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Use of Artificial Burrows by Burrowing Owls (*Athene cunicularia*) at the HAMMER Facility on the U.S. Department of Energy Hanford Site

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Prepared for the U.S. Department of Energy
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Summary

In 2003, the U.S. Department of Energy (DOE) constructed an Emergency Vehicle Operations Course (EVOC) at the Hazardous Material Management and Emergency Response (HAMMER) Training and Education Center in the southern portion of the Hanford Site. Preliminary surveys during 2001 identified an active burrow and three burrowing owls (*Athene cunicularia*) within the proposed development area. Burrowing owls are classified as a federal species of concern, a Washington State candidate species, a Washington Department of Fish and Wildlife priority species, and a Hanford Site Biological Resources Management Plan Level III resource. Therefore, the mitigation action plan for the project included the installation of 20 artificial burrows around the EVOC in spring 2003. The mitigation plan established a success criterion of 5% annual use of the burrows by owls.

In July 2005, a field survey of the EVOC burrow complex was conducted to determine use and demography at each site. Burrow locations were mapped, and signs of activity (feces, owl tracks, castings, feathers) were recorded. Of the 20 burrows, 12 were found to be active. Of the eight inactive burrows, three appeared to have been active earlier in the 2005 breeding season. A total of 19 owls were counted, but demography could not be determined. It appears that the EVOC mitigation exceeded burrow use goals during 2005. Continued site monitoring and maintenance, according to mitigation plan guidelines, should be conducted as prescribed.

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1.0 Introduction

Burrowing owls (*Athene cunicularia*) were once common throughout western North America, from Canada's southern provinces into Texas. The species is now absent from many parts of its original range, including Minnesota, Iowa, eastern parts of the Dakotas, through central Oklahoma, and central Texas (Holroyd and Birn 2003). The Washington Department of Fish and Wildlife (WDFW) classifies the burrowing owl as a state candidate species (WDFW 2005), and it is considered a species of concern (an informal term referring to a species that might be in need of conservation action) by the U.S. Fish and Wildlife Service (FWS 2005).

Typical habitat includes deserts, grasslands, prairies, and other natural areas as well as agricultural lands and man-altered environments (Collins and Landry 1977). Although burrowing owls are thought to prefer habitat that has not been modified by man, they are found in proximity to humans at golf courses and airports and in suburban areas (Coulombe 1971). Unlike other owl species, the burrowing owl nests underground rather than in trees or other above-ground structures. The owls will often use abandoned burrows created by badgers, prairie dogs, and ground squirrels. It is unknown whether burrowing owls are capable of digging their own burrows. Some authors (Collins and Landry 1977; Trulio 1995) have suggested that although they believe the owl is capable of digging its own burrow, it is more likely to inhabit abandoned burrows dug by other animals.

In the Pacific Northwest, burrowing owls are usually migratory (migrating between August and September and returning as early as March), with the occasional owl that does not migrate for the winter months. It is more likely that an adult male will not migrate than it is for a female or juvenile. The non-migratory owl will typically stay at the burrow where it had nested the previous season or at a burrow where it intends to nest for the upcoming breeding season (Coulombe 1971).

The 9-inch-tall owl prefers low vegetation accompanied by higher perches around its burrow because it increases horizontal visibility and aids in the early detection of both prey and potential predators (Green and Anthony 1989). The reduced vegetation surrounding the burrow that results from occupation by the previous tenant may attract a burrowing owl to an abandoned burrow (MacCracken et al. 1985). The owl's diet is influenced by its surroundings. Low vegetation in the springtime exposes small rodents, creating an optimal hunting environment for the owls. As the vegetation grows in the summer, it creates concealing cover for rodents, and the insect population grows. At this time, the owl becomes primarily insectivorous (Green and Anthony 1989).

Data collected through the American Breeding Bird Survey between 1981 and 2004 suggests that the burrowing owl population in Washington has declined at an annual rate of 8.7% (Conway et al. 2005). Many human-related factors are contributing to the decline of the burrowing owl population, especially suburban, agricultural, and commercial development that eliminate habitat. Burrowing animal control activities also result in a loss of burrows (Collins and Landry 1977). Diseases such as the sylvatic plague that kill prairie dogs, insecticides such as carbofuran, predators, vehicle and owl collisions, and low food supplies may also play a role in population decrease (Criddle 1999).

One method being used to help the burrowing owl population has been the installation of artificial burrows (Trulio 1995). Artificial burrows have been successfully used to reintroduce burrowing owls into British Columbia, relocate owls into safer habitat areas, and increase the owl population in southern California (Trulio 1995).

In 2003, the Hazardous Material Management and Emergency Response (HAMMER) Training and Education Center built an Emergency Vehicle Operations Course (EVOC) as part of a larger facility expansion plan. During initial site investigations in 2001, an active owl burrow and three burrowing owls were observed. Burrowing owls are classified as a federal species of concern, a Washington State candidate species, a WDFW priority species, and a Hanford Site Biological Resources Management Plan (DOE 2001) Level III resource. Therefore, mitigation of the potential impacts to burrowing owls was included as part of the mitigation action plan (MAP) for the HAMMER facility expansion (DOE 2002). The MAP required the installation of artificial burrows around the EVOC, and it required that the artificial burrows be inspected at least twice per year—once in the winter for maintenance and cleaning, and at least once in the nesting season to determine usage. The MAP defined a success criterion of at least 5% usage of the burrows by owls annually. The monitoring was to be continued for at least 5 years (DOE 2002).

No formal surveys of the physical status or usage of the EVOC artificial burrows had been conducted since they were installed. However, owls using at least one burrow were observed shortly after construction, and castings (owl sign) had been observed and informally noted during November 2004. Pacific Northwest National Laboratory researchers conducted this study for Fluor Hanford, Inc., to determine the usage of the EVOC owl burrows and to identify any maintenance needs.

2.0 Materials and Methods

Twenty artificial burrows were constructed by Fluor Hanford, Inc. (Figure 1) in spring 2003. A backhoe was used to dig 50 inches vertically into the ground, and a 5-gallon bucket was placed upside-down in the bottom of the hole (Figures 1 and 2). An elongated circle was cut out of the lip of the bucket, and one end of an 8- to 10-foot-long, 4-inch-diameter perforated corrugated plastic pipe was snuggle-fit into the circle. The rest of the pipe led up to ground level facing north, with a 90-degree bend to keep sunlight from reaching the burrow (Figures 1 and 2). The top 5-foot section of the corrugated pipe was covered with a 6-inch-diameter polyvinyl chloride (PVC) pipe to help protect the corrugated pipe from deterioration and predator attack. Spray foam was used between the two pipes to hold them together, and spray paint was used to seal in the foam. The outer end of the tube was secured in place with a bent section of rebar. A wooden T-shaped perch was placed directly over the bucket to mark the location of the burrow (Figure 3).

The burrows were not placed uniformly over the EVOC site. Seven of the burrows were placed by themselves, and the rest were clustered in two groups of two burrows each and three groups of three burrows each.

Figure 1. Construction of the Artificial Burrows

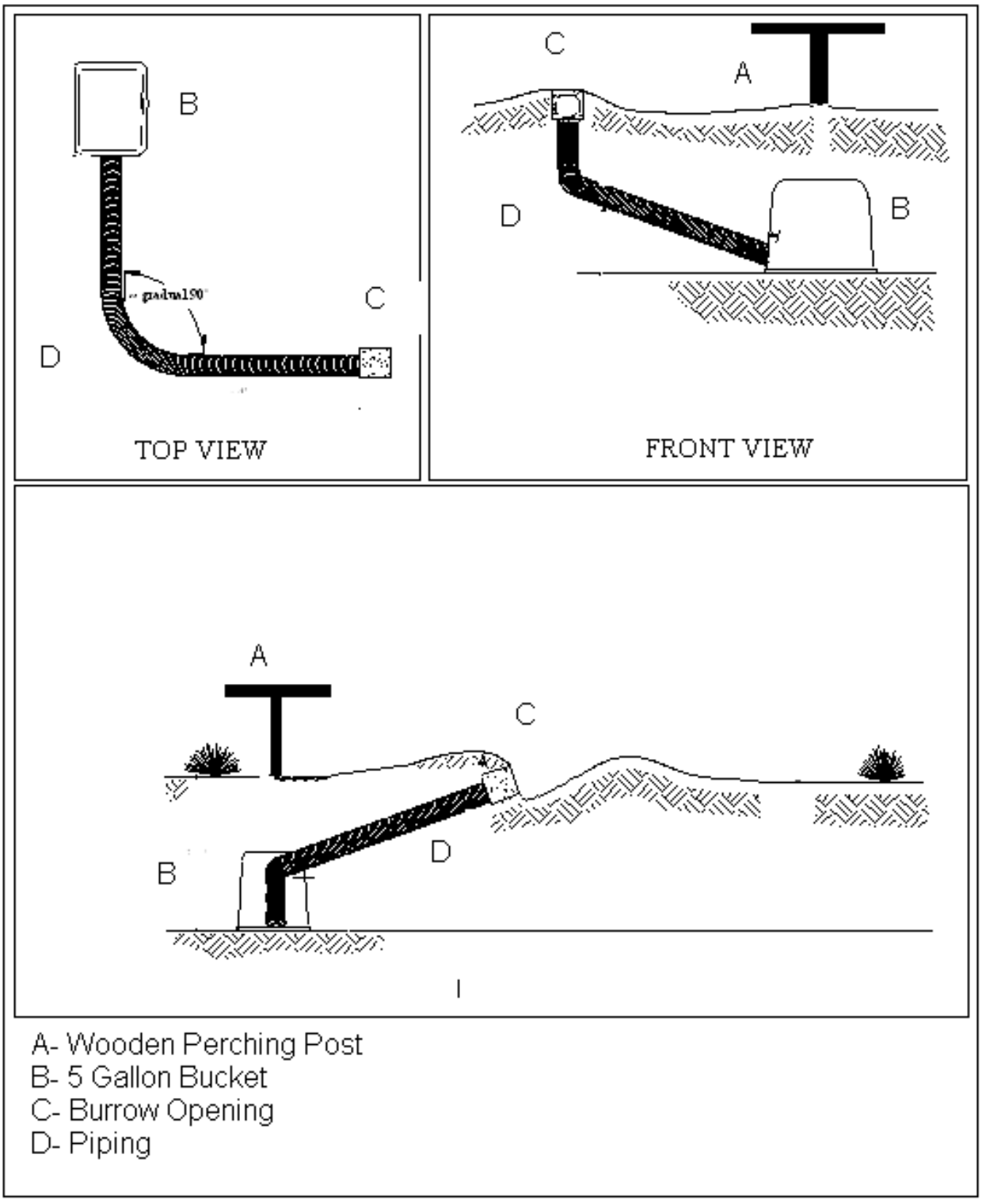

Figure 2. Recommended Layout for an Artificial Burrow

Figure 3. Perch Post Use by Burrowing Owls

In mid July 2005, burrow use around the EVOC was surveyed. A contour topographic map (Figure 4), containing the EVOC and locations of the 12 burrow sites, was used to locate each of the 20 artificial burrows. Burrow locations were recorded using a global positioning system (GPS). Owls were observed from a 50-meter distance using binoculars and a spotting scope. The owls were counted at each burrow site, and an attempt was made to determine owl demography. Activity and animal sign (feces, feathers, castings, and owl tracks) were noted at each burrow site, as well as general condition, signs of predators, and maintenance needs.

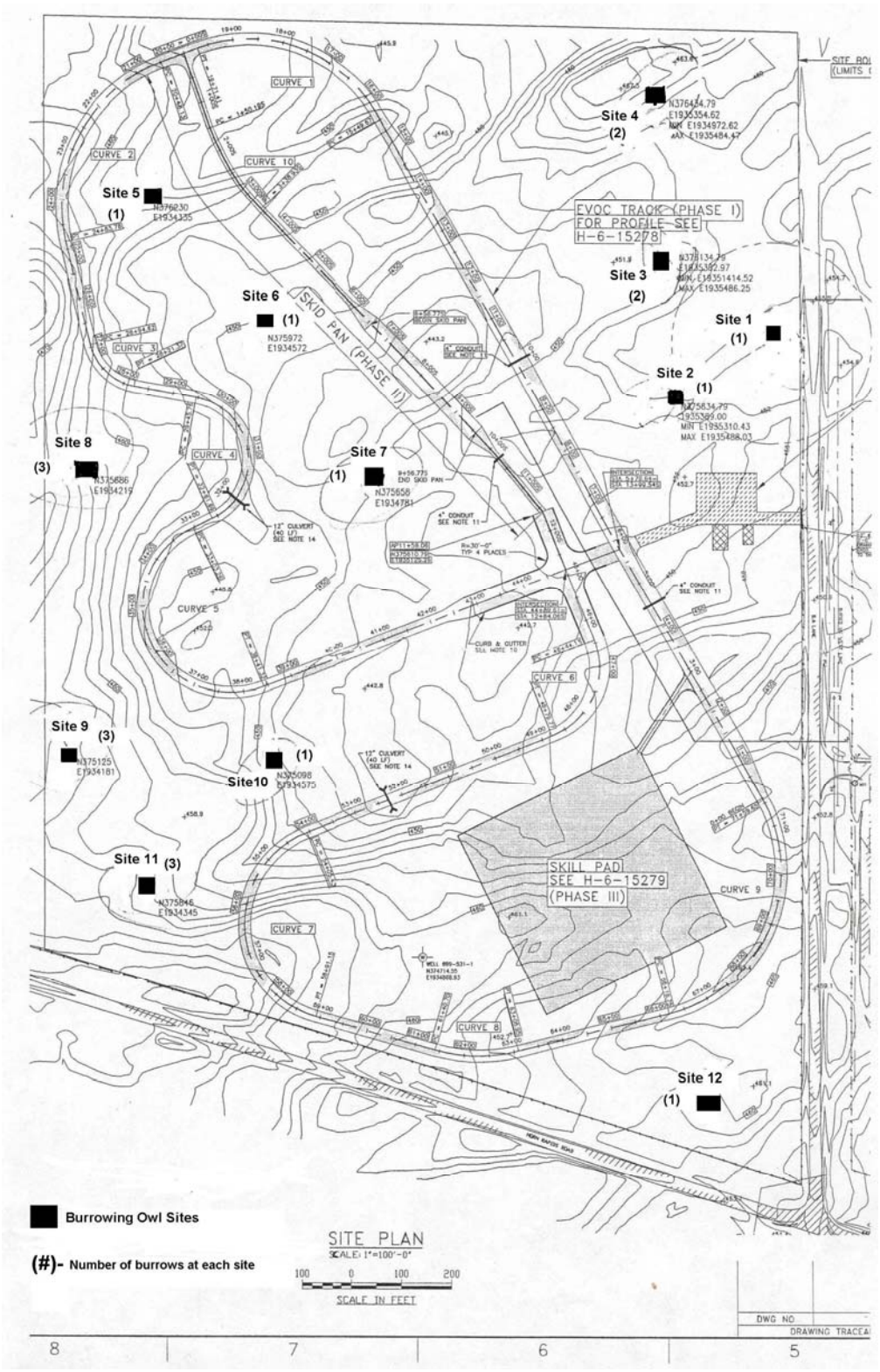

Figure 4. Topographic Map Containing the EVOC and Locations of the Twelve Artificial Burrow Sites

3.0 Results

Nineteen owls were counted at the EVOC. However, demography could not be determined due to the advanced growth stage of the fledglings. The 19 owls represent a six-fold population increase since prior to EVOC construction. The owls appeared to move as groups among clusters of burrows. For instance, seven owls were found in the vicinity of Sites 1, 2, 3, and 4 (six burrows in total) in the northeastern corner of the EVOC site (Table 1).

Table 1. Burrowing Owl Usage and Maintenance Recommendations for the Twenty Artificial Burrows at the EVOC Site

Burrow ID	Status	Number of Owls Observed July 2005	Maintenance Recommendations
1	Active Recently	7	R, S - Area over tubing has caved in and needs to be refilled.
2	Active		R, B
3A	Active		O, P, B
3B	Active		R, B
4A	Active		R, B
4B	Active Recently		R
5	Inactive	4	R, B
6	Active		R, P
7	Active		R
8A	Active	8	R, P, B
8B	Active		R, B
8C	Active		R, B, P
9A	Inactive		R, O, B
9B	Active		R, B
9C	Active		R, P, B
10	Active		R, O, B
11A	Active Recently	0	R, O, B
11B	Inactive		R, O, B
11C	Inactive		R, O, B
12	Inactive	0	R, O, B

B = Clean out obstructive vegetation (e.g., tumbleweed).
P = Refill holes created from predator attack.
O = Clean out burrow opening.
R = Replenish soil around burrow opening and remake mound.
S = Special instructions.

Seventy-five percent of the artificial burrows were used during the 2005 breeding season. Twelve were active at the time of inspection (signs of activity and had an unobstructed burrow opening), three were active recently (some signs of activity, but burrow openings were obstructed with vegetation or spider webs), and five appeared to be inactive (Table 1). Of the seven single burrow sites (sites with only one burrow), five were active or active recently and two were inactive. There are two double burrow sites, and all four of these burrows were active or active recently. Of the three triple burrow sites, only three individual burrows were inactive (Figure 5).

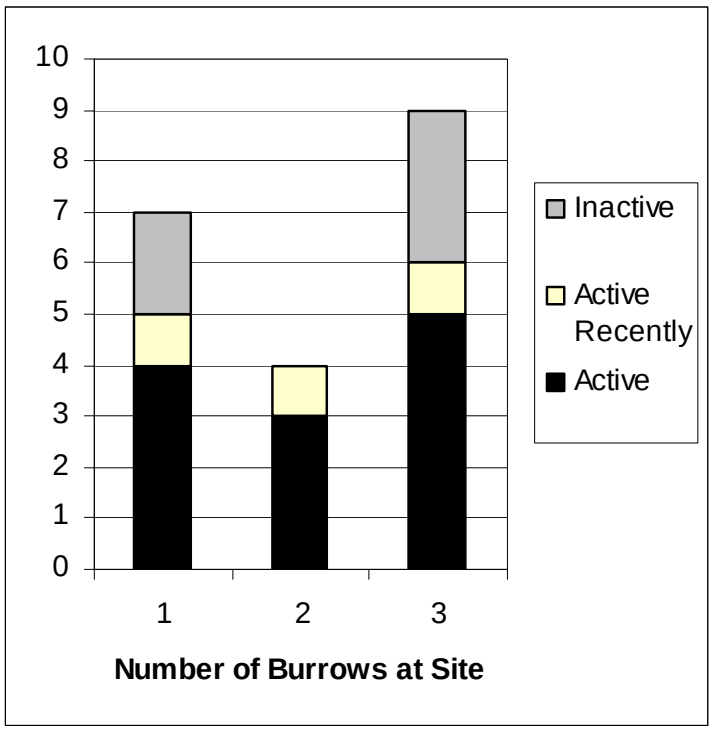

Figure 5. Number of Active Burrows for Each Site Type (single, double, or triple)

Of the five inactive burrows, four had burrow openings that were approximately 75% obstructed by soil and three were also obstructed by tumbleweed. Five of the burrows that were active this season had been partially excavated by predators. All of the artificial burrows were found to be in need of some maintenance activities (Table 1).

4.0 Discussion and Conclusions

Many variables may contribute to the successful use of artificial burrows by burrowing owls, including history of burrowing owls in the area, availability of food, surrounding vegetation, type of materials used to build the burrow, size of the burrow and entrance, number of burrows in proximity of each other, direction in which the burrow entrance is facing, number of burrow entrances per burrow, depth of the burrow, type and height of perches, and annual maintenance needs. Research is still being conducted to find out which of these factors are most important.

The MAP (DOE 2002) for the expansion of the HAMMER facility defined 5% annual use of the burrows as the success criterion. The 2005 results showed the artificial burrows to be successful, with 75% of the burrows being used. The original nesting burrows and how many mating pairs produced young at the EVOC site this year could not be determined. The study was conducted late in the breeding season, when a brood of owls will typically use multiple burrows.

The number of burrows at each site (single, double, or triple) did not appear to be related to the likelihood of burrow use. It may have been a factor when the mating pair picked out its nesting burrow early in the breeding season, but by mid- to late July, the juveniles were spread out among multiple burrow sites. For example, seven owls appeared to be using six burrows at four different sites in the northeast-portion of the EVOC (Sites 1 through 4, Figure 4). Burrowing owls typically have a clutch size of seven to nine eggs (Martin 1973), so it is possible that this was a family of two adults and five juveniles that had spread out to the surrounding burrows.

Four owls were found in the vicinity of Burrows 5, 6, and 7 in the central part of the EVOC (Figure 4). They could be a pair and their two young, two pairs, or juveniles from a different family either on or off the EVOC site that had taken up residence in the area. Eight owls were observed at Sites 8, 9, and 10 on the western part of the EVOC (Figure 4), with five of the seven burrows being used by them. This group could be a nesting pair and their five young or migrating owls.

Yearly maintenance of the artificial burrows is required under the MAP. In 2005, all 20 burrows were found to need some kind of maintenance (Table 1). All except Burrow 3A needed maintenance around the burrow opening. The plastic tubing was exposed and, in some cases, there was a space underneath the tubing between the tube and the ground. If this space is large enough, it could inhibit an owl from nesting at the burrow because nestlings would be able to exit but may not be able to re-enter the burrow. The opening of the tube should be flush with the ground. Also, creating a small dip outside of the entrance (while keeping the entrance flush with the surface) gives protective cover for the young owls when they are loafing outside the burrow and mimics a more natural burrow opening. A mound of soil adjacent to the depression mimics a natural badger burrow and provides an additional perch location.

The openings of about one-third of the burrows need to be cleaned out. Obstructions from vegetation and soil should be cleared away prior to the next mating season. Owls are capable of clearing away some soil and vegetation, but some of these burrow entrances are almost completely obstructed (Figure 5). Most of the burrows need surrounding vegetation such as dead tumbleweed (*Salsola kali*) cleared out. Small shrubs are acceptable to leave as long as they do not cover the burrow opening.

Some burrows have been excavated by predators (Figure 6). These burrows (3A, 6, 8A, and 9C) need to be recovered. Leaving the burrow or burrow tubing exposed to the sun will heat it up and can be deadly for the owls. The fill over Burrow 1 has settled over the tubing and may no longer meet the burrow design; it should be backfilled until level.

Monitoring of the burrowing owls at the EVOC site during fiscal year 2006 should be started by early March so the number of mating pairs can be determined, the nest burrows can be identified, and the clutch size and number of fledging offspring can be determined. The spatial and temporal patterns of the burrow usage by family groups can also be determined by starting earlier. Eventually, such monitoring may help to point out potential improvements for future burrowing owl mitigation sites.

Figure 6. Burrow Entrance Obscured by Soil and Vegetation

Figure 7. Artificial Burrow Entrances Excavated by a Predator

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