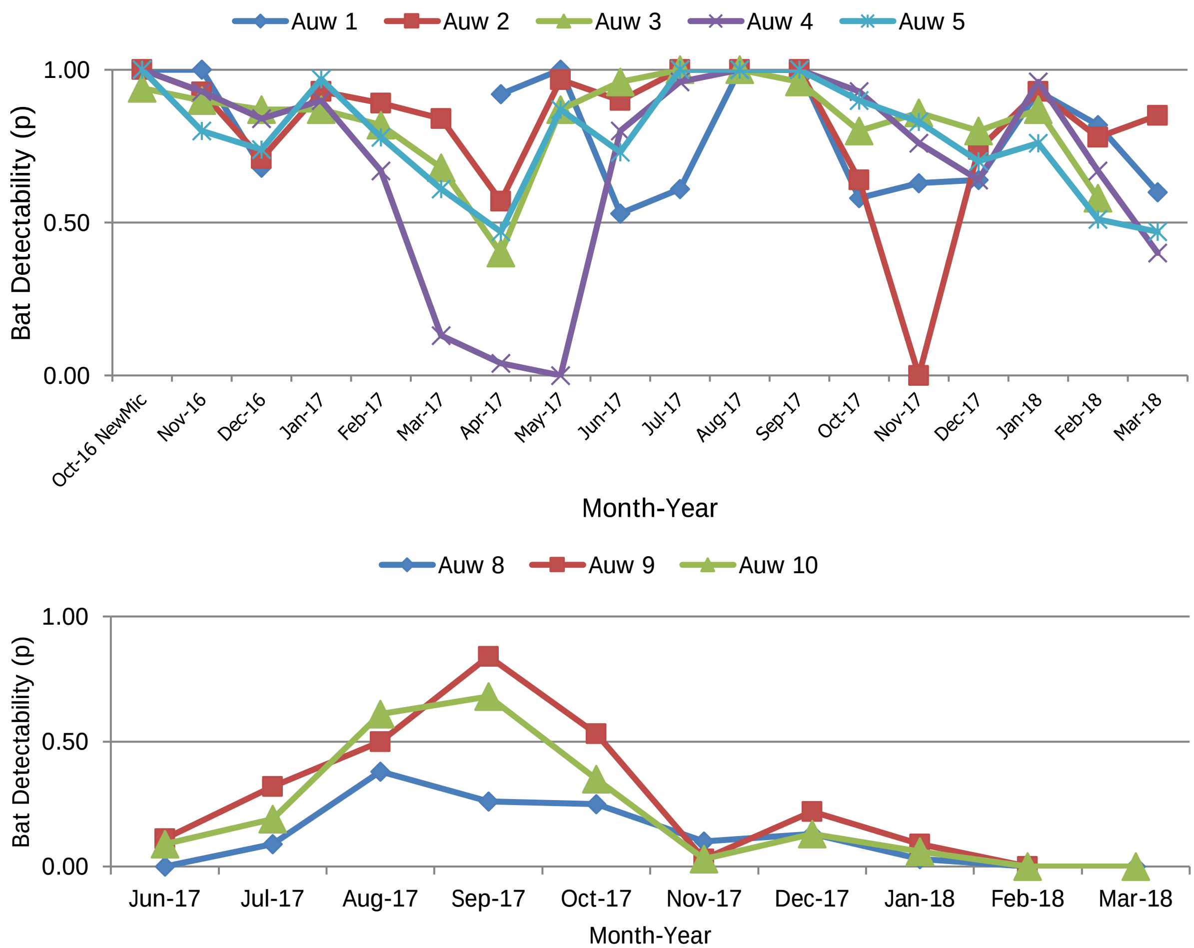


Figure 5. Mean monthly bat detectability (p)atr five i bat detection stations within the Pu'u Makua Restoration Area, October 2016–March 2018 (top) and three stations at Auwahi Wind facility, June 2017–March 2018 (bottom).

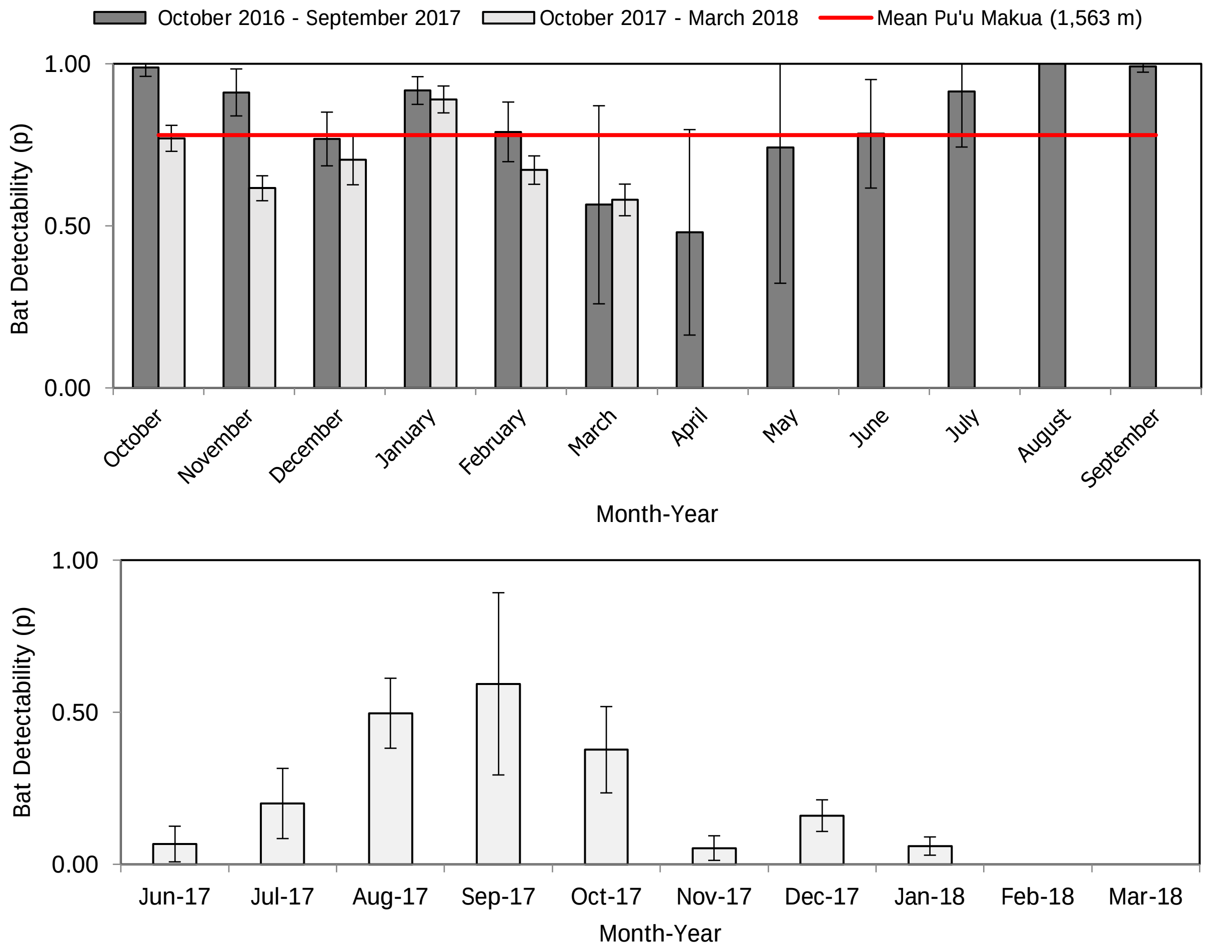


Figure 6. Pooled mean monthly bat detectability (p) for eighteen months from 5 bat detection stations at Pu’u Makua Restoration Area (top). Solid red line indicates mean “annual” detectability across the survey months at mean elevation listed, between October 2016 and March 2018. Pooled mean monthly bat detectability (p) for ten months at 3 bat detection stations at Auwahi Wind (bottom). Vertical bars above columns represent standard errors.

Figure 7. Captured adult Hawaiian hoary bats, male (left) female showing nipples (right).

Figure 8. Pond 2 site, outside of the Pu'u Makua restoration area (see red stars in map Figure 1). Bats were captured in mist nets at these artificial ponds that were constructed for wetland bird habitat.

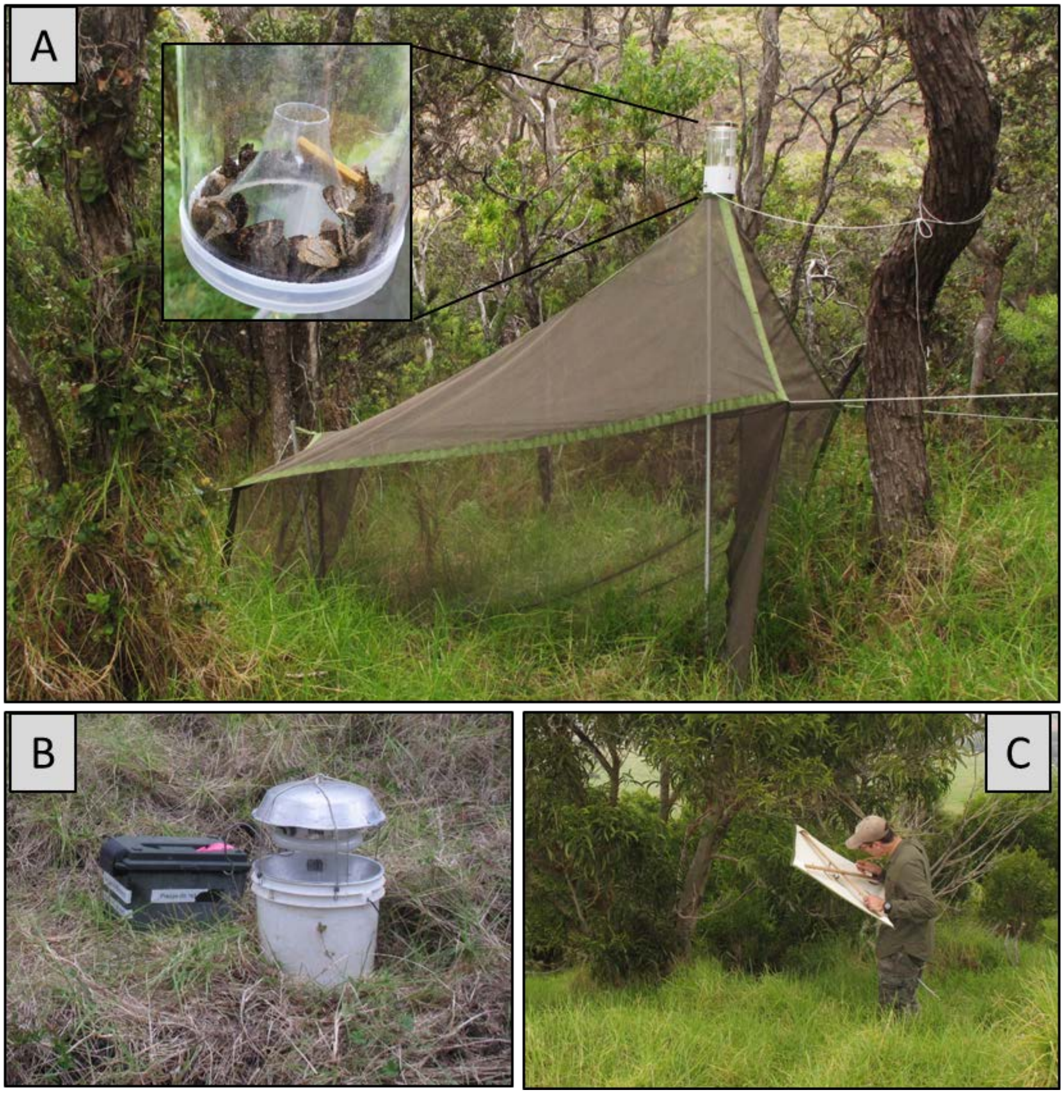


Figure 9. Methods used to collect Lepidoptera and Coleoptera at the Auwahi bat restoration area include malaise traps (A; inset shows numerous geometrid moths within the collection chamber), battery operated light traps (B), and shaking vegetation to dislodge arthropods (C).

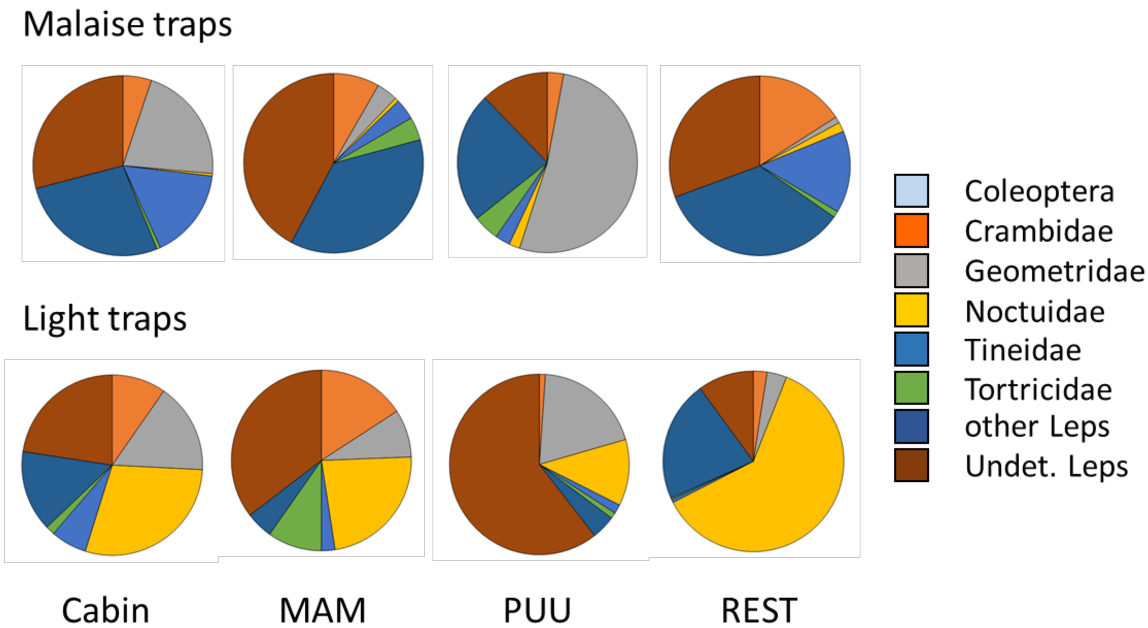


Figure 10. Relative abundance of Coleoptera and Lepidoptera collected in malaise traps (top) and light traps (bottom) at the four study sites during 2017.

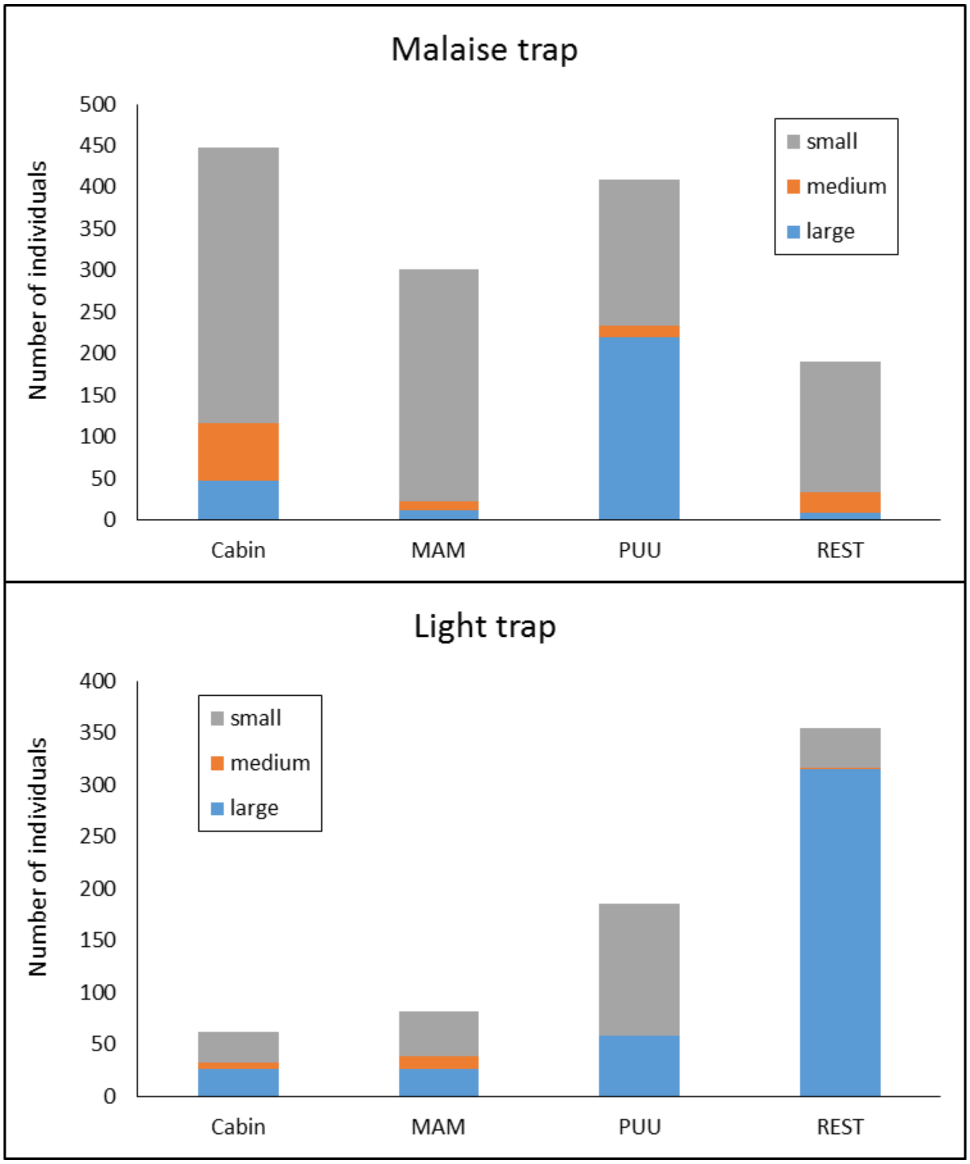


Figure 11. Size class distribution of Lepidoptera collected in malaise traps (top) and Light traps (bottom) at the four study sites during 2017. Size classes were: small (<10 mm); medium (10–15 mm); large (>15 mm).

Tables

Table 1. Summary of bat presence and acoustic information recorded for each detector site at Pu'u Makua Restoration Area between 14 October 2016 and 21 March 2018. Information for stations Auw 6 and 7 is notcomplete (nc).

Detector Station	Elevation (m)	Recording Nights	Nights Bats Present	% Nights with Bat Calls	Echolocation Pulses	Feeding Buzzes	Files with Multiple Bats
Auw 1	1,611	407	323	79%	133,085	138	326
Auw 2	1,606	523	425	81%	70,349	178	131
Auw 3	1,607	494	415	84%	34,452	75	29
Auw 4	1,515	517	368	71%	79,700	53	424
Auw 5	1,396	517	411	79%	28,164	27	36
Auw 6	1,644	nc	nc	nc	nc	nc	nc
Auw 7	1,647	nc	nc	nc	nc	nc	nc
Auw 8	363	280	39	14%	667	0	0
Auw 9	10	216	61	24%	1,890	0	1
Auw 10	150	266	61	23%	2,091	1	0

Table 2. Capture and banding information for bats in the Waihou vicinity, June and July 2017.

Bat ID	Date	Location	Time	Sex	Weight (g)	Forearm (mm)	Band (RW)	Fecal	Reproductive Condition
M50	6/20/17	Pond 1	21:00	M	17.5	47.5	Purple	yes	
M51	6/20/17	Cabin	21:05	M	15.5	47.4	Blue/Red	yes	
M52	6/22/17	Pond 2	21:35	F	24.25	50	Red/White	no	pregnant
M53	6/26/17	Pond 1	20:05	M	19.25	49	Yellow/Orange	no	
M54	6/26/17	Pond 2	22:05	F	21.75	50.2	Yellow/Green	yes	lactating
M55	6/28/17	Pond 2	22:08	M	18	46.5	White	yes	
M56	7/3/17	Pond 2	22:10	M	19	49.2	Red/Green	no	
M57	7/4/17	Pond 1	22:13	F	23.5	50.3	Green	yes	pregnant

Table 3. Abundance of Coleoptera and Lepidoptera collected from foliage of seven common plant species on 20 June 2017. The search effort for each plant species, indicated at the bottom of the table, is in minutes, except for grass, which is in individual sweeps with a hand net.

Order	**Family**	**aalii**	**black wattle**	**grass**	**koa**	**mamane**	**pine**	**redwood**
Coleoptera	Coccinelidae	20	1	3	4	1		
	Curculionidae					1		
	Undetermined family			1	1			
Lepidoptera	Crambidae					1		
	Geometridae	2	4		18			
	Lycaenidae		2					
	Tortricidae	9						5
	undetermined	2	1	1	2	5		
Search effort		40	20	200	40	60	20	20

Table 4. Lepidoptera reared from caterpillars to adults collected on six host plants during 2017.

	host plant					
Fate of caterpillar	**aalii**	**koa**	**mamane**	**redwood**	**black wattle**	**pine**
Amorbia emigratella	9			5		
Udara blackburni					2	
Scotorythra spp.	2	2			4	
Uresiphita sp.			1			
Unidentified dead caterpillar or pupa	2	1	2			2
Parasitoid emerged from caterpillar		1	3		1	
Total	13	4	6	5	7	2

Table 5. List of order, family, genus and species for insects barcoded as part of the Pu'u Makua bat food habits survey. Asterisks denote groups endemic native to Hawaii.

Order	*Family*	*Genus and Species*
Lepidoptera	Crambidae	Omiodes spp*
		Uresiphita polyhonalis virescens*
		Bissetia subfumalis
		Tawhitia pentadactylus
	Geometridae	Melanophia atrigrada
		Cleora cinctaria
		Geometridae spp.
		Eupithecia spp.
		Euphyia spp.
	Tineidae	Opogona spp.
	Tortricidae	Amorbia emigratella
		Crocidosema plebejana
		Acleris semipurpurana
	Erebidae	Melipotis indomita
		Schrankia costaestrigalis
	Noctuidae	Chrysodeixis eriosoma
		Peridroma saucia
		Mythimna unipuncta
		Agrotis subterrnea
		Ophiusa disjungens
		Agrotis munda
		Spodoptera exempta
		Athetis thoracia
	Sphingidae	Hyles lineata
	Xyloryctidae	Chereuta tinthalea
	Carposinidae	Carposina spp.
	Cosmopterigidae	Hyposmocoma spp.*
Coleoptera	Hydrophilidae	Sphaeridium scarabaeoides
	Scarabaeidae	Aphodiinae spp.
		Digitonthophagus gazella
	Staphylinidae	Philonthus spp.
Diptera	Therevidae	Therevidae spp.
	Sepsidae	Sepsis thoracica
Hemiptera	Pentatomoidea	Pangaeus bilineatus
	Lygaeidae	Lygaeidae spp.

Attachment 5

Status Update from the Leeward Haleakalā Watershed Restoration Partnership on Use of Funds for Blackburn's Sphinx Moth Mitigation

Auwahi Forest Restoration Project quarterly report to Sempra for forest restoration at Auwahi, ʻUlupalakua Ranch, Maui Progress from May 1, 2018 through July 31, 2018

We are contacting you to update you on the progress of the goals outlined for the Auwahi Forest Restoration Project to conduct primary restoration in six acres and plant 1500 *ʻaiea* (*Nothocestrum latifolium)* and 10 *ʻiliahi* (*Santalum haleakalae var. lanaiense*). We have successfully conducted primary restoration in six acres of Auwahi, planted 1,086 *ʻaiea*, and more than 20 *'iliahi* in Auwahi exclosures. From May 1 through July 31, 2018 we have planted 93 *ʻaiea* including 3 larger saplings in 2 gallon pots into Auwahi forest restoration areas.

Attachment 6
BSM Translocation

Auwahi **Wind**

Blackburn sphinx moth Translocation Form

Date 4/4/2018 Time 2:00 PM Observer Ben Campbell

Instar Stage of Development:

1st Instar – 1-2mm clear with red horn

2nd Instar – 2 mm – 1 cm taking on more green color with dark horn

3rd Instar – 1.5 cm – 3 cm green coloration, black horn

4th Instar – spherical and segmentation on side 5 cm-9 cm

5th Instar – fully grown 9 cm + grey or green morph, look for excessive frass

Number of Individuals Found 4

Location Found (UTM) Northing 2279345.76 Easting 779537.61

Habitat Characteristics Found

Gravel substrate on south berm of turbine 4 pad within 10 meter tobacco plant buffer zone. Dry drainage near trap cluster. Wiliwili, Aalii, Koa Haole, Pua Kala, Uhaloa, Kikuyu, Abutilon grandiflora. Remnant dryland native forest mixed with grazing pasture. Cattle present and grazing. Native Hawaiian cultural sites mixed into ranching landscape

Auwahi Wind

Insert Picture

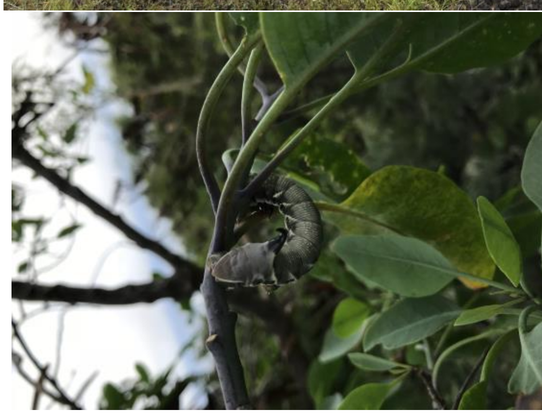
Location Relocated (UTM)

Northing 1) 2280621.30 2) 2280650.94 Easting 1) 778645.98 2) 778627.04

Habitat Characteristics Relocated

Tree tobacco plants located in lava field substrate, native dryland forest mixed with grazing pasture. Wiliwili, Kiawe, Aalii, Tobacco, Pua kala, Alahee, Hao, Haole Koa, and Kikuyu, Abutilon grandiflora. Native dryland mixed pasture. Drainage and Puu Hokuano nearby. Native Hawaiian Cultural sites mixed into ranching landscape.

Auwahi **Wind**



Auwahi **Wind**

Insert Picture

Notes *(Discussion of the results of the relocation, post translocation observations, and best methods for transporting larvae and eggs.)*

Cloudy day with low wind. Host plant flowering and above 10 ft tall. Transported in cardboard box on original host tobacco plant leaves separated from origin host plants. Placed 2 individuals per new plant. Assisted with caterpillars climbing onto new host tobacco plant. One observed eating on new host plant immediately. Caterpillars observed feeding on new plants days later. Translocated 2 per tree. Found 4th instar and when checked a week later they were 5th instar.

Attachment 7

FY 2019 Annual Work Plan and Timeline

		2018							2019				
		July	Aug	Sept	October	November	December	January	February	March	April	May	June
PCMM	Fatality Searches	Weekly Canine Assisted Searches											
	Searcher Efficiency Trials	Monthly Trials											
	Carcass Persistence Trials	Quarterly Trials											
	Predator control	Traps at turbines operational. Kill traps are monitored at 4 day intervals. Live catch traps are checked within 24 hours of triggering. Footholds and Body Grip traps shutdown during cattle grazing.											
	Bat Monitoring Utilizing Thermal and Acoustic Detectors	Weekly Data Retrieval and Equipment Maintenance											
HAPE	HAPE Monitoring	Burrow Monitoring								Burrow Monitoring			
	Predator Control to protect Petrels in mitigation area	Traps Operational All Units	Predator Activity Assessment	Traps Operational All Units. Kill traps checked bi-weekly and live catch traps are checked within 24 hours of being triggered.			Shutdown live catch traps. All other traps open to March check.		Predator Activity Assessment	Traps Operational All Units			
	Predator Control trap sensor trials using OMNI trap sensors	Deployment and trials of traps sensors at PTA											
Bat	Ungulate Control	Quarterly Fence Inspection			Quarterly Fence Inspection			Quarterly Fence Inspection			Quarterly Fence Inspection		
	Vegetation Monitoring and Invasive Species Control	Target Invasive Vegetation Management							Annual Vegetation Monitoring	Target Invasive Vegetation Management			
	Tier 1 (Reforestation-planting diversity)	Plant understory outplantings beneath established Koa canopy plantings			Re-treat grasses around out planting		Plant diversity of native plants into outplanting units					Re-treat grasses around out planting	
	Tier 2 & 3 (Acoustic monitoring at higher elevation cloud forest restoration site, dryland forest, and anchalitne pond))	Year 3 Summary Report											
	Tier 2 & 3 (Bat mark recapture at Duck Ponds)	Year 3 Summary Report											
	Tier 2 & 3 (Insect Prey Based Study)	Year 3 Summary Report											
	Tier 4	Acoustic Detection Study											
	ITP & ITL Conditions		Annual HCP Report Submitted					l Take Summary Tables S	Semiannual Progress Report Submitted				

Attachment 8

FY 2018 Expenditures for HCP Implementation

	Tier, Ongoing, or One-time	Event	Proposed Cost	Total Costs Incurred to Date (up to July 2018)	Costs Incurred FY 13 (July 1, 2012 - June 30, 2013)	Costs Incurred FY 14 (July 1, 2013 -June 30, 2014)	Costs Incurred FY 15 (July 1, 2014 -June 30, 2015)	Costs Incurred FY 16 (July 1, 2015 -June 30, 2016)	Costs Incurred FY 17 (July 1, 2016 -June 30, 2017)	Costs Incurred FY 18 (July 1, 2017 -June 30, 2018)
General Measures	Ongoing	Wildlife Education and Incidental Reporting Program	$5,000	$4,667	$3,000	$1,500	$167	N/A	N/A	N/A
	Ongoing	Downed Wildlife Post-Construction Monitoring and Reporting and Mitigation Monitoring	$1,810,000	$783,640	$100,000	$185,145	$152,901	$108,727	$96,700	$140,167
	Ongoing	*DOFAW Compliance Monitoring (only if needed)	$200,000	$12,823	N/A	N/A	$2,423	N/A	$4,600	$5,800
		Subtotal General Measures	*$1,815,000*	*$801,130*	*$103,000*	*$186,645*	*$155,324*	*$108,727*	*$101,300*	*$145,967*
Hawaiian Hoary Bat	Tier 1	Retrofit fencing and restoration measures at the Waihou Mitigation Project	$522,000	$907,631	$314,900	$63,173	$128,410	$149,833	$126,463	$124,852
	Tier 1	Acoustic Monitoring onsite	$40,000	$39,827	$5,000	$8,691	$14,663	$11,473	N/A	N/A
	Tier2	Telemetry Research	$250,000	$250,000	N/A	$32,726	$8,308	$142,819	$66,146	N/A
	Tier 3	Expanded Research	$320,000	$315,878	N/A	N/A	N/A	N/A	$234,360	$81,518
Hawaiian Petrel		Subtotal Bats	*$812,000*	*$1,513,336*	*$319,900*	*$104,591*	*$151,381*	*$304,125*	*$426,969*	*$206,370*
	Tier 1	Burrow Monitoring and Predator Control	$550,000	$599,337	$214,000	$74,572	$107,743	$56,410	$62,731	$83,880
		Subtotal Petrels	*$550,000*	*$599,337*	*$214,000*	*$74,572*	*$107,743*	*$56,410*	*$62,731*	*$83,880*
Nene	One-Time	Research and Management Funding	$25,000	$25,000	$25,000	N/A	N/A	N/A	N/A	N/A
		Subtotal Nene	*$25,000*	*$25,000*	*$25,000*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Backburn's Sphinx Moth	One-Time	Restoration of 6 acres of Dryland Forest	$144,000	$144,000	$144,000	N/A	N/A	N/A	N/A	N/A
		Subtotal Moth	*$144,000*	*$144,000*	*$144,000*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
		Total HCP-related Expenditures	**$3,346,000**	**$3,082,803**	**$805,900**	**$365,808**	**$414,448**	**$469,263**	**$591,000**	**$436,218**

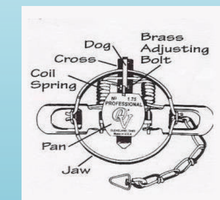
Attachment 9
Trap Sensors

Omni Remote Trap Sensors and Trap Monitoring

Prepared By: Omnim2m AUWAHI WIND

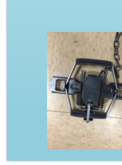
Safety Concerns

- **Personal Protective Equipment (PPE)**
  - Gloves, boots, and eye protection are recommended when securing trap sensor and trap handling
  - Appropriate trap setters and trap safeties when handling live traps
  - Proper live-catch handling and removal tools when approaching or resetting triggered traps with a live-catch
  - Minimum of 5-mil nitrile gloves to eliminate risk of exposure when handling predator carcasses
  - PPE and safety tools
  - Carry Smart phone/device with best cell phone provider coverage
  - Keep Fingers out off firing range when the trap is set and safeties are off



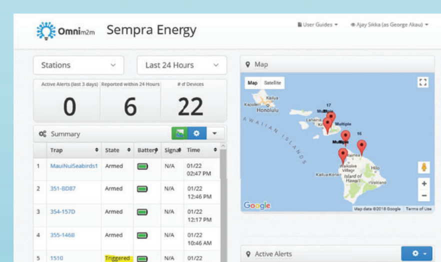
Modification and Maintenance

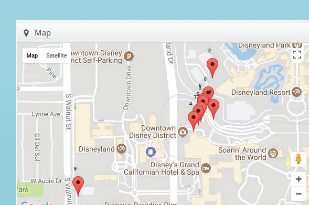
- **Protecting trap sensor**
  - Secure protective layer to electrical wire running from sensor to antennae
- **Waterproofing trap sensors**
  - Keep o-ring intact and clean of debris
- **Securing trap sensor to traps**
  - Securing sensor onto footholds using screws and ideal attachment locations
- **Reporting software**
  - Manage multiple accounts by customer or region. Assign people to different areas, link alert phone/email address, create internal reports and setup custom alerts



Where to Set

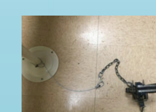
- **Low elevation**
  - Areas where Verizon cell phone service is available and away from easily accessible to the public locations
- **High elevation**
  - Away from cracks, crevices, and caves that antennae will not be positioned within
- **Areas to Avoid**
  - Public accessible areas
- **Deploy anywhere**
  - OmniM2M PestWatch™ comes with cellular Internet standard and lets you deploy traps without finding a WiFi network or installing a line of sight system

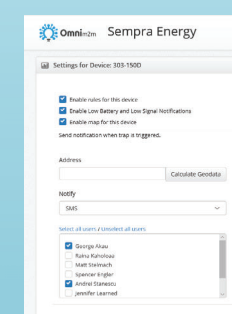




How to Set

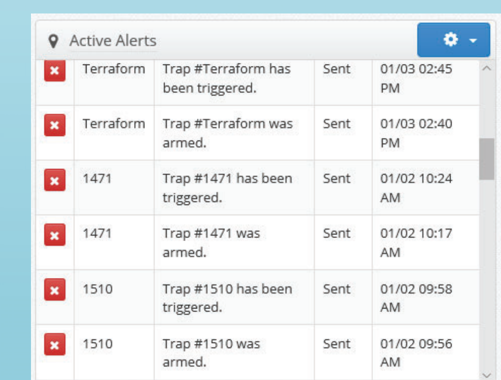
- **Prepare the set Location**
  - Find game trail or corridor and clear the ground of brush, sticks, and debris
  - Create a funnel to trap position if predator trail is wider than trap set
  - Check for Verizon cell phone coverage
- **Set the trap sensor**
  - Attach magnets to trap sensor and confirm an armed trap report through text message or website
- **Anchor trap in position predator will not get tangled or damage antennae line**
  - Position anchor cable coming of trap in opposite direction of trap sensor antennae line
  - Run trap sensor antennae line away from where trapped predator will be held
- **Camouflage**
  - Bury trap sensor electrical line and place rocks along buried line
  - Secure to trees or near by natural features
- **Final Setting**
  - Before leaving trap set remove safeties, take gps point, record trap monitoring/setting gps feature, and mark with flagging, warning stickers, and metal tag number





How to Check

- **Log into OMNI website**
  - Create username and password and log into website
  - Turn on trap sensor notifications
- **Test-Firing**
  - Separate magnets in simulated trap triggered scenario and receive a text message report
- **Re-Setting a triggered trap sensor**
  - Reconnect the magnets and wait for a trap armed text message
- **SMS/Email Alerts**
  - When a trap is activated and sustains activity levels, a message is automatically sent to operations personnel
- **Omni PestWatch™**
  - Track pest issues remotely, identify problem areas, and get real-time activity reports



Active Alerts

✕	Terraform	Trap #Terraform has been triggered.	Sent	01/03 02:45 PM
✕	Terraform	Trap #Terraform was armed.	Sent	01/03 02:40 PM
✕	1471	Trap #1471 has been triggered.	Sent	01/02 10:24 AM
✕	1471	Trap #1471 was armed.	Sent	01/02 10:17 AM
✕	1510	Trap #1510 has been triggered.	Sent	01/02 09:58 AM
✕	1510	Trap #1510 was armed.	Sent	01/02 09:56 AM

Purchasing

- Antennae styles:
  - External antennae
  - Internal antennae
- Trap sensor trigger mechanism:
  - External magnet
  - Internal magnet
- Vendors and Suppliers:
  - Omni M2M
- Monthly Payments:
  - For a low monthly fee, get your hardware, wireless data plan, and cloud software, to monitor your bait stations and/or traps
- Contact:
  - Ajay Sikka
  - Ajay@OmniM2M.com
  - www.OmniM2M.com
  - 1 (425) 818-0560

Miscellaneous Details

- **Increase efficiency**
  - Reduce unnecessary truck rolls with wireless Internet enabled rodent and pest traps that let operation personnel know when traps have been activated
- **No installation required**
  - Each Omni PestWatch™ device, comes with an antenna, sensors, cage/trap (optional) and a long lasting rechargeable battery standard, and is fully Provisioned on the Verizon Wireless network

Attachment 10

Education Outreach Events

2018 1st Quarter – Career day at Kamehameha Schools Maui

On February 15, 2018, the environmental team as well as a representative from Siemens attended career day at the high school of Kamehameha schools Maui. The group presented display materials about the work being conducted by the environmental team and information about the wind farm and its operations. Promotional items such as reusable water bottles, pens and stickers were available for the students to take home. Middle school students and high school students were able to ask questions about careers in the environmental field as well as wind energy.

2018 3rd Quarter – HSCA Ka'anapali Community Outreach Event

On June 2nd Auwahi Wind staff and Sempra Renewables corporate staff participated in the Hawaiian Sailing Canoe Association (HSCA) community outreach event at Ka'anapali beach on the west side of Maui. Sempra Renewables and Auwahi Wind were one of the sponsors for the HSCA 2018 season and hosted informational booths on the beach. The booths included reef safe sunscreen, reusable water bottles, activity books for children and native plants for people to take home. The HSCA offered canoe rides to the public free of charge.