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Final Report Bald and Golden Eagle Territory Surveys for the Lawrence Livermore National Laboratory

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Disclaimer

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Final Report

Bald and Golden Eagle Territory Surveys

for the

Lawrence Livermore National Laboratory

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Introduction

Garcia and Associates (GANDA) was contracted by the Lawrence Livermore National Laboratory (LLNL) to conduct surveys for bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) at Site 300 and in the surrounding area out to 10-miles. The survey effort was intended to document the boundaries of eagle territories by careful observation of eagle behavior from selected viewing locations throughout the study area.

Study Area

The study area included Site 300 and all suitable eagle habitats within a 10-mile radius of Site 300 as recommended by the U.S. Fish and Wildlife Service Eagle Conservation Plan Guidance (USFWS 2013). The study area encompassed an area bordered approximately by Clifton Court Forebay to the north, the City of Livermore and Del Valle Reservoir to the west, the Alameda County line to the south, and the Central Valley and San Joaquin River to the east.

Methods

Surveys were conducted from mid-January to mid-April 2014 following the Golden Eagle Protocol (Pagel et al. 2010) for golden eagles and the Bald Eagle Protocol (Jackman and Jenkins 2004) for bald eagles. Prior to conducting surveys, GANDA biologists compiled information from available sources to determine known eagle use areas. These sources included the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CDFW 2014), recent surveys conducted by the East Bay Regional Park District, surveys in support of Pacific Gas and Electric (PG&E) power line reconductoring (e.g., Pittsburg-Tesla Transmission Line), reports of studies in the vicinity of the Altamont Pass Wind Resource Area (APWRA) (Hunt et al. 1995, 1997, 1999; Hunt 2002, Hunt and Hunt 2006, 2013), and the unpublished data files of T. Hunt.

Key recommendations of the *Golden Eagle Protocol*, or variations of it, were incorporated into the work plan. Surveys were conducted during mild weather, avoiding, where possible, periods of heavy precipitation, fog, low clouds, high winds, and muddy roads. Precautions were taken to avoid flushing perched or nesting golden eagles. Ground observers surveyed from observation points (OPs) for a minimum of four hours or until territory status was determined. In instances where territory boundaries could be observed and documented in less than four hours, surveyors proceeded to other OPs to search for additional pairs.

Many golden eagle territories within the study area were known prior to the 2014 surveys. Territories in which occupancy was known to have remained constant over multiple survey years prior to 2014 were identified as "historic." In addition to historic territories, previous surveys had identified areas with ephemeral golden eagle territoriality. In these areas, territorial golden eagles were observed only sporadically over multiple years. These territories were identified as "transient." Both historic and transient territories were resurveyed in 2014 to determine current occupancy status.

In addition to historic and transient territories, additional suitable areas were surveyed for eagle presence and occupancy. Territories first observed during 2014 surveys were identified as "new[1]".

Territory occupancy was determined by presence of golden eagle(s) exhibiting the following courtship or territorial behaviors: high soaring and undulating (individually or in pairs), perching together, chasing conspecifics or other perceived threats out of an area, copulating, maintaining nests, incubating, performing nest exchanges, and making prey deliveries. Territories were categorized as either vacant or occupied. Nesting status of territorial golden eagles was not a focus of the survey, but was documented when observed.

Bald eagles are much more visible than golden eagles, usually nest within one mile of a major body of water, and their nest sites are thus much easier to find (Jackman and Jenkins 2004). GANDA followed the general guidelines of the *Bald Eagle Protocol* and searched large water bodies in the study area (e.g., Clifton Court Forebay, Del Valle Reservoir) for adult bald eagles foraging, high-perching, and nesting during spring 2014. Bald eagle nesting activity included "...nest building, nest maintenance, pair-bonding (e.g. vocalizing), copulation, and territorial defense" (Jackman and Jenkins 2004).

Site 300 Golden Eagle Territory Occupancy/Courtship Surveys

GANDA biologists conducted golden eagle occupancy surveys specific to the Site 300 area during the courtship period on January 24, 2014 and again on February 14, 2014. Surveys were conducted for four hours on one day at each of four locations in an effort to determine if territorial golden eagles were present at Site 300. Biologists searched for eagles displaying courtship and/or territorial behavior from pre-determined OPs on high ground within Site 300.

Bald and Golden Eagle Territory Occupancy/Courtship Surveys within a 10-mile radius of Site 300

GANDA biologists conducted occupancy surveys for bald and golden eagle territories within a 10-mile radius of Site 300 from January through April 2014. Surveys were conducted from many different OPs across the study area. Observation points were chosen at the discretion of the surveying biologist for the best view, and as local conditions demanded. Occupancy surveys for golden eagles were most effective during the courtship/pre-incubation period in January and February, and survey success depended upon fair weather. Territory boundaries for both bald and golden eagles, as determined by territorial displays, soaring, and hunting flights, were delineated onto field maps; each newly discovered territory received a name based on topographic map features or other nomenclature, and was assigned a 4-letter code to protect its location.

Knowledge of territorial boundaries was based on observations of pair movements and therefore somewhat imprecise. Refining boundaries often required multiple visits and multiple OPs. The primary reason for defining the boundaries was their value in indicating where to look for additional pairs and for utility in mapping territory juxtapositions. GANDA arranged, as necessary and where possible, for site access to private property to conduct surveys. Due to restricted access to certain

1) N.B. "New" in this instance means "previously undocumented." "New" territories may actually have existed continuously over time and long before this survey.

private lands, especially in the southeast quadrant of the survey area, approximately 10% of the study area was not surveyed. Based on the pattern of observations in accessible areas, we assumed that territory density and occupancy in inaccessible areas was comparable where suitable habitat existed. Thus, an additional six golden eagle territories are likely present in the study area, entirely or partially overlapping the study area boundary. The final observed total thus likely under represents the actual number of eagle territories occurring within the study area.

Results

Forty-two occupied golden eagle territories were observed within the study area (Tables 1). Within suitable golden eagle habitat, there was an overall territory density of 0.13/mi^2 (1 territory per 7.4 mi^2; Table 2), which is nearly identical to the density observed in the Livermore area by Hunt et al. (1999 [0.14/mi^2 or 1 territory per 7.3 mi^2]). Of the 42 occupied golden eagle territories, 22 occurred at historic locations where territorial pairs were consistently present during eagle surveys conducted prior to 2014. An additional five transient golden eagle territories were also occupied in 2014. Fifteen new golden eagle territories were found in previously unobserved or un-surveyed locations. One historic golden eagle territory was apparently unoccupied, as was also the case in the previous year (Hunt and Hunt 2013).

Based on observed densities, an additional six territories may be present in portions of the study area that could not be surveyed due to private land access restrictions. Including this estimate of six additional territories, the estimated total number of occupied golden eagle territories within the 10-mile radius of Site 300 is 48, with an overall density of 0.15/mi^2 (1 territory per 6.5 mi^2). This corresponds to a population of approximately 96 breeding adult golden eagles and an additional unknown number of non-breeding, non-territorial individuals (i.e. floaters) which were not the focus of this survey.

Only one bald eagle territory was observed within the study area (Table 3). No golden eagle or bald eagle territories were observed solely in the flat, rural-agricultural, or urban areas of the San Joaquin Valley or Livermore Valley. Territories on the periphery of the Diablo Range appeared to overlap only minimally with valley areas.

Site 300

Aside from a single CNDDB record in 1996 of a golden eagle nest on a PG&E distribution line pole at the south end of the central ridge at Site 300 (CDFW 2014), there has been no recorded evidence of territorial golden eagles within Site 300. There have been anecdotal observations by Site 300 staff of foraging individuals (M. Lawler Fratanduono pers. comm.).

During the golden eagle territory occupancy/courtship surveys, no courtship or territorial behaviors were observed within Site 300. However, subsequent surveys from OPs outside of Site 300 found two golden eagle territories extending into the area of Site 300. The boundary of one territory, TESL (transient but occupied, Table 1), is located mainly west of Site 300, but the eastern third of the territory overlaps with Site 300's western border and extends to just beyond the San Joaquin County line. The TESL territory does not appear to extend to the northern boundary of Site 300. The TESL pair was observed undulating and copulating mainly west of Site 300. Approximately half of the

second territory, LIRO (new and occupied, Table 1), extends to the center of Site 300 from across the eastern border, but does not appear to reach the northern boundary of Site 300. Individual adult golden eagles were observed undulating and soaring over the southeastern portion of Site 300; however, no courtship or pair activity was observed. Nesting substrate within Site 300 for these territories was limited to a few trees and transmission towers. In addition, the LIRO territory includes some cliff habitat that may provide nesting sites. No evidence of nesting was observed within Site 300.

10-mile radius of Site 300

Golden eagle territories within the Site 300 10-mile buffer were largely restricted to the rural hills of the Northern Diablo Range (Figure 1). The majority of golden eagle territories, (29), were found in rural, foothill areas dominated by a mosaic habitat of oak woodland, pine/oak woodland, grassland, and mixed chaparral, and located in the southwest and southeast quadrants of the study area (Figure 1, Table 2). In this portion of the study area, territories were densely packed (approximately 0.19/mi^2). The remaining 13 territories occurred in areas of open grassland with few trees. Open grassland territories were more thinly distributed across the landscape (approximately 0.08/mi^2). Due to limited nesting substrate and good survey coverage, it is unlikely that there were undiscovered territories in this area.

All five of the transient territories occurred in open grassland areas and appeared to overlap with the Altamont Pass Wind Resource Area (APWRA). Some of the new territories observed in 2014 may in the course of future surveys be re-identified as "transient" as well, based on their proximity to the APWRA and likely increased mortality in these areas.

The one bald eagle territory (DVRE) observed in 2014 has been recorded since 1999 (CDFW 2014). This bald eagle pair is associated with Del Valle reservoir in the southwest quadrant of the study area. Although the territory of the pair is identified as the southern end of the reservoir and associated drainage, it's likely that the pair utilize the entire reservoir on occasion. In addition, it should be noted that this bald eagle territory overlaps with three golden eagle territories.

Table 1. 2014 LLNL Golden Eagle Survey Summary

CODE	TYPE[2]	SURVEY DATE(S)	OBSERVATIONS	STATUS
APRO	Transient	2/19; 2/20; 3/4; 3/6; 3/20; 4/7	Adult pair; nest-building; undulating; tolerating sub-adults	Occupied
ARCR	New	3/7; 3/11; 3/12	Adult pair; undulating; tolerating a sub-adult	Occupied
ARMO	Historic	3/12	Adult pair; undulating; defending territory	Occupied
BERE	New	3/4; 3/5; 3/14;	Adult pair; undulating; incubating	Occupied
BRCR	Historic	2/20; 3/6; 4/10	Pair; undulating; possible sub-adult male; tolerating other eagles	Occupied
BRPE	Transient	2/19; 2/20; 4/10	Adult pair; undulating; tolerating sub-adults	Occupied
BYAI	Historic	2/20; 3/5; 3/14; 3/17; 4/10	Adult pair; perched together; undulating individuals	Occupied
CAGU	New	3/14; 3/15; 3/16	Single adult undulating; perching	Occupied
CEKN	New	3/16	Adult pair; perching; undulating	Occupied
COSR	Historic	2/11; 2/12; 2/20	Adult pair; perching together; undulating; calling; adding to nest	Occupied
COHO	Historic	2/11; 2/25	Adult pair; copulating; undulating; perching	Occupied
CRRI	Historic	3/12; 4/2	Adult pair; undulating	Occupied
DVMU	Historic	3/11	One adult; undulating; prey delivery	Occupied
DEHO	Historic	1/16; 3/19; 4/20	Adult pair undulating; incubating; adult feeding chick(s)	Occupied
DRCR	Historic	3/18; 4/6	Adult pair undulating	Occupied
EARU	Historic	1/24; 2/11; 2/21; 4/22	Adult pair in nest together; incubating; 2 chicks; 3 to 4 weeks old	Occupied
EPPA	New	3/20; 4/7	Adult pair perching together	Occupied
EYCA	New	1/15; 1/16; 4/8	Adult pair; undulating; perching together	Occupied
FMHO	Historic	4/3	Adult pair; perching together; undulating	Occupied
GRRO	New	3/20; 3/21; 4/5; 4/7	Adult pair; incubation exchange; undulating	Occupied
HICO	Historic	2/12; 2/13; 2/21	Adult pair; perching together; above 2013 nest	Occupied

[2] Type of territory includes three designations: Transient, New and Historic. Transient territories are areas documented in multiple years prior to 2014 and observed to be intermittently occupied. New territories are areas that have not been surveyed previously or areas that have been previously surveyed but no territories were observed. Historic territories are areas that have been observed to be consistently occupied during prior surveys.

CODE	TYPE[3]	SURVEY DATE(S)	OBSERVATIONS	STATUS
JRRO	Transient	2/11; 2/12; 2/18	Adult pair; undulating; territorial defense	Occupied
LIRO	New	3/27; 4/21	Adults soaring; undulating; no courtship or pair activity observed	Occupied
LIND	Historic	4/2; 4/6; 4/9; 4/11	Adult pair; undulating; perching	Occupied
LOCO	New	2/19	Adult pair; perching together; copulating; undulating	Occupied
MEND	Historic	2/7; 2/10; 4/2	No territorial eagles	Vacant
MIRO	Historic	4/2; 4/6	Adult pair; perching; undulating; calling	Occupied
MISH	New	2/11; 2/12; 2/13	Adult pair perching together; defending territory; undulating	Occupied
MTWA	New	2/21; 2/24	Adult pair; undulating; copulating; defending territory	Occupied
NTBA	Historic	1/17; 3/8; 3/9; 3/19; 4/8	Adult pair; undulating	Occupied
NTCO	Historic	3/7; 3/8	Adult pair; undulating; defending territory	Occupied
NTGA	New	2/10; 3/7; 3/8	Adult pair; copulating; undulating; defending territory	Occupied
NTHQ	Historic	2/10	Adult pair perching together; defending territory; undulating	Occupied
NOCR	Historic	2/25	Adult pair dropping in and out of nest drainage; perching; undulating	Occupied
PERI	New	3/14; 3/15	Adult pair; undulating; defending territory	Occupied
RORI	Historic	3/7; 3/10	Adult pair undulating over nest drainage	Occupied
SUBU	New	4/3; 4/8	Adult pair; undulating; perching together	Occupied
SUSP	Historic	2/12; 2/24	Adult pair; undulating; perching	Occupied
TARI	New	2/21; 2/24; 3/14	Adult pair; flying & perching together	Occupied
TESL	Transient	2/13; 2/14; 2/25; 3/25	Pair undulating together; copulating; adult female; sub-adult male	Occupied
TUCR	Historic	3/12	Adult pair; undulating	Occupied
WPPA	Transient	2/10; 2/11; 2/15; 2/16; 4/5	Adult pair; perching; undulating; copulating	Occupied
WIGU	Historic	3/10	Adult pair; undulating; defending territory	Occupied

[3] Type of territory includes three designations: Transient, New and Historic. Transient territories are areas documented in multiple years prior to 2014 and observed to be intermittently occupied. New territories are areas that have not been surveyed previously or areas that have been previously surveyed but no territories were observed. Historic territories are areas that have been observed to be consistently occupied during prior surveys.

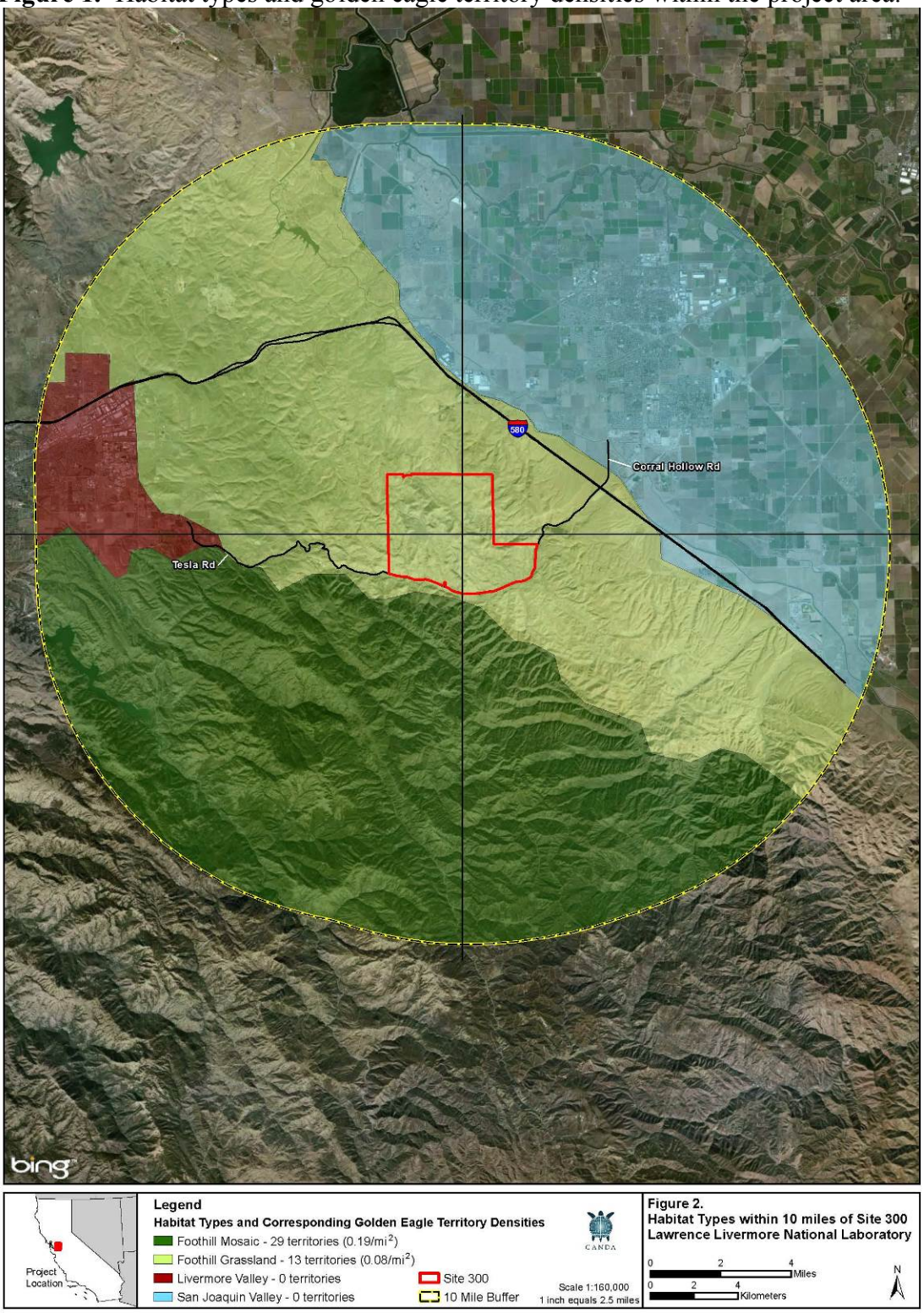
Table 2. 2014 LLNL Golden Eagle Territory Density

Golden Eagle Habitat	**Area (mi²)**	**# Territories**	**Density (#/mi²)**	**1/Density (mi²/#)**
Foothill Mosaic	154.5	29	0.19	5.33
Foothill Grassland	158.1	13	0.08	12.16
Total	312.6	42	**0.13**	**7.44**
Non-Golden Eagle Habitat				
Livermore Valley	129.7	0	0.00	n/a
San Joaquin Valley	17	0	0.00	n/a

Table 3. 2014 LLNL Bald Eagle Survey Summary

CODE	**TYPE**	**SURVEY DATES**	**OBSERVATIONS**	**STATUS**
DVRE	Historic	3/8; 4/12	Adult pair; incubating; downy chicks	Occupied

Figure 1. Habitat types and golden eagle territory densities within the project area.



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