Bechtel Nevada Corporation
Ecological Services

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DISTRIBUTION OF THE CHUCKWALLA, WESTERN BURROWING OWL, AND SIX BAT SPECIES ON THE NEVADA TEST SITE

May 1, 1997

WORK PERFORMED UNDER
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Submitted to

U.S. Department of Energy
Nevada Operations Office
Environmental Protection Division
P.O. Box 98518

Prepared by

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By

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EXECUTIVE SUMMARY

Field surveys were conducted in 1996 to determine the current distribution of several animal species of concern on the Nevada Test Site (NTS). They included the chuckwalla (*Sauromalus obesus*), western burrowing owl (*Speotyto cunicularia*), and six species of bats; namely, the pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), spotted bat (*Euderma maculatum*), small-footed myotis (*Myotis ciliolabrum*), long-eared myotis (*M. evotis*), fringed myotis (*M. thysanodes*), and long-legged myotis (*M. volans*).

Nineteen chuckwallas and 118 scat locations were found during the chuckwalla field study. Prior to 1996, 108 chuckwalla sightings had been documented on the NTS. Chuckwallas and their scat were found in rocky areas on the southern one-third of the NTS. The northern boundary of their distribution corresponded roughly with the northern boundary of the distribution of the desert tortoise on the NTS.

Eighteen western burrowing owls were found at 12 sighting locations during the 1996 field study. Excluding owls found during the 1996 field survey, 115 owls were documented at 30 sighting locations on the NTS through December 31, 1996. Western burrowing owls were found in dry, open areas with flat to gradually sloping terrain in most of the major valleys on the NTS; namely, Frenchman Flat, Jackass Flats, Mercury Valley, Rock Valley, and Yucca Flat. Nearly two-thirds of the burrows found were man-made and usually consisted of partially buried pipes and culverts with an open end at ground level. The technique of playing back the primary call of the male burrowing owl was an effective technique and increased known locations of burrowing owls on the NTS by 23 percent.

Of the eleven bat species of concern which might occur on the NTS, five, and possibly six, were captured during this survey. Presence of the small-footed myotis on the NTS is questionable due to the difficulty of being able to distinguish it from the California myotis (*M. californicus*) in the field. Specimens of bats believed to be the small-footed myotis were submitted to a qualified mammalogist for identification, but positive identification is still pending. The spotted bat was captured for the first time on the NTS. Excluding the questionable small-footed myotis captures, a total of 145 individuals of bat species of concern were captured during the 1996 field study. Prior to 1996, nine pale Townsend's big-eared bats, nine long-eared myotis, three fringed myotis, and seven long-legged myotis had been captured on the NTS. In addition, one spotted bat vocalization had been recorded, but no individuals captured. The highest diversity of mist-netted bats was found in the Great Basin Desert region of the NTS. The pale Townsend's big-eared bat, spotted bat, and long-eared myotis were found exclusively in the Great Basin Desert region. The fringed myotis was found in the Great Basin and Mojave Desert regions, while the long-legged myotis was found in the Mojave, Mojave/Great Basin Transition, and Great Basin Desert regions.

The U.S. Department of Energy, Nevada Operations Office, takes certain management actions to protect and conserve the chuckwalla, western burrowing owl, and bats on the NTS. These actions are described and include: (1) conducting surveys at sites of proposed land-disturbing activities, (2) altering projects whenever possible to avoid or

minimize impacts to these species, (3) maintaining a geospatial database of known habitat for species of concern, (4) sharing sighting and trap location data gathered on the NTS with other local land and resource managers, and (5) conducting periodic field surveys to monitor these species' distribution and relative abundance on the NTS.

1.0 INTRODUCTION

1.1 Monitoring Species of Concern on the Nevada Test Site

The Nevada Test Site (NTS) has been the site for nuclear weapons testing by the United States since 1952. From 1952 until 1992, 100 atmospheric and 828 underground tests were conducted. Although no nuclear tests have been conducted on the NTS since 1992, the site still is maintained, in part, for the possible resumption of testing. The NTS also has been the location for many other programs and experiments, such as nuclear rocket development, and testing and emergency management of accidents involving hazardous gases.

Although the NTS has been used for many years for these activities, only about 7 percent of the 3,497 square kilometers (km^2) (1,350 square miles [mi^2]) of the site has been disturbed (U.S. Department of Energy [DOE], 1996a). In part because of the large amount of undisturbed habitat on and around the NTS, the site has a large variety of plants and animals. Over 700 plant taxa in at least 67 families occur on the site (Beatley, 1976; O'Farrell and Emery, 1976). Approximately 279 vertebrate species have been observed on the NTS, including 54 species of mammals, 190 species of birds, 33 species of reptiles, and 2 species of introduced fishes (O'Farrell and Emery, 1976; Castetter and Hill, 1979; Medica, 1990; Medica *et al.*, 1990; EG&G/EM, 1993). Over 1,000 species of arthropods have been identified on the NTS, but this probably represents a small fraction of the arthropod species present (O'Farrell and Emery, 1976).

The U.S. Department of Energy, Nevada Operations Office (DOE/NV), which operates the NTS, is committed to maintaining this diversity of plants and animals on the NTS. DOE/NV recently published the following goal for the management of biological resources on the NTS.

> Maintain habitat and ecosystem processes needed to support viable populations of all native plants and animals, including state and federal endangered, threatened, and candidate species. (DOE, 1996b)

To achieve this goal, DOE/NV needs, at a minimum, information on the presence, distribution, and relative abundance of the plant and animal species that are most likely to be affected by activities on the NTS. For the past two decades, DOE/NV has implemented an ecological monitoring program on the NTS to monitor the site's ecosystem and collect data needed to identify and protect important biological resources, including species of concern and valuable habitat features (e.g., wetlands, nest sites). Species of concern include: (1) plants and animals that are protected under the Endangered Species Act (ESA) as threatened or endangered, (2) species that are candidates for listing as threatened or endangered under the ESA, (3) other federal- or state-protected or managed species (e.g., migratory birds, rare plants and animals, game species), and (4) species formerly considered Category 2 candidates for listing under the ESA.

Field surveys to determine the distribution and abundance of species of concern on the NTS are an ongoing part of the DOE/NV ecological monitoring program. Data from such surveys are used to assess potential threats to these species and develop mitigation measures to minimize or eliminate these threats. For example, field surveys for desert tortoises, the only resident animal species on the NTS that is federally listed as threatened or endangered, were conducted periodically between 1981 to 1993 to better determine the relative abundance and distribution of that species on the NTS (EG&G/EM, 1991; Rautenstrauch *et al.*, 1994). Field surveys and monitoring also have been conducted for other federal- and state-protected or -managed species (e.g., horses, mule deer, waterfowl, raptors, chukar, and kit fox) (Hunter *et al.*, 1991; Greger, 1994; 1995; Greger and Romney, 1994a; 1994b) and candidate plant species (Beatley, 1977a,b; Rhoads and Williams, 1977; Rhoads *et al.*, 1978, 1979; Cochrane, 1979; Collins and O'Farrell, 1984). Results of early plant surveys were used by the U.S. Fish and Wildlife Service (FWS) to reduce the number of NTS plants that may warrant federal protection from 24 to 12. Between 1989 and 1995, the focus of field studies and surveys was on these 12 ESA candidate plant species (Blomquist *et al.*, 1992, 1995).

Upon completion of the candidate plant monitoring efforts in 1995, surveys were developed to better understand the distribution and abundance of 13 animal species of concern which may be impacted by DOE/NV projects. At that time, these 13 species were ESA Category 2 candidates (those for which the FWS believed listing was probably deserved, but for which there was insufficient information available to support a proposal for listing) and included one reptile, the chuckwalla (*Sauromalus obesus*); one bird, the western burrowing owl (*Speotyto cunicularia*); and 11 species of bats. Chuckwallas and western burrowing owls were known to occur on the NTS, but only 5 of the 11 bats had been previously captured or audibly detected there: the pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), spotted bat (*Euderma maculatum*), long-eared myotis (*Myotis evotis*), fringed myotis (*M. thysanodes*), and long-legged myotis (*M. volans*). The other six Category 2 bat species that might occur on the NTS include the Mexican long-tongued bat (*Choeronycteris mexicana*), western mastiff bat (*Eumops perotis*), California leaf-nosed bat (*Macrotus californicus*), small-footed myotis (*M. ciliolabrum*), Yuma myotis (*M. yumanensis*), and big free-tailed bat (*Nyctinomops macrotis*).

In February 1996, the FWS released a new notice of review of ESA candidate species and announced that species for which insufficient information was available to support a listing (i.e., Category 2 candidates) would no longer be considered candidates (U.S. Department of Interior [DOI], 1996). The chuckwalla, western burrowing owl, and bats were removed from the list of ESA candidates. Taxa removed from the list are still of concern to the FWS:

> . . . the Service [FWS] remains concerned about these species, but further biological research and field study are needed to resolve the conservation status of these taxa. Many species of concern will be found not to warrant listing, either because they are not threatened or endangered or because they do not qualify as species under the definition in the Act [ESA] . . . . Such species are the pool from which future candidates for listing will be drawn. (DOI, 1996).

Additionally, the western burrowing owl is protected by the state of Nevada. The spotted bat is classified as "protected: threatened" by the state, but the Nevada Division of Wildlife (NDOW) has petitioned the state to down-list the spotted bat to "protected:

sensitive" (NDOW, 1996). NDOW has also requested that the pale Townsend's big-eared bat be classified as "protected: sensitive" (NDOW, 1996).

This report summarizes the findings of field surveys and other work conducted in 1996 for chuckwallas, western burrowing owls, and sensitive bat species. Only those six bat species of concern that were captured during mist-netting surveys are discussed in this report (pale Townsend's big-eared bat, spotted bat, long-eared myotis, fringed myotis, long-legged myotis, and possibly [taxonomic validation is pending] the small-footed myotis). Other bat species which are not species of concern and which were captured during the field surveys are mentioned in the results, but are not discussed. The objectives of these field surveys were to document the presence of these species on the NTS, estimate their distribution there, and describe the habitat where they are found. This information will be of value for evaluating and mitigating potential impacts of DOE/NV activities on these animals and for use as baseline data for monitoring trends in their distribution and abundance. It also may be useful to federal and state regulatory agencies when determining the level of protection appropriate for these species in the future.

1.2 Study Area

The NTS is located in Nye County in south-central Nevada and encompasses 3,497 km^2 (1,350 mi^2) (Figure 1-1). The NTS is divided into 26 areas for administration and management. Access to the site is strictly controlled. Land along the eastern boundary of the NTS is co-managed by the U.S. Air Force, Nellis Air Force Range, and the Desert National Wildlife Refuge. Land to the north and west also is part of the Nellis Air Force Range. Most land directly south and southwest of the NTS is managed by the U.S. Bureau of Land Management.

The southern two-thirds of the NTS is dominated by three large valleys or basins: Yucca, Frenchman, and Jackass Flats (*Figure 1-1*). Mountain ridges and hills rise above gradually sloping alluvial fans (bajadas) and enclose these basins. During years of high precipitation, surface waters collect and form shallow lakes in the closed basins of Yucca and Frenchman Flats. Jackass Flats is an open basin and drains to the southwest via Fortymile Wash. Mercury, Rock, Topopah, and Mid Valleys are smaller basins and also have drainage outlets. The northern, northwestern, and west central sections of the NTS are dominated by Pahute Mesa and Timber and Shoshone mountains. Elevation on the NTS ranges from less than 1,000 meters (m) (3,281 feet [ft]) above sea level in Frenchman Flat and Jackass Flats, to about 2,340 m (7,600 ft) on Rainier Mesa.

Elevations at the base of mountains on the NTS are an average of 975 m (3,200 ft) in the south, 1,370 m (4,500 ft) in the central region, and 1,600 m (5,250 ft) in the northern part of the NTS. Mountain peaks range from 1,400 to 1,800 m (4,600 to 5,900 ft) in the south and 2,100 to 2,300 m (6,890 to 7,550 ft) in the north. Associated with these elevational increases is the northern boundary of the Mojave Desert and the southern boundary of the Great Basin Desert within a broad east-west corridor of transition (Beatley, 1976).

NTS has a climate characteristic of high deserts, with little precipitation, very hot summers, mild winters, and large diurnal temperature ranges. Monthly average

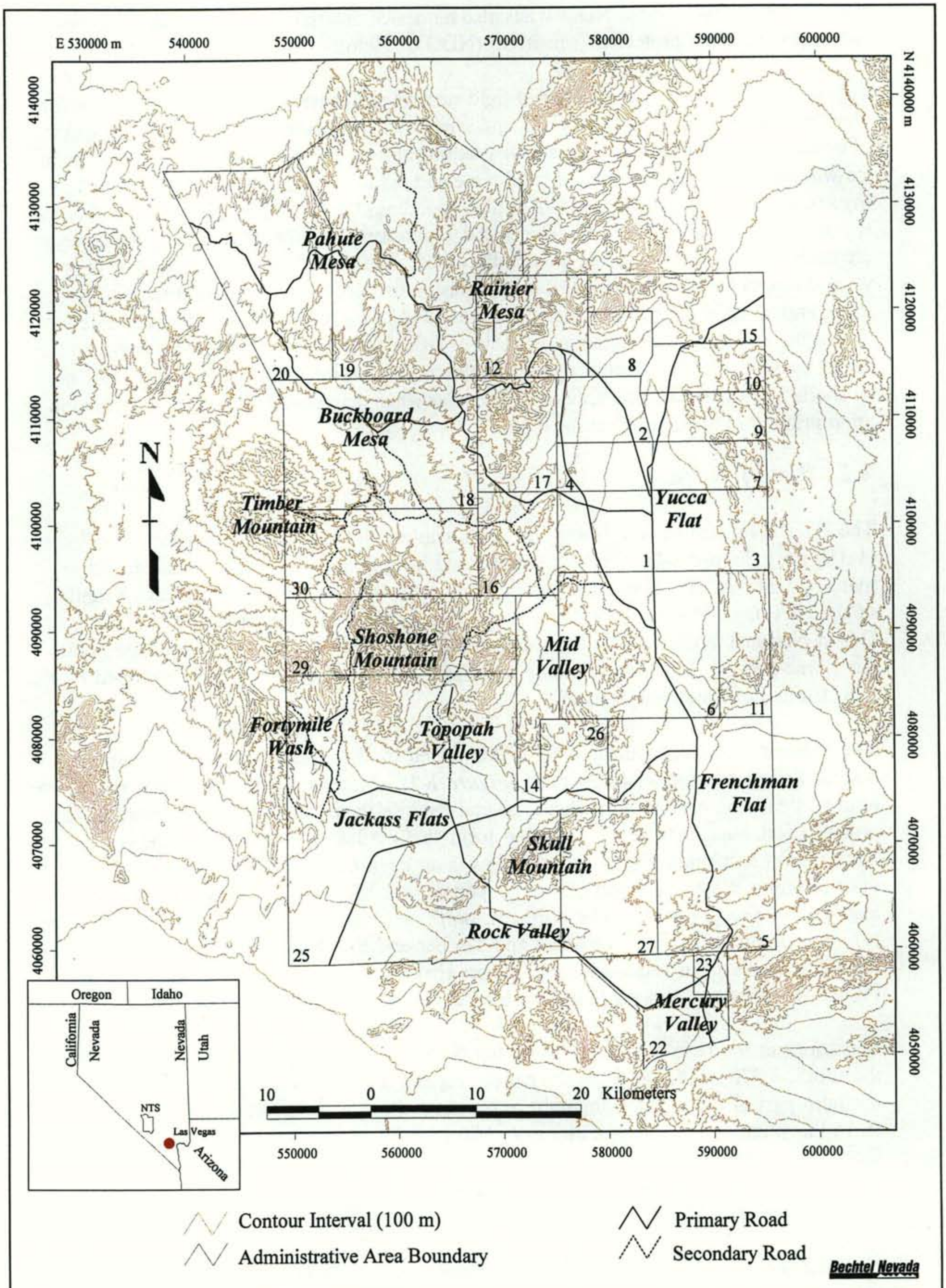

Figure 1-1 **Major Roads, Topographic Features, and Administrative Areas of the Nevada Test Site**

temperatures in the NTS area range from 7° Centigrade (C) (44° Fahrenheit [F]) in January to 32°C (90°F) in July (DOE, 1996a). The average annual precipitation on the NTS ranges from 15 centimeters (cm) (6 inches [in]) at the lower elevations to 23 cm (9 in) at the higher elevations (DOE, 1996a). About 60 percent of this precipitation occurs from September through March. Winter precipitation frequently occurs as snow which persists in northern Yucca Flat and to the north. Higher mountains commonly are snow-covered much of the winter. Snow seldom persists for more than a few hours in the southern valleys.

The following description of vegetation on the NTS is from Beatley (1976), O'Farrell and Emery (1976), and DOE (1996a). Mojave Desert vegetation is generally found in the valleys and lower elevation portions of mountains in the southern one-third to one-half of the NTS below approximately 1,220 m (4,000 ft). Creosotebush (*Larrea tridentata*) is the dominant shrub in most areas and is associated with a variety of other shrubs (white bursage [*Ambrosia dumosa*], Shockley's goldenhead [*Acamptopappus shockleyi*], shadscale [*Atriplex confertifolia*], littleleaf ratany [*Krameria erecta*], Nevada ephedra [*Ephedra nevadensis*], pale wolfberry [*Lycium pallidum*], Anderson's wolfberry [*Lycium andersonii*] and spiny hopsage [*Grayia spinosa*]) depending on soil conditions and elevation.

Vegetation unique to the transition zone between the Mojave and Great Basin deserts occur on upper alluvial fans and valley bottoms in the middle third of the NTS including Yucca Flat. Blackbrush (*Coleogyne ramosissima*) is the dominant plant species on alluvial fans (western Yucca Flat) and valley bottoms (e.g., Mid Valley, Topopah Valley) between about 1,220 m (4,000 ft) and 1,525 m (5,000 ft). Creosotebush and other Mojave Desert shrubs intergrade with blackbrush in the lower elevation portions of this plant community, but blackbrush occurs in nearly monotypic stands at the higher elevations. In addition to blackbrush, other common shrubs found in the transition zone include Nevada ephedra, shadscale, Anderson's wolfberry, spiny hopsage, winterfat (*Krascheninnikovia lanata*), fourwing saltbush (*Atriplex canescens*), and white burrobush (*Hymenoclea salsola*).

Great Basin plant communities generally occur in the northern and northwestern one-third of the NTS at elevations above 1,525 m (5,000 ft). Valley bottoms are dominated by big sagebrush (*Artemisia tridentata*) and black sagebrush (*Artemisia nova*), with fourwing saltbush and rubber rabbitbrush (*Ericameria nauseosa*) common on deep sandy soils at middle elevations (1,370 to 1,685 m [4,490 to 5,550 ft]). Singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) trees are codominant with sagebrush above 1,830 m (6,000 ft) and form an open shrub woodland.

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2.0 CHUCKWALLA

2.1 Literature Review

The chuckwalla (*Sauromalus obesus*) is a large, dark bodied, herbivorous lizard (Figure 2-1). Yearling and older chuckwalla range in size from about 100 millimeters (mm) (4 in) to 220 mm (9 in) snout-to-vent length (SVL). Males grow at faster rates than females of similar age and attain a larger size (Berry, 1974). Juveniles and subadults have banded tails. The chuckwalla is found in the southwestern deserts of the United States and northwestern deserts of Mexico (Figure 2-2), occurring from sea level to about 1,830 m (6,000 ft) (Case, 1976a; Stebbins, 1985). The northern range limit for the western chuckwalla (*S. obesus obesus*) crosses the NTS (*Figure 2-2*). Two other subspecies, the Glen Canyon chuckwalla (*S. obesus multiforamanatus*) and the Arizona chuckwalla (*S. obesus tumidus*), occur east and south of the range of the western chuckwalla. Concern for the chuckwalla exists due to over-collection, extirpation, and destruction of habitat in California, Utah, and Arizona (J. Rorabaugh, pers. comm. 1997).

Chuckwalla habitat is primarily rock outcrops and boulders (Tanner and Jorgensen, 1963; Case, 1976a; Prieto and Ryan, 1978), which provide cover and basking sites (Stebbins, 1985), but chuckwalla can be found foraging away from these sites. Mean home range size varies from about 0.2 to 1.9 hectares (ha) (0.5 to 4.7 acres [ac]) for males and about 0.2 to 0.8 ha (0.5 to 2.0 ac) for females (Johnson, 1965; Nagy, 1973; Berry, 1974). Chuckwalla densities reported vary from about 7 to 14 per ha (2.8 to 5.7 per ac) in California (Johnson, 1965; Berry, 1974) to 22 per ha (9 per ac) in the Colorado Desert (Abts, 1987).

Chuckwallas mate in April, and egg laying occurs in mid- to late June (Johnson, 1965; Berry, 1974). Reproductively active males and females measure approximately 125 mm (5 in) SVL (Prieto and Sorenson, 1977; Abts, 1988a, 1988b). Clutch size is correlated with body size and varies from about 3 to 15 eggs (Prieto and Sorenson, 1977; Werman, 1982; Abts, 1987). In Arizona, incubation of eggs was approximately 85 days and young were observed in August (Prieto and Sorenson, 1977). Locations of chuckwalla nests have rarely been reported; however, Johnson (1965) observed chuckwalla nest construction in California in an east-facing rock crevice about 34 cm (13 in) deep. Eggs were covered by 15 cm (6 in) of sand towards the opening and the nest was covered vertically by about 43 cm (17 in) of rock.

Daily activity patterns have been studied in the field (Nagy, 1973; Berry, 1974; Case, 1976b). Chuckwallas are active from February through October. They are most active at temperatures of 35° to 40°C (95° to 104°F), and may exhibit daily bimodal activity patterns in May through July or August (Case, 1976b; Nagy, 1973; Muchlinski *et al.*, 1990). Beginning in July, they may only be active for short periods every few days (Nagy, 1973; Berry, 1974; Smits, 1985). Quality of food can influence chuckwalla activity periods. For example, during dry years, food quality decreases during June (Nagy, 1975), causing negative water balance, reduced foraging, and aestivation of chuckwalla in mid-summer (Nagy, 1973; Nagy and Shoemaker, 1975). Under these

Figure 2-1 Female Chuckwalla From Rock Valley on the Nevada Test Site (photo by P. A. Medica)

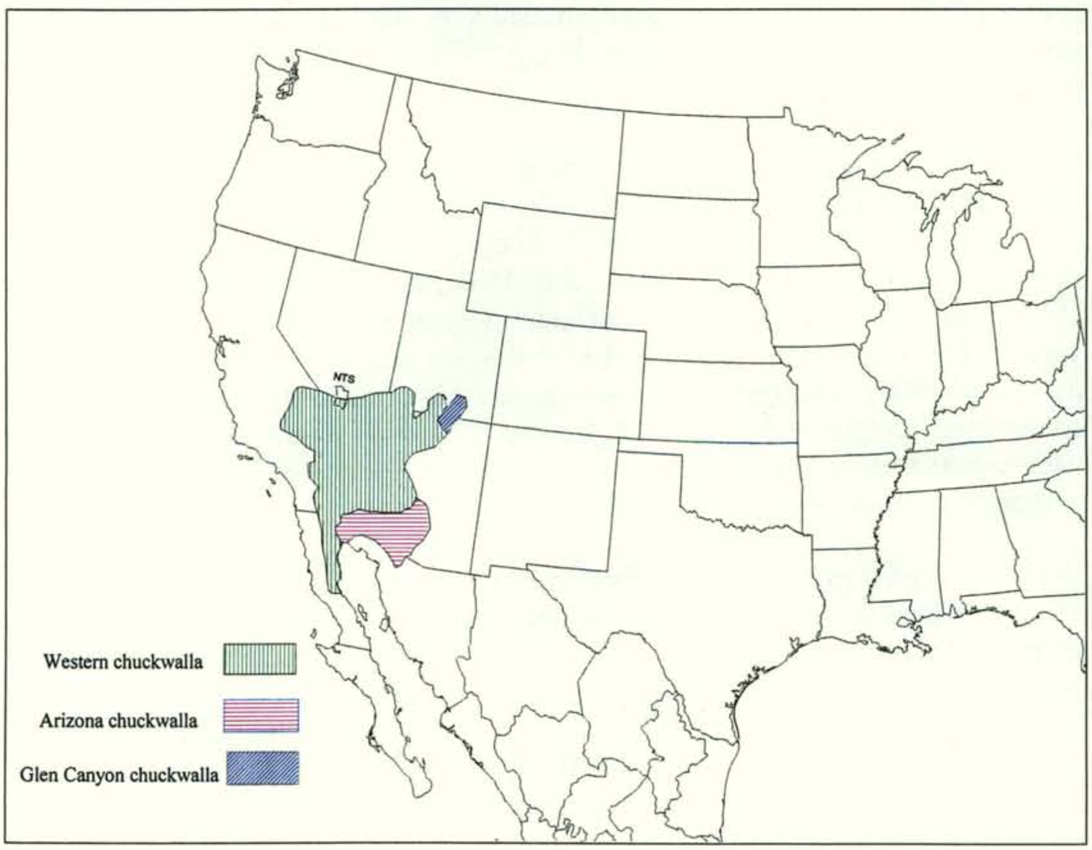

Figure 2-2 Range of the Chuckwalla in North America (adapted from Stebbins, 1985)

conditions, morning activity of chuckwallas ceased after early July and afternoon activity was restricted to basking for about one hour around sunset (Nagy, 1973).

Food habits have been documented from analysis of scat (Hansen, 1974), stomach contents (Sanborne, 1972; Nagy, 1973), field observations (Berry, 1974), and laboratory studies (Mayhew, 1963). In free-ranging chuckwallas, annual plants comprised 60 percent of the diet in April and May, but only perennials were eaten thereafter (Nagy, 1973), including a dominance of flowers and fruit of creosote bush in May and June. Sanborne (1972) reported that 26 chuckwalla ate 28 species of plants at the NTS. Mean percent volume consumed was greatest for three species, apricot globemallow (*Sphaeralcea ambigua*), littleleaf ratany (*Krameria erecta*), and brownplume wirelettuce (*Stephanomeria pauciflora*). Berry (1974) reported that feeding differed during a dry year when perennials were consumed, compared to a year of average rainfall when annuals dominated the diet. The strictly herbivorous diet of this species produces a scat of fibrose texture that is distinct in shape from other herbivorous reptiles. Chuckwalla scat varies in color from green (freshest) to brown to grey (oldest), is fibrose in texture, elongate and narrow in shape, measuring from about 15 mm (0.6 in) long by 3 mm wide (0.1 in) to about 70 mm (2.7 in) long by 10 mm (0.5 in) wide (B. Hardenbrook, pers. comm. 1996). Desert tortoise scat (although similar in appearance to chuckwalla scat) is larger in diameter and oval in shape and most can be distinguished from chuckwalla scat. Generally, only scat of small tortoises may look exactly like small chuckwalla scat.

Chuckwallas have been censused using mark and recapture methods (Berry, 1974) and observations from blinds with spotting scopes (Nagy, 1973; Berry, 1974). In addition, pit fall traps, noosing, and hand capture have also been used (Berry, 1974). Field searches can be used to locate scat which mark basking sites and favored retreats (Stebbins, 1985). Biologists from Dames & Moore (1994) used spotting surveys and searched for scat to locate active chuckwalla sites on the Nellis Air Force Range north of Indian Springs, Nevada.

Life history data of chuckwalla at the NTS is limited. Tanner (1982) conducted chuckwalla research at Mercury Pass during 1965-1971 and reported average weight gains of 38 to 77 grams (g) (1 to 3 ounces [oz]) and growth increments of 6 to 75 mm (0.2 to 3.0 in) per year for some males of 150 to 252 mm (6 to 10 in) SVL, and concluded that individuals over 200 mm (8 in) SVL grew at much slower rates. They were usually found in rocky mountainous areas. In only two cases were they collected outside but near rocky areas, one in boxthorn-hopsage (*Lycium-Grayia*) habitat and one in creosotebush-white bursage (*Larrea-Ambrosia*) habitat. Gravid females have been observed in sandy wash bottoms distant from rock outcrops (P. A. Medica, pers. comm., 1996). At the NTS, mating was reported in May and early July, gravid females were observed in July, and clutches of 4 to 14 eggs have been documented (Tanner, 1982).

Knowledge of the distribution and abundance of chuckwallas at the NTS is also limited (Tanner and Jorgensen, 1963; Sanborne, 1972; Tanner, 1982). Tanner (1982) conducted mark and recapture of 45 chuckwallas at Mercury Pass during 1965-1971, suggesting they were abundant there. Tanner and Jorgensen (1963) reported chuckwalla from six locations including Red Mountain, Mercury Pass, 2 km (1.2 mi) northeast of Mercury

Pass, CP Hogback Ridge, News Nob, and in Area 1 near the intersection of Pahute Mesa Road and the Tippipah Highway. Sanborne (1972) collected 16 chuckwallas in the Specter Range in 1966-1967 from Rock Valley and 10 at Mercury Valley Pass in 1971. During 1992-1995, 28 sightings were recorded on the NTS (DOE/NV, unpublished wildlife data, 1992-1993; DOE/Yucca Mountain Project [YMP], unpublished wildlife data, 1993-1995; EG&G/Energy Measurements, 1995a), and 14 of 24 sightings west of Fortymile Wash were yearlings. The northernmost record of chuckwalla at the NTS was reported from Yucca Flat near the intersection of Pahute Mesa Road and Tippipah Highway (Tanner and Jorgensen, 1963), although no rocky areas were present in this area. News Nob, just north of CP Hills, appears to be the northernmost chuckwalla habitat at the NTS (P. A. Medica, pers. comm., 1996).

No systematic surveys to document chuckwalla distribution have been conducted at the NTS. The purpose of this study was to survey the NTS for chuckwallas and better define the distribution and northern boundary range of this species at the NTS.

2.2 Methods

During 1996, biologists searched rocky areas using spotting scopes and binoculars (spotting surveys) and searched for sign on foot (scat surveys) to determine the distribution of chuckwalla at the NTS. Search locations (rocky sites) were selected from 7.5 minute U.S. Geological Survey (USGS) topographic maps (scale = 1:24,000). Searches were conducted only in rocky areas. As many sites as possible from each map were sampled. All sampling sites are shown in Figure 2-3.

Spotting surveys were conducted on sunny days from May 9, 1996, through June 27, 1996, by one to three biologists using spotting scopes or binoculars to search for chuckwalla on rock outcrops. Most surveys were conducted from 0900 to 1200 hrs and from 1300 to 1600 hrs when air temperatures did not exceed 40°C (104°F). One to three biologists searched areas of 1 to 3 ha (2.5 to 7.5 ac) for one hour or until a chuckwalla was found, whichever came first. This was done to maximize the number of locations sampled per day. Biologists made observations from about 200 m (656 ft) or less from the nearest rock outcrop. After completing a site, biologists moved to a different location and began a new survey. Spacing of search locations ranged from a minimum distance of about 300 m (984 ft) for small outcrops, to 1 km (0.6 mi) for long, continuous ridges. During these surveys, opportunistic sightings of chuckwallas were also recorded. Spotting surveys were discontinued after June 27, 1996, because no chuckwallas were seen in June, and because chuckwalla activity declines in mid-summer under conditions of low food availability (Nagy, 1973).

Most scat surveys were conducted from April 2, 1996, to August 28, 1996. Thirty-seven additional scat surveys were conducted from June 10-19, 1997, to better define the northern boundary range of chuckwalla in selected areas not searched in 1996 (*Figure 2-3*). One to three biologists searched areas of < 1 to 3 ha (< 2.5 to 7.5 ac) for one hour or until a scat was found, whichever came first. Biologists closely examined rock surfaces and cracks in rocks for scat, while walking a meandering transect through the area. A "valid chuckwalla scat" was generally at least 30 mm (1.2 in) in length (so as not to be confused with the scat of another animal such as a tortoise) and was located on

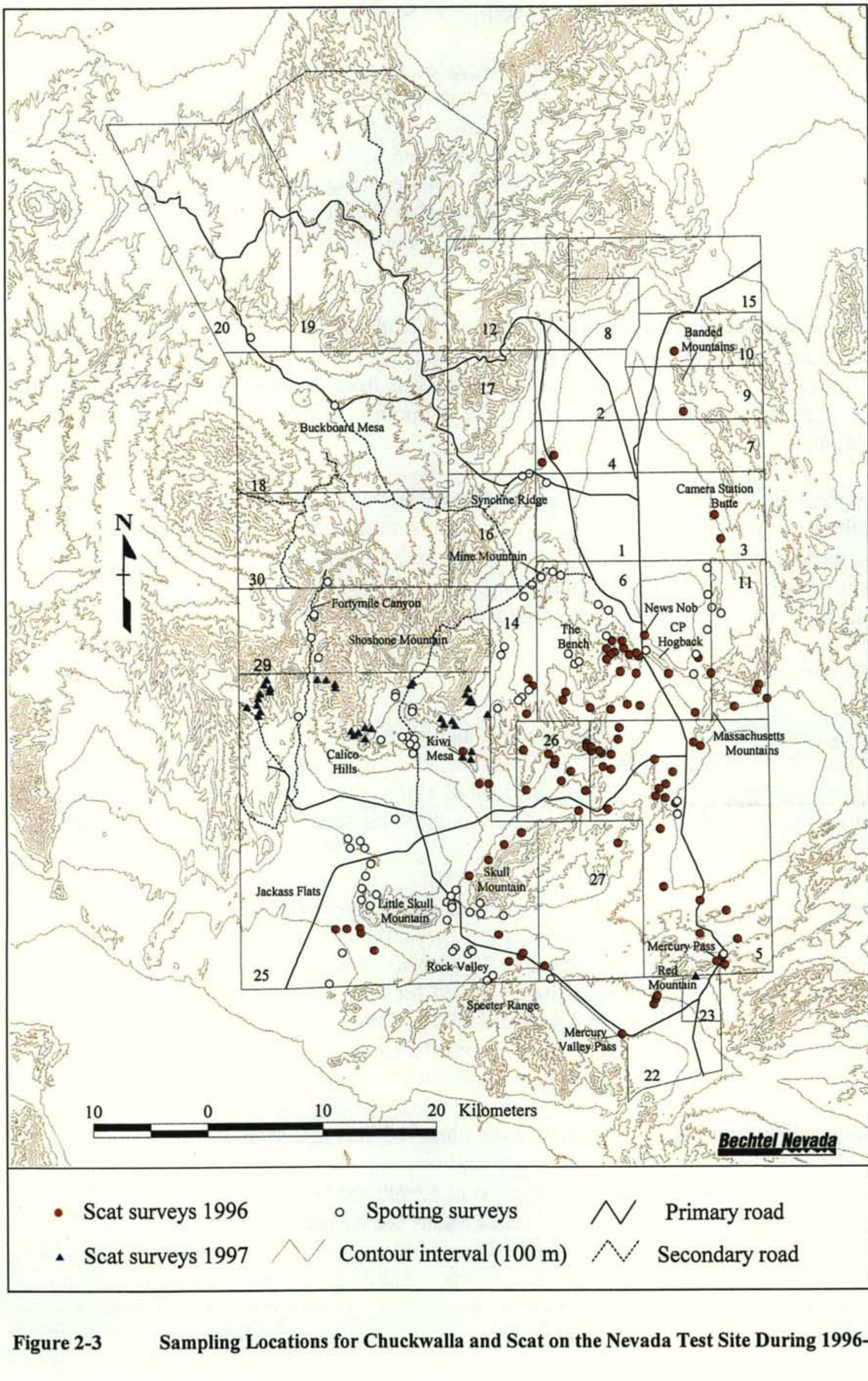

Figure 2-3 Sampling Locations for Chuckwalla and Scat on the Nevada Test Site During 1996-1997

rock outcrops where tortoises normally could not climb. Most searched locations (95 percent) where chuckwalla were not seen were searched for scat.

Data recorded for each search location included date, survey type, time of day, initial and final air temperatures (digital temperature probe) measured 1 to 2 cm (0.4 to 0.8 in) above the ground (Berry, 1974), topography (hillside, hilltop, wash), presence or absence of scat, number of individuals observed, behavior, and Universal Transverse Mercator (UTM) coordinates (Zone 11, 1927 North American Datum) for each chuckwalla and scat location, and were determined using a global positioning system (GPS) receiver (Magellan Pro V 5000). Elevations of chuckwalla and scat were estimated from marked points on topographic maps.

The approximate boundaries of all areas searched during spotting and scat surveys were marked on topographic maps. UTM coordinates and elevations of areas where chuckwalla or scat were not found were estimated from maps at the center of each 1- to 3-ha (2.5- to 7.5-ac) location and from the midpoint of elevations searched in each location.

Data collected were entered into an ArcView® GIS (geographic information system) database. Location records of chuckwalla and scat were plotted on distribution maps. The northern range boundary line was drawn using sighting and scat locations with a 1-km (0.6-mi) buffer zone extended north of each record. Given the current climate, chuckwalla are more likely to be found south of this line than north of the line.

2.3 Results

Biologists conducted 81 spotting surveys and 98 scat surveys from April 2, 1996, to August 28, 1996 (*Figure 2-3*), and observed 19 chuckwallas (Table 2-1). During spotting surveys, 17 chuckwallas in 15 of 81 (19 percent) locations were seen. During scat surveys one chuckwalla was seen. Another was seen during a vegetation survey near Cane Spring.

At 66 of 81 spotting survey locations, chuckwallas were not seen during an hour of observation. Sixty-three of these sites (95 percent) were surveyed for scat and 19 additional scat locations were found (a 30 percent increase). At seven locations where chuckwalla were seen and biologists searched for scat, all had scat. Biologists found scat at 104 locations out of 168 searched (62 percent) during 1996. During 1997, an additional 14 of 38 (37 percent) sites searched had chuckwalla scat. Overall, scat was detected at 118 of 206 (57 percent) sites searched during this study (Appendix A).

The topography where chuckwallas were observed was primarily hillsides (n = 10, 52 percent) or hilltops (n = 8, 42 percent), and one male was observed on a rock ridge along a wash. Chuckwallas were located at elevations between 1,005 and 1,280 m (3,300 and 4,200 ft). Times when chuckwallas were observed ranged from 1030 to 1530 hrs (*Table 2-1*). Three sightings were in the morning hours between 0900 and 1100 hrs. In mid-May, four individuals were observed between 1100 and 1300 hrs, indicating some midday activity during this month. Twelve chuckwallas were observed in the afternoon from 1330 to 1530 hrs.

Table 2-1 Summary of Chuckwalla Data Collected During 1996 on the Nevada Test Site. Initial and final temperatures (1 to 2 cm [.4 to .8 in] above ground surface) show the thermal range during which observations were conducted. No. = number of individuals.

Physiographic Location	Date	Time	UTM Northing	UTM Easting	No.	Behavior	Elevation m (ft)	Topography	Air Temperature C°	
									Initial	Final
Mercury Pass	5/9/96	1045	4061250	591600	1	basking	1,250 (4,100)	hillside	nd	**nd**
Jackass Flats	5/20/96	1440	4071323	558820	1	basking	1,006 (3,300)	hilltop	34	**nd**
Jackass Flats	5/21/96	1215	4067050	560030	1	basking	1,036 (3,400)	hillside	32	**40**
Cane Spring Wash	5/21/96	1110	4074027	580796	1	basking	1,250 (4,100)	hillside	nd	**nd**
Little Skull Mountain	5/22/96	1030	4066514	561304	1	basking	1,109 (3,640)	hillside	27	**40**
Little Skull Mountain	5/22/96	1330	4065537	560749	1	basking	1,176 (3,860)	hillside	27	**40**
Rock Valley	5/9/96	1410	4058950	570990	2	basking	1,097 (3,600)	hillside	31	**31**
Rock Valley	5/9/96	1415	4059400	571500	1	basking	1,048 (3,440)	hilltop	31	**31**
Rock Valley	5/23/96	1120	4064878	570447	1	basking	1,231 (4,040)	hilltop	26	**38**
Rock Valley	5/23/96	1300	4061653	569530	1	basking	1,054 (3,460)	hilltop	26	**38**
Rock Valley	5/23/96	1415	4061800	568200	1	moving	1,067 (3,500)	hillside	26	**38**
Rock Valley Pass	5/22/96	1500	4066880	568286	1	basking	1,219 (4,000)	hilltop	27	**40**
Rock Valley Pass	5/28/96	1420	4066380	567849	1	basking	1,201 (3,940)	hilltop	20	**29**
Rock Valley Pass	5/28/96	1442	4065850	567498	1	shaded in open	1,250 (4,100)	hilltop	20	**29**
Rock Valley Pass	5/28/96	1530	4065405	567948	1	basking	1,176 (3,860)	wash bank	20	**29**
West Frenchman Flat	5/30/96	1430	4073360	587632	2	basking	1,082 (3,550)	hilltop, hillside	32	**40**
Southeast of Black Ridge	8/5/96	1038	4078900	580833	1	shaded under rock	1,280 (4,200)	hillside	nd	**nd**

Rock temperatures at chuckwalla locations: [a] 39.0°C, [b] 27.4°C, [c] 32.2°C. nd =no data

Mean initial and final air temperatures during spotting surveys from May 20 through June 19, 1996, were 30.5°C (87°F) (n =1 2, SD = 5.4) and 36.4°C (97°F) (n = 9, SD = 5.4), respectively, with a range of 20° to 40°C (68° to 104°F). At 3 of the 15 sites where chuckwallas were observed basking on rocks, the surface temperatures of those rocks varied from 27° to 39°C (81° to 102°F). Sixteen individuals were observed basking on rocks, one was moving, one was in shade, and one was shaded under a rock. Most chuckwallas were observed from May 9 through May 28. One emaciated adult male (SVL of 187 mm [7.4 in]), was captured on August 5, 1996.

Scat was almost always found on rocks. During 1996 only two scats were located on the ground. Scat was most often classified as occurring on rocks on hillsides (n = 76, 73 percent) and less often on hilltops (n = 21, 20 percent). The remaining seven scat locations (7 percent) were on wash banks (2), rock piles (4), and on a talus slope (1). Scat was found between elevations of about 900 and 1,550 m (2,950 and 5,100 ft). During 1997, 11 pieces of scat were found on hillsides and three on hilltops within similar elevation ranges as in 1996. Thirteen scat locations were on rocks and only one was on bare ground.

The northernmost location on the NTS where scat was detected was at News Nob outcrop (just northeast of the CP Hills). Biologists searched for, but did not detect, chuckwalla or scat at 25 sites north of News Nob. Approximate elevations of the sites searched north of News Nob ranged from 1,200 to 1,750 m (4,000 to 5,700 ft). During 1996-1997, biologists detected chuckwallas or scat at 128 of 190 (67 percent) sites searched south of News Nob.

2.4 Discussion

Eighteen of 19 chuckwallas detected in 1996 were observed during May. No sightings were recorded from June 12 through June 27, 1996, suggesting a decline in activity during observation periods, even though spotting surveys were conducted within the optimal temperature range for this species (30° to 40°C). Although most chuckwallas were observed during the afternoon, some chuckwallas were active during midday (1100 to 1300 hrs) in May 1996, similar to midday activity recorded near Yucca Mountain (DOE/YMP, unpublished wildlife data, 1993-1995). The few sightings in June could be due to limited chuckwalla activity during survey times (0900 to 1600 hrs), as chuckwalla may have become more active in the cooler morning or late afternoon hours as daily temperatures rose. Nagy (1973) reported that in a dry year, chuckwalla were active later in the afternoon (1700 to 1900 hrs) during June-August, but did not emerge in the cooler morning hours. Because most of our observations ceased at 1600 hrs, chuckwalla activity could have been missed if they were more active later in the day.

The winter-spring of 1995-1996 was very dry. For example, only 18.1 mm (0.7 in) of rainfall were recorded during a nine-month period (October 1995 to June 1996) at the Area 5 Radioactive Waste Management Site in northwestern Frenchman Flat (969 m [3,180 ft] elevation). This is very low compared to the 33-year average rainfall of 93.5 mm (3.7 in) for the same nine month period recorded at the nearby Well 5b weather station (939 m [3,080 ft] elevation) (Levitt *et al.*, 1996). As a result, few annual plants were observed during the dry spring of 1996, and chuckwalla activity may have been limited by the lack of succulent annuals during this time. Nagy (1973) found that chuckwalla spent little time outside of cool rock crevices and reduced foraging after disappearance of succulent annuals in late May. Sanborne (1972) reported that chuckwalla consumed flowers and leaves of perennials to sustain themselves in the absence of succulent annuals during May through June of a dry year.

Overall, biologists located more sites inhabited by chuckwalla using scat surveys (104), than spotting surveys (15) in 1996. An additional 19 chuckwalla sites were found during scat surveys at 63 sites where spotting surveys were previously conducted, for a 30 percent increase in detection. This suggests that scat surveys were more effective in locating active chuckwalla sites than spotting surveys in 1996. Similarly, biologists from Dames & Moore (1994) identified 52 chuckwalla locations from scat searches and only two locations were identified by observing chuckwallas.

Chuckwallas on the NTS were present in rocky habitats within creosotebush communities at lower elevations and also occurred within blackbrush communities at higher elevational limits, similar to the distribution of the desert tortoise (Rautenstrauch *et al.*, 1994). The northern boundary of chuckwalla broadly defined, roughly matches the creosotebush limits on the NTS (Figure 2-4). The range limits roughly include the Massachusetts Mountains, CP Hogback Ridge, CP Hills, The Bench, Barren Butte, Kiwi Mesa, Calico Hills, Fortymile Canyon, and Yucca Mountain. The most northerly site was News Nob rock outcrop. Chuckwalla and their sign appeared to be absent from all sites searched north of News Nob. The majority of these sites, 21 of 25 (84 percent) were between 1,220 and 1,550 m (4,000 and 5,100 ft) elevation. These sites were within the elevation range of sites sampled south of News Nob where chuckwalla scat was found. This suggests that elevation differences do not explain the absence of chuckwalla and scat north of CP Hills. Further work is required to determine why chuckwallas are absent north of CP Hills.

Scat was not detected at 64 (38 percent) of 168 locations searched during 1996 on the NTS. This could be due to the absence of chuckwalla, chuckwalla inactivity, or the inability to detect scat. Fewer scats may be produced in a dry year due to limited activity of animals, making scat detection more difficult. Rock surface texture may also be a major factor influencing detection of scat. Overall, scat appeared easier to find on limestone (which has rough surfaces and many cracks), and appeared more difficult to find on rocks with smooth surfaces (e.g., basalt talus and boulders). Scat deposited on rough surfaces and in cracks of rocks may collect, may persist for longer periods of time, and be easy to detect. Scat deposited on rocks with smooth surfaces may fall off these rocks from rain or wind in short periods of time and be more difficult to see. Chuckwallas may occur in areas with smooth rocks, but may be difficult to detect from their scat. Because the major findings of this study are based primarily on finding scat, future studies might more closely examine potential errors associated with scat detection.

Seven of eight NTS areas known to contain chuckwallas during 1959-1971 (Tanner and Jorgensen, 1963; Sanborne, 1972; Tanner, 1982) still have or show evidence of chuckwalla use in 1996-1997. Only the Area 1 site on Yucca Flat could not be identified as chuckwalla habitat (*Figure 2-4*). The few historic records available indicate

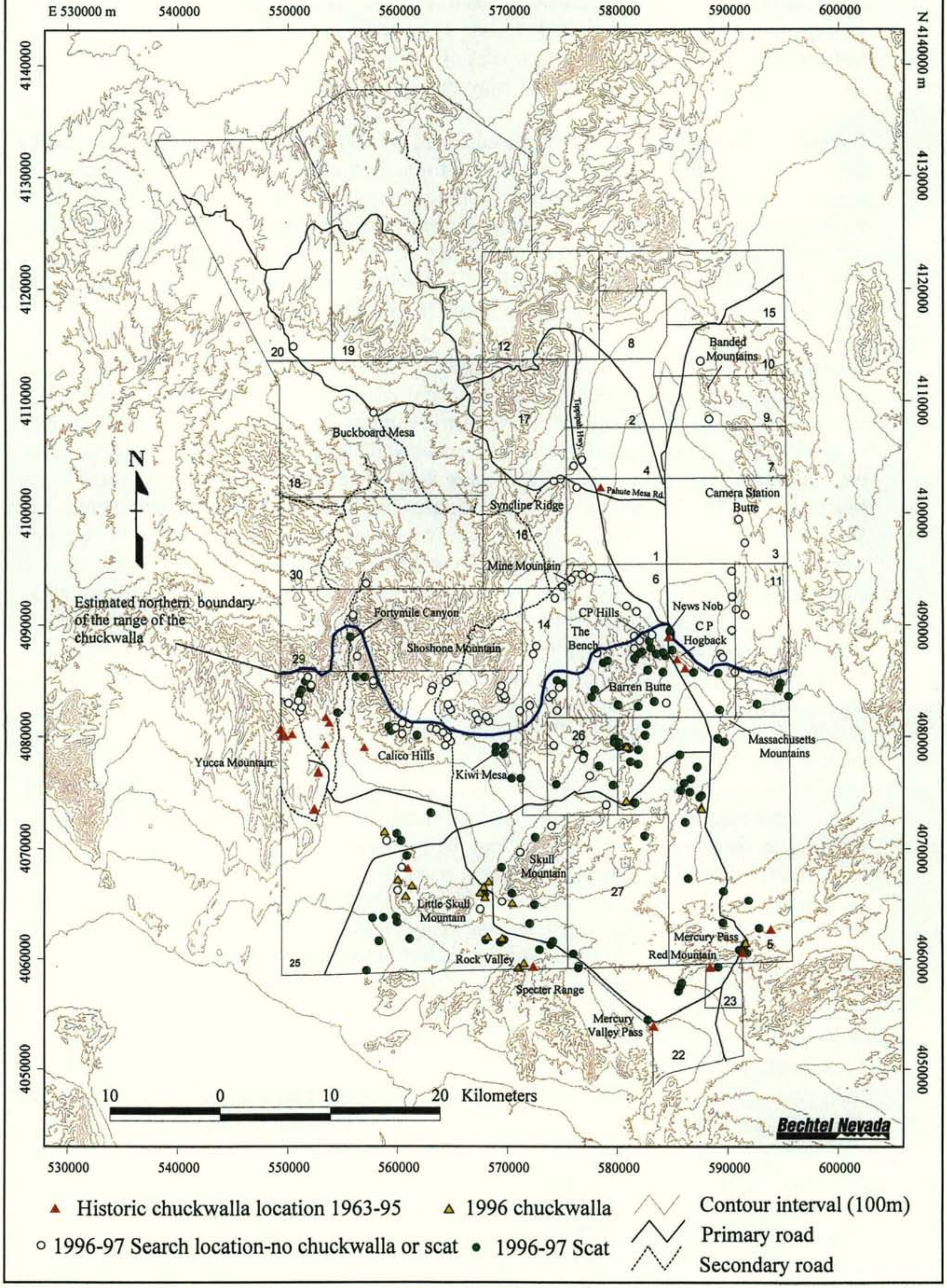

Figure 2-4 **Chuckwalla and Scat Locations and the Estimated Northern Boundary of the Range of the Chuckwalla on the Nevada Test Site**

that the highest relative abundance for this species was recorded at Mercury Valley Pass (Tanner, 1982). Historic chuckwalla site elevations agree closely with those documented during 1996. From 1963-1995, 108 individual chuckwallas were recorded from 27 locations on the NTS (Appendix B). The highest elevation known for a chuckwalla on the NTS is at the western boundary near Yucca Mountain at 1,340 m (4,400 ft) recorded in 1994. However, elevations of scat locations indicate chuckwalla can occur on NTS as high as 1,550 m (5,100 ft.).

From 1992 to 1994, 14 of 24 chuckwalla sightings (58 percent) were yearlings from west of Fortymile Wash, suggesting this species has a healthy age structure (i.e., a high proportion of juveniles to adults) in this area (DOE/YMP, unpublished wildlife data, 1993-1995). Other areas with numerous historical sightings are Mercury Pass (north of Mercury), Mercury Valley Pass, and Rock Valley. Sanborne (1972) also reported that 20 percent of the individuals collected from two locations in the Specter Range were juveniles. Based on historical records and data from this study, three regions (the areas west of Fortymile Wash, the Specter Range near Rock Valley, and the hills around Mercury Pass) appear to represent the best identified habitats for this species on the NTS (*Figure 2-4*) and may deserve consideration for protection over other regions. During this study, there were no signs of DOE project activities that might impact chuckwalla or their habitat. Because chuckwalla habitat appears centered in rock outcrops and nearby surrounding areas, minimizing or avoiding impacts in and near rocky areas within their range will reduce impacts to this species.

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3.0 WESTERN BURROWING OWL

3.1 Literature Review

The western burrowing owl (*Speotyto cunicularia hypugaea*) is one of seven subspecies of burrowing owls that occur in North and Central America (Ridgway, 1914; Peters, 1940). It is a small, long-legged, ground-dwelling owl (Figure 3-1) found throughout south-central Canada, the central and western United States, and Mexico (Figure 3-2), in flat, open, well-drained grasslands, steppes, deserts, prairies, and agricultural lands (Haug *et al.*, 1993). It is usually restricted to dry plains and is often associated with other burrowing animals (Haug *et al.*, 1993).

Western burrowing owls use burrows that are usually dug by other animals (Haug *et al.*, 1993), but have been known to use man-made structures (e.g., buried pipes and open-ended culverts) as well. The presence of a burrow for nesting is a critical requirement of this species (Thomsen, 1971; Martin, 1973a; Zarn, 1974; Wedgwood, 1978; Haug, 1985). Haug *et al.* (1993) reported that intraspecific territoriality exists around nest burrows. Distances between nest burrows ranged from less than 14 m (46 ft) at a site in Texas (Ross, 1974) to 900 m (2,950 ft) at a site in Idaho (Gleason, 1978). Home-range size of the western burrowing owl ranged from 0.049 km^2 (0.02 mi^2) in Minnesota (Grant, 1965) to 18.1 km^2 (7.0 mi^2) in western Oklahoma (Butts, 1973).

Western burrowing owls from northern portions of the United States and Canada usually migrate south during September and October and north during March and April. Owls from southern states (Texas, New Mexico, Arizona, and Nevada) are thought to be year-round residents (D. F. Desante, pers. comm. 1996; Haug *et al.*, 1993). In Nevada, western burrowing owls from the northern part of the state may migrate south, whereas those from the southern part of the state (Alcorn, 1988) and from the NTS (O'Farrell and Emery, 1976; Hill and Burr, 1973; Hayward *et al.*, 1963) are thought to be year-round residents.

Breeding of the western burrowing owl in New Mexico begins during the third week of March (Martin, 1973a). In California, breeding takes place near the end of April (Thomsen, 1971). The female produces only one clutch per year and incubates the eggs for approximately 28 to 30 days from the time the first egg is laid (Thomsen, 1971; Martin, 1973a; Zarn, 1974; Henny and Blus, 1981; Olenick, 1990). Young emerge from burrows at about two weeks of age (Zarn, 1974) and fledging occurs when young are about 44 days old (Landry, 1979).

Western burrowing owls are primarily crepuscular in their foraging habits (Haug *et al.*, 1993), although during the breeding season, they are diurnal hunters (Haug and Didiuk, 1993). Arthropods make up about 90 percent of the western burrowing owl diet, but they also feed on small rodents, birds, and small reptiles (Haug *et al.*, 1993). As insect populations decline throughout the summer, rodents become a larger portion of the owl's diet.

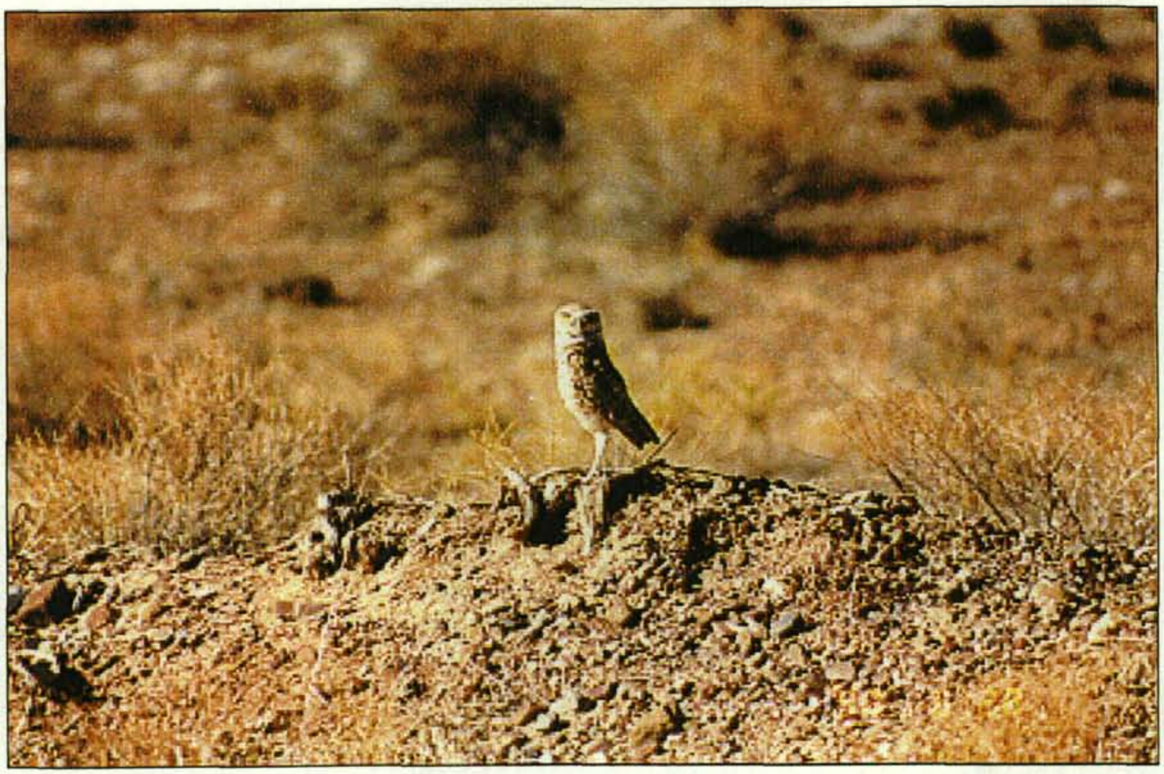

Figure 3-1 Western Burrowing Owl on the Nevada Test Site (photo by P. D. Greger)

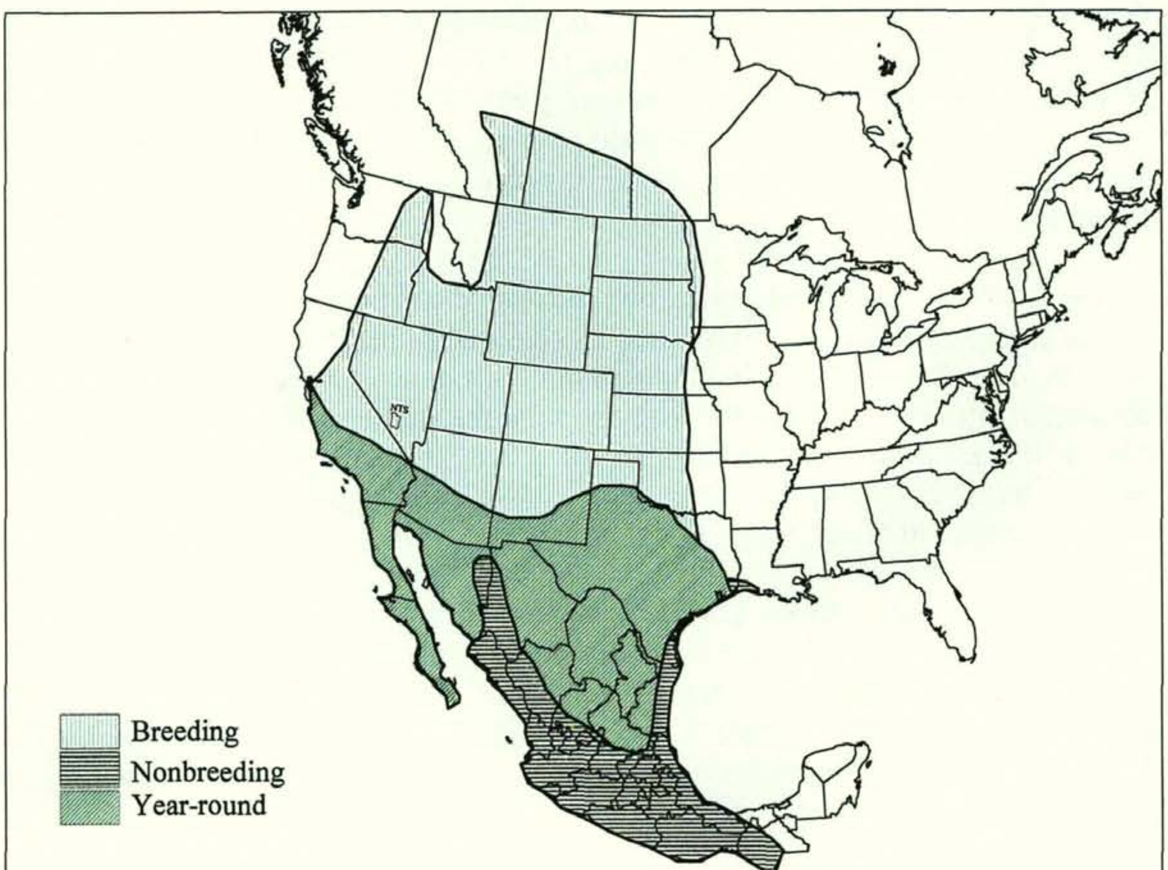

Figure 3-2 Range of the Western Burrowing Owl in North America (adapted from Haug *et al.*, 1993)

No known census surveys of western burrowing owls have been conducted in the Mojave Desert. In other regions, line transect surveys (D. F. Desante, pers. comm., 1996) and surveys using playbacks of recorded calls (Haug and Didiuk, 1993) have been used as methods for locating western burrowing owls over large areas. Line transect surveys are more labor-intensive and not as cost-effective as using playbacks of recorded calls. Additionally, Haug and Didiuk (1993),using the playback method, detected 53 percent more owls than if the area had been surveyed without the song being played. They also reported that 57 percent of owls (both males and females) observed before the primary song was played responded to the song, and response by owls to the recordings declined sharply after the young had fledged the nest.

Surveys conducted from May to July are most effective because the male is usually foraging, the female is no longer incubating eggs, and the young are just beginning to fledge from the nest but cannot yet fly. The chances of encountering western burrowing owls during surveys are much higher at this time than when the female is incubating eggs or when the young have left the nest (Rich, 1986).

Although no formal study has been conducted on the western burrowing owl on the NTS, many opportunistic sightings have been recorded by biologists during resource surveys from 1961 through 1996 (Hayward *et al.*, 1963; Hill, 1972; Hill and Burr, 1973; Castetter, 1975-1977 [unpublished field notes]; Greger, 1994; Greger and Romney, 1994a; EG&G/EM, 1995b; EG&G/EM, 1995c; Greger, 1995; Woodward *et al.*, 1995; DOE/NV, 1991-1996 [unpublished wildlife data]). These data identify 30 owl sighting locations that have been documented on the NTS, all of which occur within major flats and valleys in the eastern and southern portions of the NTS. These flats and valleys are characterized by sandy-gravelly soils, gradually sloping or zero-sloping terrain, and dominant plant species consisting of creosotebush, white bursage, blackbrush, fourwing saltbush, shadscale saltbush, Nevada ephedra, spiny hopsage, pale wolfberry, Anderson's wolfberry, and Shockley's desertthorn (*Lycium shockleyi*). Also, many areas in Yucca Flat have been severely impacted by nuclear testing, which has resulted in a disturbed vegetation type that consists of a variety of exotic and native annual species with a few scattered perennial grasses and shrubs.

Concern for the western burrowing owl has grown over the last 15 to 20 years because of documented population declines in several states and provinces. Habitat destruction, pesticides, predators, and vehicle collisions are the major factors contributing to these population declines (Haug *et al.*, 1993).

Because information about the status of western burrowing owls on the NTS is not known, this field study and literature review were conducted to determine the distribution of the western burrowing owl on the NTS and provide baseline data on the relative abundance of owls to assess trends in the owl population in subsequent years.

3.2 Methods

Although the playback of recorded western burrowing owl calls does not detect every owl present in an area, it does provide a good response rate. Because of it's cost effectiveness for sampling large areas and good response rate, it was used to determine the distribution of western burrowing owls on the NTS.

The NTS was divided into 12 sampling zones to organize the sampling effort (Figure 3-3). Within each zone, sampling (listening and looking for owls) occurred at "call stops" spaced at 3-km (1.9-mi) intervals along existing roads. The number of call stops per zone ranged from 13 in Zone 1 to 26 in Zone 10, and each call stop was visited only once between April 25 and June 20, 1996. Approximately half of the call stops in each zone were sampled in the morning and half in the late afternoon. Most of Zone 1 was not considered western burrowing owl habitat because of the wooded nature of the landscape; therefore, only 13 call stops in this zone were sampled in the late afternoon.

Because western burrowing owls are usually restricted to dry plains, roads within steep, mountainous, wooded areas were not sampled. Sampling was concentrated along roads in open areas with flat to rolling topography, regardless of elevation or vegetation type. An effort was made to sample each zone as uniformly as possible and to avoid overlapping areas that were surveyed the previous morning or evening, but sampling uniformity was dependent upon the location of roads within each zone. Sampling times were designed to meet the peak activity of the owls and still allow biologists to visually locate owls. Late afternoon surveys began four hours before sunset and continued until sunset. Morning surveys began at sunrise and continued for four hours after sunrise.

The sampling method (adapted from Haug and Didiuk, 1993), entailed broadcasting a call of the male western burrowing owl to encourage a response from other western burrowing owls in the sampling area. The call used was the "mate attraction and territorial call" used by males, and consisted of two notes of equal frequency, with the second note being longer than the first (Martin, 1973b). The call, obtained from the Cornell Lab of Ornithology, was broadcast from a public address system mounted on a vehicle. The tape was played through an amplifier and broadcast simultaneously on two loudspeakers aimed in opposite directions. The call was played six times at ten-second intervals. After the call was played, biologists monitored the sampling area by listening for callbacks and scanning the area with binoculars for five minutes. After five minutes, the call was played again and the sampling area monitored for another five minutes. The time, call stop location, and presence or absence of owls was recorded.

Call stop, owl, and burrow locations were determined using a GPS (Magellan Pro V 5000). If an owl was heard, biologists attempted to identify its location from the vehicle. If this was not possible, biologists left the vehicle and searched for the owl or its burrow in the direction that the call was heard. When an owl was observed, UTM coordinates (Zone 11, 1927 North American datum) of the burrow (if found) or the owl (if the burrow was not found) were recorded. Elevation, topography (based on Peterson, 1981), and vegetation data for the area around the burrow or owl were also collected. The response of the owl, distance between owl and burrow, type of burrow (man-made or natural), and presence of eggs or juveniles at the burrow were documented when possible. Man-made burrows were structures such as partially- or fully buried pipes or culverts with exposed openings, or animal burrows in mounds of dirt created by human excavation. Natural burrows were those found in undisturbed areas, and were primarily located in the sides of washes. If an owl was heard but not seen, the same data as

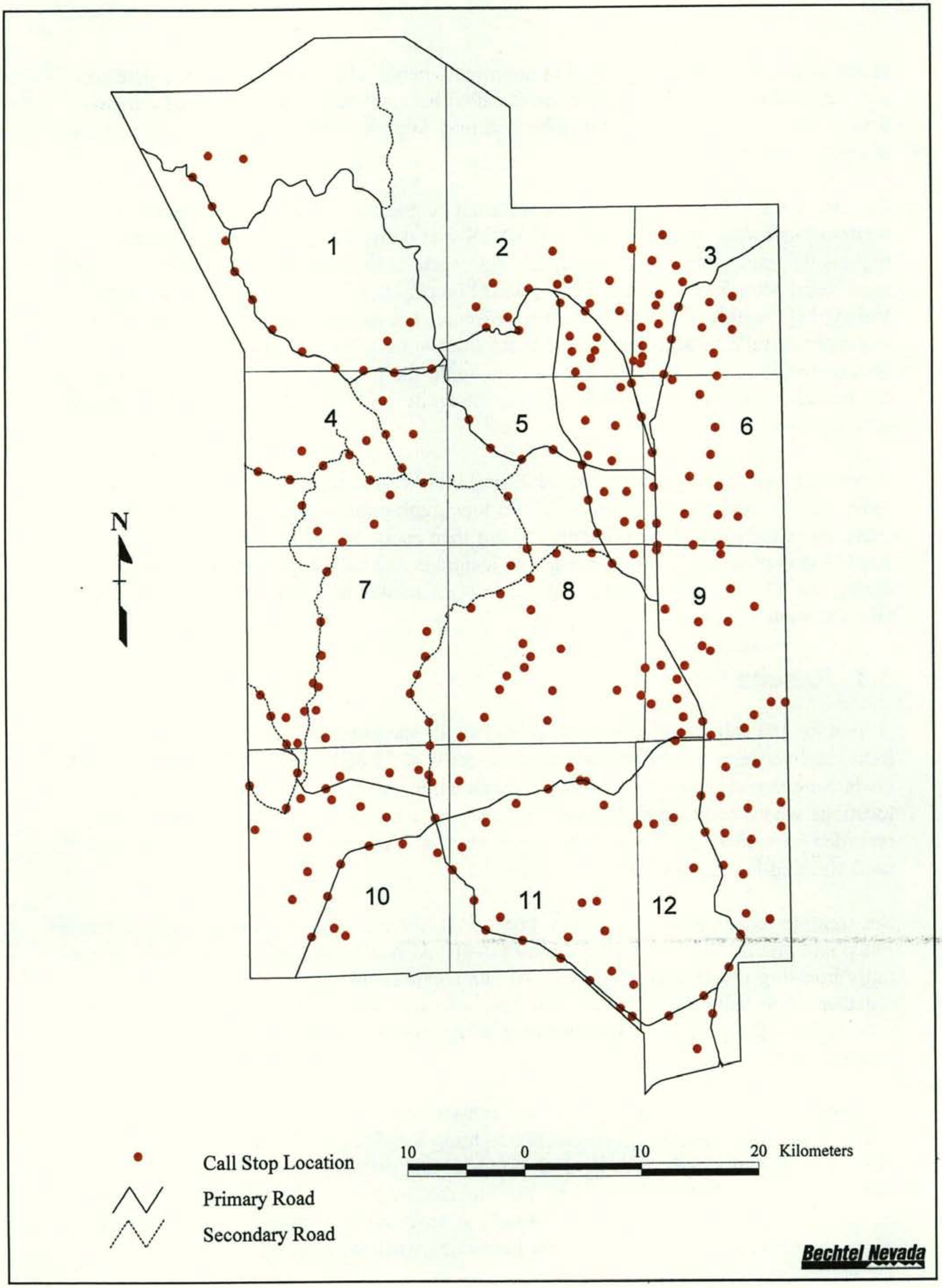

Figure 3-3 **Sampling Zones and Call Stop Locations for the 1996 Western Burrowing Owl Field Study on the Nevada Test Site**

above were collected, with the UTM coordinate being taken at the location where the owl was estimated to have been when it called back. Additional searches of burrows were conducted in late-June, mid-July, and mid-August, 1996 to determine the presence of eggs or juvenile owls.

Because the 12 NTS sampling zones were not ecologically meaningful in terms of western burrowing owl distribution, the NTS was divided into eight physiographic regions determined from physiographic and vegetation data presented in Beatley (1976): Buckboard Mesa/Upper Fortymile Canyon, Frenchman Flat, Jackass Flats, Mercury Valley, Mid Valley, Rock Valley, Pahute/Rainier Mesas, and Yucca Flat (Figure 3-4). An index of relative abundance of western burrowing owls for the entire NTS (by physiographic region) was calculated by dividing the number of owls observed or heard by the number of call stops sampled over the entire NTS and within each physiographic region, respectively.

Burrowing owl locations documented during other resource surveys from 1961 through 1996 were plotted onto 7.5 minute USGS topographic maps (scale = 1:24,000). UTM coordinates for each of these locations were then estimated. These UTM coordinates and UTM coordinates for burrowing owl locations and call stop locations acquired during the 1996 field study were entered into a database and displayed using ArcView® GIS software.

3.3 Results

A total of 250 call stops were made across all 12 sampling zones (*Figure 3-3*). Eighteen individual western burrowing owls were detected at 12 call stop locations (*Figure 3-4*). Owls were detected at 4.8 percent of the call stops sampled. Of the 12 call stop locations where owls were observed, 9 were new sighting locations and 3 had been recorded previously during other resource surveys. A summary of the data collected at each sighting location are found in Table 3-1.

Six sighting locations were found in Yucca Flat, three in Frenchman Flat, two in Jackass Flats, and one in Mercury Valley (*Figure 3-4*). At four locations, pairs of owls (potentially breeding pairs) were observed. At one location, three adult owls were observed together. The remaining sightings consisted of single owls. Of the 18 individual owls observed, 10 (56 percent) responded by calling back and/or flying, while 8 (44 percent) showed no response.

Western burrowing owls were found at elevations ranging from 988 m (3,241 ft) to 1,353 m (4,438 ft) above sea level. Six sighting locations were found on gradually sloping piedmont slopes, four in wash bottoms, and two on basin floors. Owls were found in both the Mojave Desert and the Mojave/Great Basin Transition Desert regions of the NTS (see Section 1.2, "Study Area") at locations containing a variety of dominant plant species (*Table 3-1*). No western burrowing owls were found in the Great Basin Desert region of the NTS.

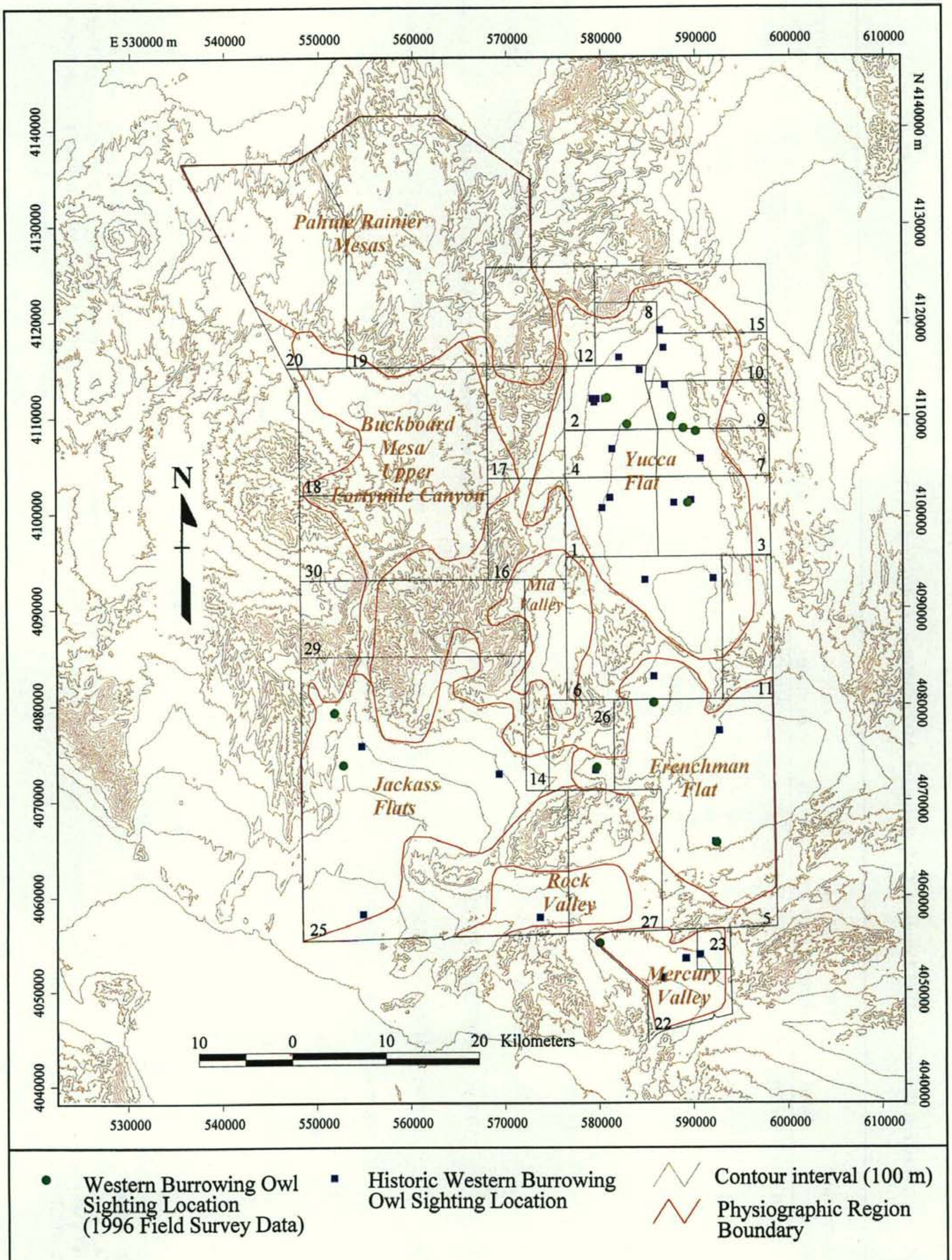

Figure 3-4 **Western Burrowing Owl Distribution on the Nevada Test Site**

Table 3-1 Western Burrowing Owl Location, Call Response, Macrohabitat, and Burrow Type Data Collected During 1996 Field Study

Physiographic Region	Date	UTM Northing	UTM Easting	Number of Owls	Call** Response	Elevation m (ft)	Topography	Dominant *** Vegetation	Burrow Type
Frenchman Flat	5/2/96	4075025	578341	3	NONE (3)	1,250 (4,100)	Wash	CORA; EPNE	Natural
Frenchman Flat	5/7/96	4081265	583951	1	C, F (1)	1,128 (3,700)	Wash	LATR; CORA; AMDU	Not found
Frenchman Flat*	6/10/96	4067731	590020	2	NONE (2)	988 (3,240)	Piedmont slope	LATR; AMDU	Man-made
Jackass Flats	5/20/96	4075258	553463	1	C, F (1)	1,036 (3,400)	Wash	LATR; AMDU	Natural
Jackass Flats	6/17/96	4080298	552626	1	C (1)	1,152 (3,780)	Piedmont slope	CORA; EPNE; KRER; LATR	Not found
Mercury Valley	5/1/96	4058028	578573	1	C (1)	1,073 (3,520)	Wash	LATR; GRSP; EPNE; AMDU	Natural
Yucca Flat	5/13/96	4107253	588129	1	C, F (1)	1,353 (4,440)	Piedmont slope	CORA; LATR; YUBR	Not found
Yucca Flat	5/14/96	4108632	585811	2	NONE (1); C, F (1)	1,286 (4,220)	Piedmont slope	BRRU; SAPA; ERsp.	Man-made
Yucca Flat	5/14/96	4107583	586941	1	F (1)	1,323 (4,340)	Piedmont slope	BRRU; SAPA; ERsp.	Man-made
Yucca Flat*	5/29/96	4100380	587341	2	C, F (2)	1,230 (4,035)	Basin floor	BRRU; SAPA; ERsp.	Man-made
Yucca Flat*	5/30/96	4110482	579514	1	NONE (1)	1,341 (4,400)	Piedmont slope	HYSA; ACHY	Man-made
Yucca Flat	5/30/96	4107957	581478	2	NONE (1); F (1)	1,295 (4,250)	Basin floor	ATCA; HYSA; ACHY; BRRU	Man-made

* Previously known location.
** C=callback; F=flight; NONE=no response to call. ( )=Number of owls exhibiting response.
*** ACHY=Indian ricegrass (*Achnatherum hymenoides*); AMDU=white bursage (*Ambrosia dumosa*); ATCA=fourwing saltbush (*Atriplex canescens*); BRRU=foxtail brome (*Bromus rubens*); CORA=blackbrush (*Coleogyne ramosissima*); EPNE=Nevada ephedra (*Ephedra nevadensis*); ERsp=buckwheat species (*Eriogonum* species); GRSP=spiny hopsage (*Grayia spinosa*); HYSA=white burrobush (*Hymenoclea salsola*); KRER=littleleaf ratany (*Krameria erecta*); LATR=creosote bush (*Larrea tridentata*); SAPA=barbed wire Russian thistle (*Salsola paulsenii*); YUBR=Joshua tree (*Yucca brevifolia*).

The distance between an owl and its burrow was documented at six of the locations and ranged from 0 to 60 m (0 to 197 ft). Burrows were detected at 9 of the 12 sighting locations. Burrows at six owl sighting locations were considered man-made burrows with five burrows consisting of partially- or fully-buried culverts or pipes with exposed openings, and one animal burrow in an earthen mound that had been created during road construction. Burrows at the remaining three locations were natural and were all found in the sides of washes. Only two of ten burrows searched contained eggs or eggshell fragments, but no juveniles were observed.

The index of relative abundance of western burrowing owls on the NTS expressed as the number of burrowing owls per call stop was 0.07 (Table 3-2). Relative abundance by physiographic region ranged from 0.0 owls/call stop in Buckboard Mesa/Upper Fortymile Canyon, Mid Valley, Pahute/Rainier Mesas, and Rock Valley to 0.15 owls/call stop in Frenchman Flat.

Table 3-2 Index of Relative Abundance of Western Burrowing Owls by Physiographic Region on the Nevada Test Site, Obtained During 1996 Field Study

Physiographic Region	Number of Call Stops	Number of Owls	Index of Relative Abundance (Owls/Call Stop)
Frenchman Flat	40	6	0.15
Yucca Flat	83	9	0.11
Mercury Valley	10	1	0.10
Jackass Flats	50	2	0.04
Buckboard Mesa/Upper Fortymile Canyon	31	0	0.00
Mid Valley	15	0	0.00
Pahute/Rainier Mesas	12	0	0.00
Rock Valley	9	0	0.00
TOTAL	**250**	**18**	**0.07**

3.4 Discussion

Combined data from literature searches (Appendix B) and the 1996 field study reveal a total of 39 western burrowing owl sighting locations on the NTS. These data indicate that the distribution of the western burrowing owl on the NTS is restricted to the major flats and valleys in the eastern and southern portions of the NTS; namely, Frenchman Flat, Jackass Flats, Mercury Valley, Rock Valley, and Yucca Flat. Fifty-six percent of all owl sighting locations were in Yucca Flat. Owls were observed at elevations ranging from 870 m (2,854 ft) in Jackass Flats to 1,380 m (4,526) in Yucca Flat. Western burrowing owls on the NTS were found in dry, open areas with flat to gradually sloping terrain, which is consistent with other findings (Hayward *et al.*, 1963; Haug *et al.*, 1993). Wash habitats were also frequently used by western burrowing owls on the NTS.

One egg and some eggshell fragments were observed in 1996, but no juvenile owls were seen. This suggests that reproductive success was poor. Poor reproductive success may have been due to the low amount of rainfall received during the winter/spring of 1996. Only 18.09 mm (0.5 in) of rainfall were recorded during a nine-month period (October 1995 through June 1996) at the Area 5 Radioactive Waste Management Site in north-western Frenchman Flat (969 m [3,180 ft] elevation), compared to the 33-year average rainfall amount of 93.47 mm (2.4 in) for the same nine-month period recorded at the nearby Well 5b weather station (939 m [3,080 ft] elevation) (Levitt *et al.*, 1996). Annual plant production was very poor because of the low rainfall, which affected rodent and insect populations that owls depend on for food.

Western burrowing owls have been documented to occur on the NTS only between January and October. The distribution map adapted from Haug *et al.* (1993) also suggests that western burrowing owls are not year-round residents on the NTS. In contrast to these findings, Hayward *et al.* (1963), Hill and Burr (1973), and O'Farrell and Emery (1976) report that western burrowing owls are year-round residents on the NTS. Further studies need to be conducted to determine if western burrowing owls are year-round residents on the NTS.

Nearly two-thirds (61 percent) of burrows detected were considered man-made and consisted mostly of partially- or fully buried pipes and culverts with exposed openings. This suggests that some human activities on the NTS have benefited the western burrowing owl by providing suitable burrows. Any cleanup projects involving the removal or disturbance of old pipes and culverts may have a negative impact on burrowing owls in certain regions of the NTS. If cleanup projects are performed, they should be done between August and January to have the least impact on western burrowing owl populations. If pipes or culverts known to be used by burrowing owls are destroyed, a possible mitigation measure may be the installation of artificial burrows. Trulio (1995) reported that burrowing owls thrive in artificial burrows if placed within 100 m (330 ft) of the destroyed burrow.

With the exception of Rock Valley, burrowing owls were found in the same physiographic regions during the 1996 field study as had been documented during historical sightings (*Figure 3-4*). The 1996 field study did not expand the range of owls on the NTS, but did reveal nine western burrowing owl locations not previously documented. Furthermore, this field study provided baseline data on the relative abundance of the western burrowing owl on the NTS by physiographic region. These baseline data can be used to compare relative abundance of owls between years so that trends in western burrowing owl populations on the entire NTS and by physiographic region can be determined.

The sampling technique did not allow 100 percent sampling coverage of the NTS, but did enable biologists to sample large areas in a relatively short amount of time. This technique yielded a 23 percent increase of known burrowing owl sighting locations on the NTS.

Based on these results, the method of playing back recorded western burrowing owl calls from a vehicle is a useful, cost-effective technique for detecting western burrowing owls on the NTS and should be used in the future.

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4.0 BATS

4.1 Literature Review

Little work has been done to document bat communities on the NTS. Jorgensen and Hayward (1965) opportunistically collected four bat species on the NTS. These included the pallid bat (*Antrozous pallidus*), pale Townsend's big-eared bat, California myotis (*M. californicus*), and western pipistrelle (*Pipistrellus hesperus*). In a 1976 literature review, O'Farrell and Emery listed the same four species as Jorgensen and Hayward, but concluded "... there are several species having ranges overlapping NTS that will no doubt be found in the future."

During the early 1990s, bat surveys on the NTS were conducted in support of the Yucca Mountain Site Characterization Project and the Basic Environmental Compliance and Mitigation Program (BECAMP). These surveys (EG&G/EM, 1993; Saethre, 1994; Woodward *et al.*, 1995) documented the presence of an additional seven bat species; namely, big brown bat (*Eptesicus fuscus*), spotted bat (*Euderma maculatum*), hoary bat (*Lasiurus cinereus*), long-eared myotis (*M. evotis*), fringed myotis (*M. thysanodes*), long-legged myotis (*M. volans*), and Mexican free-tailed bat (*Tadarida brasiliensis*). An additional species, the silver-haired bat (*Lasionycteris noctivagans*), was documented on the NTS when a dead individual was found near some buildings (M. Saethre, pers. comm., 1996).

Of the 12 bat species documented on the NTS, 5 are species of concern (former Category 2 candidates for listing under the ESA). These include the pale Townsend's big-eared bat, spotted bat, long-eared myotis, fringed myotis, and long-legged myotis. The small-footed myotis is also highly likely to occur, but has never been documented on the NTS. This may be due to the fact that it is nearly impossible to distinguish the small-footed myotis from the California myotis in the field (B. Riddle, pers. comm., 1997). An additional five bat species of concern (also former Category 2 candidates: Mexican long-tongued bat, western mastiff bat, California leaf-nosed bat, big free-tailed bat, and Yuma myotis) may occur on the NTS. Of these, only the Yuma myotis has a geographic range that overlaps the NTS. Geographic ranges of the remaining four species approach, but do not overlap the NTS.

Although 11 bat species of concern may occur on the NTS, this report focuses only on the 6 bat species of concern captured during the 1996 study, including the small-footed myotis.

4.1.1 Pale Townsend's Big-Eared Bat

The pale Townsend's big-eared bat is a subspecies of the Townsend's big-eared bat (Hall, 1981). It is clove-brown in color with extremely large ears and upwardly protruding rostrum flaps (Burt and Grossenheider, 1976). It is found in southern British Columbia, the western United States, and northern Mexico (Hall, 1981) (Figure 4-1). It has been recorded from low desert up to mid-elevation montane habitats, and is dependent on mines and caves for roosting habitat. It does not migrate, but hibernates in mixed-sex aggregations of

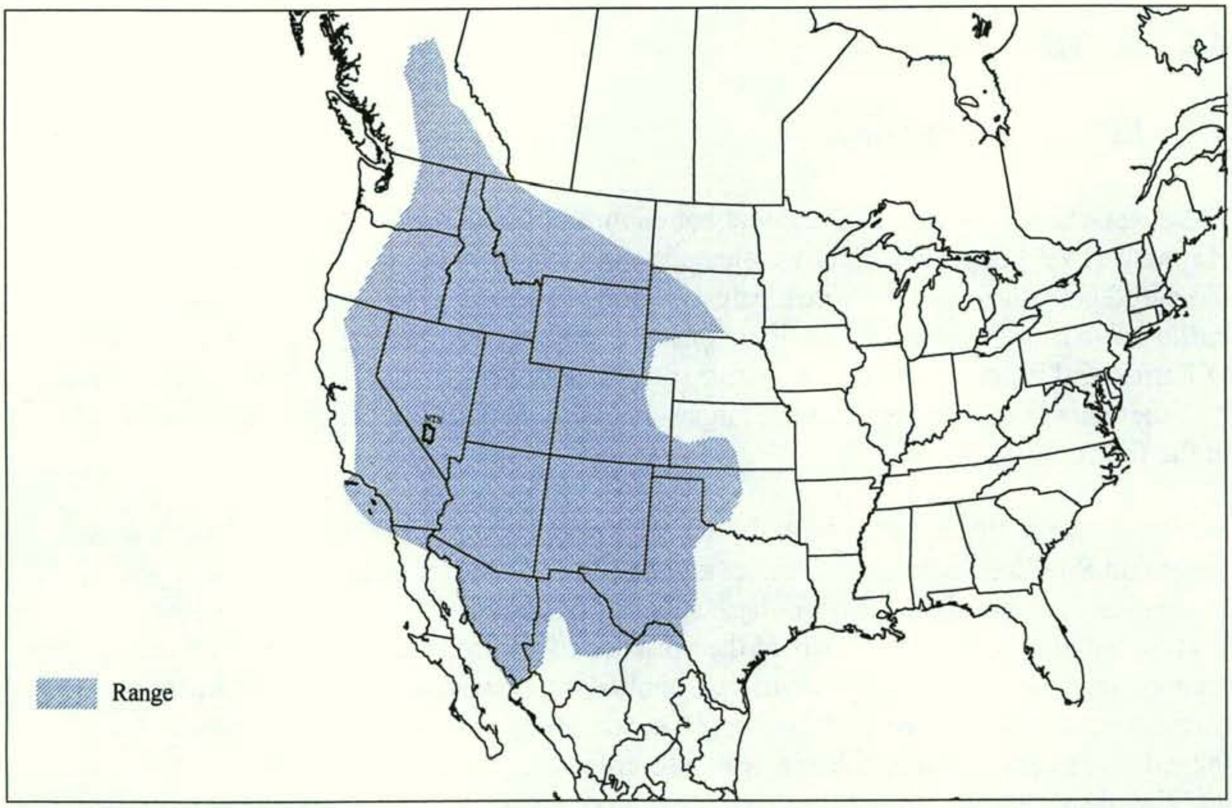

Figure 4-1 Range of the Pale Townsend's Big-Eared Bat in North America (adapted from Hall, 1981)

a few to many hundred. However, it may periodically arouse and move to another roost site and actively forage and drink throughout the winter. Females usually have one offspring per year, and birthing occurs from May to July.

Females form maternity colonies while males roost individually. It preys predominantly on small moths and forages near vegetation and other surfaces. Dobkin *et al.* (1995) radio-tracked six individual bats in Oregon during April and May and determined that they moved up to 24 km (14.9 mi) from their hibernacula to foraging areas. Distances moved from interim day roosts to foraging areas was less, ranging from 2 to 8 km (1.2 to 5.0 mi).

Substantial population declines over the past 40 years in parts of California have been documented (Brown and Pierson, 1996). Population declines in Nevada, Arizona, New Mexico, and Utah have been documented as well (NDOW, 1996). These population declines are not surprising because the pale Townsend's big-eared bat is very sensitive to disturbance at roost sites.

4.1.2 Spotted Bat

The spotted bat is easily identified by its conspicuous white rump patch and single white patches on each shoulder, contrasted with black fur covering the rest of the body (Burt and Grossenheider, 1976). While not abundant, the spotted bat is believed to be widespread in southwest British Columbia (Fenton *et al.*, 1987), the western United States, and northern Mexico (Hall, 1981) (Figure 4-2). It has a scattered distribution throughout Nevada, and is

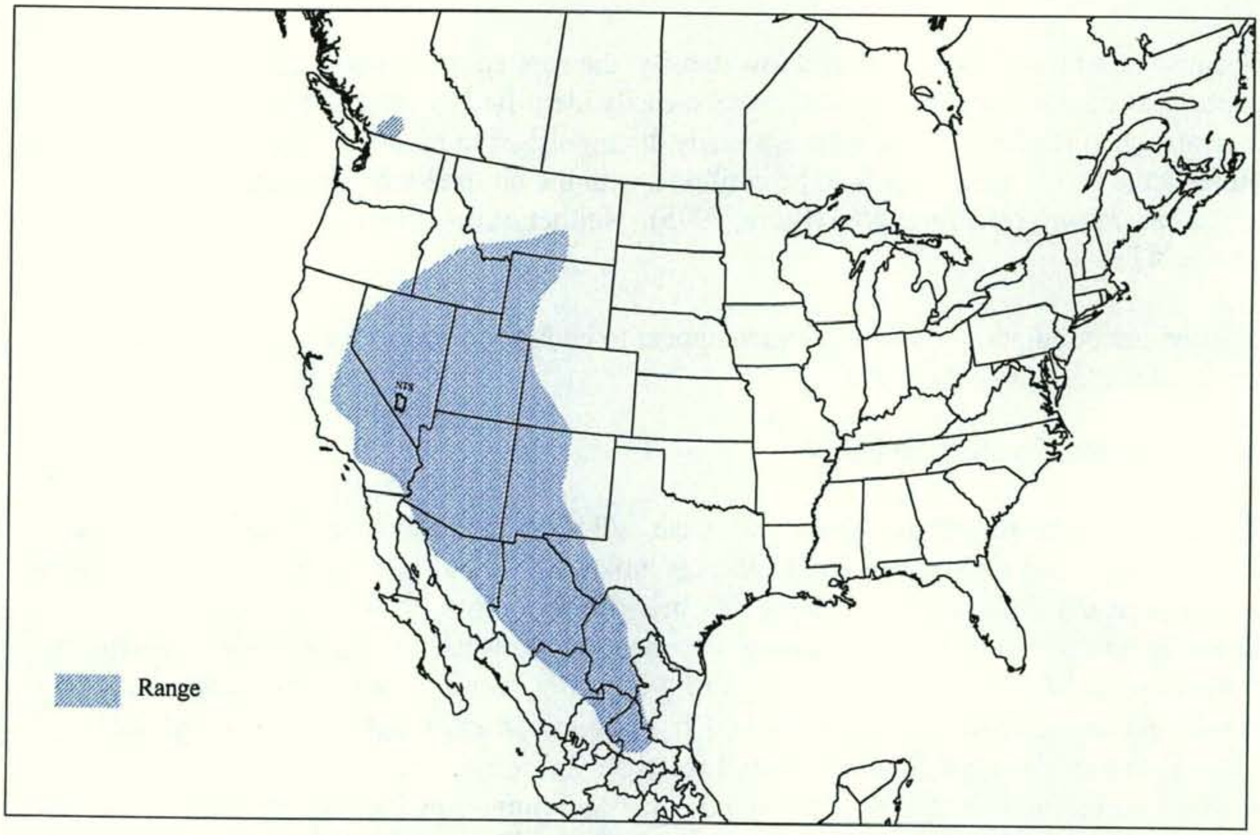

Figure 4-2 Range of the Spotted Bat in North America (adapted from Hall, 1981; Fenton *et al.*, 1987)

found from low desert scrub to high-elevation coniferous forests. Its distribution is patchy and appears to be linked to the availability of cliff-roosting habitat. During the day, it roosts primarily in cliff-face crevices. Mines and caves are possibly used during the winter. It does not migrate but hibernates, arousing periodically to actively forage and drink. Females give birth to one young per year during June or July. Both sexes likely roost singly (Brown and Pierson, 1996). The spotted bat feeds almost entirely on moths with an occasional record of a June beetle being found in the stomach (Ross, 1961, 1967; Easterla and Whitaker, 1972). Foraging occurs in canyons, in the open, over riparian vegetation, over meadows, or in open coniferous woodlands (Brown and Pierson, 1996). Foraging behavior consists of bats flying in elliptical orbits about 10 m (33 ft) above the ground, with occasional dives to within 1 m (3 ft) of the ground, presumably in response to the behavior of its prey (Leonard and Fenton, 1983).

Data collected by radiomarking spotted bats in southern British Columbia show that activity periods during the summer begin shortly after sunset and bats continue to feed in flight for several hours without returning to the roost site until one to two hours before sunrise (Leonard and Fenton, 1983; Wai-Ping and Fenton, 1989). Nightly activity level is hindered by heavy rain, while wind and lunar conditions have no effect on activity level (Leonard and Fenton, 1983). Wai-Ping and Fenton (1989) reported individual bats flying 6-10 km (3.7-6.2 mi) from their day roosts.

Because of its foraging activity and low density, the spotted bat is relatively difficult to capture using mist nets. It can, however, be easily identified by the audible echolocations it emits when feeding. These calls are easily distinguished in the field, and in southern Nevada the call is thought only to be confused with the big free-tailed bat and Allen's big-eared bat (*Idionycteris phyllotis*) (Storz, 1995). Neither of these bats have been recorded on the NTS.

Spotted bat population levels in Nevada appear to be fairly constant, with no significant declines evident (NDOW, 1996).

4.1.3 Small-Footed Myotis

The small-footed myotis has long, yellowish, silky fur and a distinct black mask across its face (Burt and Grossenheider, 1976). It looks similar to the California myotis, which makes it nearly impossible to distinguish between the two species in the field. It is found in southwestern Canada, throughout most of the western United States, and in north-central Mexico (Hall, 1981) (Figure 4-3). It is found primarily at middle and higher elevations (above 1,830 m [6,000 ft]) in Nevada and California, although it has been found at low elevations in desert habitat in California. It occupies a variety of habitats including desert scrub, grasslands, oak and pinyon-juniper woodlands, and pine forests. This species appears to use a variety of structures for both day and night roosts, including mines, trees, caves, buildings, and rock crevices. It does not migrate but hibernates during the winter. It may be able to tolerate drier and colder hibernacula than other bat species. Females give birth to one young per year with birth occurring from May to June. Females sometimes form small maternity colonies (<30 individuals). It prefers to eat small moths, flies, ants, and beetles and forages in open areas. Population trends are not well understood for this species (Brown and Pierson, 1996).

4.1.4 Long-Eared Myotis

The long-eared myotis is pale brown in color with very large black ears (Burt and Grossenheider, 1976). Its distribution ranges from southern British Columbia to northern Mexico and from California to Nebraska (Hall, 1981) (Figure 4-4). The long-eared myotis is found primarily at higher elevations around coniferous forests. It roosts during the day in hollow trees, under exfoliating bark, in rock crevices, and sometimes in mines, caves, and buildings. Night roosts are usually found in caves, mines, and under bridges. It roosts both singly or in small groups. It does not migrate, but hibernates during the winter. Females have one young per year with birth occurring in June and July. This species preys on moths, small beetles, and flies, and forages by both substrate gleaning and aerial pursuit. It forages near vegetation and the ground, along rivers and streams, over ponds, and within cluttered forest environments. Population trends are not well understood for this species (Brown and Pierson, 1996).

4.1.5 Fringed Myotis

The fringed myotis is buffy brown in color and has a conspicuous fringe of stiff hairs along the free edge of the interfemoral (tail) membrane (Burt and Grossenheider, 1976). It is

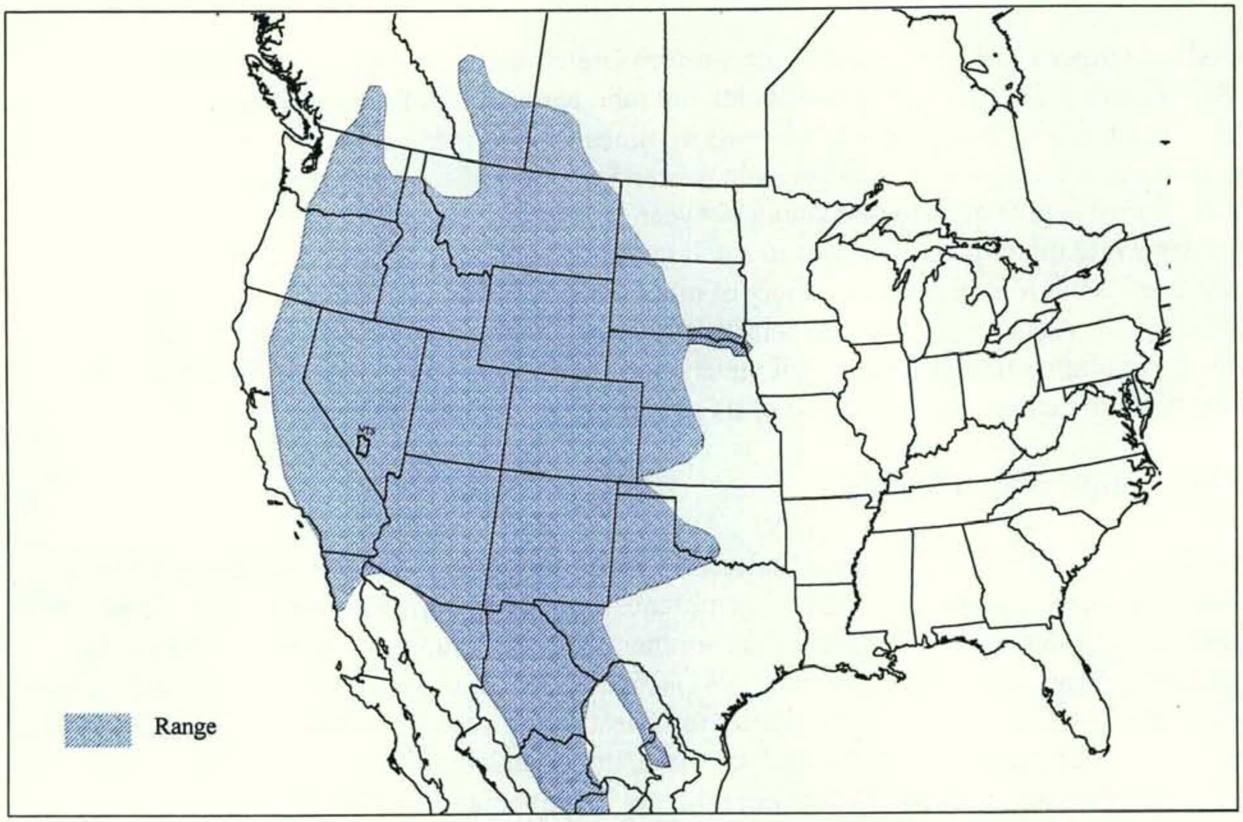

Figure 4-3 **Range of the Small-Footed Myotis in North America (adapted from Hall, 1981)**

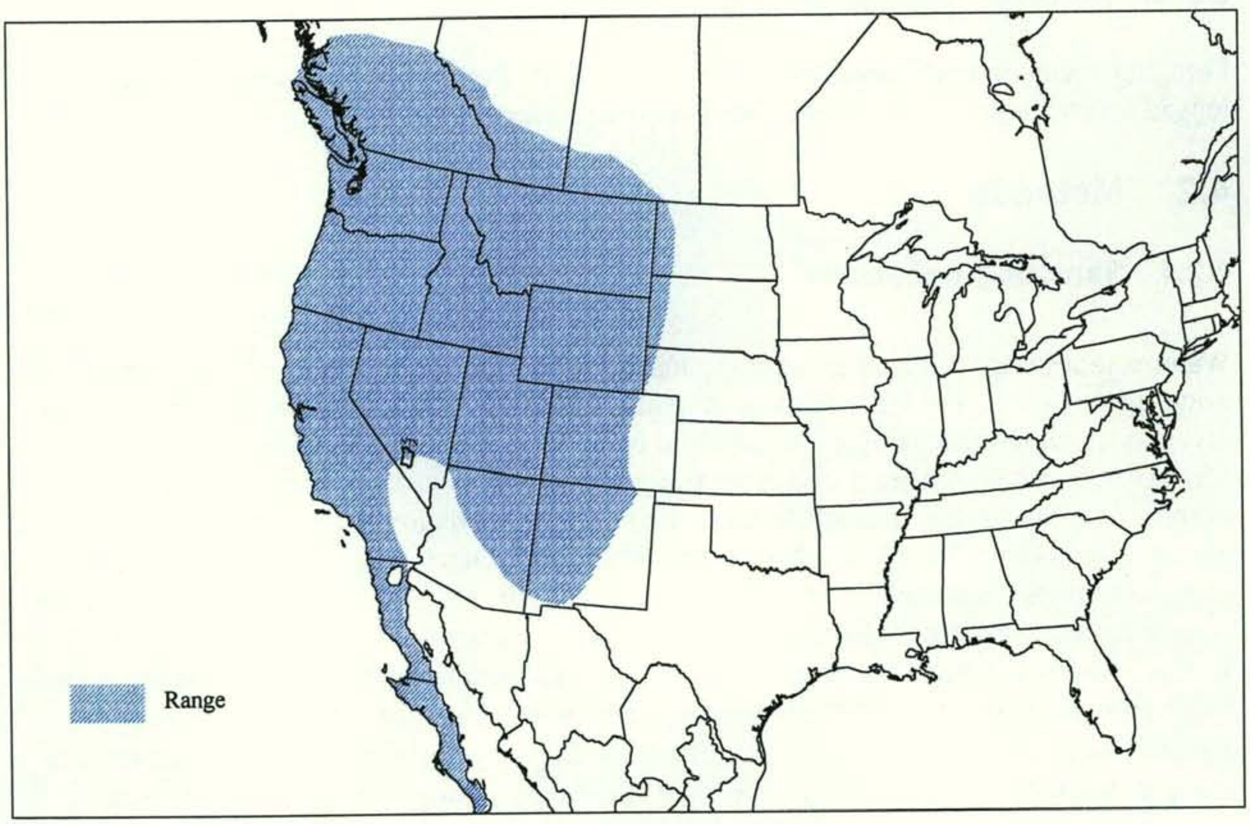

Figure 4-4 **Range of the Long-Eared Myotis in North America (adapted from Hall, 1981)**

found in southern British Columbia, the western United States, and northern Mexico (Hall, 1981) (Figure 4-5). It is widely distributed but rare, and is found from low desert scrub to high-elevation coniferous forests. It roosts in mines, caves, trees, and buildings. It does not migrate, but hibernates, with periodic winter activity. Hibernating groups contain both sexes. Females give birth to one young per year in May or June. Females form maternity colonies while males roost singly or in small groups. Its diet is comprised primarily of small beetles but also includes a variety of other insects, including moths. Foraging occurs in and among vegetation. It is very sensitive to roost disturbance (Brown and Pierson, 1996). Population trends are not well understood for the fringed myotis, but a potential for this species to decline exists because of its sensitivity to roost disturbance.

4.1.6 Long-Legged Myotis

The long-legged myotis has short rounded ears, small feet, a well-developed keel on its calcar, and fur on the underside of the membranes extending to the elbow and knee (Burt and Grossenheider, 1976). It occurs from southern British Columbia to the Baja Peninsula and from California to Nebraska (Hall, 1981) (Figure 4-6). It is found from high desert Joshua tree woodlands to montane coniferous forests. Day roosts are found mainly in hollow trees but may also occur in rock crevices, mines, and buildings. Caves and mines may be used for night roosts. It does not migrate, but hibernates with periodic winter activity. There is evidence to suggest that there are latitudinal and elevational movements between summer and winter roosts. Females give birth to one young per year in June and July, and females form maternity colonies of several hundred. It feeds primarily on moths but also eats beetles, flies, and termites.

Foraging occurs in open areas, often at canopy height. Population trends for the long-legged myotis are not well understood (Brown and Pierson, 1996).

4.2 Methods

4.2.1 Sampling Locations

Water sources were selected as sampling locations because bats routinely forage over and drink from water sources in arid environments. Therefore, it was expected that the greatest diversity and abundance of species captured could be attained by sampling over water. Moreover, because bats are found in a variety of habitats, sampling locations were purposefully distributed throughout the three major desert regions (Mojave Desert, Mojave/Great Basin Transition Desert, and Great Basin Desert) that occur on the NTS in order to capture the widest variety of bat species possible (Figure 4-7). Eight water sources were sampled. Three were located in the Mojave Desert region, three in the Mojave/Great Basin Transition Desert region, and two in the Great Basin Desert region. Biologists hoped to sample more locations but the number of suitable water sources was limited due to the lack of precipitation the previous fall and winter, closure of certain well reservoirs, and dry sump ponds throughout the NTS. The eight sampling locations are characterized below:

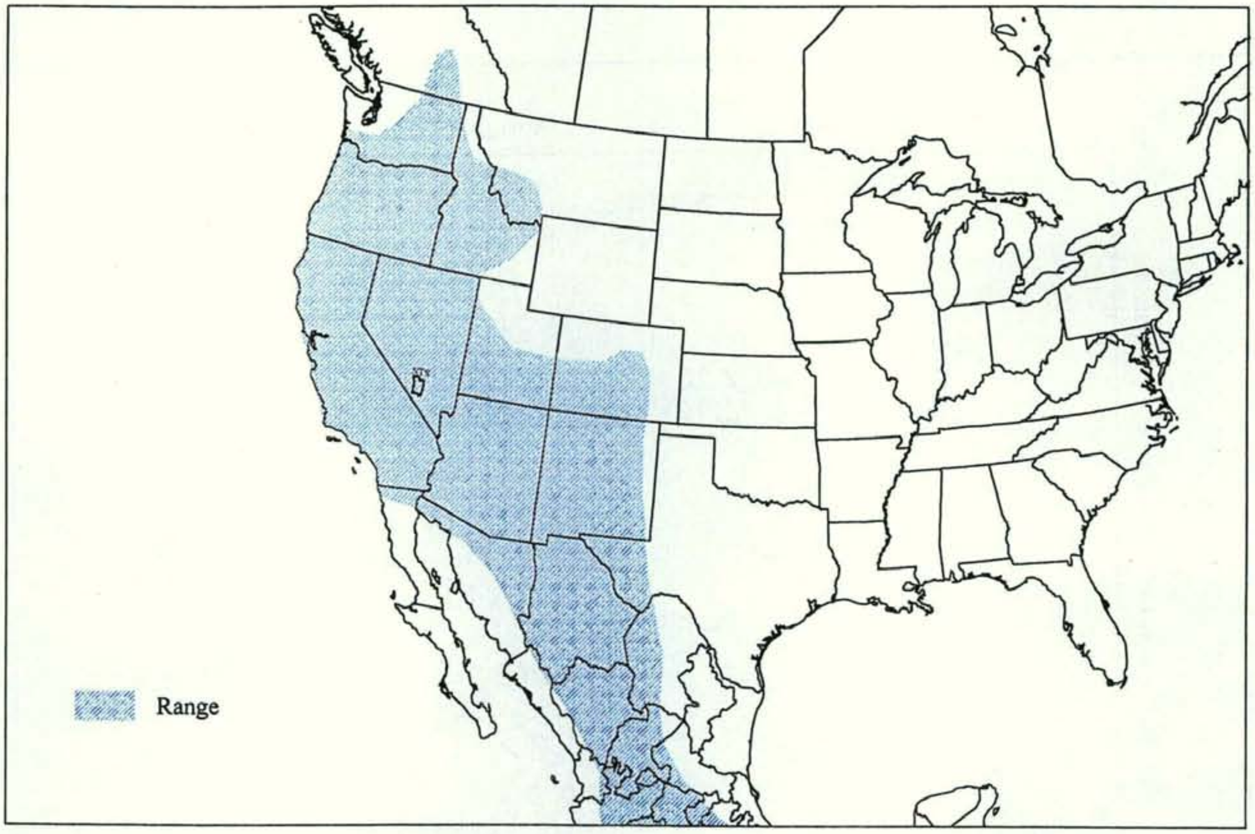

Figure 4-5 **Range of the Fringed Myotis in North America (adapted from Hall, 1981)**

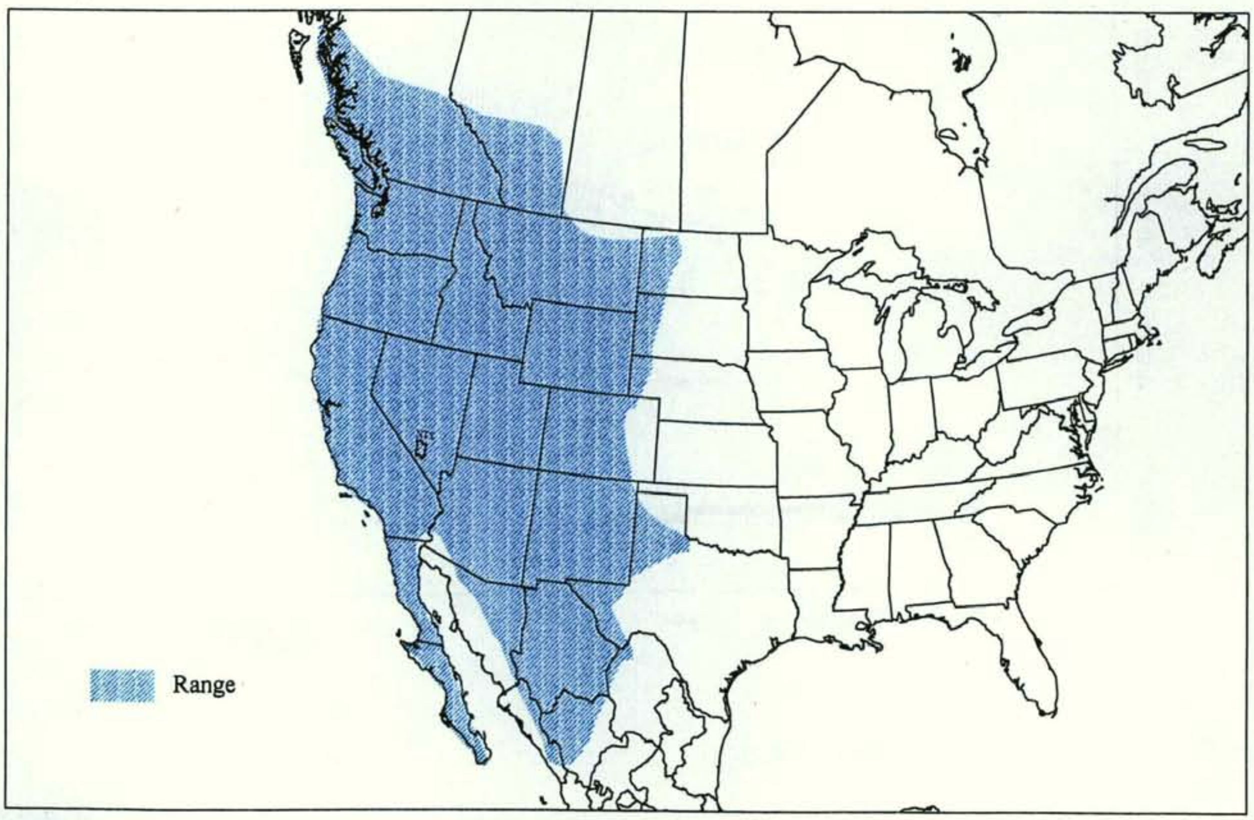

Figure 4-6 **Range of the Long-Legged Myotis in North America (adapted from Hall, 1981)**

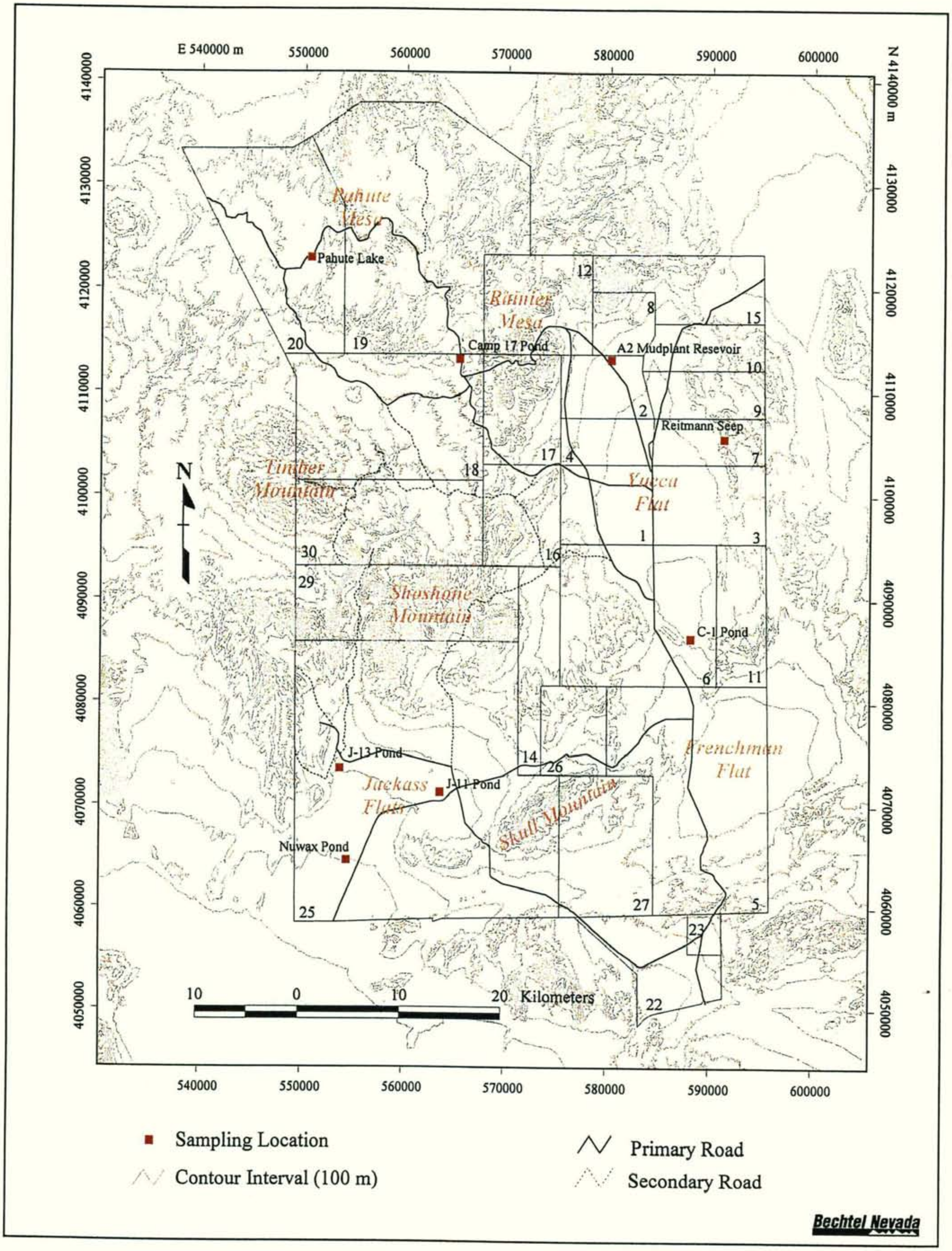

Figure 4-7 **Bat Mist-Netting Locations on the Nevada Test Site in 1996**

Mojave Desert Region

J-11 POND – J-11 Pond is a man-made well pond located in the east-central portion of Jackass Flats at an elevation of approximately 1,048 m (3,437 ft). The surface area of the pond is approximately 500 m^2 (5,382 ft^2). Several large Goodding's willow trees (*Salix gooddingii*) grow around the eastern edge of the pond. Alkali bulrush plants (*Scirpus robustus*) occur along most of the perimeter of the pond, and planted bermudagrass (*Cynodon dactylon*) extends approximately 5 to 10 m (16 to 33 ft) from the edge of the pond to a 2.4-m- (8-ft-)-high chain link fence that surrounds the pond. A small pump house and a large holding tank lie about 15 m (49 ft) east of the pond. Several buildings are within a 2-km (1.2-mi) radius of the pond.

J-13 POND – J-13 Pond is a man-made well pond located in the northwest portion of Jackass Flats at an elevation of approximately 954 m (3,129 ft). It is located in the bottom of Fortymile Wash, which is a major drainage in the southwest portion of the NTS. Its banks are nearly vertical and extend as high as 20 m (66 ft), and its width averages about 200 m (656 ft). The surface area of the pond is approximately 450 m^2 (4,844 ft^2). The perimeter of the pond is heavily vegetated with salt cedar (*Tamarix ramosissima*). A water truck filling station is located 20 m (66 ft) northwest of the pond. Runoff from a leaking valve at the water truck filling station created a large (30 m^2 [323 ft^2]) puddle no more than 10 cm (4 in) deep that was also mist-netted. The puddle had no vegetation around it.

NUWAX POND – The Nuwax Pond, also referred to as the MX Pond, is a man-made well pond located in the southwest portion of Jackass Flats at an elevation of approximately 932 m (3,057 ft). It is located 500 m (1,640 ft) east of the edge of Fortymile Wash. The surface area of the pond is approximately 900 m^2 (9,688 ft^2). Two-thirds of the perimeter of the pond is overgrown with salt cedar, weeping willow (*Salix babylonica*), and Goodding's willow trees. Hardstem bulrush (*Schoenoplectus acutus*) and southern cattails (*Typha domingensis*) are also present along the southern and eastern edges of the pond. Overflow water from the pond has flooded a small portion of road and created a large puddle (36 m^2 [388 ft^2]) less than 20 cm (8 in) deep that was also mist-netted. A portable water pump used to draw water from the pond to fill water trucks is located on the southern edge of the pond.

Mojave/Great Basin Transition Desert Region

AREA 2 MUDPLANT RESERVOIR – The Area 2 Mudplant Reservoir is a man-made, cement-lined well pond located in the northern portion of Yucca Flat at an elevation of 1,372 m (4,500 ft). The surface area of the pond is approximately 900 square meters (m^2) (9,688 square feet [ft^2]). No vegetation exists on the perimeter of the pond because of the cement lining. Vegetation around the sides of the pond consists of apricot globemallow, Indian ricegrass (*Achnatherum hymenoides*), Wright's three-awn (*Aristida purpurea*), and a variety of annual species. Most of the land adjacent to the pond has been disturbed by past activities. A large inoperable cement mixing plant is located 10 m (33 ft) northwest of the pond.

C-1 POND – C-1 Pond is a man-made well pond located in the southern portion of Yucca Flat adjacent to the Yucca Lake playa at an elevation of 1,195 m (3,920 ft). The surface area of the pond is about 1,000 m^2 (10,764 ft^2). Ninety percent of the perimeter of the pond is surrounded by dense vegetation, including salt cedar and southern cattails. There is a small electrical sub-station, a control building, an old boxcar used for storage, and a water holding tank about 20 m (66 ft) east of the pond.

REITMANN SEEP – Reitmann Seep is a small seep at the mouth of a canyon on the eastern edge of Yucca Flat at an elevation of 1,402 m (4,599 ft). The seep is a small pool of water (< 1 m^2 [11 ft^2]). Additionally, there is a small trough (< 1 m^2 [11 ft^2]) made from a 208-liter (55-gallon) drum that is located 10 m (33 ft) down slope from the seep. It is fed water through a buried pipe that originates at the seep. The water depth does not exceed 20 cm (8 in) at either the seep or the trough, and the vegetation around these water sources consists of a few annual species.

Great Basin Desert Region

CAMP 17 POND – Camp 17 Pond is a large, man-made well pond located southwest of Rainier Mesa at an elevation of 1,756 m (5,760 ft). The surface area of the pond is approximately 6,700 m^2 (72,119 ft^2). The eastern half of the pond's shore is steep and overgrown with hardstem bulrush, southern cattails, and rubber rabbitbrush. The northern half of the pond's shore gradually slopes into the pond and is mostly void of vegetation. An office trailer, water truck filling station, and an operating overhead street lamp are located on a hill approximately 15 to 50 m (49 to 164 ft) east of the pond. Several rocky cliffs and hills are located within 2 to 5 km (1.2 to 3.1 mi) of the pond.

PAHUTE LAKE – Pahute Lake is a large, man-made well pond located in the central portion of Pahute Mesa at an elevation of 1,964 m (6,442 ft). It was the largest and northernmost sampling location. Prior to 1995, this lake had not held water for several years. However, the lake was filled in the winter of 1995-1996 to support the drilling of groundwater characterization wells approximately 2 km (1.2 mi) to the northwest. After the drilling was complete, the lake was left to dry up. The surface area of the pond when full is approximately 14,400 m^2 (155,002 ft^2). At the time of sampling (June 3), only about one-eighth (1,800 m^2 [19,375 ft^2]) of the surface area contained water. Three weeks later, the entire lake had dried up and was no longer used as a sampling location. The lake is located on the edge of an open sagebrush area, much of which has been disturbed by previous activities. A couple of small tanks are located on the eastern edge of the lake, and a water truck filling station is located on the northern edge.

4.2.2 Sampling Technique

Trap sessions consisted of one to three consecutive trap nights. During each trap session, a location in a different desert region was trapped on each night. Trapping sessions began May 13, 1996, and continued every one to three weeks through July 17, 1996. Five trap sessions were conducted, for a total of eleven trap nights. J-11 Pond was sampled twice and Camp 17 Pond was sampled three times. All other locations were sampled once (Table 4-1). Four trap nights were conducted in both the Mojave and Great Basin Desert regions and three in the Mojave/Great Basin Transition Desert region.

Table 4-1 Trapping Information Relative to Each Water Source Mist-Netted

Mist-Netting Location	Date(s) Mist-Netted	Desert Region	Elevation m (ft)	Length of Session (hrs)	Total Surface Area of Nets m^2 (ft^2)	Start Temp. (°C)	End Temp. (°C)	Number of Captures*
J-11 Pond (4071100mN; 563815mE)	5/13/96 7/16/96	Mojave	1,048 (3,440)	7.5 5	99 (1,065) 167 (1,800)	31.0 30.3	16.8 25.6	1 (55) 0 (73)
J-13 Pond (4073570mN; 553800mE)	6/4/96	Mojave	954 (3,130)	6	88 (952)	29.5	23.0	0 (232)
Nuwax Pond (4064361mN; 554602mE)	7/2/96	Mojave	932 (3,060)	6	123 (1,326)	35.8	29.3	0 (81)
Area 2 Mudplant Reservoir (4112082mN; 580344mE)	7/15/96	Mojave/Great Basin Transition	1,372 (4,500)	4.5	111 (1,200)	30.5	21.0	1 (14)
C-1 Pond (4086140mN; 588190mE)	6/5/96	Mojave/Great Basin Transition	1,195 (3,921)	6	111 (1,200)	29.5	19.1	0 (18)
Reitman Seep (4105580mN; 591320mE)	6/24/96	Mojave/Great Basin Transition	1,402 (4,600)	4	23 (252)			0
Camp 17 Pond (4111880mN; 565300mE)	5/14/96 7/1/96 7/17/96	Great Basin	1,756 (5,760)	5.5 7 6	279 (3,000) 279 (3,000) 279 (3,000)	21.3 21.7 24.6	11.2 15.7 12.3	20 (53) 81 (267) 17 (159)
Pahute Lake (4122919mN; 550698mE)	6/3/96	Great Basin	1,964 (6,440)	8	223 (2,400)	19.2	5.3	25 (129)
							TOTAL	145 (1,081)

* Number of individual bats captured which were species of concern, excluding small-footed/California myotis; ( ) = total number of individuals captured, including small-footed/California myotis.

Mist nets were placed across water and along the shores of ponds. The number and size of nets used varied by sampling location, and depended on how much of the surface area was accessible and how large the water source was. The nets most commonly used were made of 30/2-diameter nylon, with a mesh size of 3 cm (1 in), and measured 3 m (10 ft) high and 18 m (59 ft) long. These nets were favorable because of their height and ability to span long distances. Other nets used ranged from 4 to 13 m (13 to 43 ft) in length and 1 to 2 m (3 to 7 ft) in height. *Table 4-1* lists the total surface area of mist nets used during each trap night.

Nets were placed on 3-m (10-ft) sections of schedule 40, polyvinyl chloride (PVC) tubing and anchored to the ground using tent stakes, rocks, or vegetation. When possible, nets were set up across a pond and accessed by styrofoam rafts or wading.

Mist nets were opened just before dusk or when the first bat was observed, and remained open until approximately 0300 hrs or until the capture success dropped off, whichever was later. On a few occasions, some nets were closed because too many bats were being captured.

In addition to mist-netting, a digital tape recorder with a hypersensitive microphone was used to record feeding vocalizations of bats at Camp 17 Pond. Recorded vocalizations were analyzed on an oscilloscope at the University of Nevada Las Vegas (UNLV) Electrical and Computer Engineering Calibration Laboratory.

4.2.3 Data Collection

Typically, bats were identified, sexed, and weighed. The time of capture was also recorded. Additionally, standard measurements (total length, tail length, foot length, ear length, and forearm length) were taken on many bats, and the reproductive condition of many females was processed, it was released away from the nets. On cool nights, some bats became slightly torpid and were unable to fly when released. These animals were warmed in biologists hands or pockets until the animal became active and then released. Weather data, including ambient air temperature, soil temperature, percent cloud cover, and wind speed and direction were recorded at the beginning and end of most trap nights and at uniform intervals throughout the night as time allowed. Lunar phase was also documented. Bat and weather data were entered into a computerized database and summarized. Moreover, UTM coordinates (Zone 11, 1927 North American datum) of each sampling location for both the 1996 study and historic studies (where species of concern were found) were taken using a GPS (Magellan Pro V 5000). These coordinates were entered into a database and displayed using ArcView® GIS software.

4.3 Results

Table 4-1 summarizes the trapping information by trap night at each sampling location. A total of 145 bats, representing 5 species of concern, were captured during 11 trap nights at eight locations (Table 4-2, *Figure 4-7*). An additional 319 bats were captured that might be the small-footed myotis or the California myotis. Because it was not possible to distinguish between the two species in the field, four unidentified specimens were collected and taken to the UNLV Biological Sciences Department to be included in

Table 4-2 Number of Bats Captured at Each Location by Species

Species Captured	J-11 Pond	J-13 Pond	Nuwax Pond	Area 2 Mud-plant	C-1 Pond	Reitmann Seep	Camp 17 Pond	Pahute Lake	Total
Species of Concern									
Corynorhinus townsendii pallescens Pale Townsend's big-eared bat							3	2	5
Euderma maculatum Spotted bat							1	3	4
Myotis ciliolabrum/californicus Small-footed/California myotis	7	4	4	5	4		241	54	319
Myotis evotis Long-eared myotis							30	3	33
Myotis thysanodes Fringed myotis							21	3	24
Myotis volans Long-legged myotis	1			1			63	14	79
Other Species									
Antrozous pallidus Pallid bat	8		32	1	3		6		50
Eptesicus fuscus Big brown bat							11	36	47
Myotis species (unidentified)	2						6	4	12
Pipistrellus hesperus Western pipistrelle	82	226	45	7	10		93	2	465
Tadarida brasiliensis Mexican free-tailed bat	28	2			1		4	8	43
Total	128	232	81	14	18	0	479	129	1,081

a DNA study developed to analyze the genetic differences of the two species. If the specimens are identified as the small-footed myotis, this will be the first collection records of them from the NTS. Because a positive identification of these two species is still pending, they will be referred to hereafter as small-footed/California myotis. No Mexican long-tongued bats, California leaf-nosed bats, western mastiff bats, big free-tailed bats, or Yuma myotis were captured. Furthermore, 618 other bats representing 4 species that are not species of concern were captured. A total of 1,081 individual bats were captured during the 1996 bat study.

Excluding small-footed/California myotis, 145 individuals (19 percent of total bats captured) were species of concern. All five species of concern were caught at both Camp 17 Pond and Pahute Lake and represented 50 and 33 percent, respectively, of all bats caught at these two locations. The spotted bat, long-eared myotis, fringed myotis, and pale Townsend's big-eared bat were caught exclusively at Camp 17 Pond and Pahute lake. The long-legged myotis was found at J-11 Pond, Camp 17 Pond, Pahute Lake, and Area 2 Mudplant Reservoir. The small-footed/California myotis was caught at all sampling locations except Reitmann Seep, where no bats were caught.

A total of four spotted bats were captured: three at Pahute Lake between 2245 and 0325 hrs on June 3-4, and one at Camp 17 pond at 0100 hrs on July 2. In addition, bat feeding vocalizations were heard at Pahute Lake, Camp 17 Pond, and around a sump pond (ER 20-6) about 1 km (0.6 mi) northeast of Pahute Lake. Bat vocalizations occurred between 2115 and 0330 hrs (June 3-4), 1230 and 0315 hrs (July 2), and 0100 and 0145 hrs (July 2) at Pahute Lake, Camp 17 Pond, and ER 20-6, respectively. Results from the oscilloscope analysis showed recorded vocalizations at Camp 17 Pond to have frequency ranges similar to those reported by other researchers for the spotted bat (Fenton and Bell, 1981; Woodsworth *et al.*, 1981; Leonard and Fenton, 1984). More than one spotted bat was observed drinking or skimming the water at once. No social interaction between spotted bats was observed and, if two bats were present, they usually maintained a distance of more than 15 m (49 ft) from each other. Spotted bat vocalizations usually occurred one-half hour or more apart but when one bat was present around the water source, another usually showed up and the two would leave about the same time.

Ambient air temperatures ranged from 5.3° to 35.8°C (41.5° to 6.4°F), soil temperature from 17.0° to 40.8°C (62.6° to 105.4°F), cloud cover from 0- to 100 percent, wind speed from 0 to 29 km/hour (0 to 18 mi/hour) from all directions, and lunar phase from no moon to full moon across all dates and sampling locations.

4.4 Discussion

All five bat species of concern previously known to occur on the NTS (Appendix D) were captured during 1996. With the possible exception of the small-footed myotis, no new bat species of concern were found. It is not surprising that no Mexican long-tongued, California leaf-nosed, western mastiff, or big free-tailed bats were captured because their geographic ranges approach, but do not overlap, the NTS. It is not known why Yuma myotis were not captured. Moreover, 10 of the 12 bat species known to occur on the NTS were captured in 1996, all except the hoary and silver-haired bats.

Results indicate that the five bat species of concern trapped in 1996 accounted for one-fifth of all bats captured on the NTS. This proportion was higher (between one-third and one-half of all bats captured) in the Great Basin Desert region (Pahute Lake and Camp 17 Pond). The highest diversity of bats captured was found in the Great Basin Desert region, with ten species caught at both Camp 17 Pond and Pahute Lake. In fact, four of the five species of concern (spotted bat, long-eared myotis, fringed myotis, and pale Townsend's big-eared bat) were caught exclusively in this region. These results suggest that the best bat habitat on the NTS is found in the Great Basin Desert region. This may be due to the fact that bats use mines, caves, crevices, trees, and/or cliffs as roost sites (Brown and Pierson, 1996), and these features are found in greater abundance in the Great Basin Desert region of the NTS than in the Mojave Desert or Mojave/Great Basin Transition Desert regions of the NTS.

The long-legged myotis appears to be the most widespread bat species of concern on the NTS because it was found at sampling locations within all three desert regions.

During 1996, the spotted bat was captured for the first time on the NTS. Before 1996, the spotted bat had only been heard on one occasion on the NTS. This occurred in 1992, when its feeding vocalizations were recorded over a sump pond (U-19c lower pond) on Pahute Mesa (EG&G/EM, 1993).

Results from the 1996 bat study and literature review have contributed substantially to the understanding of the presence and distribution of bat species of concern on the NTS. However, this and previous NTS bat studies have focused on characterizing bat communities on the NTS by sampling at or near water sources. Further studies should be conducted to determine specific roosting site preferences in order to protect these areas and/or mitigate potential impacts. Additionally, natural and man-made water sources are important resources used by many species of bats. If man-made ponds dry up, it may adversely affect bats on the NTS because water sources are few in number and widely distributed across large areas. Furthermore, activities that disturb mines, caves, crevices, buildings, and other potential roost sites may adversely affect bats because many species are sensitive to roost disturbance. Continued monitoring of bats on the NTS will help assess population trends and determine the status of bat species of concern on the NTS.

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5.0 DOE/NV MANAGEMENT OF ANIMAL SPECIES OF CONCERN

This chapter describes selected management actions related to animal species of concern which were developed by DOE/NV to implement DOE's *Land- and Facility-Use Management Policy* (O'Leary, 1994):

> . . . to manage all of its land and facilities as valuable national resources . . . based on the principles of ecosystem management and sustainable development. [DOE] will integrate mission, economic, ecologic, social, and cultural factors in a comprehensive plan for each site that will guide land and facility decisions . . . . This policy will result in land and facility uses that support the Department's critical missions, stimulate the economy, and protect the environment.

As funding permits, DOE/NV implements these actions. This chapter also includes descriptions of how the information in this report will be used to improve some of the management actions.

5.1 Preactivity Surveys and Impact Minimization Measures

It is DOE/NV policy to review all proposed habitat-disturbing activities to ensure compliance with the ESA, other federal and state legislation, and DOE/NV environmental policies. As part of this review, preactivity surveys are conducted at proposed activity sites to determine the presence of species of concern and other important biological resources. DOE/NV documents the presence of species of concern (or sign of their presence, such as chuckwalla scat) and evaluates the potential impacts of the proposed project on them. A report of survey findings is prepared, and measures to minimize impacts during project construction or operation are identified in the report. Some examples of minimization measures for important biological resources are (1) changing the start date for ground clearing to ensure that bird eggs have hatched and the young have fledged, and (2) selecting alternate access routes to avoid bisecting or disturbing populations of rare plants.

The information presented in this report on western burrowing owls and bats resulted in the modification of preactivity survey procedures. For example, surveys documented that western burrowing owls occur on the NTS during the breeding season and often use man-made structures, such as culverts, for burrows. Preactivity survey procedures have been modified to ensure that "artificial burrows" within western burrowing owl habitat (i.e., open, flat to gradually sloping terrain) are examined for nesting owls. Similarly, preactivity surveys have been modified to ensure that potential bat roost sites are now identified within proposed project sites and that impacts upon potential roosts are addressed in survey reports.

5.2 Geospatial Database of Species of Concern

DOE has developed several tools to manage important biological resources on the NTS, including the Ecosystem Geographical Information System (EGIS). The EGIS is a geospatial database that contains information on the location and description of sites where important species have been found. This database is updated annually to incorporate all new data collected. EGIS will be used to map plant and animal habitats to be protected by DOE/NV and will be used to aid in developing the comprehensive NTS land- and facility-use classification system. That classification system will characterize the compatibility of current use and condition of lands and facilities on the NTS with future uses (DOE, 1996b). For example, areas that are essential for the viability of a particular species will be identified in the EGIS and may be classified as incompatible with all other future uses. EGIS data will also be used during the preparation of future environmental assessments and environmental impact statements to identify important biological resources that may be impacted.

5.3 Sharing Data with Other Agencies

EGIS data on species of concern will be updated routinely to identify areas where species are both known to occur and where searches or sampling have occurred, but species have not been found. New information will be submitted to the Nevada Natural Heritage Program, which maintains and distributes a comprehensive database of information on sensitive species in Nevada. Making NTS data available to the FWS and other regional resource management agencies will help DOE/NV and those agencies develop a better understanding of the conservation status of species and identify necessary and effective management actions.

5.4 Continued Monitoring

DOE/NV has conducted field surveys for numerous species of concern on the NTS since the 1970s. They have included census surveys and opportunistic observations of candidate plant species of concern, desert tortoises, feral horses, and some game and fur-bearing species. The 1996 surveys of chuckwallas, western burrowing owls, and bats have provided baseline data on the distribution of these species on the NTS.

Surveys for chuckwallas, western burrowing owls, and bats will be repeated at an appropriate frequency (e.g., once every three or five years), depending on the level of DOE/NV activities on the NTS which could affect these animals. These continued, periodic surveys will sample more intensively areas of the NTS where impacts to these species are most likely to occur. These areas most likely would include the level terrain of valley basins that might be cleared during construction of project support facilities, and the cliffs, tunnels, and mines in the northern portion of the NTS at risk of disturbance from ground movement or human activity. This may mean that chuckwalla surveys, for example, may not occur in the future unless their preferred habitat of rocky outcrops are selected as sites of proposed project impacts.

DOE/NV will implement other field studies of these animals whenever possible to gather more ecological information needed to develop appropriate species-specific mitigation measures. For example, radiotelemetry studies of bats are being planned to identify bat roosts and hibernacula on the NTS in areas of expected impacts. Also, opportunities will be taken to search vacant buildings on the NTS because they are preferred roost sites of the Yuma myotis, a bat species of concern which may occur on the NTS but was not captured during the 1996 mist net surveys. Also, a field study will be implemented as soon as possible to determine if western burrowing owls are year-round residents on the NTS.

Opportunistic sightings of chuckwallas, western burrowing owls, bats, and other species of concern will continue to be documented. These sightings usually occur while conducting other ecological monitoring tasks on the NTS such as monitoring wildlife use of natural and man-made water sources, and censusing feral horses and chukar (Bechtel Nevada, 1996). Sighting data for chuckwallas, western burrowing owls, and bats will continue to be maintained in the EGIS geospatial database of species of concern.

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Appendix A

Chuckwalla Scat Locations on the Nevada Test Site Recorded During 1996-1997

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
Barren Butte	7/29/96	575240	4084600	hillside	1,341 (4,400)
Barren Butte	7/29/96	577659	4083312	hillside	1,310 (4,300)
Barren Butte	7/29/96	575040	4084730	hillside	1,341 (4,400)
Barren Butte	7/29/96	577913	4084014	hillside	1,311 (4,300)
Barren Wash	7/24/96	580050	4082640	hillside	1,234 (4,050)
Barren Wash	7/25/96	581855	4082510	hillside	1,189 (3,900)
Black Glass Canyon	6/10/97	551214	4083966	hillside	1,280 (4,200)
Black Glass Canyon	6/10/97	551039	4083540	hillside	1,280 (4,200)
Black Glass Canyon	6/10/97	551556	4084758	hillside	1,341 (4,400)
Black Ridge	7/31/96	582479	4079891	hillside	1,146 (3,760)
Black Ridge	7/31/96	582579	4080887	hillside	1,158 (3,800)
Black Ridge	8/5/96	580120	4079248	hillside	1,295 (4,250)
Black Ridge	8/5/96	579715	4079252	hillside	1,432 (4,700)
Black Ridge	8/5/96	580833	4078900	hillside	1,265 (4,150)
Black Ridge	8/5/96	580114	4078875	hillside	1,341 (4,400)
Black Ridge	8/5/96	579709	4079559	hilltop	1,524 (5,000)
Black Ridge	8/5/96	581868	4078588	hilltop	1,204 (3,950)
Black Ridge	8/5/96	581038	4078699	hillside	1,341 (4,400)
Calico Hills	6/20/96	561750	4079890	hillside	1,372 (4,500)
Calico Hills	6/16/97	559165	4080674	hillside	1,463 (4,800)
Calico Hills	6/16/97	559388	4080299	hillside	1,402 (4,600)
Cane Spring Wash	7/25/96	581571	4073851	hillside	1,219 (4,000)
CP Hogback Ridge	6/18/96	589100	4085500	hillside	1,219 (4,000)
CP Hills	7/22/96	583000	4087740	hillside	1,341 (4,400)
CP Hills	7/22/96	583500	4087200	hillside	1,295 (4,250)
CP Hills	7/22/96	584100	4087340	hillside	1,448 (4,750)

Appendix A (continued)

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
CP Hills	7/23/96	582856	4088374	hillside	1,387 (4,550)
CP Hills	7/23/96	581841	4087200	hillside	1,463 (4,800)
CP Hills	7/23/96	582200	4087400	hillside	1,463 (4,800)
CP Hills	7/23/96	581524	4086800	hillside	1,445 (4,740)
CP Hills	6/27/96	584303	4087037	hillside	1,250 (4,100)
CP Hills	7/29/96	583309	4082928	hillside	1,189 (3,900)
CP Hills	7/29/96	582708	4085763	hillside	1,280 (4,200)
CP Hills	7/29/96	584080	4085584	hillside	1,231 (4,040)
CP Hogback Ridge	6/13/96	584929	4087548	hillside	1,295 (4,250)
CP Hogback Ridge	8/6/96	586875	4085566	hillside	1,189 (3,900)
Fortymile Canyon	6/26/96	554496	4081941	hillside	1,250 (4,100)
Fortymile Canyon	6/11/97	556988	4085145	hillside	1,372 (4,500)
Fortymile Canyon	6/11/97	556182	4085166	hillside	1,250 (4,100)
Frenchman Flat	4/3/96	587220	4077050	hillside	1,058 (3,470)
Frenchman Flat	5/30/96	587632	4073360	hilltop	1,097 (3,600)
Frenchman Flat	5/30/96	587600	4074500	hillside	1,067 (3,500)
Frenchman Flat	7/22/96	595465	4083383	hilltop	1,158 (3,800)
Frenchman Flat	7/22/96	594765	4084609	hillside	1,250 (4,100)
Frenchman Flat	7/22/96	594587	4084141	hillside	1,250 (4,100)
Frenchman Flat	7/22/96	589640	4079300	hillside	1,024 (3,360)
Frenchman Flat	7/22/96	592619	4082694	hilltop	1,189 (3,900)
Frenchman Flat	7/25/96	585639	4078149	rock pile	1,061 (3,480)
Frenchman Flat	7/25/96	586117	4072118	hillside	1,036 (3,400)
Frenchman Flat	7/25/96	582445	4070899	hillside	1,204 (3,950)
Frenchman Flat	7/29/96	586624	4075980	hillside	1,067 (3,500)
Frenchman Flat	7/29/96	585712	4074964	hillside	1,097 (3,600)
Frenchman Flat	7/29/96	586559	4074801	hillside	1,097 (3,600)
Frenchman Flat	7/29/96	587440	4074342	hilltop	1,067 (3,500)

Appendix A (continued)

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
Frenchman Flat	7/29/96	586014	4075609	hillside	1,067 (3,500)
Frenchman Flat	7/30/96	589576	4065960	hillside	1,024 (3,360)
Frenchman Flat	7/30/96	589529	4063052	hillside	1,146 (3,760)
Frenchman Flat	7/30/96	592815	4062558	hillside	1,189 (3,900)
Frenchman Flat	7/30/96	591858	4065090	rocky wash bank	1,067 (3,500)
Frenchman Flat	7/31/96	586400	4067132	hilltop	1,067 (3,500)
Jackass Flats	4/9/96	557700	4063500	hillside	914 (3,000)
Jackass Flats	4/9/96	558700	4063550	hillside	945 (3,100)
Jackass Flats	4/9/96	559850	4063600	hillside	975 (3,200)
Jackass Flats	4/9/96	559950	4063120	hillside	975 (3,200)
Jackass Flats	5/20/96	560300	4070500	hillside	1,067 (3,500)
Jackass Flats	5/20/96	559900	4071100	hilltop	1,097 (3,600)
Jackass Flats	5/21/96	558300	4061400	hillside	917 (3,010)
Jackass Flats	5/21/96	560820	4069140	hillside	1,048 (3,440)
Jackass Flats	5/22/96	557150	4058700	hilltop	896 (2,940)
Jackass Flats	6/11/97	563000	4073000	hillside	1,097 (3,600)
Jackass Flats	8/28/96	561100	4061600	rock outcrop	975 (3,200)
Kiwi Mesa	7/29/96	568929	4078871	hillside	1,402 (4,600)
Kiwi Mesa	7/30/96	570357	4076054	hillslpe	1,311 (4,300)
Kiwi Mesa	7/30/96	571206	4076058	hillside	1,311 (4,300)
Kiwi Mesa	6/18/97	568918	4078405	hilltop	1,417 (4,650)
Kiwi Mesa	6/18/97	569721	4078884	hilltop	1,509 (4,950)
Kiwi Mesa	6/19/97	569650	4078222	hilltop	1,432 (4,700)
Little Skull Mountain	5/22/96	560749	4065537	hilltop	1,176 (3,860)
Little Skull Mountain	5/28/96	567920	4065660	hillside	1,207 (3,960)
Little Skull Mountain	5/28/96	567498	4065850	hilltop	1,250 (4100)
Little Skull Mountain	5/28/96	567948	4065405	rocks along wash	1,176 (3,860)

Appendix A (continued)

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
Massachusetts Mountains	7/22/96	589060	4079600	hillside	1,036 (3,400)
Massachusetts Mountains	7/22/96	589220	4082180	hillside	1,109 (3,640)
Mercury Valley Pass	4/8/96	582740	4054240	hillside	1,158 (3,800)
Mercury Valley Pass	4/23/96	576000	4060240	hillside	1,128 (3,700)
Mercury Valley Pass	6/18/97	576500	4059100	hillside	1,143 (3,750)
Mercury Pass	4/15/96	591500	4061050	hillside	1,311 (4,300)
Mercury Pass	5/9/96	591600	4061250	hillside	1,280 (4,200)
Mercury Pass	8/28/96	591000	4060600	rock outcrop	1,292(4,240)
Mercury Pass	8/28/96	591700	4060300	hill summit	1,310 (4,300)
News Nob	7/31/96	584800	4089000	hilltop	1,219 (4,000)
Paintbrush Canyon	6/10/97	552038	4084139	hillside	1,341 (4,400)
Pluto Valley	7/31/96	578331	4077139	hillside	1,323 (4,340)
Pluto Valley	7/31/96	576964	4078166	hillside	1,463 (4,800)
Pluto Valley	8/5/96	581845	4077303	hillside	1,158 (3,800)
Pluto Valley	8/5/96	581158	4077529	bottom slope	1,189 (3,900)
Red Mountain	7/30/96	585690	4057311	hillside	1,128 (3,700)
Red Mountain	7/30/96	585514	4056833	hilltop	1,085 (3,560)
Red Mountain	7/30/96	585797	4057586	hillside	1,146 (3,760)
Red Mountain	6/18/97	589180	4059320	hillside	1,219 (4,000)
Rock Valley	4/2/96	573960	4061080	hillside	1,061 (3,480)
Rock Valley	4/8/96	572920	4060620	hillside	1,067(3,500)
Rock Valley	4/23/96	574140	4061365	hillside	1,055 (3,460)
Rock Valley	5/23/96	568200	4061800	hillside	1,067 (3,500)
Little Skull Mountain	5/28/96	567498	4065850	hilltop	1,250 (4100)
Little Skull Mountain	5/28/96	567948	4065405	rocks along wash	1,176 (3,860)
Massachusetts Mountains	7/22/96	589060	4079600	hillside	1,036 (3,400)
Massachusetts Mountains	7/22/96	589220	4082180	hillside	1,109 (3,640)
Mercury Valley Pass	4/8/96	582740	4054240	hillside	1,158 (3,800)

Appendix A (continued)

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
Mercury Valley Pass	4/23/96	576000	4060240	hillside	1,128 (3,700)
Mercury Valley Pass	6/18/97	576500	4059100	hillside	1,143 (3,750)
Mercury Pass	4/15/96	591500	4061050	hillside	1,311 (4,300)
Mercury Pass	5/9/96	591600	4061250	hillside	1,280 (4,200)
Mercury Pass	8/28/96	591000	4060600	rock outcrop	1,292(4,240)
Mercury Pass	8/28/96	591700	4060300	hill summit	1,310 (4,300)
News Nob	7/31/96	584800	4089000	hilltop	1,219 (4,000)
Paintbrush Canyon	6/10/97	552038	4084139	hillside	1,341 (4,400)
Pluto Valley	7/31/96	578331	4077139	hillside	1,323 (4,340)
Pluto Valley	7/31/96	576964	4078166	hillside	1,463 (4,800)
Pluto Valley	8/5/96	581845	4077303	hillside	1,158 (3,800)
Pluto Valley	8/5/96	581158	4077529	bottom slope	1,189 (3,900)
Red Mountain	7/30/96	585690	4057311	hillside	1,128 (3,700)
Red Mountain	7/30/96	585514	4056833	hilltop	1,085 (3,560)
Red Mountain	7/30/96	585797	4057586	hillside	1,146 (3,760)
Red Mountain	6/18/97	589180	4059320	hillside	1,219 (4,000)
Rock Valley	4/2/96	573960	4061080	hillside	1,061 (3,480)
Rock Valley	4/8/96	572920	4060620	hillside	1,067(3,500)
Rock Valley	4/23/96	574140	4061365	hillside	1,055 (3,460)
Rock Valley	5/23/96	568200	4061800	hillside	1,067 (3,500)
Rock Valley	5/23/96	568000	4061500	rock outcrop	1,128 (3,700)
Rock Valley	5/23/96	569700	4061500	rock outcrop	1,036 (3,400)
Rock Valley	5/23/96	569350	4061293	hilltop	1,036 (3,400)
Skull Mountain	5/23/96	570405	4065781	talus slope	1,371 (4,500)
Skull Mountain	5/28/96	567849	4066380	hilltop	1,189 (3,900)
Skull Mountain	5/30/96	572460	4064700	hillside	1,219 (4,000)
Skull Mountain	5/30/96	572019	4062998	hilltop	1,097 (3,600)

Appendix A (continued)

Physiographic Region	Date	UTM Easting	UTM Northing	Topography	Elevation m (ft)
Skull Mountain	7/31/96	569450	4068100	hillside	1,301 (4,270)
Skull Mountain	8/7/96	572521	4070778	hillside	1,414 (4,640)
The Bench	6/17/96	578708	4086396	hilltop	1,493 (4,900)
The Bench	6/17/96	579100	4086600	hilltop	1,554 (5,100)
Wahmonie Flat	7/25/96	579599	4075446	hillside	1,265 (4,150)
Wahmonie Flat	7/30/96	574439	4075521	hillside	1,432 (4,700)
West of Fortymile Canyon	6/26/96	555653	4088709	hillside	1,280 (4,200)

Appendix B

Historical Chuckwalla Data Collected From 1959-1995 on the Nevada Test Site

Physiographic Region	Date(s)	UTM Northing	UTM Easting	Number of Animals	Behavior	Topography	Elevation m (ft)
Alice Ridge	5/13/93	[a]4079029	553457	1	doing pushups	hillside	1,146 (3,760)
Calico Hills	5/25/94	[a]4078823	557019	1	basking	wash	1,188 (3900)
Fortymile Wash	4/21/93	4081000	553800	1	nd	hillside	1,128 (3,700)
Fortymile Wash	6/28/93	4081500	553500	1	in crack of rock	ridgetop	1,158 (3,800)
Fran Ridge	5/8/93	[a] 4073263	552441	1	basking	hillside	1,036 (3,400)
Fran Ridge	6/29/93	[a] 4073260	552440	6	nd	hillside	1,066 (3,500)
Fran Ridge	7/13/93	[a] 4073360	552450	1	nd	hillside	1,036 (3,400)
Fran Ridge	4/14/94	[a] 4073250	552375	1	walking	hillside	1,036 (3,400)
Frenchman Flat[b]	6/15/93[c]	4085500	586820	1	nd	nd	1,158 (3,800)
Hogback Ridge, CP Pass[a]	1959-1962[d]	4087400	585000	nd	nd	nd	1,250 (4,100)
Little Skull Mountain	5/9/95	4068000[e]	561000	1	basking	bajada	1,051 (3450)
2 km NW of Mercury Pass[b]	1959-1962[d]	4062500	594000	nd	nd	nd	1,219 (4,000)
Mercury Valley Pass[b]	June, 1971[f]	4054200	582500	10	nd	nd	1,005-1,036 (3,300-3,400)
Mercury Pass[b]	1959-1962[d]	4060500	591500	nd	nd	nd	1,250 (4,100)
Mercury Pass[b]	1965-1968	4060500	591500	45	nd	nd	1,250 (4,100)
Mercury Pass [b]	4/27/92[c]	4060500	591500	1	nd	nd	1,250 (4,100)

Appendix B (continued)

Physiographic Region	Date(s)	UTM Northing	UTM Easting	Number of Animals	Behavior	Topography	Elevation m (ft)
Mercury Pass [b]	6/3/92[c]	4060500	591500	1	roadkill	nd	1,250 (4,100)
Mercury Pass	8/11/93	4060500	591500	1	nd	nd	1,250 (4,100)
Midway Valley	5/19/93	4079980	550425	1	nd	wash	1,176 (3,860)
Midway Valley	6/13/93	4080480	549400	1	nd	ridgetop	1,310 (4,300)
Midway Valley	6/29/93	4079800	549450	1	under a rock	hillside	1,234 (4,050)
Midway Valley	5/12/94	4080350	549300	3	basking	hillside	1,340 (4400)
Midway Valley	5/26/94	4079800	549800	1	nd	ridgetop	1,280 (4200)
News Nob, CP Pass[a]	1959-1962[d]	4089000	584700	nd	nd	nd	1,219 (4,000)
Red Mountain[b]	1959-1962[d]	4059000	588000	nd	nd	nd	nd
Rock Valley	May, June 1966	nd[f]	nd	10	nd	nd	1,005-1,036 (3,300-3,400)
Rock Valley	May, 1967	nd[g]	nd	6	nd	nd	1,005-1,036 (3,300-3,400)
Roy Ridge	6/17/93	[a]4076692	552790	1	basking	hillside	1,112 (3,650)
Roy Ridge	6/28/93	[a]4076612	552837	1	bloating	hillside	1,112 (3,650)
Roy Ridge	6/26/95	[e]4076540	552800	1	hid under rock	hillside	1,097 (3600)
Yucca Flat, Area 1[b]	1959-1962[d]	4101500	578500	nd	nd	nd	1,310 (4,300)

nd = no data available. References: [a] EG&G/EM 1995c; [b] At these sites, UTMs and elevations were estimated from plotted locations on 1:24,000 USGS topographic maps.[c] DOE/NV, unpublished wildlife data, 1992-93. [d] Tanner and Jorgensen, 1963; [e] DOE/YMP, unpublished wildlife data,1993-95; [f] Sanborne, 1972; [g] Tanner, 1982

Appendix C

Historical Western Burrowing Owl Data collected From 1961-1996 on the Nevada Test Site

Physiographic Region	Date	UTM Northing	UTM Easting	Number of Owls	Burrow Type	Topography	Elevation m (ft)
Frenchman Flat	5/25/90	4067820	589940	1	man-made	piedmont slope	990 (3,247)
Frenchman Flat	4/26/91	4067820	589940	2	man-made	piedmont slope	990 (3,247)
Frenchman Flat	4/2/92	4067820	589940	1	man-made	piedmont slope	990 (3,247)
Frenchman Flat	4/3/92	4067820	589940	2	man-made	piedmont slope	990 (3,247)
Frenchman Flat	4/13/92	4067820	589940	1	man-made	piedmont slope	990 (3,247)
Frenchman Flat	5/1/92	4067820	589940	1	man-made	piedmont slope	990 (3,247)
Frenchman Flat	5/4/92	4067820	589940	1	man-made	piedmont slope	990 (3,247)
Frenchman Flat	5/19/93	4083760	583990	1	none	piedmont slope	1,170 (3,838)
Frenchman Flat	6/2/93	4083760	583990	1	none	piedmont slope	1,170 (3,838)
Frenchman Flat	6/10/93	4083760	583990	7	natural	piedmont slope	1,170 (3,838)
Frenchman Flat	10/16/95	4078540	590380	1	none	basin floor	1,000 (3,280)
Frenchman Flat	3/26/96	4067820	589940	2	man-made	piedmont slope	990 (3,247)
Frenchman Flat	6/26/96	4074777	578251	2	natural	wast	1,250 (4,100)
Frenchman Flat	7/10/96	4074777	578251	2	natural	wash	1,250 (4,100)
Jackass Flats	7/29/96	4074380	568759	1	none	piedmont slope	1,190 (3,903)
Jackass Flats	8/21/96	4077104	555282	1	none	wast	1,090 (3,575)
Jackass Flats	8/28/96	4060870	555370	1	natural	piedmont slope	870 (2,854)
Mercury Valley	9/6/75	4056890	588400	1	none	piedmont slope	1,100 (3,608)
Mercury Valley	5/21/76	4056890	588400	1	none	piedmont slope	1,100 (3,608)
Mercury Valley	7/15/92	4054670	584780	1	none	wash	1,010 (3,313)
Mercury Valley	8/17/95	4056482	587034	2	natural	piedmont slope	1,075 (3,526)
Mercury Valley	5/22/96	4056443	586971	1	none	piedmont slope	1,075 (3,526)
Rock Valley	4/1/71	4060580	572740		none	piedmont slope	1,050 (3,444)
Rock Valley	1972	4060580	572740		none	piedmont slope	1,050 (3,444)
Rock Valley	10/18/96	4060580	572740	1	none	piedmont slope	1,050 (3,444)

Appendix C (continued)

Physiographic Region	Date	UTM Northing	UTM Easting	Number of Owls	Burrow Type	Topography	Elevation m (ft)
Yucca Flat	6/12/90	4110405	579335	2	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	6/28/90	4110405	579335	4	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	6/30/90	4110405	579335	1	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	5/21/91	unknown	unknown	2	none	piedmont slope	unknown
Yucca Flat	6/20/91	4100380	586020	1	none	basin floor	1,230 (4,034)
Yucca Flat	7/8/91	4116940	584740	1	none	basin floor	1,360 (4,461)
Yucca Flat	7/19/91	4116940	584740	5	man-made	basin floor	1,360 (4,461)
Yucca Flat	10/1/91	4114345	580730	1	none	piedmont slope	1,380 (4,526)
Yucca Flat	4/14/92	4113120	582730	1	none	basin floor	1,330 (4,362)
Yucca Flat	4/22/92	4110405	579335	2	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	4/29/92	4110405	579335	1	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	5/21/92	4110410	578375	3	man-made	piedmont slope	1,370 (4,494)
Yucca Flat	6/3/92	4113120	582730	2	none	basin floor	1,330 (4,362)
Yucca Flat	6/8/92	4110400	578515	5	man-made	piedmont slope	1,365 (4,477)
Yucca Flat	7/2/92	4110405	579335	8	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	7/9/92	4111660	585200	8	unknown	piedmont slope	1,300 (4,264)
Yucca Flat	7/22/92	4105580	580000	3	none	piedmont slope	1,310 (4,297)
Yucca Flat	6/10/93	4115225	585060	1	none	basin floor	1,330 (4,362)
Yucca Flat	6/14/93	4093110	589810	1	none	piedmont slope	1,200 (3,936)
Yucca Flat	6/23/93	4110405	579335	3	man-made	piedmont slope	1,340 (4,395)
Yucca Flat	5/10/94	4110050	578285	1	none	piedmont slope	1,375 (4,510)
Yucca Flat	5/10/94	4093000	583170	1	none	piedmont slope	1,220 (4,002)
Yucca Flat	5/23/94	4093000	583170	1	man-made	piedmont slope	1,220 (4,002)
Yucca Flat	6/1/94	4093000	583170	1	man-made	piedmont slope	1,220 (4,002)
Yucca Flat	6/9/94	4110050	578285	1	none	piedmont slope	1,375 (4,510)
Yucca Flat	7/7/94	4110050	578285	1	none	piedmont slope	1,375 (4,510)
Yucca Flat	9/21/94	4099920	579000	1	none	piedmont slope	1,300 (4,264)

Appendix C (continued)

Physiographic Region	Date	UTM Northing	UTM Easting	Number of Owls	Burrow Type	Topography	Elevation m (ft)
Yucca Flat	1/17/96	4100930[b]	579775	2	none	piedmont slope	1,290 (4,231)
Yucca Flat	3/26/96	4100650[b]	587700	2	man-made	basin floor	1,240 (4,067)
Yucca Flat	6/27/96	4104648[b]	588626	1	man-made	piedmont slope	1,300 (4,264)
Yucca Flat	8/13/96	4110412[b]	578087	1	none	piedmont slope	1,380 (4,526)
Yucca Flat, Frenchman Flat	1989	unknown[g]	unknown	7	none	unknown	unknown
unknown	7/7/61	unknown[k]	unknown	1	none	unknown	unknown
unknown	6/16/62	unknown[k]	unknown	1	none	unknown	unknown
unknown	7/27/62	unknown[k]	unknown	1	none	unknown	unknown

[a] Greger and Romney, 1994a; [b] DOE/NV, 1991-96 (unpublished wildlife data); [c] Woodward *et al.*, 1995; [d] EG&G/EM, 1995c; [e] Castetter, 1975-77 (unpublished field notes); [f] EG&G/EM, 1995b; [g] Hill, 1972; [h] Hill and Burr, 1973; [i] Greger, 1994; [j] Greger, 1995; [k] Hayward *et al.*, 1963.

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Appendix D

Documented Trap Locations of Bat Species of Concern on the Nevada Test Site Prior to 1996

Species	Number of Bats	Date(s)	UTM Northing	UTM Easting	Location	Desert Region
Pale Townsend's big-eared bat	5	10/22/63; 11/28/63	[a]unknown	unknown	unknown	unknown
Pale Townsend's big-eared bat	1	7/7/92 [b]	4111880	565300	Camp 17 Pond	Great Basin
Pale Townsend's big-eared bat	1	7/20/93 [c]	4124575	559764	U19 C lower pond	Great Basin
Pale Townsend's big-eared bat	2	8/3/93 [c]	4120440	570400	Gold Meadows Spring	Great Basin
Spotted bat	1	8/18/92	4124575	559764	U19 C [b]lower pond	Great Basin
Long-eared myotis	2	8/18/92	4124575	559764	U19 C low[b]er pond	Great Basin
Long-eared myotis	7	8/3/93	4120440	570400	Gold Me[c]adows Spring	Great Basin
Fringed myotis	1	7/7/92	4111880	565300	Camp [b]17 Pond	Great Basin
Fringed myotis	2	8/17/92	4073570	553800	J-13 [b]Pond	Mojave
Long-legged myotis	7	8/18/92	4124575	559764	U19 C low[b]er pond	Great Basin

[a] Jorgensen and Hayward, 1965; [b] EG&G/EM, 1993; [c] Saethre, 1994.

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APPENDIX E

MAP SOURCE DATA

Transportation, Nevada Test Site boundaries, western states boundaries, and topography data came from USGS 1:100,000 Digital Line Graphs.

Political boundaries of North America came from data provided by Environmental Systems Research Institute, Inc.

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