

Kahuku Wind Power Habitat Conservation Plan FY 2024 Annual Report



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Executive Summary

This report summarizes work performed by Kahuku Wind Power, LLC (KAH) at the Kahuku Wind Power Project (Project) during the State of Hawai'i fiscal year (FY) 2024 (July 1, 2023 – June 30, 2024) under the terms of the approved Habitat Conservation Plan (HCP). The HCP is dated May 27, 2010, and describes KAH's compliance obligations under KAH's state Incidental Take License (ITL) ITL-10 and federal Incidental Take Statement (ITS) Biological Opinion (BO) 2010-F-0190. The HCP covers eight species: seven are federally and state-listed as threatened and endangered and one is exclusively a state-listed endangered species. The Project was constructed in 2010 and has been operating since March 23, 2011.

Wildlife fatality monitoring at the Project continued in FY 2024 within the 35-meter radius circular search plots centered on the wind turbine generators (WTGs). Plots were searched by canine-handler teams once per week, year-round. Bias correction trials were conducted quarterly to measure the probability that a carcass persists until the next search (carcass persistence) and the probability that an available carcass would be found (searcher efficiency). The results of these trials showed mean probabilities of persistence until the next search of 0.55 (bat surrogates) and 0.90 (medium-sized bird surrogates). Searcher efficiency was 1.00 for bat surrogates and 1.00 for medium bird surrogates.

Two 'ōpe'ape'a fatalities were found in FY 2024. A total of ten bat fatalities (including the two found in FY 2024) have been observed as direct take at the Project since beginning operations on March 23, 2011. The cumulative fatality estimate using the Evidence of Absence estimator at the upper 80 percent credibility level is 22 bats, and the total indirect take for this estimate is 3 adult equivalents. Combining these values, there is an approximately 80 percent chance that cumulative take of the 'ōpe'ape'a from the start of operations through FY 2024 was less than or equal to 25 adults. KAH understands that take through FY 2024 has exceeded the permitted amount and the Project has initiated an amendment to the state HCP and a new federal HCP, and adaptive management planning for installation of acoustic bat deterrents in FY 2025. No fatalities of other Covered Species have been observed at the Project to date.

During FY 2024, KAH monitored bat activity at the Project through four ground-based acoustic detectors located near Project WTGs using the SM4BAT-FS. Between June 1, 2023 and May 31, 2024, the 'ōpe'ape'a were detected on 91 out of 1,281 detector nights (3.9 percent of detector-nights) and 97 out of 1,440 detector nights (6.3 percent) using the SM4BAT-FS with SMM-U2 microphone. Seasonal patterns of detection rate were comparable with previous years.

Baseline (Tier 1) mitigation obligations for the 'ōpe'ape'a were met prior to FY 2024. Higher Take (Tier 2) mitigation planning was initiated in FY 2020 and continued in FY 2024 with finalization of the Mitigation Plan. Implementation of the Mitigation Plan will begin in FY 2025. Mitigation obligations for baseline levels of take of waterbirds, seabirds, and the pueo were met prior to FY 2024.

KAH communicated actively with USFWS and DOFAW throughout FY 2024 with conference calls, submittal of quarterly reports, site visits, and e-mail communications related to the Project's HCP and associated mitigation. Communications included submittal of the final Tier 2 Mitigation Plan, as well as a preliminary HCP amendment development document to address higher than anticipated take of 'ōpe'ape'a and a letter of intent to seek additional take coverage. In addition, a site visit to the wind farm occurred in September 2023, an in-person HCP amendment meeting was held in February 2024, and a site visit to the Tier 2 mitigation site and an in-person semi-annual meeting occurred in June 2024.

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1.0 Introduction

The Habitat Conservation Plan (HCP) for the Kahuku Wind Project (Project) was approved by the Hawai'i Division of Forestry and Wildlife (DOFAW) in 2010. Kahuku Wind Power, LLC (KAH) received a federal Biological Opinion (BO 2010-F-0190) and associated Incidental Take Statement (ITS) from the U.S. Fish and Wildlife Service (USFWS), and a state Incidental Take License (ITL; ITL-10) from DOFAW in May and June of 2010, respectively. The ITS and ITL cover the incidental take of eight species: seven federal and state-listed threatened and endangered species, and one exclusively state-listed endangered species (collectively referred to as the Covered Species) over a 20-year permit term.

The Covered Species include:

- 'Ōpe'ape'a (Hawaiian hoary bat; *Lasiurus cinereus semotus*);
- Ae'o (Hawaiian stilt; *Himantopus mexicanus knudseni*);
- 'Alae ke'oke'o (Hawaiian coot; *Fulica alai*);
- Koloa maoli (Hawaiian duck; *Anas wyvilliana*);
- 'Alae 'ula (Hawaiian gallinule; *Gallinula galeata sandvicensis*);
- 'Ua'u (Hawaiian petrel; *Pterodroma sandwichensis*);
- 'A'o (Newell's shearwater; *Puffinus newelli*); and
- Pueo (Hawaiian short-eared owl; *Asio flammeus sandwichensis*); state-listed only.

The Project was constructed in 2010 and 2011 and commissioned for operation on March 23, 2011. The Project continues to be operated by KAH.

KAH and Tetra Tech, Inc (Tetra Tech) have collaborated to prepare this annual HCP Implementation report which describes work performed for the Project during the 2024 fiscal year for the State of Hawai'i (FY; July 1, 2023 – June 30, 2024) pursuant to the terms and obligations of the approved HCP, ITL, and ITS. Kahuku Wind submitted previous annual HCP progress reports for FY 2011 through FY 2023 to USFWS and DOFAW (Kahuku Wind 2011, Kahuku Wind 2012, Kahuku Wind 2013, Kahuku Wind 2014, Kahuku Wind 2015, Kahuku Wind 2016, Kahuku Wind 2017, Kahuku Wind 2018, Tetra Tech 2019, Tetra Tech 2020, Tetra Tech 2021, Tetra Tech 2022a, Tetra Tech 2023a).

2.0 Fatality Monitoring

In consultation with USFWS, DOFAW, and the Endangered Species Recovery Committee (ESRC), fatality search areas and search frequency have evolved over time from the start of operations in 2011 through the initiation of the current approach in April 2015. Below is a summary of how the fatality monitoring has evolved over time:

- In March 2011, the wildlife fatality monitoring effort involved twice weekly searches within a 64-meter radius circular monitoring plot centered on each WTG in addition to searches every other week within a larger 96-meter radius plot.
- In September 2014, the 96-meter radius plot searches were suspended, but searches within the 64-meter radius plots continued twice weekly.
- In December 2014, plots were reduced in size to the current 35-meter radius (Figure 1). Search frequency was monthly from December 2014 through March 2015.
- In April 2015, the search frequency of the 35-meter radius plots was increased to occur weekly. This search area and frequency has continued to be used for monitoring through FY 2024.

Weekly searches of the 35-meter radius plots were completed throughout FY 2024 for a total of 52 weekly searches. The plots were searched by trained detector dogs and their handlers (canine search teams). To accommodate the detector dogs, starting in January 2021 and continuing through FY 2023, weekly searches primarily occurred over 2 consecutive days, with searches conducted at six of the 12 WTGs on each day. Starting in July 2023, searches generally occurred on 1 day at all 12 WTGs after a change in canine handler. Fatality monitoring in FY 2024 achieved a mean search interval for WTGs of 6.92 days (Standard Deviation = 0.55 days). In FY 2024, all searches were conducted by canine teams, however, should conditions have prevented the use of dogs (e.g., weather, injury, availability of canine search team, etc.), plots would have been visually surveyed by Project staff.

Two individuals of one Covered Species, the 'ōpe'ape'a, were detected during fatality searches in FY 2024 (see Section 7.1). Other species fatalities are reported in Section 7.2, and no fatalities of other Covered Species have been observed at the Project since the start of operations.

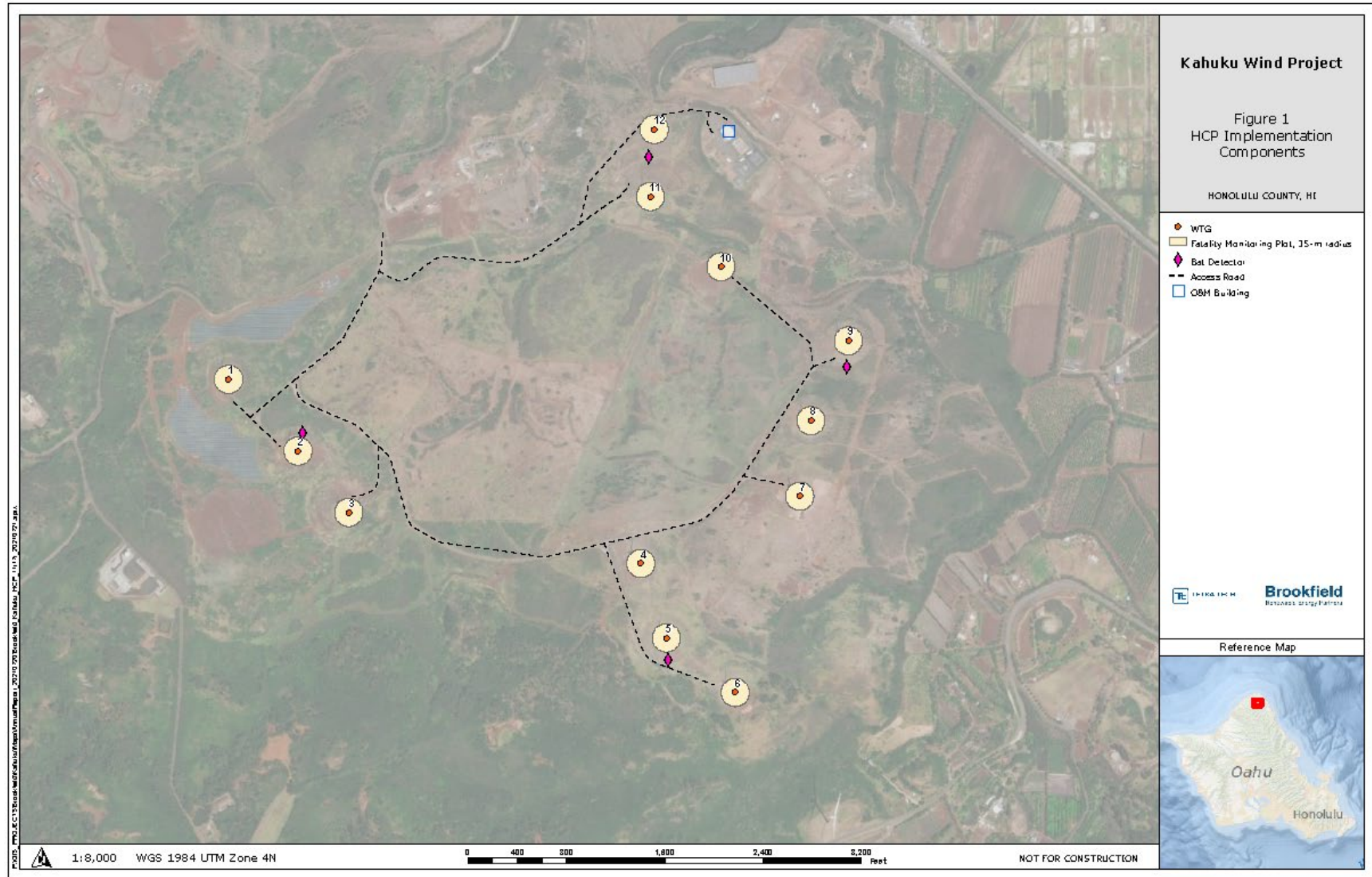


Figure 1. HCP Implementation Components

3.0 Carcass Persistence Trials

A 28-day carcass persistence trial was conducted in each quarter of FY 2024 for a total of four trials. These trials used carcasses of black rats (*Rattus rattus*) as surrogates for the 'ōpe'ape'a. Wedge-tailed shearwaters (*Ardenna pacifica*; obtained under the Project's Special Purpose Utility Permit [MBPER0055565, valid through 03-31-2025] and Protected Wildlife Permits [WL21-21 and 231228115819-WILD]) were used to represent medium-sized birds (surrogates for all avian Covered Species; see Section 1.0). In FY 2024, the mean probability that a bat surrogate carcass persisted until the next search was 0.55 (95 percent Confidence Interval [CI] = 0.41, 0.69; n=24) and for medium-sized bird carcasses was 0.90 (95 percent CI = 0.61, 0.99; n=8). KAH recognizes the probability of persistence for bats is lower than previous years, has investigated cause over the course of FY 2024 including the use of game cameras, and is working on adaptive actions for the scavenger control program in FY 2025.

4.0 Searcher Efficiency Trials

Searcher efficiency trials occurred throughout the year to test wildlife carcass detection of canine search teams (no un-aided, human only searches occurred in FY 2024). A total of 91 searcher efficiency trials were administered to canine search teams over 15 trial days during FY 2024. Carcasses of black rats were used as surrogates for the 'ōpe'ape'a. Carcasses of wedge-tailed shearwaters were used as surrogates for avian Covered Species. Of the 76 bat surrogate trial carcasses placed, 18 were lost to scavenging for a total of 58 carcasses available to be found. Fifteen wedge-tailed shearwater carcasses were placed; all were available to be found. The overall searcher efficiency in FY 2024 for bat surrogates was 1.00 (95 percent CI = 0.96, 1.00; n = 58) and for medium-sized bird carcasses was 1.00 (95 percent CI = 0.85, 1.00; n = 15).

5.0 Vegetation Management

Search plots include searchable area out to 35 meters from the base of each WTG. Search plots are comprised of bare ground and vegetation that is mowed when it reaches 4 to 6 inches in height. The search plots accommodate a relatively flat search area that is easily maintained; however, a small portion of one search plot (WTG 3) has a slope that precludes vegetation management and is consequently not searched. Vegetation within the plots consists mainly of Bermuda grass (*Cynodon dactylon*), sensitive plant (*Mimosa pudica*), and Guinea grass (*Megathyrsus maximus*).

In FY 2024, all plots were mowed at regular intervals to maintain high visibility during fatality searches. Plots were checked weekly for vegetation conditions, and generally mowed two to three times per month during the wetter months of the year and at least once per month during the drier months. Mowing consistently occurred immediately following the weekly fatality searches at the

WTGs where needed. Livestock, primarily cattle, are grazed within search plot bounds, keeping vegetation low and reducing the need for mechanical mowing.

On-site biologists maintained communication with the canine searchers to ensure there were no impacts of invasive species (e.g., sensitive plant; *Mimosa pudica*) from the searcher team.

6.0 Scavenger Trapping

In FY 2024, between 70 and 75 Doc-250s, and 15 Timms traps, were initially in use during trapping efforts. The 15 aging Timms traps were replaced with 12 Trapinator traps in March 2023, to adjust the trap type to the needs of the site due to decreasing carcass persistence. Trap set and check frequency was conducted every other week. During FY 2024, a total of 220 target animals were captured and removed, including 166 mongooses (*Herpestes javanicus*), 33 rats (*Rattus* spp.), two mice (*Mus musculus*) and 19 feral cats (*Felis catus*). Other miscellaneous non-native, non-target captures during this timeframe included four species: common myna (*Acridotheres tristis*), spotted dove (*Streptopelia chinensis*), African snail (*Lissachatina fulica*), and cane toad (*Rhinella marina*).

7.0 Documented Fatalities and Take Estimates

All downed wildlife observed during the fatality monitoring were handled and reported in accordance with the Downed Wildlife Protocol provided by USFWS and DOFAW (DOFAW and USFWS 2020). No injured (live) downed wildlife were observed at the Project in FY 2024.

Various factors affect how the number of observed fatalities is scaled to estimate the unobserved fatalities. Unobserved fatalities are due to three primary factors:

- Carcasses may be scavenged before searchers can find them;
- Carcasses may be present and not detected by searchers; and
- Carcasses may fall outside of the search area.

Sections 3.0 and 4.0 describe methods that are used to estimate the effect of the first two factors. The search area for fatalities at the Project has evolved over time; therefore, the proportion of the carcass distribution searched has varied. However, no changes to the search area have been made since December 2014 (Section 2.0). Thus, the estimate of the proportion of the carcass distribution searched in FY 2024 remains the same as described in the FY 2018 annual report (Kahuku Wind 2018) and is presented in Appendix 1.

7.1 ‘Ōpe‘ape‘a

A total of ten ‘ōpe‘ape‘a fatalities have been observed at the Project since operations began on March 23, 2011. The most recently documented ‘ōpe‘ape‘a fatalities include two individuals of unknown sex, both detected on October 2, 2023 during regular searches. Both carcasses were

observed at WTG 8, one at 12 meters and the other at 16 meters from the turbine base although one carcass was estimated to be less than one day old and the other five or fewer days old. Both carcasses were collected and transferred to the Bishop Museum in October 2024, in coordination with USFWS under the partnership established for genetic sexing. Genetic sexing results for these two bats, along with the two from FY 2023, are not yet available as the laboratory has been undergoing renovations and is unable to provide the service. Currently, four bat fatalities await genetic sexing at the Museum. All previous bat fatalities had been transferred to the U.S. Geological Survey (USGS) for genetic sexing under a program that is now discontinued.

All ten bats have been detected inside of search plots; no incidental bat fatality detections have occurred to date. Table 1 lists the observed 'ōpe'ape'a fatalities by fiscal year.

Table 1. Observed 'Ōpe'ape'a Fatalities at the Project through FY 2024

Fiscal Year	Observed Direct Take	Incidental Fatality Observations	Total
2011	0	0	0
2012	3	0	3
2013	0	0	0
2014	0	0	0
2015	1	0	1
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	1	0	1
2022	1	0	1
2023	2	0	2
2024	2	0	2
Total	10	0	10

Cumulative take is estimated from three components: (1) observed direct take (ODT) during protocol (standardized) fatality monitoring, (2) unobserved direct take (UDT), and (3) indirect take. The Evidence of Absence software program (EoA; Dalthorp et al. 2017), an agency-approved analysis tool for analyzing direct take, uses results from bias correction trials and ODT to generate an upper credible limit (UCL) of direct take (i.e., ODT + UDT). USFWS and DOFAW have requested that estimates of direct take for KAH be reported at the 80 percent UCL. Direct take values from this analysis can be interpreted as: there is an 80 percent probability that actual direct take at the Project over the analysis period was less than or equal to the 80 percent UCL. Associated indirect take is estimated based on the sex and age characteristics of bat fatalities found at the Project, and

the life history characteristics of (assumed to be representative of) the 'ōpe'ape'a, as described in the Project's approved HCP and current agency guidance (USFWS 2016).

The estimated direct take (ODT + UDT) for the ten 'ōpe'ape'a fatalities found between the start of operation (March 23, 2011) and end of FY 2024 (June 30, 2024) is less than or equal to 22 bats (80 percent UCL). Details of the estimated direct take parameters are in Appendix 1.

Indirect take is estimated to account for the potential loss of future individuals (offspring) that may occur as the result of the loss of an adult female through direct take during the breeding period when females may be pregnant or supporting dependent young. Indirect take for the Project is calculated using the USFWS (2016) guidance as follows:

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

Based on the USFWS (2016) guidance, the estimate of cumulative indirect take as of the end of FY 2024 is calculated as:

- **Total Juvenile Take Calculated from Observed Female Take (April 1 – September 15)**
 - $3 \text{ (observed females)} * 1.8 \text{ (pups per female)} = 5.4 \text{ juveniles}^1$
- **Total Juvenile Take Calculated from Observed Unknown Sex Take (April 1 – September 15)**
 - $1 \text{ (observed unknown sex)} * 0.5 \text{ (assumed sex ratio)} * 1.8 \text{ (pups per female)} = 0.9 \text{ juveniles}$
- **Total juvenile Take Calculated from Unobserved Take**
 - $12 \text{ (unobserved direct take)} * 0.5 \text{ (assumed sex ratio)} * 0.25 \text{ (proportion of calendar year females could be pregnant or have dependent pups)} * 1.8 \text{ (pups per female)} = 2.7 \text{ juveniles}$
- **Total Calculated Juvenile Indirect Take = 9.0 (5.4 + 0.9 + 2.7)**

¹ DNA results have identified the sex of five of the eight bat fatalities detected at the Project, confirming that three of the fatalities were female (Pinzari and Bonaccorso 2022). Sex identification of one carcass did not yield a confirmed sex, and the sex of the remaining four bat fatalities will be incorporated once confirmed by genetic testing.

- **Total Adult Equivalent Indirect Take** = 0.3 (juvenile to adult conversion factor) * 9.0 = 2.7

Therefore, cumulative indirect take through FY 2024 is three adults (rounded up from 2.7).

The UCL for cumulative Project take of the 'ōpe'ape'a at the 80 percent credibility level is 25 adult bats (22 [estimated direct take] + 3 [estimated indirect take, measured in adult equivalents]). That is, there is an approximately 80 percent probability that actual take at the Project at the end of FY 2024 is less than or equal to 25 bats.

KAH understands that FY 2024 take has exceeded the fully permitted amount, and the Project has initiated adaptive management planning for installation of acoustic bat deterrents in FY 2025 (Section 10). Bat deterrents have proven effective at the neighboring Kawaihoa Wind Project (Tetra Tech 2022b, Tetra Tech 2023b).

Additionally, KAH has initiated the development of an HCP amendment with agencies to address the permit exceedance, and provided a letter of intent to amend to the agencies on April 5, 2024.

7.2 Fatalities of Non-Covered Species

Six bird fatalities, representing three species, were documented at WTGs at the Project site in FY 2024. All three of the species observed in FY 2024 are protected by the Migratory Bird Treaty Act (MBTA): sooty tern (one fatality), wedge-tailed shearwater (two fatalities), and cattle egret (three fatalities). For a complete list of fatalities detected in FY 2024, including Hawaiian and scientific names, see Appendix 2.

8.0 Wildlife Education and Observation Program

Wildlife Education and Observation Program trainings continue to be conducted on an as-needed basis to provide on-site personnel with the information to respond appropriately if they observe a Covered Species or encounter downed wildlife while on-site. Wildlife Education and Observation Program trainings were provided to 10 individuals over five dates in FY 2024.

9.0 Mitigation

The Project's mitigation requirements are described in Section 7.6 of the approved HCP.

9.1 'Ōpe'ape'a

9.1.1 *On-Site Acoustic Monitoring*

The HCP commits to acoustically monitoring for bat activity during years when systematic fatality monitoring is conducted. Acoustic monitoring has been conducted continuously at the Project since the start of operations in 2011. Over the course of this long-term monitoring effort, the number of

monitoring locations and type of monitoring equipment has changed. Between FY 2014 and FY 2017, monitoring was conducted at 12 locations, including ground and nacelle-based, distributed across the Project. However, due to the low frequency in the number of nights with recorded bat activity, monitoring efforts were reduced to seven ground-based locations beginning in FY 2018 (Kahuku Wind 2018), and then to four ground-based locations (WTGs 2, 5, 9, and 12; Figure 1) beginning in FY 2019. Anabat acoustic bat detectors (models SD1 and SD2) were deployed during the first 2 years of bat acoustic monitoring. In FY 2014 (July 2013) Anabat detectors were replaced with Song Meter SM2BAT+ ultrasonic recorders equipped with SM3-U1 microphones (Wildlife Acoustics, Maynard, MA, USA). In FY 2017, SM3-U1 microphones were replaced with SMX-U1 microphones. In FY 2023, the Song Meter SM2BAT+ acoustics recorders and SMX-U1 microphones were replaced with the newest models available, the Song Meter SM4BAT-FS and SMM-U2 microphones.

The objective of monitoring is to better understand the annual and seasonal variations in bat activity at the project. Analysis of variance (ANOVA) and a Tukey's HSD test were used to determine there any differences in detection rates between FY 2014 and FY 2024 monitoring years. To test for a change in detection rates across all monitoring years, we used a linear mixed-effect model (LMM) with year, sampling effort (i.e., the number of monitoring locations), and microphone model (FY 2022, FY 2023, and FY 2024 only) as predictor variables, with interactions between these variables and included site location as a random effect. Data were normalized with an Ordered Quantile Normalization transformation using the 'bestNormalize' package in R (Peterson 2021). The distribution of residuals from the LMM were examined to check for violations of model assumptions. All tests were two-tailed, employed an alpha value of 0.05, and were conducted in R version 4.3.1 (R Core Team 2023).

Similar to the past 11 sampling years, bat activity at the Project remains generally low. Across the four detector locations sampled throughout FY 2024, 'ōpe'ape'a were detected on 91 nights out of the 1,440 (6.3 percent) detector-nights sampled (Table 2). The annual detection rate in FY 2024 (6.3 percent) was lower than the annual detection rate in FY 2023 (6.7 percent) but not significantly different (Tukey's HSD: $P = 1.00$).

Among all monitoring years, annual detection rates were consistently low and represent less than 7.0 percent of detector nights sampled (Table 2). The observed annual detection rates in FY 2023 and FY 2024 were significantly larger than all detection rates prior to FY 2022, excluding FY 2019. While the increases in FY 2023 and FY 2024 are likely attributed to updated microphone sensitivity, the annual detection rates across all monitoring years appear to be stable, with no significant increasing or decreasing trend, regardless of the variation in the sampling effort or microphone model used (Table 3; LMM; Year: $t_{12,79} = -0.47$, $P > 0.639$; Year:Sampling effort: $t_{12,79} = -0.43$, $P > 0.669$; Year:Microphone model: $t_{12,79} = 1.86$, $P > 0.067$).

Table 2. Number of Detector-Nights Sampled and Proportion of Detector-Nights with Bat Detections Between FY 2014 and FY 2024

Sampling Period ^{1, 2}	No. of Nights Sampled	No. of Nights with Detections	Proportion of Nights with Detections
FY 2014 (July 2013 - May 2014)	3,146	31	0.010
FY 2015 (June 2014 - May 2015)	3,113	12	0.004
FY 2016 (June 2015 - May 2016)	3,030	28	0.009
FY 2017 (June 2016 - May 2017)	3,093	15	0.005
FY 2018 (June 2017 - May 2018)	1,458	10	0.007
FY 2019 (June 2018 - May 2019)	1,046	12	0.011
FY 2020 (June 2019 - May 2020)	1,413	6	0.004
FY 2021 (June 2020 - May 2021)	1,283	9	0.007
FY 2022 (June 2021 - May 2022)	1,225	32	0.026
FY 2023 (June 2022 - May 2023)	1,458	98	0.067
FY 2024 (June 2023 - May 2024)	1,440	91	0.063
1. Number of monitoring sites: FY 2014 - 2017 ($n = 12$), FY 2018 ($n = 7$), FY 2021 - 2024 ($n = 4$). 2. Acoustic recorder and microphone model: FY 2014 - 2016 (SM2Bat+ with SM3-U1), FY 2017 - 2022 (SM2BAT+ with SMX_U1), FY 2023 - 2024 (SM4BAT-FS with SMM-U2).			

Table 3. Results of a Tukey's Honest Significant Difference (HSD) Test on the Annual Detection Rates for each of the sampling years at Kahuku between FY 2014 – FY 2024

Sampling Years	Difference in Means	Lower 95% CI	Upper 95% CI	P-value
2014 - 2023	1.70	0.34	3.06	0.004
2014 - 2024	1.65	0.29	3.01	0.006
2015 - 2022	1.42	0.06	2.78	0.034
2015 - 2023	2.29	0.93	3.65	0.000
2015 - 2024	2.23	0.87	3.60	0.000
2016 - 2023	2.04	0.68	3.40	0.000
2016 - 2024	1.99	0.63	3.35	0.000
2017 - 2023	2.21	0.85	3.57	0.000
2017 - 2024	2.15	0.79	3.51	0.000
2018 - 2023	1.80	0.32	3.28	0.006
2018 - 2024	1.75	0.27	3.22	0.009
2020 - 2023	2.22	0.56	3.89	0.002
2020 - 2024	2.17	0.50	3.84	0.002
2021 - 2023	1.86	0.19	3.53	0.017
2021 - 2024	1.81	0.14	3.47	0.023

In FY 2024, detection rates peaked in October (15.3 percent of detector nights) during early post-lactation reproductive period, consisting of 19 detector-nights with a detection. Following the peak in October, detection rates declined in the month of November. Detection rates remained low throughout December to March of the pre-pregnancy reproductive period with no detections observed in the months of February and March. Activity was observed again in April and May of the pregnancy reproductive period (Figure 2). The overall pattern of the detection rates in FY 2024 were similar to the patterns of detection rates observed in previous years (Figure 3).

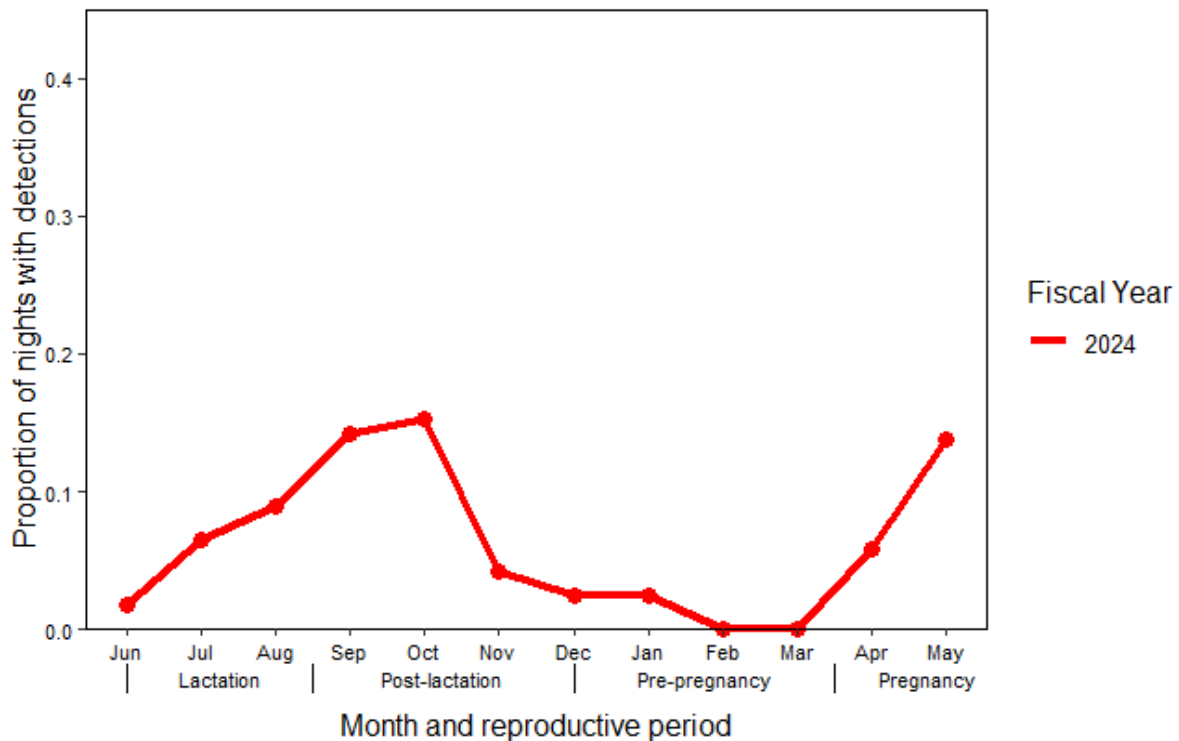


Figure 2. Monthly Bat Acoustic Activity at Kahuku for FY 2024 with Corresponding Reproductive Periods

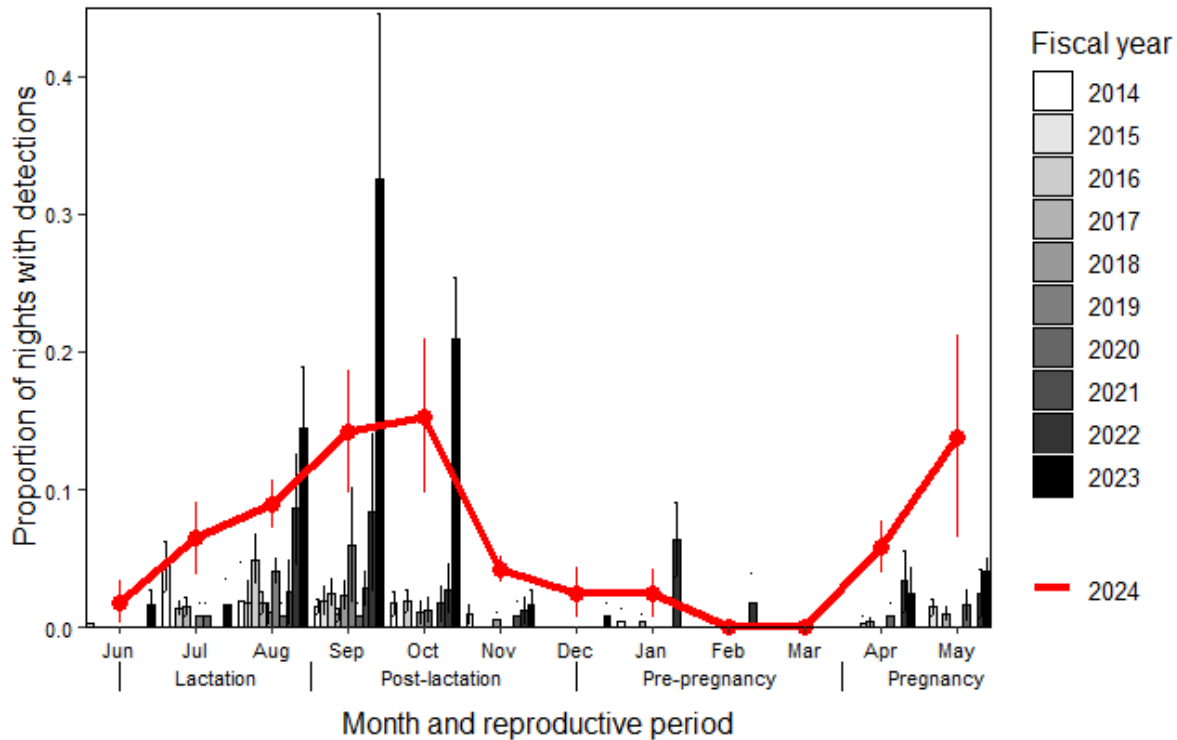


Figure 3. Monthly Bat Acoustic Activity at Kahuku for FY2023 through FY2024 with Corresponding Reproductive Periods

9.1.2 Kahikinui Forest Reserve Mitigation

The Baseline (Tier 1) Mitigation obligation for the ‘ōpe‘ape‘a is complete. Kahuku Wind paid the full obligation of \$150,000 for Tier 1 bat mitigation conducted by DOFAW at the Kahikinui Forest Reserve on Maui in September 2011 (Kahuku Wind 2012). These funds were used for 2,500 meters of ungulate fencing around a 280-acre enclosed restoration area (Landon 2015).

9.1.3 Tier 2 Mitigation

Mitigation planning for a Higher Take (Tier 2) was initiated in FY 2020. Based on input from USFWS and DOFAW, KAH is working with DOFAW O‘ahu to conduct management actions beneficial to bats at one of DOFAW’s recent bat mitigation property acquisitions on O‘ahu, the Helemano Section of the ‘Ewa Forest Reserve (Helemano Mitigation Area). Within this area, opportunities exist to perform habitat modification that are anticipated to achieve required benefits for bats. In FY 2024, KAH, in collaboration with agencies and with input from the ESRC, finalized a Tier 2 Mitigation Plan identifying habitat modification actions that are additive and complementary to the broad

management goals and forest management activities identified and previously executed by DOFAW O'ahu. KAH is now working on implementation of the plan in FY 2025.

Baseline acoustic monitoring for bat activity began in March 2023 with the deployment of 12 SM4BAT-FS detector units each with an SMM-U2 microphone placed at and moved to randomly selected locations within the mitigation area monthly. This monitoring effort was completed in July 2024. Baseline insect sampling began in August 2023 and was completed in July 2024. In addition to and separate from the primary baseline acoustic monitoring effort, one acoustic monitor (SM2BAT+ with SMX-U1 microphone) was deployed at the site of a proposed water feature installation within the Helemano Mitigation Area to capture baseline activity at the location prior to mitigation actions.

9.2 Other Covered Species

Mitigation efforts for waterbirds were completed as of FY 2015 and no further reporting is required (Kahuku Wind 2016). All mitigation efforts for 'a'o and 'ua'u were completed as of FY 2017; no further reporting is required (Kahuku Wind 2017, Pacific Cooperative Studies Unit and DOFAW 2017). Mitigation efforts for the pueo were completed as of FY 2017 and no further reporting is required (Kahuku Wind 2017).

10.0 Adaptive Management

KAH has implemented adaptive management steps in accordance with the adaptive management framework in Section 8.3 of the approved HCP to understand and reduce the risk to the 'ōpe'ape'a. Adaptive management measures that have been and continue to be implemented include adjustments in vegetation management and scavenger control efforts to maintain a high probability of detecting Project-related wildlife fatalities and implementing a Project-wide LWSC regime.

LWSC of all turbines at wind speeds of up to 5 meters per second began April 27, 2012, and is currently implemented between sunset and sunrise from April through November. Curtailment is achieved by feathering blades to minimize rotation. The Project is operating under the LWSC regime described above, and KAH conducts regular checks to confirm the LWSC programming is operating as intended. KAH has engaged USGS on the topic of a Smart Curtailment program and is reviewing acoustic data towards its development.

Seven bat fatalities have been observed over approximately 12 years since the initiation of LWSC implementation at KAH, compared to three bat fatalities found across two calendar years prior to the initiation of LWSC.

Based on the two bat fatalities found in FY 2024, KAH is working with DOFAW and USFWS on an HCP amendment, including the addition of acoustic bat deterrents to the turbines and potential redistribution of curtailment. KAH anticipates the installation of bat deterrents in FY 2025, and is planning on the use of thermal imaging in support of a deterrent efficacy study. See Section 7.1 for additional details.

11.0 Agency Meetings, Consultations, and Visits

KAH communicated actively with USFWS and DOFAW throughout FY 2024 through video teleconference, conference calls, in-person meetings, quarterly reports, and e-mail communications related to the Project's HCP (Table 3). These communications included focused discussions of 'ōpe'ape'a Tier 2 mitigation planning and the finalization of the Mitigation Plan.

Table 4. Summary of Agency Coordination and Communication in FY 2024

Date	Communication	Participants
July 3, 2023	Comments on 4th draft Tier 2 Bat Mitigation Plan	To: KAH From: DOFAW
August 1, 2023	Submission of annual report	To: DOFAW, USFWS From: Tetra Tech on behalf of KAH
August 23, 2023	Site visit coordination	Conducted by Tetra Tech on behalf of KAH, USFWS, DOFAW
September 1, 2023	Letter of determination on turbine replacement	To: KAH From: DOFAW
September 7, 2023	In-person site visit to Kahuku	KAH, Tetra Tech, DOFAW, USFWS
September 8, 2023	USFWS comments on annual report	To: KAH From: USFWS
September 15, 2023	DOFAW comments on annual report	To: KAH From: DOFAW
September 18, 2023	Tier 2 Bat Mitigation Plan	To: DOFAW, USFWS From: Tetra Tech on behalf of KAH
September 26, 2023	Email clarifying permitted bat take limits	To: KAH From: DOFAW
October 2, 2023	Email notifying agencies of two bat fatalities detected that morning	To: DOFAW and USFWS From: Tetra Tech
October 3, 2023	Final annual report	To: DOFAW, USFWS From: Tetra Tech on behalf of KAH
October 4, 2023	Downed wildlife reports for October 2nd bat fatalities	To: DOFAW, USFWS From: Tetra Tech
October 30, 2023	Presentation to ESRC regarding Tier 2 Bat Mitigation Plan	To: ESRC From: Tetra Tech on behalf of KAH
October 30, 2023	Q1 report	To: DOFAW, USFWS From: Tetra Tech on behalf of KAH
November 1, 2023	Annual Implementation Meeting (teleconference)	KWP, Tetra Tech, DOFAW, USFWS
November 6, 2023	Email request to discuss barbed wire removal at Tier 2 mitigation site	To: DOFAW O'ahu and land lessee From: Tetra Tech

Date	Communication	Participants
November 9, 2023	Email request to initiate HCP amendment process	To DOFAW and USFWS From: Tetra Tech on behalf of KAH
November 16, 2023	Annual meeting notes	To: DOFAW and USFWS From: Tetra Tech
November 20, 2023	Email providing details of potential barbed wire replacement at Tier 2 mitigation site	To: Tetra Tech From: DOFAW
December 14, 2023	Follow-up on proposed equipment modification and HCP amendment for increase bat take, amended letter of determination	To: KAH From: DOFAW
December 15, 2023	Response to DOFAW equipment modification determination	To: DOFAW From: KAH
December 20, 2023	HCP Amendment meeting (teleconference)	KAH, Tetra Tech, DOFAW, USFWS
January 4, 2024	Email requesting meeting to discuss barbed wire removal	To: DOFAW, USFWS From: Tetra Tech
January 23, 2024	DOFAW discussion topics for ESRC annual meeting	To: KAH From: DOFAW
January 24, 2024	Teleconference to discuss barbed wire removal at Tier 2 mitigation site	DOFAW, USFWS, KAH, Tetra Tech
January 25, 2024	Email clarifying DOFAW's stance on barbed wire removal at Tier 2 mitigation site	To: KAH From: DOFAW
January 26, 2024	Email requesting annual LOC	To: KAH From: DOFAW
January 31, 2024	Q2 report	To: DOFAW, USFWS From: KAH
February 7, 2024	Letter of Credit screenshot	To: DOFAW, USFWS From: KAH
February 14, 2024	Agency revised Tier 2 Mitigation Plan	To: KAH From: DOFAW
February 14, 2024	Invitation regarding a site visit to Tier 2 mitigation site (email)	To: DOFAW and USFWS From: KAH
February 15, 2024	Email requesting additional review time for revised mitigation plan and clarifying document ownership	To: DOFAW From: KAH
February 21, 2024	Clarification on DOFAW's stance on barbed wire and response to site visit invitation (email)	To: KAH From: DOFAW
February 23, 2024	In-person meeting related to HCP amendment	KAH, Tetra Tech, DOFAW, USFWS
February 26, 2024	In-person meeting related to HCP implementation	KAH, DOFAW, USFWS

Date	Communication	Participants
March 4, 2024	Barbed wire removal proposal and request for ESRC vote	To: DOFAW From: KAH
March 11, 2024	Presentation to ESRC related to barbed wire removal proposal	To: ESRC From: Tetra Tech on behalf of KAH
March 12, 2024	Email clarifying barbed wire removal and request for updated timeline and revised plan	To: KAH and Tetra Tech From: DOFAW
March 27, 2024	Revised Tier 2 Mitigation Plan	To: DOFAW, USFWS From: KAH
April 2, 2024	Teleconference related to Helemano mitigation plan	DOFAW, USFWS, KAH, Tetra Tech
April 3, 2024	Agency revised Tier 2 Mitigation Plan	To: KAH From: DOFAW Changes accepted and returned to DOFAW and USFWS
April 5, 2024	Draft HCP Concept and Letter of Intent to pursue additional take coverage	To: DOFAW, USFWS From: KAH
May 1, 2024	Q3 Report	To: DOFAW, USFWS From: KAH
May 1, 2024	USFWS approval of Tier 2 Mitigation Plan	To: KAH From: USFWS
May 17, 2024	Email requesting HEPA information related to Helemano	To: KAH From: USFWS
May 23, 2024	Newly established biweekly check in call with agencies (teleconference)	KAH, Tetra Tech, DOFAW, USFWS
May 23, 2024	Comments and edits on draft HCP Concept	To: KAH From: USFWS
May 23, 2024	Comments and edits on draft HCP Concept	To: KAH From: USFWS
May 24, 2024	Clarification on redistribution of curtailment	To: USFWS From: DOFAW
June 3, 2024	Draft MOU for Tier 2 Mitigation Work at Helemano	To: KAH From: DOFAW
June 4, 2024	Helemano (Tier 2 Mitigation) site visit	KAH, Tetra Tech, DOFAW
June 6, 2024	Semi-annual meeting (in-person)	KAH, Tetra Tech, DOFAW, USFWS
June 27, 2024	Biweekly check in call	KAH, Tetra Tech, DOFAW (USFWS updated via email due to schedules)

12.0 Expenditures

Total HCP-related expenditures for the Project in FY 2024 were \$442,900 (Table 4).

Table 5. HCP-Related Expenditures at the Project in FY 2024

Category ¹	Amount
Permit compliance	\$98,600
Fatality monitoring	\$62,300
Acoustic monitoring for bats	\$14,900
Scavenger control	\$17,900
Vegetation management	\$37,500
Equipment and supplies	\$6,100
Tier 2 Bat Mitigation ²	\$185,600
Total Cost for FY 2024	\$442,900
1. Staff labor costs are included in the overall costs for each category.	
2. Includes one year of baseline monitoring within the Helemano Mitigation Area.	

13.0 Literature Cited

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**Appendix 1. Dalthorp et al. (2017) Fatality Estimation for
'Ōpe'ape'a at the Project through FY 2024**

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Modelling Parameter		Modelling Period														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 (current)
LWSC		N/A	N/A	Partial	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s	5 m/s
Date Range of Modelling Period	Begin	1/1/2011	10/1/2011	4/1/2012	9/1/2013	8/1/2014	11/1/2014	4/1/2015	7/1/2016	7/1/2017	7/1/2018	7/1/2019	7/1/2020	7/1/2021	7/1/2022	7/1/2023
	End	10/1/2011	3/31/2012	8/1/2012	7/31/2014	10/31/2014	3/31/2015	6/30/2016	6/30/2017	6/30/2018	7/1/2019	6/30/2020	6/30/2021	6/30/2022	6/30/2023	6/30/2024
Period length (days)		273	182	122	333	91	150	456	364	364	364	364	364	364	364	364
Percent of Year		0.75	0.50	0.33	0.91	0.25	0.41	1.25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Search Interval (days)		3.5	2.5	3.5	3.5	3.5	30.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Number of Searches in Modelling period		77	72	34	94	25	4	64	51	51	52	52	52	52	52	52
Observed fatalities (X)		1	0	2	0	1	0	0	0	0	0	0	1	1	2	2
K		0.7	0.7	0.7	0.7	0.7	0.7	1 ¹	1 ¹	1 ¹	1 ¹	1 ¹	1 ¹	1 ¹	1 ¹	1 ¹
DWP		1.0	1.0	1.0	1.0	1.0	1.0	0.7 ²	0.7 ²	0.7 ²	0.7 ²	0.7 ²	0.7 ²	0.7 ²	0.7 ²	0.7 ²
ĝ	Ĝ	0.464	0.796	0.746	0.830	0.670	0.347	0.565	0.530	0.535	0.411	0.527	0.632	0.519	0.589	0.385
	95% LCI	0.262	0.675	0.611	0.647	0.460	0.166	0.486	0.465	0.464	0.326	0.434	0.549	0.421	0.521	0.290
	95% UCI	0.672	0.894	0.861	0.955	0.850	0.554	0.642	0.595	0.605	0.618	0.618	0.714	0.616	0.659	0.485
B	Ba	9.841	39.66	33.65	17.27	13.94	7.456	87.01	119.5	101.7	50.73	58.89	86.42	51.85	99.82	36.10
	Bb	11.38	10.18	11.43	3.528	6.853	14.05	67.09	105.8	88.60	72.82	52.93	50.40	48.05	70.31	57.67
M* ³		4	3	7	6	7	8	8	9	9	9	9	11	13	17	22
1. Searches performed by canine teams which have a high probability of detecting a carcass during a subsequent search if initially missed. 2. Reduced search area (See FY 2017 Annual Report for detailed analysis). 3. Cumulative value representing estimate of total direct take from the start of operations through the identified monitoring period at the 80 percent UCL.																

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Appendix 2. Documented Fatalities at the Project during FY 2024

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Species	Date Documented	WTG	Distance to WTG (meters)	Bearing from WTG (degrees)	Search/ Incidental ¹
<i>Ardena pacifica</i> (‘ua‘u kani/wedge-tailed shearwater) ²	7/25/2023	9	76	244	Incidental
<i>Lasiurus cinereus semotus</i> (‘ōpe‘ape‘a/Hawaiian hoary bat) ³	10/2/2023	8	12	330	Search
<i>Lasiurus cinereus semotus</i> (‘ōpe‘ape‘a/Hawaiian hoary bat) ³	10/2/2023	8	16	298	Search
<i>Ardena pacifica</i> (‘ua‘u kani/wedge-tailed shearwater) ²	11/29/2023	12	36	350	Incidental
<i>Bubulcus ibis</i> (cattle egret) ²	1/1/2024	10	18	180	Search
<i>Onychoprion fuscatus</i> (‘ewa‘ewa/sooty tern) ²	1/15/2024	9	39	165	Search
<i>Bubulcus ibis</i> (cattle egret) ²	6/17/2024	12	22	90	Search
<i>Bubulcus ibis</i> (cattle egret) ²	5/27/2024	11	20	340	Search
1. Incidental equates being found outside of the searched area and/or outside of the regularly scheduled search time. 2. Species protected under the MBTA. 3. Federally and State endangered species.					

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