2011 Spring Avian and Crane Surveys

Saguache Solar Energy Project
Saguache County, Colorado

Prepared for:

SolarReserve, LLC

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EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (Tetra Tech) was contracted by SolarReserve, LLC (SolarReserve) to undertake spring avian use surveys for the proposed Saguache Solar Energy Project (Project) in Saguache County, Colorado. The proposed project would consist of an array of mirrors (heliostats) that would concentrate sunlight, which would be collected at a tall central receiver tower. The Project area is comprised primarily of potato agriculture with little natural habitat.

The studies were conducted to identify potential avian impacts associated with building and operating the solar energy generation facility. Surveys were performed at the Project from March 19 to May 30, 2011, which included the mid-spring through early summer seasons. Fixed point count surveys (800-meter [m] radius) were conducted at 4 points distributed throughout the Project boundary and within a 2-mile buffer. In addition to general avian surveys, sandhill crane surveys were conducted from March 19 to April 19, 2011 while cranes were present during spring migration. Biologists conducted crane surveys for 2 hours before sunset and for 2 hours after sunrise on consecutive days.

Mean avian use was low at the two count locations located inside the Project boundary (8.8 birds/20 min), which is predominantly potato agriculture compared to the count locations outside of the Project boundary (27.0 birds/20 min or 3 times the amount inside the Project boundary), located in grasslands and shrublands, and water and associated riparian vegetation.

During surveys, 1,306 sandhill cranes (maximum 350 in one observation more than 2 miles from the Project boundary) were observed foraging, roosting, or in flight. Sandhill cranes were not found to roost or forage within the Project boundary and most observations occurred in a matrix of winter wheat stubble and rangeland to the northwest of the Project boundary.

Raptor use of the Project was low (only one northern harrier was observed within the Project boundary), and no raptor nests were found within the Project boundary likely due to the limited nesting and foraging habitat.

The Project is proposed on already converted landscape with little wildlife value. The habitat within the Project boundary consists primarily of potato agriculture with only sparse remnant natural habitat remaining. The avian count data and the crane survey data indicate that use within the Project boundary is low and that areas of higher use are found where natural habitat (grassland, shrubland) and water are found. Development of the Project will result minimal loss of wildlife habitat and low risk to raptors as no nests are located within the Project boundary and the potato fields likely do not provide foraging areas.

Table ES-1. Spring Avian Use Summary

Variable	Result	Details
Overall Avian		
Mean use within Project boundary	8.8 birds/20 min	
Federally listed[1] species observed within the Project boundary	No	
State-listed species[2] within the Project boundary	No	
Songbirds		
Mean use within the Project boundary	8.5 birds/20 min	
Federally listed species observed within the Project boundary	No	
State-listed species within the Project boundary	No	
Cranes		
Mean use within the Project boundary	0	
Federally listed species observed within the Project boundary	No	
State-listed species within the Project boundary	Yes	Sandhill crane – flyover during crane surveys
State-listed species observed nesting within the Project boundary	No	
Raptors		
Mean use within Project boundary	0.05 birds/20 min	
Eagles observed within the Project boundary	No	
Federally listed species observed within the Project boundary	No	
State-listed species within the Project boundary	No	
State-listed species observed nesting within the Project boundary	No	
Habitat		
Native habitat likely to be affected by development	No	
Lakes (waterfowl attractant)	No	
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Wet meadows north of Project boundary
Cliffs (raptor nesting and traveling)	No	
River (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	No	

[1] Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.

[2] The Colorado Division of Wildlife maintains a list of Threatened, Endangered and Special Concern Species. State threatened and endangered species are listed in addition to federally listed species.

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1.0 INTRODUCTION

1.1 Solar Energy and Birds

SolarReserve, LLC (SolarReserve) is planning to develop a 200-megawatt (MW) concentrating solar power energy-generating facility (Project) in south central Colorado in Saguache County (Figure 1). The Project is expected to be constructed in two phases each generating 100 MW. Each phase will generate power from sunlight by concentrating energy from a field of sun-tracking mirrors (heliostats) onto a receiver approximately 198 meters (m) high located on a concrete tower within the center of each solar array. The Saguache Solar Energy Project (Project) is located entirely on privately owned agricultural land. Solar energy provides a clean, renewable energy source that is in high demand. As solar power development has increased, the need to address potential environmental impacts has also increased. To date, most studies of the effects of renewable energy have focused on wind power, and data from solar power are lacking (e.g., McCrary et al. 1986, Drewitt and Langston 2006). Solar Reserve is committed to environmental due diligence and has contracted Tetra Tech EC, Inc. (Tetra Tech) to conduct spring avian surveys at the Project site to quantify local avian use in the area.

1.2 Study Description

The Project boundary encompasses approximately 6,200 acres and is located in the San Luis Valley in the Arizona/New Mexico Plateau Ecoregion. Historically, the Arizona/New Mexico Plateau Ecoregion was dominated by shrubs such as big sagebrush, saltbush, rabbitbrush, and greasewood. Land use within the Project is primarily center pivot irrigated agriculture for potatoes. Woodlots and shelterbelts are found throughout the Project.

Colorado has more than 480 documented bird species (CFO 2011) and is situated within the Central Flyway, one of the main bird migratory routes (USFWS 2008). The Central Flyway runs through the central portion of the U.S. and, as a consequence, the Project. Most birds that move along the Central Flyway travel from Canada through the central states, eventually reaching the tropics of South America flying over or around the Gulf of Mexico (USFWS 2008).

2.0 METHODS

Standardized protocols for pre-construction point counts have been established and were used in this study. Data collected from these counts are used to identify species or species groups that may be at risk from project development and may provide additional information for siting facilities to minimize impacts to birds. Results in this report are presented in terms of species groups, and highlight federal and state-listed species, and species of concern. Further, because cranes are an avian species of concern in the Project area dawn and dusk crane surveys were conducted to understand how cranes use and move through the area.

2.1 Avian Surveys

2.1.1 Fixed-point Surveys

Experienced field biologists conducted 20-minute (min) point count surveys at four locations within and outside of the Project boundary to evaluate avian use, behavior, and species composition during spring migration (Figure 2). Tetra Tech distributed the survey locations

throughout the Project boundary and a 2-mile buffer. To compare the results from inside the Project boundary to areas outside the Project boundary, surveys using the same methods are required. The points located outside of the Project boundary use the same data collection methods and are used to make a comparative analysis of the results. Survey locations maximized the 360-degree sight distance for the observer and covered a diversity of habitats. Count location 01 is located outside of the Project boundary, and the primary habitat was fallow potato fields south of the gravel road and grassland used for grazing north of the gravel road. This count location was selected because of the natural habitat in close proximity to the Project boundary. Count locations 02 and 03 were entirely within the Project boundary and the habitat consisted of primarily fallow potatoes fields with shrub-encroached center pivot corners found at count location 03. Count location 04 was located outside of the Project boundary and the habitat consisted of fallow fields, a pond, emergent wetlands, and cottonwood trees along the water and road. This count location was selected because it represented an uncommon valuable wildlife resource on the landscape. Count location 04 had the most diverse habitat of the count locations. The biologists conducted surveys from March 19 to May 30 (Table 1), thereby encompassing the spring migration to early summer breeding seasons.

The field biologists collected data on all birds observed within an 800-m radius of the point count location. Surveys at each point lasted for 20 min, during which time biologists continuously recorded any visual or auditory observations. Biologists recorded the following data: species, number of individuals, time of observation, height aboveground, behavior, and flight direction. The biologists estimated flight heights and distances using existing meteorological towers, local transmission lines, and topographic maps for reference.

Tetra Tech chose 20-min survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 min may lead to double-counting of songbirds (i.e., counting the same individual more than once) because individuals may appear and disappear from view. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-min survey, not number of distinct individual birds.

Detectability varies among species and potentially not all individuals within the 800-m radius were counted. This variation in detectability results in an overestimate of mean use for conspicuous species and an underestimate of mean use for reclusive species (Thompson 2002). Birds not easily identifiable, such as those seen under low light conditions or small birds seen at a distance, were identified to the lowest taxonomic level possible. Hence, unidentified birds are included in the results.

2.1.2 Crane Surveys

The San Luis Valley (hereafter Valley) serves as stopover habitat for the Rocky Mountain population of sandhill cranes; approximately 20,000 sandhill cranes move through the Valley each spring and fall. To understand how sandhill cranes use the Project and surrounding area, experienced field biologists conducted surveys within the Project and surrounding areas to evaluate the use, behavior, and flight pattern of sandhill cranes during spring migration. The

biologists conducted surveys from March 19 to April 19 while cranes were present during spring migration. Biologists conducted crane surveys for 2 hours before sunset and for 2 hours after sunrise on consecutive days. Based on observations at Monte Vista National Wildlife Refuge (the primary stopover site in the Valley for cranes) this time period encompasses movements to and from roosting areas. Biologists visited areas in and around the Project area that could serve as potential sandhill crane habitat. After potential habitat was visited, biologists then traveled through the rest of the Project area looking for cranes in flight or on the ground. The field biologists collected data on all sandhill cranes observed. Biologists recorded the following data: number of individuals, time of observation, flight height aboveground, behavior, flight direction and habitat. The biologists estimated flight heights using existing structures, local transmission lines, and topographic maps for reference.

2.1.3 Raptor Nest Surveys

The purpose of raptor nest surveys is to estimate the number of active and inactive raptor nests in and outside of the Project boundary. Where possible, biologists also surveyed an approximate 2-mile buffer around the Project boundary Biologists conducted the raptor nest survey across the project area before trees began to leaf out to maximize visibility of raptor nests. Once a nest was located, the biologist returned during the raptor breeding season to collect data on species, location, and activity status. The nest activity status (i.e., active or inactive) was determined by the presence of an adult or young or active territory defense by an individual. In addition, biologists assessed the nest condition and substrate. Biologists visited nests a minimum of two times, once to determine the location of the nest and once to determine if the nest was active. This second check also allowed biologists to detect late-nesting species such as Swainson's hawks. Raptor nest surveys provide an estimate of the number and species of raptors that use stick nests in the area. Ground-nesting raptor species, such as northern harriers, were not surveyed.

2.1.4 Incidental Observations

Incidental observations included observations that occurred 1) during travel between points, 2) before or after the official 20-min survey period, and 3) outside of the 800-m radius circular plot. Biologists recorded these observations on separate data sheets and these data were not used in the formal analysis; however, a summary of incidental birds is presented to provide additional information about species found in the local area.

2.1.5 Listed Species Information

The US Fish and Wildlife Service (USFWS) maintains a list of endangered and threatened species currently protected under the Endangered Species Act (ESA) and those that are candidates for listing under the ESA. For Saguache County, the USFWS lists five avian species (southwestern willow flycatcher – endangered, Mexican spotted owl – threatened, Gunnison sag-grouse – candidate, greater sage-grouse – candidate, yellow-billed cuckoo – candidate) as potentially occurring (USFWS 2011).

In addition to federal protection, the Colorado Division of Wildlife (CDOW) maintains a list of avian species that are categorized as Endangered, Threatened or of State Special Concern for Colorado based on population trend, population size and habitat rarity. Currently, Colorado has

listed four avian species as endangered, four as threatened and 11 as state special concern (CDOW 2010). The list available from CDOW does not list species by county.

2.1.6 Data Quality Assurance/Quality Control

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. To ensure legibility and completeness of data sheets, each biologist reviewed, and clarified if needed, all data sheets before data entry into a FileMaker Pro™ relational database for data storage and analysis. Prior to analysis, an independent reviewer conducted a 100-percent quality review of the data entries. Any questions that arose at this time were directed toward and answered by the field biologists.

2.2 Analysis

2.2.1 Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Tetra Tech defined raptors as vultures, hawks, eagles, falcons, and owls. As turkey vulture flight behavior is similar to raptors and as they are often included as raptors in other studies, Tetra Tech has included them with raptors for the purpose of our analyses. Non-raptors were defined as all other species groups.

2.2.2 Avian Use of the Project

Tetra Tech derived avian use (mean use) of the Project by calculating the average number of birds observed per 20-min survey at each point. To evaluate the diversity and composition of avian species using the Project, Tetra Tech first summarized the number of individuals (birds/20 min) and species. Tetra Tech also calculated a measure of variability (90 percent confidence intervals) for all mean use values. In addition, the number of observations is also presented, where an observation can be either an individual bird or a discrete flock of birds. This information helps evaluate whether high mean use is driven by a single event (e.g., a large flock of birds moving through the Project on migration). Because individual birds are not uniquely marked and identified, actual population size or abundance cannot be determined. One individual may be counted multiple times during a survey period or across survey periods. Therefore, avian mean use does not equate to abundance. Mean use was calculated for points inside the Project boundary (02, 03) and points outside the Project boundary (01, 04). All data were pooled to examine broader seasonal trends.

2.2.3 Crane Use of the Project

Tetra Tech calculated mean crane group size by dividing the total number of cranes by the total number of groups observed. Further, Tetra Tech calculated the percentage of crane observations by habitat type and also calculated percentage of behaviors by type.

3.0 RESULTS

3.1 Avian Use and Frequency of Occurrence

Biologists surveyed 933 acres within the Project boundary and 933 acres outside of the Project boundary during point count surveys. The four point count locations were surveyed 10 times each, resulting in 40 total 20-min surveys.

3.1.1 Avian use Inside the Project Boundary

A total 176 birds were observed within the Project boundary including 175 birds from 17 species and 1 bird that could not be identified to species during the fixed-point count surveys (count locations 02 and 03; Table 2a). Overall mean bird use during the surveys was 8.80 birds/20 min. Among species groups observed at count locations inside the Project boundary mean use was highest for songbirds (8.8 birds/20 min; Table 2a). Songbirds were observed in the majority of surveys and were widely distributed throughout the Project. The songbirds with the highest mean use were the horned lark (5.91 birds/20 min; 100 percent of all surveys), house sparrow (0.70 birds/20-min; 15 percent of all surveys) and red-winged blackbird (0.65 birds/20 min; 30 percent of all surveys). Other frequently observed songbird species were the sage thrasher (25 percent) and barn swallow (10 percent of all surveys; Table 2a). Each other songbird species was detected in less than 10 percent of the surveys.

Overall mean use for raptors was among the lowest of all identified groups (0.5 birds/20 min; Table 2a) and raptors were detected in 5 percent of all surveys. Only one raptor species were observed during spring point count surveys: the northern harrier.

3.1.2 Avian use Outside of the Project Boundary

A total 540 birds were observed at points outside the Project boundary including 467 birds from 35 species and 73 birds that could not be identified to species during the fixed-point count surveys (count locations 01 and 04; Table 2b). Overall mean bird use during surveys was 27.0 birds/20 min. Among species groups observed at count locations outside the Project boundary, mean use was highest for songbirds (27.00 birds/20 min; Table 2b). Songbirds were observed in the majority of surveys and were widely distributed throughout the Project. The songbirds with the highest mean use were the red-winged blackbird (3.70 birds/20 min; 70 percent of all surveys), horned lark (3.05 birds/20 min; 70 percent of all surveys), barn swallow (2.80 birds/20 min; 30 percent of all surveys), violet-green swallow (1.10 birds/20 min; 10 percent of all surveys). Other frequently observed songbird species were the western meadowlark (45 percent) and sage thrasher (30 percent), and song sparrow (25 percent; Table 2b). Each other songbird species was detected in less than 25 percent of the surveys.

The waterfowl species group had the second highest mean use (6.05 birds/20 min; Table 2b). Waterfowl were observed in 40 percent of all surveys and were only detected during surveys at point count location 04. Observed waterfowl species included the mallard (1.80 birds/20 min; 30 percent of all surveys), common merganser (0.70 birds/20 min; 10 percent of all surveys), green-winged teal (0.20 birds/20 min; 5 percent of all surveys), gadwall (0.10 birds/20 min; 5 percent of all surveys) and a flock of 65 unidentified ducks (3.25 birds/20 min; 5 percent of all surveys; Table 2).

The Cranes/Rails group was represented two flocks of sandhill cranes. Mean use for sandhill cranes was 2.80 birds/20 min; sandhill cranes were observed in 10 percent of all surveys. All observations of sandhill cranes during point count surveys were at point location 04.

Overall mean use for raptors was the lowest of all identified groups (0.65 birds/20 min; Table 2b) and raptors were detected in 40 percent of all surveys. This group was comprised of red-tailed hawk (0.50 birds/ 20 min) and northern harrier (0.15 birds/20 min).

3.1.3 Seasonal and Spatial Patterns

Mean use by non-raptors was highest during the first survey March 19, declined through the April 27, 2011 survey, increased through May 19, 2011 and declined at the last survey, May 30, 2011 when all data were pooled (Figure 3). The highest mean use occurred at point count location 04 (37.6 birds/20 min), and species associated with agriculture and water were observed here (waterfowl = 121 individuals, sandhill crane = 50 individuals, swallows = 82 individuals, red-winged blackbird = 36 individuals; Table 3, Figure 4). Point count location 01 had the second highest overall mean use with 16.40 birds/20 min. The habitat at this point count location was half agricultural fields and half rangeland with some shallow water present. The most abundant species observed at point count location 01 included the horned lark (55 individuals), red-winged blackbird (38 individuals), mourning dove (14 individuals), and western meadowlark (12 individuals; Table 3). Habitats at point count location 03 included agricultural fields, a small, drip-line irrigated windbreak, and remnant sagebrush in unplowed corners. Birds observed at this point were primarily horned lark (60 individuals), house sparrow (14 individuals), and red-winged blackbird (12 individuals; Table 3). The water from the drip-line would pool into small puddles and seemed to be an attractant for species like the red-winged blackbird and house sparrow. Point count location 02 was entirely among agricultural fields with horned larks being the most abundant (58 individuals), and all other species had less than 7 individuals (Table 3).

Mean use by raptors was low over all dates when data were pooled and peaked on April 27, 2011 where 1.0 raptors/20 minutes was recorded (Figure 5). Mean use by raptors was lowest at count locations 02 and 03 inside the Project boundary and highest at count location 04, which was located near a red-tailed hawk nest (Table 3, Figure 6).

3.2 Sandhill Crane Surveys

Sandhill crane surveys were conducted within the Project boundary and in the surrounding area from March 18 to April 20 2011. Cranes were primarily observed more than 2 miles from the Project boundary in matrix of winter wheat stubble and rangeland (Figure 8). A total of 1,306 sandhill cranes were observed during surveys (Appendix 2). Sandhill crane group sizes ranged from 1 to 350 individuals with group sizes over 100 not seen after March. Average group sizes of sandhill cranes decreased during the survey period (Survey 1 = 172.5; survey 2 =45.2; survey 3 = 14.9; survey 4 = 7.5; survey 5 = 0) with larger groups seen earlier in the season and small groups later in the season as birds were moving north to breeding grounds. The primary behavior observed was foraging (89 percent of on ground observations). Flight height was recorded for 13 observations, and 92 percent of flight heights were 50 m or below, with most flights being short distance flights within foraging areas. Two observations of flying cranes (15 percent) indicated a long distance flight (flight distance over 1 km) both appearing to be flying towards a group of sandhill cranes foraging in a wheat field. Of the 19 recorded observations of sandhill cranes on

the ground, 62 percent were observed in agriculture (likely winter wheat), 33 percent in grassland pasture, and 5 percent using disturbed areas.

3.3 Raptor Nest Surveys

Raptor nest surveys were conducted within the Project boundary and a surrounding 2-mile buffer from mid-March to late May. Ten active raptor nests representing four species were located in the Project (Figure 7; Appendix 1). Red-tailed hawk, Swainson's hawk and great horned owl were the most common nesting species with each species accounting for three active nests; a ferruginous hawk occupied the remaining nest. Two additional stick nests were located within the survey buffer but were not occupied. Raptor nests were located within windbreaks planted along field edges or for houses. Nest substrates included natural sites such as trees (e.g. cottonwood, conifer) and artificial structures such as utility poles.

3.4 Incidental Observations

Biologists documented four species that were not detected during spring point count surveys — American kestrel, Swainson's hawk, Wilson's phalarope, and yellow warbler (Table 4). Two golden eagles were detected during crane surveys. One juvenile golden eagle was observed on March 29, 2011 and 1 golden eagle of unknown age (the bird was perched on the ground) on April 10, 2011. Both observations occurred approximately 2.8 miles to the northwest from the project boundary in an area of grassland used for cattle grazing where the majority of crane observations have occurred.

4.0 DISCUSSION

The avian community found in the Project area is characterized by birds associated with agricultural communities and the remnant native shrub vegetation. The majority of the Project and surrounding areas have been developed for agricultural use or grazing land for cattle, which has likely augmented the bid community through a reduction in population sizes and the number of species in affected areas. Avian communities are known to vary seasonally and yearly. These fluctuations can be attributed to many changes (e.g., food resources, breeding, migration, and available habitat). One factor that commonly changes bird community composition is precipitation. According to the Palmer Drought Suitability Index, the Colorado Rio Grande Drainage Basin (including the Project) has been in drought conditions since late 2001 and although the severity of the drought has varied, spring 2011 surveys were conducted during a moderate drought in (Figure 9; NCDC 2011).

The Valley has been largely converted to agriculture in the vicinity of the Project, and when considered in a landscape context, the Project does not contain important wildlife resources. Mean use was three times higher and the number of species observed was two times higher outside of the Project boundary compared to inside the Project boundary. This indicates that both the number of birds and the diversity of birds are low inside the Project boundary compared to the areas surveyed outside the Project boundary. The point count locations outside of the Project (01, 04) demonstrate that areas of water or grassland, both which are not found in the Project, can provide habitat for wildlife. Point count location 04 contained an open water holding area that attracted many species of waterfowl, waterbirds and songbirds. This open water greatly affected the diversity and distribution of the surrounding avian community as more birds were observed at this point count location (376 observations) than at the other three point count

locations combined (Table 3). The wet grasslands in point count location 01, though not representative of the historic shrubland found in the Valley, provided habitat for songbirds. During the survey, the potato fields located at point count locations 01, 02, 03 provided little wildlife habitat and is not unique on the landscape. The fields were barren dirt and did not contain residual grain for food. Within the potato agriculture area, center pivot corners or small shelter belts provided the only wildlife habitat. These areas should be considered marginal as they are small, isolated, and often comprised of weeds or degraded sagebrush habitat. The high mean use early in the season when all data were pooled was driven by a sandhill crane flock observation, and mean use was lower in all other survey weeks.

4.1 Sandhill Crane Use

Every year over 20,000 sandhill cranes use the Valley as a stopover location during migration from wintering grounds at Bosque del Apache National Wildlife Refuge in New Mexico to breeding grounds in the northern United States and Canada (USFWS 2011). The Monte Vista-Alamosa National Wildlife Refuge complex lands, located approximately 23 mi from the Project boundary, are managed to provide wildlife habitat, primarily stopover habitat for sandhill cranes. The Project boundary encompasses agricultural fields, primarily potatoes, that are of minimal value to sandhill cranes as potato fields are not preferred foraging or roosting habitat. No sandhill cranes were observed roosting or foraging in the Project boundary. Sandhill cranes were primarily observed northwest of the Project in rangeland with cattle or in winter wheat stubble. Smaller crane groups were observed to the east foraging in fields with winter wheat stubble. Group sizes of sandhill cranes varied during the survey period as larger groups were seen earlier in the season and small groups later in the season. However, the groups of cranes observed around the Project area (maximum 350 in one observation over 2-miles away) represent a small fraction of the thousands that can be in the Valley at once. It is unlikely that development of the Project will impact sandhill crane foraging or roosting habitat due to minimal use of the Project and the amount of suitable habitat present outside the Project area.

4.2 Raptor Use

During avian use surveys, raptor use was low with only one northern harrier observed within the Project boundary. Raptor use was higher outside of the Project boundary and was driven in part by a red-tailed hawk nest located near count location 04. Additional raptor species observed incidental to point counts include American kestrel and Swainson's hawk. Nest locations in the area are limited to shelterbelts and utility poles with raptor activity concentrated in these areas where potential nest locations and perches exist. Nest sites were limited in the Project due to the lack of suitable nesting trees and no raptor nests were located within the Project boundary (Figure 7). Raptor use did not show any seasonal trends when all data were pooled, indicating that this area is likely not a migratory flyway for raptors.

4.3 Listed and Sensitive Species

No federal threatened, endangered, candidate species were observed during point count or crane surveys or as incidentals. Two golden eagles were observed incidentally during the crane surveys; however, no eagle nests were detected and the area within the Project boundary provides little foraging habitat as it is primarily potato agriculture. No concentrations of golden eagles were found during any aspect of the field work.

No state threatened or endangered species were observed during avian surveys or as incidental observations. The ferruginous hawk and greater sandhill crane are listed species of State Special Concern by Colorado Division of Wildlife (CDOW 2010). The Brewer's sparrow, ferruginous hawk, and golden eagle are also listed as Birds of Conservation Concern within the Bird Conservation Region (BCR) 16. Brewer's sparrows were observed at point count location 01 and 04 outside of the Project boundary where remnant patches of native vegetation were present. Ferruginous hawks were only observed outside the Project boundary during raptor nest surveys. The potential impact to these species is low as limited foraging and nesting habitat exists within the Project area.

4.4 Project Conclusions

The avian count data and the crane survey data indicate that avian use within the Project boundary is low and that areas of higher use are found where natural habitat (grassland, shrubland) and water are found. The Project is proposed on agricultural land with little wildlife value, and the habitat within the Project boundary consists primarily of potato agriculture with only sparse remnant natural habitat remaining. Development of the Project will result in minimal loss of wildlife habitat and low risk to raptors as no nests are located within the Project boundary and the potato fields likely do not provide foraging areas.

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Karl Kosciuch	6/27/11
Report Author	Date
Lynn Sharp	6/28/11
Peer Review #1	Date

FIGURES

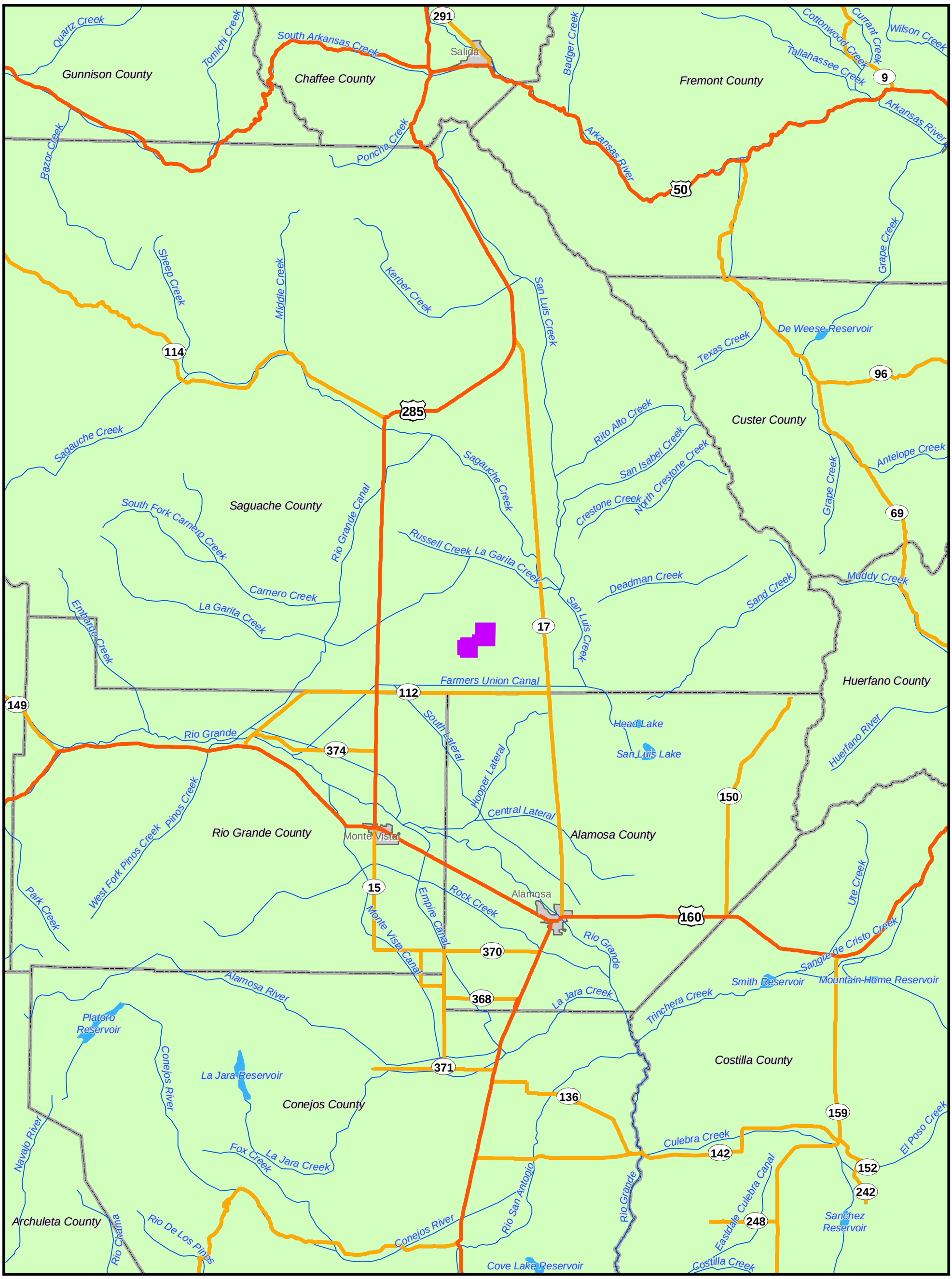


Figure 1

Vicinity Map

SOLARRESERVE®

Saguache Solar Energy Project

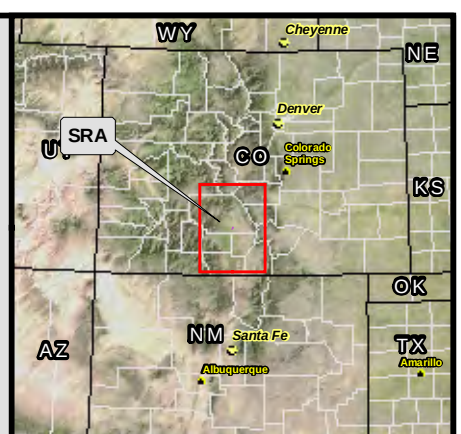
Alamosa County, CO

Project area (06-03-2011)
County boundary
Urban area
Federal highway
State highway
Lake/pond
River/stream

N

1:500,000
NAD 1983 UTM 13

0 2 4 6 8
Miles



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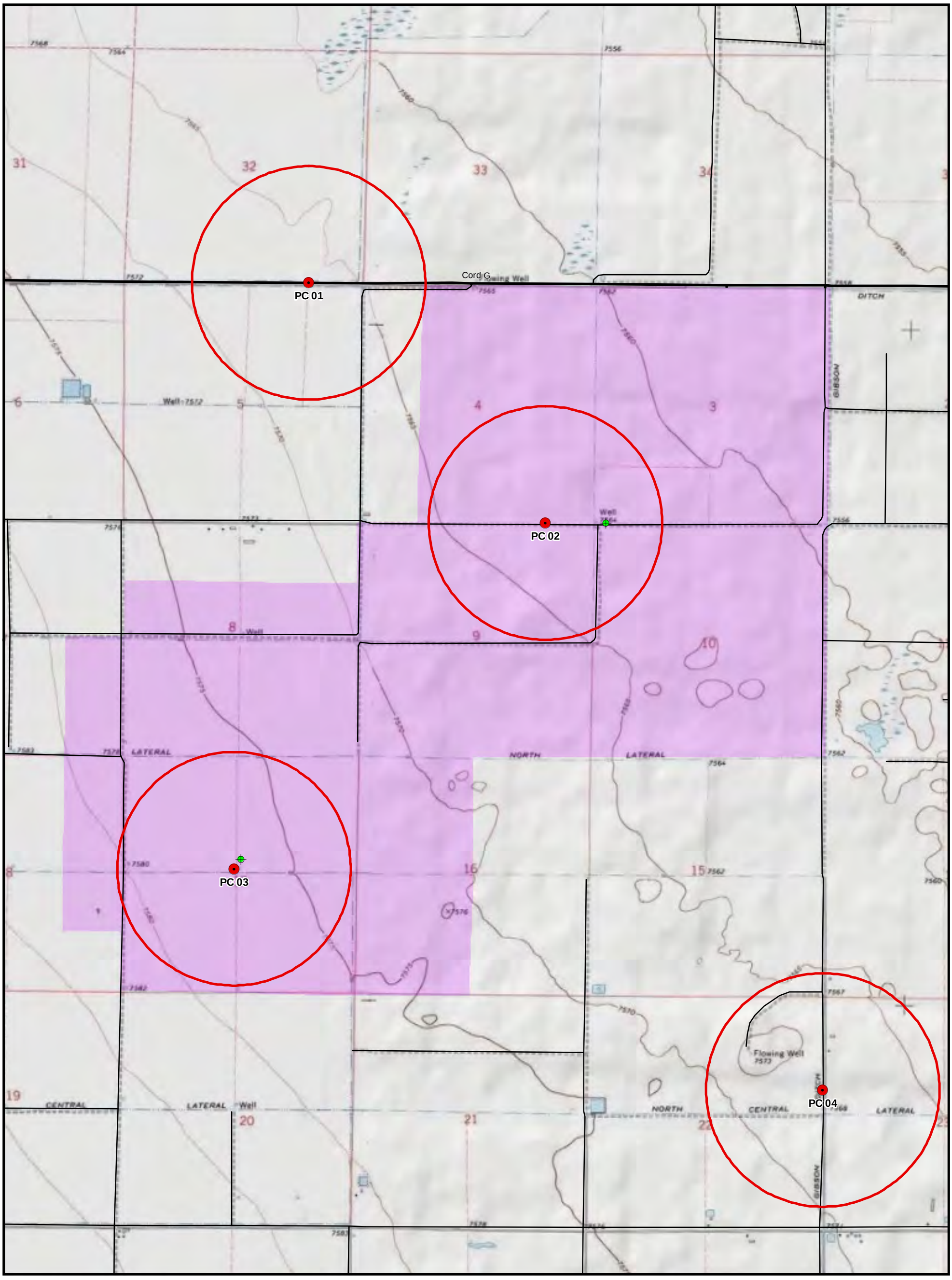

Figure 2

Point Count Location Map (Spring 2011)

SOLARRESERVE®

Saguache Solar Energy Project

Alamosa County, CO

- Avian survey point
- Avian survey point 800-m radius
- PC# Point count number
- Project area (06-03-2011)
- Receiver tower
- State highway
- Local road

N

1:25,000
NAD 1983 UTM 13
Last modified: 07/18/2011

0 0.25 0.5
Miles

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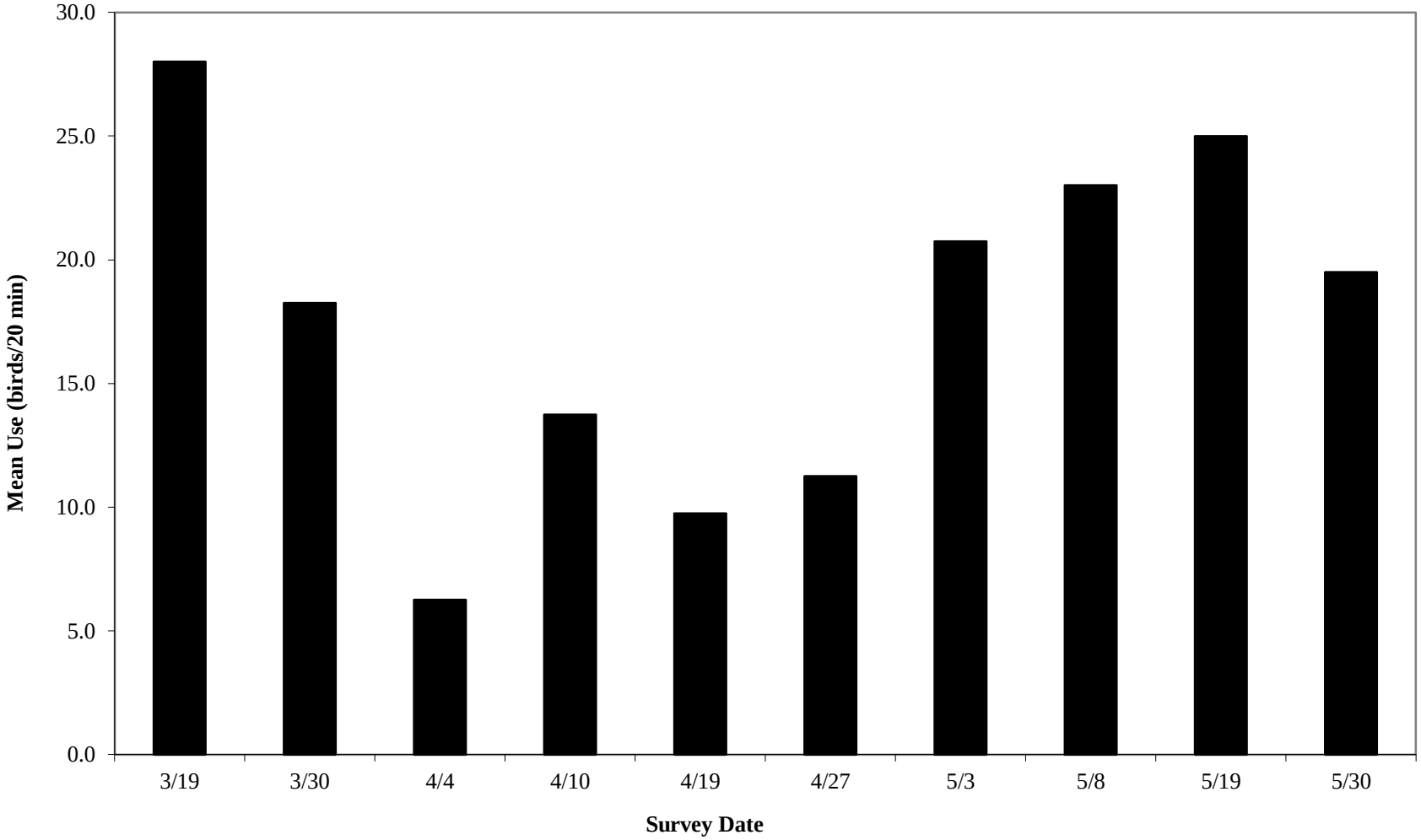
Figure 3. Non-raptor mean use by survey date for all ponts combined in Spring 2011 at the Saguache Solar Project.



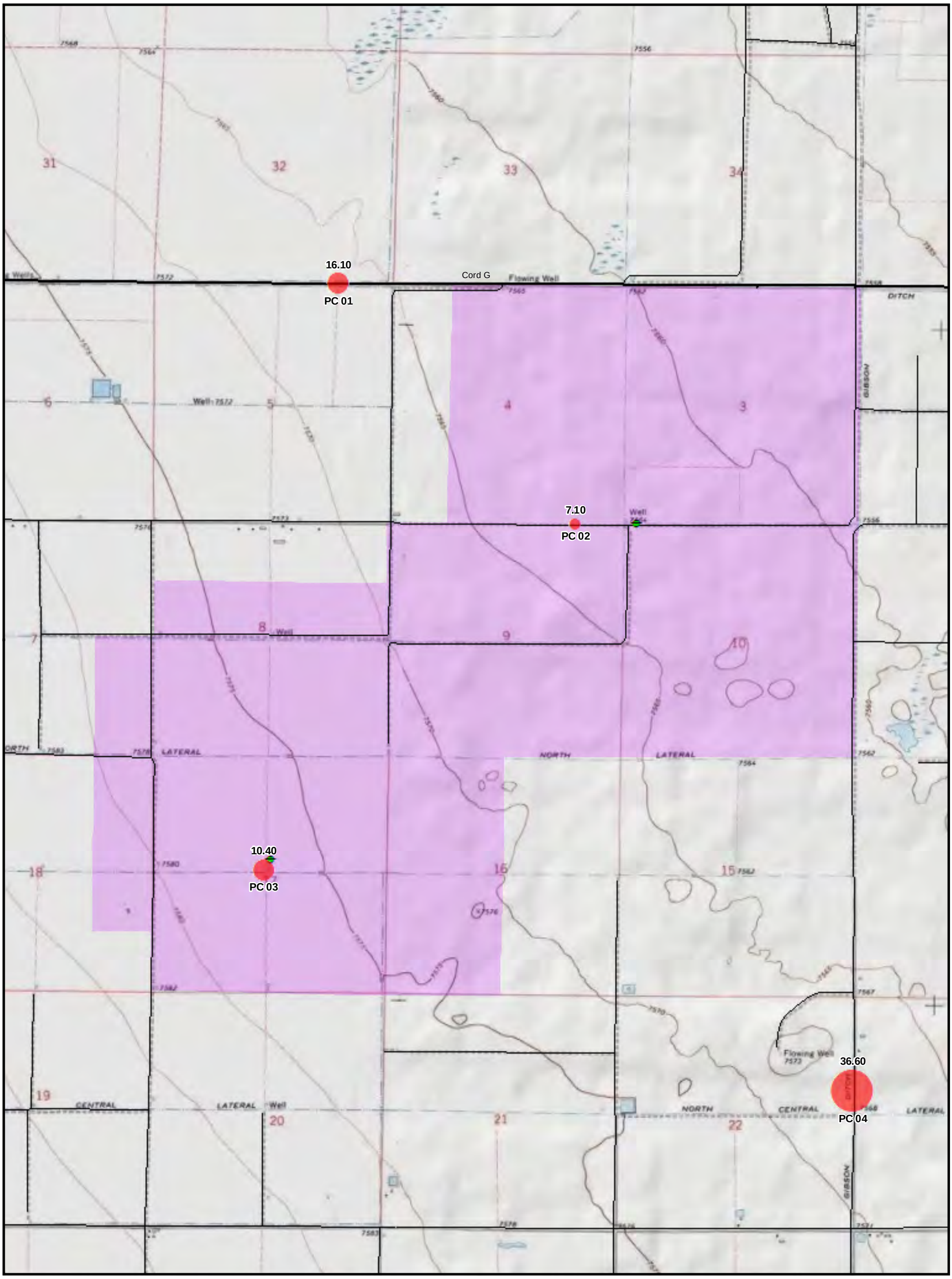


Figure 4

Non-Raptor Mean Use by Point Count Location (Spring 2011)

SOLARRESERVE

Saguache Solar Energy Project

Alamosa County, CO

Non-raptors per 20 minutes

- 0.10 - 10.00
- 10.01 - 20.00
- 20.10 - 30.00
- 30.10 - 40.00

Project area (06-03-2011)

Receiver tower

River/stream

Lake/pond

Local road

**Mean use value**

PC# **Point count number**

N

1:25,000
NAD 1983 UTM 13
Last modified: 07-18-2011

0 0.25 0.5
Miles

TETRA TECH EC,INC

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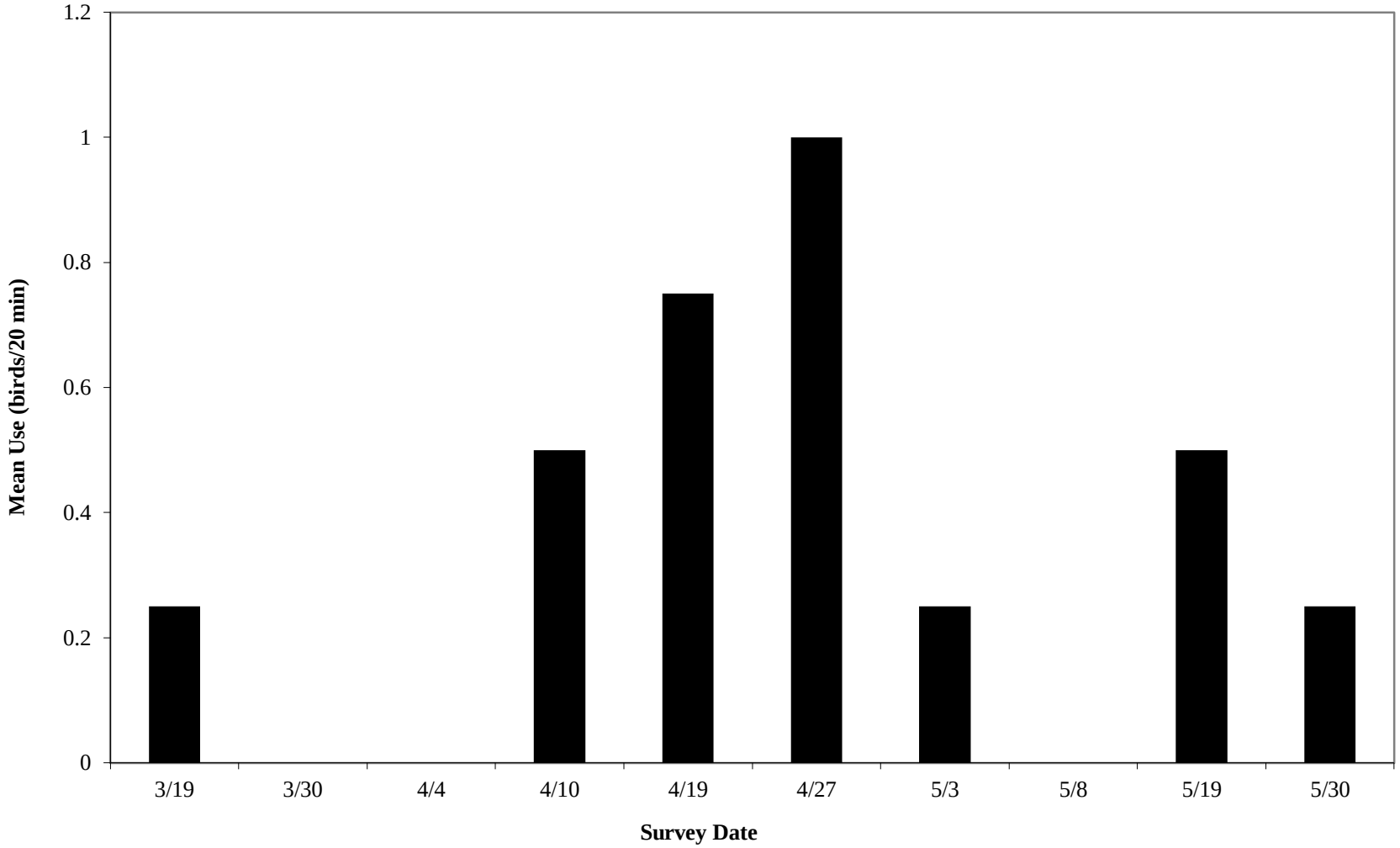
Figure 5. Raptor mean use by survey date for all points combined in Spring 2011 at the Saguache Solar Project.



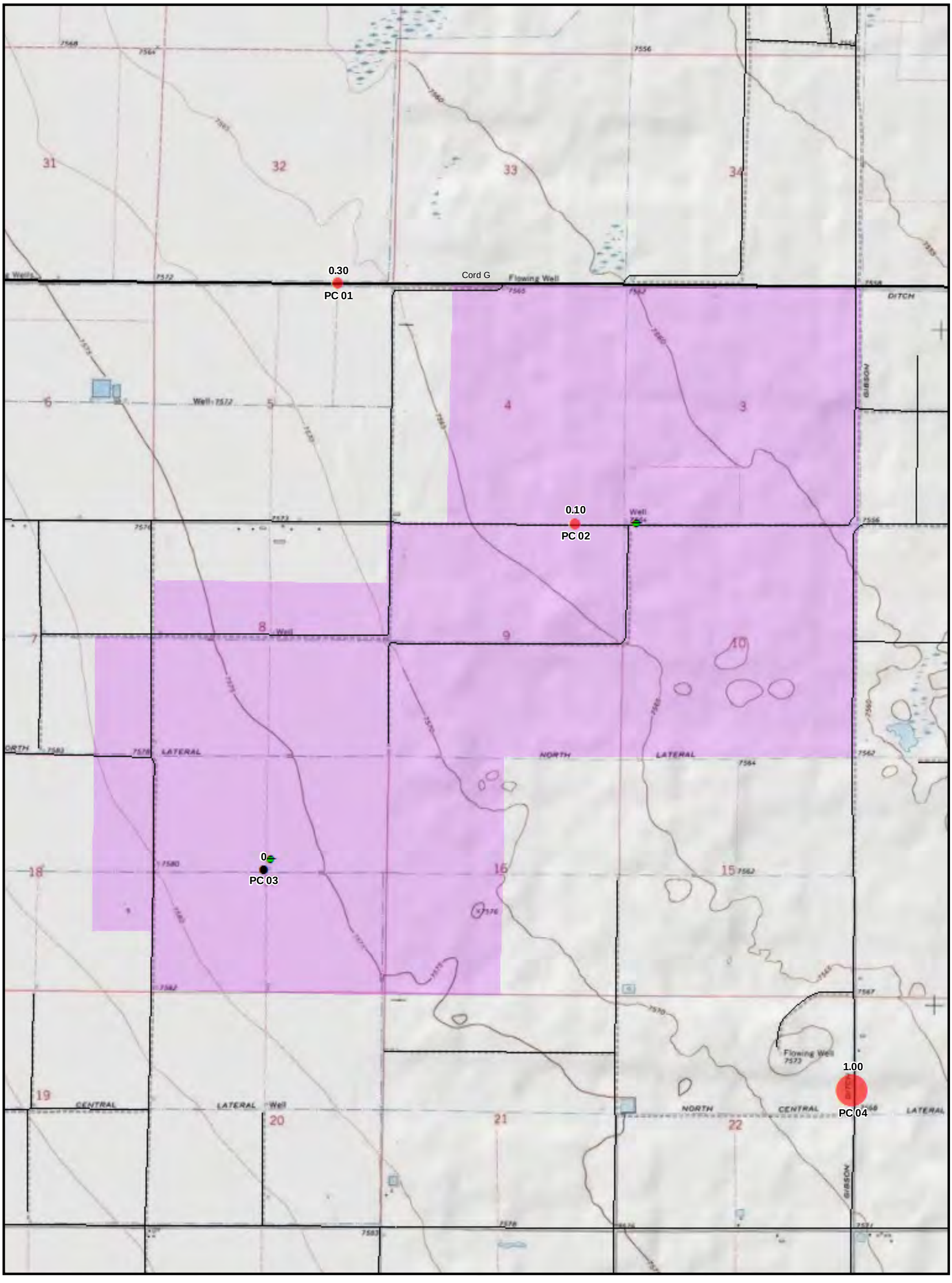


Figure 6

Raptor Mean Use by Point Count Location (Spring 2011)

SOLARRESERVE®

Saguache Solar Energy Project

Alamosa County, CO

Raptors per 20 minutes

- Zero
- 0.10 - 0.50
- 0.51 - 1.00

Mean use value

PC# Point count number

Project area (06-03-2010)

Receiver tower

River/stream

Lake/pond

Local road

N

1:25,000
NAD 1983 UTM 13
Last modified: 07-18-2011

0 0.25 0.5
Miles

TETRA TECH EC,INC

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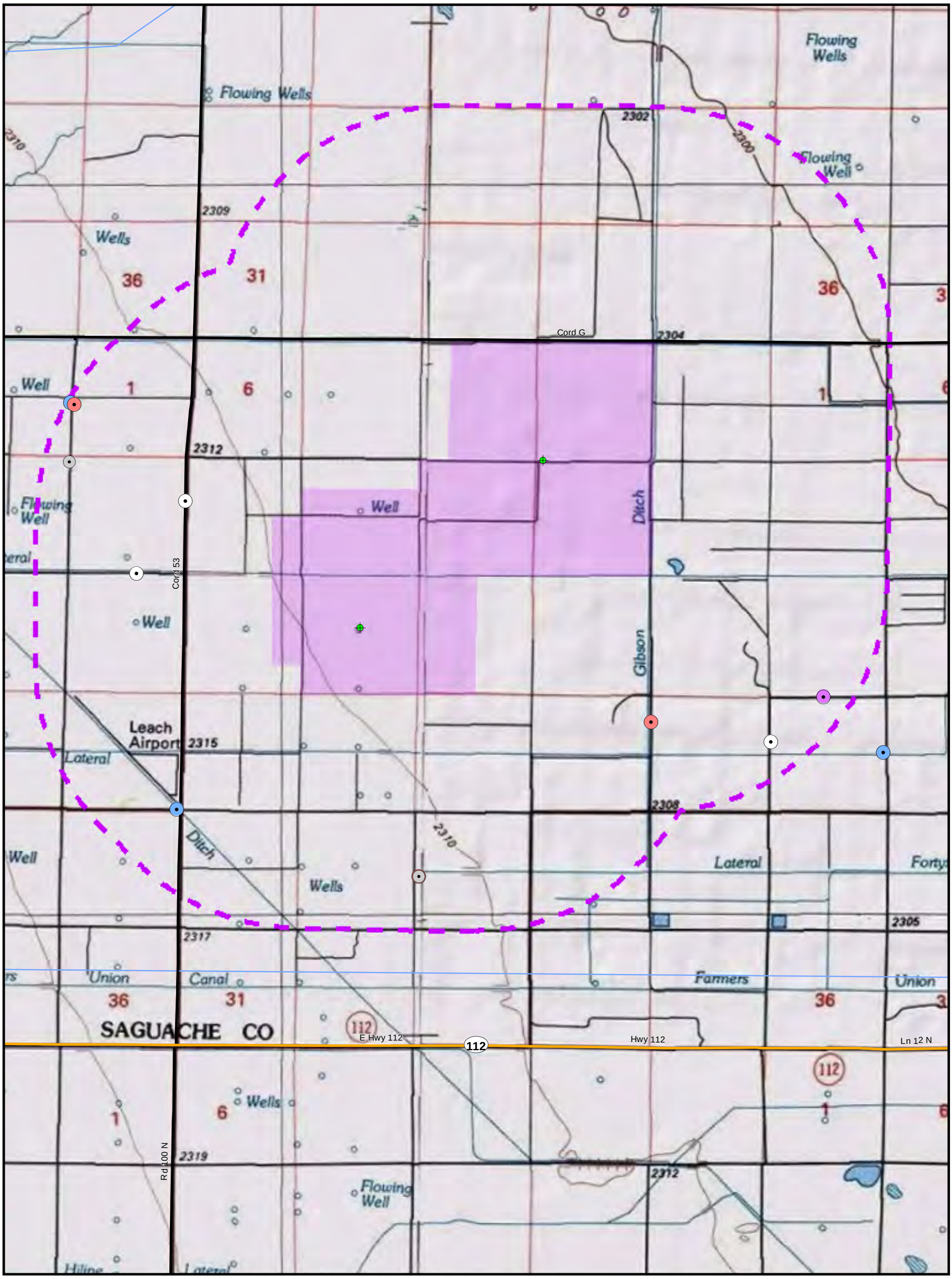

Figure 7

Raptor Nest Map (Spring 2011)

SOLARRESERVE

Saguache Solar Energy Project

Alamosa County, CO

Raptor Nest Species

- Ferruginous hawk
- Great horned owl
- Red-tailed hawk
- Swainson's hawk
- Inactive Stick Nest

Project area (06-03-2010)

Project area 2-mile buffer

Receiver tower

River/stream

Lake/pond

State highway

Local road

N

1:50,000
NAD 1983 UTM 13
Last modified: 07-18-2011

0 0.25 0.5
Miles

TETRA TECH EC,INC

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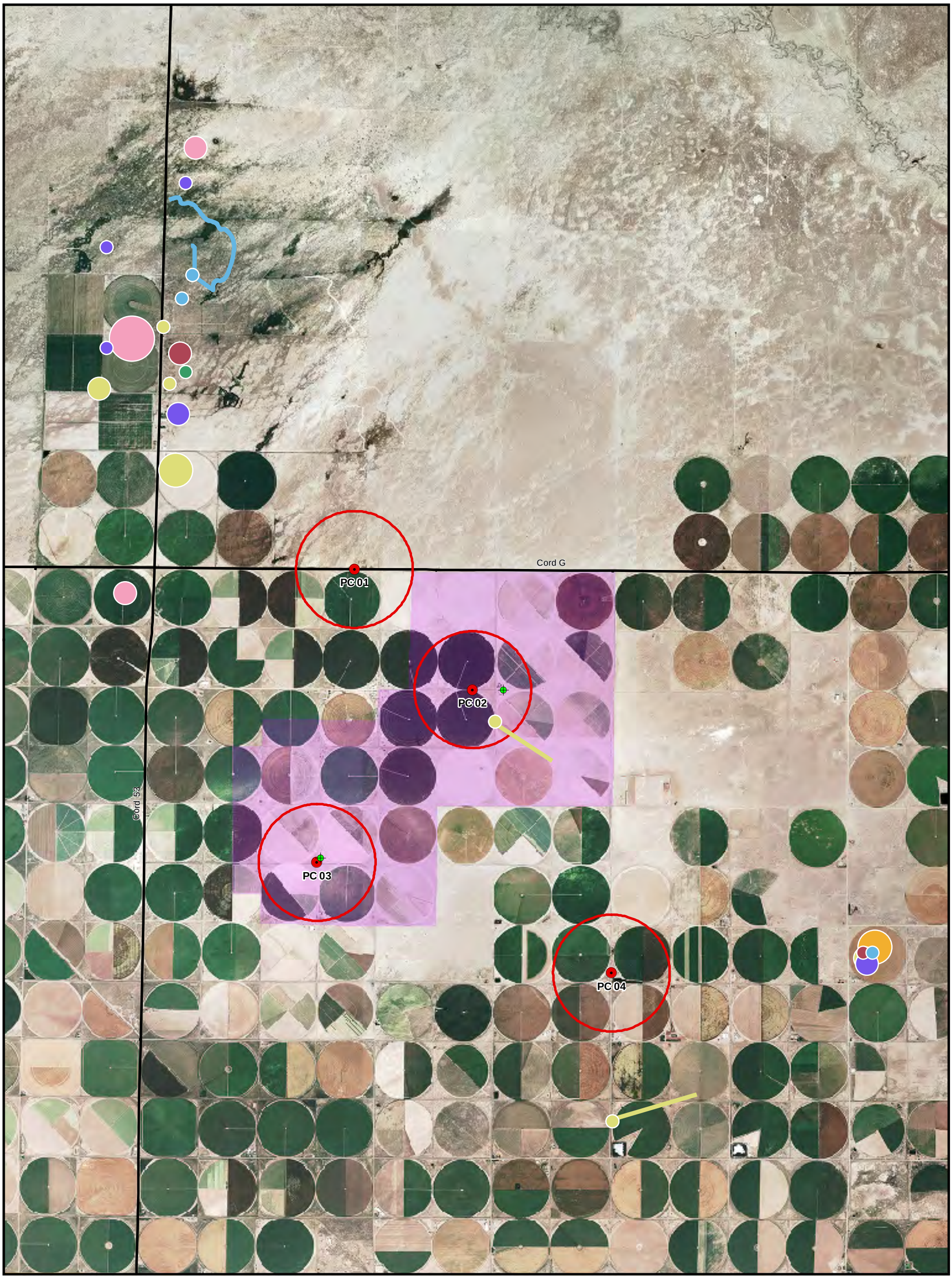

Figure 8

Crane Observations Map (Spring 2011)

SOLARRESERVE

Saguache Solar Energy Project

Alamosa County, CO

Crane observations (Date)

- 03-18-2011
- 03-19-2011
- 03-29-2011
- 03-30-2011
- 04-04-2011
- 04-05-2011
- 04-09-2011

Crane flight paths (Date)

- 03-29-2011
- 04-05-2011

Number observed

350
150
100
15

Avian survey point

Avian survey point 800-m radius

PC# Point count number

Project area (06-03-2010)

Receiver tower

State highway

Local road

N

1:50,000
NAD 1983 UTM 13
Last modified: 07-18-2011

0 0.5 1
Miles

TETRA TECH EC,INC

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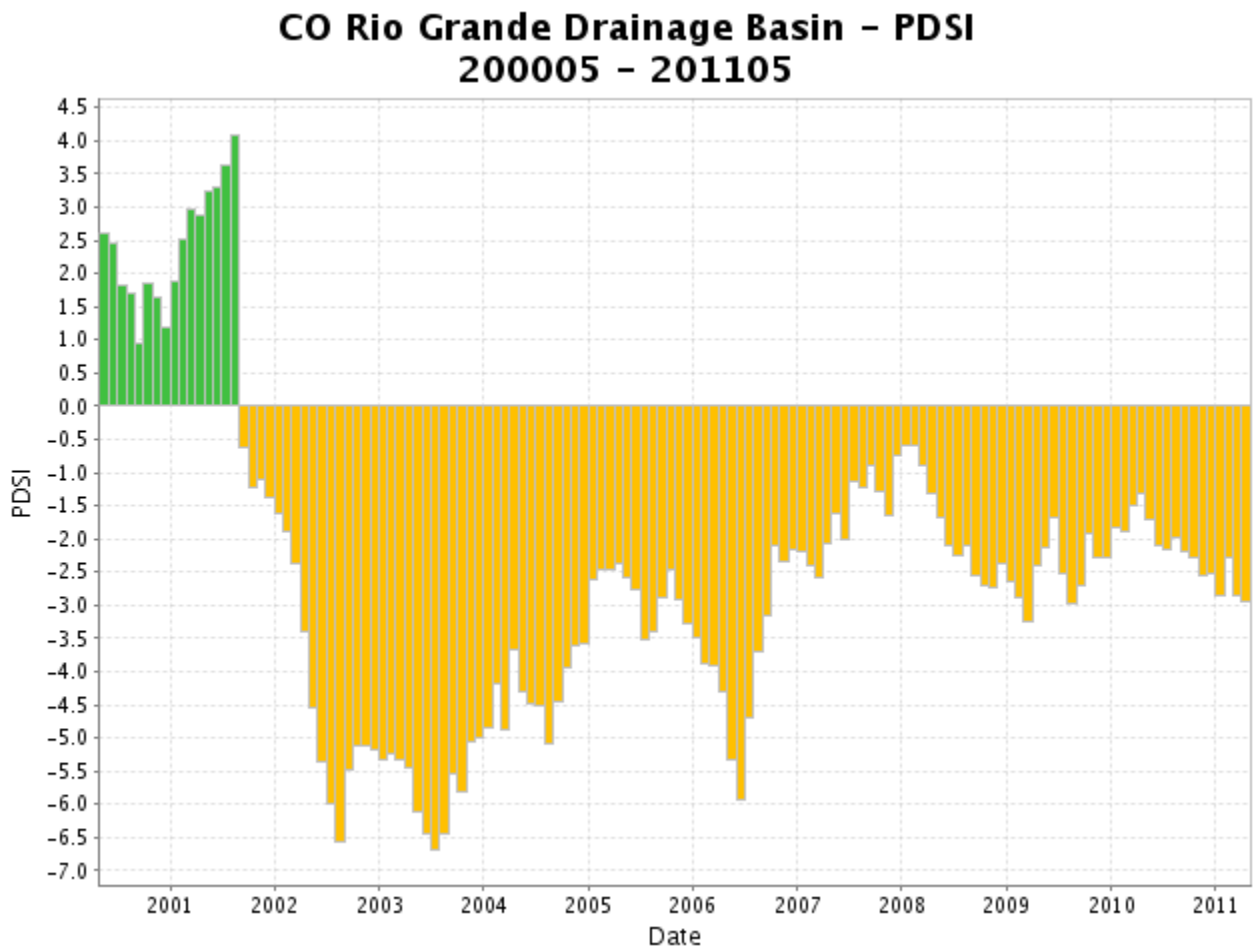
Figure 9. Palmer Drought Severity Index (PDSI) for the Colorado Rio Grande Drainage Basin region, including the Saguache Solar Energy Project, from May 2000 to May 2011. PDSI values: -4.0 or less (Extreme Drought), -3.0 or -3.9 (Severe Drought), -2.0 or -2.9 (Moderate Drought), -1.9 to +1.9 (Near Normal), +2.0 or +2.9 (Unusual Moist Spell), +3.0 or +3.9 (Very Moist Spell), +4.0 or above (Extremely Moist).



TABLES

Table 1. Spring 2011 point count survey dates at Saguache.

Survey number	Date(s)
1	3/19
2	3/30
3	4/4
4	4/10
5	4/19
6	4/27
7	5/3
8	5/8
9	5/19
10	5/30

Table 2a. Avian species, by species grouping, observed during Spring 2011 point count surveys at points within the Saguache Solar Energy Project.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Songbirds							
horned lark	1	118	41	5.90 (4.83-6.97)	100.0	69.4%	67.0%
house sparrow	2	14	3	0.70 (0.07-1.33)	15.0	8.2%	8.0%
red-winged blackbird	3	13	7	0.65 (0.06-1.24)	30.0	7.6%	7.4%
cliff swallow	4	6	1	0.30 (0.00-0.79)	5.0	3.5%	3.4%
sage thrasher	5	5	5	0.25 (0.09-0.41)	25.0	2.9%	2.8%
brown-headed cowbird	7	3	1	0.15 (0.00-0.40)	5.0	1.8%	1.7%
common grackle	8	2	1	0.10 (0.00-0.26)	5.0	1.2%	1.1%
barn swallow	8	2	2	0.10 (0.00-0.21)	10.0	1.2%	1.1%
violet-green swallow	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
vesper sparrow	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
unidentified songbird	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
northern mockingbird	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
mountain bluebird	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
Lincoln's sparrow	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
common raven	10	1	1	0.05 (0.00-0.13)	5.0	0.6%	0.6%
Group Total		**170**	**68**	**8.50** (6.62-10.38)	**100.0**		**96.6%**
Pigeons/Doves							
mourning dove	6	4	4	0.20 (0.05-0.35)	20.0	100.0%	2.3%
Group Total		**4**	**4**	**0.20** (0.05-0.35)	**20.0**		**2.3%**
Waterbirds							
killdeer	10	1	1	0.05 (0.00-0.13)	5.0	100.0%	0.6%
Group Total		**1**	**1**	**0.05** (0.00-0.13)	**5.0**		**0.6%**
Raptors							
northern harrier	10	1	1	0.05 (0.00-0.13)	5.0	100.0%	0.6%
Group Total		**1**	**1**	**0.05** (0.00-0.13)	**5.0**		**0.6%**
Grand Total		**176**	**74**	**8.80** (6.80-10.80)			

[1] A ranking of 1 indicates highest mean use

Table 2b. Avian species, by species grouping, observed during Spring 2011 point count surveys at points outside the Saguache Solar Project.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Songbirds							
red-winged blackbird	1	74	15	3.70 (2.19-5.21)	70.0	23.9%	13.7%
horned lark	3	61	26	3.05 (1.78-4.32)	70.0	19.7%	11.3%
barn swallow	4	56	6	2.80 (0.27-5.33)	30.0	18.1%	10.4%
violet-green swallow	7	22	2	1.10 (0.00-2.74)	10.0	7.1%	4.1%
western meadowlark	9	14	10	0.70 (0.36-1.04)	45.0	4.5%	2.6%
savannah sparrow	9	14	3	0.70 (0.00-1.46)	15.0	4.5%	2.6%
tree swallow	12	11	2	0.55 (0.00-1.37)	10.0	3.6%	2.0%
sage thrasher	13	10	6	0.50 (0.17-0.83)	30.0	3.2%	1.9%
yellow-rumped warbler	16	7	4	0.35 (0.05-0.65)	20.0	2.3%	1.3%
vesper sparrow	17	6	4	0.30 (0.06-0.54)	20.0	1.9%	1.1%
white-crowned sparrow	18	5	1	0.25 (0.00-0.66)	5.0	1.6%	0.9%
song sparrow	18	5	5	0.25 (0.09-0.41)	25.0	1.6%	0.9%
Brewer's sparrow	20	4	2	0.20 (0.00-0.43)	10.0	1.3%	0.7%
brown-headed cowbird	20	4	2	0.20 (0.00-0.46)	10.0	1.3%	0.7%
black-billed magpie	20	4	3	0.20 (0.01-0.39)	15.0	1.3%	0.7%
cliff swallow	26	2	1	0.10 (0.00-0.26)	5.0	0.6%	0.4%
chipping sparrow	26	2	1	0.10 (0.00-0.26)	5.0	0.6%	0.4%
Brewer's blackbird	26	2	1	0.10 (0.00-0.26)	5.0	0.6%	0.4%
yellow-headed blackbird	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
western kingbird	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
unidentified sparrow	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
unidentified songbird	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
common raven	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
American robin	32	1	1	0.05 (0.00-0.13)	5.0	0.3%	0.2%
Group Total		**309**	**100**	**15.45** (9.94-20.96)	**100.0**		**57.2%**
Waterfowl							
unidentified duck	2	65	1	3.25 (0.00-8.60)	5.0	53.7%	12.0%
mallard	6	36	7	1.80 (0.55-3.05)	30.0	29.8%	6.7%
common merganser	9	14	2	0.70 (0.00-1.69)	10.0	11.6%	2.6%
green-winged teal	20	4	1	0.20 (0.00-0.53)	5.0	3.3%	0.7%

Table 2b. Avian species, by species grouping, observed during Spring 2011 point count surveys at points outside the Saguache Solar Project.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
gadwall	26	2	1	0.10 (0.00-0.26)	5.0	1.7%	0.4%
Group Total		**121**	**12**	**6.05** (0.00-12.34)	**40.0**		**22.4%**
Cranes/Rails							
sandhill crane	4	56	2	2.80 (0.00-6.92)	10.0	100.0%	10.4%
Group Total		**56**	**2**	**2.80** (0.00-6.92)	**10.0**		**10.4%**
Pigeons/Doves							
mourning dove	7	22	8	1.10 (0.53-1.67)	40.0	100.0%	4.1%
Group Total		**22**	**8**	**1.10** (0.53-1.67)	**40.0**		**4.1%**
Waterbirds							
killdeer	15	8	6	0.40 (0.15-0.65)	30.0	47.1%	1.5%
unidentified sandpiper	20	4	1	0.20 (0.00-0.53)	5.0	23.5%	0.7%
American avocet	26	2	1	0.10 (0.00-0.26)	5.0	11.8%	0.4%
willet	32	1	1	0.05 (0.00-0.13)	5.0	5.9%	0.2%
great blue heron	32	1	1	0.05 (0.00-0.13)	5.0	5.9%	0.2%
black-crowned night-heron	32	1	1	0.05 (0.00-0.13)	5.0	5.9%	0.2%
Group Total		**17**	**11**	**0.85** (0.18-1.52)	**40.0**		**3.1%**
Raptors							
red-tailed hawk	13	10	8	0.50 (0.20-0.80)	30.0	76.9%	1.9%
northern harrier	25	3	2	0.15 (0.00-0.33)	10.0	23.1%	0.6%
Group Total		**13**	**10**	**0.65** (0.33-0.97)	**40.0**		**2.4%**
Other							
unidentified bird	26	2	1	0.10 (0.00-0.26)	5.0	100.0%	0.4%
Group Total		**2**	**1**	**0.10** (0.00-0.26)	**5.0**		**0.4%**
Grand Total		**540**	**144**	**27.00** (19.18-34.82)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Spring 2011 point count surveys at the Saguache Solar Energy Project.

Species	Number of Birds	Number of Obs.	Points			
			1	2	3	4
horned lark	179	67	55	58	60	6
red-winged blackbird	87	22	38	1	12	36
unidentified duck	65	1	0	0	0	65
barn swallow	58	8	7	2	0	49
sandhill crane	56	2	6	0	0	50
mallard	36	7	0	0	0	36
mourning dove	26	12	14	1	3	8
violet-green swallow	23	3	2	1	0	20
sage thrasher	15	11	7	0	5	3
western meadowlark	14	10	12	0	0	2
savannah sparrow	14	3	6	0	0	8
house sparrow	14	3	0	0	14	0
common merganser	14	2	0	0	0	14
tree swallow	11	2	0	0	0	11
red-tailed hawk	10	8	0	0	0	10
killdeer	9	7	6	0	1	2
cliff swallow	8	2	0	6	0	2
yellow-rumped warbler	7	4	0	0	0	7
vesper sparrow	7	5	3	0	1	3
brown-headed cowbird	7	3	1	0	3	3
white-crowned sparrow	5	1	0	0	0	5
song sparrow	5	5	0	0	0	5
unidentified sandpiper	4	1	0	0	0	4
northern harrier	4	3	3	1	0	0
green-winged teal	4	1	0	0	0	4
Brewer's sparrow	4	2	2	0	0	2
black-billed magpie	4	3	0	0	0	4
unidentified songbird	2	2	0	0	1	1
unidentified bird	2	1	2	0	0	0
gadwall	2	1	0	0	0	2
common raven	2	2	0	1	0	1
common grackle	2	1	0	0	2	0
chipping sparrow	2	1	0	0	0	2
Brewer's blackbird	2	1	0	0	0	2
American avocet	2	1	0	0	0	2
yellow-headed blackbird	1	1	0	0	0	1
willet	1	1	0	0	0	1
western kingbird	1	1	0	0	0	1
unidentified sparrow	1	1	0	0	0	1
northern mockingbird	1	1	0	0	1	0

Table 3. Avian species observed by point during Spring 2011 point count surveys at the Saguache Solar Energy Project.

Species	Number of Birds	Number of Obs.	Points			
			1	2	3	4
mountain bluebird	1	1	0	0	1	0
Lincoln's sparrow	1	1	0	1	0	0
great blue heron	1	1	0	0	0	1
black-crowned night-heron	1	1	0	0	0	1
American robin	1	1	0	0	0	1
Grand Total	**716**	**218**	**164**	**72**	**104**	**376**

Table 4. Incidental observations of birds during Spring 2011 point count surveys at the Saguache Solar Energy Project.

Species
American kestrel
common raven
northern harrier
Swainson's hawk
Wilson's phalarope
yellow warbler

APPENDICES

Appendix 1. Raptor nests observed at the Saguache Solar Project, Spring 2011.

Nest Number	Dates Surveyed	Species	Status	Substrate	Nest Height (m)	Nest Condition
2011 - 1	03/15/2011	red-tailed hawk	Active	Tree	9	Excellent
	03/30/2011	red-tailed hawk	Active			
	04/05/2011	red-tailed hawk	Active			
	04/19/2011	red-tailed hawk	Active			
	05/03/2011	red-tailed hawk	Active			
	05/19/2011	red-tailed hawk	Inactive			
2011 - 3	03/15/2011	NA	Inactive	Tree	8	
	03/19/2011	NA	Inactive			
	04/19/2011	NA	Inactive			
	05/03/2011	NA	Inactive			
	05/19/2011	Swainson's hawk	Active			
2011 - 4	03/19/2011	NA	Inactive	Tree	12	Excellent
	03/30/2011	NA	Inactive			
	04/05/2011	red-tailed hawk	Active			
	04/19/2011	red-tailed hawk	Active			
	05/03/2011	red-tailed hawk	Active			
	05/19/2011	red-tailed hawk	Active			
2011 - 6	03/19/2011	red-tailed hawk	Active	Tree	12	Fair
	03/30/2011	red-tailed hawk	Inactive			
	04/05/2011	red-tailed hawk	Active			
	04/19/2011	red-tailed hawk	Active			
	05/03/2011	red-tailed hawk	Active			
2011 - 7	03/19/2011	NA	Inactive	Tree	6	Excellent
	03/30/2011	ferruginous hawk	Active			
	04/19/2011	ferruginous hawk	Active			
	05/03/2011	ferruginous hawk	Active			
	05/19/2011	ferruginous hawk	Active			
	05/30/2011	ferruginous hawk	Active			
2011 - 8	03/19/2011	great horned owl	Active	Tree	9	Excellent
	03/30/2011	great horned owl	Active			
	04/04/2011	great horned owl	Active			
	04/19/2011	great horned owl	Active			
	05/03/2011	great horned owl	Active			
	05/19/2011	great horned owl	Active			
2011 - 9	03/29/2011	great horned owl	Active	Douglas Fir	6	Excellent
	04/04/2011	great horned owl	Active			
	04/20/2011	NA	Inactive			
	05/03/2011	great horned owl	Active			
2011 - 10	04/09/2011	great horned owl	Active	Tree	2.5	Excellent
	04/19/2011	great horned owl	Active			
	05/03/2011	great horned owl	Active			
	05/19/2011	great horned owl	Active			
2011 - 11	05/19/2011	Swainson's hawk	Active	Cottonwood	9.5	Excellent
	05/30/2011	Swainson's hawk	Inactive			
2011 - 12	05/03/2011	Swainson's hawk	Active	Utility Pole	10	Remnant
	05/19/2011	Swainson's hawk	Active			

NA means not applicable

Appendix 2. Cranes observed at the Saguache Solar Project,Spring 2011.

Date	Number of birds	Species	Flight Behavior	Flight Direction	Flight Heights (m)		On Ground Behavior	*Habitat
					Low	High		
03/18/2011	150	sandhill crane	Short Distance Flight	SW	1	4	Foraging, Loafing	AG
03/19/2011	90	sandhill crane	Flying	S	3	13	Foraging	AG
03/19/2011	350	sandhill crane	-				Foraging	AG
03/19/2011	100	sandhill crane	-				Foraging	GR
03/29/2011	7	sandhill crane	Flying	SE	0	35	Loafing	AG
03/29/2011	9	sandhill crane	Flying	SE	0	30	Loafing	DI
03/29/2011	100	sandhill crane	Flying	S	0	50	Foraging, Loafing	AG
03/29/2011	150	sandhill crane	-				Foraging, Loafing	AG
03/29/2011	80	sandhill crane	-				Foraging, Loafing	AG
03/29/2011	4	sandhill crane	Long Distance Flight	NE	100	100	-	AG
03/29/2011	1	sandhill crane	Long Distance Flight	SE	30	30	-	AG
03/30/2011	80	sandhill crane	Short Distance Flight, Other		0	1	Foraging, Loafing	AG
03/30/2011	50	sandhill crane	-				Foraging, Loafing	AG
03/30/2011	10	sandhill crane	-				Foraging	AG
03/30/2011	6	sandhill crane	Flying	E	0	50	-	AG
03/30/2011	5	sandhill crane	-				Foraging, Loafing	GR
04/04/2011	15	sandhill crane	-				Foraging, Loafing	AG
04/04/2011	60	sandhill crane	Normal Departure		8	5	Foraging, Loafing	GR
04/05/2011	10	sandhill crane	Flying	S	0	10	Loafing, Foraging	GR
04/05/2011	15	sandhill crane	Flying	SE	0	20	Loafing, Foraging	GR
04/05/2011	2	sandhill crane	Flying	E	0	8	-	GR
04/05/2011	2	sandhill crane	-				Foraging	AG
04/09/2011	15	sandhill crane	-				Foraging	GR

* AG=Agriculture, DI=Disturbed, DG=Disturbed grassland, W=Wetland, GR=Grassland, OT=Other