# Appendix F

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# Eagle and Raptor Prey Base Assessment

## Chokecherry and Sierra Madre Wind Energy Project

*October 2012*

Power Company of Wyoming LLC

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## TABLE OF CONTENTS

**Page**

Executive Summary ..... 1
1.0 Introduction ..... 4
1.1 Project Background ..... 4
1.1.1 Physiographic Setting ..... 6
1.1.2 Vegetation ..... 8
1.2 Draft Eagle Conservation Plan Guidance ..... 11
1.3 Influence of Prey Base on Golden Eagles ..... 12
1.4 Influence of Prey Base on Bald Eagles ..... 14
2.0 Species-Specific Prey Base Assessments ..... 14
2.1 White-tailed prairie dogs ..... 14
2.1.1 White-tailed Prairie Dog Occurrences in the Project Site ..... 15
2.1.2 Assessment of White-tailed Prairie Dogs as Prey in the Project Site ..... 19
2.2 Wyoming Ground Squirrel ..... 22
2.3 Leporids ..... 22
2.4 Big Game Species ..... 24
2.5 Livestock and Grazing ..... 26
2.6 Waterfowl and WaterBirds ..... 27
3.0 Discussion and Conclusions ..... 28
3.1 Foraging Habitat ..... 30
4.0 References ..... 34

## LIST OF APPENDICES

APPENDIX A: Results of 2012 Prey Base Assessment Surveys

# EXECUTIVE SUMMARY

Power Company of Wyoming LLC (PCW) is developing a proposed 1,000-turbine wind energy project in Carbon County, Wyoming, which has some of the best wind resources in the nation—Class 6 and 7—along with buildable terrain. The proposed Chokecherry and Sierra Madre Wind Energy Project (the Project) will generate 2,000–3,000 megawatts of clean, renewable wind energy, and is exactly the type of large-scale renewable energy development that the Administration has said is crucial to help transform America's energy economy.

The Project Site itself is divided into two wind turbine development areas (WDAs) referred to as Chokecherry and Sierra Madre. Chokecherry is the wind development area located in the northern portion of the Project Site (Chokecherry WDA). Sierra Madre is the wind development area located in the southern portion of the Project Site (Sierra Madre WDA) (collectively WDAs). The significance of the WDAs is that these are the only areas in which PCW will install wind turbines. There will be no wind turbines sited outside the WDAs. Moreover, within the WDAs there are areas of "likely turbine development." Thus, there are areas within the WDAs where PCW is not planning on siting turbines (turbine no-build areas).

The Service, in January 2011, released the Draft Eagle Conservation Plan Guidance (Draft ECP Guidance) that describes a process for wind energy developers to utilize in preparing an Eagle Conservation Plan to assess the risk of projects to eagles and assess how siting, design, and operational modifications can mitigate that risk. The Draft ECP Guidance calls for scientifically rigorous surveys, monitoring, assessment, and research designs proportionate to the risk to eagles.

The ECP addresses collision risk to eagles through: (1) identifying high eagle use areas through field surveys and radar; (2) identifying and understanding important foraging areas and connecting corridors; and (3) assessing the status of the resident eagle population as well as migrants and floaters. These areas and parameters are identified using the data collected in Stage 2 of the Draft ECP Guidance. In its Draft ECP Guidance, the Service defines important eagle use areas as an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles.

In August 2012 PCW submitted to the Service an Eagle Conservation Plan for the Project (ECP) that provides data on the important eagle use areas that are in proximity to the Project Site, including foraging areas and connecting corridors. Surveys and analyses were conducted by SWCA Environmental Consultants (SWCA) under contract to PCW to determine locations and abundance of potential eagle prey species in the vicinity of the Project Site and surrounding landscapes and to assess the potential of such prey species to support resident and non-resident eagles and other raptor species. This report details the results of those surveys and analyzes and supplements the ECP.

Based upon field surveys and data analysis, SWCA has concluded that:

a) Likely eagle prey items in the vicinity of the Project include white-tailed prairie dogs, waterfowl, waterbirds, greater sage-grouse, big game and lagomorphs.

b) Analyses of eagle observations indicate that foraging behavior is rare in the WDAs.

c) Highest availability of prey base for eagles and other raptors occurs outside of the WDAs and eagle use in the WDAs is more characteristic of movement between nesting and roosting or foraging locations.

d) The findings presented in SMITH (2010) are not consistent with published densities of white-tailed prairie dog burrows, WGFD's mapped colonies, the findings of WEST (2008), or the observations by SWCA and BLM biologists.

e) Based on the mapping efforts of WGFD, the conclusions made in WEST (2008) and the results of surveys completed by SWCA (Appendix A), the results of SMITH (2010) are fatally flawed and should not be relied upon.

f) There are a number of species available as prey base for eagles and other raptors within the vicinity of the Project Site; however, none of these species occur at the necessary densities required to consistently attract eagles within the Project Site or the immediate surrounding area. Because of the dispersed patterns of prey density, the most likely foraging locations for eagles occur where the distribution of multiple prey items overlap.

g) Most of the prey base occurs within the Central Basin and along the North Platte River corridor (outside the WDAs), with very limited and dispersed foraging opportunities available outside of these two areas. This is consistent with known nesting areas for eagles in the vicinity of the Project Site. Within the Central Basin, available prey base includes white-tailed jackrabbit, desert cottontail, white-tailed prairie dog, Wyoming ground squirrel, big game and waterbird species. Collectively, these prey resources are diffuse, scattered and/or limited and likely only represent opportunistic foraging opportunities for eagles; therefore they are not important eagle use areas as defined by the Draft ECP Guidance. Outside of the Central Basin (Chokecherry Plateau and Miller Hill) and Platte River corridor, the dispersed distribution of prey species represent only opportunistic foraging potential.

h) White-tailed prairie dog burrow densities are at the lower end of the range of conditions reported for other white-tailed prairie dog colonies (Menkens et al. 1987, Clark and Stromberg 1987), supporting the conclusion that the Bolten Complex provides small, scattered pockets of prairie dogs that likely provide only dispersed, opportunistic foraging potential for raptors and eagles.

i) Eagle and raptor foraging opportunities associated with white-tailed prairie dogs is low across the Project Site based upon (i) the best available scientific data for the Project (WEST 2008, SWCA 2012), (ii) the location of the highest population densities outside of areas of likely turbine development, and (iii) seasonal absence during hibernation between approximately August and March.

j) Wyoming ground squirrel colonies are unlikely to achieve the necessary densities required to consistently attract eagles and to support golden eagle nesting populations due to the restrictive activity schedule and colony structure of Wyoming ground squirrels and; therefore, are at best a secondary prey item.

k) Leporids within the Project Site likely represent a quality food source for eagles; however, due to leporid's mainly crepuscular habits and the diffuse nature of leporid populations across the many habitats within the Project Site, they are likely taken as prey opportunistically, albeit regularly, by eagles and other raptors. There are no known areas that concentrate leporid populations in the Project Site or vicinity.

l) There are no big game parturition areas within the Project Site or vicinity.

m) Winter eagle activity is low where prey and scavenging opportunities are infrequent.

n) In the vicinity of the Project, winter eagle use is closely tied to the availability of winterkill carcasses along area highways.

o) The Project Site was converted from a sheep to a cow-calf and yearling operation in 1996 dramatically decreasing potential foraging opportunities for eagles as cattle are not taken by eagles, and domestic calves are far less likely to be preyed upon than sheep or lambs.

p) Waterfowl and waterbirds provide seasonal foraging opportunities for eagles at the four reservoirs (Kindt, Rasmussen, Sage Creek, and Teton) located in the vicinity of the Project Site, as well as along the North Platte River corridor. This foraging source is available from early spring through late fall in periods when the reservoirs and the river are ice-free; however, the highest concentration of waterbird species in the vicinity of the Project Site occurs during the fall when nesting is completed and adults and juveniles of many species aggregate on the reservoirs to prepare for southerly migration.

q) PCWs identified turbine no-build areas provide movement corridors within and between WDAs that provide connections between foraging areas.

r) PCW's Project re-design which avoids high eagle use areas will avoid and minimize take of eagles and other raptors foraging within the Project Site.

# 1.0 INTRODUCTION

## 1.1 PROJECT BACKGROUND

Power Company of Wyoming LLC (PCW) is developing a proposed 1,000-turbine wind energy project in Carbon County, Wyoming, which has some of the best wind resources in the nation—Class 6 and 7—along with buildable terrain. The Project will generate 2,000–3,000 megawatts of clean, renewable wind energy, and is exactly the type of large-scale renewable energy development that the Administration has said is crucial to help transform America's energy economy.

Since the 1990s, Anschutz subsidiary and PCW affiliate The Overland Trail Cattle Company LLC (TOTCO), has owned and operated one of the largest cattle ranching and agricultural operations in the West. Located south of Rawlins and Sinclair in Carbon County, Wyoming and headquartered in Saratoga, the Overland Trail Ranch (the Ranch) encompasses approximately 320,000 acres or 500 square miles. The Ranch is located in "checkerboard" country, in which land ownership alternates between private lands (mostly owned by TOTCO) and federal lands managed by the Bureau of Land Management (BLM). A small portion of Wyoming State Land Board and Wyoming Game and Fish Department (WGFD)-managed lands (collectively state lands) are also located within the Ranch boundary. TOTCO runs an open range cow-calf and yearling cattle operation on the Ranch and has been a part of the Carbon County community and a steward of the land and wildlife resources on the Ranch for over 15 years.

In 2007 and 2011, TOTCO granted PCW a wind easement, access easement, transmission easement and other non-exclusive rights with respect to TOTCOs privately-owned land on the Ranch. Although the Project is proposed on a portion of the Ranch, it will result in less than 1% long-term surface disturbance, leaving more than 99% of the Ranch's existing vegetation communities intact and available for wildlife management, conservation and mitigation of Project impacts.

The Project Site is located within the Ranch boundary but excludes the western most portions of the Ranch on top of Miller Hill and areas east of the North Platte River (Figure 1). The Project Site in relation to the Ranch boundary is shown in Figure 1 as well. The Chokecherry Wind Development Area (WDA) portion of the Project Site is located in the northern third of the Ranch while the Sierra Madre WDA portion of the Project Site is located in the southern third of the Ranch (Figure 1). The Project Site expressly excludes any part of the (1) designated core sage-grouse population area identified by the State of Wyoming under the Governor's Executive Order 2011-5 (EO 2011-5 Version 3 map) and (2) the Red Rim-Grizzly Wildlife Habitat Management Area (Red Rim-Grizzly WHMA) identified by BLM in the Final Environmental Impact Statement for the Project (FEIS).

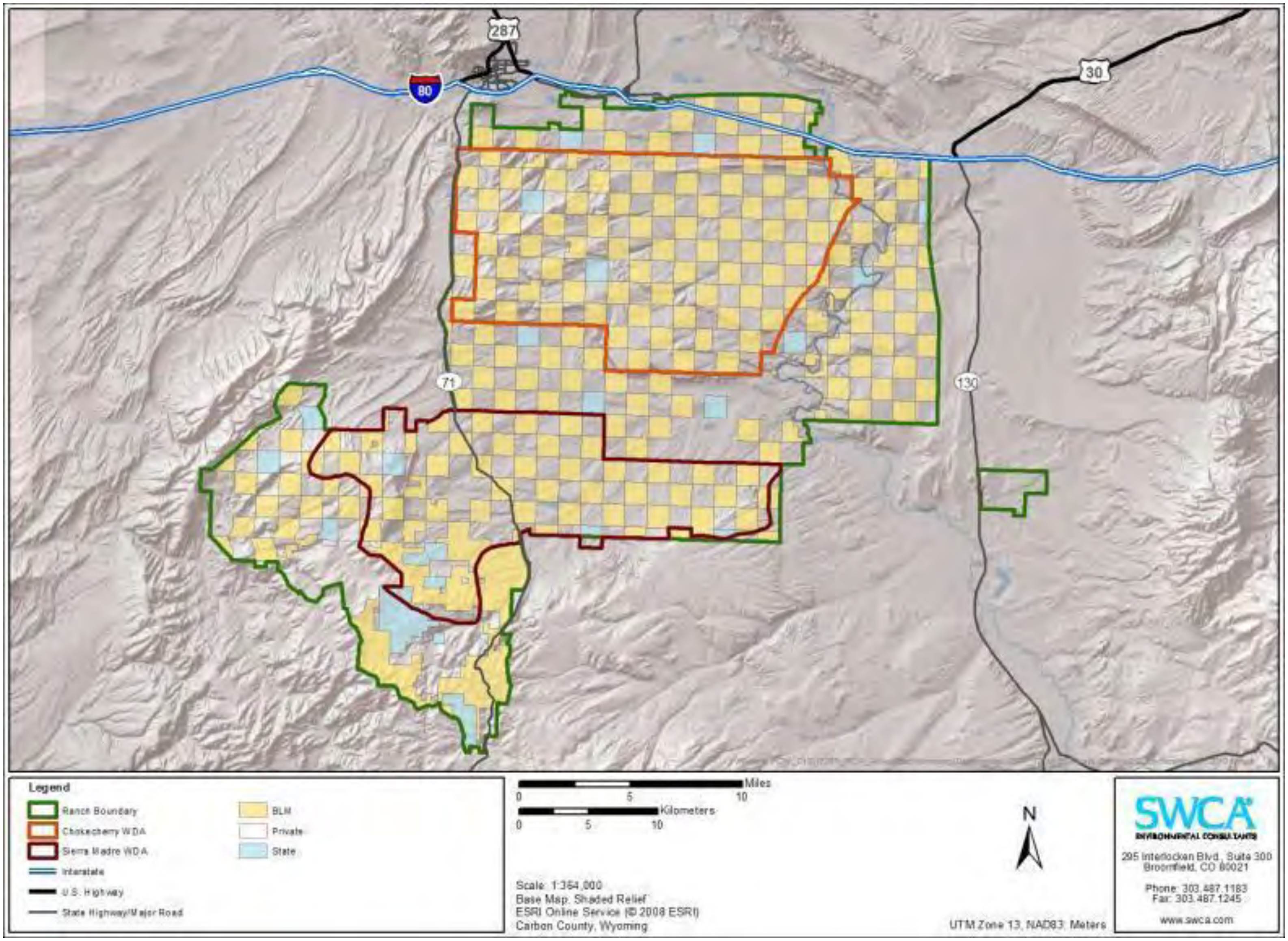


**Figure 1. Ranch boundary, Chokecherry and Sierra Madre WDAs, and land ownership.**

### 1.1.1 Physiographic Setting

The Ranch is dominated by three topographic features, Miller Hill, Chokecherry Plateau, and Sage Creek Rim, separated by a Central Basin (Figure 2). To the north, Chokecherry Plateau consists of ridges and rolling hills that generally slope northeasterly downward to the North Platte River. Approximately 25 miles of the North Platte River flow along the eastern edge of Chokecherry. Most of the northern portion of Chokecherry is defined by a small, east/west ridge commonly known as the Hogback, which is approximately 10 miles long, and the southern portion is defined by a cliff edge commonly referred to as the Bolten Rim, which is approximately 20 miles long. A prominent north/south ridge cut by three ephemeral drainages, Smith Draw, Hugus Draw, and Iron Springs Draw, bisects Chokecherry for approximately 12 miles.

The southwestern portion of the Ranch is dominated by a steep-sloped mesa commonly known as Miller Hill. This predominant feature slopes gently toward the south and southwest, with relatively level terrain near the edge of the rim and becoming increasingly undulated towards the southwest. Only a small portion of Miller Hill is within the Project Site.

The southeastern portion of the Ranch includes Sage Creek Rim, which has similar characteristics to Miller Hill, although this feature is not as large or high. Only a small portion of the top of the Sage Creek Rim is within the Project Site.

The area between these features (Central Basin) is a high desert basin transected by Sage Creek and several smaller ephemeral tributaries. Much of this basin is outside the WDAs; however, the Project haul road and internal transmission line will traverse the Central Basin and interconnect the WDAs. Larger waterbodies, which include Kindt, Rasmussen, Sage Creek, and Teton Reservoirs, are interspersed throughout this arid landscape.

Surface geology on the Ranch is predominantly Quaternary alluvium and colluvium, outwash, and eolian deposits derived from Tertiary and Cretaceous claystone, sandstone, and sedimentary rock (Chapman et al. 2004). The Chokecherry WDA is covered primarily by residuum, slopewash, and colluvium landforms, while the majority of the Sierra Madre WDA is covered by residuum landforms (Case et al. 1998).

Soils are developed from a wide variety of parent material derived from sedimentary and igneous origins, which include alluvium and residuum of limestone, sandstone, and shale, and colluvium of granite (NRCS 2004). Subsurface textures are predominantly loamy or sandy soils, while surface textures range from silty clays to coarse sands. Many physiographic features occur throughout the Ranch, but dominant features are hills, ridges, escarpments, plateaus, stream terraces, and alluvial fans (NRCS 2004).

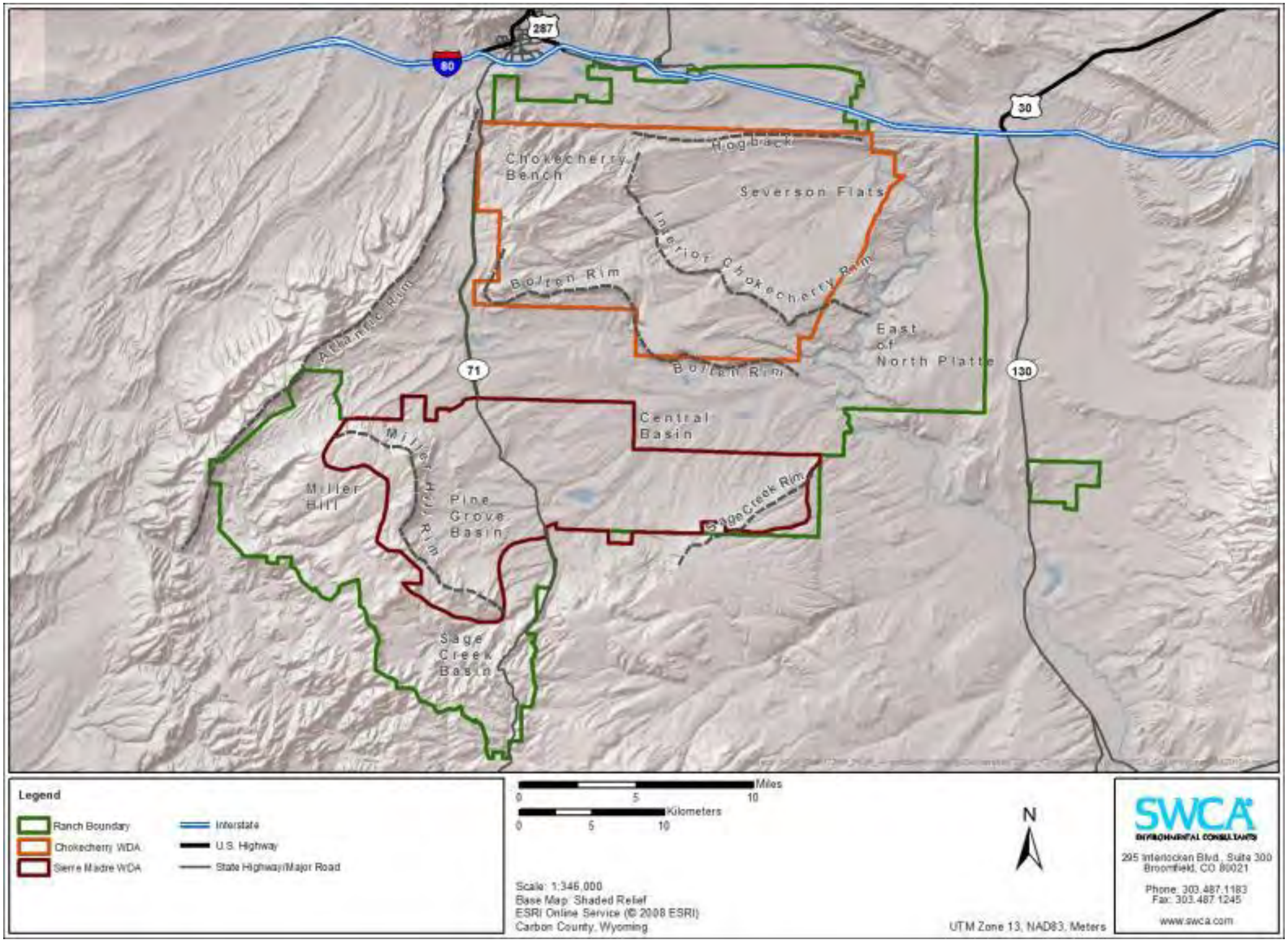


**Figure 2. Topographic features throughout the Ranch.**

### 1.1.2 Vegetation

PCWs consultant, SWCA Environmental Consultants (SWCA), did extensive field mapping and vegetation classification on the Ranch. SWCA surveyed vegetation on the Ranch at 500 randomly selected 50-meter transects in 2009. Dominant vegetation classes and associated plant communities were characterized, and detailed measurements of vegetation structure (e.g., canopy cover, canopy height, understory height) were collected. Using the field survey data, aerial imagery, and remote sensing, SWCA developed a detailed 4-meter resolution vegetation classification for the Ranch and a 3-mile buffer around the Ranch (Figures 3 and 4). Thirteen vegetation classes were created to capture the diversity of the landscape. The vegetation mapping was further confirmed through comparison to BLM vegetation mapping.

Vegetation cover is typical of Wyoming Basin and Southern Rockies ecoregions, defined by rolling sagebrush steppe, salt desert shrub basins, and foothill shrublands (Chapman et al. 2004). Rolling sagebrush steppe communities are dominated by various densities of Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*) and mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) at higher elevations, with areas of silver sagebrush (*Artemisia cana*) in the lowlands and black sagebrush (*Artemisia nova*) and low sagebrush (*Artemisia arbuscula*) in exposed, rocky soils (Figures 3 and 4).

Sagebrush steppe communities are interspersed with bunchgrass/rhizomatous grass communities and allied shrubs, and generally have relatively low forb cover. Salt desert shrub basins are characterized by sparse vegetation cover of cushion plant communities with dominant shrub cover of Gardner's saltbush (*Atriplex gardneri*), shadscale (*Atriplex confertifolia*), and black greasewood (*Sarcobatus vermiculatum*). Perennial streams throughout salt desert shrub basins are typically surrounded by basin big sagebrush (*Artemisia tridentata ssp. tridentata*) and riparian communities dominated by willows (*Salix spp*.), sedges (*Carex spp.*), and rushes (*Juncus spp.*). Foothill shrubland communities are dominated by montane deciduous shrubland consisting of mountain big sagebrush, snowberry (*Symphoricarpos spp.*), serviceberry (*Amelanchier spp.*), and mountain mahogany (*Cercocarpus spp.*), surrounded by extended groves of quaking aspen (*Populus tremuloides*), low-growing common juniper (*Juniperus communis*), and patches of limber pine (*Pinus flexilis*).

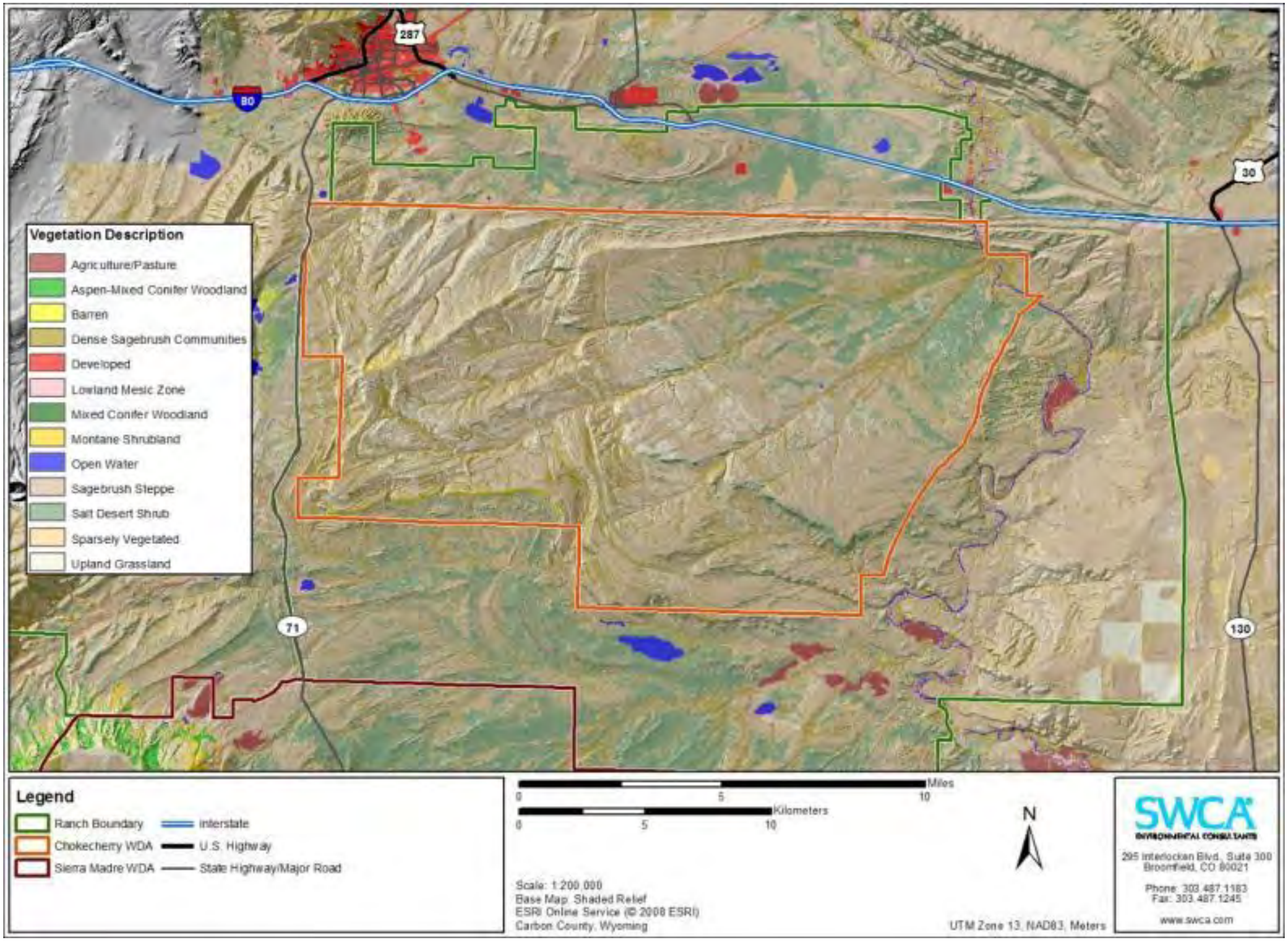


**Figure 3. Chokecherry vegetation cover.**

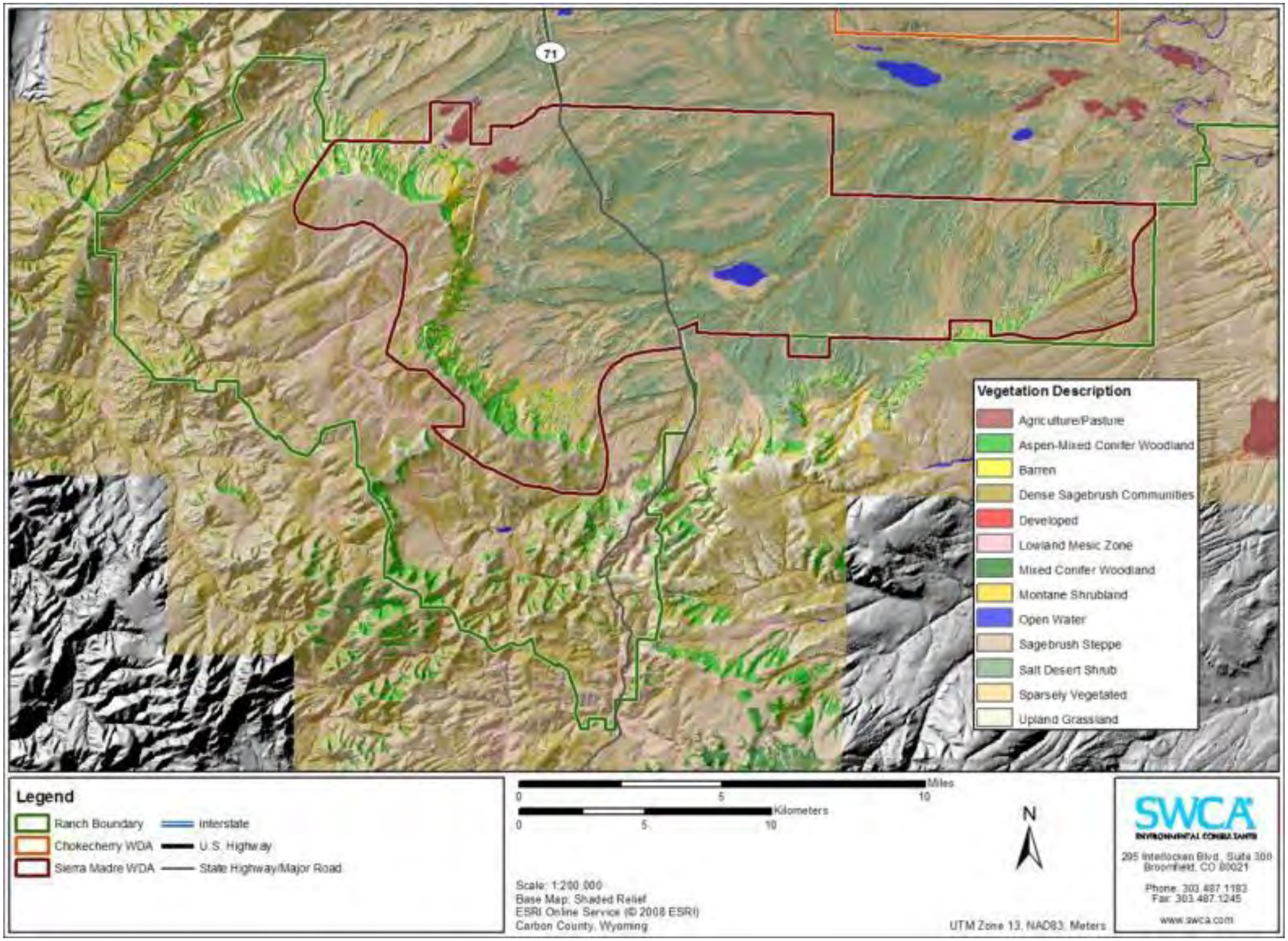


**Figure 4. Sierra Madre vegetation cover.**

## 1.2 DRAFT EAGLE CONSERVATION PLAN GUIDANCE

The U.S. Fish and Wildlife Service (Service), in January 2011, released Draft Eagle Conservation Plan Guidance (Draft ECP Guidance) to "provide a 'road map' for Service employees and industry to use for the type of analysis and science that should be considered in a robust permit application to provide flexibility to the wind energy industry while safeguarding wildlife."

The Draft ECP Guidance describes a process for wind energy developers to utilize in collecting and analyzing information that could lead to a programmatic permit under the Bald and Golden Eagle Protection Act (BGEPA) to authorize incidental take of eagles at wind energy facilities. The purpose of using the process in preparing an ECP is to assess the risk of projects to eagles and assess how siting, design, and operational modifications can mitigate that risk.

The Draft ECP Guidance calls for scientifically rigorous surveys, monitoring, assessment, and research designs proportionate to the risk to eagles. The ECP should: (a) document early pre-construction assessments to identify important eagle use areas; (b) document a commitment to avoiding, minimizing, and/or mitigating for potential adverse effects to eagles; and (c) document procedures to monitor for impacts to eagles during construction and operation.

The Service recommends that ECPs be developed in five stages. Each stage builds on the prior stage, such that together the process is a progressive, increasingly intensive analysis of the likely effects of the development and operation of a particular site and configuration on eagles. The Draft ECP Guidance recommends that at the end of each of the first four stages, project proponents determine which of the following categories the project, as planned, falls into: (1) high risk to eagles, little opportunity to minimize effects; (2) high to moderate risk to eagles, but with an opportunity to minimize effects; (3) minimal risk to eagles; or (4) uncertain.

The five-stage approach for developing an eagle conservation plan is set out below:

- Stage 1 – Identify potential wind energy facility locations with manageable risk to eagles at the landscape level.
- Stage 2 – Obtain site-specific data to predict eagle fatality rates and disturbance take at wind facility sites that pass Stage 1 assessment.
- Stage 3 – Conduct turbine-based risk assessment and estimate the fatality rate of eagles for the facility evaluated in Stage 2, excluding possible advanced conservation practices (ACPs).
- Stage 4 – Identify and evaluate ACPs that might avoid or minimize fatalities identified in Stage 3. When required to do so, identify compensatory mitigation necessary to reduce any remaining fatality effect to a no-net-loss standard.

- Stage 5 – Document annual eagle fatality rate and disturbance effects. Identify additional ACPs to reduce observed level of mortality, and determine if initial ACPs are working and should be continued. When appropriate, monitor effectiveness of compensatory mitigation.

In Stage 2 of the Draft ECP Guidance, project proponents are to collect detailed, site-specific information on eagle use of the specific sites that passed review in Stage 1. The information collected in Stage 2 is used to generate predictions of the annual number of fatalities for the Project (Stage 3) and to identify important eagle use areas likely to be affected by the Project.

In its Draft ECP Guidance, the Service defines important eagle use areas as an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles. PCW's Eagle Conservation Plan (ECP) describes the important eagle use areas that are in proximity to the Project Site.

The following sections in this report identify the potential prey species identified within the WDAs, Ranch, and surrounding landscapes and describe their potential for supporting resident and non-resident eagles and other raptor species. The analyses of the datasets presented in this report are used to inform the identification of important eagle use areas as part of Stage 2 of the Draft ECP Guidance. The data also help to inform Project siting, avoidance and minimization measures, and advanced conservation practices that have been identified in the ECP for the Project.

## 1.3 INFLUENCE OF PREY BASE ON GOLDEN EAGLES

Golden eagles (*Aquila chrysaetos*) in North America feed primarily on mammalian prey (80-90%) and secondarily on birds, while other taxa (e.g., reptiles, fish) are minor components of golden eagles' overall diet (Olendorff 1976). Within the mammalian category, leporids (e.g., rabbits and hares) and sciurids (e.g., prairie dogs, ground squirrels, marmots) comprised 49-94% of prey items reported by 24 studies in the western U.S. (as compiled in Kochert et al. 2002). However, there is regional variation in the relative importance of these two mammalian groups and even within each group (Kochert et al. 2002). Beebe (1974) also noted that some North American golden eagle nesting populations have a predator-prey association with at least one species of lagomorph, most commonly rabbits and hares. Other western U.S. studies published since Kochert et al. (2002) have also noted the predominant proportion of lagomorphs in golden eagle populations (87% of mammalian prey in Stahlecker et al. 2009; an "overwhelming proportion" of diet in Preston 2011, p. 12).

A 23-year study in southwestern Idaho found a positive correlation between golden eagle reproduction and jackrabbit abundance (Steenhof et al. 1997). In southwestern Idaho, golden eagles preferentially hunted in jackrabbit habitat during the non-breeding season and in proportion of availability during the breeding season (Marzluff et al. 1997). In eastern Utah, golden eagle nest productivity was positively correlated with rabbit abundance (Bates and Moretti 1994). A similar predator-prey feedback association is suspected for a decline in golden eagle breeding numbers and nest success rates with a decrease in the lagomorph population in the Bighorn Basin of northern Wyoming (Preston 2011).

A literature review for studies related to eagle productivity and white-tailed prairie dogs (*Cynomys leucurus*) or Wyoming ground squirrel (*Urocitellus elegans*) abundance resulted in zero publications. The majority of published papers pertain to eagle-lagomorph studies, suggesting that dispersed prairie dog colonies such as those in the Project Site and other sciurid populations cannot support nesting eagle populations and are, at best, a secondary prey item. This is further supported by the short seasonal availability and variable diurnal availability of Wyoming ground squirrels and white-tailed prairie dogs as potential prey items. Both species hibernate between approximately late July and early April (Fitzgerald et al. 1994, Clark and Stromberg 1987) and exhibit distinct diurnal use patterns during hot periods of the summer when they spend much of the daylight hours below ground (Fitzgerald et al. 1994, Clark and Stromberg 1987.

Few studies have assessed composition of prey items in the diets of golden eagles in Wyoming. A review of these studies indicates that leporids, primarily white-tailed jackrabbit (*Lepus townsendii*) and cottontails (*Sylvilagus* sp.), consistently ranked as primary prey species (MacLaren et al. 1996, Phillips and Beske 1990). Leporids comprised 40% of prey taken (and 62% of total biomass) by golden eagles near Medicine Bow (MacLaren et al. 1996), followed by prairie dogs (27% of prey, 18% of biomass), and ground squirrels (18% prey, 5% biomass). Phillips and Beske (1990) found that white-tailed jackrabbits were the most important prey species for golden eagles in Carbon and Converse counties. Deblinger and Alldredge (1996) specifically report on golden eagles preying on pronghorn (*Antilocapra americana*) on multiple occasions in the Great Divide Basin north of Rawlins. The authors note that prey species frequently taken by golden eagles in this region also included white-tailed jackrabbits, desert cottontails (*Sylvilagus audubonii*) and greater sage-grouse (*Centrocercus urophasianus*) (as cited from U.S. Dept. of Interior 1978).

Since 2008, several efforts have focused on identifying and characterizing potential eagle and raptor prey species in the Project Site (Western EcoSystems Technology, Inc. [WEST] 2008, 2008b; Smith Environmental and Engineering [SMITH] 2010; SWCA 2012, *unpublished data* [Appendix A]). In addition to these Project Site-specific survey efforts, the BLM and WGFD maintain datasets related to potential prey species. These efforts and datasets provide information necessary to identify the types of available prey and their distribution across the Project Site, Ranch, and surrounding areas.

Based on the results of these efforts, prey species potentially available within the Project Site and surrounding areas reflects the prey species that have been identified for other regions in Wyoming. White-tailed prairie dogs, leporids (white-tailed jackrabbits and cottontails), waterfowl and waterbirds, big game species, Wyoming ground squirrels, and greater sage-grouse all occupy portions of the Project Site, Ranch, or surrounding landscape. With the exception of greater sage-grouse, the status of these species within the Project Site and foraging areas that represent important eagle use areas are identified in the following sections. Greater sage-grouse are not reviewed in this assessment as a separate review has been completed specifically for sage-grouse (SWCA 2012) and incorporated into PCWs Greater

Sage Grouse Conservation Plan (August 2012). A copy of the Greater Sage-grouse Conservation Plan was provided to the Service on August 21, 2012.

### 1.4 INFLUENCE OF PREY BASE ON BALD EAGLES

Bald eagles (*Haliaeetus leucocephalus*) are considered an opportunistic feeder, but in most areas they preferentially prey on fish over other prey species (Bent 1937, Sherrod 1978, Stalmaster 1987). As a result, bald eagle densities are typically localized where fish are abundant (Johnsgard 1990), including inland lakes and waterways. Non-fish prey is typically dominated by other water-associated species such as ducks, gulls, and other waterfowl (Johnsgard 1990).

Bald eagles will prey upon land-based animals, although these occurrences are typically opportunistic and in the form of road kill and carrion. At inland locations, prey selection is seasonally biased when lakes and rivers are frozen in winter. For Wyoming's wintering eagle population, concentrated foraging habitats that generally support high prey densities include ice-free water bodies as well as areas with concentrations of big game or livestock (Service 2003). In the BLM Rawlins Field office, concentrated foraging habitats (e.g., ice-free water bodies, crucial ungulate winter ranges with high mortality, livestock stockyards) are not known to exist and foraging opportunities are often limited to scavenging events (i.e., road kill from vehicle collisions along roadways) (Service 2003).

## 2.0 SPECIES-SPECIFIC PREY BASE ASSESSMENTS

### 2.1 WHITE-TAILED PRAIRIE DOGS

Golden eagles and other raptors are known to prey on white-tailed prairie dogs (Campbell and Clark 1981); however, white-tailed prairie dogs are generally available as prey items only from about mid-March to late October (Keinath 2004) with most adults becoming unavailable beginning in late July as they enter their burrows (Fitzgerald et al. 1994, Clark and Stromberg 1987). Peak activity occurs from late May when juveniles emerge from burrows to late July when adult males begin to descend into burrows. Adult females descend two to three weeks later than males and emerge two to three weeks later in the spring. Juveniles begin to hibernate in late October or early November (Keinath 2004).

The state of Wyoming contains approximately 71% of the current national range of white-tailed prairie dog, a fossorial (burrowing) mammal that typically inhabits shrub-steppe and grassland assemblages in cool intermountain basins (Keinath 2004). Prairie dogs are known to provide habitat and forage for many other wildlife species including other BLM sensitive species, such as mountain plover (*Charadrius montanus*), western burrowing owl (*Athene cunicularia hypugaea*), swift fox (*Vulpes velox*), golden eagle, ferruginous hawk (*Buteo regalis*), and black-footed ferret (*Mustela nigripes*). The white-tailed prairie dog is a large ground squirrel (Family *Sciuridae*) that ranges in length between 33-38 cm (13-15 in) and generally weighs 0.8-1.5 kg (1.8-3.3 lbs). Habitat includes mid-elevation (approximately 1,150-3,050 meters above mean sea level) grasslands and shrublands with moderate slope (less than 20%). White-tailed prairie dogs inhabit higher elevation grasslands and shrub-steppe with more abundant shrub cover than its close relative, the black-tailed prairie dog (*C. ludovicianus*) (Campbell and Clark 1981). White-tailed prairie dogs are colonial, forming "towns" averaging 3.2 prairie dogs per hectare (Clark 1973). Unlike black-tailed prairie dogs that form tight colonies with clearly defined boundaries, white tailed prairie dogs form diffuse colonies of burrows comprised of amorphous fingers and clusters (Seglund et al. 2004).

White-tailed prairie dogs have experienced population declines in recent years and current occupancy estimates are commonly inflated because occupancy is generally based on historic data and pre-plague burrow distributions that are not indicative of current occupation (Keinath 2004, Seglund et. al 2004, Pauli et. al 2006). In 2010, the Service determined that the white-tailed prairie dog does not warrant protection as a threatened or endangered species under the Endangered Species Act (ESA) of 1973 because its overall distribution has not substantially changed and large acreages of occupied habitat exist across its range, particularly in Wyoming (Service 2010). In Wyoming, however, the white-tailed prairie dog remains listed as a sensitive species by the BLM.

Much of south-central Wyoming contains overlapping populations of several common fossorial mammal species which may potentially create challenges when attempting to delineate white-tailed prairie dog towns. Other burrowing mammals that create burrows similar to white-tailed prairie dogs include Wyoming ground squirrel (*Urocitellus elegans*), American badger (*Taxidea taxus*), and pocket gophers (*Thomomys* spp.). The burrows and activity of each species are often misidentified so it is important to understand the primary differences between fossorial mammal species and their burrowing behavior to ensure that each species is correctly identified, and occupancy and burrow densities are accurately described. Wyoming ground squirrels inhabit diffuse colonies of low density burrows and can use several habitat types from open ground to tall sagebrush. Pocket gophers are solitary with a complex burrow system that rarely overlaps other individuals. Burrow systems typically contain tubular tunnels near the surface and larger mounds with covered burrow entrances. American badgers are a wide ranging mustelid with a propensity for burrowing in a variety of soil types. They tend to have several dozen burrows spread across their range that are occupied in a rotational pattern. American badgers feed upon the smaller fossorial mammals by visiting colonies and excavating burrows.

### 2.1.1 White-tailed Prairie Dog Occurrences in the Project Site

White-tailed prairie dog occurrences have been documented within the Project Site. The Bolten Ranch Complex (hereafter Bolten Complex) is one of several areas in the State of Wyoming that has not yet been block cleared for black-footed ferrets. Numerous prairie dog colony mapping and surveys have occurred in the vicinity of the Project Site. The majority of those surveys have identified small areas of low-density dispersed use (WEST 2008, SWCA 2012, WGFD spatial data per BLM) while one survey (SMITH 2010) found large areas of fossorial mammal activity. The findings in SMITH (2010) are in conflict with the other scientific surveys in the vicinity of the Project Site and are not representative of potential eagle prey-base availability.

WGFD provided initial maps of white-tailed prairie dog colonies in the Bolten Complex from data collected in approximately the year 2000 (Figure 5, Heath Cline, BLM Rawlins Field Office Biologist, personal communication). These mapping efforts identified several active prairie dog colonies at the base of the Bolten Rim near Teton and Kindt reservoirs and in the Central Basin north of Sage Creek.

WEST collected general wildlife data beginning in 2008 as part of their baseline wildlife surveys for the Project Environmental Impact Statement (WEST 2008). WEST reported that virtually all potential prairie dog habitat within the original Sierra Madre WDA was incidentally searched while conducting mountain plover surveys, greater sage-grouse brood surveys, or during travel for avian point counts. In addition, two areas of potential prairie dog activity were identified near proposed transportation and power line corridors between the Chokecherry and Sierra Madre WDAs in the Central Basin.

WEST (2008, p.5) concluded that "there is no physical evidence to suggest that colonies within the 'non block-cleared' areas of the project boundaries ever supported anything but small, perhaps ephemeral, scattered pockets of prairie dogs and would be of poor quality for black-footed ferrets." WEST (2008) noted that the Central Basin between the WDAs does support prairie dog colonies and that two general areas of colonies may exceed 1,500 and 2,000 acres, respectively. They further noted that burrows in those two areas were scattered in distribution. These areas correspond to those that were identified by WGFD (Figure 5) along the Bolten Road. WEST's findings are consistent with the incidental observations that have been made as part of other wildlife surveys within the Project Site and are consistent with active burrow mapping completed by SWCA in 2012 and described in Appendix A and in subsequent sections of this Report. SWCA began recording incidental observations of all wildlife species within the Project Site beginning in 2009. SWCA has recorded very few observations of prairie dogs with the majority of those observations occurring in areas along the Bolten Road south of the Chokecherry WDA. No recorded observations of prairie dogs have been made in the Miller Hill area of the Sierra Madre WDA by SWCA since it first began work in the Project Site in 2009.

In 2010, BLM contracted SMITH to perform burrow mapping as part of efforts related to block clearances for black-footed ferret. The report issued by SMITH as part of this effort (SMITH 2010) present burrow densities (the report does not note what types of burrows SMITH counted in their densities) and give no indication of activity level, burrow condition or size, or observed use by white-tailed prairie dog. SMITH (2010) concludes that the Bolten Complex consists of suitable habitat characteristics for reintroduction of the black-footed ferret. This conclusion is based on identification of 198 white-tailed prairie dog colonies that comprised, in part, one complex (7-kilometer [km] criterion; Biggins et al. 1993) and two sub-complexes (1.5-km criterion; Biggins et al. 2006).

SMITH's assessment contradicts the WGFD mapped active white-tailed prairie dog colonies and the findings of WEST who concluded that "there is no physical evidence to suggest that colonies within the 'non block-cleared' areas of the project boundaries ever supported anything but small, perhaps ephemeral, scattered pockets of prairie dogs and would be of poor quality for black-footed ferrets." Additionally, the burrow densities calculated in the SMITH (2010) report exceed those reported for Wyoming in the literature (Menkens et al. 1987, Clark and Stromberg 1987) in many cases by several orders of magnitude. SMITH (2010) reports an average burrow density across the Bolten Complex of approximately 45 burrows per acre. In one case, SMITH (2010) reports an average burrow density of 1,353 burrows per acre. These extremely high values are in contrast to other published values for white-tailed prairie dog burrow densities of less than 15 per hectare (6 per acre) (Clark and Stromberg 1987).

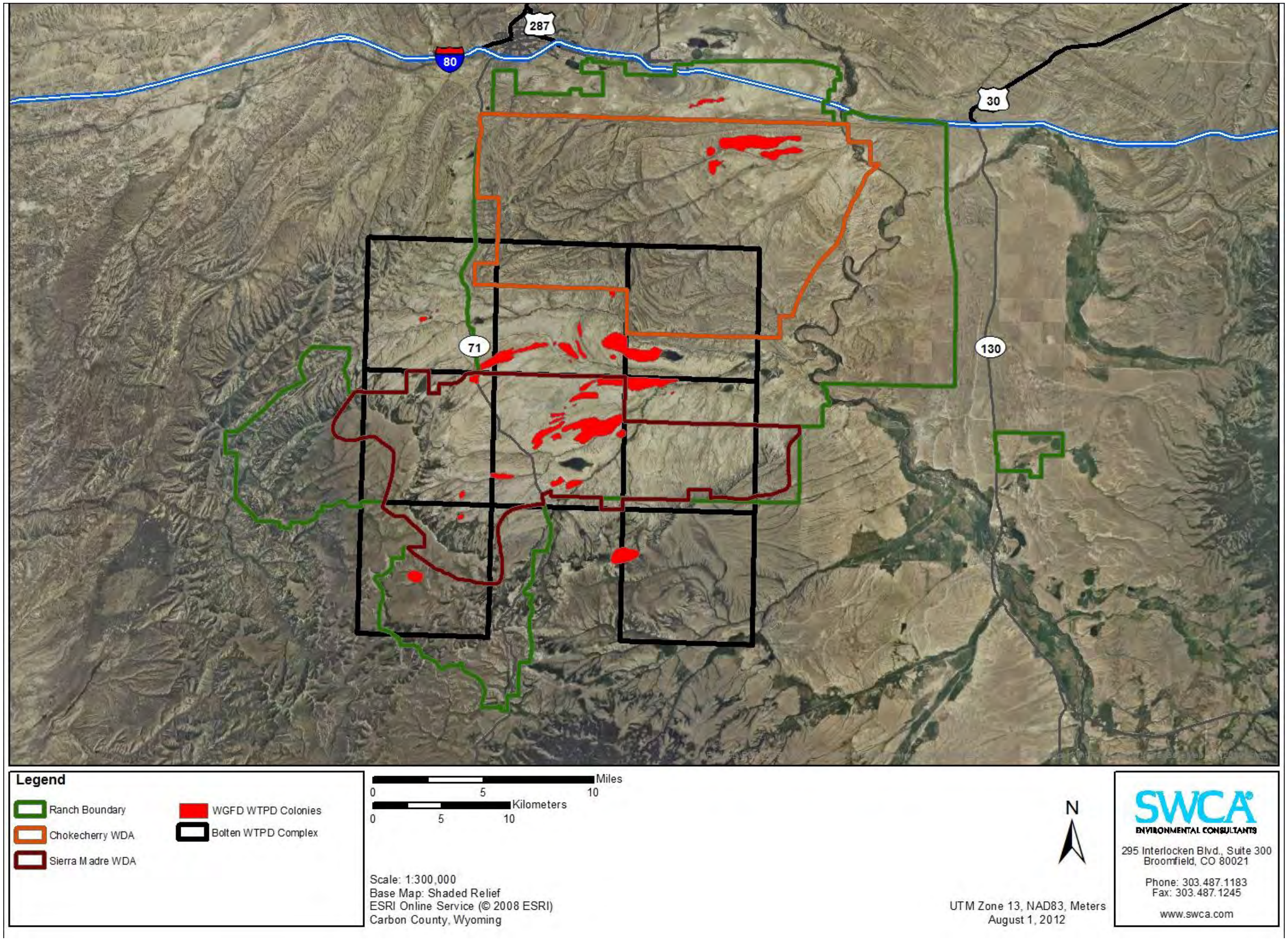


**Figure 5. White-tailed prairie dog colonies in and surrounding the Bolten Complex (WGFD 2000).**

The findings presented in SMITH (2010) are not consistent with published densities of white-tailed prairie dog burrows, WGFD's mapped colonies, the findings of WEST (2008), or the observations by SWCA and BLM biologists (Heath Cline, BLM Rawlins Field Office, personal communication). Due to these inconsistencies, SWCA initiated data collection efforts in 2012 to evaluate burrow densities in the polygons identified in SMITH (2010) to better characterize white-tailed prairie dog use across the Project Site (Appendix A, Figure 3).

Initially, SWCA conducted a full Project Site reconnaissance to formally assess the potential accuracy of the SMITH (2010) data and conclusions. An SWCA biologist evaluated 27 sites located with the polygons identified in SMITH (2010) Reconnaissance level surveys consisted of locating burrows, determining current or historical use (recent diggings, old or recent scat), recording presence of any small mammals in the area, and measuring burrow entrance diameters to aid in species identification. Appendix A to this Report contains the methods and results of these survey efforts. Reconnaissance surveys identified much lower burrow densities and activity levels than those identified in SMITH (2010). Additionally, reconnaissance survey results indicated that much of the burrowing activity in areas identified as having white-tailed prairie dog activity in SMITH (2010) could be attributed to other species including Wyoming ground squirrels, badgers, or pocket gophers.

Because of the discrepancies between reconnaissance survey results and SMITH (2010) results as well as the contradictory conclusions between the WEST (2008) and SMITH (2010) reports, an expanded survey effort was initiated to better understand burrow densities and potential use of white-tailed prairie dogs and other prey species in the Project Site. A total of 74, 1,000 meter long and 6-meter wide transects (Appendix A, Figure 3) were surveyed within the SMITH (2010) polygons using the methods described in McDonald et al. (2011) and Biggins et al. (1993). All burrows encountered during survey efforts were recorded and categorized according to condition, activity level, and species. Total white-tailed prairie dog burrows ranged from 1.8 per acre on Miller Hill to 8.8 per acre along the Bolten Road just below the Bolten Rim (Table 1). All white-tailed prairie dog burrows encountered on Miller Hill were inactive. No sign of recent activity or individuals were observed in this portion of the Project Site. In addition, the majority of burrows that were identified were of poor quality with collapsed entrances and no sign of recent occupation.

Active white-tailed prairie dog burrow densities generally followed the same trends as total burrow densities discussed above but were substantially lower than total burrow density. Active burrows ranged from zero per acre in the higher elevations of Miller Hill and Sage Creek Rim areas to 3.3 active burrows per acre in the colonies along the Bolten Road just below the Bolten Rim (Table 1). These burrow densities are at the lower end of the range of conditions reported for other white-tailed prairie dog colonies (Menkens et al. 1987, Clark and Stromberg 1987), supporting the conclusion that the Bolten Complex provides small, scattered pockets of prairie dogs that likely provide only low foraging potential for raptors and eagles.

**Table 1. Burrow densities of white-tailed prairie dogs and other fossorial mammals throughout the Project Site.**

| Location | Transects (*n*) | Total WTPD burrows (burrows/acre) | | Active WTPD burrows (burrows/acre) | |
|---|---|---|---|---|---|
| | | Average | 95% CI | Average | 95% CI |
| Bolten | 26 | 9.0 | 2.1 | 2.6 | 1.4 |
| Central Basin | 29 | 7.1 | 2.5 | 1.6 | 2.0 |
| Miller Hill | 11 | 1.8 | 1.44 | 0.0 | - |
| Sage Creek Rim | 3 | 7.9 | 5.36 | 0.0 | - |
| Severson | 5 | 6.7 | 2.10 | 0.1 | 0.26 |

### 2.1.2 Assessment of White-tailed Prairie Dogs as Prey in the Project Site

Based on the mapping efforts of WGFD, the conclusions made in WEST (2008) and the results of survey efforts completed by SWCA (Appendix A), it is apparent that the results of SMITH (2010) are fatally flawed. The burrow densities reported by SMITH (2010) are orders of magnitude greater than the highest burrow densities observed during SWCA surveys, WEST (2008), and SWCA observations (2012) (Appendix A), and densities that are reported in the literature for white-tailed prairie dogs (Clark 1973, Clark and Stromberg 1987, Menkens et al. 1987, Keinath 2004). In many cases, the burrow densities reported by SMITH (2010) are higher than those reported for the closely related black-tailed prairie dogs which are known to form dense, social communities with high burrow densities and concentrated populations (Clark 1973, Campbell and Clark 1981, Severson and Plumb 1998, Seglund et al. 2004). The assumption that delineated prairie dog colonies in SMITH (2010) contain a viable prey source for golden eagles is not valid. Colony locations identified by WGFD and burrow densities in the Project Site as measured by SWCA and as reported by WEST (2008) are more representative of expected white-tailed prairie dog use and should be used as the best available scientific information to inform Project siting and identification of important eagle use areas.

Furthermore, burrow density of white-tailed prairie dogs is not reflective of actual population density (Menkens et al. 1987) and; therefore, should not be directly correlated with identification of important foraging areas. However, the equations provided in Menkens et al. (1987) do provide a method for roughly calculating the potential density of white-tailed prairie dogs across the Project Site to identify those areas that might provide some foraging opportunities for eagles and other raptors.

$$\boldsymbol{Prairie\ dog\ density\ per\ hectare\ = 3.77 + 0.09 * Burrow\ Density}, \ (\mathbf{r^2 = 0.47, F = 2.66, p < 0.05})$$

Based on both the active and total burrow densities presented in Table 1 and using the Menkens et al. (1987) equation to predict the density of white-tailed prairie dogs, mean white-tailed prairie dog density was calculated as 1.7 prairie dogs per acre (U95% CI = 1.74, L95% CI = -1.4). Maximum density was estimated at 1.85 prairie dogs per acre. The highest density would occur in the survey areas along the Bolten Road between the Chokecherry and

Sierra Madre WDAs and in the Central Basin outside of the turbine development area in the Sierra Madre WDA. The Menkens et al. (1987) equation predicts a minimum density of 1.53 prairie dogs per acre. The actual expected minimum density in the Project is 0 prairie dogs per acre as multiple areas were identified as not having prairie-dog burrows. These low- and no-density areas occur on Miller Hill and the Sage Creek Rim in the Sierra Madre WDA, the Central Basin in the Sierra Madre WDA, and on portions of Severson Flats in the northeast corner of the Chokecherry WDA. These density calculations are lower than those reported for other areas (Menkens et al. 1987, Fitzgerald et al. 1994, Clark and Stromberg 1987) and confirm that use in the Project Site is characteristic of dispersed and ephemeral occupation by white-tailed prairie dogs. These low occupation levels provide low foraging potential for eagles and raptors.

While the population evaluation provides adequate information to identify that prairie dog activity in the Project Site only provides opportunistic foraging opportunities for eagles, additional analyses were completed to identify which of the white-tailed prairie dogs colonies provide the best foraging opportunities. Although a number of white-tailed prairie dog colonies are delineated through the Project Site and in the immediate surrounding areas, most colonies are not active (historic colonies) or have population densities too low to support foraging eagles or other raptors. The relative quality of white-tailed prairie dog colonies in the Project Site was assessed at two levels: burrow density and burrow activity. First, colonies that had total burrow densities greater than 7.0 total burrows per acre (greater than the average burrow density reported in Clark and Stromberg 1987) were considered adequate size to provide some foraging activities for eagles. Nine white-tailed prairie dog colonies (37.5 percent of all mapped colonies) satisfied this criterion (Appendix A). However, not all of these colonies had active burrows. Activity for each of the nine white-tailed prairie dog colonies was assessed to determine if the colonies were active and, if active, whether they would provide some level of foraging opportunity for eagles and other raptors. An active-to-total burrow ratio was used as an index to determine overall activity of the largest white-tailed prairie dog colonies. All colonies with total burrow densities greater than 7.0 total burrows per acre and activity index greater than 0.15 (i.e., 15% of burrows are active) were identified as adequately active colonies able to support some foraging by eagles or other raptors. Three white-tailed prairie dog colonies (12.5 percent of all mapped colonies) satisfied these criteria (Figure 6). These three colonies correspond to those along the Bolten Road with the highest active burrow densities identified in Table 1.

The low foraging potential resulting from the low densities is further reduced by the seasonal aboveground use by white-tailed prairie dogs. The absence of white-tailed prairie dogs as a prey source for up to 8 months per year during their hibernation period suggests that this species is not a key forage source for golden eagles and other raptors for the majority of the year (roughly August to April) and is at best an opportunistic prey source.

Eagle and raptor foraging opportunities associated with white-tailed prairie dogs are low across the Project Site based upon (i) the best available scientific data for the Project (WEST 2008, SWCA 2012), (ii) the location of the highest white-tailed prairie dog population densities outside of areas of likely turbine development, and (iii) seasonal absence of white-tailed prairie dog during hibernation.

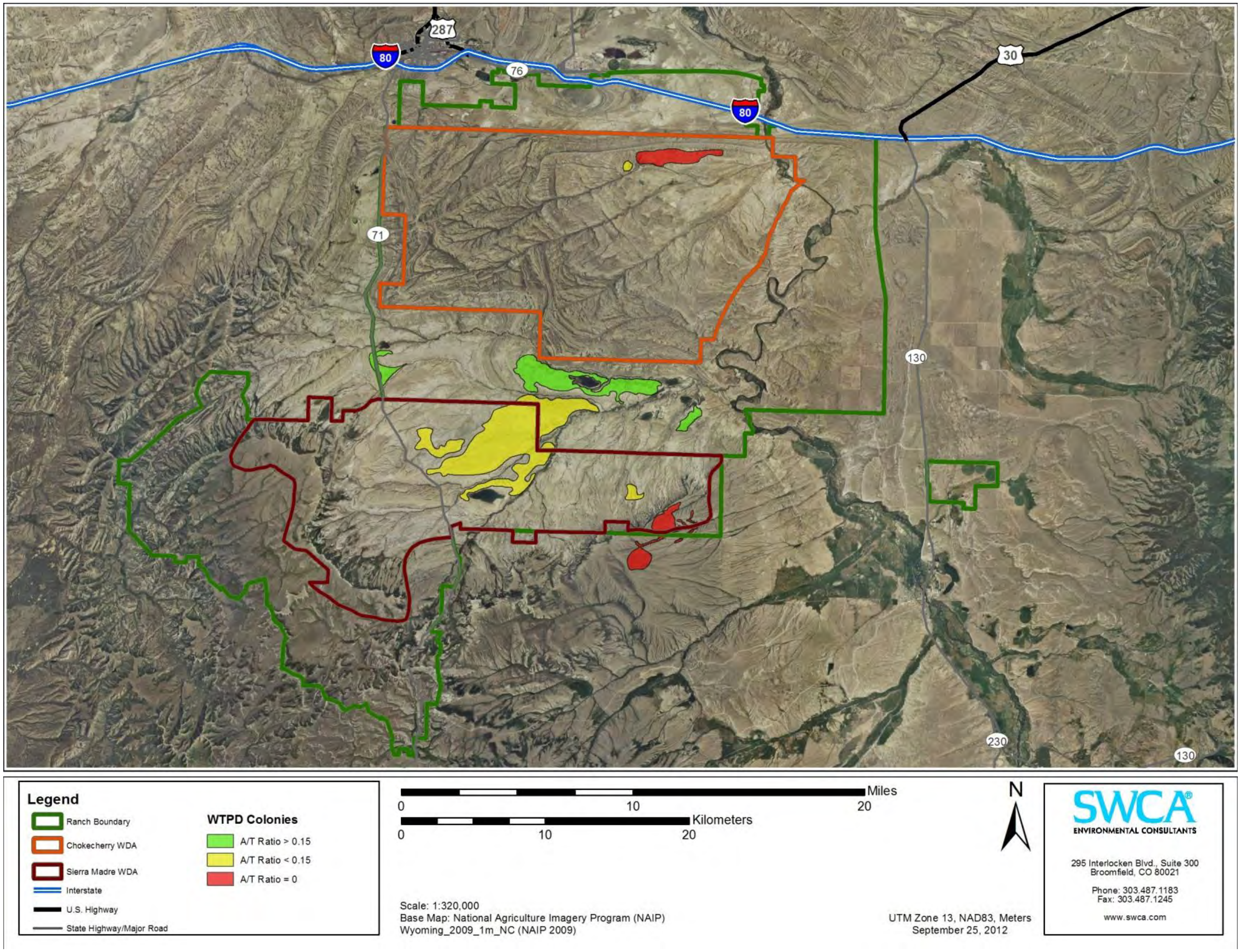


**Figure 6. Nine white-tailed prairie dog colonies with greater than 7.0 total burrows per acre (green colored polygons represent colonies with greater than 15% active burrows).**

## 2.2 WYOMING GROUND SQUIRREL

Wyoming ground squirrel occur throughout southern Wyoming and are a known prey item for golden eagles, although studies in Wyoming show they only comprise approximately 18% of the prey taken by golden eagles compared to 62% leporids and 27% prairie dogs (MacLaren et al. 1996). No additional studies on the predator-prey relationship of eagles and Wyoming ground squirrel were found.

Wyoming ground squirrel habitat includes grasslands and sagebrush with loose, deep soils. Other than eagles, predators include hawks, badgers, coyotes, bobcats, fox, weasels, and rattlesnakes. Ground predators may be a significant cause of Wyoming ground squirrel mortality (Zegers 1984). This species is one of the least social ground squirrels (Streubel 2000a). While Wyoming ground squirrels do live in colonies, in actuality these colonies are little more than loose groupings of individuals who tend to aggregate in quality habitat and foraging locations (Fitzgerald et al. 1994). Sylvatic plague can impact populations (Armstrong et al 2011). Adults weigh 7-14 oz (Reid 2006); the mean weight of adult is 10.3 oz (Zegers 1984). Mean weight when emerging from hibernation 8.2 oz for males and 6.7 oz for females (Zegers 1984). Fattening occurred in June and July, before hibernation.

Similar to white-tailed prairie dogs, Wyoming ground squirrels are only active from mid-March/early April (depending on late winter conditions) to late July when they begin to hibernate (Armstrong et al. 2011, Reid 2006). By mid-September, most all ground squirrels have entered hibernation. Males usually emerge from hibernation one to three weeks before the females. Breeding takes place a few days after females emerge from hibernation and one litter of 5 to 7 young is born in late April or May after a three- to four-week gestation period (Zegers 1984, Reid 2006). Juveniles emerge from burrows at 4 to 5 weeks old, therefore highest population densities above ground occur between May and July.

Even during their active season, ground squirrels are typically only above ground during cooler weather in the mornings and evenings, retreating into their burrows during hot weather (Clark and Stromberg 1987). Wyoming ground squirrels spend around 21 hours per day inside their burrows (Zegers 1984). Wyoming ground squirrel colonies are unlikely to achieve the necessary densities required to consistently attract eagles and to support golden eagle nesting populations due to the restrictive activity schedule and colony structure of Wyoming ground squirrels and; therefore, are at best a secondary prey item.

## 2.3 LEPORIDS

Leporids are known to be an important prey source for eagles in Wyoming. As stated previously, leporids were found to comprise up to 40% of prey taken by golden eagles near Medicine Bow by MacLaren et al. (1996), and Phillips and Beske (1990) found that white-tailed jackrabbits were the most important prey species for golden eagles in Carbon and Converse counties. Other scientific studies (Bates and Moretti 1994, Preston 2011) have determined that fitness and overall nesting success of some breeding populations of golden eagles may depend heavily on the cyclic abundance and deficiencies of leporid populations, especially the white-tailed jackrabbit (Steenhof et al. 1997). These cycles in leporid populations are caused by an abundance or shortage of available forage, with shortages of forage typically linked to periods of drought. Presently, much of Wyoming is in a stage of moderate to severe drought which has been persisting to varying degrees since 1999 (Wyoming Water Development Office 2012) and may be impacting leporid populations and the predators who depend on them.

The leporids commonly found within the Project Site are white-tailed jackrabbit, desert cottontail and mountain cottontail (*S. nuttallii*). The density of white-tailed jackrabbits in Wyoming has been estimated to average 7 per $km^2$ (Rogowitz and Wolfe 1991). Adults typically weigh 7.5 pounds and breed from late February to mid-July. Females have up to four litters per year of 1-11 young each (4-5 young on average) (Reid 2006, Streubel 2000b). Both species of cottontail weigh around 2 pounds as adults and have up to five litters per year during warm months (Reid 2006). Desert cottontail litters average 2-4 young while mountain cottontail average 4-8 young per litter.

These three species appear to be diffuse and widespread across the Project Site. White-tailed jackrabbit typically inhabit the lower-lying Central Basin of the Project Site, which is comprised if salt desert scrub and dense sagebrush steppe vegetation assemblages, but may also be found in higher areas of the Project Site. Desert cottontail may also be found in the Central Basin, the North Platte River corridor, and to a lesser extent on the Chokecherry plateau and Miller Hill, while mountain cottontail mainly occur on Miller Hill and to a lesser extent on the higher elevations of Chokecherry. All three species tend to inhabit areas with moderate shrub densities for use as cover from predators.

All three species are crepuscular, feeding predominantly during the early morning and late evening hours; however white-tailed jackrabbits are known to forage throughout the night as well. Though leporids are able to meet much of their water needs through absorbing moisture from forage, they are attracted to the moist low-lying vegetation along state and county roads surrounding the Project. This attraction leads to many individuals being killed along these roadways and may represent scavenging opportunities for eagles in the vicinity of the Project Site on public roads and highways such as Interstate 80 and State Highways 130 and 71.

Leporids differ from many potential eagle prey species in that they do not hibernate and are active during the winter months, which may create some additional foraging opportunities for eagles during this time of year. This winter activity is typically concentrated in lower-lying basin areas with little or no snow cover, or areas where they are able to forage from underneath shrub cover.

Scientific literature describes the importance of the eagle-leporid predator-prey relationship. Leporids within the Project Site likely represent a quality food source for eagles. However, due to leporid's mainly crepuscular habits and the diffuse nature of leporid populations across the many habitats within the Project Site, they are likely taken as prey opportunistically, albeit regularly, by eagles and other raptors.

## 2.4 BIG GAME SPECIES

Big game species provide eagle foraging opportunities throughout the year. During spring and summer months, big game parturition areas can be important as eagles will prey on young deer (*Odocoileus* spp.), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*). No parturition areas have been identified by PCW, WGFD, or BLM in the WDAs or Project vicinity; however, young pronghorn may be found in the Central Basin and young mule deer may be found along the North Platte River during the spring and early summer. Observations of two golden eagle and one bald eagle nest during the recovery of greater sage-grouse GPS telemetry tags have shown high concentrations of juvenile pronghorn legs located on and around the base of these nests, indicating that young pronghorn are a viable prey item taken regularly by eagles nesting in the vicinity of the Project Site.

During fall and early winter months, carcasses and remains left by hunters can be an important food base for eagles. Hunting in the vicinity of the Project Site occurs primarily in the Red Rim-Grizzly WHMA, in block federal lands south of the Sierra Madre WDA, and in the Medicine Bow National Forest. Privately owned and controlled lands are either not hunted or are hunted very lightly and do not provide adequate carcasses or remains to be important for eagle use. Areas hunted south of the Sierra Madre WDA are outside of the likely turbine development area and will not be impacted by wind development activities.

During winter months, carcasses of winter-killed or vehicle collision-killed big game species is an important forage source for bald and golden eagles. Areas of big game winter range have been identified by WGFD in the vicinity of the Project (Figure 7). Portions of mule deer winter range overlap with the northern portions of the Chokecherry WDA along the Hogback and pronghorn winter range occurs east of the Chokecherry WDA. PCW is currently working with WGFD, BLM, and the University of Wyoming to better understand use of the Project Site by mule deer and other big game species. These efforts will continue and data will be used to inform final Project design and mitigation considerations.

Presently, the principal risk to bald and golden eagles in the vicinity of the Project is collision with highway traffic. Wintering and migratory eagles are attracted to road kill on area highways (including Highway 130 north of Saratoga, Interstate 80 in the area of Sinclair and Rawlins, and other surrounding roadways). During winter 2012, the Service documented multiple eagle mortalities along these two highways in the vicinity of the Project (Travis Sanderson, personal communication). These mortalities were associated with public highway traffic and not in any way related to Project activities. During February 2012 avian survey efforts, 14 individual eagles and one ferruginous hawk concentrated around two pronghorn carcasses were observed during a 15-minute drive along a 10-mile stretch of Highway 130 east of the Project. At the same time, several others were observed along Interstate 80 north of the Project. These eagles were under immediate threat of mortality from vehicle collision. In contrast, during February 2012 survey efforts, only eight eagles were observed during 75 hours of survey within the Project Site indicating, as would be expected, that winter eagle activity is low where prey and scavenging opportunities are infrequent. In the vicinity of the Project, winter eagle use is closely tied to the availability of winterkill carcasses along area highways.

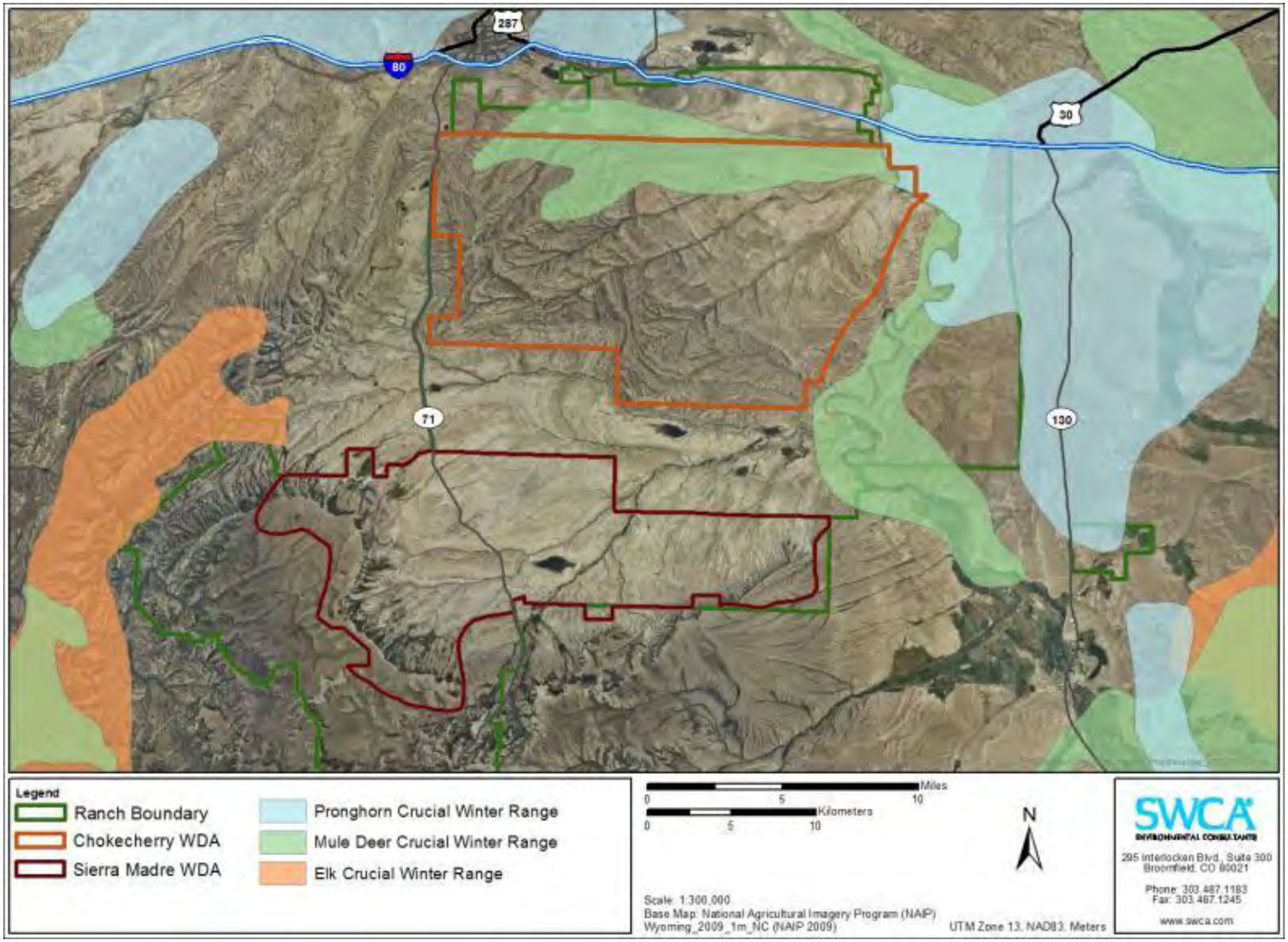


**Figure 7. Big-game winter range in and surrounding the Ranch.**

## 2.5 LIVESTOCK AND GRAZING

The Project Site was historically, and is currently, utilized as a livestock rearing operation. The Bolten Ranch (now a part of The Overland Trail Ranch) dates to the early 20th Century and was one of the largest sheep ranches in the state of Wyoming (Barclay 2011). The Bolten Ranch took its name from Isadore Bolten, a Russian immigrant, who operated the ranch as a sheep operation for the first half of the twentieth century. In the 1950s, his widow sold the ranch and it came to be owned and operated by a succession of sheep operators. In 1996, the Bolten Ranch was sold to an affiliate of the current owner TOTCO, who consolidated the Bolten Ranch with other properties to form The Overland Trail Ranch.

Golden eagle predation on livestock has been documented in many areas of the western United States (Avery 2004). Most depredations involve golden eagles preying on young lambs and goats; depredations on domestic calves occur occasionally (Avery 2004). A survey conducted from 1997 to 2002 by Wyoming Agriculture and presented in the Wyoming Agriculture Statistics, indicated that eagles, specifically golden eagles, took over 40,000 sheep/lambs during this period (Avery 2004). O'Gara (1978) draws a connection between a decline in jackrabbit populations and increased lamb predation by golden eagles, especially juvenile and subadult birds, which have no established territories.

From the turn of the century until TOTCO became the owner, the Ranch was primarily run as a sheep rearing operation. Under the ownership of Herman Werner and others, the Bolten Ranch suffered significant sheep/lamb losses due to golden eagle predation (W. Miller, TOTCO, personal communication). Under TOTCO's ownership, sheep have been removed from the Ranch and operations converted to a cow-calf and yearling operation.

The widespread availability of sheep/lambs as a prey source within the Project Site over the decades created more forage resources to potentially support a larger golden eagle population than has been observed over the three years of eagle surveys conducted by WEST and SWCA for the Project. Predation on sheep may have served to stabilize golden eagle populations during periods of declining leporid populations. This, along with the longevity of large raptor nests which have the potential to persist for decades, may explain the large number of inactive nests located within the vicinity of the Project Site, especially along the Bolten Rim, relative to active pairs of golden eagles. In 1996 when the Ranch was converted from a sheep to a cow-calf and yearling operation, this change dramatically decreased potential foraging opportunities for eagles as cattle are not preyed upon by eagles, and predation on domestic calves occurs only occasionally and is not well documented (Avery 2004, Phillips 1996). While there was still potential for eagles and other raptors to scavenge on the afterbirth left behind after calving, or to scavenge on the occasional carcass, the overall decreased prey density caused by the end of sheep rearing likely led to more competition for restricted resources, thereby causing fewer golden eagles to utilize the ranch for nesting and foraging. Recently, the Ranch has been converted to a yearling only operation further reducing foraging opportunities for eagles by eliminating calving remnants and very young calves.

For the reasons stated above, domestic livestock operations do not create or support areas of high eagle use that must be considered in avoidance and minimization measures for the ECP.

## 2.6 WATERFOWL AND WATERBIRDS

Although golden eagles are known to prey upon avian species, according to Olendorff (1976), the percentage of avian prey taken by eagles is drastically smaller than that of mammalian prey, which constitutes 80-90% of eagle prey. Waterfowl and waterbirds do provide seasonal foraging opportunities for bald and golden eagles at the four reservoirs (Kindt, Rasmussen, Sage Creek, and Teton) located on the Project Site, as well as along the North Platte River corridor. This foraging source is available from early spring through late fall in periods when the reservoirs and the river are ice-free; however, the highest concentration of waterbird species on the Project Site occurs during the fall when nesting is completed and adults and juveniles of many species aggregate on the reservoirs to prepare for southerly migration.

Waterbird surveys were conducted in 2011 during spring (April 26–May 4), summer (August 23–24), and fall (October 20–21) at each of the four reservoirs. Spring waterbird surveys resulted in a total count of 1,415 individuals representing 35 species. American coot (*Fulica americana*) was the most abundant species accounting for 364 individuals (26% of total count). Scaup (*Aythya* sp.), *Aechmophorus* grebes (i.e., western and Clark's), and eared grebe (*Podiceps nigricollis*) were the next most abundant species with 351, 209, and 113 individuals, respectively. Collectively, those four groups accounted for 1,037 individuals or 73% of all birds detected. More species and individuals were counted at Kindt Reservoir (25 species, 808 individuals), which is outside the WDAs, than the other three reservoirs. The fewest species and number of individuals (12 species, 165 individuals) were recorded at Sage Creek Reservoir during spring surveys.

In total, 1,708 individuals representing 29 species were recorded on summer waterbird surveys. Redhead (*Aythya americana*) had the highest number of individuals (815) accounting for 48% of all birds detected during summer surveys. Lesser scaup (*Aythya affinis*), mallard (*Ana splatyrhynchos*), and American coot were the next most abundant species with 157, 149, and 99 individuals, respectively. Collectively, those four species accounted for 1,221 individuals or 71% of all birds detected. The highest number of individuals (920) was recorded at Rasmussen Reservoir, where 89% (780 individuals) were redheads. Nearly all of the season's redheads (780 of 815) were recorded at Rasmussen Reservoir. Despite the high number of birds recorded at Rasmussen Reservoir, biologists recorded the fewest number of species (12) at that location.

Surveys during the fall migration period resulted in 11,473 individuals of 29 species recorded. Similar to spring, in the fall American coot accounted for the majority of individuals (8,024, 70% of total individuals). A total of 1,692 American wigeon (*Anas americana*) were also recorded. Combined, American coot and American wigeon accounted for 9,716 individuals (85% of all individuals). More individuals (8,773) and species (22) were recorded at Kindt Reservoir during fall surveys than at other reservoirs. Of the 8,024 American coots and 1,692 American wigeons recorded at all reservoirs combined, the survey at Kindt Reservoir accounted for 5,810 coots (66%) and 1,690 wigeon (99%).

Observation data from Year Two and Year Three survey efforts have indicated that Rasmussen Reservoir is an important foraging location for a known bald eagle pair nesting immediately south of the Sierra Madre WDA and south of Rasmussen Reservoir. Year Two observational data also indicate the potential use of Kindt reservoir as a foraging location for a golden eagle pair that nested just above the reservoir. Waterbirds utilizing the North Platte River are also an available prey source for eagles nesting along this corridor.

# 3.0 DISCUSSION AND CONCLUSIONS

The Project Site contains several species that have the potential to provide foraging opportunities for eagles and other raptors; however, very few of these prey species occur in high enough concentrations to represent a consistently available food source for eagles. Prey species are most likely taken opportunistically and do not attract or concentrate eagle foraging activities because of low prey population densities and widely scattered occurrences.

White-tailed jackrabbit and cottontail species (leporids) are the most widely available mammalian prey species found within the Project Site (Appendix A). White-tailed jackrabbits are found primarily throughout the Central Basin, east of the North Platte River, north and west of the Chokecherry WDA, and to a lesser extent on the higher elevations of the Chokecherry plateau and Miller Hill. Numerous scientific studies have also reported the importance of white-tailed jackrabbits as a key forage item for golden eagles as well (Preston 2011, Steenhof et al. 1997, MacLaren et al. 1996, Bates and Moretti 1994, Phillips and Beske 1990). While leporids are recognized as a key prey species for eagles and other raptors, their crepuscular nature likely means they are available as forage mainly during the morning and evening hours and infrequently through the rest of the day. Additionally, no known concentration areas for leporids have been identified over more than three years of wildlife surveys in the Project Site. Leporids are distributed in a dispersed pattern across the landscape in the Project Site and vicinity and are likely taken opportunistically as they are encountered.

White-tailed prairie dogs are also recognized as an important prey source for eagles and other raptors; however, their low densities and temporal availability within the Project Site make them less available than waterbird species and leporids, respectively. Numerous studies (WEST 2008, SMITH 2010, SWCA 2012 [Appendix A]) have been undertaken to quantify the occurrence of white-tailed prairie dogs on the Project Site. Corresponding data from WGFD, WEST and SWCA all show that white-tailed prairie dog occur in ephemeral, low-density colonies through sections of the Central Basin. During 2012 surveys, SWCA biologists documented only inactive, historic colonies within the Miller Hill and Chokecherry WDAs, with the exception of a small, low density colony located in the north central region of the Chokecherry WDA, which is located well outside of the likely turbine development area (Appendix A). SMITH (2010) observations are inconsistent with these studies and are not representative of white-tailed prairie dog populations in the Project Site. The assumption that delineated prairie dog colonies in SMITH (2010) contain a viable prey source for golden eagles is not valid. Burrow densities in the Project Site as measured by SWCA and as reported by WEST (2008) are more representative of expected white-tailed prairie dog use and should be used as the best available scientific information to inform Project siting and identification of important eagle use areas.

White-tailed prairie dog colonies within the Bolten complex (Central Basin - occurring around Kindt reservoir) reached the highest average active burrow densities at 2.6 burrows per acre (Figure 6; Appendix A), well below the average of 6 burrows per acre in other areas of Wyoming (Clark and Stromberg 1987). Other active colonies south of the Bolten complex only contain an average density of 1.6 burrows per acre. White-tailed prairie dogs are only active a limited period of time during the year and their colonies are only found in low densities in the Central Basin; therefore, they represent an intermittently available prey species that may be taken opportunistically as they are encountered during other activities by eagles and other raptors.

Similar to white-tailed prairie dog, Wyoming ground squirrel also represents an intermittently available prey species. Though they are found to be more widespread on the Project Site, they occur in lower density, more diffuse colonies than white-tailed prairie dogs. Wyoming ground squirrel also have a more restrictive activity schedule than white-tailed prairie dog with daily activity mainly occurring in the morning and evening hours, and most individuals entering hibernation between the months of July and April. Based on this, Wyoming ground squirrel are, at best, a secondary prey species taken opportunistically by eagles and other raptors on the Project Site.

Big game species present some foraging opportunities for bald and golden eagles and other raptors throughout the year. During the spring and early summer, pronghorn and mule deer fawns are available as potential prey species for eagles although there are no parturition areas identified in the Project Site that would concentrate eagle foraging. Pronghorn fawns are typically dispersed across the Project Site, while mule deer fawns may be found in areas with higher cover along the North Platte River. Throughout the rest of the year and especially in the winter, big game carcasses provide scavenge for eagles and other raptors. During the spring, summer and fall months, these scavenging opportunities occur sporadically throughout the Project Site and along roadways. In the winter, however, big game species are pushed into concentrations at lower elevations by snow cover and the need for viable forage. During these months, big game species are often killed by roadway traffic, creating numerous scavenging opportunities for bald and golden eagles and other raptors along roadways. During the winter months when there are no white-tailed prairie dog, waterbirds, or Wyoming ground squirrel to hunt, these big game scavenging opportunities along roadways and in low-lying basins represent one of the most concentrated and viable food sources for resident bald and golden eagles wintering in the vicinity of the Project Site.

The Project Site was historically, and is currently, utilized as a livestock rearing operation. From the turn of the century until TOTCO became the owner, the Ranch was primarily run as a sheep rearing operation. Under TOTCO's ownership, sheep have been removed from the Ranch and operations converted to a cow-calf and yearling operation. The widespread availability of sheep/lambs as a prey source within the Project Site over the decades created more forage resources to potentially support a larger golden eagle population than has been observed over the three years of eagle surveys conducted by WEST and SWCA for the Project. In 1996 when the Ranch was converted from a sheep to a cow-calf and yearling operation, this change dramatically decreased potential foraging opportunities for eagles as cattle are not preyed upon by eagles, and predation on domestic calves occurs only occasionally and is not well documented (Avery 2004, Phillips 1996). While there was still potential for eagles and other raptors to scavenge on the afterbirth left behind after calving, or to scavenge on the occasional carcass, the overall decreased prey density caused by the end of sheep rearing likely led to more competition for restricted resources, thereby causing fewer golden eagles to utilize the ranch for nesting and foraging. Recently, the Ranch has been converted to a yearling only operation further reducing foraging opportunities for eagles by eliminating calving remnants and very young calves.

Waterbirds are only an available source of prey during the spring, summer and fall months. During these months, waterbirds occur on all of the four reservoirs in the Central Basin of the Project Site which are located in PCW's identified Turbine No-Build Areas in the Project ECP. Highest concentrations of waterbirds occur on Kindt and Rasmussen reservoirs. However, during drought conditions such as those in 2012, Kindt Reservoir is largely drained and very few waterbirds and waterfowl utilize the reservoir. Waterbird concentrations reached their highest level at these two reservoirs in fall as adults and juveniles prepared for southerly migration. Observational data have shown that Rasmussen reservoir was a utilized foraging area for the bald eagle pair who nested south of the Sierra Madre WDA in 2011 and 2012, and that Kindt reservoir was a utilized foraging area for a golden eagle pair who nested along the southern edge of the Chokecherry WDA in 2011.

## 3.1 FORAGING HABITAT

There are a number of species available as prey base for eagles and other raptors within the vicinity of the Project Site; however, none of these species alone occur at the necessary densities required to consistently attract eagles within the Project Site. The majority of prey base and foraging opportunities occur within areas immediately surrounding the Project Site in portions of the Central Basin and along the North Platte River corridor, with very limited and dispersed foraging opportunities available outside of these two areas. Three potential foraging areas, as determined by overlapping resources and seasonal availability of prey base, occur within the Project Site or in the immediate surrounding areas (Figure 8). The North Platte River corridor, the Kindt Reservoir area, and the Bolten Road-Teton Reservoir area provide overlapping opportunities of several potential prey species that could be utilized by eagles and other raptors.

The highest quality foraging habitat for bald and golden eagles was determined using a stepwise approach, identifying key prey species, their availability on the landscape, and the seasonal availability within the Project Site and in the immediate surrounding areas. Habitat type, water resources, and management areas were also considered and included in the foraging area delineation process. The following parameters were evaluated to determine foraging habitat for bald and golden eagles:

- Large reservoirs (Kindt, Rasmussen, Teton, and Sage Creek) and waterbird survey results;
- North Platte River corridor;
- Active agricultural areas (hay meadows and stockyards);
- Prairie dog colonies identified as having minimal foraging potential for eagles;
- WGFD ungulate crucial winter range boundaries;
- WGFD greater sage-grouse core areas;
- Major highway corridors, and,
- Potential movement corridors between these locations.

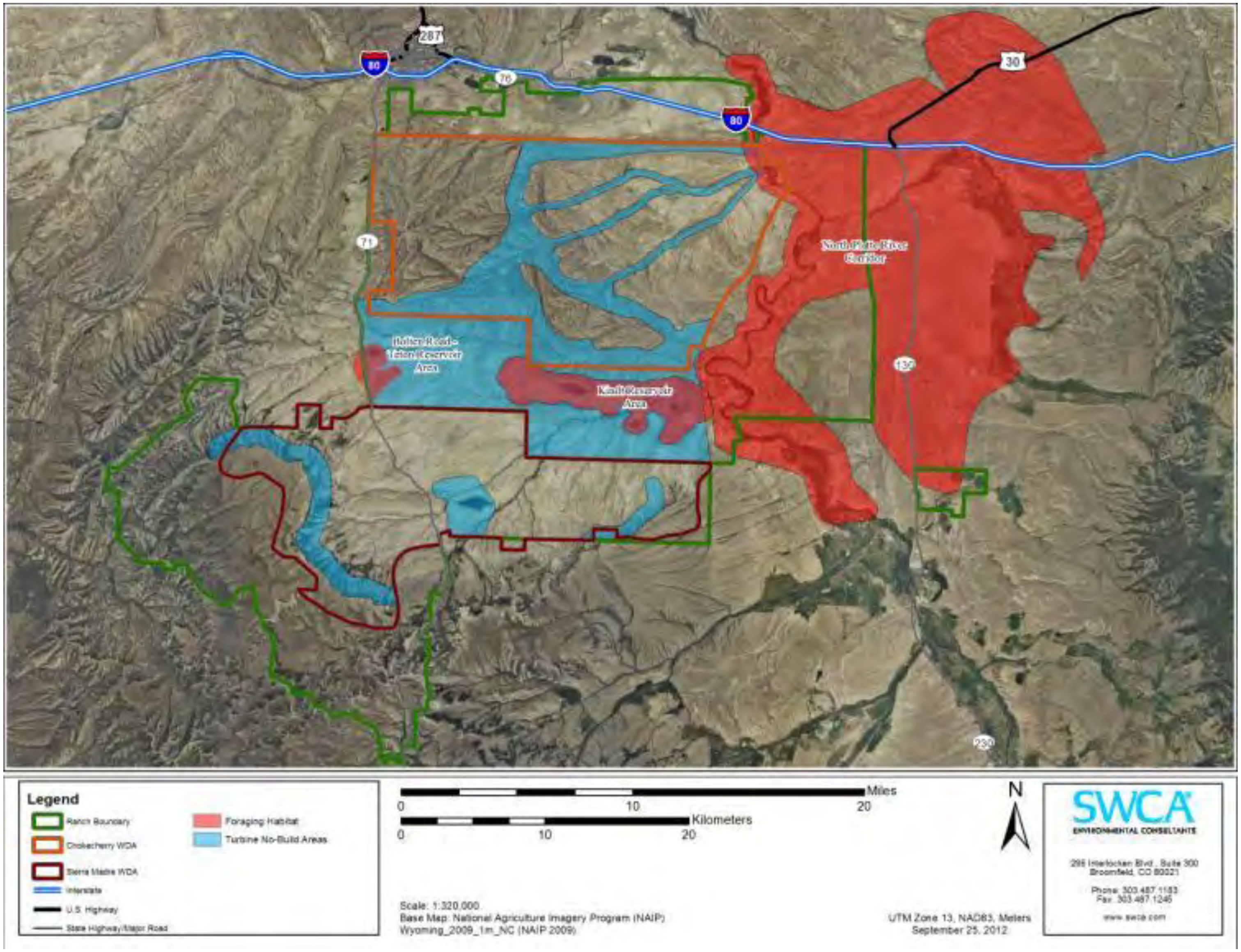


**Figure 8. Turbine no-build areas and areas representing potential foraging areas in the Project Site and the surrounding areas.**

The first step in determining the most likely foraging habitats includes identification of all potential foraging areas that support prey species. Reservoirs within the Project Site and in the immediate surrounding area provide a food source (waterbirds) during spring, summer, and fall months. Active prairie dog colonies and dispersed ground squirrel population provide a prey base between early spring and late summer but are seasonally unavailable beginning in late July through mid-March. Major highways (I-80, HWY 130, and WY 71) provide road kill and carrion throughout the year, although abundance typically increases during late fall and winter. Crucial winter range of ungulate species provides scavenging opportunities during winter. Sage-grouse core areas maintain sufficient populations of grouse during all seasons. Although these different habitats may support some level of opportunistic foraging for bald and golden eagles, foraging opportunities are greatest in areas where the above prey sources overlap. The second step in determining the most likely foraging habitats includes identifying areas that support multiple prey species. Areas where concentrations of prey are diffuse, scattered, and/or limited likely do not represent focused foraging areas for eagles. Overlapping habitat and/or seasonal ranges of multiple prey species represent likely areas where prey is more abundant and, collectively, not as dispersed.

As a result of this analysis, two potential areas that have adequate prey base to represent possible important eagle foraging areas occur within the vicinity of the Project Site (Figure 8). The North Platte River corridor and the Bolten Road corridor represent the only areas within or surrounding the Project Site with multiple overlapping prey base resources for bald and golden eagles.

The North Platte River corridor (Figure 8) provides a number of habitat types to support leporids, waterbirds, mule deer, pronghorn, sage-grouse, and Wyoming ground squirrel. The river corridor includes crucial winter range for mule deer and pronghorn along with sage-grouse core area. In addition, this area provides sufficient winter roost opportunities within cottonwood galleries and riparian vegetation along the North Platte River. The Bolten Road area includes habitat types to support white-tailed prairie dogs, leporids, waterbirds, pronghorn, and Wyoming ground squirrel. These habitats include grass hay agricultural areas and three reservoirs (Sage Creek, Kindt, and Teton).

Both of these foraging areas also provide unique hunting perch locations that are not available elsewhere in the Project Site. The North Platte and Bolten corridors are adjacent to rock faces that provide perch locations that can be utilized by eagles and other raptors to survey potential foraging locations. These features are unique to these two foraging areas and provide a mechanism for eagles to expend less energy for foraging activities; other areas in the Project Site require powered flight through less suitable foraging habitats.

These areas are also consistent with known active nesting locations for eagles. The North Platte River corridor and the eastern half of the Bolten Rim above Kindt Reservoir contain the majority of bald and golden eagle nests identified within the vicinity of the Project Site. Additionally, bald eagle foraging activities associated with the nest south of the Sierra Madre WDA have been documented at Rasmussen Reservoir.

The correspondence of these foraging areas with eagle nest locations and perch and roost locations demonstrate that these areas (Figure 8) provide the most important foraging locations for eagles in the Project Site and vicinity. Additionally, these areas and corridors connecting these areas are located outside of the WDAs or in Turbine No-Build Areas identified in PCW's ECP. This will enable continued use of these foraging locations without increasing eagle exposure in the turbine development areas.

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# Appendix A

# Results of 2012 Prey Base Assessment Surveys

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# 1.0 PURPOSE

Smith Environmental and Engineering (SMITH) was selected by the Bureau of Land Management (BLM) Rawlins Field Office to re-evaluate existing white-tailed prairie dog (*Cynomys leucurus*) towns across the Black-footed Ferret Bolten Ranch Complex (hereafter, Bolten complex) in south-central Carbon County, Wyoming (SMITH 2010). The primary objective of SMITH's efforts was to record white-tailed prairie dog town locations and calculate associated burrow densities. SMITH (2010) concluded that the Bolten Complex consists of suitable habitat characteristics for reintroduction of the black-footed ferret (*Mustela nigripes*). This conclusion is based on identification of 198 white-tailed prairie dog colonies that comprised, in part, one complex (7-kilometer [km] criterion; Biggins et al. 1993) and two sub-complexes (1.5-km criterion; Biggins et al. 2006).

The findings of SMITH (2010) contradict numerous other evaluations of white-tailed prairie dog communities in the Bolten Complex. Other evaluations have found only small areas of low-density dispersed use (Western EcoSystems Technology, Inc. [WEST] 2008, WGFD spatial data per BLM). WGFD provided initial maps of white-tailed prairie dog colonies in the Bolten Complex from data collected approximately between 1999 and 2000 (Figure 1, Heath Cline, BLM Rawlins Field Office Biologist, personal communication). These mapping efforts identified a number of active prairie dog colonies at the base of the Bolten Rim near Teton and Kindt reservoirs and in the Central Basin north of Sage Creek.

WEST collected general wildlife data beginning in 2008 (WEST 2008) as part of their baseline wildlife surveys for the Chokecherry and Sierra Madre Wind Energy Project Environmental Impact Statement (EIS). WEST reported that virtually all potential prairie dog habitat within the original Sierra Madre Wind Development Area (WDA) was incidentally searched while conducting mountain plover surveys, greater sage-grouse brood surveys, or during travel for avian point counts. In addition, two areas of potential prairie dog activity were identified near proposed transportation and power line corridors between the Chokecherry and Sierra Madre WDAs in the Central Basin.

SWCA Environmental Consultants (SWCA) provides support services to the Power Company of Wyoming LLC (PCW) by collecting and analyzing baseline information used for guiding the development of the proposed Chokecherry and Sierra Madre Wind Energy Project (Project). These services have included ongoing vegetation, wildlife, and avian surveys throughout the Project Site since 2009 to inform development decisions regarding turbine layout and micro-siting to avoid or minimize disturbance to the area's wildlife resources. During the course of conducting surveys, multiple professional biologists traverse the Project Site, particularly during the months of expected prairie dog activity (April-October) in 2010 and 2011. Although none of these surveys were specifically for prairie dogs, SWCA biologists have noted presence/absence of prairie dogs and areas of burrow activity (recent or old) incidental to other survey activities. These observations suggest that active prairie dog colonies are primarily restricted to the Central Basin between the WDAs. Since findings reported in WEST (2008) and SWCA's experience in the Project Site substantially differed from those reported in SMITH (2010), SWCA performed additional surveys in areas delineated by SMITH (2010) to identify prairie dog colonies and determine occupancy and relative density.

Surveys were conducted during the period of August 2 to August 13, 2012 by SWCA biologists to assess golden eagle prey base throughout the Project Site and to identify towns, determine occupancy, and describe relative density of white-tailed prairie dog colonies. Surveys were designed to assess the extent of burrowing mammal activity with focus on white-tailed prairie dogs in relation to other fossorial species in the general area. Sites were selected to evaluate town locations identified by SMITH (2010) because distributions and densities reported were inconsistent with incidental observations made by SWCA while conducting vegetation and wildlife surveys in the area from 2009-2012.

## 1.1 PHYSIOGRAPHIC SETTING

The Ranch is dominated by three topographic features, Miller Hill, Chokecherry Plateau, and Sage Creek Rim, separated by a Central Basin. To the north, Chokecherry Plateau consists of ridges and rolling hills that generally slope northeasterly downward to the North Platte River. Approximately 25 miles of the North Platte River flow along the eastern edge of Chokecherry. Most of the northern portion of Chokecherry is defined by a small, east/west ridge commonly known as the Hogback, which is approximately 10 miles long, and the southern portion is defined by a cliff edge commonly referred to as the Bolten Rim, which is approximately 20 miles long. A prominent north/south ridge cut by three ephemeral drainages, Smith Draw, Hugus Draw, and Iron Springs Draw, bisects Chokecherry for approximately 12 miles.

The southwestern portion of the Ranch is dominated by a steep-sloped mesa commonly known as Miller Hill. This predominant feature slopes gently toward the south and southwest, with relatively level terrain near the edge of the rim and becoming increasingly undulated towards the southwest. Only a small portion of Miller Hill is within the Project Site.

The southeastern portion of the Ranch includes Sage Creek Rim, which has similar characteristics to Miller Hill, although this feature is not as large or high. Only a small portion of the top of the Sage Creek Rim is within the Project Site.

The area between these features (Central Basin) is a high desert basin transected by Sage Creek and several smaller ephemeral tributaries. Traversing the Central Basin is the Bolten Road, which bisects the basin into its northern and southern portions. Much of this basin is outside the WDAs; however, the Project haul road and internal transmission line will traverse the Central Basin and interconnect the WDAs. Larger waterbodies, which include Kindt, Rasmussen, Sage Creek, and Teton Reservoirs, are interspersed throughout this arid landscape.

## 1.2 ADDITIONAL SURVEY EFFORTS

WGFD provided initial maps of white-tailed prairie dog colonies in the Bolten Complex from data collected in approximately the year 2000 (Figure 1, Heath Cline, BLM Rawlins Field Office Biologist, personal communication). These mapping efforts identified several active prairie dog colonies at the base of the Bolten Rim near Teton and Kindt reservoirs and in the Central Basin north of Sage Creek.

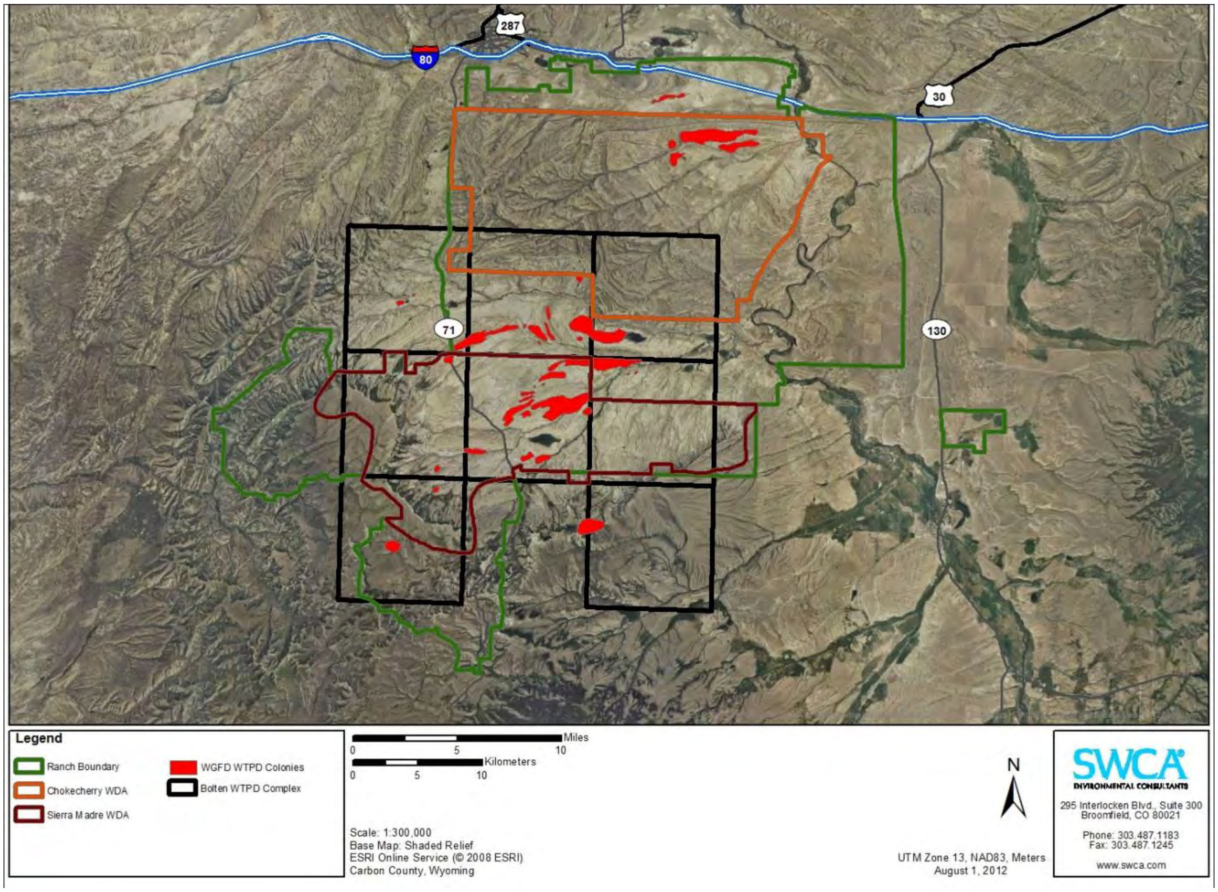


**Figure 1. White-tailed prairie dog colonies in and surrounding the Bolten Complex (WGFD 2000).**

WEST collected general wildlife data beginning in 2008 as part of their baseline wildlife surveys for the Project Environmental Impact Statement (WEST 2008). WEST reported that virtually all potential prairie dog habitat within the original Sierra Madre WDA was incidentally searched while conducting mountain plover surveys, greater sage-grouse brood surveys, or during travel for avian point counts. WEST (2008, p.5) concluded that “there is no physical evidence to suggest that colonies within the ‘non block-cleared’ areas of the project boundaries ever supported anything but small, perhaps ephemeral, scattered pockets of prairie dogs and would be of poor quality for black-footed ferrets.” In addition, two areas of potential prairie dog activity were identified near proposed transportation and power line corridors between the Chokecherry and Sierra Madre WDAs in the Central Basin. WEST (2008) noted that the Central Basin between the WDAs supports prairie dog colonies and that two general areas of colonies may exceed 1,500 and 2,000 acres, respectively. WEST further noted that burrows in those two areas were scattered in distribution. These areas correspond to those that were identified by WGFD (Figure 1) along the Bolten Road.

Initially, SWCA conducted a full Project Site reconnaissance to formally assess the potential accuracy of the SMITH (2010) data and conclusions. From June 4 to June 8, 2012, an SWCA biologist surveyed 27 sites located with the polygons identified in SMITH (2010) (Figure 2).

Reconnaissance level surveys consisted of locating burrows, determining current or historical use (recent diggings, old or recent scat), recording presence of any small mammals in the area, and measuring burrow entrance diameters to aid in species identification. Adapting the modified Biggins et al. (1993) burrow criteria described in Behl and Kane (2003) to reduce potential biases in data collection and results, SWCA assessed potential species use of burrows by evaluating burrow characteristics and by measuring burrow entrance size.

Surveys conducted at 12 sites on Miller Hill resulted in no detections of prairie dogs at any of those sites. Wyoming ground squirrels were observed at six sites. One site appeared to have burrows consistent in size and appearance for white-tailed prairie dogs, but burrow entrance sizes were less than 7 cm indicating use by Wyoming ground squirrels. Wyoming ground squirrel was found throughout the area. Pocket gopher burrows and activity were also noted, primarily on shaded slopes and along drainages.

Eleven sites were surveyed south of the Bolton Road in the Central Basin. All of these sites had evidence of historic burrowing. Six sites were currently occupied by active WTPD colonies. An overall assessment of the Central Basin indicated widespread, scattered distribution of historic or current white-tailed prairie dog colonies. Most of these sites, however, were currently unoccupied or occupied in low densities. A few sites were considered to have moderate or high occupancy and burrow densities.

SWCA surveyed four sites south of the Sage Creek Rim. None of these sites, or surrounding areas, had evidence of historic or current white-tailed prairie dog activity. Wyoming ground squirrel and American badger dig-out activity was widespread across the area at low burrow densities. Wyoming ground squirrel burrows dug out by American badgers were similar in appearance to WTPD mound complexes, but each burrow entrance (beyond the badger scrapings) was measured and considered consistent with that for Wyoming ground squirrel.

Generally, prairie dog colonies surveyed in the Central Basin were less than one acre in size, including those with high burrow densities (i.e., maximum estimate of approximately 157 burrows per acre). Colonies were considered localized with burrows concentrated in clusters and large areas devoid of burrows between colonies.

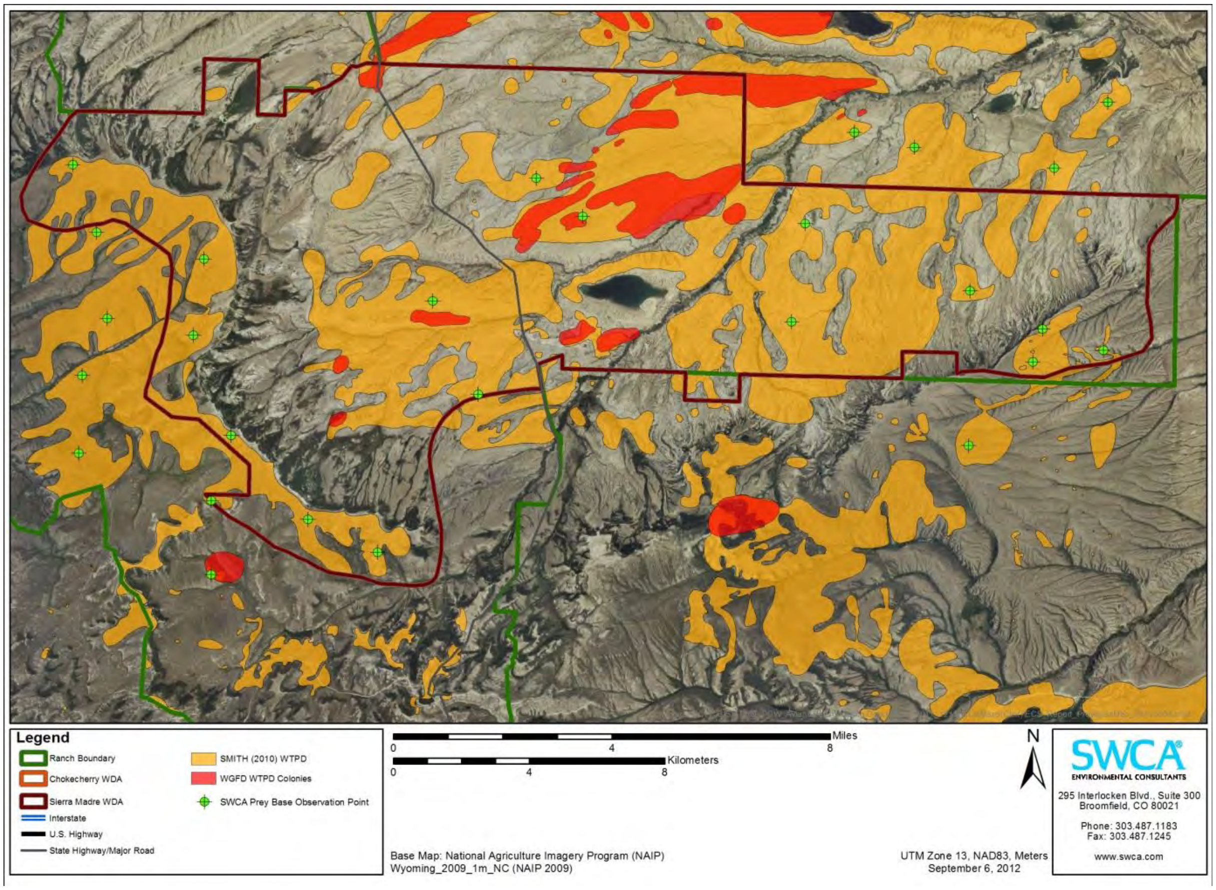


**Figure 2. SWCA white-tailed prairie dog reconnaissance and observation locations.**

## 2.0 SURVEY APPROACH

SWCA conducted 74 survey transects to assess fossorial mammal activity in the Project Site (Figure 3). Survey protocols followed U.S. Fish and Wildlife Service (Service) recommendations (McDonald et al. 2011) and were adapted from Biggins et al. 1993 (Attachment A). Surveys consisted of locating burrows, determining current or historical use (recent diggings, old or recent scat), recording presence of any small mammals in the area, and measuring burrow entrance diameters to aid in species identification. Adapting the modified Biggins et al. (1993) burrow criteria described in Behl and Kane (2003) to reduce potential biases in data collection and results, SWCA determined occupancy of white-tailed prairie dog and Wyoming ground squirrel (*Urocitellus elegans*) burrows by presence of individuals and burrow entrance size. White-tailed prairie dog burrows (8-12 centimeter [cm] in diameter) often have distinctive mounds of dirt at the entrances (Cooke and Swiecki 1992, Menkens et al. 1987); Wyoming ground squirrel burrows (5-8 cm) rarely have distinct mounding at the entrance (Yensen and Sherman 2003). Pocket gopher (*Thomomys* spp.) burrows and tunneling activity were identified by their distinct above surface dirt remnants from snow tunneling, rounded dirt mounds, and small burrow entrances (less than 7 cm) which are kept plugged with loose soil (Beauvais and Dark-Smiley 2005). American badger (*Taxidea taxus*) burrows were primarily identified by entrance diameter (greater than 12 cm).

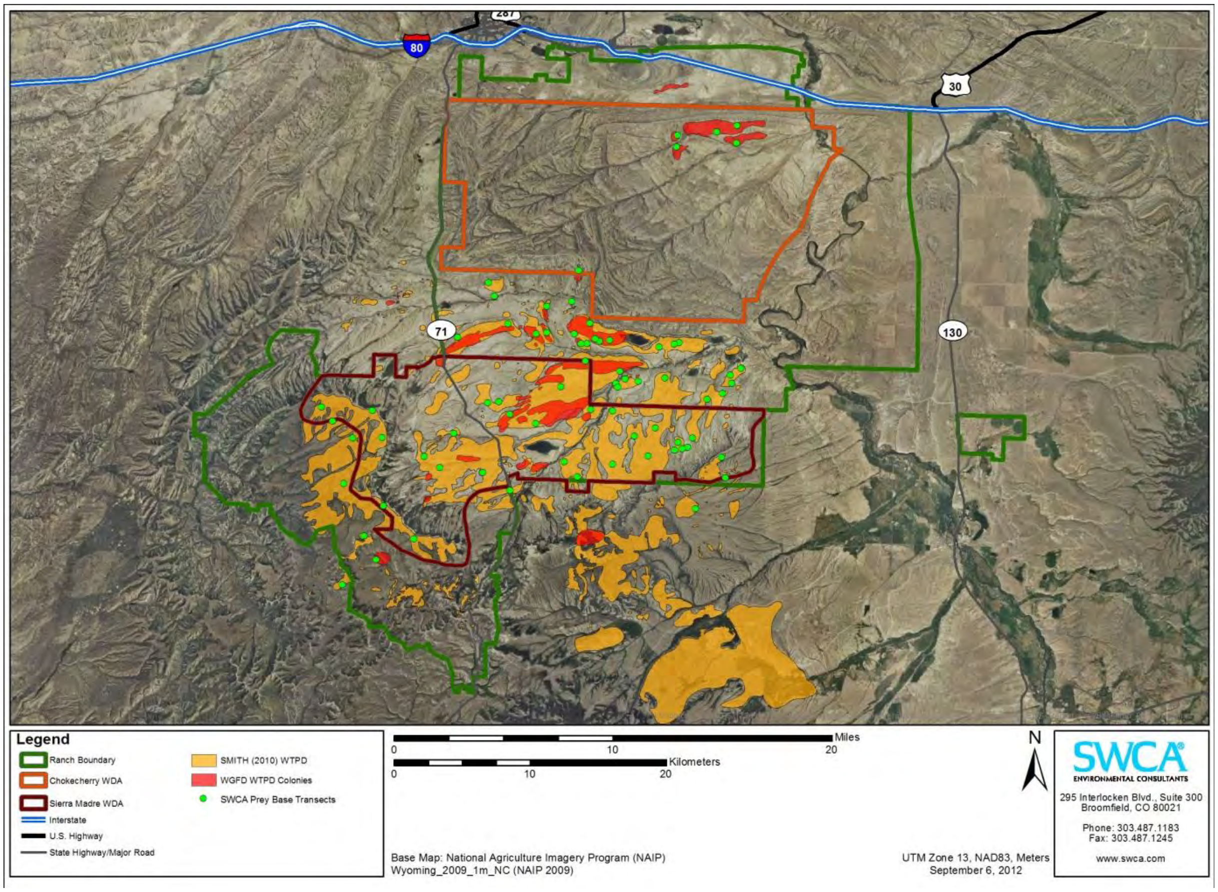


**Figure 3. Prey base survey locations across the Ranch.**

# 3.0 RESULTS

## 3.1 BOLTEN ROAD

Twenty-six transects were surveyed in the Bolten Road area (Figure 4; Attachment B), where the highest abundance of white-tailed prairie dogs and burrowing activity was observed (Table 1). Overall, burrow density for all fossorial mammals was approximately 20.5 burrows per acre. Inactive and historic prairie dog colonies accounted for approximately 44% of all burrow observations. White-tailed prairie dog activity was the highest observed, with approximately 2.6 active burrows per acre (13% of all burrowing activity). White-tailed prairie dog activity in this area ranged from 0.0-10.6 burrows per acre, with total burrowing activity (active + inactive burrows) reaching a 19.1 burrow per acre maximum. Habitat in the area may potentially support larger colonies of white-tailed prairie dog, with large areas covered with low growing vegetation (*Atriplex gardneri* and *Artemisia pedatifida*) and sparsely growing grasses and forbs. This area also included high burrowing activity for badgers.

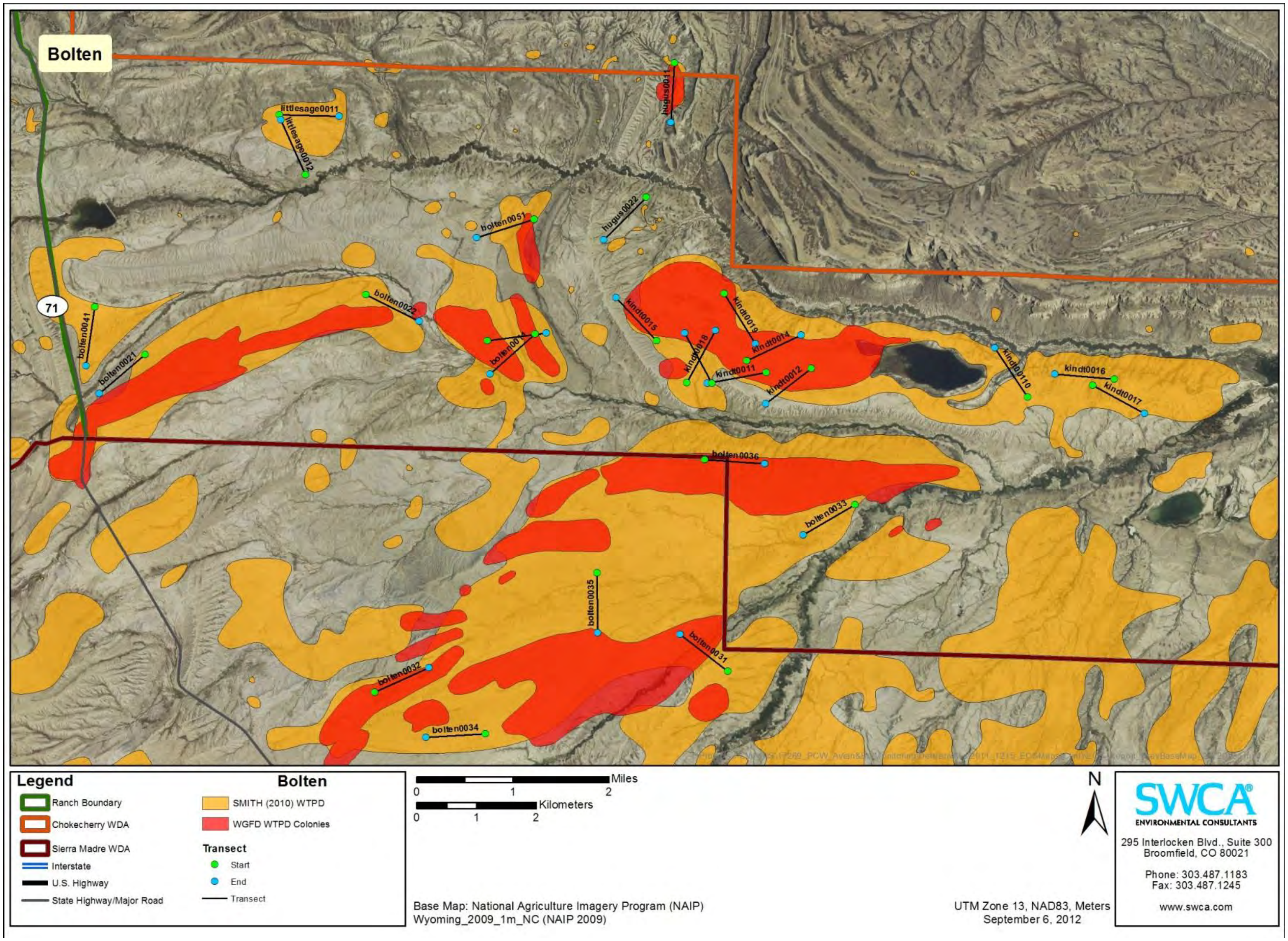


**Figure 4. Prey base survey locations in the Bolten Road area.**

**Table 1. Burrow densities of white-tailed prairie dogs and other fossorial mammals throughout the Project Site.**

| Location | Transects (*n*) | Total burrows (burrow/acre) | | Total WTPD burrows (burrow/acre) | | Active WTPD burrows (burrow/acre) | |
|---|---|---|---|---|---|---|---|
| | | Average | 95% CI | Average | 95% CI | Average | 95% CI |
| Bolten | 26 | 20.5 | 3.4 | 9.0 | 2.1 | 2.6 | 1.4 |
| Central Basin | 29 | 20.9 | 3.5 | 7.1 | 2.5 | 1.6 | 2.0 |
| Miller Hill | 11 | 22.5 | 6.9 | 1.8 | 1.4 | 0.0 | - |
| Sage Creek Rim | 3 | 22.9 | 10.8 | 7.9 | 5.4 | 0.0 | - |
| Severson | 5 | 17.9 | 4.0 | 6.7 | 2.1 | 0.1 | 0.3 |

## 3.2 CENTRAL BASIN

Overall, 29 surveys were completed in the Central Basin (Figure 5; Attachment B). Although total white-tailed prairie dog burrow density was comparable to other areas within the Project Site with the exception of Miller Hill (7.1 burrows per acre; Table 1), active burrows (1.6 burrows per acre) within these colonies were considerably lower than areas outside the Project Site and along the Bolten Road. This lower active burrow density was a result of the number of inactive and/or historic prairie dog colonies surveyed during transects; however, one transect (centralbasin004-03 [Attachment B] – selected opportunistically for survey during field work based on high density of activity) had a burrow density of 29.0 burrows per acre, which was the highest density recorded by SWCA anywhere in or surrounding the Bolten Complex.

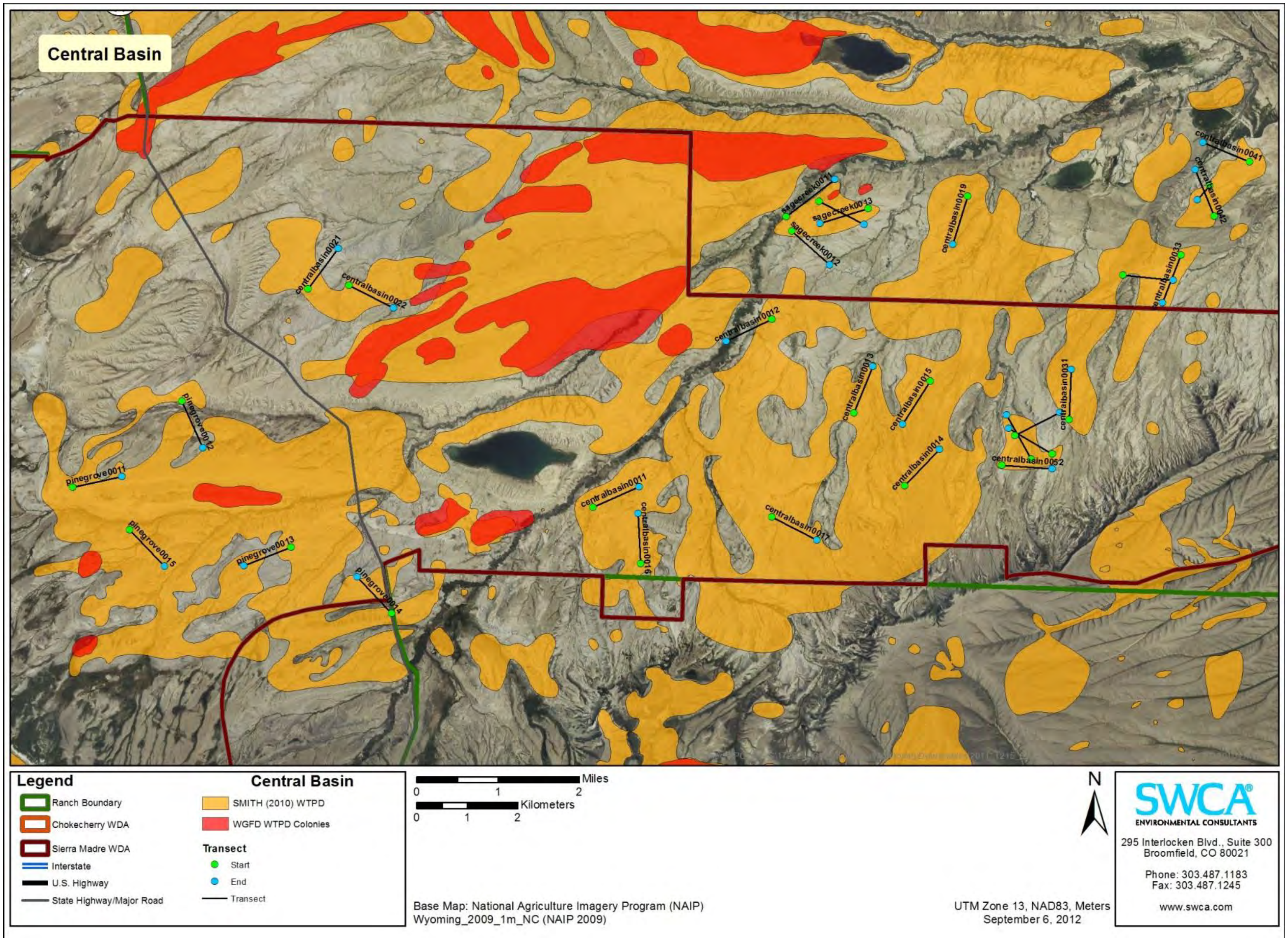


**Figure 5. Prey base survey locations in the Central Basin.**

## 3.3 MILLER HILL

Eleven transects were completed on Miller Hill and no active white-tailed prairie dog colonies or individuals were detected (Figure 6; Attachment B). Wyoming ground squirrel activity accounted for the majority of burrowing activity. Overall, burrow density for all fossorial mammals was approximately 22.5 burrows per acre. Inactive and historic white-tailed prairie dog burrows were observed on Miller Hill (1.78 burrows/acre; Table 1); however, burrows were highly scattered and the majority of burrows were old and inactive or collapsed. Historic and/or inactive White-tailed prairie dog burrows accounted for 7.9% of all burrow observations (no active borrows were found). Habitat in the area consisted of expansive extents of tall and dense mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) compared to other locations in the Project Site. Other areas on Miller Hill supported dense collections of pocket gopher burrows and activity. These sites were primarily located on shaded slopes and along drainages with grass present.

## 3.4 SAGE CREEK RIM

Three transects were surveyed south of Sage Creek Rim (Figure 7; Attachment B). No recent white-tailed prairie dog activity was observed at or surrounding any of the transect locations (Table 1). Historic and/or inactive prairie dog burrows (7.9 burrows/acre) accounted for approximately 35% of all burrow observations. American badger and Wyoming ground squirrel activity was widespread across the area (14.9 burrows/acre). Wyoming ground squirrel burrows dug out by American badger were similar in appearance to white-tailed prairie dog mound complexes, but each burrow was identified as Wyoming ground squirrel following closer inspection (based on adjacent burrow entrance diameters – 5-8 cm in diameter).

## 3.5 SEVERSON

Five transects were surveyed in the Severson Flat area of the Project Site, in white-tailed prairie dog colonies identified by the Wyoming Game and Fish Department and during baseline studies for the EIS (WEST 2008) (Figure 8; Attachment B). These areas were not surveyed as part of the SMITH Report because they are located outside of the Bolten Complex (SMITH 2010). Although colonies exhibited comparable burrow densities to other areas in the Project Site (6.7 burrows/acre; Table 1), total active white-tailed prairie dog burrows were considerably lower (0.13 burrow/acre – 1.9% active burrows). Total active burrows ranged from 0.0-0.67 burrow per acre, indicating very low activity within the surveyed colonies.

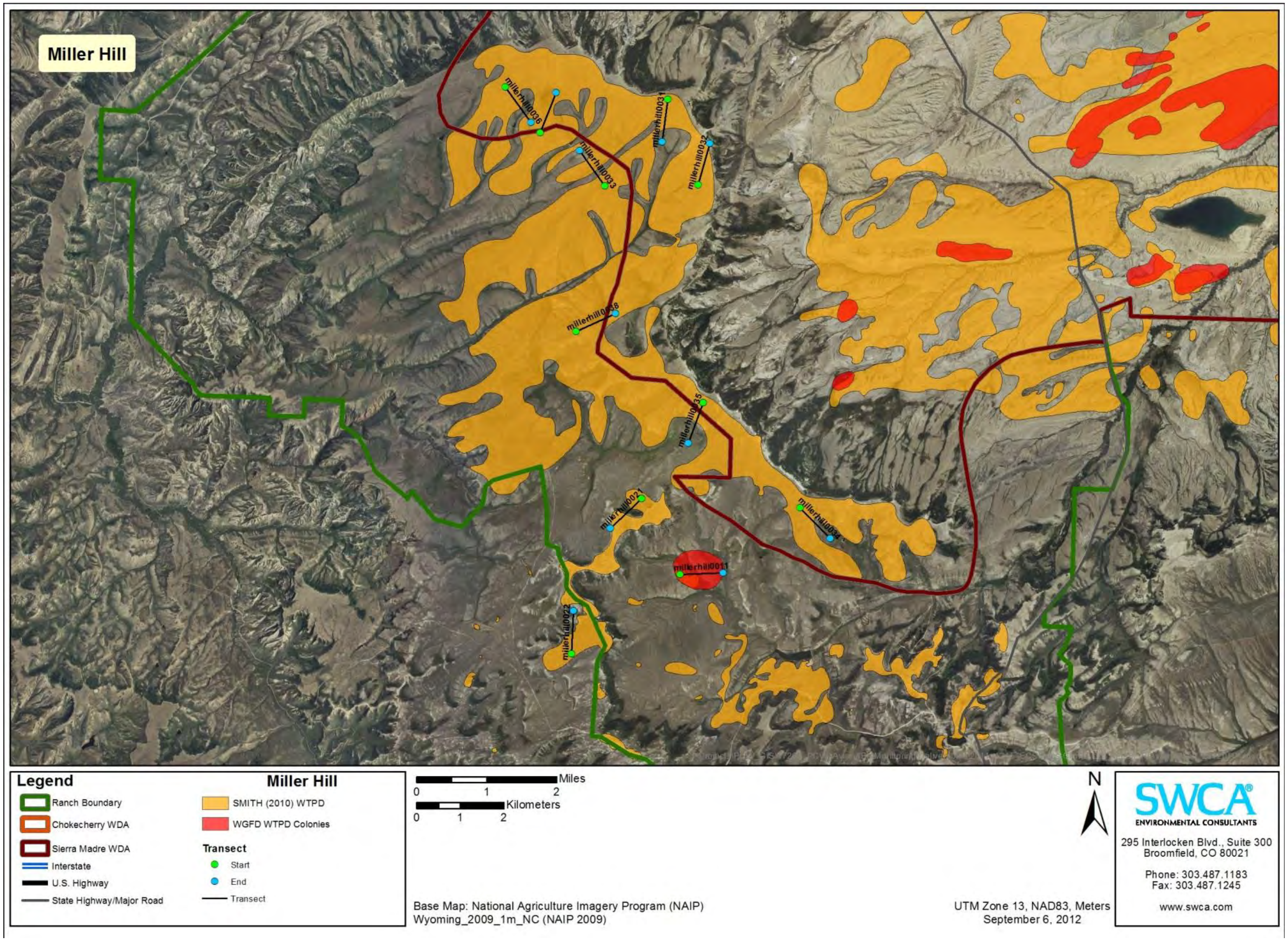


**Figure 6. Prey base survey locations on Miller Hill.**

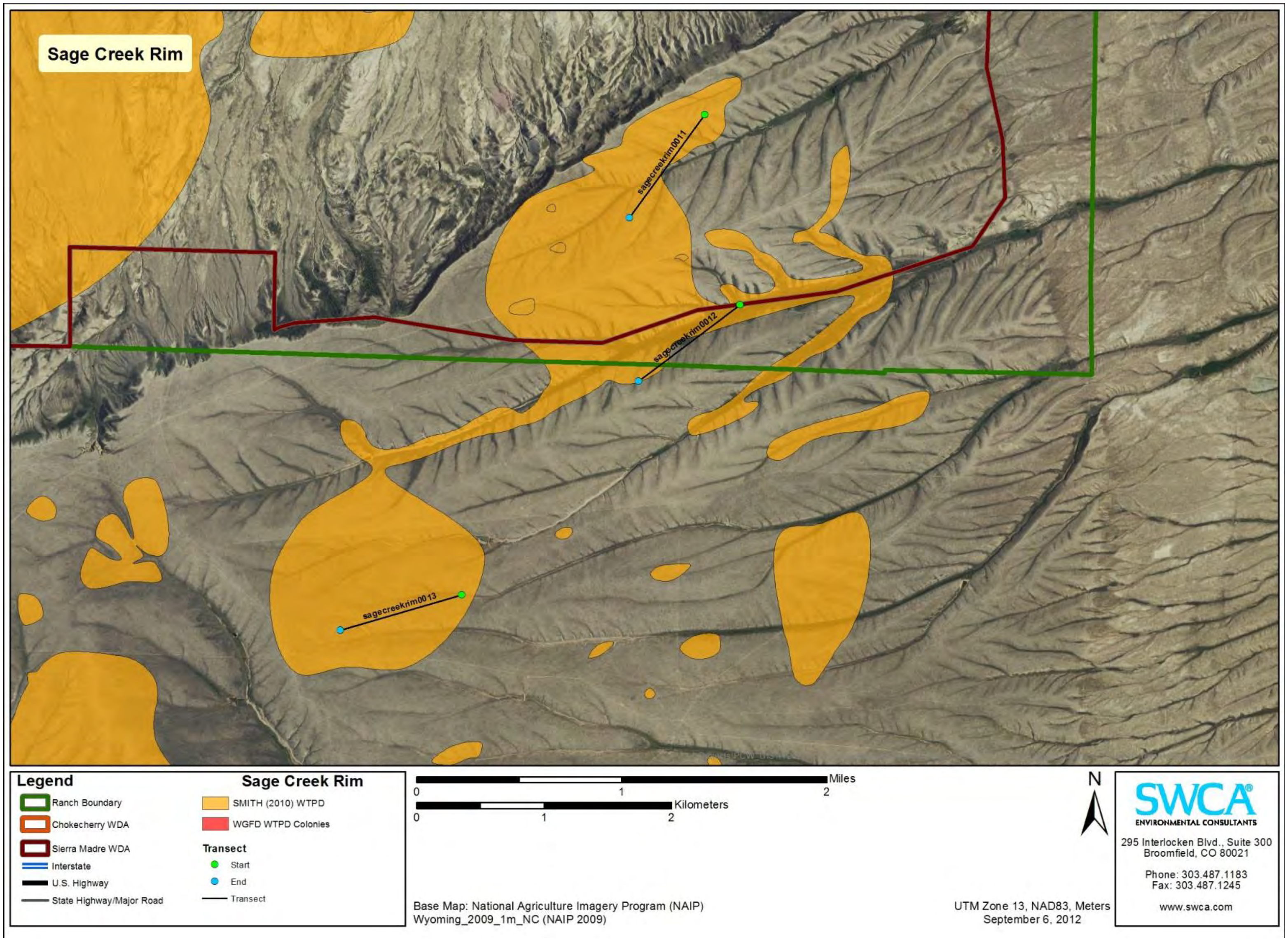


**Figure 7. Prey base survey locations in Sage Creek Rim area.**

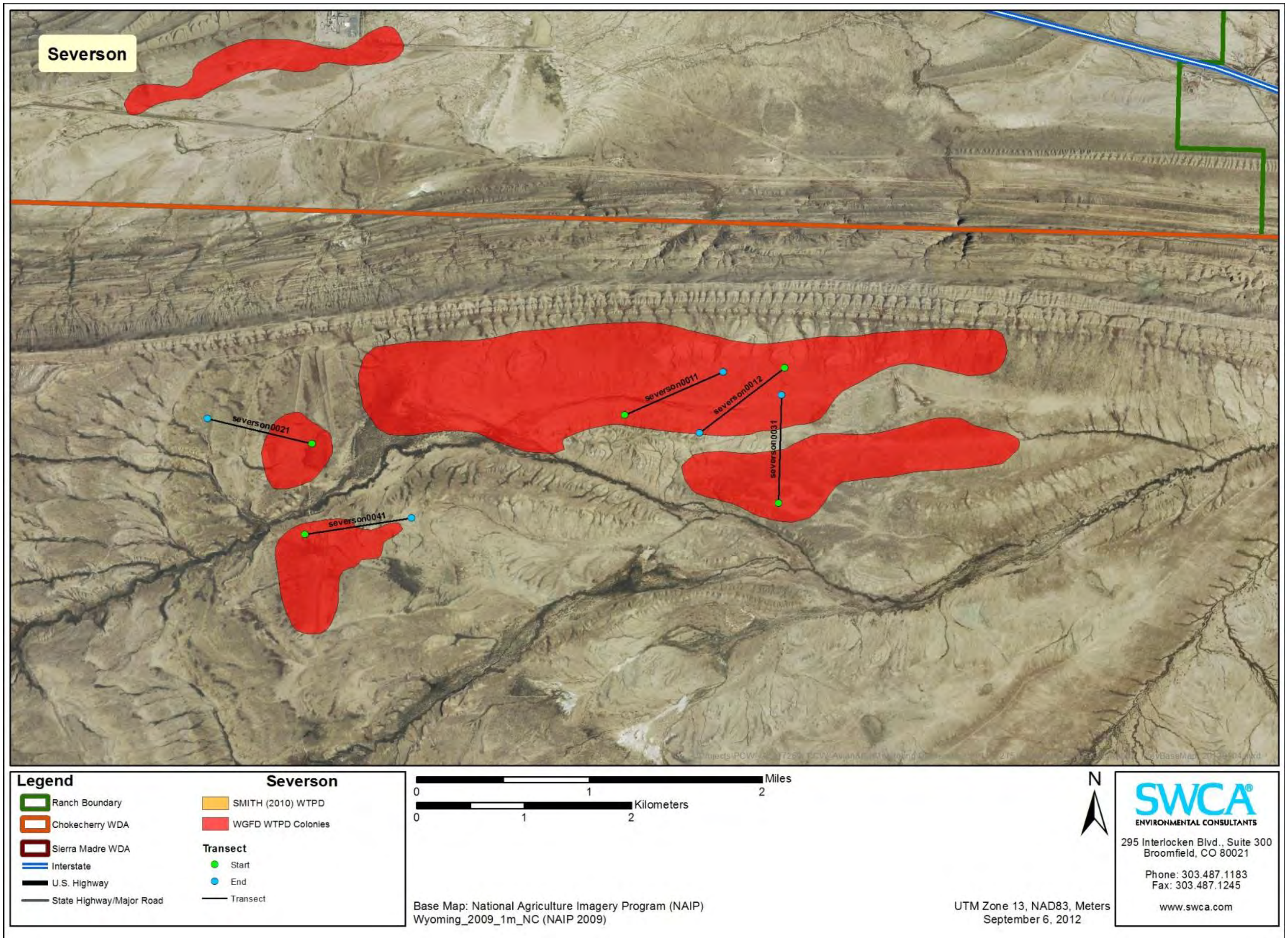


**Figure 8. Prey base survey locations in Severson Flats area.**

# 4.0 DISCUSSION

Bolten Road. White-tailed prairie dogs are most abundant in colonies along the Bolten Road (Table 1). Habitat in the area includes large expanses of flat and gently rolling terrain with large areas of low growing shrubs (Gardner's saltbush), sub-shrubs (birdsfoot sagebrush), and sparsely growing grasses and forbs. White-tailed prairie dog activity is highest in areas adjacent to suitable habitat surrounding Kindt Reservoir. Active burrows in this area account for 13% of all burrowing activity in the Bolten Road area, which is the largest proportion of activity compared to other areas on the Ranch. Active colonies in this area are concentrated in clusters throughout suitable habitat (low growing shrubs/sub-shrubs and sparse vegetation cover), surrounded by expanded areas of inactive and historic prairie dog colonies (44% of all burrow observations). Bolten Road (including areas surrounding Kindt Reservoir) supports the largest number of white-tailed prairie dog activity across the Ranch.

Central Basin. White-tailed prairie dog colonies are located along the flats within the Central Basin with their range extending to the eastern boundary of the Ranch along Bolten Road, west to the Pine Grove area, north to the base of the Bolten Rim, and south to the base of the Sage Creek Rim. The majority of burrows have visible mounding at the entrance and the burrow entrance size in active colonies ranges from 8-12 cm. Colonies are generally localized with burrows concentrated in clusters surrounded by larger areas devoid of burrows between colonies. Burrow densities in areas supporting the highest number of white-tailed prairie dogs are approximately 29 burrows per acre; colony size, including high burrow density colonies, is generally less than one acre. Burrow densities in other suitable habitats range from 6.7-8.8 total burrows per acre and 0.0-3.3 active burrows per acre (Table 1).

Miller Hill. Active white-tailed prairie dog colonies are not present on Miller Hill. However, several locations have inactive burrows with the necessary burrow entry size (8-12 cm), which may suggest potential historic white-tailed prairie dog occupancy.

Sage Creek Rim. In addition, white-tailed prairie dogs are not present in the area south of Sage Creek Rim, although some scattered clusters of badger mounds have similar characteristics to white-tailed prairie dog mounding.

Severson. White-tailed prairie dogs occupy suitable habitat in Severson (Table 1); however, activity is substantially lower when compared to other areas with active colonies. Although burrow densities for white-tailed prairie dog (6.7 burrows per acre) are comparable to other areas in the Ranch, total activity (0.13 active burrows per acre) is the lowest level of activity in the Project Site where active colonies are found. Total active burrows range from 0.0-0.67 per acre, indicating very low activity within the surveyed colonies.

Wyoming ground squirrels. Wyoming ground squirrel burrows, signs of recent activity, and individuals are commonly observed on Miller Hill, supporting the highest distribution and density of active burrows within the Project Site. Burrow entrances did not include any mounding and range in diameter from 5-8 cm. Unlike white-tailed prairie dogs, Wyoming ground squirrels appear to colonize areas of tall sagebrush and dense vegetation cover. However, Wyoming ground squirrels also use open areas with mixed vegetation cover and inhabit areas with occupied and unoccupied white-tailed prairie dog burrows. Occasionally, Wyoming ground squirrels occupy historic white-tailed prairie dog burrows.

American badgers. American badger burrow distribution is typically ubiquitous throughout the Ranch. Burrow entrances are distinctly large and typically greater than 12 cm. Recently excavated burrows are readily identified by large scraping marks on the inner wall of the burrow. Since American badgers feed extensively on fossorial mammals, it is common to observe American badger burrowing activity in areas supporting large populations of the smaller rodents. Several white-tailed prairie dog burrows appeared excavated by American badger and as a result these burrows have scoured entrances greater than 12 cm.

Pocket gophers. Pocket gophers occur throughout the Project Site in deep, loamy soils that support large shrub cover (basin big sagebrush, saltbush, and greasewood), typically on gently rising slopes off swales, draws, and rises. Burrows and tunneling activity are distinct, with above surface dirt remnants from snow tunneling, rounded dirt mounds, and small burrow entrances (less than 7 cm) typically plugged with loose soil (Beauvais and Dark-Smiley 2005). Pocket gophers in this area are generally much smaller than sciurids and seldom seen aboveground. Presence is generally assumed from recent burrowing and tunneling activity.

Leporids. The leporids commonly found on the Project Site are white-tailed jackrabbit, desert cottontail (*Sylvilagus audubonii*) and mountain cottontail (*Sylvilagus nuttallii*). All three species are crepuscular, feeding predominantly during the early morning and late evening hours; however white-tailed jackrabbits are known to forage throughout the night as well. These three species appear to be diffuse and widespread across the Project Site. All three species tend to inhabit areas with moderate shrub densities for use as cover from predators. White-tailed jackrabbit typically inhabit the lower-lying Central Basin of the Project Site, which is comprised if salt desert scrub and dense sagebrush steppe vegetation assemblages, but may also be found in higher areas of the Project Site. Desert cottontail may also be found in the Central Basin, the North Platte River corridor, and to a lesser extent on the Chokecherry plateau and Miller Hill, while mountain cottontail mainly occur on Miller Hill and to a lesser extent on the higher elevations of Chokecherry.

# 5.0 CONCLUSIONS

Overall, Wyoming ground squirrel, American badger, and pocket gopher burrows are more frequently observed than white-tailed prairie dog at most areas across the Project Site. Higher elevation areas on Miller Hill and south of Sage Creek Rim consist of large areas of rocky soils and dense sagebrush that is typically unsuitable for white-tailed prairie dogs. Upland areas with loamy soils and saltbush scrub along Bolten Road and the Central Basin provide more suitable habitat. In these areas, white-tailed prairie dogs colonies are distributed over wide ranges supporting several inactive burrows and generally low populations in occupied colonies. Sylvatic plague may potentially be responsible for the current lack of white-tailed prairie dog activity and the number of inactive colonies in this area, since the Project Site has very little development and recreational shooting is controlled. Sylvatic plague is known to have large scale effects on white-tailed prairie dog populations within its range (Menkens et al 1987, Behl and Kane 2003, Keinath 2004, Seglund et al. 2004, Pauli et al. 2006).

Wyoming ground squirrels are widespread across most habitat types in the Project Site. Miller Hill supports the highest density of Wyoming ground squirrel primarily due to their ability to colonize tall and dense sagebrush communities. In addition, Wyoming ground squirrels occupy areas with rockier substrate and are able to burrow underneath larger rocks and dense shrubs. White-tailed prairie dogs appear to avoid these habitat conditions.

WEST (2008) and SWCA (2012) survey results are contradictory to those provided in SMITH (2010). Also noteworthy is the lack of prairie dog observations within the Sierra Madre WDA by SWCA biologists during extensive vegetation and wildlife surveys from September 2009 to the present. Resolving this contradiction and accurately determining locations of active prairie dog colonies within the Project Site is important in evaluating golden eagle prey base potential within the Project Site. As stated above, the Smith (2010) data do not provide a count or density calculation of prairie dogs for individual colonies or collectively; nor can a population estimate be calculated from a count of active burrows. The assumption that delineated prairie dog colonies in SMITH (2010) contain a viable prey source for golden eagles is not valid. Prey base assessments should be conducted based on the revised burrow density estimates from this report. These data represent the best available scientific data and clearly demonstrate that the SMITH (2010) data are inadequate to address white-tailed prairie dog activity and prey base within the Project Site.

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# ATTACHMENT A

# Survey Protocols

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**White-tailed Prairie Dog (*Cynomys leucurus*) – Survey Protocols (from McDonald et al. 2011 – Appendix 6)**

*Ground Survey Procedure for Identifying Occupancy and Activity of Colonies*

Abundance of burrows often has been used as an index to the abundance of their inhabitants; however, previous studies of this relationship have produced variable results (McDonald et al. 2011). A significant positive correlation between densities of occupied burrows and prairie dogs was estimated for WTPDs (Biggins et al. 1993) and BTPDs (Biggins et al. 1993, Johnson and Collinge 2004, Chipault 2010) although others have failed to detect such a relationship (Powell et al. 1994, Severson and Plumb 1998). Although it is intuitive that a positive correlation exists because prairie dogs are notably burrowing mammals and occupied prairie dog burrows cannot exist without prairie dogs (recently present, at least), we do not suggest that statistically valid inferences regarding population abundance can be extrapolated from our survey methods. Our primary purpose for assessing prairie dog burrows will be to estimate the proportion of a sampled colony on which prairie dogs recently were present. Because catastrophic losses of prairie dogs due to poisoning or plague can happen quickly (weeks or even days), and scat can appear relatively fresh for somewhat longer periods of time, the term recent implies occupancy within the past couple of months.

We propose use of belt transects to sample densities of burrow openings (occupied and unoccupied) on colonies selected for ground truthing. Before completing these activities, it will be necessary to determine the colonies to be sampled and secure permission to access private lands. Although weather patterns can affect results, sampling should not be inordinately sensitive to minor variations in prairie dog activity due to weather during this spring-summer period. However, long spells of extreme drought and periods of extreme thunderstorm activity should be avoided. The former might cause reduced activity in prairie dogs and flooding during the latter can destroy or re-distribute scat.

The following methodology was adapted from transect procedures described by Biggins and others (1993):

1. A prairie dog burrow opening is defined as an opening of diameter ≥ 7 cm with a tunnel extending beyond view. Large, badger-reamed burrows are included because prairie dogs often continue to use these burrows after the badger departs.
2. A burrow is classified as occupied if it has white-tailed prairie dog activity and/or fresh scat within 0.5 m of the opening. Fresh scat is defined as droppings that are not dried hard and bleached white but are greenish, black or dark brown. A close, detailed inspection of each burrow is not necessary or desirable. A maximum of 10 seconds per burrow is sufficient, and active burrows are often obvious at a glance.
3. Belt transects are 6 meters in width, with a length of 1,000 m (0.6 ha transects). The width is maintained by the operator (on foot or on an ATV).
4. Operator should record the coordinates of begin and end points of each transect, and each burrow opening is coded as occupied or unoccupied (*see* **Datasheet**).
5. Operator determines course direction (e.g., 180 degrees) and picks a corresponding landmark far ahead to maintain bearing (something on the horizon or at least several kilometers away). Concentration is maintained on the navigation landmark rather than on

burrow openings in the vicinity of the observer or immediately ahead. Peripheral vision is used to determine when to stop and examine a burrow opening for inclusion (that is, when more than half the burrow opening is inside the end of the bar). The long, narrow plots have a great deal of edge, so extreme care must be used to avoid biasing the decision regarding inclusion of burrow openings. Avoid letting any burrow opening influence direction of travel. This procedure sounds onerous and time consuming, but close calls will not be common, and a rapid pace usually is easy to maintain. Routinely, 10-15 km of transects can be completed per person per day.

The above steps describe collection of quantitative information. Also collect qualitative notes on sensitive species occurrence (e.g., mountain plover, Wyoming pocket gopher, pygmy rabbit) other prey base species (ground squirrels, pocket gophers, other rodents, lagomorphs, etc.), observations of digging, plugged burrows, burrows with spider webs, prairie dogs seen (dead or alive), clipped vegetation, evidence of poisoning (flagging, bait remnants, soil shoveled into burrows), and mounds with crusted soil (*see* **Datasheet**).

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## WTPD Survey Data Sheet (2012)

| | | | |
|---|---|---|---|
| Transect ID | | Survey Date | |
| Observer | | Survey Time | |
| Begin UTM | N | End UTM | N |
| | E | | E |
| Survey azimuth | | Temperature | |
| Survey Length (m) | | Wind Speed | |
| | | Cloud | |
| | | Precipitation | |

| WTPD Burrows | | TOTAL | Other Burrows | | TOTAL |
|---|---|---|---|---|---|
| Active | | | WYGS | | |
| Inactive | | | POGO | | |
| | | | Badger | | |
| | TOTAL | | Collapsed | | |

| | | TOTAL | Preybase | | TOTAL |
|---|---|---|---|---|---|
| WTPD Individuals | | | WYGS | | |
| | | | Lagomorphs | | |

| Sensitive Species | | | | Other | |
|---|---|---|---|---|---|
| MOUP | | GOEA | | | |
| PYRA | | BUOW | | | |
| WYPG | | Other | | | |

Notes:

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# ATTACHMENT B

# Field Observations

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| Area | Transect | Tran ID | Observer | Date | Time | Bearing | Length (m) | Area ($m^2$) | Burrow Counts | | | | | | | | Burrow Density | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | WTPD (active) | WTPD (inactive) | WYGS | POGO | BADG | Collapsed | WTPD (TOTAL) | TOTAL | WTPD (active) | WTPD (TOTAL) | TOTAL |
| Bolten Road | hugus001 | 01 | RBD | 08/08/2012 | 17:25 | 183 | 999.86 | 5999 | 0 | 1 | 1 | 3 | 1 | 9 | 1 | 15 | **0.000** | **0.675** | **10.119** |
| Bolten Road | hugus002 | 02 | RBD | 08/08/2012 | 18:57 | 212 | 1002.68 | 6016 | 0 | 1 | 5 | 2 | 2 | 9 | 1 | 19 | **0.000** | **0.673** | **12.781** |
| Bolten Road | kindt001 | 01 | JWW | 08/04/2012 | 11:25 | 254 | 1005.79 | 6035 | 13 | 7 | 5 | 3 | 0 | 2 | 20 | 30 | **8.718** | **13.412** | **20.118** |
| Bolten Road | kindt001 | 02 | JWW | 08/04/2012 | 12:50 | 228 | 996.54 | 5979 | 0 | 22 | 1 | 0 | 1 | 11 | 22 | 35 | **0.000** | **14.890** | **23.689** |
| Bolten Road | kindt001 | 03 | JWW | 08/03/2012 | 13:18 | 333 | 971.64 | 5830 | 12 | 13 | 7 | 0 | 3 | 2 | 25 | 37 | **8.330** | **17.354** | **25.684** |
| Bolten Road | kindt001 | 04 | JWW | 08/04/2012 | 12:09 | 057 | 955.72 | 5734 | 15 | 12 | 0 | 3 | 0 | 10 | 27 | 40 | **10.586** | **19.055** | **28.229** |
| Bolten Road | kindt001 | 05 | JWW | 08/04/2012 | 13:47 | 317 | 1017.18 | 6103 | 7 | 6 | 11 | 7 | 1 | 9 | 13 | 41 | **4.642** | **8.620** | **27.186** |
| Bolten Road | kindt001 | 06 | JWW | 08/10/2012 | 15:53 | 275 | 997.55 | 5985 | 13 | 15 | 1 | 0 | 0 | 3 | 28 | 32 | **8.790** | **18.932** | **21.636** |
| Bolten Road | kindt001 | 07 | JWW | 08/10/2012 | 12:15 | 117 | 1000.79 | 6005 | 13 | 5 | 0 | 0 | 0 | 3 | 18 | 21 | **8.761** | **12.131** | **14.153** |
| Bolten Road | kindt001 | 08 | JWW | 08/10/2012 | 10:00 | 029 | 996.09 | 5977 | 4 | 1 | 5 | 0 | 3 | 7 | 5 | 20 | **2.708** | **3.386** | **13.542** |
| Bolten Road | kindt001 | 09 | JWW | 08/10/2012 | 10:48 | 145 | 1003.14 | 6019 | 7 | 19 | 9 | 2 | 2 | 4 | 26 | 43 | **4.707** | **17.481** | **28.912** |
| Bolten Road | kindt001 | 10 | JWW | 08/10/2012 | 13:25 | 325 | 993.43 | 5961 | 3 | 8 | 0 | 0 | 0 | 0 | 11 | 11 | **2.037** | **7.468** | **7.468** |
| Bolten Road | littlesage001 | 01 | RBD | 08/09/2012 | 15:05 | 090 | 1002.34 | 6014 | 0 | 8 | 13 | 0 | 5 | 14 | 8 | 40 | **0.000** | **5.383** | **26.916** |
| Bolten Road | littlesage001 | 02 | RBD | 08/09/2012 | 14:10 | 337 | 1006.72 | 6040 | 0 | 3 | 5 | 2 | 3 | 5 | 3 | 18 | **0.000** | **2.010** | **12.060** |
| Bolten Road | bolten001 | 01 | RBD | 08/08/2012 | 12:01 | 228 | 1007.18 | 6043 | 2 | 5 | 6 | 0 | 3 | 6 | 7 | 22 | **1.339** | **4.688** | **14.733** |
| Bolten Road | bolten001 | 02 | RBD | 08/08/2012 | 11:25 | 081 | 1001.60 | 6010 | 0 | 8 | 3 | 0 | 1 | 4 | 8 | 16 | **0.000** | **5.387** | **10.774** |
| Bolten Road | bolten002 | 01 | MJP | 08/07/2012 | 15:45 | 228 | 1009.49 | 6057 | 0 | 3 | 7 | 0 | 0 | 4 | 3 | 14 | **0.000** | **2.004** | **9.354** |
| Bolten Road | bolten002 | 02 | RBD | 08/07/2012 | 14:02 | 115 | 1000.42 | 6003 | 0 | 11 | 3 | 3 | 1 | 9 | 11 | 27 | **0.000** | **7.416** | **18.203** |
| Bolten Road | bolten003 | 01 | JWW | 08/14/2012 | 15:33 | 308 | 1006.34 | 6038 | 0 | 4 | 7 | 0 | 2 | 1 | 12 | 22 | **0.000** | **8.043** | **14.745** |
| Bolten Road | bolten003 | 02 | RBD | 08/15/2012 | 6:54 | 064 | 1002.48 | 6015 | 0 | 16 | 9 | 0 | 2 | 42 | 13 | 66 | **0.000** | **8.747** | **44.405** |
| Bolten Road | bolten003 | 03 | JWW | 08/14/2012 | 14:44 | 237 | 1006.03 | 6036 | 0 | 10 | 8 | 15 | 0 | 12 | 14 | 49 | **0.000** | **9.386** | **32.851** |
| Bolten Road | bolten003 | 04 | RBD | 08/14/2012 | 12:53 | 268 | 1002.98 | 6018 | 0 | 2 | 7 | 0 | 0 | 14 | 15 | 36 | **0.000** | **10.087** | **24.209** |
| Bolten Road | bolten003 | 05 | JWW | 08/14/2012 | 13:11 | 178 | 1006.01 | 6036 | 0 | 1 | 4 | 12 | 0 | 8 | 16 | 40 | **0.000** | **10.727** | **26.818** |
| Bolten Road | bolten003 | 06 | JWW | 08/14/2012 | 14:05 | 093 | 1005.51 | 6033 | 4 | 10 | 8 | 0 | 1 | 7 | 17 | 33 | **2.683** | **11.403** | **22.136** |
| Bolten Road | bolten004 | 01 | JWW | 08/07/2012 | 12:09 | 188 | 1000.84 | 6005 | 7 | 9 | 9 | 3 | 1 | 11 | 16 | 40 | **4.717** | **10.783** | **26.956** |
| Bolten Road | bolten005 | 01 | RBD | 08/08/2012 | 14:15 | 249 | 1012.26 | 6074 | 1 | 4 | 5 | 1 | 2 | 9 | 5 | 22 | **0.666** | **3.332** | **14.659** |
| Central Basin | pinegrove001 | 01 | JWW | 08/06/2012 | 14:04 | 078 | 1000.16 | 6001 | 0 | 2 | 4 | 0 | 3 | 3 | 2 | 12 | **0.000** | **1.349** | **8.092** |
| Central Basin | pinegrove001 | 02 | JWW | 08/06/2012 | 15:15 | 157 | 1014.15 | 6085 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 5 | **0.000** | **0.000** | **3.325** |
| Central Basin | pinegrove001 | 03 | JWW | 08/07/2012 | 15:14 | 248 | 1001.46 | 6009 | 0 | 13 | 2 | 7 | 0 | 3 | 13 | 25 | **0.000** | **8.755** | **16.837** |
| Central Basin | pinegrove001 | 04 | JWW | 08/07/2012 | 14:08 | 316 | 995.90 | 5975 | 1 | 21 | 20 | 9 | 0 | 19 | 22 | 70 | **0.677** | **14.900** | **47.408** |
| Central Basin | pinegrove001 | 05 | JWW | 08/06/2012 | 16:01 | 136 | 999.99 | 6000 | 0 | 9 | 3 | 0 | 1 | 5 | 9 | 18 | **0.000** | **6.070** | **12.141** |
| Central Basin | sagecreek001 | 01 | RBD | 08/12/2012 | 16:40 | 039 | 1221.92 | 7332 | 0 | 5 | 6 | 1 | 1 | 14 | 5 | 27 | **0.000** | **2.760** | **14.903** |
| Central Basin | sagecreek001 | 02 | JWW | 08/08/2012 | 10:42 | 132 | 1001.89 | 6011 | 0 | 18 | 7 | 0 | 0 | 9 | 18 | 34 | **0.000** | **12.118** | **22.889** |
| Central Basin | sagecreek001 | 03 | RBD | 08/10/2012 | 11:25 | 251 | 1002.76 | 6017 | 0 | 2 | 3 | 0 | 2 | 7 | 2 | 14 | **0.000** | **1.345** | **9.417** |
| Central Basin | sagecreek001 | 04 | RBD | 08/10/2012 | 12:40 | 118 | 1001.34 | 6008 | 0 | 0 | 5 | 0 | 1 | 9 | 0 | 15 | **0.000** | **0.000** | **10.104** |

| Area | Transect | Tran ID | Observer | Date | Time | Bearing | Length (m) | Area ($m^2$) | Burrow Counts | | | | | | | | Burrow Density | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | WTPD (active) | WTPD (inactive) | WYGS | POGO | BADG | Collapsed | WTPD (TOTAL) | TOTAL | WTPD (active) | WTPD (TOTAL) | TOTAL |
| Central Basin | centralbasin001 | 01 | JWW | 08/02/2012 | 11:22 | 066 | 999.61 | 5998 | 0 | 7 | 7 | 0 | 4 | 19 | 7 | 37 | 0.000 | 4.723 | 24.965 |
| Central Basin | centralbasin001 | 02 | JWW | 08/02/2012 | 13:36 | 244 | 1005.92 | 6036 | 0 | 1 | 3 | 0 | 1 | 7 | 1 | 12 | 0.000 | 0.671 | 8.046 |
| Central Basin | centralbasin001 | 03 | JWW | 08/02/2012 | 14:58 | 020 | 1000.01 | 6000 | 0 | 11 | 5 | 1 | 3 | 18 | 11 | 38 | 0.000 | 7.419 | 25.630 |
| Central Basin | centralbasin001 | 04 | JWW | 08/02/2012 | 16:36 | 044 | 1001.43 | 6009 | 0 | 18 | 6 | 0 | 1 | 7 | 18 | 32 | 0.000 | 12.123 | 21.552 |
| Central Basin | centralbasin001 | 05 | JWW | 08/02/2012 | 15:58 | 208 | 1010.32 | 6062 | 0 | 0 | 14 | 1 | 4 | 4 | 0 | 23 | 0.000 | 0.000 | 15.354 |
| Central Basin | centralbasin001 | 06 | RBD | 08/14/2012 | 16:00 | 360 | 1002.25 | 6013 | 0 | 4 | 6 | 0 | 1 | 19 | 1 | 27 | 0.000 | 0.673 | 18.170 |
| Central Basin | centralbasin001 | 07 | RBD | 08/14/2012 | 18:41 | 116 | 1000.07 | 6000 | 0 | 5 | 6 | 0 | 1 | 13 | 2 | 22 | 0.000 | 1.349 | 14.837 |
| Central Basin | centralbasin001 | 09 | JWW | 08/14/2012 | 11:06 | 197 | 1002.47 | 6015 | 0 | 37 | 12 | 0 | 3 | 17 | 3 | 35 | 0.000 | 2.018 | 23.549 |
| Central Basin | centralbasin002 | 01 | JWW | 08/06/2012 | 12:00 | 037 | 998.40 | 5990 | 0 | 10 | 5 | 0 | 0 | 12 | 10 | 27 | 0.000 | 6.756 | 18.240 |
| Central Basin | centralbasin002 | 02 | JWW | 08/06/2012 | 12:40 | 115 | 990.60 | 5944 | 5 | 22 | 8 | 1 | 0 | 7 | 27 | 43 | 3.404 | 18.384 | 29.278 |
| Central Basin | centralbasin003 | 01 | JWW | 08/03/2012 | 13:30 | 002 | 999.65 | 5998 | 0 | 9 | 10 | 1 | 0 | 6 | 9 | 26 | 0.000 | 6.072 | 17.543 |
| Central Basin | centralbasin003 | 02 | JWW | 08/03/2012 | 14:51 | 096 | 996.44 | 5979 | 0 | 9 | 7 | 0 | 0 | 6 | 9 | 22 | 0.000 | 6.092 | 14.891 |
| Central Basin | centralbasin003 | 03 | JWW | 08/03/2012 | 11:45 | 192 | 1010.60 | 6064 | 2 | 2 | 7 | 6 | 1 | 22 | 4 | 40 | 1.335 | 2.670 | 26.696 |
| Central Basin | centralbasin004 | 01 | JWW | 08/09/2012 | 11:15 | 292 | 1003.34 | 6020 | 3 | 20 | 13 | 0 | 2 | 14 | 23 | 52 | 2.017 | 15.461 | 34.956 |
| Central Basin | centralbasin004 | 02 | JWW | 08/09/2012 | 10:26 | 338 | 999.43 | 5997 | 13 | 7 | 6 | 9 | 0 | 0 | 20 | 35 | 8.773 | 13.497 | 23.620 |
| Central Basin | centralbasin004 | 03 | JWW | 08/09/2012 | 12:05 | 220 | 372.54 | 2235 | 16 | 0 | 2 | 0 | 0 | 2 | 16 | 20 | 28.968 | 28.968 | 36.209 |
| Central Basin | centralbasin005 | 01 | JWW | 08/03/2012 | 17:30 | 301 | 997.95 | 5988 | 0 | 12 | 5 | 3 | 12 | 14 | 12 | 46 | 0.000 | 8.110 | 31.090 |
| Central Basin | centralbasin005 | 02 | JWW | 08/03/2012 | 16:50 | 094 | 999.45 | 5997 | 0 | 14 | 7 | 0 | 4 | 16 | 14 | 41 | 0.000 | 9.448 | 27.669 |
| Central Basin | centralbasin005 | 03 | JWW | 08/08/2012 | 14:12 | 331 | 998.19 | 5989 | 0 | 5 | 23 | 0 | 0 | 7 | 5 | 35 | 0.000 | 3.378 | 23.649 |
| Central Basin | centralbasin005 | 04 | JWW | 08/08/2012 | 15:02 | 063 | 999.54 | 5997 | 2 | 14 | 10 | 3 | 0 | 7 | 16 | 36 | 1.350 | 10.797 | 24.292 |
| Miller Hill | millerhill001 | 01 | MJP | 08/10/2012 | 13:59 | 086 | 1001.92 | 6012 | 0 | 5 | 5 | 4 | 2 | 3 | 3 | 17 | 0.000 | 2.020 | 11.444 |
| Miller Hill | millerhill002 | 01 | JWW | 08/13/2012 | 16:57 | 225 | 1000.29 | 6002 | 0 | 0 | 3 | 3 | 7 | 5 | 0 | 18 | 0.000 | 0.000 | 12.137 |
| Miller Hill | millerhill002 | 02 | MJP | 08/10/2012 | 11:01 | 001 | 997.97 | 5988 | 0 | 5 | 5 | 3 | 0 | 0 | 0 | 8 | 0.000 | 0.000 | 5.407 |
| Miller Hill | millerhill003 | 01 | MJP | 08/09/2012 | 14:49 | 186 | 997.64 | 5986 | 0 | 10 | 14 | 4 | 3 | 7 | 10 | 38 | 0.000 | 6.761 | 25.691 |
| Miller Hill | millerhill003 | 02 | MJP | 08/09/2012 | 15:30 | 014 | 997.94 | 5988 | 0 | 5 | 12 | 1 | 0 | 5 | 5 | 23 | 0.000 | 3.379 | 15.545 |
| Miller Hill | millerhill003 | 03 | MJP | 08/09/2012 | 15:21 | 323 | 999.26 | 5996 | 0 | 0 | 11 | 3 | 3 | 10 | 0 | 27 | 0.000 | 0.000 | 18.224 |
| Miller Hill | millerhill003 | 04 | MJP | 08/10/2012 | 15:00 | 134 | 998.47 | 5991 | 0 | 3 | 3 | 4 | 7 | 4 | 8 | 26 | 0.000 | 5.404 | 17.563 |
| Miller Hill | millerhill003 | 05 | JWW | 08/13/2012 | 12:45 | 200 | 1001.56 | 6009 | 0 | 0 | 6 | 7 | 6 | 22 | 0 | 41 | 0.000 | 0.000 | 27.610 |
| Miller Hill | millerhill003 | 06 | JWW | 08/13/2012 | 15:46 | 144 | 1004.67 | 6028 | 0 | 0 | 15 | 6 | 21 | 10 | 0 | 52 | 0.000 | 0.000 | 34.910 |
| Miller Hill | millerhill003 | 07 | JWW | 08/13/2012 | 14:58 | 019 | 997.93 | 5988 | 0 | 3 | 23 | 0 | 21 | 9 | 3 | 56 | 0.000 | 2.028 | 37.849 |
| Miller Hill | millerhill003 | 08 | JWW | 08/13/2012 | 13:56 | 064 | 1003.23 | 6019 | 0 | 0 | 6 | 25 | 13 | 17 | 0 | 61 | 0.000 | 0.000 | 41.011 |
| Sage Creek Rim | sagecreekrim001 | 01 | JWW | 08/09/2012 | 13:45 | 216 | 1002.32 | 6014 | 0 | 5 | 7 | 2 | 0 | 9 | 5 | 23 | 0.000 | 3.365 | 15.477 |
| Sage Creek Rim | sagecreekrim001 | 02 | JWW | 08/09/2012 | 14:20 | 242 | 1000.21 | 6001 | 0 | 19 | 6 | 0 | 11 | 14 | 19 | 50 | 0.000 | 12.812 | 33.717 |
| Sage Creek Rim | sagecreekrim001 | 03 | JWW | 08/09/2012 | 15:25 | 255 | 997.40 | 5984 | 0 | 11 | 2 | 7 | 0 | 9 | 11 | 29 | 0.000 | 7.439 | 19.611 |
| Severson | severson001 | 01 | MJP | 08/08/2012 | 12:31 | 065 | 999.93 | 6000 | 0 | 12 | 7 | 0 | 0 | 7 | 12 | 26 | 0.000 | 8.094 | 17.538 |

| Area | Transect | Tran ID | Observer | Date | Time | Bearing | Length (m) | Area ($m^2$) | Burrow Counts | | | | | | | | Burrow Density | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | WTPD (active) | WTPD (inactive) | WYGS | POGO | BADG | Collapsed | WTPD (TOTAL) | TOTAL | WTPD (active) | WTPD (TOTAL) | TOTAL |
| Severson | severson001 | 02 | MJP | 08/08/2012 | 11:02 | 231 | 999.07 | 5994 | 0 | 13 | 10 | 1 | 1 | 6 | 13 | 31 | **0.000** | **8.776** | **20.928** |
| Severson | severson002 | 01 | RBD | 08/13/2012 | 13:49 | 284 | 1004.63 | 6028 | 1 | 10 | 6 | 2 | 2 | 9 | 11 | 30 | **0.671** | **7.385** | **20.141** |
| Severson | severson003 | 01 | MJP | 08/08/2012 | 13:40 | 357 | 1006.31 | 6038 | 0 | 10 | 12 | 5 | 1 | 3 | 10 | 31 | **0.000** | **6.702** | **20.778** |
| Severson | severson004 | 01 | RBD | 08/13/2012 | 15:00 | 083 | 1005.40 | 6032 | 0 | 4 | 2 | 4 | 0 | 5 | 4 | 15 | **0.000** | **2.683** | **10.063** |

# Chokecherry and Sierra Madre Wind Energy Project

# 2013 White-tailed Prairie Dog Survey Report and Eagle Use Assessment

Prepared for

Power Company of Wyoming LLC

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September 2013

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## TABLE OF CONTENTS

1.0 Introduction ... 1
2.0 Project Background ... 1
3.0 Results and Disussion ... 8
3.1 Chokecherry ... 8
3.2 Upper Miller Hill ... 10
3.3 Lower Miller Hill ... 12
4.0 Conclusions ... 17
5.0 References ... 18

## LIST OF FIGURES

Figure 1. CCSM Project development areas and phasing ... 3
Figure 2. 2013 survey area in relation to CCSM Project phasing. ... 5
Figure 3. CCSM Project physiographic features ... 7
Figure 4. Eagle flight pathways and active eagle nest locations (2008, 2011, 2012, and 2013) in relation to WTPD colonies in the Chokecherry portion of the 2013 survey area. ... 9
Figure 5. Eagle flight pathways in relation to white-tailed prairie dog colonies identified during surveys of Upper Miller Hill ... 11
Figure 6. Location of WTPD colonies within the Lower Miller Hill portion of the 2013 survey area ... 14
Figure 7. Eagle flight pathways and active eagle nest locations (2008, 2011, 2012, and 2013) in relation to WTPD colonies having adequate size and density in the Lower Miller Hill portion of the 2013 survey area. ... 15
Figure 8. Eagle flight pathways in relation to the two WTPD colonies identified as having combinations of documented eagle use and sufficient WTPD colony size and burrow density. ... 16

# 1.0 INTRODUCTION

This document, the 2013 White-tailed Prairie Dog Survey Report and Eagle Use Assessment, (2013 CCSM Prey Base Report), updates and supplements the CCSM Project Eagle and Raptor Prey Base Assessment (SWCA 2012), provided to the U.S. Fish and Wildlife Service (the Service) in October 2012.

PCW's 2012 CCSM Project Eagle and Raptor Prey Base Assessment supplemented PCW's Eagle Conservation Plan meeting the Service's January 2011 Draft Eagle Conservation Plan Guidance which called for surveys documenting foraging areas that might represent "important eagle use areas" under the definitions provided in 50 CFR 22.3. In April 2013, the Service issued its Final Eagle Conservation Plan Guidance which confirmed the Draft ECP Guidance on this issue.

The 2013 CCSM Prey Base Report incorporates the field surveys and analysis completed in 2013, and focuses specifically on Phase I of the CCSM Project, as described in more detail below. The 2013 surveys were conducted in compliance with both the Draft and the Final ECP Guidance to determine locations and abundance of White-tailed Prairie Dogs in the vicinity of Phase I of the CCSM Project and to assess the potential of such prey species to support resident and non-resident eagles.

The 2013 survey data and analysis discussed below further supports the conclusions that SWCA outlined in the 2012 CCSM Project Eagle and Raptor Prey Base Assessment, including that eagle and raptor foraging opportunities associated with white-tailed prairie dogs is low across the Phase I CCSM Project Site based upon (i) the best available scientific data for the Project (WEST 2008, SWCA 2012, data collected in 2013), (ii) the location of the highest population densities outside of areas of likely turbine development, and (iii) seasonal absence during hibernation in the CCSM Project Site between approximately August and mid-late March.

# 2.0 PROJECT BACKGROUND

Power Company of Wyoming LLC (PCW) proposes to construct, operate, maintain and decommission the Chokecherry and Sierra Madre Wind Energy Project (CCSM Project), located in Carbon County, Wyoming. The CCSM Project consists of up to 1,000 wind turbines capable of generating approximately 2,000 to 3,000 megawatts (MW) of clean, renewable wind energy. The primary components of the CCSM Project include the wind turbine generators, an internal road network, a rail facility, a quarry, an internal electrical collection and transmission system, substations, and operations and maintenance buildings.

The CCSM Project is located south of the city of Rawlins, primarily within the bounds of the Overland Trail Ranch (Ranch). The Ranch is owned and operated by PCW affiliate, The Overland Trail Cattle Company LLC (TOTCO). The Ranch is situated within an area of alternating sections of private and federal lands commonly referred to as the "checkerboard." The vast majority of the private lands are owned by TOTCO and the federal lands are administered by the Bureau of Land Management (BLM) Rawlins Field Office (RFO). A small percentage of the land within the Ranch is owned by the State of Wyoming and is administered by the State Board of Land Commissioners. Finally, Anadarko Land Corporation owns some sections located on the periphery of the northwest boundary of the Ranch.

In 2008, PCW applied to BLM for right-of-way grants to construct, operate, maintain and decommission the CCSM Project on federal land within the CCSM Project Area. On June 29, 2012, the Notice of Availability for the Final EIS concerning the CCSM Project was published in the Federal Register (77 FR 63328). On October 9, 2012 the Secretary of the Interior signed the Record of Decision (ROD). In the ROD, BLM determined that over 200,000 acres located on the Overland Trail Ranch were suitable for wind energy development, subject to the requirements described under the Selected Alternative in the ROD: the Chokecherry wind development area (Chokecherry WDA) and the Sierra Madre wind development area (Sierra Madre WDA).

The Sierra Madre WDA consists of two distinct areas divided by Highway 71 (BLM 2012; Figure 3-1). The portion of the Sierra Madre WDA located west of Highway 71 is referred to as Miller Hill and the portion of Sierra Madre located east of Highway 71 is referred to as Sage Creek Basin (BLM 2012a; App. B at 4-25 and 4-26, Figure 4-10). The Chokecherry WDA is located entirely east of Highway 71, and is divided into Western and Eastern Chokecherry based on topography (BLM 2012a; App. B at 4-26, Figure 4-10).

Development of the CCSM Project will occur in two phases. Phase I of the CCSM Project (Phase I) will include development of Miller Hill (Upper and Lower), Western Chokecherry, and the portion of Eastern Chokecherry located west of the CCSM Project Haul Road (Figure 1). Phase II development will include Sage Creek Basin and the remainder of Eastern Chokecherry (Phase II).

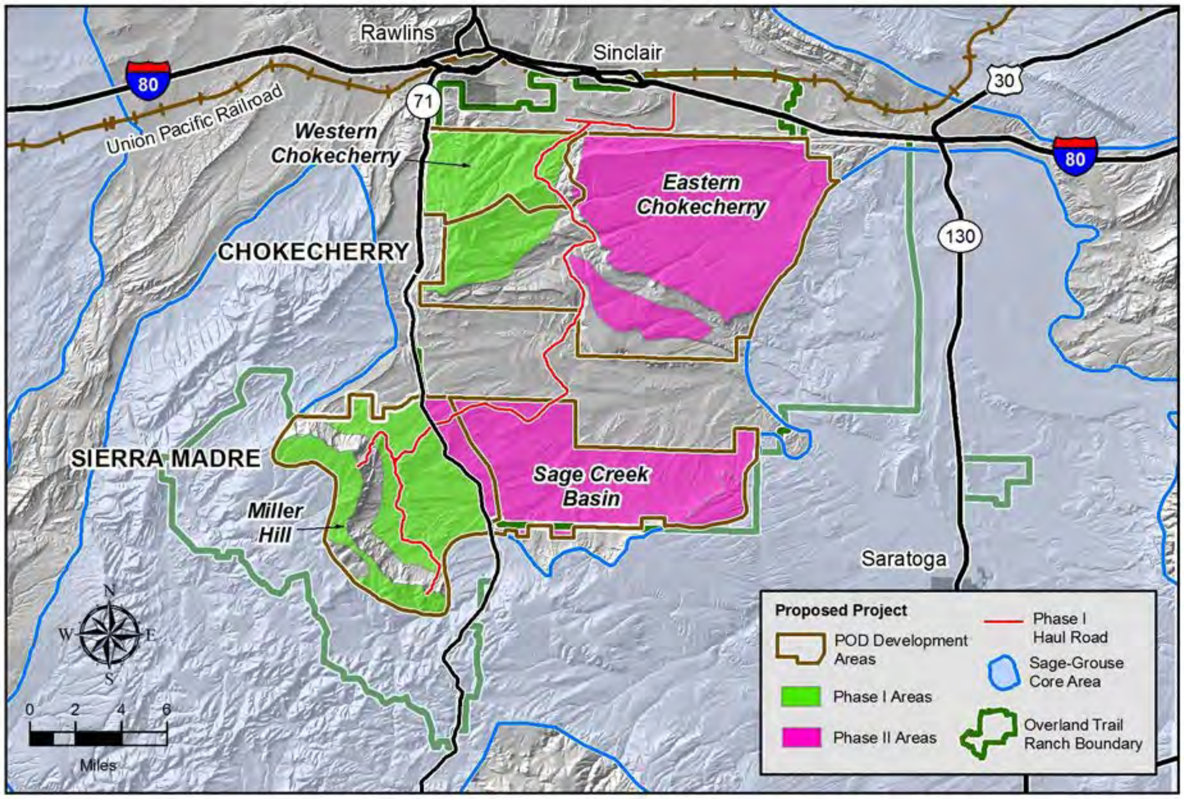


**Figure 1.** CCSM Project development areas and phasing

Surveys for white-tailed prairie dog (*Cynomys leucurus*; hereafter WTPD) activity were conducted from May 1 to August 30, 2013 to identify WTPD colonies, determine current occupancy, and describe the relative density of the colonies. The 2013 survey area included all of Phase I and limited portions of Phase II of the CCSM Project (Figure 2). The 2013 survey area was based on the limits of disturbance for the CCSM Project infrastructure, including a minimum of a 100 foot buffer around the limits of disturbance. Colonies extending outside of the survey area were delineated to their full extent. This report identifies areas located during the 2013 survey where there is evidence of historic and current WTPD activity and refines the WTPD data presented in the CCSM Project Eagle and Raptor Prey Base Assessment (SWCA 2012).

The CCSM Project Eagle and Raptor Prey Base Assessment (SWCA 2012) describes the relationship of prey base to eagle use (SWCA 2012; Section 1.3). As detailed in the Final Eagle Conservation Plan Guidance issued by the Service in 2013, analysis of the data presented in this report will be used to inform the identification of important eagle use areas as part of a Stage 2 Assessment. An important eagle-use area is defined in 50 CFR 22.3 as "an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles."

For the purposes of this assessment, consistent, frequent, multi-year evidence of foraging and use by eagles would be required to identify a WTPD colony as an important eagle use area. This report uses the additional 2013 WTPD survey data in connection with eagle flight pathways collected from 2011 to 2013 to determine if there is a pattern of association with delineated WTPD colonies. Comparing colony locations to eagle flight paths provides evidence of either foraging and use by eagles or the lack thereof.

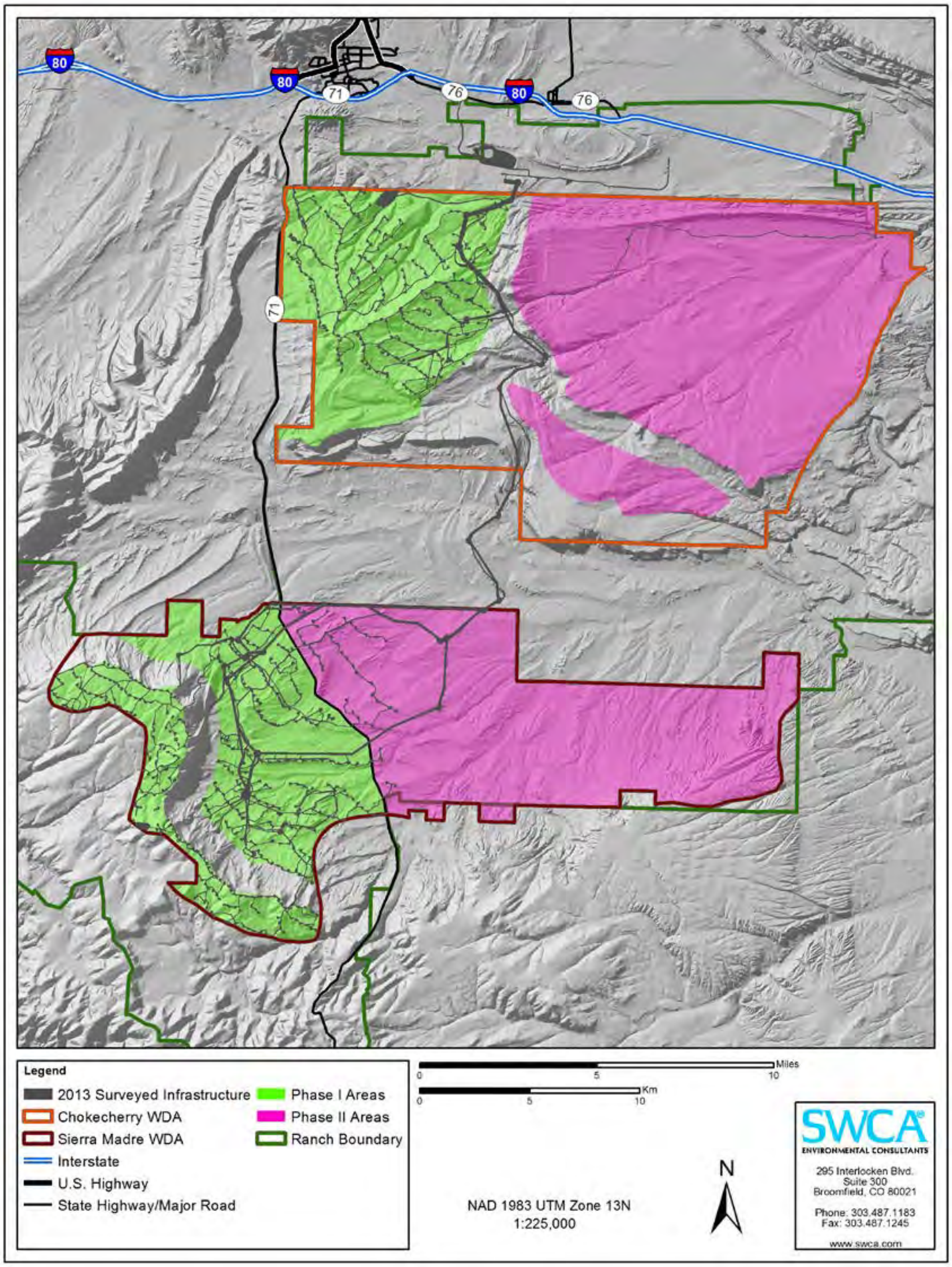


**Figure 2.** 2013 survey area in relation to CCSM Project phasing.

**Physiographic Setting**

The CCSM Project Site is dominated by three topographic features: Chokecherry Plateau, Miller Hill, and Sage Creek Rim, which are separated by a Central Basin (Figure 3).The Chokecherry Plateau, located in the northern portion of the CCSM Project Site, consists of ridges and rolling hills that generally slope down to the northeast to the North Platte River. Most of the northern extent of the Chokecherry Plateau is defined by a ridge that runs east/west, commonly known as the Hogback, which is approximately 10 miles long; the southern portion is defined by a sheer cliff known as the Bolten Rim, which is approximately 20 miles long.

The southwestern portion of the CCSM Project Site is dominated by a steep-sloped mesa known as Miller Hill. This predominant feature slopes down to the southwest, with relatively level terrain near the edge of the rim which becomes increasingly undulated towards the southwest. Only a small portion of Miller Hill is within the CCSM Project Site. For reporting purposes, Miller Hill is divided into Upper Miller Hill and Lower Miller Hill (Figure 3).

The Central Basin, located between Chokecherry Plateau and Miller Hill, is a high desert basin transected by Sage Creek and several smaller perennial and ephemeral tributaries. Much of this basin is outside the WDAs; however, the CCSM Project Haul Road and internal transmission line will traverse the Central Basin and connect the WDAs. Larger water bodies, including Kindt, Rasmussen, Sage Creek, and Teton Reservoirs, are interspersed throughout this arid landscape.

**Survey Approach**

Survey protocols for white-tailed prairie dog complexes were consistent with those for the 2012 surveys (SWCA 2012; App. A) and were adapted from McDonald et al. (2011); surveys focused on areas with active and inactive WTPD burrows. Activity was determined by WTPD presence, fresh burrowing activity, or other signs of recent activity (fresh droppings, fresh scraping, reduced vegetative cover, etc.). For inactive sites, SWCA determined species identification based on burrow characteristics and entrance size. WTPD burrows often exhibit distinctive mounds of dirt with entrances measuring 8-12 centimeters in diameter (Cooke and Swiecki 1992, Menkens et al. 1987).

When WTPD burrows were encountered, the perimeter of each complex within the survey area was delineated with a global positioning system (GPS) device. Biologists also completed a visual scan of the colony to determine if satellite colonies were adjacent to the delineated colony. If present, the observer delineated adjacent satellite colonies. An approximate distance of 50 meters was used for determining separate colonies for delineation.

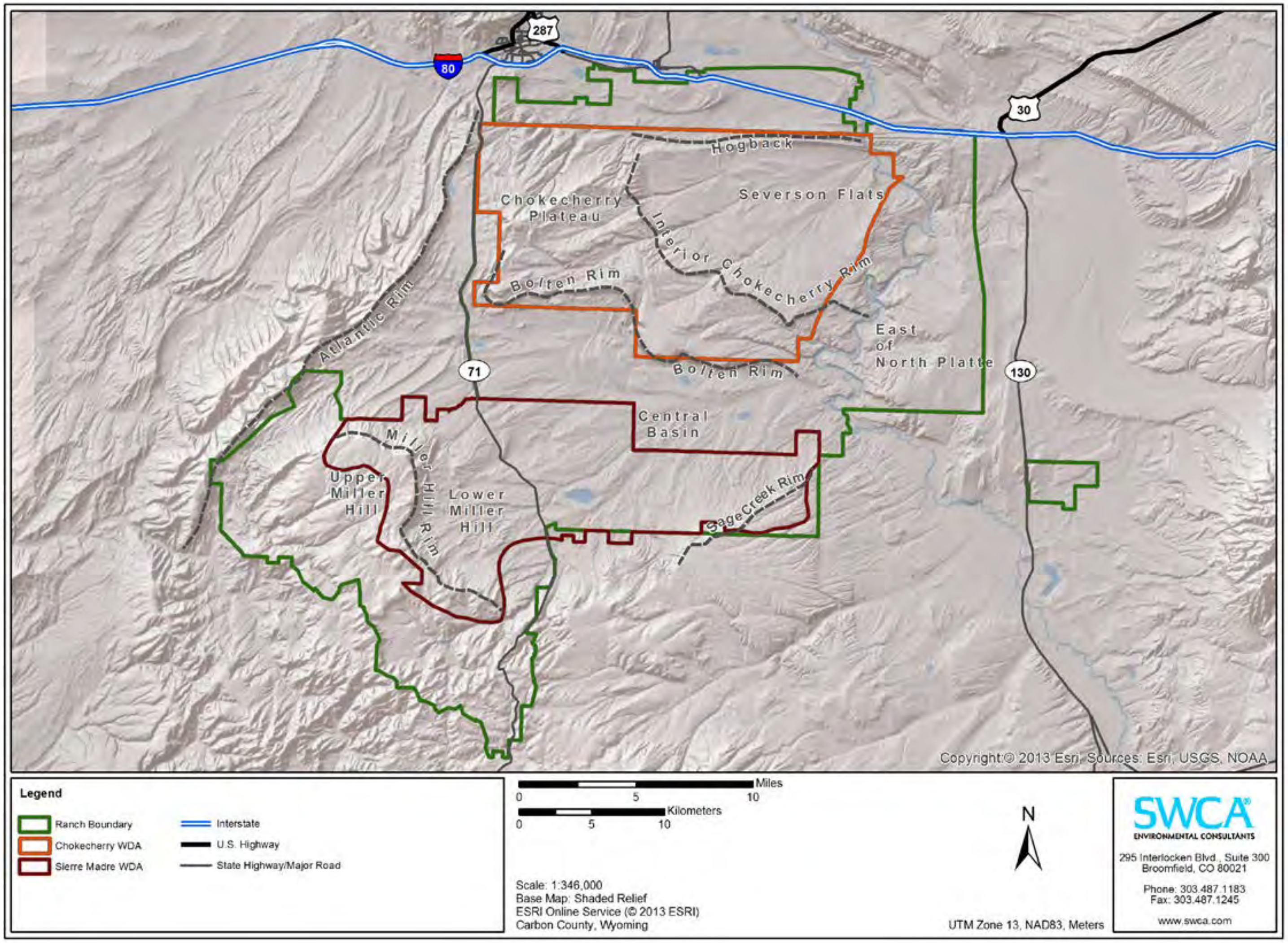


**Figure 3. CCSM Project physiographic features**

# 3.0 RESULTS AND DISUSSION

## 3.1 CHOKECHERRY

SWCA identified twelve WTPD colonies in the Chokecherry portion of the 2013 survey area, all of which were located outside of the Phase I turbine development in the Chokecherry WDA. Eleven of these colonies were found between Interstate 80 and the Hogback, and one colony was located approximately four miles east of the others on top of Chokecherry Plateau (Figure 4). Of the eleven colonies between Interstate 80 and the Hogback, ten were clustered in close proximity (Figure 4).

Five of the twelve colonies identified in the Chokecherry portion of the 2013 survey area contained at least one active WTPD burrow. All five active colonies were located between Interstate 80 and the Hogback outside of the Chokecherry WDA. A total of 88.2 acres, including the extent of all burrows (active and inactive), was delineated for the five active colonies. Six of the eleven colonies between Interstate 80 and the Hogback and the single colony on Chokecherry Plateau were determined to be inactive due to the lack of sign of recent activity or presence of prairie dogs (e.g., fresh scat or fresh digging).

All of the colonies identified in the Chokecherry portion of the 2013 survey area were located outside of the Phase I turbine development in the Chokecherry WDA (Figure 4); therefore, the Phase I portion of the Chokecherry WDA provides little to no eagle foraging opportunity associated with WTPD. As a result, no important eagle use areas have been identified in the Phase I portion of the Chokecherry WDA. The areas north of the Chokecherry WDA between Interstate 80 and the Hogback provide the most likely foraging locations for golden eagle nest 145 (active in 2008) and the other two active eagle nests along the northern edge of the Chokecherry WDA in Phase II (Figure 4).

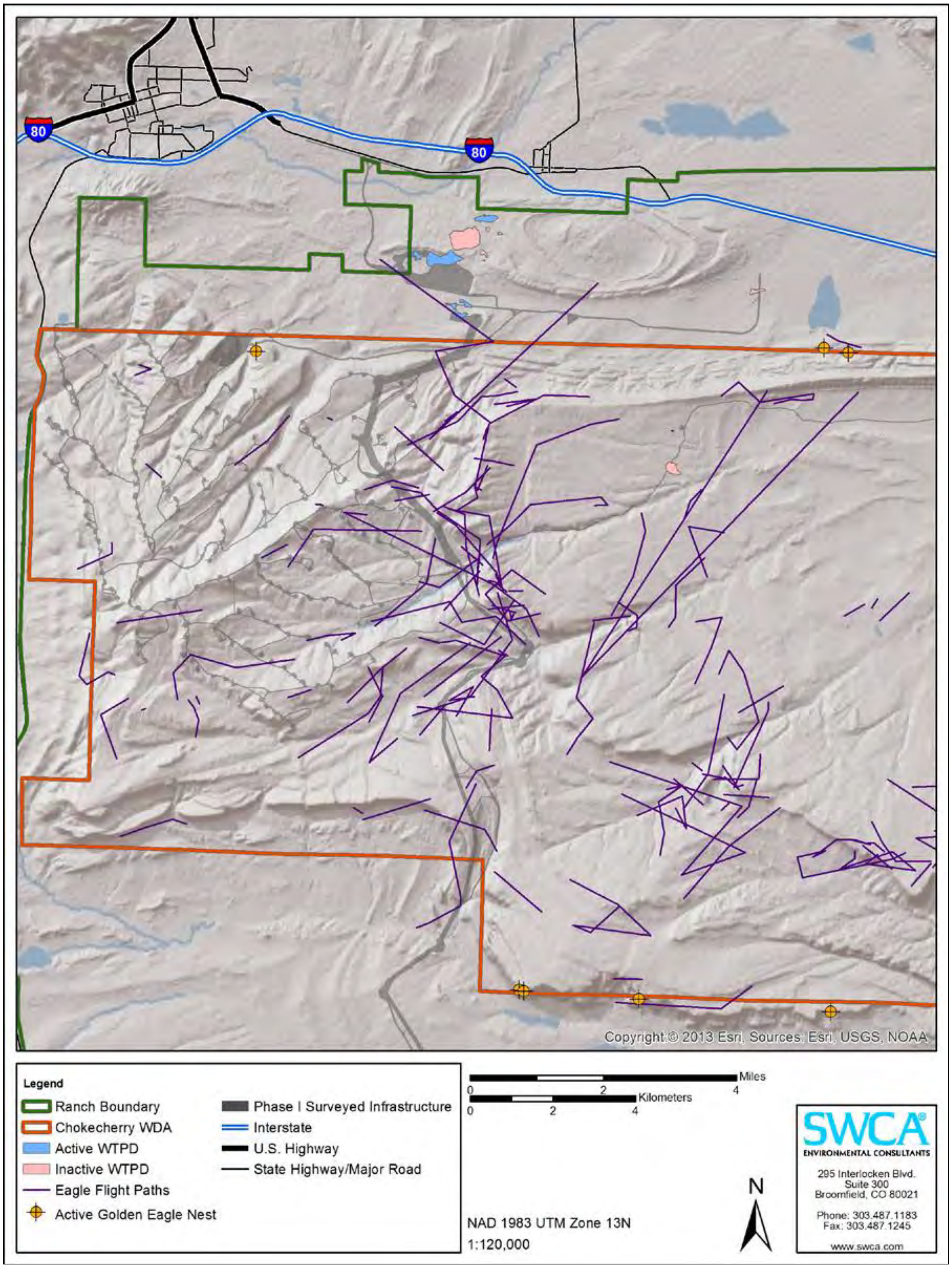


**Figure 4.** Eagle flight pathways and active eagle nest locations (2008, 2011, 2012, and 2013) in relation to WTPD colonies in the Chokecherry portion of the 2013 survey area.

## 3.2 UPPER MILLER HILL

Surveys on Upper Miller Hill[1] identified eight white-tailed prairie dog colonies, all very small and all within an approximate 1.8 mile stretch along the northern portion of Miller Hill Rim (Figure 5).

WTPDs or signs of recent activity were noted at three of the eight colonies; therefore, these are deemed active colonies. Two of the three active colonies contained only one active burrow and the population size of the other colony was estimated as being between 1 and 5 prairie dogs based on observations of individuals and burrowing activity. The collective acreage for all three active prairie dog colonies was 3.7 acres (average of less than 1 acre per colony). Five colonies, each consisting of a single prairie dog burrow, were determined to be inactive due to the lack of WTPDs and/or signs of recent activity.

Eagle flight pathways mapped on Upper Miller Hill show no pattern of association with the delineated WTPD colonies. Because WTPD hibernate in the CCSM Project site between August and mid-late March each year and are not available as potential prey, only those eagle flight paths recorded between April 1 and September 30 were compared to colony locations to identify potential use (Figure 5). The lack of association between eagle flight paths and colony locations demonstrates that the ephemeral and very small WTPD colonies on Upper Miller Hill do not provide consistent or adequate resources for foraging by eagles. As a result, no important eagle use areas have been identified on Upper Miller Hill, which is included in Phase I of the CCSM Project.

[1] Upper Middle Hill is part of the Sierra Madre WDA.

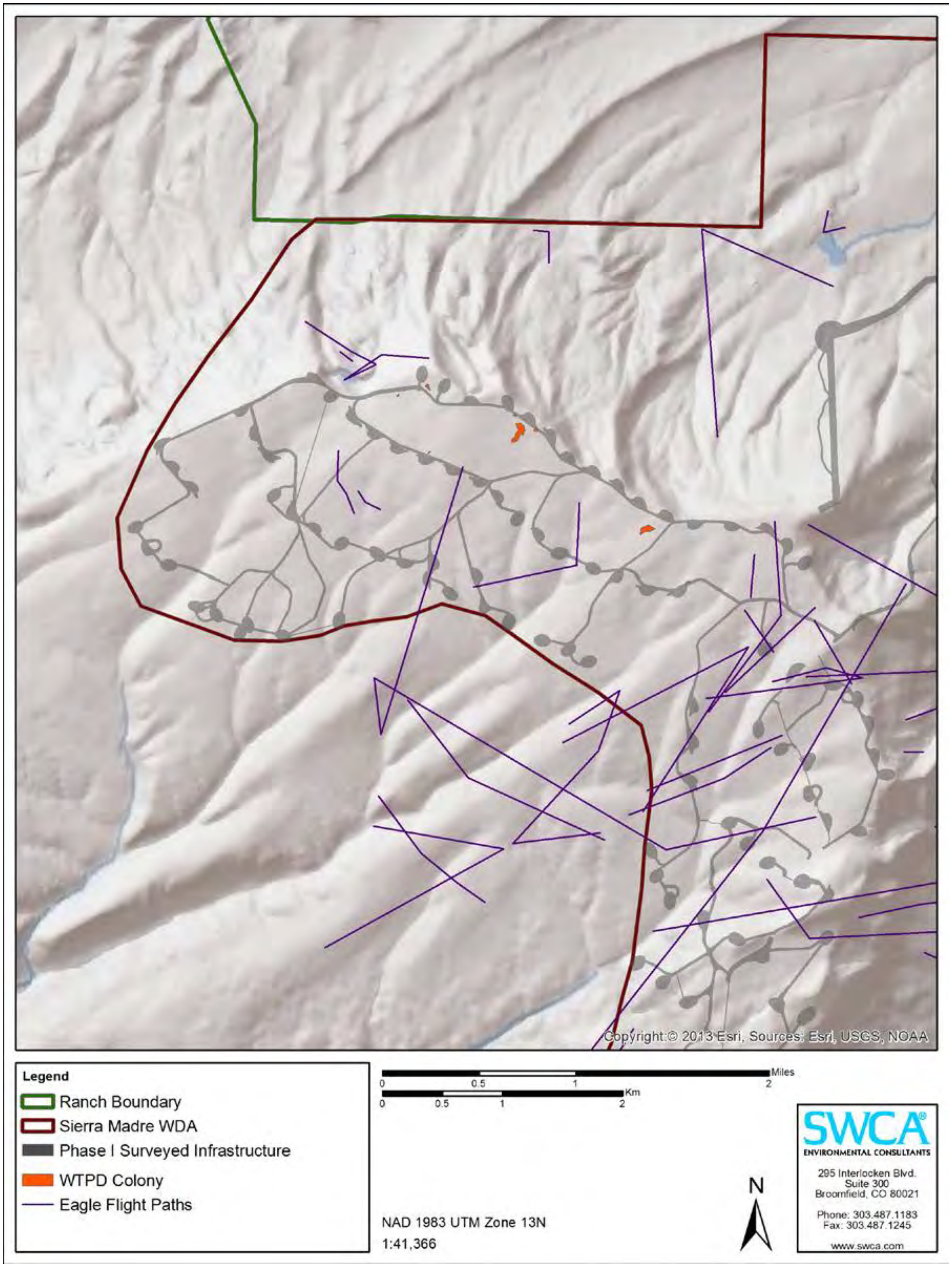


**Figure 5.** Eagle flight pathways in relation to white-tailed prairie dog colonies identified during surveys of Upper Miller Hill

### 3.3 LOWER MILLER HILL

The Lower Miller Hill[2] portion of the 2013 survey area includes Lower Miller Hill (Phase I) and the western portion of Sage Creek Basin (Phase II) (Figure 2). SWCA identified 127 WTPD colonies in the Lower Miller Hill portion of the 2013 survey area (Figure 6).

Of the 127 colonies identified, twenty-eight colonies were determined to be inactive. The remaining 99 colonies had at least one prairie dog present or a burrow with sign of recent activity. Of the 99 active colonies, 43 colonies were less than 5 acres in size and were located in scattered or loosely associated groups and 14 were identified as having burrow densities of less than five burrows per acre with very few individuals. These 57 colonies were removed from consideration as important eagle use areas due to their small population and ephemeral nature, both of which indicate they are not suitable for consistent foraging that would be essential for continued viability of the site for eagle foraging (50 CFR 22.3).

The remaining 42 colonies in Lower Miller Hill were active, more than five acres in size, and had burrow densities of more than five burrows per acre. These locations were compared to observed eagle flight paths and behaviors to identify potential important eagle use areas associated with prairie dog colonies having combinations of suitable prey density and eagle use (Figure 7). Because WTPD hibernate in the Project site between August and mid-late March each year and are not available as potential prey, only those eagle flight paths recorded between April 1 and September 30 were compared to colony locations to identify potential use.

Overlaying eagle flight paths collected between 2011 and 2013 and active WTPD colonies having suitable prey density, only two areas provide potentially suitable foraging opportunities and have documented patterns of use by eagles (Figure 8). One area is located north of Rasmussen Reservoir in an area included in Phase II of the CCSM Project and the second is located in Phase I of the CCSM Project immediately south of Lone Tree Creek.

To evaluate the potential of these locations as important eagle use areas (50 CFR 22.3), the frequency and duration of use and individual behavior of observed eagles was analyzed based on eagle use data collected from 2011 to 2013. For the location north of Rasmussen Reservoir, use was observed during only two survey events for a total of 7 minutes. When compared to the 7,640 survey minutes completed between April 1 and October 30 at the two sites from which observations were made (RM15 and RM16), eagle use over this WTPD colony occurs only 0.09% of the time. This demonstrates that this location does not meet the definition of important eagle use area (50 CFR 22.3) because it does not provide the frequent and consistent use that would be essential for continued viability of the site for eagle foraging.

[2] Lower Middle Hill is part of the Sierra Madre WDA.

For the location south of Lone Tree Creek, use was observed during four survey events for a total of 11 minutes. When compared to the 7,169 survey minutes completed between April 1 and October 30 at the two sites from which observations were made (RM15 and RM16), eagle use in the vicinity of this WTPD colony occurs only 0.15% of the time. Of the observations made over this location, more than 50% were recorded as having circle soaring and soaring behavior more than 150 meters above the ground surface. No observations were made of foraging behavior during surveys. This demonstrates that this location does not meet the definition of important eagle use area (50 CFR 22.3) because it does not provide the frequent and consistent use with foraging behavior that would be essential for continued viability of the site for eagle foraging.

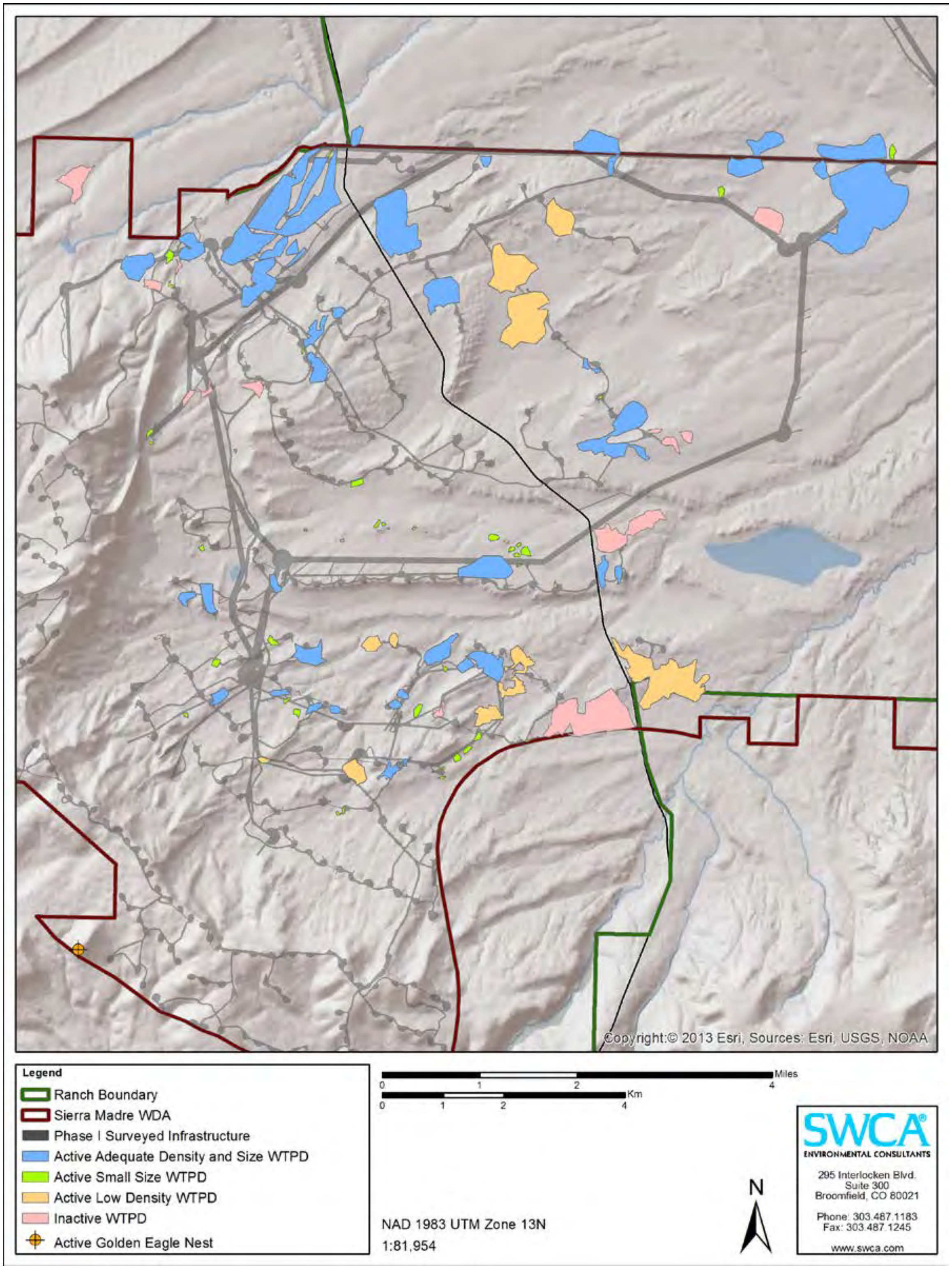


**Figure 6.** Location of WTPD colonies within the Lower Miller Hill portion of the 2013 survey area

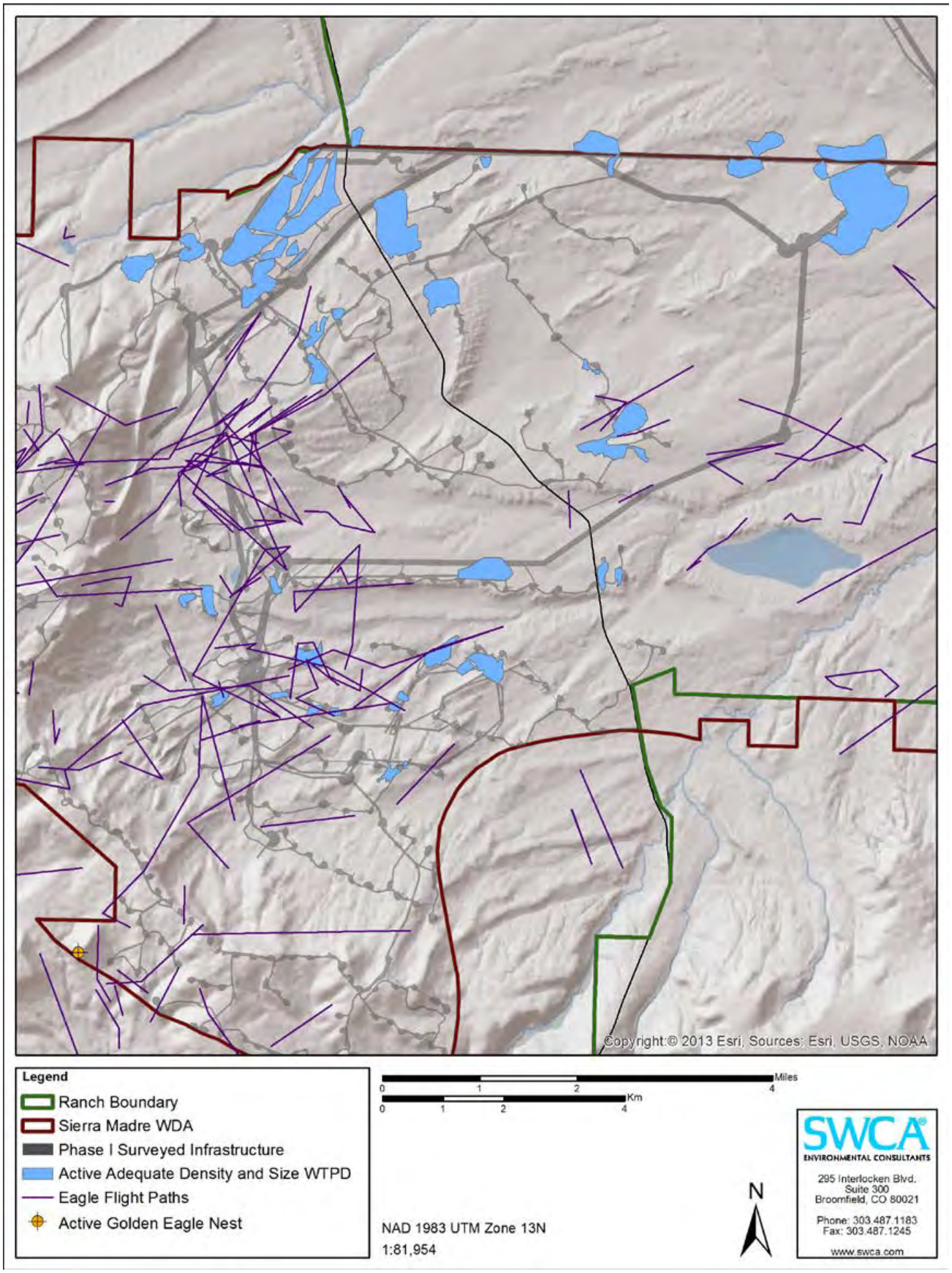


**Figure 7.** Eagle flight pathways and active eagle nest locations (2008, 2011, 2012, and 2013) in relation to WTPD colonies having adequate size and density in the Lower Miller Hill portion of the 2013 survey area.

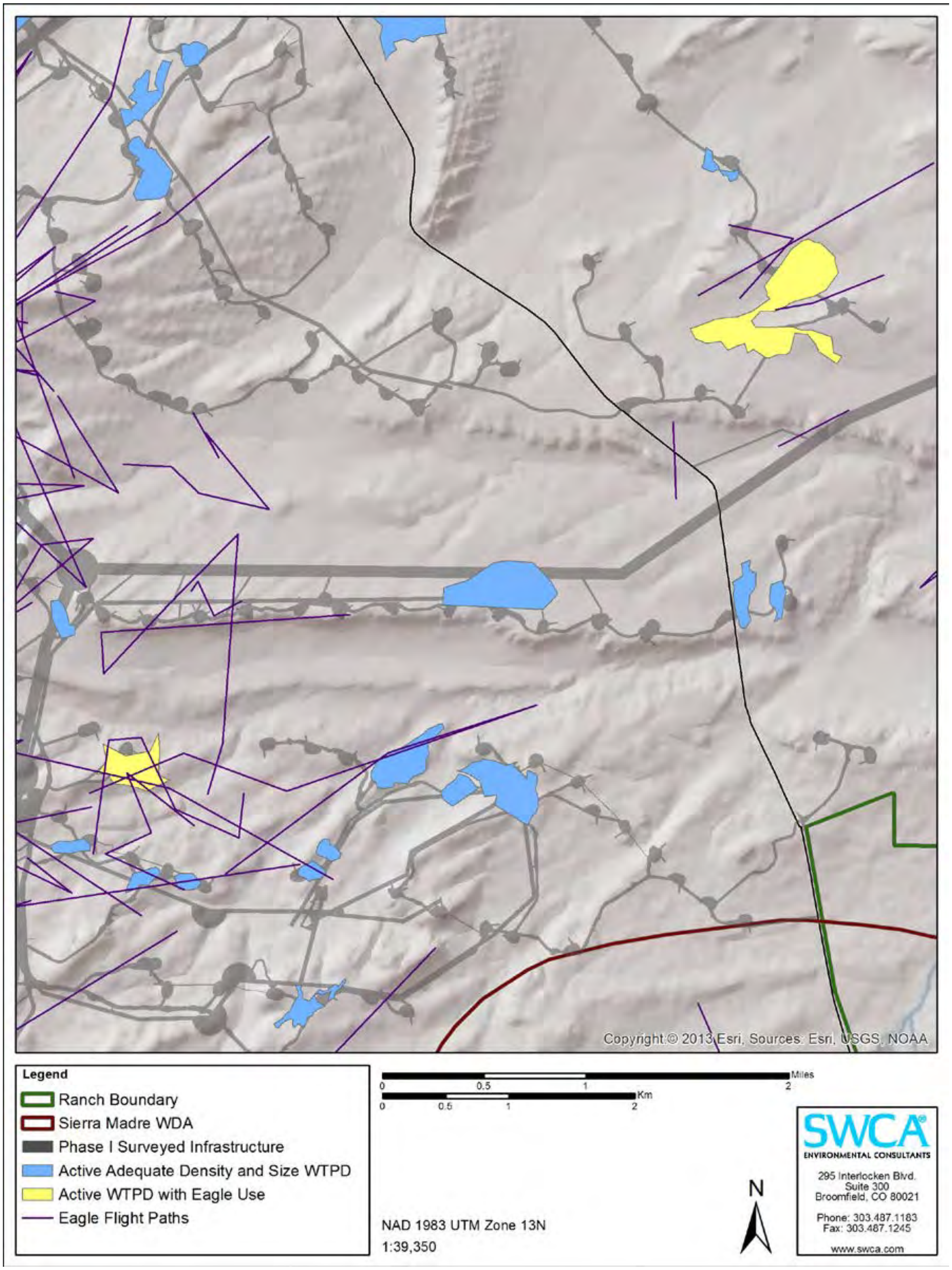


**Figure 8.** Eagle flight pathways in relation to the two WTPD colonies identified as having combinations of documented eagle use and sufficient WTPD colony size and burrow density.

# 4.0 CONCLUSIONS

Overall, active and inactive WTPD colonies are scattered throughout the 2013 survey area (covering all of Phase I of the CCSM Project and a portion of Phase II) and generally consist of small, low density colonies. Areas on Upper Miller Hill (Phase I) and within the Phase I portion of the Chokecherry WDA are generally characterized by shallow, rocky soils that provide unsuitable to marginal habitat for burrowing. The lack of sufficient numbers and sizes of WTPD colonies on Upper Miller Hill (Phase I) and in the Phase I portion of the Chokecherry WDA indicate that these locations do not provide suitable conditions for consideration as important eagle use areas associated with foraging locations. The areas within the 2013 survey area between Interstate 80 and the Hogback, outside of the Phase I and Phase II Chokecherry WDA, provide the most likely foraging locations for golden eagle nest 145 (active in 2008) and the other two active eagle nests along the northern edge of the Chokecherry WDA in Phase II (Figure 4).

The highest numbers of WTPD colonies were located in the Lower Miller Hill portion of the 2013 survey area where deeper soils provide better habitat for burrowing mammals. The Lower Miller Hill portion of the 2013 survey area includes areas of Phase I and a portion of Phase II. Within the Lower Miller Hill portion of the 2013 survey area, two locations were identified for further evaluation as potential eagle use areas, (1) a location north of Rasmussen Reservoir, and (2) a location south of Lone Tree Creek. These locations were identified due to observations of eagle use overlapping with WTPD colonies of sufficient size and population density to support foraging activities. Eagle use at the location north of Rasmussen Reservoir, outside of the Phase I portion of the Lower Miller Hill, was observed in 2011 and 2012; however, use was only observed on two days indicating opportunistic foraging and that this site is not be an important eagle use area. Eagle use was observed at the location south of Lone Tree Creek on three dates in June 2012 and one date in September 2011. Behavior data indicate that use surrounding this WTPD location consists primarily of circle soaring behavior at altitudes greater than 150 meters above the ground surface. While this behavior could be an indication of potential hunting, no foraging attempts were observed.

In sum, the field data and analysis supports that there are no important eagle use areas located within Phase I of the CCSM Project. As an initial matter, WTPD are not available as prey resources for much of the year due to hibernation. This fact combined with the scattered, ephemeral nature of WTPD locations and the results of comparisons of WTPD activity, eagle use, and eagle behavior indicate that any eagle foraging associated with WTPD locations within Phase I of the CCSM Project is likely opportunistic. It is likely that other parts of the Overland Trail Ranch (areas surrounding Kindt Reservoir, adjacent to the Bolten Road, and surrounding the Bolten Ranch pastures) represent locations that could be considered important eagle use areas associated with WTPD activity (SWCA 2012). The North Platte River corridor also likely represents a possible important eagle use area because of the overlap of suitable foraging and nesting habitats. These areas provide suitable and consistent foraging opportunities adjacent to active nesting territories between April and October. These areas are also within turbine no-build areas or are outside of the Chokecherry and Sierra Madre WDAs and will not be impacted by either Phase I or Phase II of the CCSM Project.

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# Appendix G

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# April 2011–March 2012 Supplemental Wildlife Report
# Chokecherry and Sierra Madre Wind Energy Project

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**October 2012**

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# TABLE OF CONTENTS

**Page**

INTRODUCTION ........ 1
RAPTOR SURVEYS ........ 1
MIGRATORY BIRD SURVEYS ........ 2
BREEDING BIRD SURVEYS ........ 6
WATERBIRD SURVEYS ........ 9
Spring Surveys ........ 9
Summer Surveys ........ 11
Fall Surveys ........ 12
ACOUSTIC BAT MONITORING ........ 13
REFERENCES ........ 16

# LIST OF FIGURES

**Figure** **Page**

1 Average number of bat passes per survey-hour, June 15–October 20, 2011. ........ 15

# LIST OF TABLES

**Table**

1 Summary of Observations from Year Two Long-watch Surveys. ........ 2
2 Percentage of Major Habitat Categories within 200-m Radius of Migratory Bird Survey Points (Minimum 5%). ........ 3
3 The Number of Individuals, Flocks, Species Frequency, and Mean Use for All Migratory Bird Survey Point Locations Combined, April 2011–March 2012. ........ 4
4 Summary of Key Metrics for Individual Migratory Bird Point Count Locations, April–November 2011. ........ 5
5 Summary Statistics for Grid-based Breeding Bird Surveys, June 2011. ........ 7
6 The Number of Species and Number of Individuals per Grid-based Breeding Bird Survey Site, June 2011. ........ 9
7 Species, Number of Individuals, and Spring Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011. ........ 10
8 Species, Number of Individuals, and Summer Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011. ........ 11
9 Species, Number of Individuals, and Fall Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011. ........ 12
10 Level of Effort and Bat Pass Summary for Locations Surveyed in 2011. ........ 14

# INTRODUCTION

Between April 2011 and March 2012, SWCA Environmental Consultants (SWCA) performed a second year of avian and bat surveys for the Power Company of Wyoming, LLC (PCW) within the Chokecherry and Sierra Madre Wind Energy Project (Project) site. These Year Two survey efforts included long-watch raptor surveys, aerial raptor nest surveys within 5-miles of the Project, migratory bird point counts, breeding bird grid surveys, waterbird surveys, greater sage-grouse monitoring, and acoustic bat monitoring. Year One surveys were conducted between June 2008 and June 2009 with the primary intent of collecting data for the development of an Environmental Impact Statement (EIS) for the Project. Year One surveys consisted primarily of 20-minute avian point counts, aerial raptor nest surveys within 1-mile of the Project, greater sage-grouse monitoring, and acoustic bat monitoring.

All protocols and survey methodologies used to assess wildlife in the Project site during Year Two surveys were developed in consultation with the U.S. Fish and Wildlife Service (Service), and are in accordance with recommendations made by the Service, the Bureau of Land Management (BLM), and the Wyoming Game and Fish Department (WGFD). Many of the Year Two data pertaining to eagles, raptors, nests, and greater sage-grouse have been previously analyzed and presented in the Project Eagle Conservation Plan (ECP), Bird and Bat Conservation Strategy (BBCS), 2011 and 2012 Summary Nest Reports, and Sage-grouse Conservation Plan, respectively. More detailed summaries of data from other survey efforts are contained herein.

# RAPTOR SURVEYS

Bi-weekly long-watch raptor surveys were completed at 15 sites between April 4 and November 16, 2011. Monthly surveys were completed between December 2011 and March 2012. Long-watch raptor surveys were conducted at 4,000-meter (m) radius plots strategically distributed across the Chokecherry and Sierra Madre Wind Development Areas (WDAs). Fixed-point surveys were conducted in a 4,000-m radius to maximize areal coverage for the purposes of identifying high-use areas while maintaining observer confidence in species identification. For the purposes of this report, only a brief summary is presented for raptor surveys; more detailed summaries and analyses for eagles and raptors are provided in the Project ECP and BBCS, respectively.

Year Two surveys were conducted for a total of 129,750 minutes, or 49.4% of the total 262,800 daylight minutes in the year. During Year Two, 324 long-watch raptor surveys were conducted between April 2011 and March 2012. Of the 324 total surveys, 109 were conducted in the spring, 45 in the summer, 110 in the fall, and 60 during the winter (Table 1). The total 129,750 minutes of survey conducted during all Year Two long-watch surveys were evenly distributed between sites and between spring and fall; however, summer and winter survey minutes were lower because the survey effort was scaled down between July 2 and August 14, and between November 17 and March 31.

**Table 1. Summary of Observations from Year Two Long-watch Surveys.**

| Season | Surveys | Raptor Observations |
|---|---|---|
| Spring | 109 | 486 |
| Summer | 45 | 94 |
| Fall | 110 | 341 |
| Winter | 60 | 102 |
| **Total** | **324** | **1,023** |

In total, 178 surveys were conducted in the Chokecherry WDA, while 146 surveys were conducted in the Sierra Madre WDA. Across all seasons, 1,023 raptor observations were made at all long-watch locations; however, most of the observations were likely the same birds being observed multiple times per survey date. This is often detailed in observational notes taken by field personnel during raptor surveys, and is further exemplified by the raptor use calculations presented in the Project BBCS, as well as information presented in the 2011 and 2012 Summary Nest Reports. The Raptor use calculations presented in the BBCS show relatively consistent use between all seasons during Year Two, which indicates there are not large influxes of migrant raptors moving into the Project during the spring and fall months. Additionally, the results presented in the 2011 and 2012 Summary Nest Reports show relatively low numbers of nesting raptors occurring in the Project site and immediate surrounding area. These data indicate that the majority of the 1,023 raptor observations are likely repeat observations of the same resident individuals as there does not appear to be strong raptor migration through the area, nor are there high numbers of nesting raptors occurring in the Project.

## MIGRATORY BIRD SURVEYS

Migratory bird point count surveys were completed in conjunction with the long-watch raptor surveys, and therefore the number of sites as well as the weekly scheduling was identical to the raptor surveys. Each migratory bird survey point was established in representative habitat near each raptor monitoring site at sufficient distance to ensure that the observer for the raptor surveys would not likely impact migratory bird species behavior at the point count location.

Point count surveys were conducted across all daylight hours to account for time-of-day effects. For any individual point, surveys were conducted between 7:30 am and 6:30 pm on a pre-determined, systematic schedule. All birds detected within a 200-m radius were recorded during the point count surveys. The data collected during these counts included species, number of individuals, radial distance from observer, behavior, and general demographic data. Standard survey and environmental data (e.g., time, date, wind speed, temperature) were also collected.

The metrics used to characterize avian use are number of species, number of individuals, number of flocks, species frequency (the percentage of 20-minute surveys on which a species was observed), occurrence frequency (percentage of surveys with at least one bird detection), and mean use (average number of individuals per 20-minute survey).

Vegetation data collected across 500 transect surveys conducted by SWCA in 2009 was used to characterize major habitat types at each point. Table 2 summarizes the percentage of major habitat types (minimum 5% of total acreage) within the 200-m radius survey area (31.03 acres) of each location center.

**Table 2. Percentage of Major Habitat Categories within 200-m Radius of Migratory Bird Survey Points (Minimum 5%).**

| Survey Site | Habitat Category | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Aspen-Mixed Conifer | Dense Sagebrush | Sagebrush Steppe | Salt Desert Shrub | Upland Grassland | Sparsely Vegetated | Lowland Mesic Zone | Montane Shrubland |
| 1 | | 18 | 74 | | 6 | | | |
| 2 | | | | 95 | | | | |
| 3 | 39 | | 54 | | | | | |
| 4 | 23 | | 30 | | 30 | 5 | | 6 |
| 5 | | | 62 | 6 | 30 | | | |
| 6 | | | 67 | | 31 | | | |
| 7 | | | 52 | | 43 | | | |
| 8 | | 16 | 69 | | 14 | | | |
| 9 | | | 75 | 9 | 11 | | | |
| 10 | | | 89 | 7 | | | | |
| 11 | | 11 | 75 | | 9 | | | |
| 12 | | | 45 | | 51 | | | |
| 13 | | 17 | 70 | | | | 8 | |
| 14 | | | 16 | 63 | | 18 | | |
| 15 | | 13 | 45 | 37 | | | | |

Note: Due to rounding error and minimum requirement of 5% coverage, total habitat coverage may not equal 100%.

Sagebrush steppe comprised a substantial portion (≥30%) of 13 survey sites. Salt desert shrub dominated at survey sites 2 and 14 (95% and 63%, respectively). Aspen-mixed conifer was well-represented at survey sites 3 and 4 (39% and 23%, respectively), as was upland grassland with ≥30% coverage at survey sites 4, 5, 6, 7, and 12. Dense sagebrush, sparsely vegetated, lowland mesic zone, and montane shrubland were also identified with >5% coverage at several survey sites. Barren ground was the only major habitat category to not register at least 5% coverage on any site.

Between April 4, 2011, and March 27, 2012, 295 migratory bird surveys were conducted. Point count locations were each surveyed 16 to 23 times, with the variation in number of surveys due to safety and accessibility concerns arising from inclement weather. These same factors are also the cause of differences in the overall number of migratory bird surveys relative to long-watch raptor surveys.

In sum, 1,518 individuals in 969 flocks representing 43 species were recorded during all surveys combined in the 12-month survey period (Table 3). Of the 295 surveys completed, no birds were recorded on 74 of the surveys for an occurrence frequency of 75% (221 of 295 surveys). Mean use was 5.1 individuals/survey. Horned lark (*Eremophila alpestris*) dominated the number of observations, accounting for 951 (62%) individuals with a mean use of 3.2 individuals/survey. Horned lark was also the most frequently encountered species on surveys, with the species recorded on 67% of surveys.

**Table 3. The Number of Individuals, Flocks, Species Frequency, and Mean Use for All Migratory Bird Survey Point Locations Combined, April 2011–March 2012.**

| Species | # of Individuals | # of Flocks | Species Frequency (as %) (n = 295) | Mean Use |
|---|---|---|---|---|
| Horned Lark | 935 | 530 | 67 | 3.2 |
| Brewer's Sparrow | 70 | 65 | 13 | 0.2 |
| Vesper Sparrow | 68 | 67 | 15 | 0.2 |
| American Crow | 55 | 2 | <1 | 0.2 |
| Rock Wren | 43 | 40 | 11 | 0.1 |
| Sage Thrasher | 41 | 39 | 11 | 0.1 |
| Sage Sparrow | 42 | 34 | 6 | 0.1 |
| Common Raven | 34 | 27 | 8 | 0.1 |
| Western Meadowlark | 29 | 25 | 6 | 0.1 |
| Sparrow sp. | 29 | 19 | 6 | 0.1 |
| American Robin | 18 | 10 | 3 | 0.1 |
| Greater Sage-grouse | 18 | 3 | 1 | 0.1 |
| Mountain Bluebird | 16 | 11 | 4 | 0.1 |
| Common Nighthawk | 12 | 9 | 2 | 0.0 |
| Undetermined sp. | 12 | 11 | 3 | 0.0 |
| Passerine sp. | 9 | 6 | 2 | 0.0 |
| American Kestrel | 8 | 7 | 2 | 0.0 |
| Green-tailed Towhee | 7 | 7 | 3 | 0.0 |
| White-throated Swift | 6 | 1 | <1 | 0.0 |
| Barn Swallow | 5 | 3 | 1 | 0.0 |
| Black-billed Magpie | 5 | 3 | 1 | 0.0 |
| Tree Swallow | 5 | 4 | 1 | 0.0 |
| American Goldfinch | 4 | 4 | 2 | 0.0 |
| Song Sparrow | 4 | 4 | 2 | 0.0 |
| Violet-green Swallow | 4 | 4 | 1 | 0.0 |
| Warbler sp. | 4 | 2 | 1 | 0.0 |
| Chipping Sparrow | 3 | 3 | 1 | 0.0 |
| Evening Grosbeak | 3 | 3 | <1 | 0.0 |
| Mourning Dove | 3 | 2 | 1 | 0.0 |
| Savannah Sparrow | 3 | 3 | 1 | 0.0 |
| Brown-headed Cowbird | 2 | 2 | 1 | 0.0 |
| Dark-eyed Junco | 2 | 2 | 1 | 0.0 |
| Northern Flicker | 2 | 2 | 1 | 0.0 |
| Gray-crowned Rosy-Finch | 2 | 1 | <1 | 0.0 |
| Turkey Vulture | 2 | 1 | <1 | 0.0 |
| Brewer's Blackbird | 1 | 1 | 1 | 0.0 |
| Golden Eagle | 1 | 1 | <1 | 0.0 |
| House Finch | 1 | 1 | <1 | 0.0 |
| House Wren | 1 | 1 | 1 | 0.0 |
| Killdeer | 1 | 1 | <1 | 0.0 |

| Species | # of Individuals | # of Flocks | Species Frequency (as %) (n = 295) | Mean Use |
|---|---|---|---|---|
| Loggerhead Shrike | 1 | 1 | <1 | 0.0 |
| Northern Harrier | 1 | 1 | <1 | 0.0 |
| Red-tailed Hawk | 1 | 1 | <1 | 0.0 |
| Rufous Hummingbird | 1 | 1 | <1 | 0.0 |
| Sharp-shinned Hawk | 1 | 1 | <1 | 0.0 |
| Swallow sp. | 1 | 1 | <1 | 0.0 |
| Western Kingbird | 1 | 1 | <1 | 0.0 |
| Woodpecker sp. | 1 | 1 | <1 | 0.0 |
| **Total (43)** | **1,518** | **969** | **75*** | **5.1** |

* Seventy-four surveys resulted in zero bird detections; therefore, percentage of surveys with at least one bird detection was 75%.

Note: Because of rounding error, mean use values may not equal total shown.

Summary results for individual point count locations are presented in Table 4. Values for number of species (range = 6–18), number of individuals (range = 26–168), number of flocks (range = 23–94), and mean use (range = 1.3–8.1) varied between sites.

**Table 4. Summary of Key Metrics for Individual Migratory Bird Point Count Locations, April–November 2011.**

| Survey Site | # of Surveys | # of Species | # of Individuals | # of Flocks | % of Surveys w/ Bird Detections | Mean Use[1] |
|---|---|---|---|---|---|---|
| 1 | 20 | 6 | 86 | 60 | 60 | 4.3 |
| 2 | 20 | 6 | 26 | 23 | 70 | 1.3 |
| 3 | 16 | 17 | 120 | 57 | 81 | 7.5 |
| 4 | 19 | 11 | 76 | 50 | 84 | 4.0 |
| 5 | 20 | 9 | 113 | 76 | 70 | 5.7 |
| 6 | 20 | 10 | 111 | 94 | 70 | 5.6 |
| 7 | 20 | 7 | 67 | 41 | 70 | 3.4 |
| 8 | 21 | 11 | 118 | 93 | 81 | 5.6 |
| 9 | 19 | 6 | 94 | 64 | 79 | 4.9 |
| 10 | 20 | 12 | 161 | 72 | 80 | 8.1 |
| 11 | 20 | 10 | 88 | 71 | 75 | 4.4 |
| 12 | 19 | 10 | 99 | 70 | 74 | 5.2 |
| 13 | 23 | 18 | 168 | 91 | 74 | 7.3 |
| 14 | 19 | 8 | 116 | 50 | 79 | 6.1 |
| 15 | 19 | 9 | 75 | 57 | 79 | 3.9 |
| **Total** | **295** | **43**[2] | **1,518** | **969** | **75%**[3] | **5.1** |

[1] Because of rounding error, mean use values may not equal total shown.

[2] The same species were observed at multiple sites; therefore, this total represents the number of individual species observed at all sites.

[3] Seventy-four surveys resulted in zero bird detections; therefore, percentage of surveys with at least one bird detection was 75%.

Survey site 2 had relatively few birds (26 individuals; mean use = 1.3) recorded on the 20 surveys conducted at that site. Survey sites 10 and 13 had the highest number of individuals (161 and 168, respectively), and sites 3 and 10 had the highest mean use (7.5 and 8.1, respectively). All sites had at least three surveys when no birds were recorded.

## BREEDING BIRD SURVEYS

SWCA established and conducted 15 breeding bird survey grids in the Project site following protocols established in Rocky Mountain Bird Observatory's *Field Protocol for Spatially Balanced Sampling of Landbird Populations* (Hanni et al. 2010). This study design allows for analyses of population trends for diurnal, regular-breeding landbird species. Its application in the Project site would allow for integration into and comparison with Rocky Mountain Bird Observatory's similar efforts in the Atlantic Rim Natural Gas Development Project Area (Van Lanen et al. 2011), as well those across broader landscapes where similar studies are conducted (see White et al. 2011).

Survey areas for each grid were selected using generalized random-tessellation stratification (GRTS), a spatially balanced sampling algorithm (Stevens and Olsen 2004), without sample weighting (i.e., not accounting for any factor expected to influence a species' distribution [e.g., habitat type]). By using GRTS, data-embedded information on spatial autocorrelation can increase density estimate precision. This spatially balanced sampling design also allows for adjustment of sampling effort among years while preserving a random sampling design (Hanni et al. 2010).

Each survey site consisted of 16 point count locations in a 4 × 4 grid, with 250 m spacing between points. Each grid was surveyed once in June 2011. Surveys were initiated within 30 minutes of local sunrise and were completed by 10:00 am. Habitat information was collected at each point count location prior to conducting the avian count to allow birds time to adjust to the presence of field personnel. Habitat data collected included proximity to human-made structures (e.g., roads, fences) and variables used to describe overstory, shrub layer, and groundcover components. Standard weather (e.g., wind speed, cloud cover) variables were also collected prior to starting the avian survey. Upon completion of the habitat data collection, biologists conducted an avian survey at each point for 6 minutes. All bird detections were recorded regardless of distance. Data for each detection included species, number of individuals, horizontal distance from observer, age, sex, and how detected.

The 15 grids of 16 point counts were surveyed in June 2011 for a total of 240 individual sampling points. For all sites combined, 1,944 individuals representing 63 species were recorded (Table 5). The most prevalent species, based on total number of individuals recorded and frequency of detection (on grids and individual points), was horned lark (411 individuals, 100% occurrence on the 15 grids, and on 73% of the 240 point counts). Following horned lark, in order of prevalence, were Brewer's sparrow (*Spizella breweri*; 283, 100%, 65%), vesper sparrow (*Pooecetes gramineus*; 216, 93%, 55%), and sage thrasher (*Oreoscoptes montanus*; 138, 80%, 46%), all species closely associated with sagebrush communities. These four species combined for 1,048 individuals or 54% of all detections.

**Table 5. Summary Statistics for Grid-based Breeding Bird Surveys, June 2011.**

| Species | # of Individuals | % Frequency on Grids (n = 15) | % Frequency on Individual Points (n = 240) |
|---|---|---|---|
| Horned Lark | 411 | 100 | 73 |
| Brewer's Sparrow | 283 | 100 | 65 |
| Vesper Sparrow | 216 | 93 | 55 |
| Sage Thrasher | 138 | 80 | 46 |
| Green-tailed Towhee | 116 | 87 | 35 |
| Rock Wren | 104 | 67 | 31 |
| Sage Sparrow | 89 | 47 | 25 |
| Western Meadowlark | 58 | 60 | 15 |
| Brown-headed Cowbird | 49 | 60 | 13 |
| American Robin | 47 | 40 | 16 |
| Common Raven | 41 | 73 | 13 |
| Sparrow sp. | 32 | 93 | 10 |
| Common Nighthawk | 28 | 53 | 10 |
| Greater Sage-grouse | 23 | 13 | <0.5 |
| Warbling Vireo | 23 | 27 | 8 |
| House Wren | 22 | 20 | 6 |
| American Goldfinch | 21 | 27 | 5 |
| Yellow Warbler | 21 | 20 | 6 |
| Red-winged Blackbird | 17 | 13 | 5 |
| MacGillivray's Warbler | 16 | 27 | 5 |
| Mountain Bluebird | 15 | 33 | 4 |
| Chipping Sparrow | 14 | 20 | 3 |
| Dusky Flycatcher | 11 | 7 | 3 |
| Sora | 10 | 13 | 3 |
| Orange-crowned Warbler | 9 | 13 | 3 |
| Brewer's Blackbird | 8 | 7 | 3 |
| Killdeer | 8 | 20 | 2 |
| Mourning Dove | 8 | 20 | 2 |
| Savannah Sparrow | 8 | 13 | 3 |
| Northern Flicker | 7 | 20 | 3 |
| N. Rough-winged Swallow | 7 | 20 | 1 |
| Red-tailed Hawk | 7 | 27 | 2 |
| Undetermined sp. | 7 | 27 | 3 |
| Song Sparrow | 6 | 20 | 2 |
| Broad-tailed Hummingbird | 5 | 20 | 2 |
| Common Yellowthroat | 4 | 7 | 1 |
| Say's Phoebe | 4 | 13 | 1 |
| Tree Swallow | 4 | 20 | 2 |
| Wilson's Snipe | 4 | 7 | 1 |
| Ruby-crowned Kinglet | 3 | 7 | 1 |
| Western Wood-Pewee | 3 | 7 | 1 |
| American Kestrel | 2 | 13 | <0.5 |
| Bald Eagle | 2 | 7 | 1 |

| Species | # of Individuals | % Frequency on Grids (n = 15) | % Frequency on Individual Points (n = 240) |
|---|---|---|---|
| Black-capped Chickadee | 2 | 7 | 1 |
| Black-crowned Night Heron | 2 | 7 | <0.5 |
| Common Merganser | 2 | 7 | <0.5 |
| Common Poorwill | 2 | 13 | 1 |
| Dark-eyed Junco | 2 | 13 | <0.5 |
| Hermit Thrush | 2 | 13 | 1 |
| Lark Sparrow | 2 | 7 | <0.5 |
| Northern Harrier | 2 | 7 | <0.5 |
| Yellow-rumped Warbler | 2 | 7 | <0.5 |
| Barn Swallow | 1 | 7 | <0.5 |
| Bewick's Wren | 1 | 7 | <0.5 |
| Black-billed Magpie | 1 | 7 | <0.5 |
| Blackbird sp. | 1 | 7 | <0.5 |
| Blue-gray Gnatcatcher | 1 | 7 | <0.5 |
| Cliff Swallow | 1 | 7 | <0.5 |
| Empidonax sp. | 1 | 7 | <0.5 |
| Hammond's Flycatcher | 1 | 7 | <0.5 |
| Loggerhead Shrike | 1 | 7 | <0.5 |
| Mountain Chickadee | 1 | 7 | <0.5 |
| Oriole sp. | 1 | 7 | <0.5 |
| Swainson's Thrush | 1 | 7 | <0.5 |
| Violet-green Swallow | 1 | 7 | <0.5 |
| Wilson's Warbler | 1 | 7 | <0.5 |
| Yellow-breasted Chat | 1 | 7 | <0.5 |
| **Total (63)** | **1,944** | **100** | **99*** |

* One point count survey resulted in zero bird detections; although rounding to the nearest whole number would result in a 100% frequency (239 of 240 = 99.58%); this table shows 99% to recognize the single point count with no birds.

The number of species and number of individuals varied between survey grid sites (Table 6). The mean number of species per grid was 16 (range of 9–30), while the mean number of individuals was 130 (range of 58–182). Although the number of species at four survey locations (sites 42, 49, 94, and 263) differed from the mean by more than 50%, only one site (163) differed by 50% from the mean in the number of individuals recorded.

**Table 6. The Number of Species and Number of Individuals per Grid-based Breeding Bird Survey Site, June 2011.**

| Grid Identifier | # of Species | # of Individuals |
|---|---|---|
| 42 | 30 | 182 |
| 49 | 29 | 131 |
| 94 | 30 | 157 |
| 151 | 10 | 113 |
| 163 | 11 | 58 |
| 208 | 10 | 92 |
| 224 | 9 | 121 |
| 263 | 28 | 169 |
| 321 | 15 | 143 |
| 335 | 15 | 173 |
| 358 | 13 | 155 |
| 470 | 12 | 119 |
| 482 | 12 | 121 |
| 575 | 12 | 123 |
| 605 | 10 | 87 |
| **Total** | **63**[1] | **1,944** |

[1] The same species were observed at multiple sites; therefore, this total represents the number of individual species observed at all sites.

# WATERBIRD SURVEYS

Waterbird surveys were conducted in 2011 during spring (April 26–May 4), summer (August 23–24), and fall (October 20–21) at each of the four major reservoirs (Kindt, Rasmussen, Sage Creek, and Teton) occurring within the Project site and surrounding area. These surveys were conducted to help build a baseline of potential prey species and assess their spatiotemporal abundance in the Project site at locations with the potential to attract and/or concentrate eagles and other raptor species. Surveys were conducted using spotting scopes to maximize coverage from a minimal number of viewing locations, as well as to facilitate species identification. Along with standard survey information (i.e., date, location, observer, time, weather conditions), species-specific data collected included species, age, sex, and number of individuals.

## SPRING SURVEYS

Spring waterbird surveys were conducted between April 26 and May 4, 2011. These surveys resulted in a total count of 1,415 individuals representing 35 species (Table 7). American coot (*Fulica americana*) was the most abundant species accounting for 364 individuals (26% of total count). Scaup (*Aythya* sp.), *Aechmophorus* grebes (i.e., western and Clark's), and eared grebe (*Podiceps nigricollis*) were the next most abundant species with 351, 209, and 113 individuals, respectively. Collectively, those four groups accounted for 1,037 individuals or 73% of all birds detected.

**Table 7. Species, Number of Individuals, and Spring Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011.**

| Species | Kindt 5/2/11 | Rasmussen 5/4/11 | Sage Creek 4/26/11 | Teton 5/4/11 | Total Count |
|---|---|---|---|---|---|
| *Aechmophorus* sp. | | 71 | | | **71** |
| American Avocet | 2 | 4 | 2 | | **8** |
| American Coot | 198 | 5 | 100 | 61 | **364** |
| American White Pelican | 2 | 1 | | 3 | **6** |
| American Wigeon | 5 | 1 | | | **6** |
| Bufflehead | 6 | 2 | 1 | 1 | **10** |
| *Calidris* sp. | 3 | | | | **3** |
| Canada Goose | | | | 5 | **5** |
| Canvasback | 4 | | | | **4** |
| Cinnamon Teal | | | | 3 | **3** |
| Clark's Grebe | | | | 1 | **1** |
| Common Loon | | 4 | 1 | | **5** |
| Common Merganser | 53 | | 7 | 14 | **74** |
| Double-crested Cormorant | | | | 6 | **6** |
| Eared Grebe | 59 | 31 | 6 | 17 | **113** |
| Gadwall | 8 | 8 | 5 | 11 | **32** |
| Greater Scaup | 4 | | | | **4** |
| Greater Yellowlegs | 2 | | | | **2** |
| Green-winged Teal | 2 | 6 | | 6 | **14** |
| Horned Grebe | | | 1 | | **1** |
| Killdeer | 16 | | 5 | 1 | **22** |
| Least Sandpiper | 1 | | | | **1** |
| Lesser Scaup | 84 | 19 | | | **103** |
| Lesser Yellowlegs | 1 | | | | **1** |
| Mallard | 4 | | | 2 | **6** |
| Marbled Godwit | 7 | 1 | | | **8** |
| Northern Pintail | 2 | | | 1 | **3** |
| Northern Shoveler | | 2 | | 6 | **8** |
| Pied-billed Grebe | | | 1 | | **1** |
| Redhead | 69 | 11 | | 5 | **85** |
| Ring-billed Gull | | 1 | | 1 | **2** |
| Ring-necked Duck | 8 | 2 | | 16 | **26** |
| Ruddy Duck | 9 | | | | **9** |
| Scaup sp. | 200 | 44 | | | **244** |
| Western Grebe | 39 | 50 | 34 | 14 | **137** |
| White-faced Ibis | | 3 | | | **3** |
| Willet | 17 | 2 | 2 | | **21** |
| Wilson's Phalarope | 3 | | | | **3** |
| **Total** | **808** | **268** | **165** | **174** | **1,415** |
| **Number of Species** | **25** | **18** | **12** | **19** | **35** |

More species and individuals were counted at Kindt Reservoir (25 species, 808 individuals) than the other three reservoirs (Table 7). The fewest species and number of individuals (12 species, 165 individuals) were recorded at Sage Creek Reservoir during spring surveys.

**SUMMER SURVEYS**

A total of 1,708 individuals representing 29 species were recorded on summer waterbird surveys conducted on August 23 and 24, 2011 (Table 8). Redhead (*Aythya americana*) had the highest number of individuals (815) accounting for 48% of all birds detected during summer surveys. Lesser scaup (*Aythya affinis*), mallard (*Anas platyrhynchos*), and American coot were the next most abundant species with 157, 149, and 99 individuals, respectively. Collectively, those four species accounted for 1,221 individuals or 71% of all birds detected.

The highest number of individuals (920) was recorded at Rasmussen Reservoir, where 89% (780 individuals) were redheads (Table 8). Nearly all of the season's redheads (780 of 815) were recorded at Rasmussen Reservoir. Despite the high number of birds recorded at Rasmussen Reservoir, biologists recorded the fewest number of species (12) at that location.

**Table 8. Species, Number of Individuals, and Summer Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011.**

| Species | Kindt 8/23/11 | Rasmussen 8/24/11 | Sage Creek 8/23/11 | Teton 8/24/11 | Total Count |
|---|---|---|---|---|---|
| American Avocet | 10 | 4 | 5 | 6 | **25** |
| American Coot | 30 | | 45 | 24 | **99** |
| American White Pelican | 10 | | 12 | 2 | **24** |
| American Wigeon | 2 | | 4 | 5 | **11** |
| Black-crowned Night Heron | | | 4 | 3 | **7** |
| Blue-winged Teal | | 14 | 6 | | **20** |
| California Gull | | | | 2 | **2** |
| Canada Goose | 16 | 12 | | | **28** |
| Common Loon | | 2 | | | **2** |
| Common Merganser | 1 | 16 | | | **17** |
| Double-crested Cormorant | | | 5 | 6 | **11** |
| Eared Grebe | 27 | 9 | 7 | 7 | **50** |
| Gadwall | 26 | | | 10 | **36** |
| Great Blue Heron | | | 1 | 1 | **2** |
| Green-winged Teal | 26 | | | 42 | **68** |
| Herring Gull | 3 | | | | **3** |
| Killdeer | 1 | 5 | 1 | 3 | **10** |
| Lesser Scaup | 80 | 18 | 59 | | **157** |
| Mallard | 102 | 13 | 25 | 9 | **149** |
| Northern Pintail | 4 | | 6 | | **10** |
| Pied-billed Grebe | 3 | | | 7 | **10** |
| Redhead | | 780 | 35 | | **815** |
| Ring-billed Gull | | 4 | 2 | | **6** |
| Ruddy Duck | | | 9 | | **9** |

| Species | Kindt 8/23/11 | Rasmussen 8/24/11 | Sage Creek 8/23/11 | Teton 8/24/11 | Total Count |
|---|---|---|---|---|---|
| Snowy Egret | | | 1 | | **1** |
| Spotted Sandpiper | 2 | | 2 | | **4** |
| Unknown dabbling duck | | | 35 | 12 | **47** |
| Unknown gull | | 13 | | 1 | **14** |
| Western Grebe | 3 | 30 | 24 | 10 | **67** |
| Willet | 1 | | | | **1** |
| Wilson's Phalarope | | | | 3 | **3** |
| **Total** | **347** | **920** | **288** | **153** | **1,708** |
| **Number of Species** | **18** | **12** | **19** | **16** | **29** |

## FALL SURVEYS

Surveys during the fall migration period on October 20 and 21, 2011, resulted in a total of 11,473 individuals of 29 species recorded (Table 9). Similar to spring, in the fall American coot accounted for the majority of individuals (8,024, 70% of total individuals). A total of 1,692 American wigeon (*Anas americana*) were also recorded. Combined, American coot and American wigeon accounted for 9,716 individuals (85% of all individuals).

More individuals (8,773) and species (22) were recorded at Kindt Reservoir during fall surveys than at other reservoirs (Table 9). Of the 8,024 American coots and 1,692 American wigeons recorded at all reservoirs combined, the survey at Kindt Reservoir accounted for 5,810 coots (66%) and 1,690 wigeon (99%).

**Table 9. Species, Number of Individuals, and Fall Survey Dates of Waterbird Surveys at Four Major Reservoirs within the Chokecherry-Sierra Madre Wind Resource Area, 2011.**

| Species | Kindt 10/21/11 | Rasmussen 10/21/11 | Sage Creek 10/20/11 | Teton 10/20/11 | Total Count |
|---|---|---|---|---|---|
| American Avocet | | | 8 | | **8** |
| American Coot | 5,810 | 2,088 | | 126 | **8,024** |
| American Wigeon | 1,690 | 1 | 1 | | **1,692** |
| Bufflehead | 2 | | | 1 | **3** |
| Canada Goose | 38 | | 5 | | **43** |
| Canvasback | 5 | | 1 | | **6** |
| Common Loon | | 2 | | | **2** |
| Common Merganser | | | 64 | 6 | **70** |
| Eared Grebe | 3 | 98 | 9 | | **110** |
| Gadwall | 554 | 20 | 3 | | **577** |
| Greater Yellowlegs | 4 | | | | **4** |
| Green-winged Teal | 10 | 33 | 44 | | **87** |
| Herring Gull | | 1 | | 2 | **3** |
| Hooded Merganser | | | 3 | | **3** |
| Horned Grebe | 16 | 13 | 5 | | **34** |
| Lesser Scaup | 24 | | | | **24** |

| Species | Kindt 10/21/11 | Rasmussen 10/21/11 | Sage Creek 10/20/11 | Teton 10/20/11 | Total Count |
|---|---|---|---|---|---|
| Long-billed Dowitcher | 4 | | | | **4** |
| Mallard | 121 | 20 | 8 | 3 | **152** |
| Northern Pintail | 50 | 4 | 3 | | **57** |
| Northern Shoveler | 1 | 1 | 11 | | **13** |
| Pectoral Sandpiper | 1 | | | | **1** |
| Pied-billed Grebe | 6 | 3 | | | **9** |
| Redhead | 328 | 27 | 4 | | **359** |
| Ring-billed Gull | 1 | 7 | 11 | 9 | **28** |
| Ring-necked Duck | 84 | | | | **84** |
| Ruddy Duck | 17 | 13 | 4 | | **34** |
| Surf Scoter | | 6 | | | **6** |
| Western Grebe | 4 | 25 | 3 | 1 | **33** |
| White-winged Scoter | | 3 | | | **3** |
| **Total** | **8,773** | **2,365** | **187** | **148** | **11,473** |
| **Number of Species** | **22** | **18** | **17** | **7** | **29** |

# ACOUSTIC BAT MONITORING

Anabat (Titley Electronics, Australia) is a bat detection system that uses a broadband microphone that can detect ultrasonic sounds and record them onto a compact flash data card. This system uses a frequency division technique called Zero-Crossings Analysis to produce sonograms that can be viewed on a PDA or computer screen using the AnalookW program. These sonograms display the shape of individual pulses on a frequency graph plotted against time. Bat species produce echolocation vocalizations based on their ecological niche requirements, which may demand different frequency bandwidth, pulse duration, and other characteristics discernible in the sonograms. Sonograms produced through Zero-Crossings Analysis generally have enough information to label a pulse sequence as belonging to a group of bats with similar acoustic characteristics (e.g., 25-kilohertz [kHz] bats) and even allow for identification of acoustically distinctive species (e.g., hoary bat [*Lasiurus cinereus*]) (Kunz et al. 2007). In North America, *Myotis* bat species are generally recognized as being the most difficult to differentiate due to similarities in vocalization characteristics and pulses are often placed within a frequency group (e.g., 40-kHz Myotis).

An index of bat activity was calculated by counting the number of bat passes per detector-hour past sunset (Kunz et al. 2007) for data collected in 2011. The number of detector-hours per night was calculated by summing the number of minutes surveyed between sunset and sunrise and dividing by 60 for each night surveyed. A bat pass was defined as a pulse sequence (commonly referred to as a “call”) consisting of at least one individual pulse that was separated by >1 second from the next pulse (White and Gehrt 2001). An index of activity is used because the number of bats cannot be quantified from acoustic data (Kunz et al. 2007). Individual bats are not identifiable in an acoustical dataset as pulses may have been produced by the same or different individuals over the course of a single night survey period (Hayes 2000 in Kunz et al. 2007). All bat passes were categorized through assessment of both qualitative (e.g., shape) and quantitative (e.g., characteristic frequency) qualities (Weller and

Baldwin 2012). Individual passes were labeled by characteristic frequency type (e.g., 25 kHz, 30 kHz, 40 kHz), then grouped into low (<25 kHz), mid- (30–40 kHz), and high (>50 kHz) characteristic frequency groups. Diagnostic call sequences were labeled by species. For reporting purposes, except where indicated, species-specific passes were combined with the appropriate frequency group.

In 2011, four locations (sites 2-1, 3-1, 3-2, and 4-1) were surveyed for nightly bat activity. Table 10 provides the level of effort (number of nights and number of survey-hours), the total number of bat passes, and the number of passes per survey-hour.

**Table 10. Level of Effort and Bat Pass Summary for Locations Surveyed in 2011.**

| Site | Date Span | # of Survey Nights | # of Survey-Hours | Total # of Bat Passes | # of Bat Passes per Survey-Hour |
|---|---|---|---|---|---|
| 2-1 | Jun 15–27 | 13 | 114.4 | 19 | 0.2 |
| 3-1 | Jun 30–Jul 26 | 27 | 244.9 | 79 | 0.3 |
| 3-2 | Jul 27–Aug 22 | 27 | 267.1 | 33 | 0.1 |
| 4-1 | Sep 23–Oct 20 | 28 | 349.7 | 7 | 0.0 |
| **Total** | **Jun 15–Oct 20** | **95** | **976.1** | **138** | **0.1** |

The average number of bat passes per survey-hour across a season may be beneficial to delineate approximate dates of local bat activity, including arrival of spring migrants and departure of fall migrants. Furthermore, variation in the number of bat passes per night at an individual site may be useful in identifying migratory pulses.

Activity levels were inconsistent during the survey period (Figure 1). This inconsistency is likely due to lack of recognizable foraging areas (e.g., slow-moving streams, ponds, wooded sites) at the survey locations and the seemingly random occurrence of a bat traveling between roost and foraging sites being detected by the Anabat. The steep increase in the number of bat passes on July 24 (26 bat passes in 9.3 survey-hours = 2.8 bat passes/survey-hour) is four times higher than the next highest average count at that site. Activity levels decreased in mid-August. No survey data were collected from August 23 to September 22 due to system error. Activity levels were low during the September 23 to October 20 survey period with no more than 0.1 bat pass per survey-hour on any given night.

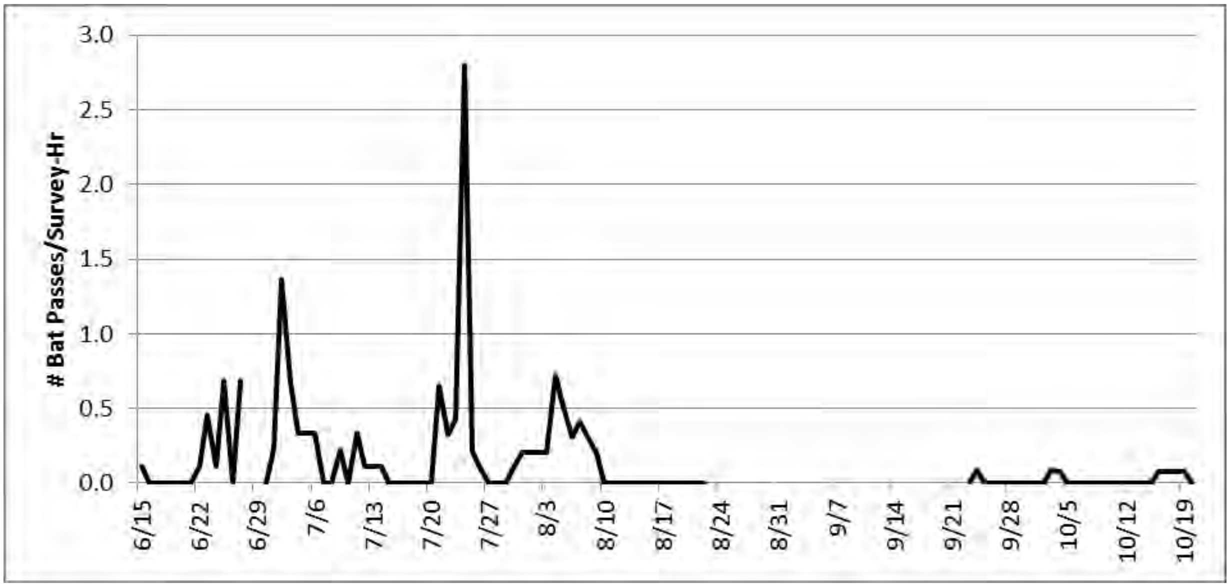


**Figure 1. Average number of bat passes per survey-hour, June 15–October 20, 2011.**

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