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4. Species Accounts

This section provides information on the status, life history, habitat requirements, and range of sensitive species that occur, or have the potential to occur, in the project area. Sensitive species include both federal and state listed species, as well as species currently being considered for listing. Information on the distribution and population status of listed species in the project area and surrounding region, as determined through recent survey efforts, published and unpublished literature, management plans, and communication with local experts, is also included. The following criteria were used to determine the list of sensitive species covered in this document and preliminary analysis:

- Species considered in the WMP that are federally or state listed as threatened, endangered, candidate or proposed, and occur or have the potential to occur within the project area. Non-federally listed species considered herein are examined if there appears to be a potential of a future federal listing;

- Species observed in the project area as recorded in the California Natural Diversity Database (CNDDB 2002);

- Species that have the potential to occur in the project area as determined or suggested by USFWS;

- Species on the Ventura USFWS Office list "Listed and Proposed Species That Occur in San Bernardino County, California" that occur or have the potential to occur in the project area.

4.1 Wildlife

4.1.1 Federally-Listed Species

4.1.1.1 Desert Tortoise *(Gopherus agassizii)*

4.1.1.1.1 Legal Status

The USFWS emergency-listed the desert tortoise as endangered on August 4, 1989 (USFWS 1989 [54 FR 32326]). The Mojave population - the species in California, Nevada, Utah, and parts of Arizona north of the Colorado River - was listed in the final rule on April 2, 1990 as threatened (USFWS 1990 [55 FR 12178]). The Sonoran population, the species in the remainder of Arizona, is not listed and does not have protected status under the ESA. On June 22, 1989, the California Fish and Game Commission listed the species as threatened under the California Endangered Species Act (CESA) (California Fish and Game Commission 1989, Section 670.5). On February 8, 1994, the USFWS designated critical habitat for the Mojave population of the desert tortoise (USFWS 1994a [59 FR 5820]), encompassing approximately 6,446,200 acres (2,608,741 ha). One critical habitat unit (CHU), the Superior-Cronese Lakes CHU, intersects the project area (Figure 4-1).

On March 30, 1993, the USFWS released the *Draft Recovery Plan for the Desert Tortoise - Mojave Population* (USFWS 1994b), which identified six, evolutionarily significant recovery units and recommended the establishment of 14 reserves or Desert Wildlife Management Areas (DWMAs). DWMAs act as reserves in which recovery actions will be concentrated. The project area lies partially within the West Mojave recovery unit (Figure 4-1). The Superior-Cronese Lakes DWMA, as proposed in the Recovery Plan, included the Superior Valley Parcel of the withdrawal area. Presently however, due to the military land withdrawal, the area has been removed from inclusion in the proposed DWMA and is no longer represented as being included within the proposed boundaries on DOI maps (BLM 2003).

4.1.1.1.2 Species Description

The desert tortoise is a medium-sized, terrestrial turtle in the Family Testudinidae. Its unhinged shell is colored in shades of brown with faint orange or yellow in the centers of some scutes (the keratinized shell cover). Muted mottling is variously present on the plastron (ventral shell), especially in juvenile tortoises. Rear legs are post-like and the forelimbs are attached to a broad clavicle and have well-developed muscles to maximize digging efficiency. Length ranges from about 1.4 in (3.5 cm) at hatching to 11–16 in (28–40 cm) for adults and the lifetime range in mass are 0.04–15 lbs (0.02–6.8 kg) (Boarman 1994). Males differ morphologically from females in their concave plastron, longer tail, long and upturned gular projection, and large chin glands (Stebbins 1985, Ernst et al., 1994). Boone and Holt (2001) also observed a statistically wider forefoot in males.

4.1.1.1.3 Geographic Range

The desert tortoise is one of five species of North American tortoises, four of which belong to the genus *Gopherus*: *G. agassizii* (desert tortoise), *G. berlandieri* (Texas tortoise), *G. flavomarginatus* (bolson tortoise), and *G. polyphemus* (gopher tortoise). A fifth species, *Xerobates lepidocephalus* (scaley-headed tortoise) is known from southern Baja California, Mexico, and may be a relict descendent of the desert tortoise (Ottley et al., 1989). Only the desert tortoise inhabits the southwest north of Baja California, with a current range extending from Southwestern Utah, west to the Sierra Nevada Range in California and south through Nevada and Arizona into Sonora and northern Sinaloa, Mexico (Ernst et al., 1994; Germano et al., 1994) (Figure 4-2).

4.1.1.1.4 Habitat

The desert tortoise occupies arid habitats below approximately 4,000 ft (1,200 m) in elevation (Karl 1983, Weinstein 1989). Common vegetation associations in the Mojave Desert include creosote bush scrub, saltbush scrub, Joshua Tree woodland, and Mojave yucca communities. In the Colorado and Sonoran deserts of southern California and Arizona, desert tortoises occupy more lush desert habitats, with increased bunch grasses, cacti, and trees; thorn scrub is occupied in the Sinaloan Desert. Because of the burrowing nature of tortoises, soil type is an important habitat component (Karl 1983, Weinstein et al., 1986). In California, tortoises typically inhabit soft sandy loams and loamy sands, although they are also found on rocky slopes and in rimrock that provide natural cover-sites in crevices. In portions of Nevada and elsewhere, where a near-surface durapan limits digging, tortoises often occupy caverns in the exposed caliche of wash banks. Hills with rounded, exfoliating granite boulders often host higher densities than the surrounding flats, especially in Arizona. Valleys, alluvial fans, rolling hills and gentle mountain slopes are inhabited; only playas and steep, talus-covered slopes are avoided.

4.1.1.1.5 Natural History

Activity Patterns and Home Range

Tortoises are ectotherms. Their body temperatures are not controlled by internal mechanisms, but

Figure 4-2: Range wide Distribution of the Desert Tortoise rather by ambient (surrounding) temperatures and their seasonal and daily activity patterns are, in turn, partially similarly dictated. The greatest activity periods are spring and fall, when ambient temperatures remain below lethal thresholds, forage is most available, and reproductive activities occur. Tortoises are essentially inactive during the hot summer months when forage is unavailable and ambient temperatures typically exceed lethal levels for most of the day. Tortoises then remain in burrows except during periods of rain, when they exit to replenish bodily water stores. Tortoises hibernate during the winter. Entry into hibernacula begins in mid to late October, with 98 percent of tortoises in burrows by mid-November (TRW 1997a). Most tortoises exit hibernacula from March through early April. Tortoises are diurnal (active during the day) and during the activity season may be active aboveground when the ground surface temperature is less than approximately 43°C (109°F) (Karl 1992) to 45°C (113°F) (Zimmerman et al., 1994). Above-ground activity was estimated at only 1.7 percent of the year in one study (Nagy and Medica 1986), but this is probably an underestimate based on the small sample size in the study (11 tortoises) and limited sampling intensity (1-several days at 2–4 week intervals).

Tortoises are opportunistic in their burrowing habits, burrowing into hillsides and using rock caverns where available, and altering the burrows of other burrowing species, such as kit and gray foxes, rodents, and hares. Burrows may extend several feet deep, are generally more or less straight, and are dug at a gentle slope; vertical depths below the soil surface at the end of a burrow are typically less than a meter (e.g., Burge 1978). The deepest burrows are used in winter for thermal buffering; the greatest short-burrow use (including pallets) occurs in spring (TRW 1997b).

Several reports of the mean number of burrows used in a year of average or better forage are similar: 6.2–13.8 (range: 2–18) (Duda et al., 1999) and 11.7 (range: 4–23) (TRW 1997b). Bulova (1994) reported 9.1 burrows (range: 3–18) for only a five-month period from June to October. An average of 4.8 new burrows may be constructed per year; more new burrows will be constructed following a winter of heavy rainfall with concomitant collapse of existing burrows (TRW 1997b). There was no significant difference between males and females in the number of burrows used, although the pattern of use was different, probably due to reproductive activities (Bulova 1994, TRW 1997b).

Tortoises tend to use a group of burrows, then move to another group, and so on (Rautenstrauch and Holt 1995). Generally, males have been shown to have larger home ranges than females in studies of sufficient length and sample size (O'Connor et al., 1994; TRW 1999). Using Minimum Convex Polygon techniques, home ranges were calculated as 43.5 acres (range: 4.7–143.3 acres) (17.6 ha; range: 1.9–58.0 ha) for adult females and 111.6 acres (range: 10.4–487.8 acres) (45.2 ha; range: 4.2–197.5 ha) for males, in a three-year study when tortoises were recaptured at least 50 times/year (TRW 1999). By contrast, home ranges were substantially smaller in studies with sample sizes of <21 tortoises and/or short study length (e.g., 5 months for O'Connor et al., 1994): 18–26.4 acres (range: 2.0–84.5 acres) (7.3–10.7 ha; range: 0.8–34.2 ha) for adult females in years of average or better forage levels and 19–65.2 acres (range: 9.1–108.9 acres) (7.7–26.4 ha; range: 3.7–44.1 ha) for adult males (Burge 1977, Barrett 1990, O'Connor et al., 1994, Duda et al., 1999). Home ranges for both genders (Duda et al., 1999) or for males only (TRW 1999) decreased significantly in drought years.

Foraging Behavior

Desert tortoises are herbivorous, although they have commonly been observed consuming soil and, occasionally, lichen (Henen 1993, TRW 1995) bones (TRW 1995), canid scat, lagomorph scat (TRW 1995) and bovid scat (Bostick 1990). Forage typically comprises annual forbs and grasses, as well as perennial grasses and succulent perennials, including cacti. An annual diet may include many species (43 [Esque 1991], 45 [TRW 1995], and 61 [Esque 1993]), but only a few species account for the majority of biomass consumed. While there is a high correlation of a forage species' availability to its percentage of the diet (Avery 1992), preferences do not always reflect availability. The Mojave Desert is dominated by exotics, in particular, the annual grass, split-grass (*Schismus arabicus*). In combination with other annual grasses (e.g. red brome [*Bromus madritensis rubens*]) and forbs (filaree [*Erodium cicutarium*]) exotics are observed to comprise a high percentage of most tortoise diets; they were preferred forage items in several studies (Esque 1993; Avery 1993; TRW 1995). This foraging pattern strongly correlates with seasonal and annual drought, when exotics may be the only species available. For instance, in below-average rainfall years, few species may germinate except for exotics, which have high germination potential and low water requirements (Beatley 1966). Similarly, during spring, plants begin to dry out as temperatures increase in mid-season, but non-native biomass remains relatively high. Oftedal et al. (2002) observed that in a year of high rainfall when native annuals were readily available, juvenile tortoises preferentially chose several native annuals over split-grass, despite extreme dominance of the latter.

One study found no significant difference in the nutritional quality between groups (e.g., forbs, grasses) of native and non-native annual species (Shemanski et al., 2002). Again, such a study may not account for diet preference in years of high forage availability. Oftedal et al. (2002) showed that in a year of high annuals production, wild juvenile tortoises selected a diet that was an order of magnitude more nutritious than the cumulative available forage base. So, while non-native species are consumed, and some are relatively nutritious, the availability of high quality forage items in years of good forage, including native species, may be important for tortoise growth, maintenance, and reproduction.

Reproduction

Mojave Desert tortoises lay eggs from early May through mid-July (Karl 1998a, Wallis et al., 1999). The incubation period is 80–112 days (Mueller et al., 1998), with hatchlings emerging in late summer and early fall. Annual fecundity for Mojave tortoises is correlated with tortoise length (Karl, 1998a, reported this correlation for non-drought years only). As such, reports of average annual fecundity depend on female size in the study cohort. In four studies, average annual fecundity was reported as 6.6 eggs, 7.1 (Karl 1998a) 7.0, 7.3 (Wallis et al., 1999) and 8.2 (Mueller et al., 1998). Karl (1998a) reported an annual fecundity for tortoises over 188.4 mm in length of 5 eggs, plus 1 egg for every 14.4 mm increments in length. The smallest size at first reproduction in wild tortoises is 180 mm (Karl 1998a), which may be reached when a tortoise is 16–20 years of age (Miller 1955, Nichols 1953, Medica et al., 1975, Turner et al., 1987, Karl 1998b). There is no reproductive senescence – tortoises continue to reproduce until they die, with no decrease in reproductive output with age. In fact, reproductive output increases as tortoises continue to grow with increasing age (i.e., indeterminate growth). Annual clutch frequency ranges from 1.5–1.8 (Karl 1998a, Mueller et al., 1998, Wallis et al., 1999).

4.1.1.1.6 Threats to Survival

Listing of the desert tortoise was prompted by precipitous declines in several populations throughout the Mojave portion of the species range (USFWS 1990 [55 FR 12178]). The emergency listing package for the desert tortoise identified population declines of at least 10 percent annually for the previous six years at eight sites in the western Mojave Desert (USFWS 1989 [54 FR 32326]). Concern that an upper respiratory disease, initially labeled as "URDS" (Upper Respiratory Disease Syndrome), was responsible for the declines and could be epidemic further prompted the listing. The final rule, listing the desert tortoise as threatened under the ESA, identified habitat loss and degradation, as well as excessive predation and illegal collections as major threats to the continued existence of the tortoise. Specific activities cited as contributing to these factors included urban expansion, mine development, energy generation facilities and waste facilities, military activities, grazing, ORV, and highway construction. The *Desert Tortoise Recovery Plan* (USFWS 1994b) also concluded that desert tortoise populations in the Mojave region were threatened by the cumulative effects of disease-related mortality, habitat destruction and degradation, and population fragmentation. Threats of disease, drought, and anthropogenic effects are discussed further below, and in Luke et al. (1991), USFWS (1994b), Boarman (1999), and Lovich and Bainbridge (1999).

Disease

URDS was subsequently re-designated as Upper Respiratory Tract Disease (URTD). URTD may be variously expressed by rhinitis, a serous to purulent nasal discharge, conjunctivitis, edema of the eyelids and ocular glands, sunken eyes, and/or dull skin and scutes (Brown et al., 1994; Schumacher et al., 1997). Lethargy and anorexia, leading to dehydration, emaciation, and eventual death may result, depending on the virulence of the particular strain (Brown et al., 1999). *Mycoplasma agassizii* is the pathogenic agent causing URTD in desert tortoises and gopher tortoises (Brown et al., 1994 and 2001) and "mycoplasmosis" has become an interchangeable term with URTD. Other *Mycoplasma* species may also be pathogenic (Homer et al., 1998) as well as several opportunistic nasal and cloacal bacteria, including *Pasteurella testudinis, Pseudomonas* sp., *Aeromonas hydrophila, Klebsiella oxytoca* (Jacobson et al., 1991, Snipes et al., 1995), *Citrobacter* sp., *Xanthomonas maltophilia* (Homer et al., 1998) and *Salmonella* spp. (Dickinson et al., 2001). Herpes virus has also been diagnosed in wild and pet captive tortoises (Harper et al., 1982, Pettan Brewer et al., 1996, Johnson et al., 2002b, Origgi et al., 2002).

Tortoises with clinical signs of mycoplasmosis were first identified on the Desert Tortoise Natural Area (DTNA) in the west Mojave in 1988 (Peterson 1994). Subsequent surveys in 1988 and 1989 identified that the disease was widespread in the west Mojave (Jacobson et al., 1991) and that a high percentage of the population was infected (Knowles 1989). During this period, dramatic declines in tortoise populations were observed, including a 90 percent decline of adult tortoises at the DTNA from 1988 to 1992 (Berry 1997). As mycoplasmosis studies continued, the disease was found at many sites throughout the Mojave Desert (Lederle et al., 1997, Homer et al., 1998, Christopher et al., 2002).

It has been speculated that URTD may have been introduced into wild populations by released pets (Jacobson 1997). Johnson et al., (2002a, b) observed that 81 percent of 183 pet tortoises from Barstow and the surrounding towns tested positive for *M. agassizii* exposure. Marlow et al. (1997) conducted a survey in southern Nevada and observed the highest occurrence of symptomatic tortoises adjacent to urbanized areas and highways. However, *M. agassizii* most likely evolved with its host and has been present in desert tortoises since the late Pleistocene (Brown, M.B. pers. comm. To Karl, A., February 2003); this would be consistent with typical *Mycoplasma*-host relationships. As such, it would be present throughout the species range, generally subclinically, maintaining its persistence and spread via outbreaks during periods of stress to tortoises. Consistent with this hypothesis is the observation that numerous tortoises have tested positive for exposure to *M. agassizii* and/or had clinical signs in many remote locations where introductions of pet tortoises would be highly unlikely or not occurring, including, but not limited to, the Goffs, Ivanpah (Christopher et al., 1997, 2002), and Yucca Mountain (Lederle et al., 1997) study sites. It is likely, then, that disease outbreaks are the natural result of physical stress and immunodepression due to drought-related dehydration and starvation. In fact, most disease researchers have hypothesized that drought may be an associated or pre-disposing factor to URTD (Christopher et al., 1997, Jacobson 1997, Lederle et al., 1997, Berry et al., 2001, Lance and Rostal 2002 and 2003). This does not negate, however, the possibility that the disease may be exacerbated in certain locations by releases of pets or by other unnatural stressors such as habitat loss, habitat degradation and habitat fragmentation. Mortality associated with the disease will vary depending on the virulence of individual strains of *M. agassizii* (Brown et al., 1999) and the environmentally-influenced physiological condition of the tortoise.

A comparison of the Yucca Mountain, Nevada, study site to a Las Vegas Valley site may illustrate both the natural presence of *M. agassizii* in tortoise populations and the association between environmental conditions and the expression of mycoplasmosis. Yucca Mountain is approximately 94 mi (150 km) northwest of Las Vegas and is an isolated area that has been closed to the general public for 30 years. Tortoises tested seropositive (positive for exposure to *M. agassizii*) in 19 percent of 283 samples, but only 2 percent of the samples exhibited clinical signs consistent with mycoplasmosis (Lederle et al., 1997). This three-year study occurred during a period of average to above-average precipitation (i.e., average to abundant forage). By contrast, 53 percent of seropositive tortoises in a Las Vegas Valley study conducted during a drought exhibited clinical signs (Schumacher et al., 1997). This association of clinical signs with drought is consistent with observations in the far west Mojave, where 43 percent of 468 live tortoises showed clinical signs of mycoplasmosis during drought in a 1989 survey of the Rand Mountains and Fremont Valley (Knowles 1989).

In conclusion, mycoplasmosis is thought to be a major factor in population declines in the Mojave Desert (Jacobson et al., 1995, Brown et al., 1999). The microorganism is probably naturally occurring, but the virulence and spread may be influenced by pet releases, especially localized to desert cities (e.g., Barstow, Las Vegas) or high-profile areas (e.g., the DTNA). The link between environmental stress factors and mycoplasmosis has not been successfully defined, but it is generally agreed that physical stress would increase tortoises' susceptibility to the disease.

A second disease, cutaneous dyskeratosis, was first observed on the Chuckwalla Bench study plot in 1982 (Berry 1990), although earlier photographs from the site identified the presence of the condition as early as 1979 (Jacobson 1994). This site experienced a mortality rate of 12.2 percent (based on shell remains) between 1977 and 1982 and a 70 percent loss of adults between 1982 and 1988 (Berry 1990).

Cutaneous dyskeratosis is a disease characterized by shell lesions, with a loss of integrity in the cornified layers of the affected scutes (Jacobson et al., 1994). The cause is unclear but does not appear to be consistent with infection, and bacterial or fungal colonizations are probably secondary (Jacobson 1997). It may be a deficiency disease (Jacobson 1997) and may be associated with liver disease (Homer et al., 1998). Population effects have not been determined (Homer et al., 1998).

Drought

Despite the fact that the link between drought and mycoplasmosis has not been unequivocally defined, drought has been independently identified as a major cause of desert tortoise mortality (Peterson 1994; Christopher et al., 1997; Karl 1998c, 2002a, b, Appendices C and D of this BA, respectively). The Mojave Desert has experienced unusually severe drought in the last 14 years. In the west Mojave, 7 of the last 14 years have been spring drought years with either negligible or well below-average forage production. In the east Mojave, drought has occurred 8 of the last 14 springs (United States Department of Commerce, National Oceanic and Atmospheric Administration 1981-2002 [USDC NOAA 1981-2002]).

The California portion of the Mojave Desert has a winter-dominated precipitation pattern, which produces spring tortoise forage; summer storms are highly unpredictable in both their occurrence and intensity. Furthermore, few of the annuals germinated by summer rains comprise tortoise forage, although perennial grasses, which provide forage but are relatively rare, may produce new shoots in response to summer rain. Tortoises rehydrated by standing water from summer storms may also be able to consume dried winter annuals. In summary, then, Mojave Desert tortoises rely primarily on spring forage for maintenance, growth and reproduction. In two cases in the west Mojave the droughts spanned two or more years; this has occurred in three cases in the east Mojave. While the desert tortoise is adapted to seasonally dry conditions and intermittent annual drought, frequent drought years within a relatively short period result in high desert tortoise mortality. This is especially true where the drought spans two consecutive years. This result has been observed by field workers (e.g., Henen, B.; Medica P.; and Peterson C., pers. comm. to Karl, A., unpublished field notes, April 1996).

With the exception of Chuckwalla Bench (see Table 4-1), the most dramatic documented declines in desert tortoise populations have occurred during this drought cycle. For instance, the 90 percent decline of adult tortoises observed at the DTNA from 1988 to 1992 (Berry 1997) coincided with severe drought in 1989 and 1990. High mortality at the Ivanpah site was also attributed to this two-year drought (Peterson 1994, Christopher et al., 1997). Losses of 18.4 percent of 76 tortoises (Turner et al., 1984), 60 percent of 10 adult tortoises (Nagy, K. pers. comm. to Karl, A. October, 1996), and 39.2 percent of 125 tortoises (Berry 1995) were observed during other studies associated with drought. Annual mortality rates for larger immature and adult tortoises, which are considered normal at approximately 2 percent (Turner and Berry 1984), were 24 percent for adult tortoises (Germano and Joyner 1994), 30 percent for adult females (Karl 1998c), and 10.8–46.5 percent for adults (Karl 2002a, Appendix C of this BA) during drought. Observations such as Karl's (2002a, Appendix C), in which 31 of 97 dead tortoises that died during a drought, supports the hypothesis that tortoises experience high mortality during drought from internal causes, such as starvation, dehydration, or disease. In the only study (Ivanpah) where physiological attributes were monitored, causes of death were consistent with extreme dehydration and/or starvation (Peterson 1994, Christopher et al., 1997). Less direct effects of drought are also evident in reduced reproduction, both during a year of reduced forage (Turner et al., 1984, Henen 1993; Henen and Nagy 1995, Karl 1998a, Lovich et al., 1999, and Averill-Murray and Klug 2002) and as a residual effect the following year (Karl 1998a). If the drought is sufficiently severe, no reproduction will occur (Karl 1998a, Lovich 1999). During drought years, females may face a tradeoff between reproduction and body condition; if total body water is too low, egg production is forfeited to increase total body water (Henen 1995). Growth tradeoffs were also evident in smaller females (Karl 1998a).

Drought is undoubtedly a critical contributing factor to the recent declines in tortoise populations. It directly results in increased mortality and indirectly reduces recruitment into the population. It may contribute to other factors that are directly responsible for tortoise mortality, such as mycoplasmosis. Peterson (1994) also identified that predation on adult desert tortoises by coyotes, probably due to prey switching as a result of the drought, was a major source of mortality at his DTNA site between 1988 and 1990. The extent to which drought is a proximate factor or an ultimate factor in desert tortoise mortality is unknown, but it is substantial overall. Habitat alteration by long-term grazing and the current dominance of exotic annual species throughout much of the desert may have contributed to drought impacts. However, drought has an undeniably severe impact in and of itself. In a Sinaloan, Mexico site where desert tortoises have experienced high mortality during recent droughts, there is little to no introduction of exotic vegetation (Rodriguez Garcia, F. pers. comm. to Karl, A. October 2002).

Table 4-1: Plot Declines Reported for BLM Trend Plots and Associated Drought Conditions (Source: Karl 2003)

PLOT	OBSERVED POPULATION DECLINE	ASSOCIATED DROUGHT
Beaver Dam Slope, Utah and Arizona	1981–1986: Capture rates decreased by 62 percent for tortoises ≥140mm MCL[1] (Coffeen and Welker 1986)	1981: Onsite drought reported (Coffeen and Welker 1986).
Chemehuevi Valley and Wash, San Bernardino County, CA (east Mojave)	1992–1999: Density declined from 88 to 6 tortoises/km^2. Over 300 shell remains were collected for this 7-year period. (Berry et al., 2001)	1992–1999: Droughts occurred in 1994, 1996, 1997, and 1999 (USDC NOAA 1981-2002; Karl, field notes). Drought severity on the plot is unknown.

Chuckwalla Bench, Riverside County, CA	1977–1982: 120 carcasses of tortoises ≥140mm MCL were found (12.2 percent annualized mortality rate). 1982–1988: capture rates for tortoises ≥140mm MCL statistically decreased and 160 carcasses were recovered (8.3 percent annualized mortality). (Berry 1990)	Data for nearby Eagle Mountain show that 1977 was a severe drought (California Department of Water Resources 1981) 1987 had below-average rainfall (USDC NOAA 1981-2002).
DTNA Interpretive Center, Kern County, CA (west Mojave)	1985–1989: 111 tortoises of all sizes died (Berry 1990).	Data from nearby Mojave show that the springs of 1984, 1987, and 1989 were moderate to severe drought years (51, 41, and 90 mm below mean precipitation for previous winter, respectively) (USDC NOAA 1981-2002).
DTNA Interior Plot	1982–1988: 81 tortoises (mostly adults) died (Berry 1990) (6 percent annualized mortality). In 1989, 40 of 149 tortoises marked in 1988 were found dead (Berry 1990) (26.8 percent annualized mortality).	See above.
DTNA Interior Plot plus Health Investigations Plot	1988–1992: 90 percent mortality in adults (Berry 1997)	Data from nearby Mojave show that the springs of 1989 and 1990 were severe drought (USDC NOAA 1981-2002).
Fremont Peak, Kern County, CA (west Mojave)	1985 and 1993: Significant decline in adult tortoise densities between plot surveys (Berry 1996 in BLM 2003)	See DTNA, above.
Fremont Valley, Kern County, CA (west Mojave)	1981–1987: 66 carcasses of tortoises ≥140mm MCL were recovered (Berry 1990) (8.2 percent annualized mortality).	
Goffs, San Bernardino County, CA (east Mojave)	1994–2000: Densities declined from 173 to 34 tortoises/km^2; many shell remains were present (Berry et al., 2001)	See Chemehuevi Valley and Wash, above.

Johnson Valley, San Bernardino County, CA (west Mojave)	1980 and 1990: Significant decline in adult tortoise densities between plot surveys (Berry 1996 in BLM 2003)	Data from nearby Mojave show that the springs of 1984, 1987, 1989 and 1990 were moderate to severe drought years (USDC NOAA 1981-2002).
Kramer Hills, San Bernardino County, CA (west Mojave)	Significant decline in adult tortoise densities between plot surveys in 1982 and 1991 (Berry 1996 in BLM 2003)	
Upper Ward Valley, San Bernardino County, CA (east Mojave)	51 carcasses of tortoises ≥140mm MCL were found that were estimated to have died between 1992 and 1995 (Berry 1995) (15 percent annualized mortality rate)	A moderate drought occurred in 1994 (USDC NOAA 1985-2002), although it was not severe enough a few miles north to result in increased mortality rates (Karl, field notes)

Anthropogenic Effects

Development for urban, waste facility, energy, agriculture, transportation, and mining purposes, plus recreation, military training, and grazing are also responsible for direct tortoise losses, habitat loss, habitat degradation, and habitat fragmentation. Antelope Valley in the western Mojave Desert is the most broadly urbanized area in the Mojave Desert. This valley is characterized by numerous cities, towns, highways, industry, Edwards Air Force Base, several airports, agriculture and old-fields, numerous cleared lots, and an expanding human population (USFWS 1994b). Only 90 mi^2 in a 225 mi^2-area surrounding the City of Lancaster were undeveloped in 1991 (Tierra Madre 1991 in USFWS 1994b). Very few tortoise sign have been observed in the Antelope Valley (USFWS 1994b) and the sign that has been observed is likely to be from released captives.

The actual conversion of habitat into uses associated with urban growth (e.g., housing, shopping and business centers, schools, hospitals, parking lots) results in potential loss of individual tortoises, habitat loss, and habitat fragmentation. It is also accompanied by reduced habitat quality near urban areas due, in part, to recreation, illegal trash dumping, dogs, landfills, and increased levels of certain subsidized predator populations. Impacts occur not only at the main urban use areas, but also with associated linear facilities (e.g., pipelines, transmission lines) that provide vital services to the developed areas. With the exception of agriculture, other recent land uses are generally accompanied by conservation measures to mitigate some or all of the impacts to desert tortoises and other species.

Roads that are constructed, improved or expanded to accommodate these various forms of development extend their impacts. Data from several studies (Nicholson 1978, Karl 1989, Boarman 1994, LaRue 1993, Marlow et al., 1997) strongly support the hypothesis that heavily traveled roads are mortality sinks for tortoises, based on decreased tortoise densities and carcass counts next to roads. Because of the dissecting nature of roads through habitat, they can result not only in lower tortoise densities nearby but also fragmented populations.

Common ravens are natural predators of juvenile tortoises, the shells of which are commonly found below raven roosts and nests in the desert (e.g., fence posts, transmission line towers, telephone poles, Joshua trees). One oft-repeated observation reported over 250 shells below one active raven nest in the west Mojave (Woodman and Juarez 1988 and unpubl. data cited in Boarman 2002). Between 1968 and 1992, raven populations in the Mojave Desert increased by over 1,000 percent due to increased food, water and nesting sites from landfills, highways, urban expansion, agriculture, transmission lines, and other artificial structures (Boarman and Berry 1995). Effects of raven depredation on surrounding tortoise populations are not quantified, but it is clear that it occurs at unnatural levels, subsidized by human activities.

Livestock grazing has been ongoing in the western deserts since the mid-1800s. As of the early 1980s, livestock grazed on 4.5 million acres (1.8 million ha) of the CDCA and impacted 93 percent of existing desert habitat in California (Luke et al., 1991). It has generally been difficult to detect distinct negative effects of livestock grazing on desert tortoises (Turner et al., 1981, Medica et al., 1982, Oldemeyer et al., 2000). However, Avery (1998) identified direct competition for forage between tortoises and cattle and grazing in poor-forage years may result in reduced forage levels below the threshold required for tortoise reproduction (Tracy et al., 1994). Burrow crushing by livestock has also been documented (see Boarman 1999 for review). Grazing's negative effects on other taxa have also been demonstrated (Beatley 1966). Less easily measured are the substantial changes in the historical composition of plant communities in the arid southwest that occur as a result of grazing. Coombs (1979) observed that cattle exclosures on the Beaver Dam Slope, Utah, had healthy stands of perennial grasses, compared to adjacent grazed areas. Both Hohman et al. (1978) and Luke et al. (1991) found evidence in the literature suggesting that the Mojave Desert was formerly shrubby, perennial grassland in the early late 1800s to early 1900s. Currently, there are few perennial grasses remaining, except in highly localized sites. The importance of perennial grasses to tortoises may be largely related to their low potassium levels and relatively high water content compared to annual species (Minnich 1977), although little is known because of their rarity in tortoise habitat.

Losses of perennial grasses may be the result of preferential grazing as well as the introduction and dominance of Mediterranean, annual plant species by grazing (Luke et al., 1991; Boarman 1999). These highly competitive introduced species may reduce the amount of water and nutrients available for use by perennials (*cf* Brooks and Santos 2003), as well as increasing the fuel for wildfires. Proliferating exotic annuals are responsible for increased numbers of wildfires in the Mojave Desert (Brooks and Pyke 2001, Brooks and Esque 2002) and resultant loss of native habitat for tortoises.

OHV recreation has proliferated in the southwestern desert since the mid twentieth century (USFWS 1994b). While there are "Open" areas set aside by BLM for OHV recreation, illegal activities as well as ingress into previously inaccessible areas, facilitated by transmission line access roads and pipeline construction, are well-documented (USFWS 1994b, Boarman 1999). Direct and indirect impacts to desert habitat are numerous and well documented. They include habitat destruction and degradation in the forms of vegetation removal and damage, proliferation of exotic annual vegetation, wildfire facilitation, soil compaction, soil erosion, and destruction of cryptobiotic soil crusts (Luke et al., 1991, Boarman 1999). For tortoises, OHV impacts can result in lost food, cover, and burrowing potential. Direct crushing of individuals and burrows by OHV activity has been documented (Boarman 1999) and negative effects on tortoise density, as well as on other reptiles, mammals and birds, were statistically significant at several sites (Luke et al., 1991).

4.1.1.1.7 Population Status in the Action Area

General Methods to Determine Tortoise Densities

Three methods have been employed to determine tortoise densities: plot studies, transects, and line distance sampling. Plot studies use labor-intensive, mark-recapture techniques to determine tortoise density (i.e., number of tortoises per unit area) at a single, small site (e.g., 1 km^2, 1 mi^2). The density estimates are generally assumed to be accurate, although precision of the estimate may be low, especially in low-density populations or due to other sampling artifacts (e.g., observer experience, drought). Because tortoise distribution can be extremely patchy, the results obtained at one site cannot be easily extrapolated to surrounding, unsampled sites (Karl 2001, Appendix E of this BA).

The transect method uses belt transects, typically 33 ft (10 m) wide by 1.5 mi (2.4 km) long, walked at various sampling rates (e.g., one transect per square mile) to sample broad areas. All observed tortoise sign is recorded along the belt transect and the results are correlated to sites of known tortoise density. With the exception of expansion area transects conducted at Fort Irwin in 2001 and 2002 (Karl 2002a and b, Appendices C and D of this BA), most transect studies have been conducted at sampling intensities of typically <1 to 1 transect/mi^2; a few studies have sampled at a rate of 2 transect/mi^2. At these sampling rates, which amount to <1 percent of a square mile, and for a variety of other biological and statistical reasons, transects have generally been poor predictors of tortoise density (see Karl 2001, Appendix E of this BA, for a review), despite the fact that they have been commonly used to both estimate tortoise densities over broad areas and provide support for management decisions. The value of such transects has been in providing a general idea of regional tortoise abundance (e.g., "hot spots" and low density areas) and distribution and identify areas for further study. For the 2001 and 2002 Fort Irwin expansion area studies, transect sampling techniques incorporated several statistical and sampling improvements over previous studies, including increasing the sampling rate to 10 transects/mi^2. Based on the extremely high correlation values between sign counts on transects and known tortoise densities, these transects were reliable predictors of tortoise density.

The third method, line distance sampling, uses a different kind of transect and cumulative results to determine the abundance of tortoises in a region (e.g., the number of tortoises in the Superior-Cronese Lakes DWMA). This method was adopted by USFWS in 2000 to assess tortoise abundance and temporal trends in CHUs of the Mojave population and was implemented range-wide in 2001 in this population, although it was used locally in Utah before 2001 (McLuckie and Fridell 2002). While the method has historically been applied successfully to other species (Buckland et al., 1993), desert tortoises have presented several species-specific difficulties for the method, largely because (1) tortoises are underground much of the year and more during drought years, (2) densities of this widespread species are low throughout much of its range, especially following the recent declines, and (3) population growth rates are naturally low, which makes significant upward trends in population sizes difficult to detect. As such, the method has undergone several revisions since in its application to desert tortoises (Anderson and Burnham 1997). Data for the first few years of the survey are still being analyzed and results are not yet available (Medica P., USFWS, pers. comm. to Karl, A., January 2003).

4.1.1.1.7.1 Historic Population Densities

Systematic attempts to determine the range and density of desert tortoises in the Mojave Desert began in the late 1970s by the BLM. Coarse measures of the status of desert tortoise populations on a landscape scale were primarily obtained from belt transects at the sampling rate of 0.3–1 transect/mi^2. Long-term mark-recapture plots were established to identify spot densities and population trends; data from habitat condition and human uses and from other special studies augmented the transect and plot data (Berry and Nicholson 1984a). In the project area, other studies included the transect study by Woodman et al. (1990), who ran 255 transects on Fort Irwin and Goldstone to estimate tortoise densities in 1983; the sampling rate was approximately 0.7 transects/mi^2. The USFWS also conducted 90 BLM-type transects at the sampling rate of 0.3 transects/mi^2 in 1988 south of the UTM 90 Area and in areas that are now withdrawn (USFWS 1988). The purpose of the latter survey was to estimate tortoise densities for an earlier Fort Irwin expansion proposal. While the tortoise densities estimated by the transect studies are not defensible (see discussion in *General Methods to Determine Tortoise Densities,* above), they are presented here as identified by the respective authors in order to provide a relative picture of abundance (e.g., low, medium, high).

West Mojave Region

Berry and Nicholson (1984a) estimated that the western Mojave Desert contained broad areas with densities of desert tortoise ranging from <20 to >250 tortoises/mi^2 (8–96 tortoises/km^2). While the total number of tortoises in the western Mojave could not be reliably determined from their transect sampling techniques and highly localized mark-recapture plots, they did identify three areas where high tortoise densities were suggested from the data, potentially from 100 to over 250 tortoises/mi^2 (37 to over 96 tortoises/km^2) (Figure 4-3). Two of these high-density areas were extensive and encompassed much of the future Fremont-Kramer DWMA. These high-density areas, or "core" tortoise populations, occur in areas containing the resources necessary to support large tortoise populations during periods of favorable environmental conditions. Core populations tend to be persistent through time (Brown 1995), whereas satellite populations, in which resources may be less predictable or scarcer, may be more fragile and prone to localized extirpation.

Proposed Superior-Cronese Lakes DWMA

Tortoise densities in the proposed, original Superior-Cronese Lakes DWMA were estimated in the late 1970's and 1980's to range from 0 to over 250 tortoises/mi^2 (0 to >96 tortoises/km^2) from transect studies (Berry and Nicholson 1984a, USFWS 1988). One core (high density) population was entirely within this DWMA and a second overlapped the Superior-Cronese Lakes and Fremont-Kramer DWMAs (Figure 4-1).

Project Area

In the Superior Valley parcel of the withdrawal area, tortoise densities estimated from transects were low, estimated at primarily 0–50 tortoises/mi^2 (0–19 tortoises/km^2); the northwestern corner was estimated to represent 20–50 tortoises/mi^2 (8–19 tortoises/km^2; Berry and Nicholson 1984a) or 51–250 tortoises/mi^2 (20–96 tortoises/km^2; USFWS 1988). The Calico BLM trend plot, immediately south of the Superior Valley portion of the withdrawal area, was estimated to have only 30 tortoises/mi^2 (12 tortoises/km^2) (Berry and Nicholson 1984b).

Transects in the Eastgate portion of the withdrawal area were interpreted to have low to very low tortoise densities: 0–20 tortoises/mi^2 (0–8 tortoises/km^2; Berry and Nicholson 1984a) or 0–50 tortoises/mi^2 (0–19 tortoises/km^2; USFWS 1988).

In the UTM 90 Area, densities were estimated by transects as 0–50 tortoises/mi^2 (0–19 tortoises/km^2) by Berry and Nicholson (1984a). USFWS (1988) estimated tortoise densities immediately south of the UTM 90 Area, west of the Alvord Mountains, and at the southeastern corner of Fort Irwin as moderate to high: 51–250 tortoises/mi^2 (20–96 tortoises/km^2). The remainder of the area south of Fort Irwin was considered to represent very low densities: 0 or 0–50 tortoises/mi^2 (0–19 tortoises/km^2).

While the techniques used were inadequate to reliably estimate tortoise densities, the results of the surveys nonetheless suggested that densities were very low in the future Superior Valley and Eastgate expansion areas in the late 1970s and 1980s. Densities along the southern UTM 90 Area were too broadly categorized to identify any specific high-density areas, but suggested that the tortoise populations might be somewhat higher than elsewhere surrounding Fort Irwin. No core areas could be identified from surveys in the project area, even though techniques were similar or identical to those used by Berry and Nicholson (1984b) for the remainder of the west Mojave area, in which core areas were identified.

4.1.1.1.7.2 Recent and Current Densities

Several transect and plot studies were completed in the west Mojave region since the drought cycle began in approximately 1989. They are summarized in Table 4-2.

West Mojave Region

Using standard BLM transects, the BLM surveyed 3,615 square miles of the western Mojave Desert from 1998–2002 to identify low, moderate, and high-density tortoise areas (BLM 2003). While analyses are incomplete and the methods aren't adequate to identify densities, a pattern of decline in the general tortoise abundance in the western Mojave Desert from the early 1980s was evident (compare Figures 4-3 and 4-4). Sign counts on transects were generally lower in the proposed DWMAs in the late 1990s, with fewer sign found on a greater proportion of transects than in the 1970s and 1980s (BLM 2003). For instance, there were 180 mi^2 in the West Mojave Plan Area estimated to support more than 250 tortoises/mi^2 in 1984, whereas no sign counts were found in 1998 or 1999 equal to this density level; 1,400 mi^2 in 1984 were estimated to support 50 or more tortoises/mi^2, compared to only 53 mi^2 in 1998 and 1999 (BLM 2003). Seven of nine

Figure 4-3: Historic Core Tortoise Populations in the West Mojave Region

Figure 4-4: 1990 – 2001 West Mojave Plan Tortoise Sign Surveys

Map located in pocket in back of BA

BLM plots experienced significant declines in the western Mojave Desert by the 1980s and 1990s (Berry 1996 in BLM 2003).

Table 4-2: Summary of Methods Used to Estimate Desert Tortoise Density in the Project Area From 1990 to 2002 (Source: Karl 2001, Appendix E)

Study and Method	Description	Specific Study Goals
PLOT STUDY		
Sierra Delta (1990)	Single, 100 percent cover of 2.59 km^2 plot, in winter	Tortoise density at 1 site in the UTM 90 Area
Chambers Group Inc (Chambers) (1992a)	Single, 100 percent cover of 9 km^2 plot in winter, with video camera	Tortoise density at 1 site in the UTM 90 Area
Karl (1999)	Two 1-km^2 mark-recapture plots with large crew and rapid completion of both capture and recapture surveys (Lincoln-Peterson analysis stratified by tortoise size)	Tortoise density at 2 sites in the UTM 90 Area
Chambers (1994)	Multiple mark-recapture on 27 500 x 500m plots (Lincoln-Peterson Analysis)	Tortoise density in the UTM 90 Area
Chambers (1996)	Multiple mark-recapture on 9 300 x 300m subplots to determine density for each of 8 2.25 km^2 plots (Schnabel Analysis)	Tortoise density at 8 sites in the UTM 90 Area
Berry (1998)	15 1-km^2 mark-recapture plots	Tortoise density at15 sites in Goldstone
Berry (1996) in BLM 2003	9 1mi^2 mark-recapture plots sampled at several-year intervals	Tortoise density and population trends
Karl (2002a, Appendix C)	1-km^2 mark-recapture plots with large crews and rapid completion of both capture and recapture surveys (Lincoln-Peterson analysis stratified by tortoise size)	Tortoise density at 6 sites in the Superior Valley Area and 1 site in the UTM 90 Area
Karl (2002b, Appendix D)	1-km^2 mark-recapture plots with large crews and rapid completion of both capture and multiple recapture surveys (Lincoln-Peterson and Schnabel analyses, stratified by tortoise size)	Tortoise density at 2 sites in the UTM 90 Area and support for statistical model used
TRANSECT STUDY		
Chambers (1990)	468 2.4 km x 10 m, triangular belt transects; transect density =1(-1.5) transect per adjacent sections	Tortoise density and distribution in the proposed expansion area
Chambers (1992b)	343 2.4 km x 10 m, triangular belt transects; transect density =1 transect per adjacent section	Tortoise density and distribution in Silurian Valley
Chambers (1993)	134 2.4 km x 10 m triangular belt transects; transect density =2 transects per adjacent section	Total number of tortoises inhabiting North Alvord Slope

Krzysik and Woodman (1994)	406 2.4 km x 10 m triangular belt transects; transect density not stated	Examination of training impacts on tortoise density by comparing sites among years
BLM (2003)	3915 2.4 km x 10 m, triangular belt transects in 3615 mi^2 from 1998 to 2002; transect density generally = 1 transect per mi^2 sampled	Tortoise density and distribution in the Western Mojave Planning Area
Karl (2002a, Appendix C)	568 2.4 km-long belt transects in 145 km^2 in the Superior Valley Area and UTM 90 Area; transect density = 4 transects per km^2 (10+ transect per mi^2) in mostly adjacent km^2	Combined with plots, estimate tortoise density for 71 percent of the main use area in Superior Valley Area. Also, tortoise densities in western UTM 90 Area.
Karl (2002b, Appendix D)	116 2.4 km-long belt transects in 29 additional km^2 in the Superior Valley Area and UTM 90 Area; transect density = 4 transects per km^2 (10+ transect per mi^2) in mostly adjacent km^2	Combined with plots, estimate tortoise density for 83 percent of the main use area in Superior Valley Area and 71 percent of the UTM 90 Area north and west of Alvord Mountain

Of the three core areas present in 1984, only the Mud Hills area north of Barstow remained intact by 2002 (Figure 4-5). The Kramer core area was fragmented and the DTNA core area was eliminated. In the latter, sign counts were extremely low in the 1998–2002 surveys (Figure 4-2) although historic plot studies had been among the highest - 137–181 adult tortoises/mi^2 (53–70 tortoises/km^2) (Berry 1996 in BLM 2003). The habitat of these "core", high-density tortoise populations originally contained the resources necessary to support large tortoise populations during periods of favorable environmental conditions. With the exception of forage resources, which typically fluctuate with annual weather conditions, the remaining resources in these areas (e.g., topography, soil type, shrub density and species richness) appear to have experienced little change since the earlier density estimates. It could be expected, then, that when the drought recedes, all resources, forage included, should again be available to support high-density populations in the original core areas. Despite the presence of high quality environmental conditions, however, it is unknown if current tortoise densities are adequate to allow for recovery to former levels.

The total number of tortoises present in the west Mojave region cannot be ascertained from current data. Once the analyses are finished, it is hoped that the line distance sampling data will be able to identify tortoise abundance in the west Mojave. The BLM is also currently attempting to estimate the amount of tortoise habitat in the west Mojave (BLM 2003).

Proposed Superior-Cronese Lakes DWMA

The only comparison that can be made between historic and recent densities is between BLM transect data sets (Berry and Nicholson 1984a and BLM 2002c, respectively). No trend plots were consecutively studied. Given the imprecision of the methods, no trend in tortoise densities in the proposed Superior-Cronese Lakes DWMA can be identified.

Project Area

Prior to 2001, no plot studies had been conducted in the Superior Valley area and recent transect studies completed on and around Fort Irwin failed to provide the level of accuracy or precision necessary to identify impacts to desert tortoises from the expansion of the training (see Karl 2001 and 2002a [Appendices E and C of this BA, respectively] for a review of studies and their limitations). In response to the need for a more precise estimate of desert tortoises in the proposed project area, eight mark-recapture plots were placed in (six plots) and adjacent to (two plots) the project area and an intensive survey using four belt transects/km were completed on generally adjacent, square kilometers within the project area. This increased the historic sampling intensity ten-fold. Several improvements in data collection and analysis were also employed to increase the accuracy and precision for estimating tortoise densities lacking in the earlier studies. Efforts were concentrated in the Superior Valley parcel because little was known about tortoises there.

Based on these studies, current densities in the Superior Valley parcel and surrounding areas are low. Nearly 50 percent of the Superior Valley area was estimated to have 3 or fewer tortoises/ mi^2 (1 tortoise/ km^2) and <2 percent was estimated to have >26 tortoises/ mi^2 (>10 tortoises/ km^2). Nowhere did estimated densities exceed 39 tortoises/ mi^2 (15 tortoises/ km^2) (Figure 4-6). For the entire Superior Valley parcel as it was depicted on Army planning maps at the time of the survey (66,000 acres [26,7107 ha]), the total number of adults was estimated in 2002 at 563–595 tortoises, with an approximate confidence interval of 531–1158 tortoises (Karl 2002b, Appendix D of this BA). Due to an adjustment to the final withdrawal boundary not accounted for in these surveys, the final estimate is 626–658 adult tortoises (Table 4-3) for the Superior Valley parcel.

Figure 4-5: Current Core Tortoise Populations in the West Mojave Region

Figure 4-6: Estimated Tortoise Densities 2001-2002 Studies

Table 4-3: Estimated Number of Adult Tortoises in the Project Area

Location	Total Area[1]	Estimated Number of Tortoises (Abundance)[2]	Approximate Confidence Interval for Abundance Estimate
Superior Valley	70,045 acres (28,347 ha)	626-658	516-1,143[4]
UTM 90 Area North and West of Alvord Mountain	16,401 acres (6,640 ha)	430-441	337-640[4]
UTM 90 Area East of Alvord Mountain	6,813 acres (2,757 ha)	96-124[3]	----[5]
Eastgate	48,629 acres (19,680 ha)	288[3]	----[5]
Goldstone	1,472 acres (596 ha)	5[3]	----[5]
TOTAL	143,360 acres[1, 6] (58,018 ha)	1,445-1,516	1,245-2,206[4]

1. Includes all conservation areas in Project Area except those on Fort Irwin (NASA Goldstone) and the 2 Square Mile Conservation Area off-post
2. Source: Karl (2002b; Appendix D), plus additions based on current withdrawal area boundary
3. See text, below, for assumptions supporting calculations
4. Confidence intervals are based on calculated limits for sampled kilometers, plus the total number of tortoises estimated for unsampled kilometers
5. Could not be determined based on approximation method used to estimate abundance
6. Includes Acreage for the Goldstone transit route

On Goldstone, densities are similarly low. Recent studies include 15 mark-recapture plots completed in 1998, where only 19 live tortoises were observed and not all of these on the plots (Berry 1998). Captures on the plots were mostly 0–1 tortoises; two plots registered 6 tortoises each. Based on these results, densities probably currently average <5 tortoises/mi^2 (<2 tortoises/km^2). While earlier studies in the area comprised low-sampling-rate transect studies (0.3-0.7 transects/mi^2) and consequently produced unreliable results, their suggested densities for Goldstone were low, similar to the current estimates. Woodman et al. (1990) walked 17 transects in Goldstone in 1983. Twelve, including all of those intersecting the area of the Goldstone Road, had no sign; the remaining five transects were estimated to represent tortoise densities of <100 tortoises/mi mi^2 (<39 tortoises/km^2). USFWS (1998) summarized the earlier transect studies (Berry and Nicholson 1984a, USFWS 1988, Woodman et al. 1990) and various anecdotal reports of tortoises sighted in the area and concluded that tortoise densities for Goldstone fell into the broad density groupings of 0–20, 20–50, and 50–100 tortoises/mi^2 (0–39 tortoises/km^2). Assuming a three-mile transit route through Goldstone in the area proposed, and an average home range diameter of 75 acres (30 ha), then potentially 5 adult tortoises have home ranges that could include the route (Table 4-3). Densities were probably never high in the Superior Valley-Goldstone areas, based on elevation and resultant habitat influences (Karl 2002a, Appendix C of this BA). The current low-density estimates are consistent with those from historic surveys before the current, 14-year drought cycle (Berry and Nicholson 1984). Nonetheless, it is still likely that current densities are depressed due to high mortality and depressed reproduction during the drought. The high adult annualized mortality rates observed on the expansion area plots (9.6–50.0 percent) during drought support this hypothesis (Karl 2002a, Appendix C).

The Eastgate parcel has low to very low tortoise densities. Transects walked in or adjacent to the Eastgate Area conducted by Chambers (1993) and BLM (2002c) registered very low sign counts (Figures 4-7 and 4-4, respectively). For the Chambers study, 14 of 15 transects on the east side and immediately east of the future Eastgate parcel had no sign, while the remaining transect had 1–3 sign. For the BLM transects on the west side of the Eastgate parcel, transects largely registered 0 or 1–3 sign, with occasional transects having slightly higher sign counts, 4–8. While tortoise densities cannot be reliably determined from these transect data sets, the data strongly indicate that tortoise densities are very low in the Eastgate area, especially the large northern portion. There are also at least 840 acres of non-tortoise habitat (slopes >30 percent, >4,500 ft in elevation, playas). To roughly estimate the total number of tortoises in the area, data the Eastgate transects had to be defined in terms of tortoise density. For the eastern half of Eastgate (approximately 23,000 acres [9,300 ha]), an average of 1 tortoise/mi^2 was estimated. The extremely mountainous portions in the center of the parcel and the playas, at least 840 acres, were estimated to have no tortoises. For the western portion of Eastgate, the following method was used to estimate density: BLM transect groupings of 0 and 1-3 sign in Superior Valley (same study as that for Eastgate) corresponded to areas estimated to have 0–3 and 4–13 tortoises/mi^2 (1–5 tortoises/km^2) during the Fort Irwin expansion studies (Karl 2002a and b, Appendices C and D of this BA). Applying the midpoint of this range, 6.5 tortoises/mi^2 to the approximately 24,789 acres (10,032 ha) of remaining potential tortoise habitat in the Eastgate area yielded a cumulative estimate for the entire parcel of 288 adult tortoises. This estimate is probably quite high, due to the large number of transects with zero sign, but is conservation oriented for the purposes of this BA.

The UTM 90 Area has a substantially higher population than is present elsewhere in the project area. Figure 4-6 shows that estimated densities ranged from 2.6–85.2 adult tortoises/mi^2 (1–32.9 tortoises/km^2) in 2002, with the highest densities occurring in the southwestern corner (Karl 2002b, Appendix D of this BA). The cumulative estimated adult tortoise abundance for the surveyed area north and northwest of Alvord Mountain was 430-441 tortoises (Table 4-3).

Tortoise abundance in the eastern portion of the UTM 90 Area, where densities were not estimated in 2001 and 2002 (Karl 2002b, Appendix D of this BA), was estimated identically to Eastgate (see above), using sign counts on transects walked by Chambers (1992b) and the BLM (2003). The BLM's transects in the eastern UTM 90 Area consistently had 1–8 sign. This sign count grouping was also observed on BLM transects in Superior Valley where Karl (2002a and b, Appendices C and D of this BA) estimated densities of 2–5 tortoises/km^2. The midpoint of this range, 3.5 tortoises, was then applied to all square kilometers in the eastern UTM 90 Area. For the Chambers data set, this midpoint value was 4.5 (from a range of 0–9 tortoises). The eastern portion of the UTM 90 Area, then, is estimated to have approximately 96-124 adult tortoises (Table 4-3).

The UTM 90 Area has moderate densities that are more consistent over the area and better habitat than the Superior Valley area, so it may have supported higher densities in the past. In 1993, Chambers (1994) estimated that there were 5,000–6,000 tortoises on the north Alvord Slope, the latter encompassing the UTM 90 Area plus that area south to approximately UTM 85 gridline and west to Fort Irwin Road. This was calculated from transects results (sampling rate: 0.77 transects/ km^2) that estimated broad areas to have >39 tortoises/km^2, and even 97 tortoises/km^2. This is substantially higher than the 2001 estimates, when the maximum density predicted for this area was generally ≤17 tortoises/km^2. If the differences are accurate and not attributable to differences in techniques and analysis, they would suggest a high, continuous mortality rate or high rates with pulses of very high rates.

Relative Importance of the Project Area Tortoise Population to the Total Population

Historically, high tortoise densities occurring in the range of the Mojave population included a number of areas exceeding 200 tortoises/mi^2 (77 tortoises/km^2), with medium densities exceeding 50–100 tortoises/ mi^2 (19–39 tortoises/km^2) across broad areas. In the project area, current tortoise densities are low. They are very low in Eastgate – an average estimated 4 adult tortoises/mi^2 (1.5 tortoises/km^2) with a range of 0–13 tortoises/mi^2 (1–5 tortoises/km^2) – and in Superior Valley – an average of 6 adult tortoises/mi^2 (2.3 tortoises/km^2) with over 50 percent of the area estimated to have 3 or fewer tortoises/mi^2 (1 tortoises/km^2) and less than 2 percent estimated to have more than 26 tortoises/mi^2 (>10 tortoises/km^2). Densities have probably never been high in Superior Valley based on environmental factors. This is somewhat supported by the results of several surveys since 1988 that have not identified medium to high densities in Superior Valley or surrounding areas. In the project area, the highest current densities, still comparatively low, are in the UTM 90 Area west of Alvord Mountain, a mean of 17 tortoises/mi^2 (7 tortoises/km^2). While densities could not be derived from earlier survey techniques, surveys in 1988 and the 1990s suggested that densities in this portion of the UTM 90 Area may have been higher before the drought. Still, no portions of or adjacent to the project area represent historic or current core tortoise populations.

In conclusion, the tortoise population in the project area, especially in the Superior and Eastgate areas, represents a very low percentage of the entire Mojave population. At known peak historic densities, the project area's population likely still represented a low percentage of the entire population, although it is unclear what populations were in the UTM 90 Area of Fort Irwin prior to military maneuvers.

4.1.1.1.8 Critical Habitat

Designated critical habitat in the project area total 97,856 acres (39,602 ha) inclusive of proposed conservation areas. Of that total, 87,300 acres (35,330 ha) of critical habitat will be directly impacted by the proposed project (Figure 4-1), thus assuming a 100 percent loss of habitat within the use areas this represents the following percentages of each designation:

- 1.36 percent of total designated Critical Habitat for the Mojave Population (6,446,200 acres [2,608,741 ha]);
- 5.14 percent of the West Mojave Recovery Unit (1,711,498 [692,633 ha]);

- 11.47 percent of the Superior-Cronese Lakes CHU (766,900 acres [310,360 ha])

4.1.1.1.9 Conclusion

Individuals and designated critical habitat are both found within the Project Area. Desert tortoise and its designated critical habitat may be affected by the proposed training activities. Therefore, this species and its designated critical habitat will be considered further in this BA.

Figure 4-7: Results of Non-BLM Desert Tortoise Abundance Studies Prior to 2001

4.1.1.2 Bald Eagle *(Heliaeetus leucocephalus)*

4.1.1.2.1 Legal Status

The bald eagle is State of California listed as endangered and federally listed as threatened. It has been proposed for federal delisting (July 1999).

4.1.1.2.2 Species Description

The bald eagle is one of North America's largest birds. It weighs 8–14 lbs and has a wingspan of 6.5–8 ft. Females are larger than males and birds from the northern portion of their range tend to be larger than those from the southern portion of the range. Adults have dark brown plumage with pure white heads and tails. Immature birds have mottled plumage coloration with varying amounts of dark brown and white, acquiring adult plumage between 4 and 5 years of age (CDFG 2002c).

4.1.1.2.3 Geographic Range

The range of the bald eagle occurs entirely within North America, including Alaska, Canada, the lower 48 states, and northwest Mexico. Bald eagles are fairly common as local winter migrants at a few favored inland waters in southern California including Big Bear Lake, Cachuma Lake, Lake Mathews, Nacimiento Reservoir, San Antonio Reservoir, and along the Colorado River (CDFG 2002b). Within the Mojave Desert they have been observed at Harper Lake and along the Mojave River between Barstow and Victorville southwest of the project area and in the Cady Mountains southeast of the project area (BLM West Mojave Evaluation Report Map, and 2002b).

4.1.1.2.4 Habitat

Bald eagles may be found throughout California at lakes, reservoirs, rivers, and some rangelands and coastal wetlands during the winter months. In the winter, they roost communally in dense, sheltered, remote conifer stands. The breeding habitats in California are mainly in mountain and foothill forests and woodlands near lakes, rivers, and reservoirs. Most breeding territories are in northern California, however, they also nest at a few scattered locations in the Sierra Nevada mountains and foothills, at several locations from the central coast to inland southern California, and on Santa Catalina Island. Bald eagles perch high on large limbs in tall trees, in broken topped trees, on snags, or on rocks near water (CDFG 2002b).

4.1.1.2.5 Natural History

Bald eagles are monogamous, forming mating pairs that may remain together until the death of one member. They nest in large old-growth stands of trees, usually conifers. They build large stick platform nests usually in the upper canopy of tallest trees in the area. Bald eagles breed from February to July with peak activity from March to June. Clutches of 1–2 eggs, sometimes 3 are laid in late winter or early spring with an incubation period lasting generally 34–36 days. Chicks fledge the nest after 11 to 12 weeks. Bald eagles prey on fish, waterfowl, and various small mammals. They also eat carrion including salmon, deer, and cattle (CDFG 2002b).

Bald eagles spend the summer months in the northern portion of their range, where nesting occurs, and winter in the southern portion of their range. Migratory bald eagles arrive in California from nesting areas in northwestern states and provinces during fall and early winter. Wintering birds stay until February or March with some as late as April (CDFG 2002b).

4.1.1.2.6 Conclusion

Habitat documented to support wintering bald eagles does not occur in the project area. Bald eagles have been observed outside the project area but not documented to occur in the project area. They may occur as migrants in spring or fall through the area. The likelihood of occurrence for them in the project area is low. The Proposed Project is likely to have no effect on the bald eagle. Therefore, this species will not be considered further in this BA.

4.1.1.3 Least Bell's Vireo *(Vireo bellii pusillus)*

4.1.1.3.1 Legal Status

The least Bell's vireo is federally listed as endangered and state-listed as endangered.

4.1.1.3.2 Species Description

The least Bell's vireo is a subspecies of the Bell's vireo. It is a small songbird that is olive-gray in color above with a single faint wingbar, a thick bill, thin but distinct "spectacles," and a long tail that is flipped intensely from side-to-side (BLM 2002a).

4.1.1.3.3 Geographic Range

The least Bell's vireo breeds in southwestern California and adjacent northwestern Baja California. It largely occurs in cismontane southern California, but it does extend into transmontane areas along the western flank of the Anza-Borrego desert (San Diego County), in the vicinity of Palm Springs (Riverside County), at Leona Valley (Los Angeles County), and in San Bernardino County at Morongo Valley and along the Mojave River. There are breeding records for this subspecies north in the southern Owens Valley of Inyo County and it regularly breeds just northwest at the South Fork of the Kern River Preserve. Elsewhere in the west Mojave, the Bell's vireo is an occasional migrant (BLM 2002a).

The eastern limit of the range of the least Bell's vireo in California is contentious, in that the ranges of the least Bell's vireo and the Arizona Bell's vireo (*V. b. arizonae*) in California are based more on supposition than on direct evidence. It is generally believed that the Arizona Bell's vireo is confined to the Lower Colorado River Valley, whereas the least Bell's vireo occurs in cismontane southern California and on the western edge of the deserts, extending north up the Mojave River into the Owens Valley, and eastward into Death Valley National Park, along the Amargosa River (Inyo County) and at Fort Piute in the East Mojave Desert (BLM 2002a). The breeding population along the Mojave River is south of the project area. Least Bell's vireos are potential migrants across the project area. They also potentially occur at Paradise Springs in Paradise Mountain just outside the western portion of the project area. Paradise Springs contains flowing and standing water and riparian habitat vegetation including willows, but also has a significant infestation of non-native salt cedar (*Tamarix* spp.).

4.1.1.3.4 Habitat

The least Bell's vireo occurs in riparian habitats. It typically breeds in willow riparian forest supporting a dense, shrubby understory of mulefat (Baccharis salicifolius) and other mesic species. They have also been observed to use oak woodland with a willow riparian understory. Individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage. Least Bell's vireos in cismontane California occur in riparian forest dominated by willows and tend to avoid riparian areas dominated by non-native salt cedar (BLM 2002a).

4.1.1.3.5 Natural History

In mid-March, least Bell's vireos arrive at their breeding grounds, with males arriving slightly before females. They generally depart by September, but some individuals remain into late November. This subspecies winters primarily in Baja California, with occasional individuals remaining through the winter in southern California. They nest from early April through the end of July, generally attempting two broods within this period. Over 60 species of plants have been used by Bell's vireos for nest sites. This subspecies, however, predominantly uses willows (*Salix* spp.). Nests are suspended from forks in tree or shrub branches. The least Bell's vireo diet consists almost exclusively of arthropods, with insects and spiders comprising most of their food (BLM 2002a).

4.1.1.3.6 Conclusion

Habitat documented to support least Bell's vireo does not occur in the project area. Least Bell's Vireos have not been documented to occur in the project area. The likelihood of their occurrence in the project area is low. However, they may occur at Paradise Springs in the Paradise Mountains next to the project area. The Proposed Project is likely to have no effect on least Bell's vireo. Therefore, this species will not be considered further in this BA.

4.1.1.4 Southwestern Willow Flycatcher *(Empidonax traillii extimus)*

4.1.1.4.1 Legal Status

The southwestern willow flycatcher is federally listed as endangered.

4.1.1.4.2 Species Description

The southwestern willow flycatcher is a small bird, usually less than 6 inches in length including its tail and weighs 12-13 grams. Its body is brownish-olive to gray green above with a whitish throat, a pale yellow-tinged belly, and a pale olive breast. It has conspicuous light-colored wingbars and lacks the pale eye-ring found in similar species of *Empidonax* (AGFD 2002, BLM 2001, USGS 2002).

4.1.1.4.3 Geographic Range

The southwestern willow flycatcher breeds widely across temperate North America and migrates to middle and northwestern South America for the winter. Although its wintering range is uncertain, it is known to winter from the west coast of central Mexico to northern South America. The subspecies *extimus* breeds in southern California, southern Nevada, southern Utah, Arizona, New Mexico and extreme western Texas. *E. t. extimus* arrives at breeding locations in May and departs in the fall in August and September. In southern California, populations of the subspecies *extimus* are found at the following principal sites: along the South Fork Kern River near Weldon, along the Santa Ynez River from Vandenberg AFB to Buellton, Prado Basin on the Santa Ana River near the city of Corona, along the Santa Margarita River from Camp Pendleton to Fallbrook, and along the San Luis Rey River, from the La Jolla Indian Reservation to Lake Henshaw. In the Mojave Desert, the southwestern willow flycatcher is found at the Big Morongo Wildlife Preserve, along the Mojave River at Mojave Narrows Regional Park, and near the I-15 crossing (AGFD 2002, BLM 2001, USGS 2002).

4.1.1.4.4 Habitat

The southwestern willow flycatcher breeds in dense riparian habitats along rivers, streams, or other wetlands across the southwestern U.S. The riparian woodland used by willow flycatchers is typically next to or over water and has a canopy and understory of shrub and sapling vegetation. The vegetation composition of occupied habitats varies between sites and may include one or more of the following: native willows, ash, alder, coast live oak, mature nonnative tamarisk, cottonwoods, boxelders, and nonnative Russian olive (AGFD 2002, BLM 2001, USGS 2002).

4.1.1.4.5 Natural History

The southwestern willow flycatcher is insectivorous, catching its prey primarily in the middle story of the riparian woodland. Most are monogamous within one breeding season, however some males have two mates. Nests are usually started within one week of pair formation and two weeks after spring arrival. Nests are open cups and are usually placed in a branch fork of a willow near water. A typical clutch includes 3–4 eggs and is laid between May and June. Incubation lasts 12–13 days and nestlings fledge after two weeks (AGFD 2002, BLM 2001, USGS 2002).

4.1.1.4.6 Conclusion

Habitat known to support the southwestern willow flycatcher does not occur in the project area. They have not been documented to occur in the project area, and the likelihood of occurrence in the project area is low. However, they may occur at Paradise Springs in the Paradise Mountains next to the project area. The Proposed Project is likely to have no effect on the southwestern willow flycatcher. Therefore, this species will not be considered further in this BA.

4.1.1.5 Western Snowy Plover *(Charadrius alexandrinus nivosus)*

4.1.1.5.1 Legal Status

The snowy plover (*Charadrius alexandrinus*) Pacific Coast population of the species (*C. a nivosus*) is federally listed as threatened and is a state species of special concern

4.1.1.5.2 Species Description

The Pacific coast populations are those occurring within 50 miles of the coast. The interior populations are treated discretely from coastal ones and lack any special status. Snowy plovers are small shorebirds generally 5–7 in (15–17 cm) in length and weighing approximately 40–43 grams. Snowy plovers have an incomplete breast band that is restricted to dark lateral patches at the shoulders. They have pale brown under parts, thin black bills, blackish legs and feet, and abbreviated breast bands that distinguish them from the semipalmated plover. Markings on their forecrown, ear coverts, and at the sides of their breasts are black in males, browner in females, and inconspicuous in immature birds (BLM 2002a).

4.1.1.5.3 Geographic Range

The species as a whole breeds over much of Eurasia, Africa, Australia, the eastern coast of Asia, the western coast of South America, and western, south-central and southeastern North America. On the Pacific Coast, snowy plovers nest as far north as northern Washington and south to southern Baja California, including the northern Gulf of California. Interior populations in the west breed at playa lakes and other shallow water habitats from east-central Oregon south to the Salton Sea, Imperial County and east through the Great Basin. Snowy plovers nest on certain playas, or dry lakes, in the Mojave Desert region. Most appear to depart in the winter, but migrants and wintering birds are known from a few localities as well. Small relatively stable breeding populations have been recorded at China, Koehn, and Rosamond dry lakes. Higher counts were recorded at Harper Lake. During the breeding season, snowy plovers are also regularly observed at the salt evaporating ponds at Dale Dry Lake and at the Edison Solar I ponds near Daggett. However it is unlikely that they nest at these sites. Snowy plovers are generally absent from the region in winter, however, a few do winter at Piute Ponds and the Lancaster Sewage Ponds. They have also been recorded at Harper Lake in late October and one record is reported for a single plover at East Cronese Lake in mid-November (BLM 2002a). All of the above-mentioned sites are outside the project area. Snowy plovers have the potential to occur on dry lakes next to or in the project area.

4.1.1.5.4 Habitat

On the coast, snowy plovers use sandy beaches, lagoons, and salt evaporating ponds for nesting and feeding. In the interior, they inhabit salt plats around playa lakes and evaporation ponds. In the interior they also use diked sewage treatment ponds and ponds managed for wintering waterfowl (BLM 2002a).

4.1.1.5.5 Natural History

On the coast, snowy plovers nest on sandy beaches with little slope while in the interior they nest on sparsely vegetated alkali flat at dry lake margins and at evaporation ponds. Clutches range from 2–6 eggs and both male and female snowy plovers participate in incubation, which lasts 26–32 days. Coastal snowy plovers may raise multiple clutches in a breeding season. Their diet consists of brine flies, shrimp, amphipods, polychaetes, and beetles along with other invertebrate prey often found in tidal flats or shallow water margins (BLM 2002a).

4.1.1.5.6 Conclusion

Habitat known to support the western snowy plover (Pacific Coast population) does not occur in the project area. They have not been documented to occur in the project area, and the likelihood of occurrence in the project area is low. The Proposed Project is likely to have no effect on the western snowy plover. Therefore, this species will not be considered further in this BA.

4.1.2 Federal Candidate Species

4.1.2.1 Yellow-Billed Cuckoo *(Coccyx's Americans)*

4.1.2.1.2 Legal Status

The Yellow-billed cuckoo is a candidate for federal listing as endangered and is state listed as endangered.

4.1.2.1.3 Species Description

Yellow-billed cuckoos are streamlined birds with rich brown upper parts and creamy white under parts. The primary and outer tail feathers have a rufous tinge. The under tail is black with prominent white spots, as with many members of the cuckoo family. Yellow-billed cuckoos have a yellow to orange lower mandible (beak) contrasting with a black upper mandible. Females tend to be larger than males, with brighter orange bills and a larger white spot on the underside of the tail. They are approximately 12 in (30 cm) in length and weigh approximately 64 grams. Their diet consists primarily of insects. Their prey is obtained primarily by gleaning foliage but also by gleaning while hovering, and even hopping to the ground (BLM 2002a).

4.1.2.1.4 Geographic Range

Yellow-billed cuckoos have a wide distribution throughout North America. They breed from the West Indies and the northern third of Mexico north to extreme southern Canada and winter from northern South America south to northern Argentina, primarily east of the Andes.

The western subspecies, the California yellow-billed cuckoo (*C.a. occidentals*), has a much smaller range and more restrictive habitat requirements. It breeds in California, Idaho, Utah, Arizona, New Mexico, Texas, possibly Nevada, and western Colorado at dispersed locations with suitable habitat. A survey for the yellow-billed cuckoos conducted across California in 1986 and 1987 found a total of 30–33 pairs and 31 unmated males at nine localities. Most of the birds were found along the upper Sacramento River and at the South Fork Kern River with the remaining cuckoos at various other locations including the Mojave River near Hodge, southwest of the project area. Cuckoos have been observed during the breeding season along the Mojave River between Victorville and Barstow; however, there are no confirmed nesting areas within this region of the Mojave Desert. They could occur at any desert oasis with willow and cottonwoods although there are very few records of migrant yellow-billed cuckoos in the vicinity (BLM 2002a). They could potentially occur during migration at Paradise Springs in Paradise Mountain, just outside the western portion of the project area.

4.1.2.1.5 Habitat

Yellow-billed cuckoos have one of the most restrictive suite of macro-habitat requirements of any bird species. The habitat type, size, and configuration are extremely important. During the breeding season in California, they are confined to cottonwood-willow riparian habitat. They have a large home range often exceeding 50 acres and sometimes approaching 100 acres (BLM 2002a).

4.1.2.1.6 Natural History

Yellow-billed cuckoos migrate to California in the spring and begin nesting shortly after their arrival in June, with a few records of arrivals in May. They build a loose platform nest with stick and twigs and line it with leaves and other vegetation. Generally, yellow-billed cuckoos lay only one clutch of eggs. However, in years of above-average food supply, many pairs will lay two clutches and successfully fledge two broods. A clutch consists of 2–5 light bluish-green unmarked eggs. The male and female tend the nest equally, however, the male does all of the nocturnal incubation and brooding. Yellow-billed cuckoos are normally solitary nesters and monogamous. Fall migration begins in early August and most cuckoos depart California by mid-September (BLM 2002a).

4.1.2.1.7 Conclusion

Habitat known to support the yellow-billed cuckoo does not occur in the project area. Yellow-billed cuckoos have not been documented to occur in the project area, and the likelihood of occurrence in the project area is low. However, they may occur at Paradise Springs in the Paradise Mountains. Because of this and because the yellow-billed cuckoo is not federally listed, this species will not be considered further in this BA.

4.1.2.2 Mountain Plover *(Charadrius Montanez)*

4.1.2.2.1 Legal Status

The mountain plover is a candidate for federal listing and a state species of special concern.

4.1.2.2.2 Species Description.

The mountain plover is a fairly large bird generally reaching 9 in (21–23 cm) in length. The mountain plover breeding plumage consists of a black loral stripe that extends from the black bill to the eye and contrasts with the white forehead and throat. A black forecrown bar and unmarked white breast distinguished the mountain plover from all other plovers in North America. A sandy brown coloration of upper parts extends to the neck and sides of the breast and adds camouflage in its native habitat (BLM 2002a).

4.1.2.2.3 Geographic Range.

The winter range extends from northern California through southern California, southern Arizona, and central and coastal Texas to northern Mexico. Mountain plovers do not breed in California, but a large portion of them (70 percent) winter in the state. The major wintering areas in California are the Sacramento, San Joaquin, and Imperial valleys. Smaller numbers are known to winter in the Mojave Desert, the San Jacinto Santa Maria, and Salinas valleys, the Carrizo Plain, Seal Beach, Tijuana River Valley, and the lower Colorado River. Mountain plovers are recorded annually in the fall and winter in the agricultural lands east of Lancaster and at Harper Lake, southwest of the project area. The species may occur, at least irregularly, in Lucerne Valley and on dry lakebeds throughout the Mojave Desert (BLM 2002a). Mountain plovers potentially occur, at least irregularly, on dry lakebeds next to or in the project area.

4.1.2.2.4 Habitat.

Mountain plovers do not nest in mountains, but at relatively high elevation of approximately 2,000–8,500 ft (640–2,580 m) in elevation in short-grass prairies and plains. They are seldom found near water and tall, dense cover is avoided at all seasons. The mountain plover is endemic to open, sparsely vegetated habitats in North America. The breeding range includes the dry tablelands of the western Great Plains and the Colorado Plateau (BLM 2002a).

4.1.2.2.5 Natural History.

In the spring, mountain plovers return to their breeding areas. The breeding season for mountain plovers is from March to early August, after which they disperse across the southern and western Great Plains before migrating to their winter areas. Their nests are shallow depressions in the ground often lined with plant material. A clutch usually consists of three eggs. Females may lay consecutive clutches in separate nests and one adult will then incubate each clutch. Mountain plovers congregate in winter in large flocks often exceeding 100 birds and sometimes up to 500 birds. Flocks are often organized loosely and range widely foraging for food, consisting of large insects and other invertebrates (BLM 2002a).

4.1.2.2.6 Conclusion

The Superior Lakes in the western portion of the project area may provide potential wintering habitat. However mountain plovers have not been documented to winter in the project area and the likelihood of occurrence for them is low. The Proposed Project is likely to have no effect on the mountain plover. Therefore, this species will not be considered further in this BA.

4.1.3 State-Listed Species

4.1.3.1 Mohave Ground Squirrel *(Spermophilus mohavensis)*

4.1.3.1.1 Legal Status

The Mohave ground squirrel is listed as "threatened" under the California Endangered Species Act (CESA). In 1993 a petition to list the Mohave ground squirrel under the federal ESA as threatened was received by the USFWS. In 1995, the USFWS published its 90-day finding stating that the "…Service finds that the petition did not present substantial information indicating that the petition action may be warranted" (60 FR 173, p. 46569-46571)

4.1.3.1.2 Species Description

The Mohave ground squirrel is a medium-sized ground squirrel that measures 8–9 inches in length and has a tail nearly 3 inches in length. There is little difference in size between the sexes. The squirrel is light gray or brown in color, often with a wash of cinnamon or pink, with white or cream colored under parts. It has small ears and white eyelids (BLM 2002a, CDFG 2002a).

4.1.3.1.3 Geographic Range

The Mohave ground squirrel occupies portions of Inyo, Kern, Los Angeles, and San Bernardino counties in the western Mojave Desert. The species range extends from Palmdale, Los Angeles County in the southwest to Olancha, Inyo County in the north. The northern extent of its range includes the Coso Range and the Argus Range (Inyo County) in the northwest and the Avawatz Mountains and the Soda Mountains (San Bernardino County) in the northeast. The southern extent of its range includes Palmdale in the southwest and the Mojave River in the southeast. The San Bernardino and San Gabriel mountains limit the species distribution further south. The project area is within the range of the Mohave ground squirrel. They have been observed in the Superior Valley portion of the project area (BLM 2002a, CDFG 2002a).

4.1.3.1.4 Habitat

The Mohave ground squirrel occupies all major desert scrub habitats in the western Mojave Desert. It has been observed in the following habitats (as described by Holland 1986) which are found throughout its range: Mojave creosote scrub, desert saltbush scrub, desert sink scrub, desert greasewood scrub, shadscale scrub, Joshua tree woodland, and, in the northern portion of its range, Mojave mixed woody scrub. It inhabits areas with flat to moderate terrain and is not generally found in steep contours. The species has been found most frequently in sandy, alluvial soils. It is also found in gravelly soils, and occasionally in rocky soils. Specific habitat requirements include the availability of food resources and soils with appropriate composition for burrow construction.

Shrubs provide a reliable food source during drought years and may be critical for a population to persist in a particular area (BLM 2002a, CDFG 2002a).

4.1.3.1.5 Natural History

The Mohave ground squirrel is diurnal and exhibits a seasonal cycle of activity. The species typically emerges from hibernation in early- to mid–March. The timing of emergence appears to vary geographically, with individuals in the southern portion of the range emerging up to one month earlier. Aestivation begins once enough fat has been accumulated, generally anytime between July and September. However, in drought conditions it may begin as early as April or May (BLM 2002a, CDFG 2002a).

The diet of the Mohave ground squirrel consists primarily of the leaves and seeds of forbs and shrubs and varies by season. When herbaceous annuals are available, they forage on their leaves, flowers, seeds, and pollen. When herbaceous annuals are no longer available, the leaves of perennial shrubs make up a large part of the diet. Invertebrates are also consumed, but make up a relatively small proportion of the diet. The squirrel acquires water from its diet and drinks freely when water is available (BLM 2002a, CDFG 2002a).

Adults remain solitary except during the breeding period, which occurs soon after the animals emerge from hibernation. Litter size is between four and nine. Juveniles emerge from natal burrows between March and May, 4–6 weeks after birth. The mortality rate for juveniles is high during the first year. The reproductive success of the Mohave ground squirrel depends on the amount of fall and winter rain. When annual rainfall is low, annual herbaceous plants are not readily available, and the species may forego breeding entirely (BLM 2002a, CDFG 2002a).

The Mohave ground squirrel uses burrows often located at the base of shrubs for cover. Individuals may maintain several home burrows that are used at night in addition to accessory burrows that are used for temperature control and predator avoidance. One burrow is dug specifically for use during the summer and winter period of dormancy. Adult home ranges vary between years and throughout a season, most likely as a result of variation in food resources. Juveniles initially stay close to the natal burrow with some individuals eventually dispersing (BLM 2002a, CDFG 2002a).

4.1.3.1.6 Conclusion

Mohave ground squirrels have been observed in the western portion of the project area, as well as habitat documented to support them. The portion of Mohave ground squirrel habitat in the project area is a relatively small portion of its entire range within the Mojave Desert. Because the Mojave ground squirrel is not listed federally, this species will not be considered further in this BA.

4.1.3.2 Gila Woodpecker *(Melanerpes uropygialis)*

4.1.3.2.1 Legal Status

The Gila woodpecker is state-listed as endangered.

4.1.3.2.2 Species Description

The Gila woodpecker is a relatively large woodpecker with a grayish-brown head, neck, and under parts. It has black and white barring on its back and central tail feathers and has a conspicuous white patch on the wing at the base of the primaries. Males have a red crown patch. The Gila woodpecker eats insects, mistletoe berries, cactus fruits, corn, and, occasionally, the contents of galls on cottonwood leaves, bird eggs, acorns, and cactus pulp. It also gleans from the trunks and branches of trees and shrubs. It is primarily a cavity nesting species, excavating its own cavity in riparian trees or saguaros. The species breeds from April through July, with most activity in April and May. It seems to be a monogamous and solitary breeder. Clutch size ranges from 3–5 eggs with both sexes incubating the eggs for approximately 14 days. Occasionally two broods are raised in one season. The species resides in California; however, they may wander during non-breeding seasons (CDFG 2002d).

4.1.3.2.3 Geographic Range

The Gila woodpecker was formerly found along the California portion of the lower Colorado River and adjacent Arizona. It also occurred in the cottonwood groves and in farms and ranch yards of the Imperial Valley south to the Salton Sea. Presently, it is only known from a few scattered locations along the California side of the Colorado River between Needles and Yuma and locally near Brawly, Imperial County (CDFG 2002d). It was observed near Sheep Creek Spring in the foothills of the Avawatz Mountains (Chambers 1996), just northwest of the current Fort Irwin boundary and north of the project area.

4.1.3.2.4 Habitat

The Gila woodpecker is a permanent resident of mature cottonwood-willow riparian forests and mesquite riparian woodlands. Desert riparian trees, shade trees, and date palms also supply cover in California. Saguaros can provide cover but are scarce in the state (CDFG 2002d).

4.1.3.2.5 Conclusion

The Gila woodpecker has been observed in the general area of Fort Irwin. However, habitat documented to support the Gila woodpecker does not occur in the project area. It may occur as a visitor at Paradise Springs in the Paradise Mountains next to the project area. The likelihood of occurrence for the Gila woodpecker in the project area is low. Because of this and because the Gila woodpecker is not federally listed, this species will not be considered further in this BA.

4.1.3.3 Swainson's Hawk (*Buteo swainsoni)*

4.1.3.3.1 Legal Status

Swainson's hawk is state-listed as threatened.

4.1.3.3.2 Species Description

Swainson's hawks are relatively small buteos with males ranging from 25–33 ounces (693–936 grams) and females ranging from 33–48 ounces (937–1,367 grams). Their plumage coloration is polymorphic and includes a range of light, dark, and rufous gradations. The underside or belly is lighter in contrast to darker upper parts and underside of flight wings. Undertail coverts are buffy white and barred in dark brown (BLM 2002a).

4.1.3.3.3 Geographic Range

Most Swainson's hawks spend the summer months in the northern hemisphere and winter in Argentina, South America. Some birds also winter in other parts of South and Central America and various southern states of the U.S. The breeding range of Swainson's hawks in California includes the Great Basin and Modoc Plateau, the Sacramento and San Joaquin valleys, and a few scattered locations in the Colorado and Mojave deserts. All documented nesting attempts in the Mojave Desert occur in the Antelope, Victor, and Apple Valley's southwest of the project area. The Sacramento-San Joaquin River Delta is the only confirmed regular wintering site for Swainson's hawks in California (BLM 2002a). They have been observed in the general area surrounding Fort Irwin (Chambers 1996).

4.1.3.3.4 Habitat

The habitat requirements of breeding Swainson's hawks include suitable foraging habitat with adequate prey, nest sites, and isolation from disturbances that may disrupt breeding activities. In the Mojave Desert, Joshua tree woodland, riparian woodland, and ornamental plantings provide nesting opportunities. In the region, Joshua trees have been used for nest sites (BLM 2002a).

4.1.3.3.5 Natural History

Their diet includes a variety of mammals, birds, lizards, snakes, amphibians, and insects, with insects making an important part of the diet throughout the year. Natural foraging habitat for this hawk includes relatively open stands of grass-dominated vegetation and relatively sparse shrub lands. They are also known to forage in agricultural fields. Nests are almost exclusively found in trees, typically in transition areas between woodland and either grass or shrub land habitats or in isolated groves of trees in open terrain. Swainson's hawks migrate over a long distance, making a round trip between North America and Argentina. They return to nest sites in North America in March and April then form pairs and begin nesting. Nests are built in the following couple of weeks. The average clutch size ranges from 1–4 eggs with an average clutch size of 2.5 eggs. In late August and September, migratory flocks begin to form. Most birds arrive at their wintering grounds by November (BLM 2002a).

4.1.3.3.6 Conclusion

Swainson's hawks have not been documented to nest in the project area. However, Joshua tree woodland may provide potential nesting habitat and is in the western portion of the project area. Swainson's hawk has been observed in the general area, and may be found during migration through the area in spring or fall. Because of this and because the Swainson's hawk is not federally listed, this species will not be considered further in this BA.

4.2 Vegetation

4.2.1 Federally-Listed Species

4.2.1.1 Lane Mountain Milk-vetch *(Astragalus jaegerianus)*

An in-depth discussion of the biology, range, species status and summary of all available information on the species is located in Appendix F to this report (Charis Corporation, *Distribution and Abundance of Lane Mountain milk-vetch (Astragalus jaegerianus) Report of Spring – Summer Survey 2001*, September 2002). What is presented below is a summary of the information contained in that report and additional information gathered since the report's publication.

4.2.1.1.1 Legal Status

Lane Mountain milk-vetch was federally listed as endangered on October 6, 1998 (USFWS 1998 [63 FR 53596]). The species was first recommended for endangered status in January, 1975 (USFWS 1975). Lane Mountain milk-vetch has also appeared in the California Native Plant Society (CNPS) rare plant inventory since the list was first compiled. In the first edition (CNPS 1974), the species was given the common name of "Coolgardie locoweed" and listed under "very rare and rare and endangered plants." The rare plant status report listed an additional common name, "Jaeger milkvetch" (CNPS 1977). In the current rare plant inventory (CNPS 2001), the status is the same (now designated as list 1B), but the common name has changed to the more familiar Lane Mountain milk-vetch. As stated previously, the USFWS is currently under court order to make a final critical habitat designation by September 15, 2004 (Center for Biological Diversity et al. v. Gale Norton et al, 212 F.Supp.2d 2002).

4.2.1.1.2 Biological Description

Lane Mountain milk-vetch (*Astragalus jaegerianus,* Munz) is a narrowly endemic species in the pea family Fabaceae. The genus *Astragalus* contains 1,600–2,000 species and is considered to be one of the largest genera of flowering plants. Its species are found primarily throughout the northern hemisphere with approximately 400 species in North America. Most genus diversification has been in arid continental, desert, and Mediterranean climates.

Lane Mountain milk-vetch is a perennial herb with thin, relatively weak stems that become somewhat woody during the growing season. Plants are usually found growing through and within small desert shrubs. Plants can be as tall as 24 in (60 cm) and rarely to 31 in (80 cm). Leaves are light gray to greenish, sometimes almost dull purple, pinnately compound, 1–3 in long (2–6 cm), and have 7–15 narrow leaflets. The presence of L-shaped trichomes imparts a grayish cast to the leaves. Plant anatomy indicates that the stems are important photosynthetic organs in addition to the leaves (Gibson et al., 1998).

Flowers are dull yellowish white to lavender-rose, and arranged in racemes of 5–15 flowers. The pollinators are unknown, but probably include solitary bees as in other western *Astragalus* (Geer et al., 1996; Goertz 2001; Green and Bohart 1975; Hurd 1978; Kalin Arroyo 1981; Karron 1987; Kaye 1999;and Sugden 1985).

Information regarding the life history of the Lane Mountain milk-vetch is limited, although more is known about this plant than many of its desert cohabitants. Similar to other Mojave Desert perennials, it presumably begins its growth cycle in correspondence with sufficient soil moisture, usually in the late fall or winter, and goes dormant in the late spring or summer months when moisture is depleted. The theory that the growth cycle begins with the presence of sufficient moisture in the soil has recently been bolstered by research being conducted at University of California, Los Angeles (UCLA) by botanist Barry Prigge (Prigge, B., pers. comm. to Wertenberger, M., February, 2003). Prigge planted 100 un-culled seeds that had been collected in 2002 under a permit issued by the USFWS. The seeds were all planted in native soil in a greenhouse at UCLA. No other environmental factor was controlled other than water. Fourteen of the seeds germinated over a period ranging from 2–24 weeks. Plants are being grown in pots with the dried stems of other plants being used to create a supporting trellis, plants have reached as high as one half meter in 24 weeks (Prigge, B., pers. comm. to Wertenberger, M., February 10, 2003).

Blooming typically occurs in April and May. The flowers are presumed to be insect pollinated, probably by bees as are other *Astragalus* species, but the extent to which self-pollination occurs is unknown. Prigge manually cross pollinated several blooming Lane Mountain milk-vetch in his research which was successful and resulted in the production of seed pods and harvestable seeds (Prigge, B., pers. comm. to Wertenberger, M., February, 2003). Plants are commonly absent during dormancy and re-growth is from underground rootstalks. Plants almost always grow within the canopy of a host plant (nurse plant) and form seed pods, which split and drop seeds directly below while still attached. The seeds lack ancillary structures to promote dispersal. There is limited data on longevity, and very little data on seed dispersal, pollination, herbivory, age structure, or patterns of recruitment of the Lane Mountain milk-vetch.

4.2.1.1.3 Threats to Species Survival

Threats to the Lane Mountain milk-vetch identified by the USFWS include habitat destruction from dry wash gold mining, rock and mineral collecting, ORV recreation and threats due to military activity (USFWS 1998). An increase of non-native grasses spreading from road grading and other ground disturbing activities increases the potential for fire frequency and species competition, and may have long-term deleterious effects on Lane Mountain milk-vetch. Small populations, like those of other species, are vulnerable to extirpation simply by chance due to fluctuating environmental conditions and demographic stochasticity. A small portion of the distribution of the species (see below), near Brinkman Wash, on Fort Irwin and, as a result, is subject to habitat disturbance associated with military training. However the area is infrequently used and most of the area has been designated as a "no dig zone" and off-limits for mechanized training since 1991 (a portion of the Brinkman Wash – Montana Mine population in the UTM 90 Area) and 2001 (the NASA Goldstone Population).

4.2.1.1.4 Habitat

The physical habitat for Lane Mountain milk-vetch is commonly characterized by shallow soils with granite bedrock near the surface, occurring on gentle slopes between 3,100–4,200 ft (945–1,280 m) in elevation (Bagley 1989; Gibson et al., 1998; Lee and Ro Consulting Engineers 1986; Prigge et al., 2000; Charis 2002). Plants are typically found in patches, often following micro-topographic features such as small ridges, in areas with whitish or pinkish granitoid rocky soils with coarse-grained sand (Charis 2002).

Plants most commonly grow under and within the canopy of low growing desert shrubs such as California buckwheat (*Eriogonum fasciculatum ssp. polifolium*), burrobush, turpentine broom (*Thamnosma montana*), Nevada joint fir (*Ephedra nevadensis*), and Cooper goldenbush (*Ericameria cooperi* var. *cooperi*) (Prigge et al., 2000; Charis 2002). A very small percentage of the plants – 3 percent in the Prigge et al. (2000) study and 0.5 percent in the Charis (2002) study – have been found growing in the open without a shrub canopy. The host plant environment may enhance germination, seedling establishment, and/or growth and survival of the mature plant. Prigge et al. (2000) and Charis (2002) provide detailed analyses of the use of different species of shrubs as host or nurse plants by Lane Mountain milk-vetch, and its relative preferences for or against certain species. Particularly noteworthy is the fact that creosote bush, by far the most common shrub of these communities, is virtually never used as a host plant by Lane Mountain milk-vetch.

When compared with the surrounding area, the host plant environment moderates extreme air temperatures, and has different soil and water potentials and nutrient levels. Leaf litter is trapped and may aid in local soil development. Gibson et al. (1998) concluded that host plants were acting trellis-like, allowing Lane Mountain milk-vetch plants to position shoots for optimal levels of light, while the host plants benefit from nitrogen fixed by milk-vetch. Effects of the host plant environment on germination and seedling establishment are unknown.

Lane Mountain milk-vetch has been found growing within two complementary vegetation types, Mojave creosote bush scrub and Mojave mixed woody scrub (community designations follow Holland 1986), although it does not appear to use creosote bush as a host plant. Both plant communities can be quite diverse in their composition; however, both contain similar elements where milk-vetch populations are encountered. These vegetation types can also overlap and intergrade extensively, making a distinction between the two sometimes rather arbitrary. In both vegetation types, milk-vetch has been found in areas containing diverse assemblages of small to moderate-sized shrubs and scattered (sometimes very widely scattered) Joshua trees.

Prigge et al. (2000) referred to Lane Mountain milk-vetch sites as "islands in a sea of alluvial, creosote bush scrub." Plants were most often encountered on shallow ridges where soils were thinner and bedrock much closer to the surface. The suggestion was that more water was available here as compared to the deep alluvial soils in the intra-ridge areas. Physiological measurements of creosote bush (including shoot water potential, assimilation, and transpiration) indicated that Lane Mountain milk-vetch sites had better soil moisture supplies than surrounding areas (Prigge et al., 2000).

4.2.1.1.5 Geographic Range and Population Size

The discovery and accumulation of knowledge concerning the distribution and abundance of Lane Mountain milk-vetch are recounted in the Charis (2002) report. Intensive plot and transect surveys by Prigge et al. (2000, 2001) and Charis (2002) have covered all areas previously known or suspected to support the species, and have resulted in the most complete picture of its distribution to date. Other vegetation work in the region has not resulted in the discovery of additional areas of occurrence, and the investigators most familiar with the plant believe it is unlikely that significant new populations will be discovered, although this possibility cannot be ruled out (Charis 2002).

As of May 2003, a new survey for additional habitat is being conducted by Charis Corporation under contract to the U.S. Army. The goal of the survey is to identify new habitat areas outside of the previously delineated population polygon boundaries. The survey, as of this writing is not complete. Nevertheless, new habitat has been identified thus far that will enlarge the Coolgardie Mesa population as discussed below. Additional survey work will be performed during May and June 2003 with the results of the survey will be submitted to the USFWS in mid-summer 2003. As this time frame should be within the formal consultation period, the report will be submitted as an amendment to this BA to be used in consideration in formulation of the BO.

Lane Mountain milk-vetch is now known to occur in four relatively discrete locations (Prigge et al., 2000, 2001; Charis 2002). For identification purposes, the populations have been named Coolgardie Mesa, Paradise Valley, Brinkman Wash–Montana Mine, and NASA Goldstone (Figure 4-8). Each area supports what can be considered a distinct geographic population (IUCN 1994) of the species. The Coolgardie Mesa population and a small portion of the Paradise Valley Population are outside the project area. The rest of the Paradise Valley Population, the Brinkman Wash–Montana Mine Population, and part of the NASA Goldstone Population is in the project area and on Fort Irwin. A portion of the NASA Goldstone Population is present on land permitted for use by the Army to NASA. The names and general locations of the areas other than NASA Goldstone, follow previous usage by the USFWS (2001b).

Of the four populations, only the NASA Goldstone Population was not previously known to exist. The Coolgardie Mesa population was previously thought to contain approximately one hundred plants, but was subsequently discovered to be the largest known population containing an estimated 8,000 to 20,000 individual plants and nearly 46 percent of the total known habitat.

Surveys for Lane Mountain milk-vetch during the spring and summer of 2001 by Charis (2002) identified a much larger total population and distribution than was previously known, with a combined distribution of over 21,000 acres (8,499 ha). Not counting seedlings records, a total of 5,723 Lane Mountain milk-vetch plants have been individually recorded and mapped in a geographic information system (GIS) database in non-overlapping surveys by Prigge et al. (2000, 2001) and Charis (2002). Slightly over 2,000 plants were recorded from Coolgardie Mesa,

Figure 4-8: Lane Mountain Milk-Vetch

approximately 1,500 each from Paradise Valley and Brinkman Wash, and approximately 500 from NASA Goldstone (Table 4-4).

Table 4-4: Total Acreages of Known Lane Mountain Milk-Vetch Populations

	NASA Goldstone	Brinkman Wash–Montana Mine	Paradise Valley	Coolgardie Mesa	All Locations Combined
Acreage[1]	1,283	5,497	4,794	9,775	21,349
Total Recorded Plants[2]	555	1,487	1,667	2,014	5,723
Transect Acreage	501	2,615	1,832	3,697	8,644
Recorded Plants in Transects[3]	546	1,479	1,652	2,000	5,677
Population Area Covered by Transects	39 percent	48 percent	38 percent	38 percent	40 percent
Percentage of Total Known Habitat	6 percent	26 percent	22 percent	46 percent	100 percent

1. Total acreage in polygons.

2. Mature plants only. Seedlings are excluded from the total. Includes plants from 2001 Survey and Prigge et al., 2000, 2001.

3. Includes only the mature plants recorded in conjunction with transects surveys of specific areas. Other plants were located on random reconnaissance that were not included in this total.

Population boundaries as shown in Figures 4-9 A-D include every GPS-recorded occurrence of Lane Mountain milk-vetch available at the time of the analysis and were constructed so as to reasonably depict the species' known distribution.

As discussed in the Charis (2002) report, a number of considerations led to the reasonable expectation that less than 100 percent of the plants that were actually present within surveyed plots and transects were detected, tallied and mapped by the investigators. Because of the expectation that a certain percentage of plants were not seen, it was deemed appropriate to adjust the initial population size estimate by an "observability factor", i.e. the percentage of plants present that were observed versus those that were actually present but may not have been seen. Observed density is then divided by the observability factor to compute the estimated actual density of plants.

Without additional information to quantify the actual percentage of plants undetected, the observability factor must be expressed as a range. There are a number of issues relative to Lane Mountain milk-vetch biology, transect design, and surveyor efficiency that must be considered in evaluating the observability factor as with any survey of this type (Charis 2002). There are no data to indicate what the entire population abundance is based on the number of plants observed in previous surveys, this is because observability has not been correlated to actual density (Charis 2002). However, Table 4-5 shows the estimated population size based on a range of observability. If the data in Table 4-4 are adjusted for observability, the estimated total population ranges from approximately 14,121 at 100 percent observability to approximately 141,207 plants at 10 percent observability (see Charis 2002b for details).

Figure 4-9A: NASA Goldstone LMMV Population

Figure 4-9B: Brinkman Wash-Montana Mine LMMV Population

Figure 4-9C: Paradise Valley LMMV Population

Figure 4-9D: Coolgardie Mesa LMMV Population

Table 4-5: Estimated Population of Lane Mountain Milk-Vetch Adjusted by Observability Factor

Percentage of Observability	NASA Goldstone	Brinkman Wash-Montana Mine	Paradise Valley	Coolgardie Mesa	All Locations Combined
100 percent	1,399	3,109	4,324	5,288	14,121
90 percent	1,555	3,455	4,804	5,876	15,690
80 percent	1,749	3,887	5,405	6,610	17,651
70 percent	1,999	4,442	6,177	7,554	20,172
60 percent	2,332	5,182	7,207	8,813	23,534
50 percent	2,799	6,219	8,648	10,576	28,241
40 percent	3,498	7,774	10,810	13,220	35,302
30 percent	4,664	10,365	14,413	17,627	47,069
20 percent	6,996	15,547	21,620	26,440	70,603
10 percent	13,993	31,094	43,239	52,881	141,207

Several environmental factors may increase or decrease habitat size and population on a yearly basis. Notably, the 2001 survey season was one of average rainfall preceded by two years of drought; therefore the rainfall that year produced a likely minimum population snapshot for the current drought cycle.

4.2.1.1.6 Conclusion

Lane Mountain milk-vetch is present within the boundaries of the project area and may be affected by military training activities. Therefore, impacts to this species will be considered further in this BA.

4.2.2 Species with a Potential for Listing Under the ESA as Threatened or Endangered

4.2.2.1 Desert Cymopterus *(Cymopterus deserticola)*

4.2.2.1.1 Legal Status

The desert cymopterus is a Federal Species of Concern, is BLM Sensitive, and on the CNPS Inventory List 1B. A petition for the desert cymopterus to be listed as endangered was received by the USFWS on April 15, 2002.

4.2.2.1.2 Species Description

The desert cymopterus is an herbaceous perennial plant in the carrot family *(Apiaceae)*. It is a long-lived perennial geophyte with perennating buds located underground at the top of the root crown. It is an acaulescent plant (without a stem), that usually reaches 6 in (15 cm) in height. It has long, slender, deep, tap roots with one or more leaves arising from a short combined stem-root crown. The desert cymopterus typically has one to several leaves. The petioles are usually as long or longer than the leaf blades, but much of the petiole is often underground. Leaf blades are oblong-ovate in outline, highly dissected, grayish-green, and hairless. Purple flowers are clustered in a compact globe at the end of each leafless peduncle that rises above the leaves (BLM 2002a).

Desert cymopterus typically grows in the winter and spring under moist conditions. Plants dry out at the end of the rainy season and go dormant with the onset of hot weather, usually in April or May. The plants are not visible above ground during dormancy, because the above-ground portions of the plant, the leaf blades, petioles, and flowers, die back during this period. In dry years it appears that many plants remain dormant throughout the growing season. Observable population numbers seem to fluctuate widely from year to year, apparently in response to the amount and timing of annual rainfall (BLM 2002a).

4.2.2.1.3 Habitat

The desert cymopterus occurs on substrates that include deep, loose, well drained, fine to coarse sandy soils of alluvial fans and basins. It also occurs on stabilized low sand dune areas and occasionally on sandy slopes. It is found at 2,060–3,060 ft (692–933m) in elevation. Desert cymopterus occurs in Mojave creosote bush scrub, desert saltbush scrub, and Joshua tree woodland with creosote bush scrub or desert saltbush scrub understory (as described by Holland 1986). Common perennial plants often found growing with desert cymopterus include creosote bush, Joshua tree, saltbush (*Atriplex polycarpa, A. canescens, A. spinifera, A. confertifolia)*, burrobush, goldenhead (*Acamptopappus sphaerocephalus*), winter fat, peachthorn *(Lycium cooperi)*, cheesebush, desert croton *(Croton californicus* var. *mohavensis)*, and Indian rice-grass *(Oryzopsis hymenoides)*. The latter four species, in particular, are indicators of sandy habitats. Desert cymopterus also occurs at a few sites within the Mojave mixed woody scrub community type. Plants tend to occur in open spaces between shrubs and are usually scattered throughout the area in which they are found. A diversity of annual species typically also occurs in these sandy habitats (BLM 2002a).

4.2.2.1.4 Geographic Range

Desert cymopterus ranges from Apple Valley, San Bernardino County, northward approximately 55 miles (89 km) to the Cuddeback Lake basin, San Bernardino County, and westward approximately 45 miles (73 km) to the Rogers and Buckhorn Lake basins on Edwards AFB, in Kern and Los Angeles counties. However, recent attempts to locate desert cymopterus at historic collection sites in Apple Valley have been unsuccessful. These sites may have been lost to urban development and OHV use. The known extant, or remaining portion of its range, occurs in three adjacent areas: the Rogers Lake basin (including the small Buckhorn Lake area to the west and the Kramer Hills to the east), the Harper Lake basin, and the Cuddeback Lake basin (BLM 2002a). The documented range of the desert cymopterus was extended northeast with the location of an additional population in the Superior Valley in 2001 (BLM 2002d).

4.2.2.1.5 Population Status in the Project Area

One population of desert cymopterus is known from a site in the Superior Valley, in the western portion of the project area. Forty-two plants have been recorded at this location (BLM 2002d). A separate record of one site appears to be from the same population (CDFG 2002b).

4.2.2.1.6 Conclusion

The population of desert cymopterus in the western portion of the project area may be affected by military training activities. Therefore, impacts to this species will be considered further in this BA.