

Draft Reintroduction Plan for Bison at RMA-NWR



I. EXECUTIVE SUMMARY

The U.S. Fish and Wildlife Service at Rocky Mountain Arsenal National Wildlife Refuge (RMA) proposes to reintroduce bison into portions of the refuge. RMA would be used to manage a metapopulation of genetically “pure” bison (i.e., those with no cattle genes) as part of a larger, multi-refuge effort to preserve true bison. In addition, grazing by bison would restore a natural disturbance regime which, in combination with prescribed burning, would invigorate grassland succession and reduce competition from non-native plants. Grazing presents some challenges for maintaining the integrity of caps and covers at RMA as well as logistics of future visitor services and other activities. This plan examines these issues, after discussing the natural history of bison, the historical context of reintroduction at RMA, the infrastructural and biological requirements for a successful reintroduction program, and the likely impacts of having bison at RMA, including the effects on neighboring communities. This document concludes that it will be feasible and preferable to have a small bison herd grazing portions of RMA. An initial phase of the plan would involve a pilot project on a small area of the refuge to determine if bison can be managed safely, and in a manner that is consistent with grassland habitat management goals and would not interfere with remediation of other areas of the site. The plan also discusses a “contingency plan” should bison escape fenced portions of the refuge or the refuge as a whole.

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II. THE AMERICAN BISON (*Bison bison*)

Biogeography

Historic

The disappearance and subsequent recovery of bison is well documented. In brief, it is estimated that there were once 40 - 60 million bison in North America. Reduced to a population low of perhaps a few hundred animals by the early 1900s, they have recovered to close to 1 million animals in wild and captive or semi-domestic herds (Gates et al. 2005). The historic range of bison and the fossil evidence suggests that bison of both subspecies (wood bison and plains bison) were dispersed throughout the interior of North America (Figure 1).

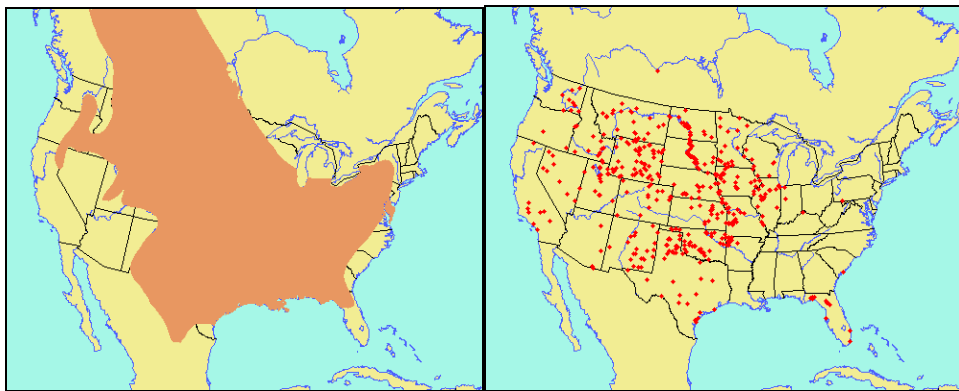


Figure 1. Predicted (Left) and fossil (right) distribution of *Bison bison*. Source: Faunmap. Illinois State Museum Map server.

Current

Presently, bison exist on less than 1% of their former range (Figure 2). Most large herds are in public trusteeship in national, state or provincial parks, and wildlife refuges. Many smaller herds (though some are large as well) are privately owned. And some of these private and public herds have experienced hybridization with cattle.

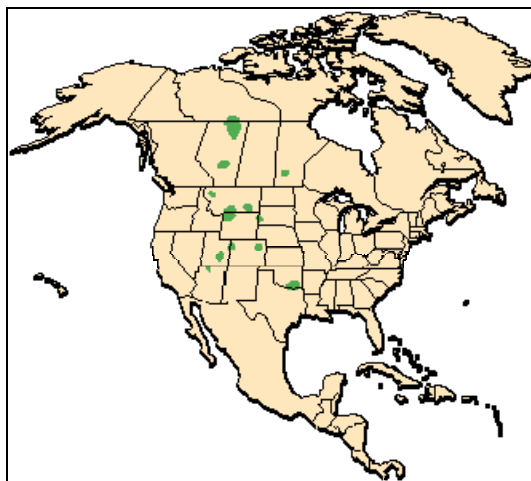


Figure 2. Current Range Map (Redrawn from Burt and Grossenheider, 1976).

Ecology and Life History

Reproduction

The breeding season occurs from mid-July to late September, with the peak rutting period in early August. The sexes form separate herds outside of the breeding season. Dominance among bulls is established by display, sparring matches, and violent fighting between evenly matched bulls.

Sexual maturity is attained at 2 to 3 years of age for both males and females, and while females usually produce their first calf at age 3, males generally do not breed until they are at least 7 or 8 years of age. Younger bulls are capable of breeding but are prevented from doing so by older males.

After a 9-month gestation, cows give birth to a single calf (twins are rare) from April until July, but the peak of calving occurs in May. At birth, calves have reddish-tan coats which turn dark chocolate brown by about 3 months of age. Although calves will feed on grass within a few days of birth, they continue to nurse for 7 months or longer, gradually increasing forage intake until they rely entirely on an adult diet of grasses, sedges, and other plant matter.

Survival

Normal life span is around 12-15 years; however, mortality can be high during the first year. Young calves use up their limited fat reserves during winter and are not efficient at foraging or avoiding predators.

Movements

Due to their large body size, limited natural predators, and the climate in which they live, bison may be active at any hour, although there appears to be a preference for daylight. Most feeding occurs in the early morning and around dusk. If unrestricted, daily movements of around 3 miles are average, with a group circulating in a home range 20-60 square miles in size depending on the season.

Although certain populations make large seasonal migrations, this should not occur at RMA where the elevation and climate do not vary across the refuge.

Behavior

Bison are gregarious and form mixed groups of cows, calves, yearlings, and sub-adults. Mature bulls are usually solitary or form small groups of their own, joining the cow herds during the breeding season.

Grooming is a frequent activity among bison, with animals rubbing themselves on trees until all of the bark has been torn off and the trunk left smooth. Dust bathing in loose patches of soil is a frequent activity. These "wallows" or bare patches of soil are then used by other animals or in subsequent years creating small-scale disturbances which can be important habitat features for other wildlife. Despite their size, bison are able to run at speeds of up to 40 miles per hour and swim rivers or lakes over half a mile wide. During the breeding season, males will bellow - a sound which may carry up to 3 miles.

The herds are wary and sensitive to disturbance. Bison have a keen sense of smell, but limited vision. They are dangerous when provoked or disturbed. Numerous injuries and some human deaths have occurred in national parks and other locations where bison come in contact with humans. Cows will protect calves and even solitary bulls can be aggressive.

Bison are grazers, feeding on grasses and some forbs (non-woody, broadleaf plants). In winter, bison forage in deep snow by using their heads as a snowplow, pushing snow aside with powerful side-to-side sweeping movements.

Genetics

Conservation and restoration of bison herds, while successful, have been accompanied by two important issues concerning the genetics of these populations. The first issue has been the loss of genetic diversity because most herds today are directly descended from the few hundred or so animals left in the early 1900's. The second issue is that of hybridization with cattle, or introgression of cattle genes into the bison population. It is important to preserve genetically pure bison while maximizing genetic diversity. Maintaining a metapopulation (i.e., multiple populations of an organism within an area in which interbreeding could occur, but does not due to geographic barriers, www.nps.gov/plants/restore/library/glossary.htm) of genetically pure bison in various locations can help resolve this issue with minimal risk of disease or extreme conditions destroying entire herds.

Health & Diseases

Three major bacterial diseases affect wild bison: *brucellosis*, *bovine tuberculosis*, and *anthrax*. Brucellosis and tuberculosis were introduced to North America, while anthrax is native. Brucellosis causes abortions, still births, lower pregnancy rates, and can cause crippling arthritis in infected joints. Bovine tuberculosis is a chronic, infectious disease that usually progresses slowly in bison. Animals infected with anthrax become sick and usually die within four days. The Service's veterinarian would check all bison for disease. No bison with any of these diseases would be reintroduced to RMA and would be very unlikely to contract them after arrival.

Limiting Factors

Water

Bison require less water than do cattle or horses; however, the water sources (stock ponds and tanks) must be large enough for many bison to drink at once. Surface drinking area is important because when the lead cow leaves the water, the herd will follow even if some did not get to drink. Under normal circumstances, prairie potholes and streams provide ample watering area. In domesticated or confined herds, this limitation can be avoided by providing water to troughs that are large or long enough to accommodate many animals at one time. By one estimate (McPeak, 1995), a mature bison requires a minimum of 10 gallons of water per day. At RMA, where surface water is scarce, dispersed and seasonal, this would require occasional supplementary water by means of small ponds and troughs that can be filled from tanker trucks, pipelines and/or groundwater wells.

Habitat & Spatial Requirements

Bison require large tracts of grassland. They will travel more while grazing than cattle and utilize steeper slopes and higher elevations. Most areas of RMA could be utilized by bison, although some portions of the refuge (e.g., the south-central sections) would not be practical to have public use activities occurring with wild bison present.

Nutritional Requirements

A large bison cow may weigh 1,100 lbs and a large bull will weigh nearly a ton. A 1,000-pound bison has the same nutrient needs as a 1,000-pound beef cow; however, bison have the ability to digest

low quality forages more completely than cattle. In addition, a bison's metabolism slows during winter when they require less forage, and generations of severe natural selection developed a digestive system in bison that is very effective in utilizing forages of lesser quality than would be used with other bovidae. Dietary requirements for bison are based on the knowledge that bison are far more selective of grasses than are other herbivorous wildlife (Holechek et al., 1989). The current forage on RMA would be adequate for a small herd of bison (see Section V. for estimates of carrying capacity).

Interactions with Other Wildlife

Predation

Predation by mountain lions and wolves on bison in some areas can have significant impacts on population dynamics (Gates et al. 2005). At RMA, however, where coyotes are the only large predator of note, there is likely to be little mortality on calves directly caused by predation.

Competition

There is only a small likelihood that deer would incur some competition with bison for early season grasses. However, grazing and other disturbances by bison could reduce standing vegetation which serves as critical cover for fawns (Horejsi, 1982). This is most likely in the northern half of RMA, and may negatively affect mule deer fawn survivorship. This competition would be avoided by preventing overgrazing.

Mutualisms

Prairie dogs appear to facilitate grazing opportunities for bison by clipping taller vegetation, especially decadent stands of grasses. In much the same way a fire stimulates vigorous growth and removes chaff, prairie dogs, along the margins of colonies, will create a zone of vigorous growth that is selected by bison (Coppock, 1980). The preference of bison for grazing, breeding, and resting in prairie dog towns has been demonstrated by other researchers (Whicker and Detling 1993; Coppock et al. 1983). Even more interesting, Krueger (1986) found that bison and prairie dogs have a mutually positive relationship, as the foraging efficiency of prairie dogs increases in the presence of bison, and bison, in turn, prefer the vegetative conditions caused by prairie dogs.

III. RMA History & Project Overview

RMA Background

Pre-refuge History

Rocky Mountain Arsenal National Wildlife Refuge is located at the western boundary of the ecoregion known as the Central Shortgrass Prairie. Defined by climate, fire and grazing, the shortgrass prairie once encompassed almost 100,000 square miles in 7 states. Native Americans (Arapaho and Cheyenne) lived on or near RMA where a central focus of their culture was the Plains Bison (*Bison bison*). Fossil remains of bison as well as projectile points and other tools have been discovered at RMA.

Early explorers referred to the area as a “desert” because the low-growing plant life is brown for much of the year. However, there is a spring “green-up” and seasonal color provided by wildflowers. The brown color and low vegetation result from a semi-arid climate, drier than the mixed-grass and tallgrass prairies farther east. Intense, but short-term grazing by bison and the disturbances caused by periodic fire maintained the plant community structure of the prairie. Grasses and annual forbs thrived where woody vegetation could not compete, although shrubs did occur on the site, sometimes in abundance.

Native shortgrass prairie has been reduced by as much as 60% due to cultivation and development or other conversion (TNC 1998). The cyclic processes of bison grazing and periodic fire in the remaining shortgrass prairie have been disrupted by drought and the invasion of introduced species of plants.

RMA History

The history of RMA is well documented (Hoffecker 2001). Briefly, the vast majority of the site’s native shortgrass prairie was converted to cropland between 1870 and 1920. In 1942, the land was acquired by the United States for use as a chemical weapons production facility in support of World War II. At various times between 1942 and 1969, the U.S. Army produced a variety of chemical weapons at RMA. During the 1970’s, the Army mission focused on demilitarization and destruction of the chemical munitions. From 1946 to 1982, the Army leased out some production facilities to private companies, including Shell Chemical Company. Shell and its predecessor firms produced pesticides in the South Plants production area.

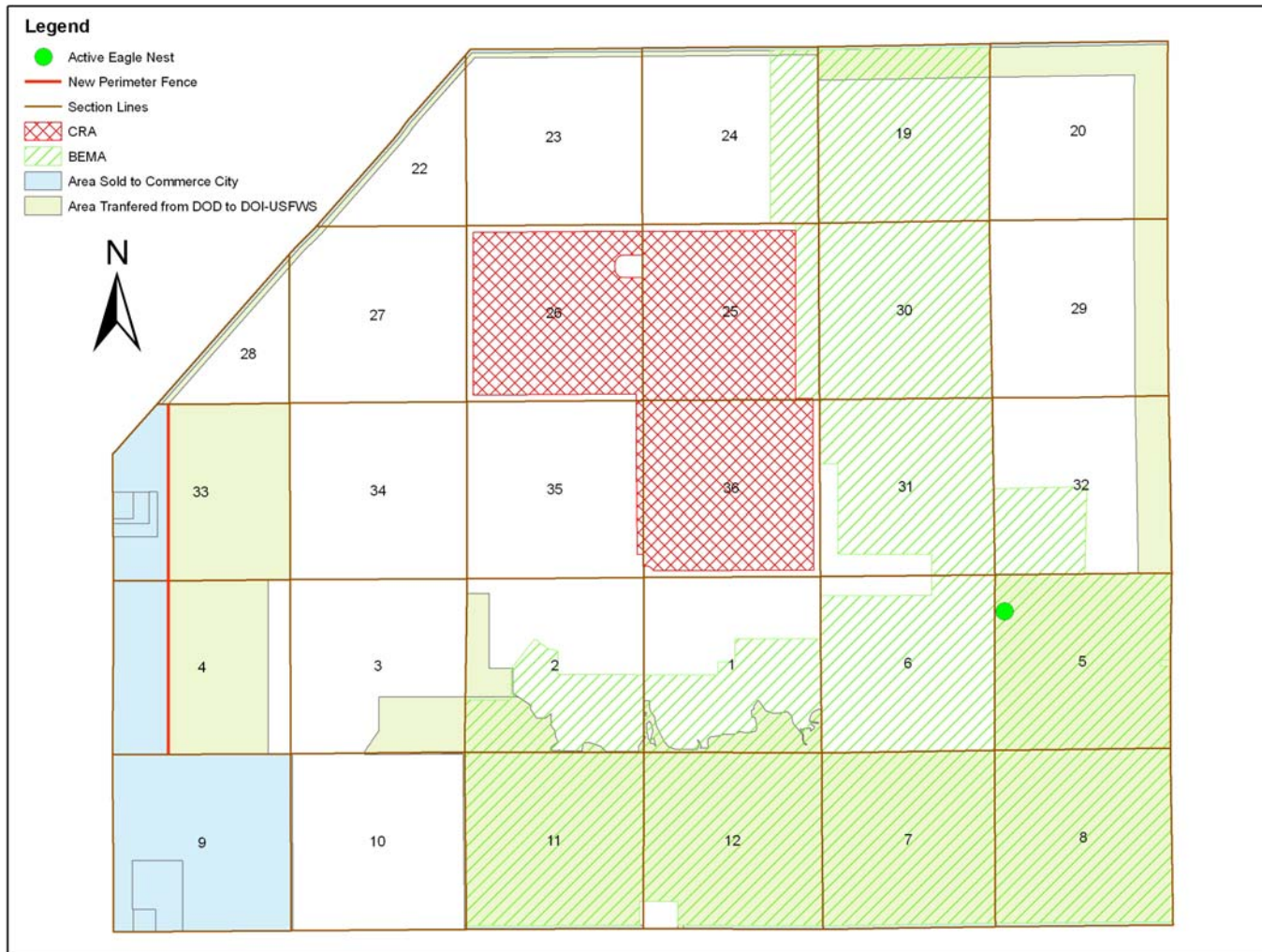
Operations and waste disposal techniques used between 1942 and 1982 resulted in numerous releases of hazardous chemicals that polluted groundwater, soil and structures. RMA was added to the National Priorities List of sites requiring environmental remediation under the “Superfund” law, in 1984.

In 1986 a communal roost of wintering bald eagles was discovered at RMA. Subsequent investigation revealed that while contaminants were causing wildlife mortalities in the highly contaminated industrial core of RMA, wildlife was thriving in the much larger and uncontaminated buffer zone of RMA. Those discoveries led to the 1992 designation of RMA as a National Wildlife Refuge, following remediation of the site. Since 1996, the Service, Army and Shell Oil Company have been implementing the Record of Decision for the sites remediation. The remedy should be complete in 2011. To mitigate wildlife impacts of the cleanup, approximately 8,000 – 10,000 acres (at least half) of RMA is being restored to native prairie vegetation. The current status of RMA provides approximately 14,000 acres of wildlife habitat, 1,700 acres of area that are still under remediation (known as the Central Remediation Area or CRA), and 1,156 acres that have been transferred to Commerce City, Denver Water Board, or other public entities (Figure 3).

Refuge Enacting Legislation, the CMP, and Current Status

Once cleanup has been completed, about 15,000 of RMA’s remaining 16,000 acres will be managed by the U.S. Fish and Wildlife Service as a wildlife refuge, in accordance with the Rocky Mountain Arsenal National Wildlife Refuge Act of 1992. The act specifies eight purposes for which the refuge was established. At least four of these purposes are potentially relevant to bison reintroduction.

Figure 3. Generalized map of the Rocky Mountain Arsenal National Wildlife Refuge, Commerce City, CO, 2007. Map includes the current Central Remediation Area (CRA) and Bald Eagle Management Area.



- To conserve and enhance populations of fish, wildlife, and plants within the refuge, including populations of waterfowl, raptors, passerines [songbirds], and marsh and water birds.
- To provide opportunities for compatible scientific research.
- To provide opportunities for compatible environmental and land use education.
- To conserve and enhance the land and water of the refuge in a manner that will conserve and enhance the natural diversity of fish, wildlife, plants, and their habitats.

Of the Arsenal's original 17,000 acres, 917 were sold to Commerce City, CO. in 2004. The Army will retain approximately 1,000 acres as caps, covers, and other remedy related facilities.

In March of 1996, the USFWS completed the Comprehensive Management Plan (CMP) for RMA. This document, which guides future management of the refuge and its resources, established the goal of reintroduction of native ungulates including plains bison and pronghorn antelope.

"Pending approval within the Service, the Service may introduce a herd of 10 to 100 bison in the northern zone within 5 years after cleanup completion. At one time, bison were present in the ecosystem, and this species provides a necessary grazing/trampling component in sustaining a short-grass prairie. Additionally, bison would be a major attraction in the urban setting of Denver and would facilitate educating visitors/students in plains ecology and ecosystem management." (p. 52, Comprehensive Management Plan, U.S. Fish and Wildlife Service, Rocky Mountain Arsenal NWR, Commerce City, CO 80022, 1996).

This passage from the CMP and additional sections of the document stress the importance of establishing a grazing regime, preferably with a native grazer such as bison, which could maintain the native vegetation with which it evolved. Native grasses respond with added vigor to moderate grazing that helps to suppress invasion by non-native plants. Public interest at the time of the CMP's development in native species reintroductions at RMA was and continues to be high. The CMP notes the value of reintroductions for visitor attraction/interest and environmental education.

As mandated by the National Wildlife System Improvement Act of 1997, sec. 5(B), the Service must also manage RMA in a manner that provides for the biological integrity and diversity of this shortgrass native prairie system. Restoration of the ecological functions that native grazers such as bison provide is an integral part of any management plan for RMA.

Future of RMA

Refuge Design

Resource Management

Following cleanup (around the year 2011), ongoing management of RMA resources will likely focus on maintaining a native grassland system in the northern half of the refuge, and a mix of grasslands, wetlands and riparian woodlands in the southern portion of RMA. Ongoing weed control will be a constant focus of management, as will continuing establishment of native vegetation. Other components of resource management will be to provide resources for nesting and roosting eagles and other raptors, and the prey (especially prairie dogs) on which they rely. In addition, continued recreational fishing at RMA will require management of the aquatic habitats and fish populations that are currently present. Deer herd management will also continue to be a prominent focus of management because of continued interest in chronic wasting disease throughout the West, and because of the visibility and watchable wildlife value of the CWD-free deer at RMA.

Restoring and maintaining the ecological integrity of the shortgrass prairie at RMA requires grazing by large herbivores (deer do not provide that ecological function) and periodic prescribed fire. Thus, management of a grazer and preferably a native species of ungulate, is essential to meeting all of the management goals stated above.

Visitor Services

Providing high-quality opportunities for environmental education and other forms of wildlife-dependent recreation will continue to be an important component of RMA management in the future. Of the eight establishment purposes of RMA, two specifically mandate public use of the refuge and will be manifested through the following activities:

- Daily drop-in programs at the refuge visitor center and walking trail system for wildlife interpretation, observation and photography,
- Staff-led interpretive programming for the general public,
- Guided tours providing wildlife interpretation and photography,
- Fishing programs including a permitted program for the general public and special programs for youth and people with disabilities,
- Staff and teacher-led on-site environmental education programs, and
- Other special programs and events

As these programs are developed, they will require new infrastructure. Current plans include renovating and remodeling a new visitor center in the southwest corner of Section 3 using the current Building 618. A tram route will provide guided tours of the refuge on a paved road loop where visitors can likely view wildlife. The tram route will cross cattle guards and/or gates, taking it into and out of the area grazed by the bison herd. Many of the section roads that currently exist will either be left to become un-maintained two-tracks or restored to a native grassland condition.

On-going Monitoring, Caps & Covers

Caps, covers, landfills and other sensitive areas where contaminants are stored will be retained by Army, and surrounded by a gated fence and accessed only by service roads for monitoring. Monitoring wells that remain will also be accessible by service roads. Some of these wells may need to be modified to prevent damage by bison that may rub against them (Figure 4).

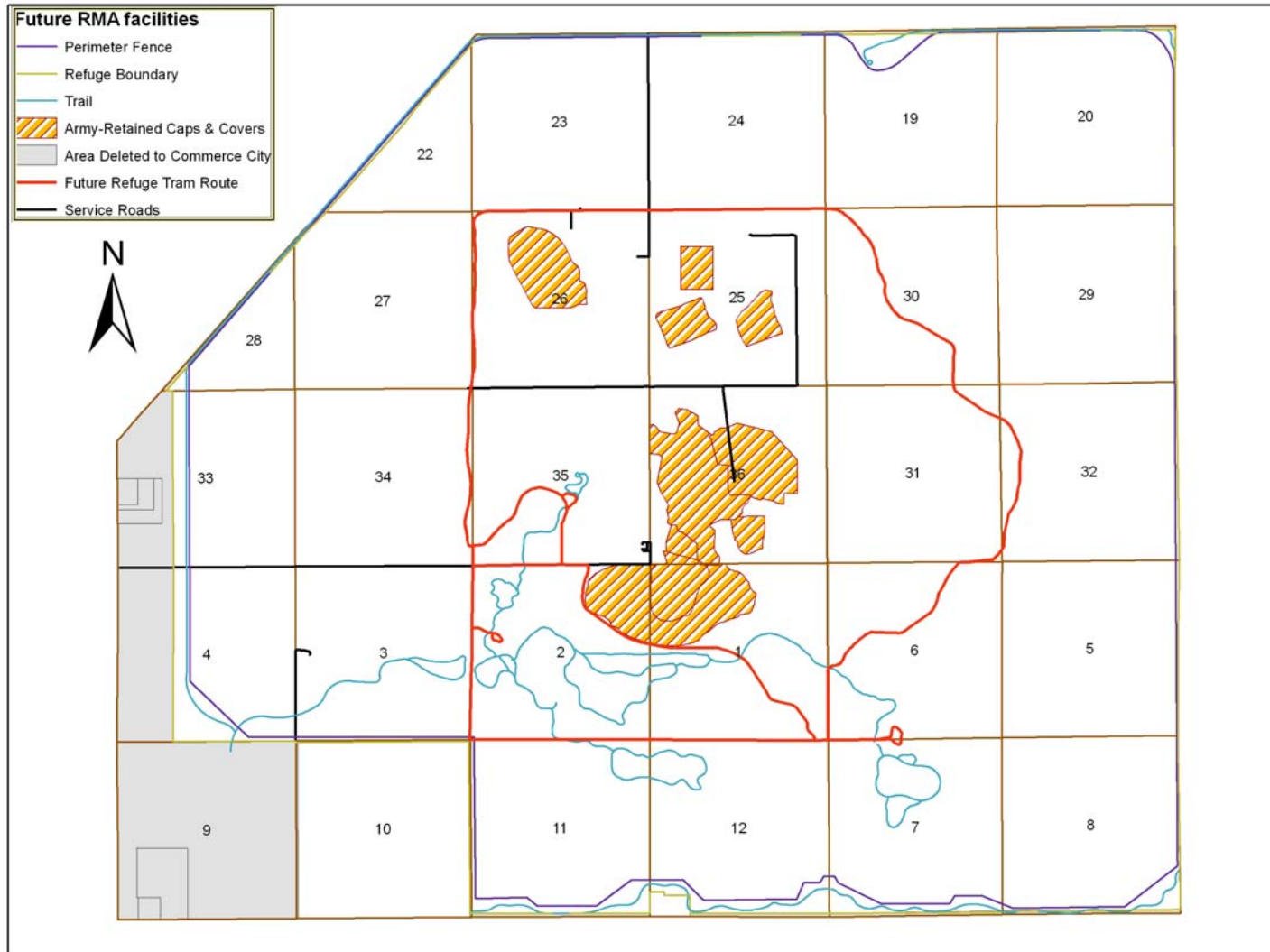
Surrounding Environment

Social

RMA lies on the eastern boundary of Commerce City, just eight miles from downtown Denver, and adjacent to Denver International Airport (DIA). Commerce City has annexed land along the north and northeast boundary of RMA and is positioned for continued growth and expanding urban and suburban development, making RMA an important enclave of habitat for local wildlife. Given this environment of continued residential and commercial development on RMA's borders, prescribed burning will be increasingly problematic to use as a habitat management tool owing to air quality restrictions. Thus, grazing by bison becomes even more important for maintaining the health of native grasslands on the refuge.

Native plains culture centered on hunting bison and using bison parts in addition to the meat for many important aspects of Indian life. When bison were eliminated from most of their range, native cultures lost an important part of their heritage. It is therefore understandable that the bison reintroduction may be of interest to Native Americans.

Figure 4. Map of future layout of the Rocky Mountain Arsenal National Wildlife Refuge, Commerce City, CO, 2007.



Economic

Plans for commercial development along the southwest border of RMA (in Section 4) include retail shops, a soccer stadium, and youth soccer practice fields. When built, a new RMA visitor center and RMA's visitor services program may benefit the local economy as an attraction to, and recreational opportunity for the local community.

Restoration of an Ecological Process: Bison as a Tool for Ecosystem/ Habitat Management

Prior to European settlement of North America, periodic fire and grazing by native ungulate herds sustained the structure, composition, and complexity of prairie ecosystems by removing biomass and recycling nutrients. These two disturbance factors, fire and grazing, are not processes that occur homogeneously across landscapes or independent of one another. According to Fuhlendorf and Engle (2004):

*“the probability of fire is greatest on areas with high biomass accumulation within a grazed grassland landscape. A positive feedback occurs when a recent fire event attracts grazing animals, which further disturbs the site. On prairie landscapes grazed by bison *Bos bison* L., the most recently burned patches are preferentially selected from a diverse [landscape]. . .”*

They go on to describe...

“... tall graminoid species decrease in dominance, and bare ground and forbs increase, on recently burned patches that are focally grazed. These changes in composition and productivity are associated with a negative feedback because focal grazing reduces biomass. This reduces the probability and intensity of fire, which in turn lowers the probability that the patch will be grazed. The grazing animal subsequently focuses on other patches that have been burned more recently ([Coppedge, Leslie & Shaw 1998](#)) and the tall graminoid species eventually recover dominance. So, the fire-grazing model predicts that grazing animals and fire interact through positive and negative feedbacks to cause a shifting mosaic. The landscape includes local patches that have been burned and heavily grazed, dispersed within a patchwork of areas in various states of recovery ([Fuhlendorf & Engle 2001](#)).”

Grazing, when used as a management tool, can assist refuges in creating a mosaic of diverse habitats, and in reducing competition from non-native plants and weeds. Along with prescribed fire, grazing can create habitat for other wildlife species such as mountain plover, prairie dogs, swift fox, and others. Bison create small-scale disturbances and open stands of dense grasses, providing more food and habitat for deer, prairie dogs, songbirds, and other wildlife.

Without grazing, or something that closely mimics its effects, it will be much more difficult, and perhaps impossible to maintain native grasslands once they have been restored. Grazing is an essential component to implementing the clause of the National Wildlife Refuge System Improvement Act of 1997 directing the Secretary of the Interior to ensure that we maintain the "biological integrity, diversity, and environmental health" of the System.

Conservation and Restoration of a Native Species

Prairie ecosystems in North America evolved at least in part with large ungulate grazing disturbances created by bison. Restoration of this native grazer is desirable to incorporate the processes that maintain healthy and natural prairie systems.

What is Native?

As bison were eliminated from North America's prairies, domestic cattle replaced them in some areas. "Native" implies that the species was originally found in that location, at least at the time Europeans arrived, and played a significant role in the ecological community.

Genetics and Germ Plasm

Small populations that originated from a few individuals (founders) and are reproductively isolated from one another may be compromised by inbreeding and loss of genetic diversity. Maintaining or conserving genetically pure populations of bison has proven to be difficult as many herds have recently been found to contain hybrid genes from cattle. With this in mind, four objectives of bison management related to genetics follow:

1. To retain maximum genetic diversity, including unique or "private" alleles that are a feature of some individual herds.
2. To minimize, and where possible eliminate hybridization with cattle in public herds.
3. If it is found that elimination of hybrid genes is not possible, then to reduce the level of hybridization in public herds to a level (on average) where it is significantly less than in private herds.
4. To maintain multiple populations.

Prudent species conservation requires maintaining multiple populations so that if a disease, natural disaster, or accident causes one population to become extinct, the entire species will not be lost. This "not all eggs in one basket" approach will be benefited by adding a population of bison at RMA.

Education and Recreation

Wildlife-dependent recreation, education, and outreach affect millions of National Refuge System visitors each year. Bison certainly draw the public to learn more about the values of ecosystem processes, the inter-relationships among other wildlife, and the roles of the US Fish and Wildlife Service and the National Wildlife Refuge System in protecting and maintaining these trust resources.

Priority public uses at RMA include wildlife observation, wildlife photography, environmental education, interpretation, and fishing. In part, bison are a useful model species for interpretation and appreciation of native systems and processes such as grazing. RMA is also a designated "watchable wildlife" site.

Cultural/Historical Significance

As an icon of the "Old West" bison hold cultural and historic significance. More importantly, bison were a central focus for many indigenous cultures in North America. For centuries before Europeans came to this continent, bison were the center of life for the Plains tribes of North America, providing them with food, shelter, clothing and spiritual inspiration.

Today, bison still hold cultural and historic significance for both Native Americans and the descendants of Europeans. There exists a strong desire to see bison populations continue to grow, at least where they do not come into conflict with other human uses of the land and its resources.

Research

USFWS refuges and field stations manage and maintain bison herds in part to conduct and contribute research findings on the role that native ungulates play in ecosystem dynamics and function. Large native herbivores such as bison, as opposed to domestic cattle, influence nutrient cycling, competition among plants, and habitat for other wildlife in ways that are unique. Thus, bison serve to illustrate how grazing by native species can be used as a habitat management tool to achieve desired management objectives such as the reduction or elimination of non-native vegetation, the reduction of fire fuels, or the creation of specific habitat types (e.g. mountain plover nesting habitat).

Summary of Purpose and Need Specific to RMA

Reintroduction and management of a herd of bison at RMA would directly support habitat management goals at the refuge. Secondly, bison would also satisfy goals providing educational opportunities for the public and contributions to conservation of this native species. The following purposes are specific to RMA.

Grazing

Most of the area that is the Rocky Mountain Arsenal has been devoid of large herbivores since European settlement turned the sod into farmland. In order to return the ecosystem to shortgrass prairie, grazing must be an integral part of the management. The shortgrass prairie evolved with grazing by bison. Proper, well managed grazing will increase plant community diversity, which is essential for a healthy ecosystem.

Native Species

Reintroduction of bison to RMA will be a hallmark event in the process of cleanup and restoration that converts this Superfund site back into native prairie. The bison, as well as the prairie dog, is a keystone native species that is needed for a fully functional prairie ecosystem. Without these grazers and the disturbance regimes they create, it is unlikely that a native and functional prairie can exist at RMA unless there is constant intervention by humans to replace the role that bison play.

Public Interest

The proposed reintroduction of bison at RMA is likely to generate substantial public interest. Wildlife viewing, and similar recreational opportunities such as photography will be enhanced by the addition of charismatic native species such as bison. While these opportunities bring new challenges, such as visitor safety issues, they also elevate the public's awareness of the National Refuge System, the mission of the Service, and the need for conservation.

IV. Habitat at RMA

Vegetation Description

The Comprehensive Management Plan identifies three distinct zones within RMA based on “a combination of current habitat types, historical disturbance, likely levels of public use, and anticipated cleanup activities” (Chapter 1, p. 40). The northern “native prairie” zone, which is mainly grassland

and weedy annual forbs, is the zone being considered for most of the grazing by bison. Much less of the southern zone, which has several lakes, riparian areas, tree groves and shrub thickets interspersed with grassland, would be considered for inclusion in the bison grazing plan. The CMP recognized that much of a western zone, the “product of economic and political realities” would be, and as of the writing of this document, has been sold to Commerce City for commercial development as part of a complex transaction that includes revenues which will be used to build a new visitor’s center at RMA.

Habitat Availability

Most of the northern zone should be made available to bison. Grazing parts of the southern zone would be feasible in the same way the northern zone would. These include areas in the southeast and southwest portions of RMA. These may be included in the total area to which bison would have access. The habitat that is proposed for bison grazing at this time is the area north of 7th Avenue excluding the administration area, landfills, caps and covers (except under special circumstances requiring grazing for maintenance), and the water treatment system. This area would be approximately 7,000 acres. Portions of the southern zone, especially Sections 5 and 8, could be added, bringing the total area grazed up to 9,000 – 9,500 acres. Parts of Sections 3 and 4 in the southwest portion of the refuge may be considered for additional grazing acreage at a later time.

V. Objectives

Reintroduction Goals

Populations

RMA Carrying Capacity

In order to estimate a carrying capacity for bison on the Arsenal, several assumptions must be made. First, 500 lbs of forage per acre will be the estimate used in the equation. Second, a 50% utilization rate is assumed. Third, a 1,000-lb grazer uses 26 lbs of forage per day. Using these assumptions, the first two of which are conservative, up to 253 bison could be managed on 9,500 acres. A total of 100-253 bison would probably be sufficient to meet both goals of genetic conservation and habitat management.

Grazing Management

Bison Management Units.

The entire area where bison are allowed to roam on the Arsenal would be fenced off from the remainder of the Refuge. Cross-fencing within this larger area could be used to allow some locations to be more intensively grazed. One-square-mile (640-acre) pastures could be fenced and managed as a bison management unit. Or prescribed burning could be employed to attract bison to specific areas. Eventually, as the habitat converts to a greater portion of native grasses due to restoration and grazing management, the fences could be removed and the bison allowed to roam freely over almost the entire northern tier. Although unlikely, fencing along critical riparian habitat may be warranted to prevent over-utilization and stream degradation.

Grazing

In general, grazing would be used as a habitat management tool on the Arsenal, the goal of which would be to drive succession toward a climax shortgrass prairie community with maximum plant and

animal diversity and minimal non-native species. Bison would be utilized more heavily in areas with cool season grasses so that the warm season grasses would have a competitive advantage. This would be accomplished using a combination of fencing, burning, and water placement.

Any grazing strategy at RMA would have to be flexible and adaptable enough to make adjustments based on the particular characteristics of the physical and biological environment at RMA. Therefore, a small herd will be introduced under a pilot program which will provide crucial information for management of a larger herd. This pilot project should help to clarify what the impact of bison grazing would be on restoration sites and how soon after seeding and the establishment of native vegetation these areas could be grazed.

Logistics & Procedures

Infrastructure

Prior to release of bison at RMA, several aspects of the infrastructure required to maintain and control a small herd of bison must be in place. Fencing, corrals, chutes, loading ramps, watering facilities, and cattle guards may be incorporated as management facilities in the future, depending on the need.

Fencing

A challenge in the design specifications for perimeter fencing as well as interior fencing (sometimes referred to as “cross-fencing”) will be to build fences sturdy enough to withstand the strength and leaping ability of bison, while at the same time, not allow cross-fencing to restrict the movements of other wildlife such as deer. There are several designs and material types employed for fencing bison. These can and should be quite different than those employed for fencing cattle because bison are larger, stronger, and less tolerant of fences. Excellent sources of information are available on fencing requirements for bison, including those from other National Wildlife Refuges that hold bison.

The existing perimeter fence at RMA, parts of which will be moved inward, will suffice to keep bison inside the refuge boundaries. Experience has shown, however, that this 8-foot-high chain-link fence can and has been compromised by vandalism and an occasional automobile that drives through it. Where the fence is moved back from public roads, however, these problems should not be as much of a concern. It is recommended that the existing chain-link fence be replaced with a woven wire fence of similar height, but using metal or treated wooden posts (Figures 5a, b, c, d), wherever the fence is going to be moved.

An interior fence will be required to prevent bison from entering other areas within the refuge. The specifications of this fence need not be the same as the existing perimeter fence so that wildlife, especially deer, can pass freely across it. This fence can “tie” into additional fences that will surround the caps and covers. A more detailed description of the specifications of this fence is found in the next section. Additional fencing and gates, or other protection, will be required to keep bison from damaging sensitive structures or equipment such as monitoring stations.

Fence Alignments

The fence alignment shown below offers the maximum acreage for grazing; approximately 9,500 acres, and excludes bison from some riparian areas along First Creek where native fish and vegetation may be negatively impacted (Figure 6).



Figure 5a. Current RMANWR chain-link perimeter fence.



Figure 5b. Current Fence Close-up.



Figure 5c. Proposed woven wire perimeter fence.



Figure 5d. Woven wire fence close-up.

Interior Fencing

Interior fencing may not be required to manage this size bison herd according to prescriptive and desired grazing regimes, except to keep bison out of the southern zone and other specific areas or to keep them inside the Bison Pilot Area. A flexible grazing plan that incorporates some prescribed burns would provide for some areas to be grazed intensively and other areas to be moderately and lightly grazed. However, the Bison Pilot Project will help the Service establish the need for cross-fencing within the Refuge.

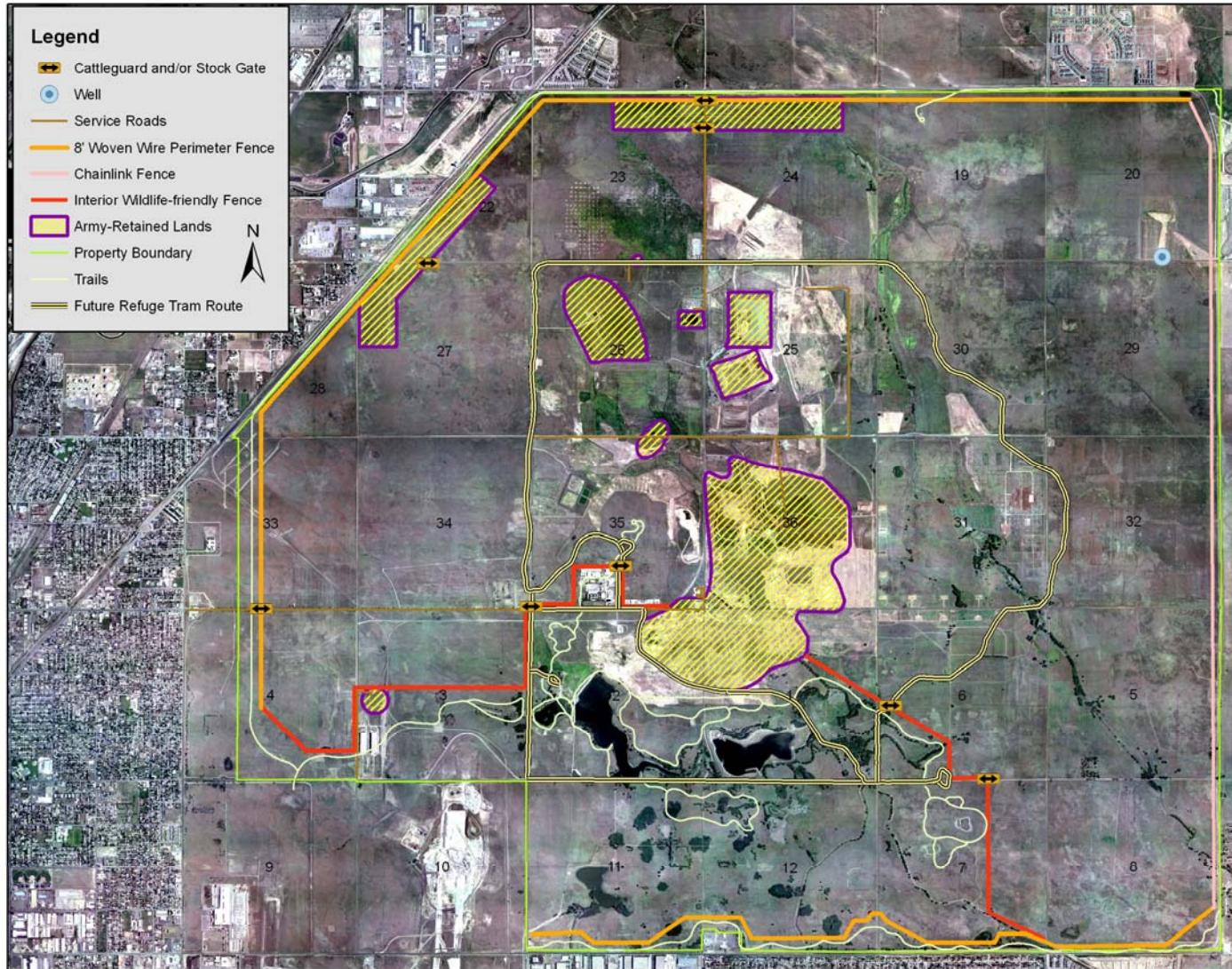
Cattle guards

Bison are more agile than cattle, and therefore require double-wide cattle guards to prevent them from escaping areas where gates are not used at road crossings within the Refuge or are left open through the perimeter fence for vehicle entry and exit.

Gates

Roadway gates for bison should be constructed with 7 or 8 cross rails to increase torsional rigidity, rather than the 4 – 6 rails typically used in cattle operations.

Figure 6. Proposed future fence alignments for bison management, RMA NWR, 2007.



Alternatively, gates at corrals may have a sheet of steel attached to them. This would not only strengthen the gate in the same way extra cross-bars would, but would hide what lies behind them and discourage attempts by bison to escape through the gate (Figure 7).



Figure 7. A bison gate with solid sheet of steel attached.

Chutes, Corrals, & Squeeze Boxes

The requirements for handling bison are different than for other livestock. Handling is required if bison are to be administered medications and vaccinations. Bison must be sorted like sheep - in a single file chute - not a wide lane. Bison will remain calmer if each animal is brought up individually to the squeeze chute from a “crowd pen”. Bison waiting in the single file chute will often become agitated. They will stay calmer if they remain in a crowd pen with their mates.

The squeeze chute should have solid sides as well as a solid top. A solid top will prevent bison from rearing. If animals are held standing in a single file chute like cattle, bison should be held in separate compartments between solid sliding gates. This way they will not be pressed ahead by the animal behind them.

RMA, however, may not need to make use of any handling facilities unless animals are known to be unhealthy, injured, or in need of separation from the rest of the herd. The pilot work on bison should identify whether corrals need to be permanent facilities or temporary, mobile structures.

Coordination with State Agencies

Because the State of Colorado classifies bison as alternative agricultural livestock rather than wildlife, reintroduction will have to be coordinated with other State and Federal agencies related to agriculture to meet requirements for health certification. These requirements will be reviewed prior to planned transport so all requirements can be met. Below are contacts from USDA and the Colorado State Veterinarian’s office.

US Dept. of Agriculture, Colorado branch:
303-231-5385

Colorado State Veterinarian:
303-231-4162

Herd Management

Water

Bison require less water than do cattle and will spend less time at watering locations. Because of the impact of the lead animal on the herd, it is important to have watering tanks large enough for as many bison as possible to drink at one time. Once the lead cow has left the area, all the others will follow even if they have not had time to drink. Potential water sources include areas of First Creek that will be accessible to the herd, a solar-powered well with an attached stock tank, and an appropriate number of additional stock tanks placed strategically for the number of bison present and the location of both bison and water sources. Water can be hauled to sites, but most tanks will be situated near sources of piped water.

Supplemental Feed

Supplemental feed will probably not be needed on the Arsenal due to the low stocking rate, the amount of available forage, and the bison's ability to digest low quality forage more completely than cattle. In addition, a bison's metabolism slows down in winter so less forage is needed for winter maintenance. Nevertheless, hay and pellets that are used for cattle would be sufficient and made available to bison under extreme conditions.

Minerals & Salt

Bison require salt and minerals to maintain their health. Most of these elements can be found in their natural forage. If the soil is lacking minerals, the forage will also lack minerals. Mineral blocks normally sold for cattle can be used to supply the necessary elements for bison, and have the added benefit of drawing animals to areas of the pasture that may be underutilized.

Animal Health

Periodic health checks will be required to maintain a healthy herd. Vaccinations and other preventative health checks would be conducted as needed.

VI. Issues of Concern

Human Safety

Paramount among concerns about bison at RMA is the safety of visitors and RMA employees. Bison are aggressive and dangerous animals that have been known to injure and even kill humans. The presence of a free-ranging or even semi-confined herd of bison at RMA presents challenges in this regard as refuge personnel (and possibly visitors) will be vulnerable at times. All and any attempts to minimize the potential for conflict between bison and humans must be made, either by maintenance of fences, training of personnel, or restrictions on activities around these animals.

In addition, an approved protocol will be established with cooperation from local law enforcement, should a bison escape either onto the southern zone or off the refuge. This "contingency planning" will be dealt with more fully in a Section (VIII) below.

Direct Costs of Reintroduction

Providing the infrastructure and maintenance of a bison herd at RMA will be costly. Fencing alone will be expected to cost between \$50,000 and \$100,000. If a corral and chutes are determined to be necessary, they may cost between \$10,000 and \$15,000. Total costs for fencing, gates, cattle guards and other infrastructure could range from \$65,000 to \$200,000 depending on the type and quality of material used.

VII. Pilot Project

Prior to implementing the full reintroduction plan, it is recommended that a trial or pilot project be conducted with a small number of bison (12-16) on a small portion of the refuge (2-5 square miles). A pilot project would accomplish several important objectives.

First, it will enable refuge biologists to determine if habitat management goals are being met by a regime of small scale disturbance and variable levels of grazing. Specifically, biologists will use the pilot project to study the effects of grazing disturbances on increasing and maintaining native grasses and forbs while discouraging invasive and exotic plant species. They will also be able to observe the degree to which potential fire fuels are utilized as forage.

Second, biologists, maintenance staff, and other managers will use the pilot project to gain valuable experience working with bison, and the day-to-day activities that will sustain a larger future herd on a much larger area. Insights into fence specifications, methods for moving bison between pastures, and the behaviors of a herd this size on this type of grassland, will be better understood after a pilot project.

Third, biologists and managers would use knowledge gained from the pilot project to determine the feasibility of employing bison on caps and covers to manage the vegetation. If considered feasible, recommendations regarding length of grazing periods, fence construction, etc. would be anticipated.

Last, a pilot project should be able to further determine feasibility of having bison at RMA without investing capital expenditures for a full-scale level of infrastructure. If, after the pilot project, it is determined that bison are not desirable at RMA, then little has been invested. The small number of animals would be moved to a more appropriate facility. And the fences used for other purposes or removed.

On the other hand, if the pilot project is successful, these animals would be retained and the fences and other infrastructure used as part of the full-scale project. A design for the pilot project in the west-central portion of RMA is displayed in Figure 8. This area was chosen because of the habitat condition.

VIII. Contingency Planning

Prior to the arrival of bison at RMA, a contingency plan would be established that would consider what actions would be used should bison escape either the portion of the Refuge

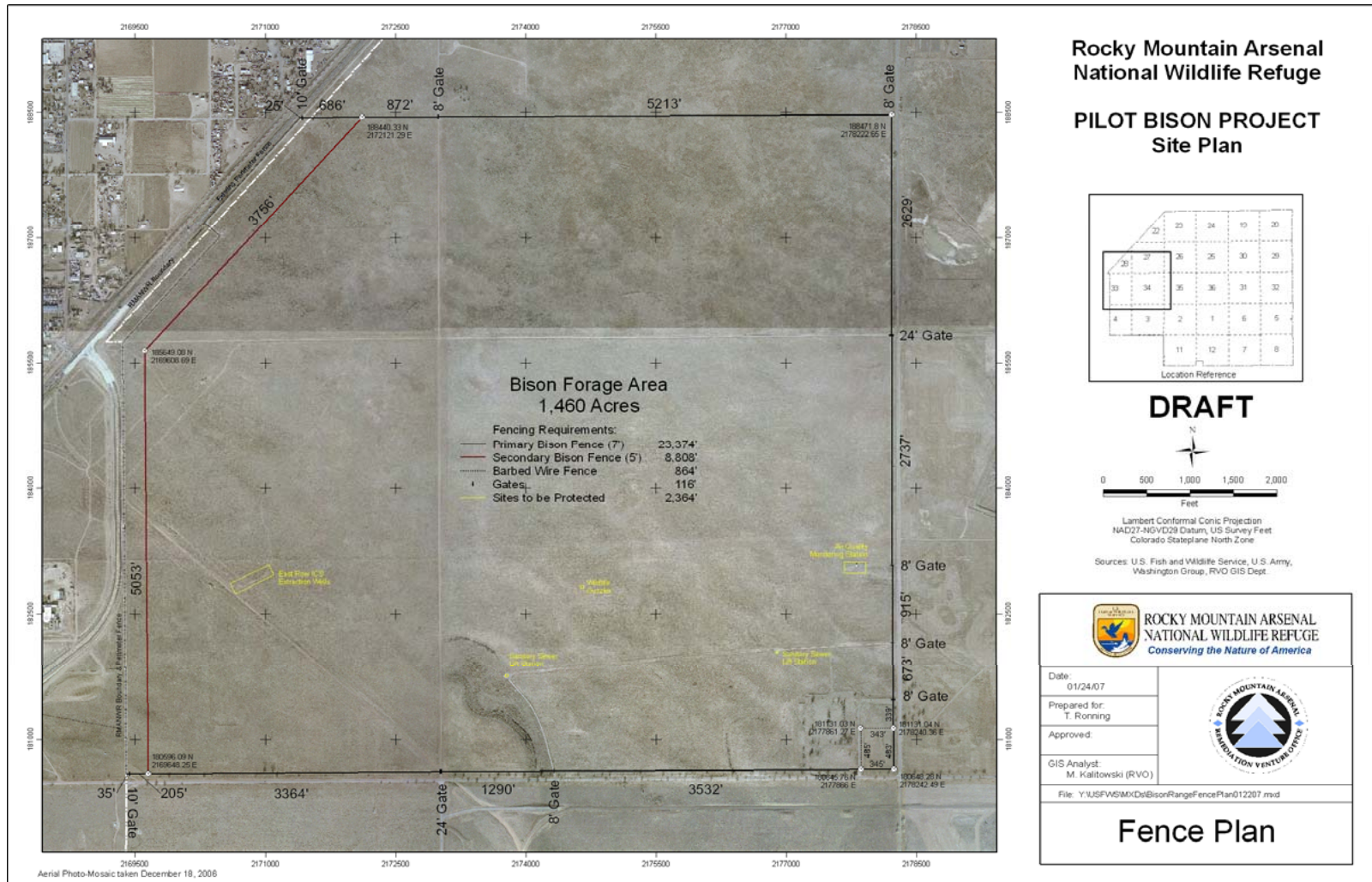


Figure 8. Bison Pilot Area, RMA NWR, 2007.

intended for grazing, or the refuge as a whole. Components of the plan will guide how Service personnel will respond and what actions are likely under what circumstances.

Should a bison escape from the fenced grazing area but still remain on the refuge, initial attempts at either herding it back into the enclosed fenced area or attracting it back using feed, grain, water, or some other attractant will be made. Should these attempts fail, then immobilization with dart gun and tranquilizers will be used.

Should a bison escape off the refuge, then immediate notification of the appropriate jurisdictional authority (Adams County Sheriff, Denver County Sheriff, Commerce City Police Dept.) will be made. The animal would likely be tranquilized immediately. Lethal force would be used only as a last resort. Following immobilization, the animal would be transported back to the refuge.

IX. Consultation and Coordination

USFWS will seek consultation and feedback on this proposal through a process of internal solicitation and a public meeting. A final version of this document will be available in March, 2007. The public meeting will be scheduled for February 10, 2007, at which time guidance and feedback will be solicited from interested citizens, partners, and user groups.

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