

**LANAI METEOROLOGICAL TOWERS
HABITAT CONSERVATION PLAN
FOURTH ANNUAL REPORT**

Prepared for:

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1.0 INTRODUCTION

In August 2008, Castle & Cooke Resorts LLC (Castle & Cooke) and Tetra Tech EC, Inc. (Tetra Tech), in collaboration with the U.S. Fish and Wildlife Service (USFWS) and Hawaii Division of Forestry and Wildlife (DOFAW), finalized a joint Habitat Conservation Plan (HCP) for the construction and operation of six meteorological (met) towers on the island of Lanai (Tetra Tech 2008). The HCP was developed to obtain an incidental take permit and incidental take license (ITP/ITL) issued by USFWS and DOFAW in September and October 2008, respectively, for four federally and state-listed species including the Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian hoary bat (*Lasiurus cinereus semotu*), the Hawaiian stilt (*Himantopus mexicanus knudseni*), and the Newell's shearwater (*Puffinus newelli*).

The met tower HCP establishes an incidental take limit for each of the covered species for the period during which the met towers are in operation. Take limits established for the Newell's shearwater, Hawaiian hoary bat, and Hawaiian stilt are two individuals each. A two-tiered take limit was established for the Hawaiian petrel authorizing the take of up to 7 individuals with an associated level of mitigation. Tier 2 provides a contingency should tier 1 take levels be exceeded, authorizing the take of up to 14 individuals total, and triggers additional mitigation. To date, there has been no take of any of the covered species.

The initial term of the HCP was through March 1, 2010, the expected two-year time period the met towers were to be in operation. On December 7, 2009, Castle & Cooke requested a minor amendment to the ITP/ITL to extend the period of coverage for an additional 2 years (through March 1, 2012) and to reduce the monitoring and reporting requirements. The changes that were approved by DOFAW and USFWS include the following:

- 1) Five of the six met towers previously installed were taken down in February 2010. Met tower 1 remains in operation to continue collecting wind data. The amendment would permit the re-installation of met towers 2 through 6 during this permit period if so desired by Castle & Cooke.
- 2) Surveys are conducted monthly rather than every 10 days, carcass removal trial requirements are reduced, and searcher efficiency trials are not required. The protocol is discussed in section 3.0.
- 3) Reporting requirements include informal quarterly emails and the annual report.
- 4) DOFAW and Castle & Cooke will coordinate on ungulate removal in the Lanaihale through an extension of the MOA or some other mechanism.

The two primary programs implemented as part of the HCP includes a post construction monitoring plan (PCMP) at the met towers and an offsite mitigation plan. The PCMP, which has been implemented for 4 years, was developed as a means to document impacts to the covered species as a result of operation of the project, and to ensure compliance with the authorized provisions and take limitations of the HCP and the associated ITP/ITL. The mitigation plan, which consists of a combination of predator control and habitat restoration on Lanai, was

designed to compensate for potential incidental take of the four covered species during the period of the ITP/ITL, providing a net benefit to the covered species. The mitigation plan has been fully implemented by DOFAW and is not addressed further here. A summary of completed mitigation is provided in the 2010 (Year 3) annual report (Tetra Tech 2010).

2.0 STUDY AREA

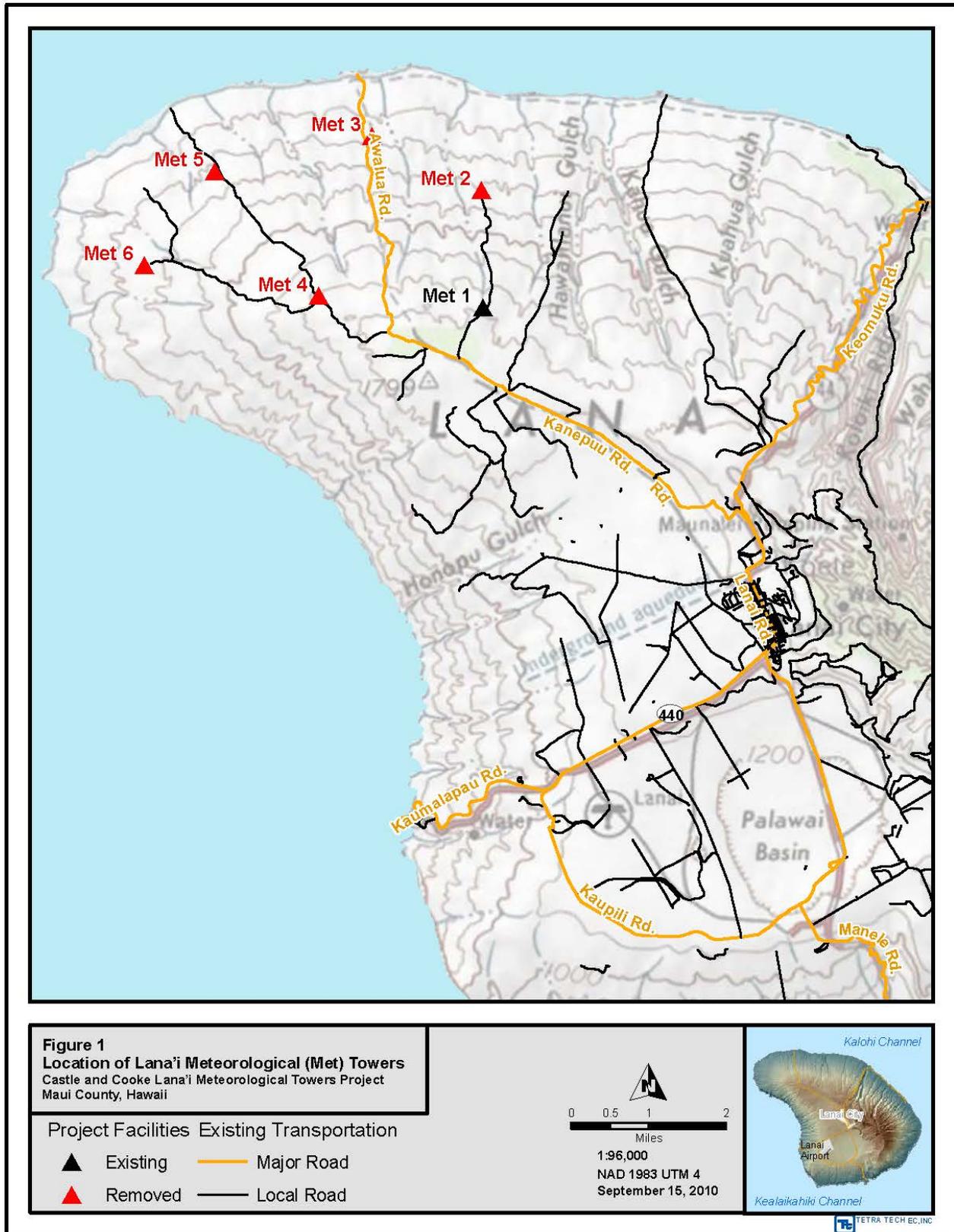
The met tower project area is located on the northwestern portion of Lanai (Figure 1). Lanai is generally a hilly island that rises gradually to 1,027 meters (3,369 feet) above sea level at Lanaihale, or Mount Palawai. The Kalohi Channel separates the island of Lanai from the island of Molokai to the north, and Auau Channel separates Lanai from the island of Maui to the east. The project area is remote, with a few dirt roads that allow access to the shoreline and the met tower locations. There are no nearby existing structures. Lanai City is located about 3 kilometers (5 miles) southeast of met tower 1.

Much of the terrestrial habitat on Lanai has been disturbed by several factors, including the establishment of the Cook Island pine (*Araucaria columnaris*), 100 years of island-wide Dole pineapple plantations, cattle grazing, the release of non-native game species, and the incidental release of non-native terrestrial species such as house cats (*Felis domesticus*), Norway rats (*Rattus norvegicus*), and black rats (*Rattus rattus*). All of these factors have negatively impacted many of the native species and have altered the ecology of the island. Habitat within the met towers footprint and surrounding area ranges from barren eroded soils to shrub/scrub, interspersed with open grassland areas. The met tower footprint includes the 0.8 square meters (9 square feet) of the tower base plate and the anchor points for the four sets of guy wires that radiate from the tower pole approximately 30.5 to 33.5 meters (100 to 110 feet).

Met tower 1 is in a badlands area and the central portion of the search plot consists of bare ground, beyond which is grassland where Angleton grass (*Dichanthium aristatum*) predominates (AECOS 2007). Grass height is approximately 1 meter (3 feet) or lower. Scattered shrub growth, located on the eastern and western margins of the search plot, consists of 'a'ali'i (*Dodonaea viscosa*), lantana (*Lantana camara*), uhaloa (*Waltheria indica*), and Brazilian pepper (*Schinus terebinthifolius*). This vegetation typically ranges from approximately 1 to 2 meters (3 to 7 feet) in height.

3.0 PCMP METHODS

Survey protocol implemented in 2011, were consistent with methods implemented in 2010. A description of each element is provided below. Should met towers 2 through 6 be reinstalled, the same protocol would be implemented at these towers. The USFWS Special Purpose Permit was amended on June 2, 2010 (valid through March 31, 2012), and the Protected Wildlife Permit was amended by DOFAW on March 11, 2010 (valid through March 11, 2012).



P:\GIS_PROJECTS\Castle_and_Cooke\Lana'i\MXD\HCP\Figure1_Location_of_Lana'i_Meteorological_Towers_85111_091510 - Last Accessed 9/15/2010 - Map Scale correct at: ANSIA (8.5" x 11")

3.1 Carcass Searches

Standardized carcass searches were conducted at met tower 1 during the seasons when seabirds are expected to be present on Lanai (March through December), as requested by USFWS and DOFAW. The seasons are defined as: spring (March 15-June 15), summer (June 16-September 15), and fall (September 16-December 15). Carcass searches may end prior to December 15 if DOFAW has verified that the seabirds have left the colony. Personnel discontinue surveys if the study area is not accessible as a result of storm events or road conditions, and/or if staff safety is questionable.

Carcass surveys were conducted approximately every 30 days at met tower 1 provided the vegetation is managed to maintain a high level of searcher efficiency. Carcass surveys were conducted between April 27 and August 31, 2011. Based on vegetation conditions in the monitoring plot, vegetation management was conducted in 2011 to enhance ground visibility.

3.2 Searcher Efficiency Trials

The objective of searcher efficiency trials is to estimate the percentage of bird fatalities that searchers are able to find. Searcher efficiency trials, conducted during each season in years 1 and 2 of monitoring, documented a high level of searcher efficiency for birds. Searcher efficiency trials are not required in the revised protocol if vegetation management continues as needed within the survey plot. The high rates of searcher efficiency for birds (93.8 percent, SD = 11.5) documented in 2009 would be applied to any carcass of a listed species found during 2011 searches. Searcher efficiency is not discussed further.

3.3 Carcass Removal Trials

The objective of the carcass removal trials is to document the length of time carcasses remain in the search area and are thus available to be detected by searchers. Carcass removal trials were conducted once per season to account for changes in weather, climate, and scavenger densities. For carcass removal trials, the current protocol requires that one carcass be placed near each active met tower at the beginning of each season (defined above) and its status checked at the time of the next monitoring event (30 days later). If a carcass is removed during this time, the search interval would return to once every 10 days and carcass removal trials would be implemented as previously conducted and as defined in the HCP (Tetra Tech 2008).

To provide a better estimate of variation in carcass removal rates, Tetra Tech increased the level of effort required by placing two carcasses near met tower 1 at random distances and directions from opposite search plot corner stakes and checking their status every 10 days. To avoid confusion with potential met tower-related fatalities, planted carcasses were placed outside of the search area boundary. Conducting more frequent checks than once a month as required under the amendment enables Tetra Tech to better document the actual date of carcass removal if it were to occur.

The spring carcass removal trial was initiated on May 7, 2011, and conducted through June 6, 2011. Two adult wedge-tailed shearwater carcasses were planted during the spring trial. The

summer carcass removal trial was initiated on July 26, 2011, and conducted through August 25, 2011. Two adult wedge-tailed shearwater carcasses were placed during the summer trial.

3.4 Statistical Methods

Mortality rate estimates are based on observed number of carcasses found during standardized carcass searches, searcher efficiency rates, and carcass persistence. Statistical methods for searcher efficiency, carcass removal rates, and mortality rate estimation are provided in the HCP (Tetra Tech 2008).

4.0 PCMP RESULTS

This section summarizes the results of surveys and trials conducted to date in 2011. Results of monitoring conducted in fall 2010 are also provided because surveys continued through December 2010 after the completion of the 2010 annual report.

4.1 Standardized Carcass Searches

4.1.1 2011 Standardized Carcass Searches

To date Met tower 1 has been searched seven times in 2011 (April 27, May 27, June 26, July 26, August 25, September 24, October 24); additional searches will be conducted in November and December. All surveys were completed within the established search intervals. No bird or bat mortalities of any threatened or endangered species have been detected during 2011 spring, summer, or fall carcass surveys.

4.1.2 2010 Standardized Carcass Searches

Met tower 1 was searched nine times in 2010 (April 12, May 12, June 11, July 11, August 10, September 9, October 9, November 8, and December 8). All surveys were completed within the established search intervals. No bird or bat mortalities of any threatened or endangered species were detected during 2010 spring, summer, or fall carcass surveys.

4.2 Carcass Removal Trials

4.2.1 2011 Carcass Removal Trials

Of the two carcasses placed during the spring 2011 carcass removal trial, one was scavenged on day 1 and remained as a feather spot through the end of the trial. A litter of 5 feral kittens was observed nearby. The other carcass remained intact with some scavenging by insects through the day 20 check, but was a feather spot at the day 30 check. Average carcass persistence during spring 2011 was 30 days (SD = 0 days; Table 1).

Of the two carcasses placed during the summer 2011 trial, both were intact through the end of the trial. One carcass had minor evidence of scavenging by insects. Average carcass persistence during summer 2011 was also 30 days (SD = 0 days; Table 1).

4.2.2 2010 Carcass Removal Trials

During the spring 2010 carcass removal trial, two adult wedge-tailed shearwater carcasses were placed; one of which was scavenged but remains persisted through the end of the trial. On day

20, one wing and a group of 20 feathers was found approximately 4 feet from the original placement location where it remained throughout the length of the trial. The other carcass was intact for the length of the trial, with some scavenging by insects. Average carcass persistence during spring 2010 was 30 days (SD = 0 days; Table 1).

Two adult wedge-tailed shearwaters were placed during the summer 2010 carcass removal trial; both of which were scavenged but remains persisted through the end of the trial. Both carcasses were scavenged by insects by the first check of the trial and one carcass showed evidence of more substantial scavenging but remained in its original location throughout the trial. Average carcass persistence during summer 2010 was also 30 days (SD = 0 days; Table 1).

Three adult wedge-tailed shearwater carcasses were placed during the fall 2010 carcass removal trial. On day 1 of the trial, one carcass had been scavenged and consisted of a detached wing, feathers, and lower part of the body. Remains of this carcass persisted through the end of the trial. A second carcass had evidence of more substantial scavenging by insects but remained throughout the trial. The third carcass was intact throughout the trial.

Table 1. Results of carcass removal trials conducted for the Lanai met tower project during spring and summer, 2011, with 2010 carcass removal trial results for comparison.

Carcass Size Class	Season	No. Carcasses Placed	Mean Persistence (days)
Birds 2011	Spring	2	30
	Summer	2	30
	Overall	2	30
Birds 2010	Spring	2	30
	Summer	2	30
	Fall	3	30
	Overall	7	30

5.0 PCMP DISCUSSION AND CONCLUSIONS

5.1 Mortality

In 2011, as in the previous years, no carcasses of the four covered species or any other listed species were found during standardized carcass searches, or incidentally by searchers. One carcass of a non-listed bird species found in 2010 in the project vicinity (a gray francolin chick) indicates that searchers are finding carcasses when they occur. The operation of the met tower does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, or Hawaiian hoary bats (Table 2). The flagging and bird diverter hardware installed the met tower may be contributing to birds avoiding collisions.

Table 2. Comparison of overall (seasons combined) carcass persistence and mortality estimation between the Lanai met tower project and similar post-construction monitoring studies.

Study Site ^{1, 2}	Carcass Persistence (days)		Mortality Estimation (per tower or turbine)	
	Avian	Bat	Avian ⁷	Bat
Lanai 2011	30.0	-	0.0	0.0
Lanai 2010	30.0	-	0.0	0.0
Lanai 2009	28.0	8.7	0.0	0.0
Lanai 2008	27.6	-	0.0	0.0
Buffalo Ridge ^{3, 4}	7	11	0.98	2.16
Stateline (2002-2003) ⁵	26	16	1.93	1.12
Foote Creek Rim ⁶	29	20	2.04	2.38
Oklahoma ⁷	-	-	-	1.19 – 1.71
Stateline (2006) ⁸	-	-	0.81	0.63
Hopkins Ridge ⁹	23.3	26.6	2.21	1.13
Wildhorse ¹⁰	-	-	2.79	0.70
Bighorn ¹¹	34.9	20.6	3.81	2.86
Judith Gap (2006-2007) ¹²	12.3	9.1	4.52	13.4
Biglow I ¹³	14.0	10.1	2.90	3.29
Judith Gap (2009) ¹⁴	9.7	8.9	3.33	7.20
Biglow II ¹⁵	6.6	3.5	12.73	6.24
Top of Iowa ¹⁶	-	-	-	4.45 – 7.14
Kaheawa Wind Power ¹⁷	-	-	-	0.06

¹ Sites used for comparison are operating wind farms and are most similar in habitat to Lanai among sites with published post-construction monitoring results (i.e., shrubland, short-grass prairie, and other grassland habitat types).

² Some comparison sites used a combination of small and large birds for trials and analysis. Small birds often used as surrogates for bats.

³ Johnson et al. (2002)

⁴ Johnson et al. (2003)

⁵ Erickson et al. (2004)

⁶ Young et al. (2003)

⁷ Piorkowski (2006)

⁸ Erickson et al. (2007)

⁹ Young et al. (2007)

¹⁰ Erickson et al. (2008)

¹¹ Kronner et al. (2008)

¹² TRC Environmental (2008)

¹³ Jeffery et al. (2009)

¹⁴ Poulton and Erickson (2010)

¹⁵ Enk et al. (2011)

¹⁶ Jain et al. (2011)

¹⁷ SWCA (2011)

5.2 Carcass Removal

The bird carcass removal rates for the Lanai met tower project area in 2010 and 2011 were low in comparison with other published post-construction mortality monitoring studies (Table 2). Although most of the carcasses were scavenged by insects relatively quickly, and some were more substantially scavenged, no carcasses were removed. These results are consistent with carcass removal rates documented in 2008 and 2009 on Lanai. This is likely due to the few predators that live on the island. Feral cats and rats are the most likely scavengers in the project area, and cat tracks and scat have been documented near the met towers in previous years.

5.3 Vegetation Management

Vegetation management was identified in 2008 as being needed to increase searcher efficiency because some of the survey plots were densely vegetated or had patches of dense vegetation. Tall grass or shrubs at the met tower site can obscure carcasses and decrease the likelihood that searchers will find carcasses. Vegetation management will continue at met tower 1, as needed, throughout the 2011 monitoring year.

5.4 Conclusions

The most substantial finding during the 2010 and 2011 monitoring seasons to-date was that no carcasses of the four covered species or any other threatened or endangered species were found during standardized carcass searches, or incidentally by searchers. The carcass persistence time for birds indicates that the 30-day search interval is an adequate time frame to minimize any losses due to scavenging. Searcher efficiency documented in 2009, which would apply to any carcasses found in 2011, was high, indicating that searchers are finding carcasses when they occur. Thus, the operation of the Lanai met tower project does not appear to be having a direct effect on Hawaiian petrels, Newell's shearwaters, Hawaiian stilts, or Hawaiian hoary bats or any other flying wildlife species during its 4 years of operation.

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