

Altamont Pass Wind Resource Area **Bird and Bat Mortality Monitoring Protocols**

APWRA Bird Mortality Monitoring

The APWRA Bird Mortality Monitoring Project includes approximately 2,500 turbines grouped into 84 plots located throughout the APWRA within Alameda County (and one location in Contra Costa County; Figure 1). Each plot includes one or more strings of turbines. Using Altamont Pass Road as a dividing line, these 84 plots were assigned approximately equally to either the North or South monitoring areas. Each of the 2,500 turbines is searched once every month. Searches alternate daily between North and South monitoring areas to avoid site- and time-based biases, and turbines are searched in a similar order each month.

The search area for each turbine extends 50 meters out from the turbine on all sides, except for the EnXco Tres Vaqueros site in Contra Costa County where the search radius is 60 meters. During each survey, mortality search transects are walked within the turbine search area during which the searcher scans the ground for bird and bat carcasses and/or parts of carcasses such as feathers and bones. The distance between transects within each search area averages 6 to 8 meters depending on the terrain, height of the vegetation, and the height of the individual searcher. When evidence of a fatality is found, the location of the find is marked with flagging, and the searcher then continues to search the remaining area within the plot. After completing the search of the entire plot, the searchers return to each flagged location to record data on all the finds.

To be considered a turbine-related fatality, each find must include at least 5 tail feathers or 2 primaries within at least 5 meters of each other, or a total of 10 feathers. Any evidence less than this could be remains of a previously found fatality that was dragged in from somewhere else, or in the case of feathers, could be the result of a bird molting at that location. When partial remains are detected, the data collected are cross-referenced with data collected for finds at adjacent turbines to avoid double-counting of remains from birds found during previous monthly searches.

When remains are discovered, information on the location, condition, and type of bird or bat is recorded on a standard datasheet (Table 1). The following information is collected for each bird or bat found:

- **Incident number** (a unique number for all birds/bats collected, regardless of cause of death, that includes the year, month, date, and a number corresponding to the number found each day. For example, the third bird found Oct. 10, 2005 would be #20051010-03).
- **Species**- Species is identified as accurately as possible (red-tailed hawk, unknown Buteo, unknown hawk, California myotis). If unknown, it is listed as “unknown small bird” (smaller than a mourning dove), “unknown medium bird” (between a mourning

dove and raven), “unknown large bird” (red-tail hawk-sized or larger) or “unknown bat”.

- Site- the site access gate at which the fatality was found, including the company that manages it. The turbines behind a particular gate may be managed by multiple companies. Typically there are multiple plots that are accessed by each gate.
- Age & Sex- if known.
- Photo Number- At least 5 photographs are taken with a digital camera: 4 of the fatality before it is disturbed and 1 of the surrounding area (such as overhead lines, turbines, fences, electrical poles, roads). The photo ID number is recorded and photos are regularly downloaded from the camera and transferred to TEAM’s ftp site.
- Turbine Number- the nearest intact turbine (has a motor and blades). This information is included even if the remains are far from any turbines or appears to be an electrocution.
- Degree- the compass bearing from the nearest intact turbine to the remains.
- Distance- the distance from the nearest intact turbine to the remains in meters. An intact turbine is defined as having a motor and 3 blades.
- Nearest Structure (if closer to fatality than an intact turbine) – the nearest structure to the fatality (met tower, power pole, derelict turbine, other)
- GPS location- in UTM’s (datum NAD27).
- Body parts- all body parts found (for example, “whole bird” or “right wing” or “flight feathers only” or “skull, vertebrae, and sternum”). Bone measurements are included here.
- Cause of Death – probable cause of death as determined by carcass location and condition (turbine blade collision, electrocution, predation, overhead lines, hit by car, etc.).
- Evidence--reason for determination of cause of death when cause other than unknown is circled (e.g., fatality has broken right humerus, <10 m from turbine).
- Estimated Time Since Death – age of fatality (fresh, <1 week, <1 month, >1 month.) Presence and type of insects, condition of flesh and eyes, whether or not leg scales or bones are bleached, coloration of marrow in bones, etc. are used to estimate time since death. Due to difficulty of determining age after ~1 week, categories are quite large.
- How ID’ed --how species identification was determined (e.g., plumage, bone measurements, etc.). If rare species, give details of determination in “Notes”.

- Scavenger/Predator- the type of scavenger or predator (vertebrate or invertebrate), if possible to determine, and the effects of scavenging/predation.
- Insects Present – if the bird has insects on it or not at the moment.
- Types –type of insects observed. If other, state size and briefly describe.
- Decay- stage of decay of the carcass (e.g., fresh, flesh and feathers, feathers and bone, feathers only).
- Flesh- condition of the flesh of the carcass (fresh, gooey, dried).
- Eyes –condition of the eyes (round and fluid-filled, sunken, dried, empty skull)
- Enamel- if the waxy covering on the culmen and claws is present or not.
- Color- if the color of the leg scales or cere have begun to fade.
- Notes- additional information such as carcass condition and location, details for identification of rare species, band number if banded, obvious injuries, and potential cause of death if other than those listed above.
- Searchers- first and last initials of all present in case of future questions. The searcher recording the data lists his/her initials first.

If a State or Federally Threatened or Endangered species is found (i.e., golden eagle), data is collected on the find and it is then flagged to mark its location. This information is then reported to the Livermore Operations office (925-245-5555) at the end of the day. The find is then collected and processed by a designated Altamont Infrastructure Company (AIC) employee. If a non-native species such as rock pigeon, European starling, or house sparrow is found, data on the fatality is collected, and the searchers remove and dispose of the carcass off-site. All other species are individually placed in separate bags with a identification labels that include the following information: incident number, site, turbine number, species, and date found, and placed in the TEAM freezer at the field house. If the species cannot be identified in the field, the carcass may be taken by a TEAM member to the UCD Wildlife Museum to attempt identification. When the freezer is full, carcasses are taken to the U.S. Fish & Wildlife office in Sacramento for disposal. This will be coordinated with Rene Culver, the biologist at AIC.

All suspected electrocutions are documented as usual, marked with an orange pin flag and left in the field. These fatalities are also reported to Livermore Operations office at the end of the day they are found and are subsequently picked up by an AIC employee.

Fatalities found by turbine field maintenance personnel within designated search areas are documented by Rene Culver, marked with black electrical tape on the legs, and left in place for

TEAM searchers to find. When TEAM searchers find these marked remains, standard data is collected on it and it is documented like any other remains. These finds will not be used to supplement the data on searcher efficiency.

If an injured bird or bat is found at any time on site, Operations is contacted immediately and a designated AIC employee will come to take the bird to a local rehabilitation facility.

Fatalities found incidentally outside the turbine search areas are documented and collected following the same protocol for fatalities found during searches. However, for those fatalities a note is added at the top of the datasheet indicating the find was incidental.

Diablo Winds Fatality Searches

Mortality searches of each of the 31 turbines in the Diablo Winds monitoring area are conducted monthly using the APWRA Monitoring study protocol, with the exception of the search radius. Because the Diablo Winds turbines are much larger than all other turbines in the APWRA, the search radius for each turbine was extended out to 75 meters to ensure adequate coverage (Figure 2).

AVIAN USE SURVEYS

Monitoring Observations

The primary objective of avian use surveys are to estimate the relative use of the project area by species, and to provide data on the behavior of birds relative to topography, weather and facility characteristics that can be used in resource selection analyses (Manly et al. 2003). Eighty-three observation stations have been established within the monitoring area (Figure 1.). Surveys are conducted once each month at each station. Each survey lasts for 30 minutes, with the first 20 minutes devoted to gathering behavior data, and the last 10 minutes are used to conduct a 10-minute point count. Morning and afternoon observations are generally not conducted on the same day or by the same person. As with searching, observations alternate between the North and South areas on a daily basis.

For each observation session, data on ambient environmental conditions is recorded at the beginning and end of the session. These data include: temperature (C°), average and maximum wind speeds (km/hr), wind direction, percentage cloud cover, visibility, and precipitation.

Surveys are not conducted when the average wind speed reaches more than 55 km/hr or if there is heavy rain or fog.

During the 20-minute behavior observation session the biologist surveys an area consisting of a 180-degree coverage area focused on a turbine string or strings of interest within 500 m of the observer. The location of the 20-minute behavior survey may be off-set from the 10-minute point count survey to ensure good views of the turbine strings. These coverage areas include areas within which birds are most likely to demonstrate representative behaviors in response to the presence and operation of the turbines. At every 30-second interval during the observation period, if a bird has been detected, its location, flight characteristics (type, height in m), and other relevant behavior information will be recorded on a map as well as the datasheet (Table 2).

For each bird detection during the behavior survey, the following information is recorded: alphanumeric code, species identification, number of individuals, and height above ground. Estimates of distance to the turbines in the observation area and whether the turbines closest to birds are actively turning are also recorded. Age and sex of bird is noted whenever possible. If the bird being observed is perching, the type of perching structure and height (m) is also recorded (see Table 3 for list of perching structures and heights). To ensure that all perched birds within the observation area are identified, a scan of the entire plot is conducted with binoculars immediately before and after the 30-minute survey period.

Because some of the observation areas have large numbers of gulls flying back and forth from the landfill to the reservoirs, major flight routes (i.e., gull corridors) will be indicated on the maps with one letter used to designate flocks of gulls flying in one direction, and another letter used to designate gulls flying in the other direction or along another main flight route. At the end of the observation period, the width of the corridor will be indicated on the map and an estimate of the total number of gulls that flew through each corridor will be recorded on the datasheet. Any large group of gulls observed kettling within plot boundaries will be recorded on the map and given a separate alphanumeric code to distinguish them from the gulls passing through the plot.

During the 10-minute point count survey the observer scans the entire plot (360 degree coverage) throughout the observation period. When a bird (American kestrel size and larger) is detected,

data are recorded onto a datasheet. Each detection (individual bird or flock of birds) is designated by an alphanumeric coding system with the letter corresponding to the individual bird or flock and the number corresponding to the minute in which the bird was observed. For the 10-minute point count survey, a map that includes an 500-m observation buffer overlaid onto a topographical map (Figure 3) and the observer records the location of each bird using the alphanumeric code, and draws an arrow indicating direction of movement. Separate maps and datasheets will be used for the 20-minute behavior observations and 10-minute point counts.

Diablo Winds Area Observations

30-minute behavior observations will be conducted at 8 observation stations located throughout the Diablo Winds area (Figure 1.). These observations will follow the same protocols used for the monitoring observations described above.

SEARCHER EFFICIENCY TRIALS

Searcher efficiency trials are conducted to estimate the percentage of avian and bat fatalities that are actually found by searchers compared to the total number of fatalities that occur (detected and undetected). The results of these trials are then used to adjust annual fatality estimates for detection bias.

These trials will focus on specific target raptor species (American kestrel, red-tailed hawk, and burrowing owl) and are conducted in plots used for regular carcass searches. A trial administrator secretly places trial carcasses in test search areas. On the same day, search personnel conduct normal searches without knowledge of where or how many test carcasses have been placed out in their search area. Within each search plot, carcass location is determined by randomly selecting a compass bearing and distance. Carcasses are marked with green tape on the legs and placed (by dropping from waist height) within the areas to be searched prior to the search on the same day.

Immediately after searches are conducted, the trial administrator determines how many of the efficiency trials were detected by the searcher, and returns to the search plots to recover any undetected trial carcasses. The number and location of the detection carcasses found during the carcass search are recorded, and the number of carcasses available for detection during each trial is

determined immediately after the trial by the person responsible for distributing the carcasses. Carcass locations and trial results are recorded on the searcher efficiency datasheet (Table 4).

CARCASS REMOVAL/SCAVENGING TRIALS

In addition to searcher efficiency trials, carcass removal/scavenging trials, 2 per season, will occur during the project to estimate the length of time bird and bat carcasses remain in the search area. Similarly, the data from these trials is used to adjust carcass counts for removal bias in the determination of annual fatality rates. Carcass removal includes removal by predation or scavenging, or removal by other means such as being plowed into a field. Some trials have already been conducted during this study and the Diablo Winds study. Additional trials will be conducted following the protocol below.

Carcass removal trials will be conducted throughout the study period to incorporate varying weather conditions, vegetative conditions and other effects. Fresh carcasses of target raptors (with the exception of golden eagles) will be left in the field to be monitored. Carcasses will be marked with green tape hidden under the bird on the legs and left in place as a trial carcass. If fresh carcasses of target raptors or surrogates are available to supplement carcasses found during searches, these will be placed randomly throughout the wind project site. Supplemental carcasses will be placed within 50 meters of randomly selected turbines. For each of these turbines, a random compass bearing between 1 and 360, and a random distance between 1 and 50 will be selected. In the field, a flag is placed at each random location, but the actual carcass is placed 10 m north of the flag in order to help conceal the carcass. Each carcass is marked with green electrical tape on both legs for recognition by searchers and wind farm personnel, and dropped from waist height. Upon placing carcasses, the species, degree of exposure (1-3), UTM coordinates, date, and time is noted on the carcass removal datasheet (Table 5).

Experimental carcasses are checked over a period of 60 days. Carcasses are checked every day for the first 3 days after placement, twice a week for the next two weeks, then once per week for the remainder of the 60-day trial. At each visit, it is noted whether the carcass is intact (I), scavenged (S), a feather spot (FS; >10 feathers), or absent (0; <10 feathers). In addition the type and degree of scavenging, and possible scavengers are noted, and photos are taken on each day of the trial. All remaining trial carcasses and feathers will be removed after the 60-day trial is terminated. When feasible, game tracker cameras will be set up to photograph the different types of scavengers attracted to each carcass.

Table 1. Datasheet used for fatalities found during regular searches and incidentally for the APWRA Monitoring and Diablo Winds studies

Fatality# _____ **Date** _____ **Species** _____
Age & Sex _____ **Site** _____ **Plot #** _____
Nearest Operational Turbine# _____ **Degree** _____ **Distance** _____
Nearest Structure (if closer than op. turb.) _____ **Degree** _____ **Distance** _____
Photo #'s (at least 5, 4 of fatality) _____
GPS (UTMs, NAD27) _____
Body Parts: _____

Cause of Death:
 Blade Strike/Turb. Collision Electrocutation Line Strike Predation Other Unknown
Evidence: _____
Estimated Time Since Death:
 0-3 days (fresh) / 4-7 days / < month / > month / unknown
How ID'ed: _____
Type of Scavenger/Predator: n/a / vertebrate / invertebrate / unclear
Effects of Scavenging/Predation: _____
Insects Present Y / N **Types** beetles / ants / flies / larva / pupa / other
Decay fresh / feathers and flesh / flesh and bone / bone and feathers / bone / feather spot
Flesh fresh / gooey / dried / n/a
Eyes round, fluid filled / sunken / dried / empty, skull / no head
Enamel present not present n/a culmen / claws
Color leg scales: n/a / original / partially bleached / bleached
cere: n/a / original / partially bleached / bleached
Notes: _____

Sample Taken Y / N **Sample Type:** _____
Searchers _____

Table 3. Behavior and feature codes used during avian observations in the Diablo Winds and APWRA Monitoring studies.

<u>Behaviors</u>	<u>Perches</u>
<ol style="list-style-type: none"> 1. Flying through 2. Gliding 3. Soaring 4. Column soaring 5. Flapping (buy staying in plot) 6. Contouring 7. Stilling/Kiting/Hovering 8. Diving 9. Interacting 10. Perching 11. Landing 12. Displaying 13. Copulating 	<ol style="list-style-type: none"> 1. Turbine devices <ol style="list-style-type: none"> 1a. Wind meter 1b. Catwalk 1c. Ladder 1d. Housing 1e. Blade 1f. Lattice 1g. Transformer box 2. Electrical Dist. Pole <ol style="list-style-type: none"> 2a. Wire 2b. Pole top 2c. Crossbar 3. Metal/Electrical Tower <ol style="list-style-type: none"> 3a. Tower crossbar 3b. Met. tower 3c. Commun. tower 3d. Tower lattice 3e. Guy wire 4. Landscape Features <ol style="list-style-type: none"> 4a. Rockpile 4b. Rock outcrop 4c. Fence 4d. Ground 4e. Low vegetation 4f. Sign 4g. Tree 4h. Water 4i. Building 4j. Other
<u>Heights</u>	
Wooden electrical pole = 12 m	
Metal electrical/communications tower = 40 m	
Enertech lattice turbine = 18 m	
Bonus, WEG, Nordtank tubular turbine = 25 m	
Horizontal lattice turbine (short windwall) = 20 m	
Horizontal lattice turbine (tall windwall) = 45 m	
Diablo Winds tubular turbine = 50 m	

Table 4. Searcher efficiency trials datasheet.

Searcher Efficiency Trials: Carcass Placement Log								
General Information: Season _____ Month _____ Other _____								
No.	Species/Age	Placed By	Date	Time	Plot: Location	Found? (yes/no)	Retrieved? (yes/no)	Notes
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Weather notes for days that carcasses are placed:

Date _____ Time _____ Temp _____ Wind Dir. _____ Wind Speed _____ Precip _____
 Date _____ Time _____ Temp _____ Wind Dir. _____ Wind Speed _____ Precip _____
 Date _____ Time _____ Temp _____ Wind Dir. _____ Wind Speed _____ Precip _____

Table 5. Datasheet for carcass removal trials.

Carcass Removal Trials Form (page 1)																				
General Information: Season _____ Month _____ Other _____																				
Information Regarding Carcass When Placed							Condition ¹ of Carcass on Days Checked										Possible Scavenger	Notes		
No.	Species /Age	Plot & Location	Expos. ²	Placed By	Date	Time	Day	Day	Day	Day	Day	Day	Day	Day	Day	Day			Day	Day
1																			(1)	
2																			(2)	
3																			(3)	
4																			(4)	
5																			(5)	
6																			(6)	
7																			(7)	
8																			(8)	
							Checked by: _____													

¹ Condition: **I** = intact, no evidence of scavenging, **S** = evidence of scavenging, **FS** = feather spot, **0** = carcass not present or <10 feathers

² Exposure: **1** = exposed position, **2** = hidden, **3** = partially hidden

General Comments:

Notes about location of each carcass and other carcass specific comments and photo numbers (continued on back):

- (1) _____
- (2) _____
- (3) _____
- (4) _____
- (5) _____
- (6) _____
- (7) _____
- (8) _____

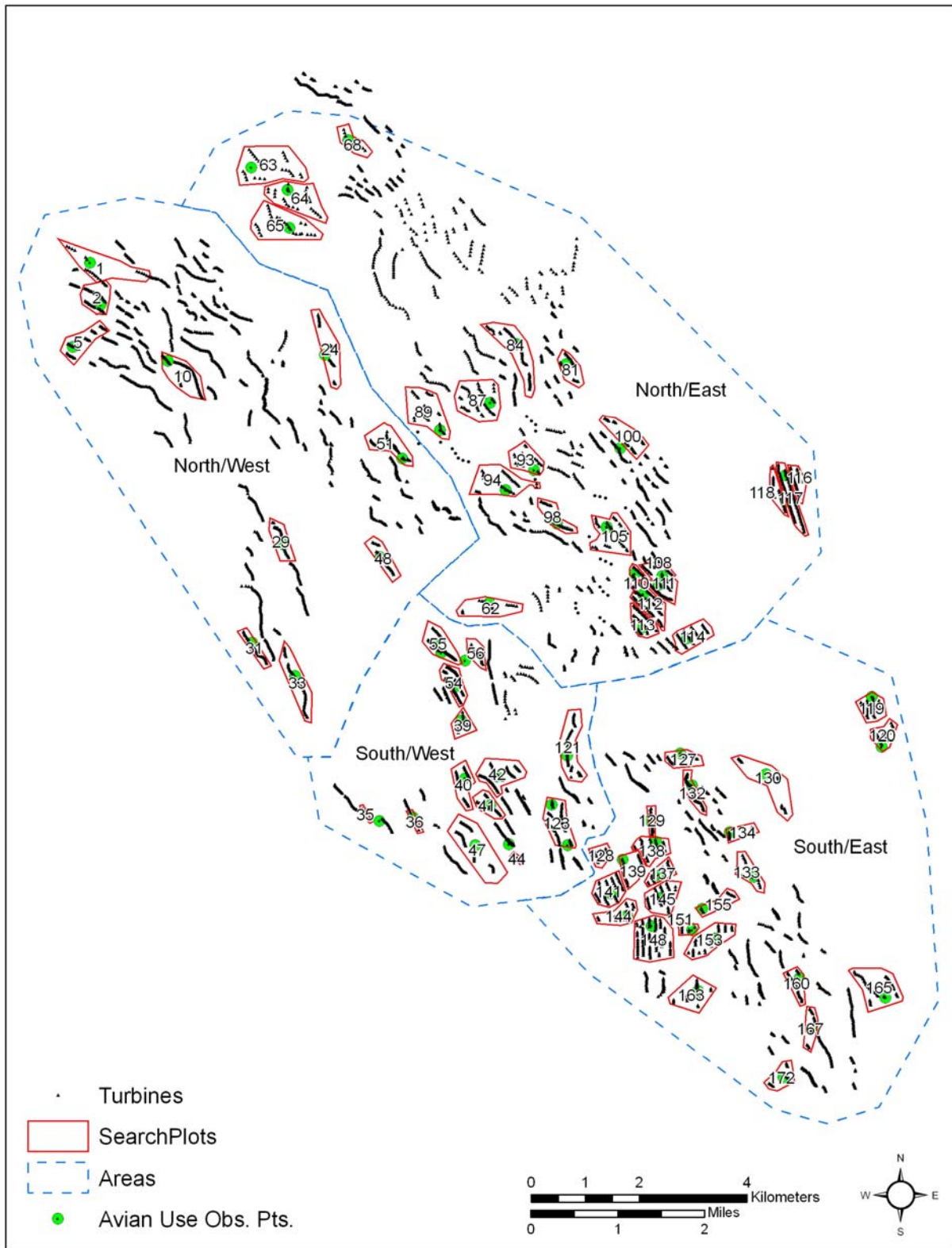


Figure 1. Fatality search plots and observation points for the APWRA Monitoring Study.

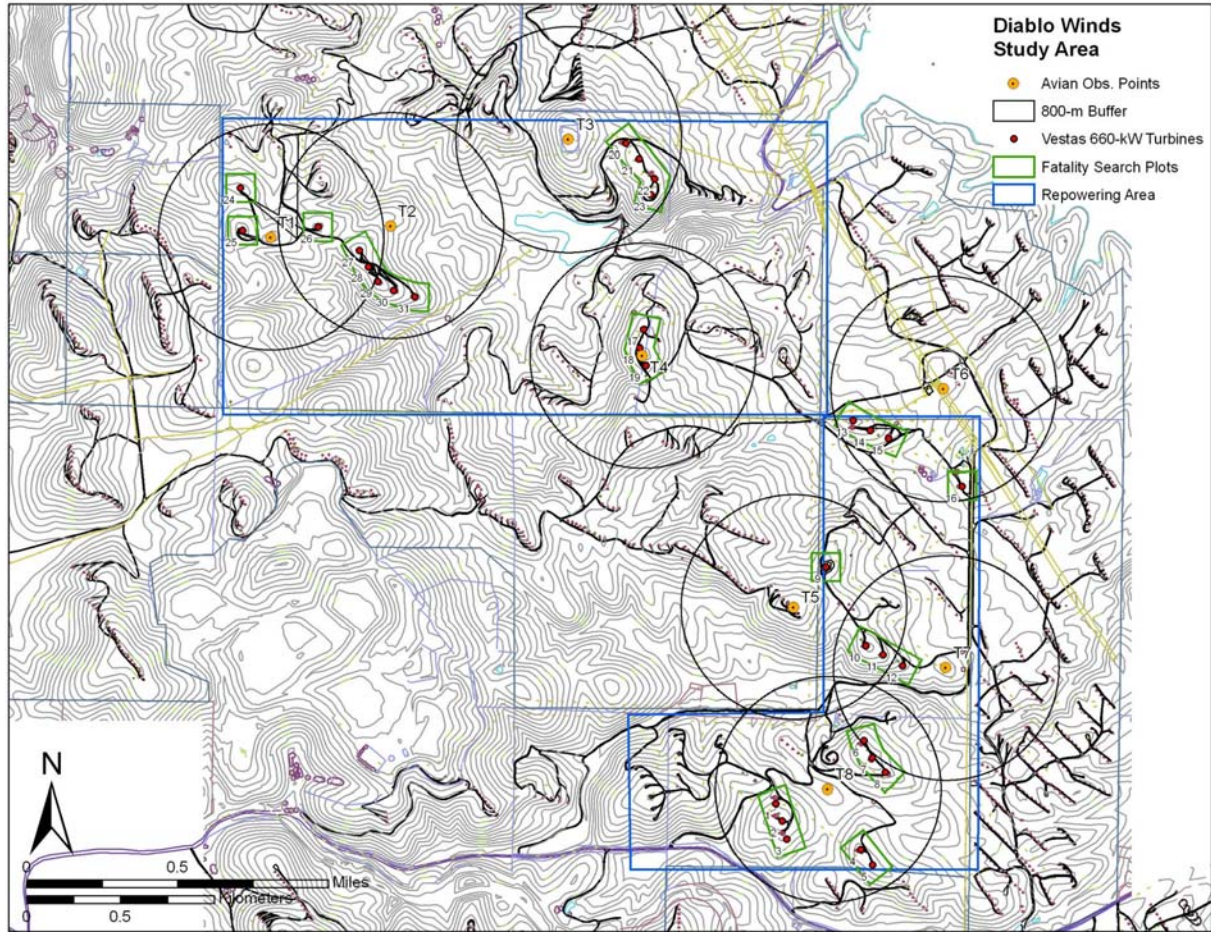


Figure 2. Fatality search areas and avian observation points in the Diablo Winds repowering area.

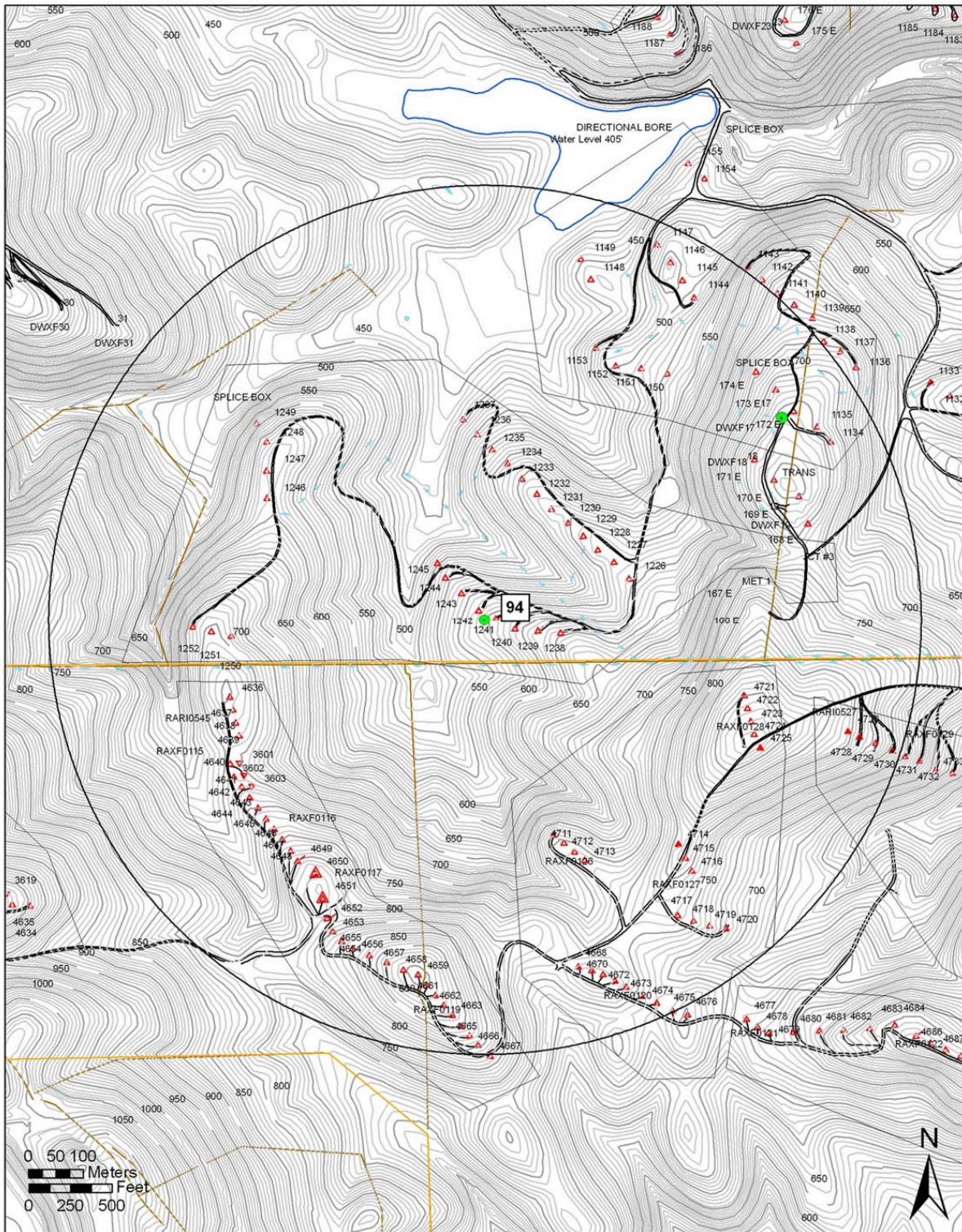


Figure 3. Topographic map with search area (800-m radius for APWRA Monitoring) used to map bird movements during 30-min observation periods.