Appendix 1: Non-lethal management

A1.1. Conflict Prevention

Advance planning can prevent human/prairie dog conflicts. Development plans should take into account open space and prairie dog areas, including potential dispersal routes (*see* Part 2, Sections 3.3 and 3.4). By analyzing dispersal routes (generally low-lying areas or drainages), land managers can predict where prairie dogs may appear in the future and have a plan in place either to prevent colonization with barriers or other non-lethal means, or to direct colonization to prairie dog-friendly areas. Prairie dogs avoid areas where they have no line of sight, so visual barriers such as fencing or tall vegetation can help prevent colonization. On the flip side, manipulated grazing, mowing, or controlled burns can encourage prairie dog migration into open areas.

A1.2. Barriers

Manmade and vegetative barriers can be useful to exclude prairie dogs from incompatible areas such as athletic fields, agricultural lands, residential and commercial areas, and trails. To be effective, barriers should provide both a physical and visual deterrent.

Key points for manmade barriers:

- Final placement should avoid splitting prairie dog family units (if absolutely necessary, the entire family unit should be relocated; see below)
- Minimum height should be three feet
- The barrier should be made of opaque materials
- Candidate materials include: metal sheeting, PVC, wooden privacy fence, brick, or rock walls. Wood slat snow fence and chain-link fence can be used with modifications. Woven electric fence and electric fence with poultry wire have promise in certain situations. Temporary barriers include solid black silt fence (very short life) or vinyl (longer life depending on installation)
- May or may not be buried into the ground. If the barrier is not buried, consider backfilling rock or soil against the bottom of the barrier to discourage light from passing beneath it.
- Should include a burrowing and tunneling preventive, such as four-foot-wide, one-inch netting poultry wire anchored on top of the ground with ample six-inch sod pins, directly abutting the prairie dog side of the barrier. On some barrier materials (wood and vinyl), the poultry wire should lip up the back no more than 12- inches, to inhibit prairie dogs from chewing through the bottom of the barrier
- Hardscaping with decorative pavers, 4- to 6-inch cobble or rip-rap as effective substrate in parking lot medians, next to walkways, along exterior building foundations, or in seating areas

Key points for vegetative barriers (grasses and shrubs):

- Effective when manmade barriers are impractical. For example, along field fence or large landscapes in open space and rural areas.
- Create plant mosaics (varying plants with different growth cycles)

- Can be used in agriculture (dense crops such as barley, corn, winter wheat)
- Can be used in open ranges (mixed and tall height grasses, woody vegetation and rushes and sedges)
- Deferred grazing and mowing, especially during spring and early summer, can prevent prairie dogs from colonizing (tactics include rotational livestock grazing and moving water tank locations)
- Irrigation creates undesirable wet habitat for prairie dogs
- In areas where prairie dog expansion is desired, livestock grazing, mowing, and prescribed burns are useful techniques to create habitat

For detailed descriptions and examples of what does and does not work for both artificial and vegetative barriers, see "Attachment 1: Prairie Dog Barriers Overview."

A1.3. Birth control

Two contraceptive products have been experimentally tested on black-tailed prairie dogs: DiazaCon and GonaCon™.

DiazaCon, an oral contraceptive carried in bait, works by inhibiting the cholesterol production needed to produce sex hormones. In a small study, the number of pups born was reduced by 95.5 percent and the contraceptive worked for one breeding season. Primary exposure to non-target species may occur if the baits are directly consumed, and secondary exposure to non-targets might occur if a prairie dog was consumed. More research will be needed before this product becomes readily available (Yoder et al., 2016). DiazaCon is not presently registered by the Environmental Protection Agency (EPA). If approved it will be registered as a restricted use chemical that may only be applied by qualified individuals or agencies (USDA, 2010).

GonaCon™ is a vaccine that prevents the formation of GnRH, a sex hormone, for more than one year. As GonaCon™ is a vaccine, primary non-target species exposure would not occur and if a vaccinated prairie dog was consumed, the vaccine would quickly degrade. The disadvantage is that individual prairie dogs must be captured to administer the vaccine (Yoder et al., 2010). GonaCon™ is currently registered by the EPA as a restricted use chemical and may only be used by USDA Wildlife Services or state wildlife agencies, or individuals working under their authority (USDA, 2010).

Using population modeling, Yoder et al. (2008) evaluated four different scenarios: no control, lethal control, fertility control, and a combination of lethal control and fertility control using GonaCon™ for black-tailed prairie dogs. To summarize their results:

1. Population models are predictions based upon the best available information and may not be applicable at large scales.
2. Modeled populations that were subject to culling (lethal control) of 50-90% of the total colony went extinct more quickly than populations that received contraceptives applied at the same levels.
3. Populations could be stabilized at their current size with 12.79% yearly culling **or** 33.25% yearly contraception.

4. Populations remained relatively stable over 100 years when 50% of the population was culled initially, followed by 85.8% contraception once every 3 years.

A1.4. Passive relocation

Passive relocation is a process that manipulates the habitat of prairie dogs, causing them to move out of disputed areas without handling the animal. This method can involve several approaches such as grazing and mowing management, irrigation, tilling, or direct manipulation of each burrow (Reverse Dispersal Translocation™, or RDT). One main requirement for the success of passive relocation is that burrows must be available within a reasonable distance of the RDT site to receive the prairie dogs that are moving. The process should ideally be performed when populations are lower thereby reducing conflicts amongst individuals competing for limited natural resources (burrows, vegetation, etc.). For a detailed description of the RDT methodology, see "Attachment 2: Reverse Dispersal Translocation™ (RDT)."

A1.5. Active Relocation

Active relocation is the physical removal of prairie dogs from one area (the take site) and transferal of the animals to another area (the receiving site). Relocation may be undertaken to save animals from imminent death or habitat destruction, to reestablish colonies that have succumbed to plague, or to expand large-scale conservation areas.

Because prairie dogs are physically handled during the relocation process, wildlife agencies may require an intra- or inter-state permit. The permitting process may take anywhere from weeks to months, even years, depending on the species of prairie dog and the laws of individual states and local governments. Various factors are considered during the permitting process, such as whether the new receiving site is adequate for release and what mitigation tactics can be employed if there are conflicts with adjacent landowners.

Relocations should use well-thought-out strategies to maximize success and ensure that prairie dogs acclimate quickly to a receiving site. Prairie dogs should never be "dumped" into an open area. For relocation best practices, see the City of Boulder's prairie dog working group Phase I & Phase II recommendations (https://bouldercolorado.gov/osmp/prairie-dog-working-group); Section A1.5.1; and IUCN Guidelines for reintroductions and other conservation translocations (https://portals.iucn.org/library/efiles/documents/2013-009.pdf).

A1.5.1. Relocation Best Practices

The following are best practices to ensure a positive outcome from prairie dog relocations. Only trained professionals should attempt to relocate prairie dogs; these guidelines are provided to give a sense of what to expect from a relocator.

Relocate at the appropriate time of year. Populations moved in early spring and early summer may contain a high number of juveniles that would not have survived even if they were not relocated. Approximately 50 percent of the juvenile population typically succumbs to natural mortality in undisturbed prairie dog colonies (Hoogland, 1995; Hoogland, 2006). Therefore, relocations are best undertaken 2 to 3 months after first juvenile emergence.

1. Black-tailed prairie dogs should be moved with these timing conditions in mind:
    a. Birthing, weaning, and first juvenile emergence occurs March through June 1st and relocations are generally discouraged during that time. If possible, capture should be postponed until juveniles have been coming above-ground for at least six weeks (late June or early July for most colonies) (Long et al, 2006).
    b. Relocations are affected by seasonal conditions. Torpor (semi-hibernation) can occur in the winter, sometimes for weeks, and during hot summer days.
    c. The best relocation period is late August through mid-November; however, late fall and winter relocations should take into account the conditions of the receiving site; for example, sites with natural burrows may be more appropriate for winter relocations than sites that have no existing burrows, since the prairie dogs will not have to dig in frozen ground. Long et al. (2006) recommend cessation of capture by October in most latitudes.

2. Gunnison's, Utah, and white-tailed prairie dogs hibernate and therefore cannot be relocated year-round.
    a. Breeding occurs from mid-March to early April. Gestation lasts an average of 29 days, and the pups emerge above ground in June.
    b. Hibernation begins August/September and lasts through late February/early March.
    c. The best time for relocations is late June through late August.

Relocation is a multi-step process:

1. Evaluation of the take (removal) site. This generally involves three uninterrupted observations of the colony layout and a physical count of prairie dogs on separate days during the times that prairie dogs are most active. For best results, mapping of territorial family units (coteries) occurs at this time.

2. Evaluation of receiving (release) site suitability. This analysis reviews information about historical presence of prairie dogs, adequate vegetation, soil conditions, and slope gradient. Historical presence, whether one year or 200 years ago, is important because it is one of the best indicators of soil suitability. The site is further examined for evidence of existing intact burrows and whether artificial chambers will be required to accommodate all captured prairie dogs.

    Degraded vegetation may be a problem on some prairie dog sites. Where vegetation is very poor and predominately comprised of introduced pasture grass monocultures and Eurasian forbs, a restoration strategy to reverse or at least mitigate undesirable plants and increase plant diversity should be considered.

    Human intervention may be required to control noxious weeds and reintroduce native grasses and forbs that are resilient or resistant to prairie dog grazing. Prairie dogs do not necessarily need to be removed to restore damaged areas as they are known to survive on nonnative plant species and in some cases aid in the control of undesirable species by dead-heading weeds or exhausting nonnative grasses. In some cases, tall grasses may need to be mowed before prairie dogs are reintroduced.

3. Preparing the take site**.** All burrows are dusted with DeltaDust™, family units are identified (flagged or staked) and traps are set in pre-bait (traps grained and left locked open). Pre-baiting may require one to two weeks depending on the behavior of prairie dogs around the traps and bait consumption patterns. Traps in pre-bait should be monitored every day. There should be ample traps laid out on the site to capture all individual animals.

4. Preparing the receiving site. In this stage, the receiving site is more thoroughly evaluated for suitable natural receiving burrows and, if needed, strategic placement of artificial chambers. Natural burrows should be a minimum of 2 to 3 feet long and approximately 4 inches in diameter. Some semi-degraded burrows can be reopened using a two-inch in diameter, two-foot-long bulb-planting bit on a hand drill (attempting to reopen burrows with larger equipment could destroy tunnel systems). Most natural burrows initially accept two to three prairie dogs; larger burrows can accept more prairie dogs. Artificial chambers will be required if natural burrows are too degraded. An artificial chamber should be large enough for prairie dogs to sit up inside it and bring in nesting materials and structurally sound enough that it does not collapse under the weight of the soil or degrade in inclement weather. Using a backhoe or a ditch witch, the chamber is buried 4-feet below ground (or deeper depending on frost line) with two exit tubes that connect directly to the chamber and extend above ground (Figure 1).

   Using an auger to create new burrows for receiving prairie dogs has been done with mixed success. Effectiveness is largely contingent upon the unique composition of soils on individual sites. Some challenges associated with augering new holes include maneuvering heavy equipment and drilling at a 45 degree angle (the recommended angle for artificial burrows), soil compaction at the end of the auger bit creating difficult digging conditions for prairie dogs, and a wide opening which allows predators to easily trap prairie dogs inside. With ingenuity, augured holes can be fitted with an acclimation cap for some protection from predators. Inclement weather may also present problems as rain can quickly fill augered holes causing flooding and rapid disintegration. Despite these issues, augering should not be entirely dismissed, as it has been useful in select applications.

5. Trapping. Traps should be set when prairie dogs are the most active. Trapping must be avoided during very hot periods when temperatures exceed 80 degrees; heat stress can kill prairie dogs. Captured animals in traps are covered with a towel or sheet to reduce stress, and ideally released at the receiving site the same day or the next morning. Trap-shy prairie dogs may be flushed with soapy water. In some cases the take site burrows are lightly covered with soil to locate active prairie dogs. If non-target animals (corvids, songbirds, and rabbits, for example) are trapped, they should be released at the take site. Injured or sick target or non-target animals should be taken to a vet or licensed rehabilitator.

6. Other important factors.

   - **Proper care of animals in captivity.** In some cases, prairie dogs may need to be held overnight, several days, or longer. Holding facilities require special permitting and an onsite inspection by a state wildlife officer(s) who ensures the safety of the wild animals and their human caretakers. Wildlife officers have permission to enter the holding facility on a 24/7 basis. Care of prairie dogs should include:

- Adequate housing and shelter away from harsh weather or other potential conflicts (other animals, unnecessary noise)
- Separate housing for prairie dogs from different family units
- Containment so they cannot get loose or become injured inside the facility
- Daily fresh food (dry and wet sources)
- Daily freshened bedding
- Climate control
- Sickly or injured animals (very rare) should be immediately transported to a certified wildlife rehabilitator or veterinarian.

- **Transparency is important, but restricting access at specific times is also necessary.** In some cases the public is very interested in the process and progress of the take and release sites, but knowing who and when visitors are coming onto either site is important. This is to ensure that the public does not interfere during critical periods (trapping) or disturbing equipment. Trapping the first day can be hectic and is generally not an ideal time for disturbance by a large public viewing or media event. Moving prairie dogs is a lot of work, and keeping animals as stress-free as possible is a priority.

- **Move prairie dogs as family units.** Truett et al. (2001) suggests that regardless of the species, capture and translocation of intact family units probably minimizes stress and post-release dispersal, and multiple relocators have reported prairie dogs' attempts to reestablish social unity at release sites. Prairie dogs should be placed into the release site in the same orientation they held at the take site. For example, prairie dogs on the northwest corner of the take site should be released in the northwest corner of the release site and so on.

- **Be conscious of predation risk.** Raptors, coyotes, and badgers may rapidly prey upon newly relocated prairie dogs. Techniques to reduce predation risk include keeping acclimation caps over natural tunnel systems longer (though acclimation caps should not be kept over artificial burrows longer than 3 to 5 days) and mowing vegetation to increase predator visibility (Long et al., 2006). Wildlife managers have also trapped offending badgers and relocated them. In very remote areas, wildlife managers have camped on the receiving sites to haze off predators.

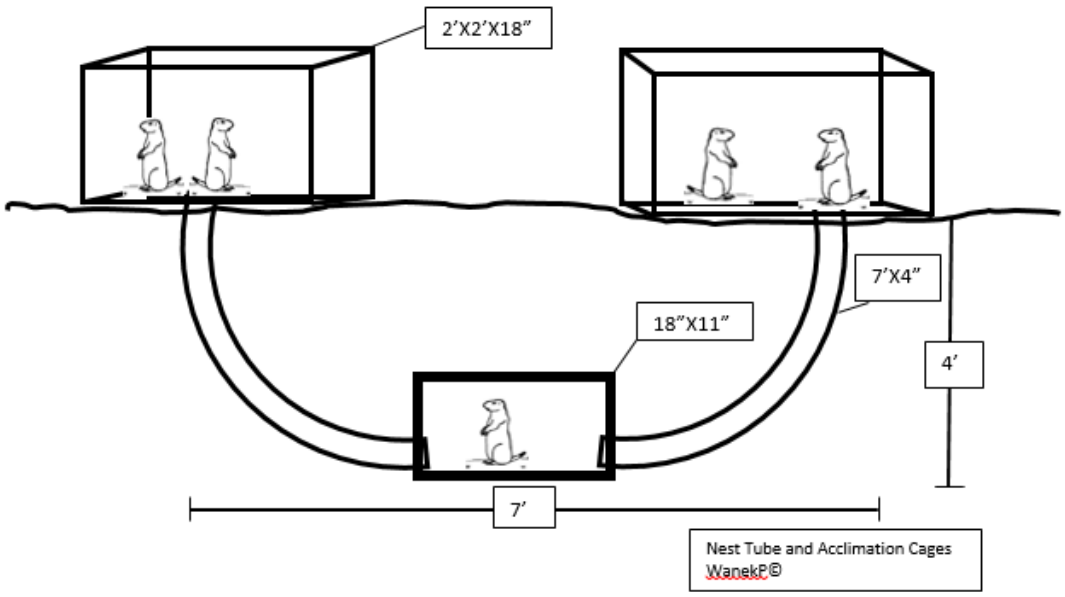
- **Release a sufficient number of prairie dogs**. The suggested minimum is 60 to 100 individuals (Long et al., 2006). This is a cumulative total at the release site including individuals that were present before the introduction of new prairie dogs. Source populations do not necessarily need to come from one colony; prairie dogs can be removed from multiple colonies and relocated into the same area as long as family units are relocated intact and they are not encroaching on existing prairie dog residents. Recall that colonies consist of multiple territorial family units.

- **Practice proactive plague abatement.** DeltaDust (Deltamethrin) should be used to pretreat fleas in prairie dog burrows at <u>both</u> take and release sites. On sites where colonies have succumbed to plague within the last year or two, prairie dog burrows may still be intact for reintroduction. Waiting too long post-plague may mean that artificial

chambers need to be installed. While some managers may want to wait for one or two years for reintroduction post-plague, others (D. Biggins, pers. comm., 6/3/12) think that waiting longer than two months post-plague is unnecessary, as long as fleas are managed via dusting with Deltamethrin and the newly relocated prairie dogs are pretreated, also with Deltamethrin. After treatment of burrows with Deltamethrin, prairie dogs were successfully re-established in a colony that had succumbed to plague only several weeks earlier (Long et al., 2006).

- **Use acclimation caps.** In most cases, acclimation caps (used to help prairie dogs adjust to the new area while protecting them from predators) are fitted above ground over natural burrows or on extended nest chamber tubes (Figure 1). Animals in acclimation caps are checked and fed both dry and moist foods daily. Caps should not remain on artificial burrows more than 3 to 5 days. After acclimation caps are removed, prairie dogs from the same family group can be freely released into the same chamber without replacing the acclimation cap. It is a generally accepted practice that once the acclimation cap is removed it should not be reused on the same burrow if the chamber is still occupied by prairie dogs.

Figure 1. Underground nest chambers connected with tubes to above-ground acclimation caps (Wanek, 2017)



A1.6. Augmentation

In some cases there may be a need to augment existing colonies. This is most likely to occur on isolated colonies that are not expanding as expected. As with any colony that has a plague history, all active and inactive burrows should be dusted with insecticide. Even if the receiving colony succumbed five years prior, dust all burrows because many other rodent species—mice and voles that may be plague resistant—could still carry plague-infected fleas.

When augmenting post-plague sites that have active populations of prairie dogs present, new prairie dog transplants should be reintroduced 100 feet away from existing core active burrows. This same guideline is used if artificial chambers are installed. Artificial chambers are used as anchor points; once prairie dogs are free to roam they will reestablish their own territories and open up old degraded burrows and tunnel systems. If vacated burrows are being used, focus on periphery burrows and use passive relocation techniques prior to population augmentation through relocation (*see* Attachment 2) to protect releasable burrows and help establish new territory.

Animals for augmentation can be brought in from different sites. If prairie dogs are being removed from a single source colony, but the goal is to retain the source colony, Long et al. (2006) recommend removing no more than 25 percent of adults (at least one year old) and juveniles in late summer as a "sustainable harvest."

A1.7. Bibliography

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