PREDECISION

ENVIRONMENTAL ASSESSMENT

AQUATIC RODENT DAMAGE MANAGEMENT IN COLORADO

Prepared By:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

In Cooperation With:

Colorado Department of Agriculture

Colorado Division of Wildlife

U.S. Fish and Wildlife Service

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1.1 INTRODUCTION

Across the United States, wildlife habitat has substantially changed as human populations have expanded and land has been transformed to meet varying human needs. These changes often compete with wildlife and have inherently increased the potential for conflicts between wildlife and people. Some species of wildlife have adapted to and thrive in the presence of humans and the changes that have been made. These species, in particular, are often responsible for the majority of conflicting activities between humans and wildlife. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services[1] (WS) Final Environmental Impact Statement (FEIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1997):

> *"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife generally is regarded as providing economic, recreational and aesthetic benefits . . . , and the mere knowledge that wildlife exists is a positive benefit to many people. However, . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural, and economic considerations as well."*

USDA is mandated to protect American agriculture and other resources from damage associated with wildlife. This function is carried out by the USDA, APHIS, WS program. The primary authorities for the WS program come from the Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1468; 7 U.S.C. 426-426b and 426c). WS activities are conducted in cooperation with other federal, state, and local agencies, as well as private organizations and individuals. This Environmental Assessment (EA) evaluates a portion of this responsibility, specifically, management of aquatic rodents including beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) to resolve conflicts in Colorado.

Wildlife damage management (WDM), or control, is defined as the alleviation of damage or other problems caused by wildlife (Leopold 1933, The Wildlife Society 1990, Berryman 1991). WS uses an Integrated WDM (IWDM) approach (sometimes referred to as "Integrated Pest Management") described in Volume 4, Chapter 1, pages 1-7 of the WS FEIS (USDA 1997). This includes nonlethal strategies such as the modification of habitat or the offending animal(s) behavior, and lethal control of the offending animal(s) or local population of the offending species.

The FEIS contains detailed discussions of potential environmental impacts from methods that are used for WDM in Colorado (USDA 1997). The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) authorize agencies to eliminate repetitive discussions of issues addressed in programmatic Environmental Impact Statements (EIS) by tiering to the broader documents (CFR (Code of Federal Regulations) 1500.4(I); 1502.20). Thus, this EA incorporates relevant discussions and

[1] Wildlife Services was previously known as the Animal Damage Control program. The name change became effective in 1997.

analysis from the FEIS. The FEIS may be obtained by contacting the USDA, APHIS, WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS's mission, developed through a strategic planning process, is to *"provide leadership in wildlife damage management for the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety"* (USDA 1989). This is accomplished through:

- training of wildlife damage management professionals;
- development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
- the collection, evaluation, and dissemination of management information;
- cooperative wildlife damage management programs;
- informing and educating the public on how to reduce wildlife damage; and
- providing technical advice and a source for limited-use management materials and equipment such as cage traps.

WS' Policy Manual[2] reflects this mission and provides guidance for engaging in wildlife damage control activities. Before wildlife damage management is conducted, *Agreements for Control* or *WS Work Plans* must be executed by WS and the land owner/administrator/agency representative. WS cooperates with land and wildlife management agencies, when appropriate and as requested, to combine efforts to effectively and efficiently resolve wildlife damage problems in compliance with all applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies.

1.1.1 The Colorado WS Program. WS responds to aquatic rodent damage throughout Colorado. Colorado encompasses about 66.6 million acres divided into 63 counties as shown in Figure 1. Aquatic rodent damage management (ARDM) was conducted on properties totaling only 612,321 acres in FY 00 (Federal fiscal year 2000= October 1, 1999-September 30, 2000) or about 0.91% of the area in Colorado. This information is kept in (MIS[3] 2000). Aquatic rodents, though, only inhabit the waterways and wetlands within the properties under agreement which reduces considerably the area on such properties that are actually worked for ARDM. Colorado has about 241,000 surface acres of permanent water sources in lakes and reservoirs that have a surface area of over 40 acres and rivers that are one-eighth mile or more in width and 500,000 acres in smaller permanent and semi-permanent wetlands including ponds and streams which represents about 1% of the total area of the State. Therefore, the total water surface acreage actually worked for ARDM in FY 00 by WS was probably greater than 6,123, acres of surface water (1% of the 612,321 acres under agreement). The acreage of water worked, though, would likely be much higher depending on the ratio of water to land on the properties under agreement.

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2 **WS Policy Manual** - Provides guidance for WS personnel to conduct wildlife damage management activities through Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Section.

3 **MIS** - Computer-based Management Information System used by WS for tracking Program activities. WS in Colorado has had the current MIS system operational since FY 94. Throughout the text, MIS will be noted along with the year, ie. 1996, when the data was entered. MIS reports though will not be referenced in the Literature Cited Section since most reports from the MIS are not kept on file. A database is kept that allows queries to be made to retrieve the information needed.

WS conducts ARDM in cooperation with several other agencies in Colorado. The Colorado Department of Agriculture (CDA) is a primary cooperator with WS for aquatic rodents because they have management authority over agricultural damage caused by these species. WS and CDA have an MOU which lists responsibilities and authorities as they relate to ARDM. Under the MOU, WS has the authority to respond to all damage requests to agricultural endeavors regarding these species. The Colorado Division of Wildlife (CDOW) has management authority over beaver and muskrats causing damage to non-agricultural property or when they are considered nuisance animals. CDOW issues permits to take beaver and muskrats to regulate and control recreational harvest. WS acts as an agent for entities requesting assistance with agricultural depredations and for private individuals that request assistance in reducing damage to private property. The Colorado Department of Public Health and Environment (CDPHE) has management authority over beaver and muskrat when they are impacting human health and safety and prohibited methods are needed to resolve a particular problem. WS cooperates and acts upon requests from CDPHE when necessary.

WS is a cooperatively funded, service-oriented Program. Cooperators range from private citizens to other agency personnel. A primary cooperator of the Colorado WS Program, by legislation, is CDA. Their mission and support is primarily focused on the development and protection of Colorado agriculture. The relationship and responsibilities between WS and CDA are defined in an MOU. WS also cooperates with several counties in Colorado and focuses most ARDM efforts in these areas where funding allows for staffing. WS generally conducts limited work in non-cooperating counties, but may consider more projects as funding becomes available from interested governmental agencies and private individuals.

1.2 PURPOSE

This EA analyzes ARDM for the protection of agriculture, property, natural resources, and human health and safety. These problems are resolved on a case-by-case basis. Normally, according to the APHIS procedures for implementing NEPA, individual ARDM actions are categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, 1995). We have decided to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of cumulative impacts.

ARDM is conducted on private, federal, state, tribal, county, and municipal lands in Colorado. In FY00, WS conducted ARDM on properties totaling about 612,321 acres or about 0.91% of the total acreage in Colorado. The proportion of this total in each type of land class as of October 2000 was 91.7% private, 7.4% U.S. Forest Service (USFS), and less than 1% on county/city/state lands.

1.3 NEED FOR ACTION

The need for action is based on the necessity for a program to protect resources from damage by aquatic rodents. Comprehensive surveys of damage by aquatic rodents in Colorado have not been conducted. However, WS obtains estimates of the type and value of damage from property and resource owners or managers who request WS assistance, or WS personnel that respond to such requests. Damage data thus obtained are summarized for FY00 through FY02 in Table 1a for beaver and Table 1b for muskrats. These data represent only a portion of the total damage caused by aquatic rodents, as not all people who experience such damage request assistance from WS. Of the 2 species of aquatic rodents found in Colorado, beaver

are responsible for about 99% of requests for assistance WS receives and the damage reported to or verified by WS.

Resource owners and government agencies have used a variety of techniques to reduce aquatic rodent damage. However, all lethal and nonlethal methods developed to date have limitations based on costs, logistics, or effectiveness. The cost effectiveness of the Colorado ARDM program has not been determined. However, such a determination has been made in at least one other WS program based on comparing estimates of the amount of damage prevented from occurring with the cost of conducting ARDM. WS in North Carolina (WS 2003) was able to document a 7.1:1 ratio of resource savings per dollar spent for ARDM. This indicates that ARDM as a management tool is highly cost effective for the protection of resources.

Table 1a. Value of damage caused by aquatic mammals in Colorado as reported to or verified by Wildlife Services in FY00 (October 1, 1999- September 30, 2000), FY01, and FY02. The damage reported in this table is only a fraction of the actual damage caused by beaver in Colorado.

BEAVER DAMAGE IN COLORADO REPORTED BY WS IN FY00-FY02							
CATEGORY	SUBCATEGORY	FY00		FY01		FY02	
		Req.	Value	Req.	Value	Req.	Value
Agriculture	Field Crops	1	$400	3	$2,400	1	$500
	Range/Pasture	12	$50,750	5	$7,800	5	$3,400
	Trees	10	$9,800	2	$2,000	18	$213,300
Natural Resources	Forestry	3	$35,000	3	$1,400	1	$300
Property	Landscaping/Turf	40	$133,800	34	$64,250	19	$21,925
	Dikes/Irrigation System	54	$44,995	90	$106,550	73	$38,350
	Roads/Bridges	7	$17,400	6	$23,550	1	$125
	Structures/Utilities	2	$4,000	1	$100,000	1	$500
	Other Property	2	$1,200	-	-	1	$20,000
TOTAL		131	$297,345	144	$307,950	120	$298,400

Requests = Requests for assistance

Table 1b. Value of damage caused by muskrats in Colorado as reported to or verified by Wildlife Services in FY00, FY01, and FY02.

MUSKRAT DAMAGE IN COLORADO REPORTED BY WS IN FY00-FY02							
CATEGORY	SUBCATEGORY	FY00		FY01		FY02	
		Requests	Value	Requests	Value	Requests	Value
Property	Landscaping/Turf	-	-	1	$100		
	Dikes/Irrigation System	2	$3000	1	$100	2	$1005
TOTAL		2	$3000	2	$200	2	$1005

Requests = Requests for assistance

To conduct ARDM, it is important to have knowledge about each species. Full accounts of the life histories for these species can be found in mammal reference books. Some background information is given below for each species, especially the information pertaining to their range in Colorado.

1.3.1 Beaver. Beavers are part of Colorado's wildlife heritage. They probably once occupied stream valleys and other suitable habitat in Colorado at a maximum carrying capacity prior to European settlement. Population fluctuations of beavers in the pre-European era were determined by plant succession and its influence upon the amount and quality of habitat. Between the years 1800 and 1850, the major explorations beyond civilization were made solely for the purpose of discovering new beaver trapping areas. About midway through this 50 year period the steel trap was invented enabling the trapper to operate with much greater efficiency than had been possible when fur trapping was at its peak (Seton 1937). In what is now Colorado, fur trappers worked their way up the Platte and Arkansas Rivers from the east, and the Colorado River system from the west prior to 1850. By the late 1850's, Colorado's beaver population had been severely depleted and this trend happened throughout the west. The low point of beaver populations was reached between 1890 and 1900 (Seton 1937).

As a result of the decline, most western states, including Colorado, gave complete protection to beavers starting sometime around 1900. Since beavers were protected, their populations have experienced a steady growth in numbers (Yeager and Hill 1954). In 1937, a permit system was established in Colorado to control nuisance beavers and could be taken on public lands. In 1941, land owners could retain 50% of the nuisance beaver pelt value while the other 50% went to CDOW (Yeager and Hill 1954). By the early 1950's, beaver populations on public lands in Colorado could no longer be ignored. Many observers had recorded the rapid build up of the beaver population to levels, in many cases, far exceeding the carrying capacity of the available habitat (Seton 1937). Beavers have few natural predators in Colorado allowing their populations to grow, especially because they create their own environment to escape from predators. In Colorado, predators would include coyotes (*Canis latrans*), mountain lions (*Felis concolor*), bobcats (*Lynx rufus*), river otter (*Lutra canadensis*), black bears (*Ursus americanus*), possibly wolverines (*Gulo gulo*), and mink (*Mustela vison*), who prey on the young (Miller and Yarrow 1994), but none of them would have a great deal of impact on their population. Other factors may also limit their population growth in an area. Studies of beaver populations in the early 1920s in the Tower Junction area of Yellowstone National Park reported that 232 beaver were present with numerous dams. Repeat surveys in the same area in the early 1950s and in 1986 found no beaver or dams (Chadde and Kay 1991). Beavers need aspen or tall willows for food and building materials, resources that have been made scarce by the lack of fires and floods, and feeding by elk, moose, and domestic livestock.

In 1951, the Colorado Cooperative Wildlife Research Unit at Colorado State University in Fort Collins, in cooperation with CDOW, initiated the first studies to evaluate beaver populations and their ecology. In 1954, Federal Aid Project W-83-R, Beaver Investigations, began. Under this project, several studies were initiated and dealt with characteristics of beaver abandoned streams, and beaver productivity, habitat suitability requirements, and harvest potential (Rutherford 1964).

By the 1970's, the still expanding beaver populations began to cause increased damage to properties, natural resources, and agriculture largely due to increased human development. The beaver population in Colorado began dramatically increasing. Beaver activities can be beneficial or detrimental depending on their activities and location. Habitat modifications from beaver, a result of dam building and tree cutting, can be beneficial to other species of wildlife and the watershed. However, these modifications can conflict with human land or resource management objectives and can suppress different species of plants and animals including threatened and endangered (T&E) species. Such conflicts, which are viewed as "damage" by resource owners, result in adverse impacts that often outweigh benefits. Most of the damage caused by beavers is

a result of dam building, bank burrowing, tree cutting, or flooding. The value of beaver damage is perhaps greater than that of any other single wildlife species in the United States. The economic damage was estimated to have exceeded $4 billion in the southeastern U.S. over a 40-year period (Arner and Dubose 1979). Damage throughout the U.S. has increased since that time and is likely to be at least a magnitude greater at present. WS has documented increasing numbers of requests by individuals, especially since 1994, in Colorado and throughout the country.

Beaver are responsible for a variety of different kinds of damage (Wade and Ramsey 1986, Miller and Yarrow 1994, Willging and Sramek 1989, and Loven 1985). Beaver damage documented by WS in Colorado was $300,000 in both FY00 and FY01. Types of damage that result include: (1) flooding of crop fields and livestock pastures, residential areas and other property, and forested tracts of lands killing the trees; (2) damage to irrigation structures and other waterways; (3) flooding of roads or railways and areas adjacent to them that results in erosion of road and railway beds; and (4) cutting trees for building the dam which have lumber or aesthetic values, and could be important for creek bank stabilization. In flat terrain, a relatively small beaver dam may cause hundreds of acres to be flooded.

Beavers also can create damage from other activities. While feeding beavers can damage and kill trees by gnawing, girdling and cutting. They can also feed on agricultural crops. Beavers sometime burrow into man-made dams and levies or obstruct overflow structures and spillways which can cause such water control structures to fail. Beavers are known to gnaw on or burrow into Styrofoam and wood supports under boat houses and docks requiring expensive repairs.

Beaver activities also destroy critical habitat types (e.g. free-flowing water, riparian areas and bird roosting and nesting areas) which are important to many wildlife species, including certain species of fish and mussels. Patterson (1951) and Avery (1992) reported that the presence of beaver dams can negatively affect fisheries. Stream restoration projects to improve vegetation for salmonids in the northwestern United States have been severely hampered by beaver (DuBow 2000). Another example of where beaver have been detrimental to fish was in Nevada, and was resolved by the WS program. Beaver had created extensive dams across the Walker River, a watershed where beaver were not native, which reduced the flow of water below the beaver dams to 10% of the flows from above. Water in the numerous dams, which created sinks, was evaporating and percolating into the soils. Water below the dam was crucial for Walker Lake as it was lowering, getting precariously to the point that a fish die off could occur in the lake, which had happened in the past during an extensive drought. The federally listed threatened Lahontan cutthroat trout (*Onchorhynchus clarki stomias*) was becoming susceptible to rising water temperatures and salinity in the lake as a result of the loss of waters. Removing the beaver and their dams from site returned the water flows to 90% of the water from above providing much more water for Walker Lake.

Beaver dams may also adversely affect stream ecosystems by increasing sedimentation in streams, and thereby negatively affect wildlife that depend on clear water. The Louisiana WS program has conducted beaver damage management activities to protect the threatened Louisiana pearlshell (*Margaritifera hembeli*), which requires clear, free-flowing water to survive (D. LeBlanc, USDA/APHIS/WS, personal communication 2003) for the U. S. Fish and Wildlife Service (USFWS).

Beaver impacts on trout habitat have been a major concern of the Wisconsin Department of Natural Resources and the general public since as early as 1950. Patterson (1951) found that beaver impoundments

in the Peshtigo River Watershed caused significant negative impacts to trout habitat by raising water temperatures, destroying immediate bank cover, changing water and soil conditions, and silting of spawning areas. Studies from other areas also reported negative aspects of beaver impoundments in regard to trout habitat (Sayler 1935, Cook 1940, Sprules 1940, Bailey and Stevens 1951). The Wisconsin Department of Natural Resources guidelines for management of trout stream habitat stated that beaver dams are a major source of damage to trout streams (White and Brynildson 1967, Churchill 1980). More recent studies have documented improvements to trout habitat upon removal of beaver dams. Avery (1992) found that wild brook trout populations in tributaries to the north branch of the Pemebonwon River in northeastern Wisconsin improved significantly following the removal of beaver dams. Species abundance, species distribution, and total biomass of non-salmonids also increased following the removal of beaver dams (Avery 1992).

Increased soil moisture both within and surrounding beaver-flooded areas can result in reduced timber growth and mast production, and increased bank destabilization. These habitat modifications can conflict with human land or resource management objectives and can oppress some plants and animals, including T&E species. For example, WS in Oregon conducted beaver damage management to protect the Nelson's checker-mallow (*Sidalcea nelsoniana*) which was being flooded by a beaver dam. Their dams can severely reduce the flow of water downstream or flood areas which can negatively impact many native plant communities (Hill 1982).

Beaver often inhabit sites in or adjacent to urban/suburban areas and cut or girdle trees and shrubs in yards, undermine yards and walkways by burrowing, flood homes and other structures, destroy pond and reservoir dams by burrowing into levees, gnaw on boat houses and docks, and cause other damage to private and public property (Wade and Ramsey 1986). Additionally, roads and railroads may be damaged by saturation from beaver flooding or by beaver burrowing. Consequently, roadbed and railroad bed integrity is compromised. Beaver also cause an assortment of damage such as: flooding of croplands, pastures, and timberlands, feeding on crops such as corn, soybeans, sorghum, etc., interfering with irrigation systems and water level control structures, and causing washouts of ponds and levees (Hill 1982, Woodward 1983, Wade and Ramsey 1986, Miller and Yarrow 1994).

Beaver activity in certain situations can become a threat to public health and safety; for example, burrowing into or flooding of roadways and railroad beds can result in serious vehicle accidents (Miller 1983, Woodward 1983). Increased water levels in urban areas resulting from beaver activity can lead to unsanitary conditions and potential health problems by flooding septic systems and sewage treatment facilities (De Almeida 1998, Loeb 1994). Beaver damming activity also creates conditions favorable to mosquitoes (*Aedes spp.*)and can hinder mosquito control efforts or result in population increases of these insects (Wade and Ramsey 1986). While the presence of these insects is largely a nuisance, mosquitoes can transmit diseases, such as encephalitities like West Nile virus (Mallis 1982, The Centers for Disease Control (CDC) 2003); Colorado was the number one state in West Nile human cases in 2003 and as of September 15, 2003, 1,214 cases had been confirmed, more than double the next state, South Dakota with 548 (CDC 2003).

Beaver are carriers of the intestinal parasite *Giardia lamblia*, also known as *G. duodenalis* and *G intestinalis*, which can contaminate water supplies and cause outbreaks of the disease giardiasis in humans (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986, Miller and Yarrow 1994, Ainsworth 2002, Rockwell 2003). Furness et al. (2000) from CDC reported that *Giardia* is the most commonly detected intestinal protozoan in the world and it likely causes a range of 100,000 to 2.5 million cases annually in the United States. Reports for different states ranged from 0.9 to 42.3 per 100,000 people. Colorado was one

of ten states reporting an incidence rate of greater than 20 cases per 100,000 people. Though the infection source is frequently unknown, most of the cases in humans probably occur from person to person contact and is most frequently diagnosed in the 0-5 and 31-40 age groups during late summer to early fall, coinciding with recreational water use at communal pools and swimming areas including lakes (Furness et al. 2000). Giardiasis has been referred to as "beaver fever" because there has been a presumed link to water-dwelling animals starting with early reports of the disease in Canada. However, it now appears that it is more likely that humans have carried the parasite into the wilderness and that beavers may actually be the victims. In particular, there is a growing amount of data showing that beavers living downstream from campgrounds have a high *Giardia* infection rate compared to a near-zero rate for beavers living in more remote areas. In either case, beavers can and do contract giardiasis. Being water-dwellers, they are able to contaminate water more directly than an animal that defecates on the ground (Rockwell 2003). Undoubtedly, beavers are the source of some infections in the United States, but mostly as a result of prior infection by people.

Beaver also have been linked to other human diseases. They are known carriers of tularemia, a bacterial disease that is transmittable to humans through bites by insect vectors or infected animals or by handling animals or carcasses which are infected (Wade and Ramsey 1986); tularemia is also responsible for large-scale beaver die-offs (Addison et al. 1998). Skinner et al. (1984) found that in cattle-ranching sections of Wyoming the fecal bacterial count was much higher in beaver ponds than in other ponds, something that can be a concern to ranchers and recreationists. On rare occasions, beaver may contract the rabies virus and attack humans. In February 1999, a beaver attacked and wounded a dog and chased children that were playing near a stream in Vienna, Virginia; approximately a week later, a beaver was found dead at the site and tested positive for rabies (E. Hodnett, Fairfax Virginia Animal Control, pers. comm. 2002).

Beaver damage and requests reported to Colorado WS have increased significantly over the past 6 years. WS data provide only a fraction of the damage because much damage is not reported to WS. Concerns about increased beaver damage have prompted this EA because WS has become much more involved in responding to damage complaints. WS expects that ARDM activities may increase int the future because damage has increased significantly in the last 6 years.

Although beaver may cause extensive damage and are considered a pest, many benefits are associated with their daily activities. Beaver are generally considered beneficial where their activities do not compete with human use of the land or property (Wade and Ramsey 1986). Positive ecological influences on wetland habitats (Arner et al. 1969, Reese and Hair 1976) and economic gains from fur production (Hill 1976, Arner and Dubose 1979) make beaver important animals in the United States. Opinions and attitudes of individuals, communities, and organizations vary greatly and are primarily influenced and formed by benefits and damage directly experienced by each person or entity (Hill 1982). Property ownership, options for public and private land use, and effects on adjacent property impact public attitudes toward beaver (Hill 1982). In many cases, the beaver damage exceeds the benefits, resulting in a demand for beaver damage management.

Woodward et al. (1976) found that 24% of landowners who reported beaver activity on their property indicated benefits to having beaver ponds on their land. However, many landowners desire assistance with beaver pond management (Hill 1976, Lewis 1979, Woodward et al. 1985). Some of the benefits of beaver ponds include activities such as photography, trapping, hunting, and fishing. Beaver ponds also can provide a potential water source for livestock, and the ecological value of beaver ponds in the natural environment is important. For example, beaver ponds contribute to the stabilization of water tables, help reduce rapid run-

off from rain (Wade and Ramsey 1986), and serve as basins for the entrapment of streambed silt and eroding soil (Hill 1982). These wetland ecosystems also function as sinks, helping to filter nutrients and reduce sedimentation, thereby maintaining the quality of nearby water systems (Arner and Hepp 1989). Costanza et al. (1997) rated established freshwater lakes and rivers as one of the most valuable terrestrial ecosystems worldwide and estimated the value at about $3,500/ acre. Beaver ponds are considered part of the riverine or riparian habitat type (Hansen et al. 2000, Natural Heritage Program 2003).

Beaver may increase habitat diversity by flooding and opening forest habitats which result in greater interspersion of successional stages and subsequently increases the floral and faunal diversity of a habitat (Hill 1982, Arner and Hepp 1989). Creation of standing water, edge, and plant diversity, all in close proximity, results in excellent wildlife habitat (Hill 1982). Beaver created impoundments also are attractive to warm water fishes (Hanson and Campbell 1963). The resulting wetland habitat, which usually takes years to develop depending on pre-existing hydrology,, may be beneficial to some fish, reptiles, amphibians, waterfowl, shorebirds, and furbearers such as muskrats, otter and mink (Arner and Dubose 1979, Naimen et al. 1986, Miller and Yarrow 1994).

Habitat modification by beaver, primarily dam building and tree cutting, can benefit many species of wildlife (Jenkins and Busher 1979, Arner and Dubose 1979, Hill 1982, Arner and Hepp 1989, Medin and Clary 1990, 1991). Beaver once played important roles in shaping vegetation patterns in riparian and meadow ecosystems in the Rocky Mountains (Knight 1994). Beaver ponds are known to maintain fish and invertebrate populations (Schlosser 1995), and create and maintain riparian zones critical to some species of wildlife (Chadde and Kay 1991; Knight 1994). Yet, the beaver is virtually absent in many areas (Chadde and Kay 1991). Beavers are currently making a comeback in the Rocky Mountains, but the 150-year decline has left a legacy of channelized creeks and altered water tables in most watersheds. Beaver impoundments can provide aesthetic and recreational opportunities for wildlife observation through the attractiveness of habitat diversity and environmental education (Wade and Ramsey 1986). In addition, beaver ponds may be beneficial to T&E species. In Oregon where, threatened coho salmon (*Onchorhynchus kisutch*) depend on still pools, off-channel ponds and large woody debris within the stream for the successful rearing of juvenile salmonids; beaver activities, especially the building of dams, help to create these habitat elements. In Colorado, several of the state and federally listed T&E fish species including lake chubs, brassy minnows and greenback cutthroat trout may depend on established beaver ponds, especially during dry seasons and where areas are dewatered by developments. At the same time, though, extensive beaver ponds in their areas could be detrimental to them. The key is that beaver ponds provide them with refuge during low water times, but not impact their spawning and feeding grounds.

In time, beaver ponds can become wetlands and these habitat changes can prove beneficial for several species and be important for restoration projects (Albert and Trimble 2000). USFWS estimates that up to 43% of T&E species rely directly or indirectly on wetlands for their survival (Environmental Protection Agency (EPA) (EPA 1995). In Mississippi, beaver ponds over three years in age were found to have developed plant communities which increase their value as nesting and brood rearing habitat for wood ducks (Arner and Dubose 1979). Reese and Hair (1976) found that beaver pond habitats were highly attractive to a large number of birds year-round and that the value of the beaver pond habitat to waterfowl was minor when compared to other species of birds (Novak 1998a).

1.3.2 Muskrat. The muskrat is a native aquatic rodent found throughout Colorado and is abundant in suitable habitat. They inhabit creeks, rivers, lakes, ponds, and drainage ditches with a steady water level feeding primarily on cattails, bullrushes, and aquatic grasses. It has historically been the most heavily exploited furbearer in North America with 6-20 million harvested annually since about 1935 (Boutin and Birkenholz 1998). Boutin and Birkenholz (1998) provide a comprehensive review of muskrat natural history and population dynamics.

Damage by muskrats is usually not a major problem, but can be significant locally in particular situations (Wade and Ramsey 1986). Muskrat damage documented by WS in Colorado was $3,000 in FY00, $200 in FY01, and $1,005 in FY02. They typically do not cause as much damage as beavers, but can damage several resources. For example, muskrats often burrow into levees or dams used to hold water causing washouts which result in the loss of irrigation water or other water supplies, and flooding damage where the water drains, depending on the situation. Muskrats can also damage crops, wetlands, landscaping, and other resources where these are adjacent to muskrat habitat (Wade and Ramsey 1986).

On the other hand, in many areas muskrats are considered beneficial and provide opportunities for recreation and satisfaction to people that like to observe wildlife in a natural setting. In the prairie pothole region of the United States and Canada, as well as in Colorado, especially along the front range, muskrats clear or open small areas through feeding and house building in otherwise dense cattail marshes. The small openings create nesting and brood rearing habitat for nesting waterfowl (Wade and Ramsey 1986).

1.3.3 Summary of Proposed Action. The proposed action is to continue the current WS ARDM activities in Colorado for the protection of agriculture, property, natural resources, and human health and safety and increase ARDM activities as necessary to respond to the increasing damage levels. The objective of ARDM, as conducted in the proposed action, is to minimize loss or the risk of loss to the above resource categories from aquatic rodents by responding to all requests with technical assistance (advice and/or demonstrations) or direct control. WS employees give technical assistance to resource owners on a variety of methods that can be used to resolve problems under certain circumstances and where resource owners can handle the problem themselves or where cooperative funds are not available. WS will also assist resource owners through educational programs on damage identification and prevention.

Direct control support is mostly given with methods that are difficult for the public to implement, especially those that involve lethal control measures, and where cooperative funding is available; resource owners that are given direct control assistance are also encouraged to use additional management strategies when and where appropriate to help reduce present and future problems.

Under the proposed action, IWDM will be implemented which encourages the use of practical and legal techniques and methods, used singly or in combination, to meet the needs of requesters for resolving conflicts with aquatic rodents. Most wildlife damage situations require professional expertise, an organized control effort, and the use of multiple control methods to sufficiently resolve them; this will be the task of WS personnel who are trained professionals and equipped to handle most damage situations. The resource, species, location and type of damage, and all available biologically sound, cost-efficient and legal methods will be analyzed by WS personnel to determine the action taken to correct each conflict with aquatic rodents.

A wide range of legal methods are available to resource owners and WS personnel. These fall into different categories including habitat modification (ie. beaver pond leveler, dam removal, and exclusion), and population management (ie. traps and shooting). Population management methods are used lethally in most, but not all, situations. ARDM will be allowed in the State under the proposed action when and where requested and on public and private lands where signed *Agreements for Control* or an appropriate Annual Work Plan are in place. All ARDM will comply with federal, state, and local laws and current MOUs between WS and the various management agencies. WS personnel will communicate with other agency personnel when appropriate and necessary.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

1.4.1 WS Programmatic EIS. WS has issued a final EIS (USDA 1997) and Record of Decision on the USDA-APHIS-WS nationwide program. The final EIS (USDA 1997) did discuss ARDM at the nationwide level and concluded that the nationwide WS program did impact aquatic rodent populations. This EA is tiered to and pertinent portions of the EIS are incorporated by reference in this EA.

1.5 DECISION TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore responsible for the scope, content, and decisions to be made. CDA, CDOW, USFWS, and the U.S. Army Corps of Engineers (Corps) have had input during the preparation of this EA to facilitate an interdisciplinary approach in compliance with NEPA, and agency mandates, policies, and regulations.

Based on the scope of this EA, the decisions to be made are:

- Should ARDM, as currently implemented, be continued (the no action alternative)?
- If not, how should WS fulfill its legal responsibilities?
- What mitigation measures should be implemented?
- Would the proposal have significant impacts requiring an EIS analysis?

1.6 SCOPE OF THIS EA ANALYSIS

1.6.1 Actions Analyzed. This EA evaluates ARDM to protect agricultural and natural resources, property, and human health and safety from aquatic rodents in Colorado.

1.6.2 Counties Not Part of the Operational WS ARDM Program. Some counties in Colorado (18) have Cooperative Agreements with WS to conduct an ARDM program. Because the current WS ARDM program's mission is to provide assistance when requested and where funds are available, this EA analyzes impacts not only at the current program level, but at potential program levels (statewide) should nonparticipating counties, or currently nonparticipating resource owners/managers in cooperating counties, decide to enter the program. Currently, WS does provide limited direct control support in non-cooperating counties.

1.6.3 Native American Lands and Tribes. Tribes have requested WS to provide assistance with ARDM in Colorado for the protection of resources on tribal lands. The methods employed and potential impacts

would be the same as for any private land upon which WS could provide service. WS discusses the methods to be used and addresses concerns with tribal representatives at the time the agreement is signed. Therefore, this EA covers such actions as requested and implemented.

1.6.4 Federal Lands. WS may provide ARDM on federal lands in Colorado including USFWS, USFS, BLM, the Corps, and others. The methods employed would be restricted by Amendment 14 of the Colorado Constitution, however the potential impacts for those tools would be the same on these lands as they would be on private lands upon which WS provides service. If WS were requested to conduct ARDM on federal lands for the protection of private resources, this EA would cover such actions implemented. However, if the request is to protect federal resources, the requesting federal agencies are actually responsible for NEPA documentation.

1.6.5 Period for which this EA is Valid. This EA will remain valid until WS and other appropriate agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects that must be analyzed. At that time, this EA would be supplemented or reissued pursuant to NEPA with the appropriate analyses. Review of the EA will be conducted yearly to ensure that the EA is accurate and sufficient and all ARDM activities have been analyzed in the EA.

1.6.6 Site Specificity. This EA analyzes potential impacts of ARDM and addresses WS ARDM activities on all lands under *Cooperative Agreement* or *Agreements For Control* within Colorado. It also addresses the impacts of ARDM on areas where additional agreements with WS may be written in the reasonably foreseeable future within Colorado. Because the proposed action is to continue the current ARDM program, and because the current programs goal and responsibility is to provide service when requested within the constraints of available funding and manpower, it is conceivable that additional ARDM efforts could occur. Thus, this EA anticipates potential expansion and analyzes the impacts of such expanded efforts as part of the current program. This EA emphasizes significant issues as they relate to specific areas whenever possible; however, the issues that pertain to aquatic rodent damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 will be the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by WS in Colorado (See USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). Decisions made using the model will be in accordance with any mitigation and standard operating procedures (SOPs) described herein and adopted or established as part of the decision.

1.6.7 Interdisciplinary Development of the EA. Comments were solicited from CDA, CDOW, USFWS, and the Corps. Comments are maintained in an administrative file located at the Colorado WS State Office in Lakewood, CO.

1.7 AUTHORITY AND COMPLIANCE

1.7.1 Authority of Federal[4] and State Agencies to Conduct ARDM

1.7.1.1 WS Legislative Authority. USDA is directed by law and mandated by Congress to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for USDA is the Act of March 2, 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

In 1988, Congress passed the Rural Development, Agriculture, and Related Agencies Appropriations Act which strengthened the Act of March 2, 1931 at that time (the amended Act of March 2, 1931 in 2001 superseded this Act). This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.7.1.2 Colorado Division of Wildlife. CDOW has the responsibility to manage all protected and classified wildlife in Colorado, except Federally listed T&E species, regardless of the land class on which the animals are found (Colorado Revised Statutes (CRS) Title 33). CDOW has management responsibility for migratory birds under the direction of USFWS. CDOW is authorized to cooperate with WS for controlling nuisance and non-agriculture property damage caused by aquatic rodents. Landowners, lessees or any other person may obtain a permit to take any wildlife species causing excessive damage to property in Colorado (CRS 33-3-106) and beaver and muskrat can be taken year-round on lands owned or leased by private individuals when causing damage (CRS 33-6-107 {9}). WS is considered an agent of the landowner for the purpose of this section.

Amendment 14, which was an Initiative Measure amending Article XVIII of the Constitution of the State of Colorado, prohibits or severely restricts the use of leghold traps, body-gripping traps, snares, and poisons to take wildlife in the State of Colorado. Exceptions include (1) use by municipal

[4] Detailed discussions of WS legal responsibilities and key legislation pertinent to wildlife damage management are found in USDA (1997).

departments of health for the purpose of protecting human health or safety; (2) use to control wild or domestic rodents, except for beaver or muskrat; (3) use of nonlethal traps and snares for research, falconry, relocation, or for medical treatment; and (4) use on private property used for agricultural production by private landowners, lessees, or their employees for no more than a 30-day period per year and so long as the owner can present on site evidence that ongoing damage to livestock or crops has not been alleviated by the use of nonlethal control methods which have not been prohibited. The lethal methods that can only be used for a 30 day period in a calendar year include leghold traps, body-gripping traps, and snares. Amendment 14 did not limit the use of shooting or live traps, used as a lethal method, which can be used by private persons and WS to control damage on private or public lands.

1.7.1.3 Colorado Department of Agriculture. CRS Title 2, Article 12 (1995) discusses CDA's responsibilities regarding depredating animals and rodent control. CRS Title 35 authorizes CDA to enter into agreements with WS for the purpose of cooperating in the management of damage caused by coyotes, wolves, mountain lions, bobcats, and other depredating animals. It also allows CDA to enter into agreements with other entities to conduct ARDM. CDA currently has an MOU with WS. This document establishes a cooperative relationship between WS and CDA, outlines responsibilities, and sets forth objectives and goals of each agency for resolving wildlife damage in Colorado.

1.7.1.4 Colorado Department of Public Health and Environment. Under Amendment 14, CDPHE can issue a permit to use prohibited methods for the protection of human health and safety, including issues involving aquatic rodents.

1.7.1.5 Colorado Division of Water Resources. Administers laws and regulations covering water resources in the State of Colorado.

1.7.1.6 Natural Resource Conservation Service (NRCS). NRCS is responsible for certifying wetlands under the Wetland Conservation provisions of the Food Security Act (16 U.S.C. 3821 and 3822). Topographic maps are available through their offices that identify the presence of wetlands.

1.7.1.7 U.S. Fish and Wildlife Service. USFWS has statutory authority to manage Federally listed T&E species through the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543, 87 Stat. 884) and migratory birds under the Migratory Bird Treaty Act of 1918 (16 U. S. C. 703-711; 40 Stat. 755), as amended.

1.7.1.8 U.S. Army Corps of Engineers. The Corps regulates and permits activities regarding waters of the United States including protection and utilization under Section 404 of the Clean Water Act.

1.7.1.9 U.S. Environmental Protection Agency (EPA). EPA is responsible for administering and enforcing the Section 404 program of the Clean Water Act with the Corps; Section 404 established a permit program for the review and approval of water quality standards that directly impact wetlands.

1.7.2 Compliance with Federal Laws. Several Federal laws regulate WS and ARDM. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.7.2.1 National Environmental Policy Act (NEPA). All federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). NEPA sets forth the requirement for all major federal actions to be evaluated in terms of their potential significant impact on the quality of the human and natural environment for the purpose of avoiding or, where possible, minimizing significant adverse impacts. NEPA established the Council on Environmental Quality (CEQ) to oversee the federal government's responsibilities. Federal activities affecting the physical and biological environment are regulated in part by CEQ through regulations in Title 40 CFR, Parts 1500-1508. Each agency, such as APHIS, develops its own guidelines to comply with NEPA requirements. In accordance with CEQ and USDA regulations, APHIS Guidelines Concerning Implementation of NEPA Procedures, as published in the Federal Register (44CFR 50381-50384) provide guidance to APHIS and WS regarding the NEPA process. WS follows the CEQ regulations implementing NEPA (40 CFR 1500 et seq.), USDA (7 CFR 1b), and the APHIS Implementing Guidelines (7 CFR 372) as a part of the decision-making process. These laws, regulations, and guidelines generally outline five broad types of activities that need to be accomplished as part of any project: scoping, analysis, documentation, implementation, and monitoring.

This EA for ARDM, with WS as the lead agency, is the first time that all land classes under *Cooperative Agreements* or *Agreements for Control* will be analyzed in the analysis area in a comprehensive manner. WS coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern. Federal agency requests for WS assistance to protect resources outside the species discussed in this EA would be reviewed, and if necessary, the agency requesting the assistance would be responsible for NEPA compliance.

1.7.2.2 Endangered Species Act (ESA). It is WS and Federal policy, under ESA, that all Federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts consultations with the USFWS, as required by Section 7 of the ESA, to utilize the expertise of the USFWS, to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species. . .*" (Sec.7(a)(2)). WS has obtained a Biological Opinion from USFWS describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). Colorado WS has also conducted an informal consultation with USFWS and CDOW for the proposed ARDM program specifically concerning the T&E species in Colorado (Appendices B and C).

1.7.2.3 Migratory Bird Treaty Act of 1918 (16 U. S. C. 703-711; 40 Stat. 755), as amended. The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. Migratory birds are not targeted in ARDM, but any migratory birds taken incidentally to ARDM as nontargets are regulated under the Act.

1.7.2.4 Clean Water Act (Section 404). Section 404 (33 U.S.C. 1344) of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States without a permit

from the Corps unless the specific activity is exempted in 33 CFR 323 or covered by a nationwide permit in 33 CFR 330. The removal of most beaver dams are covered by these regulations (33 CFR 323 and 330). However, a recent court decision, the Tulloch Rule Decision, determined that minimal quantities of material released during excavation activities, such as may occur during beaver dam removal, may be considered "incidental fallback" which would not be governed by Section 404 and is allowed (Wayland and Shaeffer 1997).

1.7.2.5 Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act encourages federal agencies to conserve and promote conservation of nongame fish and wildlife and their habitats to the maximum extent possible within each agency's statutory responsibilities.

1.7.2.6 Food Security Act. The Wetland Conservation provision (Swampbuster) of the 1985 (16 U.S.C. 3801-3862), 1990 (as amended by PL 101-624), and 1996 (as amended by PL 104-127) farm bills require all agricultural producers to protect wetlands on the farms they own. Wetlands converted to farmland prior to December 23, 1985 are not subject to wetland compliance provisions even if wetland conditions return as a result of lack of maintenance or management. If prior converted cropland is not planted to an agricultural commodity (crops, native and improved pastures, rangeland, tree farms, and livestock production) for more than 5 consecutive years and wetland characteristics return, the cropland is considered abandoned and then becomes a wetland subject to regulations under Swampbuster and Section 404 of the Clean Water Act. The Natural Resources Conservation Service (NRCS) is responsible for certifying wetland determinations according to this Act.

1.7.2.7 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The registration, classification, and regulation of all pesticides used in the United States are regulated under FIFRA. All pesticides used or recommended by the WS program are registered with and regulated by the EPA and CDA. WS uses the chemicals according to labeling procedures and requirements as regulated by the EPA and CDA. Currently, all use of pesticides for beaver and muskrat has been banned in Colorado except in emergency situations as deemed necessary by CDPHE. Zinc phosphide is registered for use to take muskrats under FIFRA.

1.7.2.8 National Historical Preservation Act of 1966 as amended (NHPA). The NHPA and its implementing regulations (CFR 36, 800) require federal agencies to: 1) determine whether proposed activities constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources; and 3) consult with appropriate American Indian tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Activities described under the proposed action do not cause major ground disturbance and are not undertakings as defined by the NHPA.

1.7.2.9 Native American Graves Protection and Repatriation Act. The Native American Graves Protection and Repatriation Act requires Federal agencies to notify the Secretary of the Department that manages the Federal lands upon the discovery of Native American cultural items on Federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

1.7.2.10 Environmental Justice and Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Environmental Justice has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires Federal agencies to make Environmental Justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. Environmental Justice is a priority both within USDA, APHIS and WS. APHIS plans to implement Executive Order 12898 principally through its compliance with the provisions of NEPA.

WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to ensure Environmental Justice. WS personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by APHIS-WS are regulated by the EPA through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), CDA, by MOUs with Federal land managing agencies, and by ADC Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used following label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

1.7.2.11 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045). Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, and physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionally affect children, WS has considered the impacts that this proposal might have on children. The proposed ARDM program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

1.8 A PREVIEW OF THE REMAINING CHAPTERS IN THIS EA

This EA is composed of 5 chapters and 4 appendices. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and mitigation and SOPs. Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA. Appendix A is the literature cited in the EA. Appendix B is the Biological Assessment of ARDM affects on T&E species.

CHAPTER 2: ISSUES

Chapter 2 contains a discussion of the issues, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), and those that were used to develop mitigation measures and SOPs. In addition, some issues arose that, with rationale, were not considered in detail. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional information on affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Issues are concerns of the public or professional communities about potential environmental problems that might occur from a proposed federal action. Such issues must be considered in the NEPA decision process. Issues relating to the management of wildlife damage were raised during the scoping process in preparing the programmatic WS FEIS (USDA 1997) and were considered in the preparation of this EA. These issues are fully evaluated within the FEIS, which analyzed data specific to the Colorado WS Program

2.1 ISSUES CONSIDERED

Following are issues that have been identified as areas of concern requiring consideration in this EA.

- Effects on Target Aquatic Rodent Species Populations
- Effects on Nontarget Species Populations, Including T&E Species
- Humaneness of Control Techniques
- Effects of Beaver Dam Removal on Wetland Wildlife Habitat
- Effects of ARDM Methods on Public Safety

Potential environmental impacts of the Proposed Action and Alternatives in relation to these issues are discussed in Chapter 4. All issues except the final two have also been addressed in detail in the FEIS (USDA 1997). As part of this process, and as required by CEQ and APHIS, NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" published in local media and through direct mailings of the Notice to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

2.2 ISSUES USED TO DEVELOP MITIGATION

2.2.1 Effects on Nontarget Species Populations, Including T&E Species. A common concern among members of the public and wildlife professionals, including WS personnel, is the impact of ARDM methods and activities on nontarget species, particularly T&E species. WS SOPs include measures intended to mitigate or reduce the effects of ARDM on nontarget species populations and are presented in Chapter 3.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of potential effects and the establishment of special restrictions or mitigation measures. A description of mitigation measures established to avoid jeopardizing T&E species are presented in Chapter 3. The results of the biological evaluation are given in Chapter 4.

2.2.2 Humaneness of Methods Used by WS. The issue of humaneness and animal welfare as it relates to killing or capturing wildlife is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns if "*. . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*"

Suffering is described as a "*. . . highly unpleasant emotional response usually associated with pain and distress.*" However, suffering "*. . . can occur without pain . . .*" and "*. . . pain can occur without suffering . . .*" (American Veterinary Medical Association (AVMA) 1987). Because suffering carries with it the implication of a time frame, a case could be made for "*. . . little or no suffering where death comes immediately . . .*" (California Department of Fish and Game (CDFG) 1991), such as shooting.

Defining pain as a component of humaneness in WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would "*. . . probably be causes for pain in other animals . . .*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991).

Pain and suffering, as it relates to damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering since "*. . . neither medical nor veterinary curricula explicitly address suffering or its relief*" (CDFG 1991). Research suggests that some methods, such as restraint in leg-hold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The AVMA states "*... euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness.*" (Beaver et al. 2001).

Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild and feral animals. The AVMA states that "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting or harvesting, recognizing that a distress-free death may not be possible.*" (Beaver et al. 2001).

The decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals, but also the welfare of humans if damage management methods were not used. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and improved products are proven practical and reliable, a certain amount of animal suffering could occur when some wildlife damage management methods are used. In certain situations non-lethal damage management methods are not practical or effective. Georgia WS personnel are experienced and professional in their use of management methods to increase humaneness as much as possible under the constraints of current technology, workforce and funding. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

Some people are concerned about the humaneness of drowning beaver and muskrats while restrained by leg-hold traps. Considerable debate and disagreement among animal activists, veterinarians, wildlife professionals, fur trappers and nuisance wildlife specialists is apparent. Debate centers around an uncertainty as to whether drowning animals are rendered unconscious by high levels of carbon dioxide (CO_2) and thus insensitive to distress and pain (Ludders et al. 1999). The AVMA identifies drowning as an unacceptable method of euthanasia (Beaver et al. 2001), but provides no literature citations to support this position. Ludders et al. (1999) concluded drowning is not euthanasia based on the animals not dying from CO_2 narcosis, because CO_2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded. Ludders et al. (1999) showed death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia. Ludders et al. (1999) also concluded that animals that drown are distressed because of stress related hormones, epinephrine and norepinephrine; therefore, drowning is not euthanasia.

CO_2 causes death in animals by hypoxemia and some animals (i.e. cats, rabbits, and swine) are distressed before death (Beaver et al. 2001). Even though these animals are distressed, the AVMA states this death is an acceptable form of euthanasia (Beaver et al. 2001). Thus, the AVMA does not preclude distress or pain in euthanasia. In fact, the AVMA supports inducing hypoxemia related distress when necessary to reduce total distress, because reducing total distress is a more humane death.

Death by drowning in the classical sense is caused by inhalation of fluid into the lungs and is referred to as wet drowning (Gilbert and Gofton 1982, Noonan 1998). Gilbert and Gofton (1982) reported that all submerged beaver do not die from wet drowning, but die of CO_2 induced narcosis. According to Gilbert and Gofton (1982) and Noonan (1998), the AVMA accepts CO_2 as a suitable form of euthanasia. Gilbert and Gofton (1982) also reported that after beaver were trapped and entered the water struggling occurred for 2-5 minutes followed by a period of reflexive responses. Andrews et al. (1993) reports that with some techniques that induce hypoxia, some animals have reflex motor activity followed by unconsciousness that is not perceived by the animal. Gilbert and Gofton (1982) stated it is unknown how much conscious control actually existed at this stage and anoxia may have removed much of the sensory perception by 5-7 minutes post submersion. However, Gilbert and Gofton (1982) have been criticized because levels of CO_2 in the blood were not reported (Ludders et al. 1999) and there was insufficient evidence that the beaver in their study were under a state of CO_2 narcosis when they died (V. Nettles, Southeastern Cooperative Wildlife Disease Study, letter to W. MacCallum, Massachusetts Division of Fisheries and Wildlife, June 15, 1998). Adding to the controversy, Clausen and Ersland (1970) did measure CO_2 in the blood for submersed restrained beaver, yet none of the beaver in the study died. Therefore, Clausen and Ersland (1970) could not determine if beavers die of CO_2 narcosis. However, Clausen and Ersland (1970) were able to demonstrate that CO_2 increased in arterial blood while beaver were submersed and that CO_2 was retained in tissues. While Clausen and Ersland (1970) did measure the amounts of CO_2 in the blood of submersed beaver they did not attempt to

measure the analgesic effect of CO_2 buildup to the beaver (V. Nettles, Southeastern Cooperative Wildlife Disease Study, letter to W. MacCallum, Massachusetts Division of Fisheries and Wildlife, June 15, 1998).

When beaver are captured using leg-hold traps with intent to drown, beaver are exhibiting a flight response. Gracely and Sternberg (1999) reported that there is stress-induced analgesia resulting in reduced pain sensitivity during fight and flight responses. Environmental stressors that animals experience during flight or fight activate the same stress-induced analgesia (Gracely and Sternberg 1999).

Use of drowning trap sets has been a traditional wildlife management technique in trapping aquatic mammals such as beaver, nutria, and muskrats. Trapper education manuals and other wildlife damage management manuals written by wildlife biologists recommend drowning sets for leghold traps set for beaver (Howard et al.1980, Randolph 1988, Bromley et al. 1994, Dolbeer et al. 1994, Miller and Yarrow 1994). In some situations drowning trap sets are the most appropriate and efficient method available to capture beaver and muskrats. For example, a drowning set attachment should be used with leg-hold traps when capturing beaver to prevent the animal from injury while restrained or from escaping (Miller and Yarrow 1994). Animals that drown die relatively quickly (e.g., within minutes) versus the possible stress of being restrained and harassed by people, dogs and other wildlife before being euthanized. Drowning sets make the captured animal and trap less visible and prevent injury (i.e., bites and scratches) to people who may otherwise approach a restrained animal. Furthermore, some people are offended seeing dead animals and drowning takes the dead animal out of public view. Some sites may be unsuitable for body-gripping traps or snares because of unstable banks, deep water or substrate conditions. However, these sites would be suitable for leghold traps. In some situations where muskrats occur in high densities, multiple catch colony traps may be the most efficient method to reduce populations and alleviate damage. Therefore, drowning is a humane way of killing muskrats (Gilbert and Gofton 1982) in colony traps.

Given the short time period of a drowning event, possible analgesic effect of CO_2 buildup to beaver, the minimum, if any, pain or distress on drowning animals, the AVMA's acceptance of hypoxemia as euthanasia and a minimum of pain and distress during euthanasia, acceptance of catching and drowning muskrats approved by International Humane Trapping Standards (Fur Institute of Canada 2000), the conclusion has been drawn that drowning, though rarely used by WS, is acceptable. Some people will disagree and remain unswayed.

WS has improved the selectivity of management devices through research and is striving to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in those situations when nonlethal damage management methods are not practical or effective. Colorado WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

2.2.3 Effects of Beaver Dam Removal on Wetland Wildlife Habitat. Some people are concerned about the effects of the alternatives on the wetland ecosystem and that the removal of beaver or breaching beaver dams from an area will result in the loss of wetland habitat and the plant and animal species included in those wetlands.

Beavers build dams primarily in smaller riverine wetlands (intermittent and perennial streams and creeks) with dams consisting of mud, stick and other vegetative materials. Their dams obstruct the normal flow of water and typically change the preexisting wetlands' hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment; the depth of the bottom sediment depends on the length of time an area is covered by water and the amount of suspended sediment in the water.

WS beaver damage management activities are primarily conducted to alleviate damages to agricultural crops, timber resources, and property such as roads, irrigations structures, bridges and water management facilities. Activities are also conducted to enhance or reclaim wildlife and stream fishery habitats. WS operations routinely incorporate population reduction with dam breaching or installation of temporary water levelers or exclusion devices. Dams are breached by hand, where possible, or with small charges of binary explosives. No heavy equipment such as backhoes or bulldozers are used by WS in these damage reduction and wildlife enhancement activities, but can be by private individuals. These activities take place on small watershed streams, tributary drainages, and ditches and can best be described as small projects conducted to restore water flow through previously existing channels. Only that portion of the dam blocking the stream or ditch channel is altered or breached. Projects involving the use of binary explosives are all conducted by trained WS Specialists who are certified explosive specialists. After a blast, any remaining fill material still obstruction the channel is normally washed downstream by water current. The only noticeable side effects from this activity are diluted mud, water, and small amounts of debris from the dam scattered around the blasting site. Considerably less than 10 cubic yards of material is moved in each of these project activities.

Beaver dams in time can establish new, but different wetlands. The Corps and the U. S. Environmental Protection Agency's (EPA) regulatory definition of a wetland (40 CFR 232.2) is:

> *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

Therefore, per this definition, a site needs to meet three qualifications to be considered a wetland. First, it must contain soils saturated by surface or ground water during a specific period of the growing season. Hydric soils are those soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. In general, hydric soils form much easier where wetlands preexisted. Secondly, the site must exhibit evidence of wetland hydrology. An area has wetland hydrology if it is inundated or saturated to the surface for at least 5% of the growing season in most years. Finally, the site must be dominated by hydrophytic vegetation which are those species tolerant of and specially adapted to live in saturated soil conditions. Hydrophytic vegetation includes those plants that grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. These three factors must be present for an area to be classified as a wetland (CDOW 2002). If a beaver dam is not breached and water is allowed to stand, hydric soils and hydrophytic vegetation eventually form. This process, though, can take years depending on preexisting conditions.

The preexisting habitat and the altered habitat have different ecological values to the fish and wildlife native to the area. Some species will abound by the addition of a beaver dam, while others will diminish. For example, some species of darters listed as T&E species require fast moving waters over gravel or cobble

beds which beaver dams can eliminate, thus reducing the habitat's value for these species. Beaver dams can potentially be beneficial to some species of wildlife such as river otter and waterfowl when it becomes an established wetland. Since a potential exists for beaver damage management to impact wildlife habitat, this is being considered as an issue.

The intent of most dam breaching is not to drain old established wetlands. With few exceptions, requests for assistance by WS from public agencies, and private individuals and entities involve dam removal to return an area back to its preexisting condition within a few days to a few years after the dam was created. If an area did not have preexisting hydric soils, it usually takes many years for them to develop and a wetland to become established; this often takes more than 5 years as recognized by the Swampbuster provisions. Most beaver dam removal by WS is allowed under exemptions stated in 33 CFR parts 323 and 330 of Section 404 of the Clean Water Act or parts 3821 and 3822 of the Food Security Act. However, the removal of some beaver dams can trigger certain portions of Section 404 that require landowners to obtain permits from the Corps. WS personnel determine the proper course of action upon inspecting a beaver dam impoundment. Appendix D describes the procedures used by WS to assure compliance with the pertinent laws and regulations.

2.2.4 Effects of ARDM Methods on Public Safety. A formal risk assessment of WS methods, including almost all of those used for ARDM in Colorado, concluded low risks to humans (USDA 1997, Appendix P). One specific method was not addressed in the assessment: the use of explosives to remove beaver dams.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 WS's Impact on Biodiversity. No WS wildlife management program in Colorado is conducted to eradicate a native wildlife population. WS operates in accordance with international, federal, and state laws and regulations enacted to ensure species viability. Any reduction of a local population or group would be temporary because immigration from adjacent areas or reproduction would soon replace the animals removed. The impacts of the current WS Program on biodiversity are not significant nationwide or in Colorado (USDA 1997). WS operates on a relatively small percentage of the land area in Colorado and WS take is a small proportion of the total population of the species analyzed in Chapter 4.

2.3.2 Wildlife Damage Should Be an Accepted Loss -- a Threshold of Loss Should Be Reached Before Providing ARDM Services. WS is aware of concerns that federal WDM should not be allowed until economic losses become unacceptable. Although some loss of resources to wildlife can be expected and tolerated, WS has the legal direction to respond to requests for WDM, and it is Program policy to aid each requester to minimize losses. WS uses the Decision Model discussed in Chapter 3 to determine an appropriate strategy.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie NF, et al., the United States District Court of Utah upheld the determination that a WDM program may be established based on threatened damage. In part, the court found that a forest supervisor need only show that damage (from predators) is threatened to establish a need for WDM (Civil No. 92-C-0052A January 20, 1993). Thus, there is precedent for conducting ARDM when damage has not yet occurred but is only threatened.

2.3.3 Wildlife Damage Management Should Be Fee Based and Not a Taxpayer Expense. WS is aware of concerns that WDM should not be provided at the expense of the taxpayer or that it should be fee based. WS was established by Congress as the agency responsible for providing WDM to the people of the United States. Funding for WS ARDM comes from a variety of sources in addition to federal appropriations. Such nonfederal sources include local government funds (county or city), producer associations, and individual private citizens which are all applied toward program operations. Federal, state, and local officials have decided that WDM needs to be conducted and have allocated funds for these activities. Additionally, WDM is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility. A commonly voiced argument for publicly funded WDM is that the public should bear the responsibility for damage to private property caused by "publicly-owned" wildlife.

2.3.4 American Indian and Cultural Resource Concerns. The National Historic Preservation Act of 1966, as amended, requires federal agencies to evaluate the effects of any federal undertaking on cultural resources and to consult with appropriate American Indian Tribes to determine whether they have concerns for cultural properties in areas of these federal undertakings. The Native American Graves and Repatriation Act of 1990 provides protection of American Indian burials and establishes procedures for notifying Tribes of any new discoveries. Senate Bill 61, signed in 1992, sets similar requirements for burial protection and Tribal notification with respect to American Indian burials discovered on state and private lands.

WDM has little potential to cause adverse effects to sensitive historical and cultural resources. ARDM activities, specifically, will have no adverse effects on historical and cultural resources.

In consideration of Native American cultural and archeological interests, the WS Program requested a list of the Tribes in Colorado from the Bureau of Indian Affairs (BIA). Each Tribe will be solicited for comments regarding the EA and ARDM activities in Colorado. ARDM actions on Tribal property currently occur as requested by Tribal officials, assuring that Tribes can decide what actions occur considering any overriding cultural resource concerns.

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 ALTERNATIVES ANALYZED IN DETAIL

3.1.1 Alternative 1 - Continue the Current Federal ARDM Program (the Proposed Action). This is the Proposed Action as described in Chapter 1 and is the "No Action" alternative as defined by CEQ for ongoing Programs.

3.1.2 Alternative 2 - No Federal WS ARDM. This alternative consists of no federal ARDM. Affected resource owners would be left to their own accord to stop damage created by aquatic rodents.

3.1.3 Alternative 3 - Technical Assistance Only. Under this alternative, WS would not conduct any direct operational ARDM activities in Colorado. If requested, affected resource owners would be provided with technical assistance information only.

3.1.4 Alternative 4 - Nonlethal Required Before Lethal Control. This alternative would not allow lethal control by WS until nonlethal methods had been tried and found to be inadequate in each damage situation.

3.2 DESCRIPTION OF THE ALTERNATIVES

3.2.1 Alternative 1 - Continue the Current Federal ARDM Program. A succinct description of the proposed action was presented in Chapter 1. The discussion that follows contains further information intended to foster understanding of WS's rationale for constructing the proposed action.

3.2.1.1 IWDM. For more than 70 years, WS has considered, developed, and used numerous methods of managing wildlife damage problems (USDA 1997, P. 2-15). The efforts have involved research and development of new methods and the implementation of effective strategies to resolve wildlife damage. The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and control of damage caused by wildlife based on an analysis of the local problem and the informed judgement of trained personnel. The WS Program applies IWDM (WS Directive 2.105), to reduce damage through the WS Decision Model (Slate et. al. 1992) described in the FEIS (USDA 1997).

The philosophy behind IWDM is to implement effective management techniques in a cost effective manner while minimizing the potentially harmful effects on humans, target and nontarget species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. IWDM may incorporate cultural practices (i.e. animal husbandry), habitat modification, animal behavior (i.e. scaring), local population reduction, or any combination of these, depending on the characteristics of the specific damage problems. In selecting management techniques for specific damage situations consideration is given to the:

- Species responsible;
- Magnitude and geographic extent of damage;
- Duration and frequency of the damage;
- Prevention of future damage (lethal and nonlethal techniques); and
- Environmental concerns such as T&E species in the same area.

The cost of IWDM may be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

3.2.1.2 IWDM Strategies That WS Employs. WS employs different strategies to resolve wildlife damage problems. In certain situations, WS may provide cooperators with the information necessary to resolve the problem themselves (technical assistance). In others, WS may directly resolve the problem (direct assistance). However, the most common strategy to resolve wildlife damage is to use a combination of these approaches as outlined in IWDM.

Technical Assistance Recommendations. WS may be requested for assistance, but only provide advice on how to resolve the problem and implementation is the responsibility of the requestor. WS personnel provide information, demonstrations, and advice on many of the available IWDM techniques. Technical assistance includes demonstrations on the proper use of management devices (pond-levelers, cage traps, etc.) and information and advice on habitat management and animal behavior modification devices. Technical assistance is generally provided following an on-site visit or verbal consultation with the requestor. Generally, several management strategies are described to the requestor for short and long-term solutions to damage problems; these strategies are based on the level of risk, the abilities of the requestor, need, and practical application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual management is primarily the responsibility of the requestor.

Direct Control Assistance. Some ARDM activities are directly conducted or supervised by WS personnel. Direct control assistance is implemented when the problem cannot effectively be resolved through technical assistance alone or when *Cooperative Agreements* provide for WS direct control assistance. WS conducts direct control operations with any of the following methods on private property only if a signed *Agreement For Control On Private Property* is on file, or where *Agreement For Control On Nonprivate Property* or *Work Plans* on federal, state, county or other local government lands are in place that cover the intended target species and methods to be used. The initial investigation defines the nature and history of the problem, extent of damage, and the species responsible for the damage. Professional skills of WS personnel are often required to effectively resolve problems, while some problems may require the direct supervision of a wildlife professional. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al. 1992). The recommended damage management program to resolve a problem may include any combination of preventive and corrective actions that could be implemented by the requestor, WS, or other agency, as appropriate. Two strategies are used by WS, preventive and corrective management.

Preventive damage management is applying ARDM strategies before damage occurs, and is usually based on historical damage problems. As requested and appropriate, WS personnel provide

information, conduct demonstrations or take action to prevent these historical problems from recurring. For example, in areas where substantial damage by flooding has occurred historically and beaver have been removed, WS may provide information about effective exclusion, pond levelers or other nonlethal techniques, or be requested to conduct operational ARDM after new activity is noticed prior to new damage. However, preventive population management is not frequently used in ARDM.

Corrective damage management is applying ARDM to stop or reduce current losses. As requested and appropriate, WS personnel provide information and conduct demonstrations or, with the appropriate signed agreement, take action to prevent additional losses from recurring. For example, in areas where roads have been flooded, WS may provide information about exclusion methods or pond levelers, and conduct operational ARDM to stop the losses. Corrective damage management is usually the most common ARDM strategy. Most people typically do not want assistance with beaver until they have already caused damage, unless they have had damage in the past.

3.2.1.3 ARDM Methods. This section summarizes the best technology for resolving aquatic mammal damage that has evolved from continued development and refinement by research and the experience of professional wildlife biologists. Several ARDM methods are available for use. Resource owner practices consist primarily of nonlethal preventive methods such as exclusion and habitat modifications. Resource owners are encouraged to use these methods, based on the level of risk, need, and professional judgement of their effectiveness and practicality (Slate et al. 1992). WS employs several lethal control methods to selectively remove aquatic rodents causing damage where nonlethal techniques would not adequately address the damage situation. A formal risk assessment of all mechanical devices used by the WS ARDM program in Colorado is in the FEIS, Appendix P (USDA 1997).

Most ARDM methods have strengths and weaknesses in each specific damage situation, and can range from being very effective at reducing damage to being of virtually no value. WS personnel using the WS Decision Model (Slate et al. 1992) can determine for each ARDM situation the method or combination of methods that is most appropriate and effective. Following is a basic list of methods given consideration by WS for ARDM, a discussion of their use, and the specific species targeted by their use. Methods fall into 3 basic categories: resource management, physical exclusion, and wildlife management.

Resource Management

Modification of human behavior is often used by WS personnel to resolve potential conflicts between humans and wildlife by altering the perception of an action. For example, WS may talk with residents of an area to eliminate the feeding of wildlife that occurs in parks, recreational sites, or residential areas to reduce damage by certain species of wildlife. Many wildlife species adapt well to human settlements and activities, but their proximity to humans may result in damage to structures or threats to public health and safety. Eliminating wildlife feeding and handling can reduce potential problems, but many people who are not directly affected by problems caused by wildlife enjoy wild animals and engage in activities that encourage their presence. It is difficult to consistently enforce

no-feeding regulations and to effectively educate all people concerning the potential liabilities of feeding wildlife.

Habitat management such as the removal of vegetation near water and damage prone areas reduces cover and eliminates food sources which might discourage the presence of aquatic rodents. Other than this, most habitat management is aimed at reducing the presence of beavers.

Beaver dam removal is done when beaver create a dam where the resource owner does not want the area to be flooded. Beaver damming activities can have varying affects on the environment. Their dams can create valuable wetland habitat for wildlife, especially where a dam holds water during drought periods. On the other hand, their dams can create sinks where water evaporates and percolates into the ground which decreases water flows which may be needed for agricultural activities, some fish and wildlife species, and other resources. Beaver dam removal is generally conducted to maintain existing stream channels and drainage patterns, and reduce flood waters that have affected established silviculture, agriculture (i.e., ranching and farming activities), roads, bridges, and residential and commercial property, or drainage structures such as culverts. Beaver dams are made from natural debris such as logs, sticks, and mud that beaver take from the immediate area. It is this portion that is dislodged during a beaver dam breaching operation. The impoundments that WS removes are usually from recent beaver activity and the area has not been flooded or inundated with water long enough for the area to take on the qualities of a true wetland (i.e., hydric soils, hydrophytic vegetation, preexisting function) although this is not always the case.

Unwanted beaver dams can be breached by hand with a rake, power tools (e.g., a winch) or machinery (e.g., backhoe), or with binary explosives (discussed below). Beaver dam breaching by hand, with power tools, machinery or with binary explosives does not affect the substrate or the natural course of the stream and returns the area back to its preexisting condition with similar flows and circulations. Because beaver dams involve waters of the United States, removal is regulated under Section 404 of the Clean Water Act. WS projects involving beaver dam breaching are discussed with the U.S. Army Corps of Engineers or are specifically exempted under Section 404.

Beaver dam breaching can have varying effects, both positive and negative on T&E species, depending on the species present. The breaching of recently built beaver dams from irrigation ditches and other artificial waterways such as culverts where roads, bridges, buildings or houses are constructed will not have an effect on most T&E species. However, the breaching of beaver dams that have been created along natural drainages such as creeks and streams could have varying affects on T&E species depending on the species that could potentially be affected.

Binary explosives are an efficient, cost-effective means to reduce flooding and property damage caused by beaver. WS uses a binary (i.e., 2-part) explosive composed of ammonium nitrate and nitro-methane. Mixed together, these chemicals become a Division 1.1 explosive (US Alcohol, Tobacco, and Firearms classification). Depending on the surrounding area at a particular site, WS explosives specialists may use one of three different initiation systems: 1) fuse, 2) electric, or 3) non-electric. All explosives materials are consumed during the explosion; therefore, residual chemicals and other materials are nonexistent. However, some fumes and toxic gases are created during the explosion. Because dam breaching by use of explosives is normally conducted in an open area,

vapors dissipate quickly. Fumes and vapors created by WS explosives use do not appear to effect the wildlife inhabiting the project area.

WS personnel must receive explosives training and be certified by WS before using explosives on any official projects (WS Directive 2.435). All WS explosive specialists are required to attend 30 hours of extensive explosive safety training and spend time with a certified explosive specialist in the field prior to obtaining certification. All blasting activities are conducted by well-trained, certified blasters and are closely supervised by professional wildlife biologists. WS Explosives Safety Manual on explosives handling and use follow the rules and guidelines set forth by the Institute of Makers of Explosives, the safety branch of the Commercial Explosive Industry in the United States and Canada. Additionally, a minimum of 8 hours of approved explosives refresher training are required every 2 years to maintain WS certification. All WS use, storage, and transportation of explosives are conducted in strict compliance with applicable Federal, State, and local laws and regulations and with the procedures outlined in the WS Explosives Safety Manual and in Occupational Safety and Health Administration Standard 1910.109, Explosives and Blasting Agents.

When a dam is removed, debris is discharged into the water. The debris that ends up in the water is considered "incidental fallback" or discharge fill. The Tulloch Rule Decision (Court Case No. 93cv01754) determined that "incidental fallback" did not trigger Section 404 permit requirements. It was not determined if beaver dams fit this category, but EPA and the Corps issued guidance to their regulatory offices that beaver dam removal may not require permits under Section 404 (Wayland and Shaeffer 1997). These agencies stated that they would give their field offices further guidance at a later date. However, in most beaver dam removal operations, the material that is displaced, if considered to be discharge, is exempt from permit requirements under 33 CFR 323 or 330. A permit would be required if the impoundment caused by a beaver dam was considered a true wetland. WS personnel survey the beaver dam site and impoundment to determine whether conditions exist suggesting that the area may be a wetland as defined above. If such conditions exist, the landowner is asked the age of the dam or how long he/she has known of its presence to determine whether Swampbuster, Section 404 permit exemptions, or the Nationwide Permit (NWP) program allows removal of the dam. If not, the landowner is required to obtain a section 404 permit from the Corps before the dam will be removed by WS personnel.

The following information explains Section 404 exemptions and conditions that pertain to the removal of beaver dams.

33 CFR 323 - Permits For Discharges of Dredged or Fill Material into Waters of the United States. This regulation provides guidance to determine whether certain activities require permits under Section 404.

Part 323.4 Discharges not requiring permits. This section establishes exemptions for discharging certain types of fill into waters of the United States without a permit. Certain minor drainage activities connected with normal farming, ranching, and silviculture activities where they have been established do not require a permit as long as these drainages do not include the immediate or gradual conversion of a wetland (i.e. beaver ponds greater than 5 years old) to a non-wetland. Specifically part (a)(1)(iii)(C)(i) states, "*...fill material incidental to connecting upland drainage*

facilities [e.g., drainage ditches] *to waters of the United States, adequate to effect the removal of excess soil moisture from upland croplands...*". This indicates that beaver dams that block ditches, canals, or other structures designed to drain water from upland crop fields can be removed without a permit.

Moreover, (a)(1)(iii)(C)(iv) states the following types of activities do not require a permit "*The discharges of dredged or fill materials incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainageways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainageway as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption.*"; this allows the removal of beaver dams in natural streams to restore drainage of agricultural lands within one year of discovery.

Part 323.4 (a) (2) allows "*Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.*"; this allows beaver dams to be removed without a permit where they have resulted in damage to roads, culverts, bridges, levees, and irrigation structures and associated structures such as the irrigation ditch head gate, if it is done in a reasonable amount of time.

33 CFR 330 - Nationwide Permit (NWP) Program. The Corps Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment. The NWPs are listed in Appendix A of 33 CFR 330 and permittees must satisfy all terms and conditions established in order to qualify for their use. Individual beaver dam removal activities by WS may be covered by any of the following NWPs if not already exempted from permit requirements by the regulations discussed above. WS complies with all conditions and restrictions placed on NWPs for any instance of beaver dam removal done under a specific NWP.

There are numerous exceptions to the use of NWPs. If utilized, the Colorado WS program will document compliance with those exceptions.

NWP 3 authorizes the rehabilitation of those structures, such as culverts, homes, and bridges, destroyed by floods and "discrete events" such as beaver dams provided that the activity is commenced within 2 years of the date when the beaver dam was established. The removal of a dam under this NWP requires notification of the Corps District Engineer.

NWP 18 allows minor discharges of dredged and fill material, including the removal of beaver dams, into all waters of the United States provided that the quantity of discharge and the volume of

excavated area does not exceed 10 cubic yards below the plane of the ordinary high water mark (this is normally well below the level of the beaver dam) or is in a "special aquatic site" (wetlands, mudflats, vegetated shallows, riffle and pool complexes, sanctuaries, and refuges). The District Engineer must be "notified" (general conditions for notification apply), if the discharge is between 10-25 cubic yards for a single project or the project is in a special aquatic site and less than 1/10 of an acre is expected to be lost. If the values are greater than those given, a permit is required. Beaver dams rarely would exceed 2 or 3 cubic yards of backfill into the waters and probably no more than 5 cubic yards would ever be exceeded. Therefore, this stipulation is not restrictive. Beaver dams periodically may be removed in a special aquatic area, but normally the aquatic site will be returned to normal. However, if a true wetland exists, and beaver dam removal is not allowed under another permit, then a permit must be obtained from the District Engineer.

NWP 27 provides for the discharge of dredge and fill for activities associated with the restoration of wetland and riparian areas with certain restrictions. On non-federal public and private lands, the owner must have: a binding agreement with USFWS or NRCS to conduct restoration; a voluntary wetland restoration project documented by NRCS; or notified the District Engineer according to "notification" procedures. On Federal lands, including Corps and USFWS, wetland restoration can take place without any contract or notification. This NWP "*...applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas. This NWP does not authorize the conversion of natural wetlands to another aquatic use...*" If operating under this permit, the removal of a beaver dam would be allowed as long as it was not a true wetland (i.e., 5 or more years old), and for non-federal public and private lands the appropriate agreement, project documentation, or notification is in place.

A quick response without delays resulting from permitting requirements can be critical to the success of minimizing or preventing damage. Exemptions contained in the above regulations or NWPs provide for the removal of the majority of beaver dams that WS encounters. The primary determination that must be made by WS personnel is whether a beaver impounded area has become a true wetland or is just a flooded area. The flexibility allowed by these exemptions and NWPs is important for the efficient and effective resolution of many beaver damage problems because damage can escalate rapidly the longer an area remains flooded.

Water-level control devices (pond levelers) have been used for many years with varying degrees of success. Several devices such as the Three-log Drain (Roblee 1983), the T-culvert Guard (Roblee 1987), wire mesh culvert (Figure 1) (Roblee 1983), and the Clemson beaver pond leveler (Miller and Yarrow 1994) may be used to regulate water levels in beaver ponds. Additionally, the Beaver Deceiver is a water-level control system that attempts to quiet, calm, and deepen the water in front of culverts (i.e., to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996).

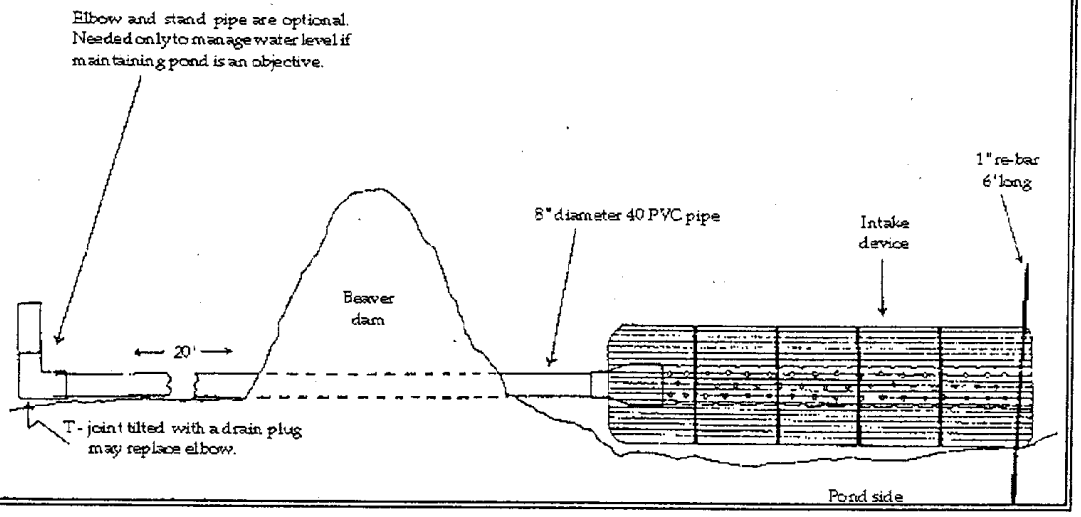
Various types of beaver pond levelers have been described (Arner 1964, Laramie and Knowles 1985, Lisle 1996, Roblee 1984) and installation of beaver pond levelers can be effective in reducing flooding in certain situations, if properly maintained (Minn. Dept. Nat. Res. 1994, Miller and Yarrow 1994). Water-level control devices generally are of two designs. One design is a perforated pipe passing

through the beaver dam and the second is a fence erected 15 - 90 feet in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996.). The second design may include a perforated pipe extending from the fence to the culvert to allow water to continue to flow if the fence becomes clogged with debris.

The cost of water-level control devices is variable, depending on number of devices per dam, type of device, materials used, and labor. Dams may need multiple devices to accommodate the volume of water in the flowage. Materials and installation for water-level control devices can be relatively modest for a three-log drain (Arner 1964), $496 - $560 for a single modified Clemson leveler, $1050 - $2,300 for a single beaver stop, or more than $1,000 for a Beaver Deceiver (C. Sloan, WS-MS, pers. comm. 2002). The use of pond levelers or water-level control devices may require frequent maintenance, depending on the type of water-level control device used. Because stream flow, leaf fall, floods, and beaver activity may bring debris to the water-level control device, frequent maintenance is often required (Nolte et al.2000). Nolte et al. (2000), checking the status of Clemson pond-levelers that had been in the field anywhere from a few months to a few years, found that about 45% remained effective. For those situations where the leveler did work, it required many man hours in effort to maintain the pond-leveler working and required additional costs associated with their use. They also found that their effectiveness was somewhat related to the land-use objectives of the landowner (e.g., wanted a pond for waterfowl habitat). Nolte et al. (2000) also found that the use of pond-levelers were most effective (95%) where beaver numbers were controlled in an area and kept at a low population level.

Water-level control devices are most effective on wetlands lacking in-stream flow (C. Sloan, WS-MS, pers. comm. 2002) and may be ineffective in beaver ponds located in broad, low-lying areas (Organ et al. 1996). Pond-levelers are also very effective at culverts where the entrance to the culvert is deepened to reduce the potential for beavers wanting to build a dam at the site (D. Nolte, NWRC, pers. comm. 2003). Water-level control devices may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device and debris is

Figure 1. Pond Leveler



continuously carried to the site. Similarly, water-level control devices may be ineffective during periods of unusually high rainfall or increased water flow (Wood et al. 1994).

Physical Exclusion

General exclusion pertains to methods that prevent access to resources through fencing or other barriers. Fencing of small critical areas such as around culverts and drain pipes can sometimes prevent beavers from plugging them and around aquaculture facilities can prevent access to otter. Construction of concrete spillways may reduce or prevent damage to dams by burrowing aquatic rodent species. Riprap can also be used on dams or levees at times, especially to deter muskrat burrowing. Electrical water barriers have proven effective in limited situations for beaver; an electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at keeping beaver out. The effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted because beaver will avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997). Fencing, especially if it is installed with an underground skirt, can prevent access to aquatic mammals to areas such as yards, hay meadows, aquaculture facilities, and poultry barns. Lastly, hardware cloth or other metal barriers can sometimes be practical to prevent girdling and gnawing of valuable trees.

Abrasives are materials that discourage, reduce or prevent gnawing behavior of rodents. Abrasives produce an unpalatable surface which irritates the teeth and mouth of rodents when they attempt to gnaw or chew on the surface. Flexible materials, such as sandpaper, grinder pads and fine-mesh stainless steel screening can be placed on or over objects (e.g., electrical wiring, plastic piping, fruit trees, etc) that are susceptible to rodent gnawing. Fine sand can be added and mixed with paint, glue or other suitable liquid adherents to formulate a paste or heavy mixture that can be brushed-on or applied to a surface to discourage rodent gnawing. This method has had limited success when applied or painted to tree trunks to discourage beaver from cutting down trees. Recent preliminary tests of applying a textural repellent (e.g., sand mixed in paint) by WS' National Wildlife Research Center (Nolte et al. 2003) suggest that this method may be more applicable for large diameter trees and where other trees are available for beaver to take. However, additional research is needed to fully evaluate the efficacy and practicality of abrasives.

Wildlife Management

Reducing wildlife damage through wildlife management is achieved through the use of a myriad of techniques. The objective of this approach is to alter the behavior of or repel the target species, remove specific individuals from the population, reduce local population densities, or suppress/extirpate exotic species populations to eliminate or reduce the potential for loss or damage to property and natural resources.

Relocation, the translocation of an animal, may be appropriate in some situations (i.e., a suitable relocation site is available, if the problem species' population is at very low levels at the relocation site, and the additional dollars needed for relocation can be obtained.) However, species that often cause damage problems are often abundant and relocation is not necessary for the maintenance of

viable populations. Relocation may also result in future depredations if the relocated animal encounters protected resources again, and in some cases could require payment of damage compensation claims. Additionally. CDOW would have to authorize relocations before they could be done per Title 5 section 65.378. CDOW has authorized the relocation of beaver to reintroduce beaver into areas where they were extirpated, but primarily to assist in better watershed management of an area. WS has assisted CDOW with many of these projects, but has reduced these efforts because beaver are now abundant throughout the State. On the other hand, muskrats have rarely been relocated in comparison.

AVMA, The National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologist all oppose the relocation of mammals because of the risk of disease transmission, particularly for small mammals such as raccoons or skunks (Center for Disease Control 1990). Relocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats. Although relocation is not necessarily precluded in all cases, it would in many cases be logistically impractical and biologically unwise. WS has not conducted relocation with any aquatic mammal, but could if that were the desire of CDOW. All of the aquatic rodents in Colorado are abundant in their preferred habitat.

Chemical repellents are nonlethal chemical formulations used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally liquids, gases or granules, and require application to areas or surfaces in need of protection. Taste repellents are compounds (i.e., liquids, dusts, granules) aversive to the target animal that are normally applied to trees, shrubs and other materials that are likely to be ingested or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by irritating them or making the area undesirable for travel. Most repellents are ineffective or are short-lived in reducing or eliminating damage caused by wildlife, therefore, are not used very often by WS. In addition, no proven repellents are currently available for ARDM.

Capture or take methods involve several methods available to capture or take offending animals. The appropriateness and efficacy of any technique will depend on a variety of factors. Many capture methods are nonlethal and the animal could be relocated or euthanized following capture. Most aquatic rodents are euthanized by WS. Lethal damage management involves methods specifically designed to remove aquatic rodents in certain situations to a level that stabilizes, reduces or eliminates damage. Level of removal necessary to achieve a reduction of aquatic rodent damage varies according to the resource protected, habitat, population, effectiveness of other damage management strategies and other ecological factors. Despite the numerous damage management methods developed, trapping remains the most effective method of removing beaver and reducing damage (Hill 1976, Hill et al. 1977, Wigley 1981, Weaver et al. 1985). Intensive trapping can eliminate or greatly reduce beaver populations in limited areas (Hill 1976, Forbus and Allen 1981).

Leg-hold traps can be effectively used to capture a variety of rodents. Leg-hold traps are either placed beside or in travel ways being actively used by target species. Placement of traps is contingent upon habits of the respective target species, habitat conditions and presence of non-target

animals. Effective trap and lure placement, adjustment and use by trained WS personnel contributes to the leg-hold trap's selectivity. An additional advantage is that leg-hold traps can allow for on-site release of non-target animals. Use of leg-hold traps requires more skill than some methods, but leg-hold traps are indispensable in resolving many damage problems. Aquatic rodents live-captured in leg-hold traps are often euthanized by shooting.

Snares are capture devices comprised of a cable formed in a loop with a locking device. Snares are often placed in travel ways and equipped with a swivel to minimize cable twisting and breakage. Leg-hold traps can be difficult to keep operational during periods of inclement weather. However, snares are easier and less effected by inclement weather. Target animals are caught around the neck, body, or leg and later euthanized by shooting.

Cage traps come in a variety of styles for WDM to target different species. The most commonly known cage traps used in the current program are box traps. Box traps are usually rectangular, made from wood or heavy gauge wire mesh (very heavy gauge for beavers). These traps are used to capture animals alive and can often be used where many lethal or more dangerous tools would be too hazardous. Box traps are well suited for use in residential areas for all the aquatic rodents.

Cage traps do have a few drawbacks. Some individual target animals avoid cage traps. Some nontarget animals become "trap happy" and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. For example, an animal may die quickly if the cage trap is placed in direct summertime sunlight. Another potential problem with the use of cage traps is that some animals will fight to escape and become injured. Aquatic rodents caught in cage traps are often euthanized with drugs or shooting. They also could be relocated, if this were desired by CDOW.

Hancock traps (suitcase/basket type cage traps) are designed to live-capture primarily beaver. This type of trap is constructed of a metal frame covered in chain-link fence that is hinged with springs. Trap appearance is similar to a large suitcase when closed. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal. One advantage of using the Hancock trap is the ease of release of beaver or non-target animals. Disadvantages of these traps are expense (approximately $275 per trap), cumbersome and bulky size, and difficulty to set (Miller and Yarrow 1994). Hancock traps can also be dangerous for humans to set (i.e., hardhats are recommended when setting suitcase traps), are less cost and time-efficient than snares, leg-holds and body-gripping traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999). Beaver captured in Hancock traps would be euthanized by shooting or with drugs, or relocated according to CDOW desires.

Colony traps are multi-catch traps used to either live-capture or drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1998b). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes. Colony traps are effective and relatively inexpensive and easy to construct (Miller 1994). The stovepipe trap, a common type of colony trap, is usually made with sheet metal and may capture two to four muskrats on the first night

(Miller 1994). Muskrats live-captured in colony traps would be euthanized by shooting or with drugs.

Body-gripping (e.g., Conibear®) traps are designed to cause a fairly quick death of the animal that activates the trap. The number 330 body-gripping trap is generally used for beaver and the 110/120 for muskrats. Body-gripping traps for beaver capture are used exclusively in aquatic habitats, with placement depths varying from a few inches to several feet below the water surface. Smaller body-gripping traps, such as those used for muskrats, can be set either in or out of the water. Placement of these traps is in travel ways or at their lodge or burrow entrances. Animals are captured as they travel through the trap and activate the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking or removing the traps. Body-gripping traps do present a risk to nontarget animals; however, the take of nontargets is much less for professional users than novices because they have expertise in selective placement of the traps and the trigger which can reduce nontarget hazards significantly (D. Nolte, NWRC, pers. comm. 2003).

Shooting is the most selective method for removing target species and may involve use of spotlights and shotguns, rifles or pistols. Shooting is an effective method to remove small numbers of aquatic rodents in damage situations, especially where trapping is not feasible. Removal of specific animals in the problem area can sometimes provide immediate relief from a problem. Shooting is sometimes used as one of the first lethal damage management options because it offers the potential of resolving a problem more quickly and selectively than some other methods, but it does not always work. Shooting may sometimes be one of the only ARDM options available if other factors preclude setting of damage management equipment. WS personnel receive firearms safety training to use firearms that are necessary for performing damage management duties.

Firearms use is very sensitive and a public concern because of safety issues related to the public and misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years thereafter (WS Directive 2.615). Many WS employees carry firearms as a condition of employment and are required to certify that they meet the criteria as stated in the *Lautenberg Amendment*. The *Lautenberg Amendment* prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. Under certain circumstances, WS personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce these risks. For example, chemical immobilization has often been used to take animals in residential areas where public safety is at risk. WS employees that use immobilizing and euthanizing drugs are certified for their use and follow the guidelines established in the WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Telazol® (tiletamine), and Ketamine/Xylazine are immobilizing agents often used by WS to capture and remove predators and other animals. These are typically used in urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system (e.g., darts from rifle, pistol, or blow gun, or syringe pole). Immobilization is usually followed by relocation when

appropriate or euthanasia. Euthanasia is usually performed with drugs such as Beuthanasia-D® or Fatal-Plus® which contain forms of sodium phenobarbital. Euthanized animals are disposed of by incineration or deep burial to avoid secondary hazards. Drugs are monitored closely and stored in locked boxes or cabinets according to WS policies, and Department of Justice, Drug Enforcement Administration guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the U.S. Department of Justice, Drug Enforcement Administration which WS does holds. It is WS' conclusion that the use of immobilizing and euthanizing drugs will have no effect on T&E species because they are highly target specific.

3.2.2 Alternative 2 - No Federal WS ARDM. This alternative would consist of no federal involvement in ARDM in Colorado. Neither direct operational management nor technical assistance would be provided from WS. Information on future developments in nonlethal and lethal management techniques that culminate from WS's research branch would not be available to producers or resource owners. It would be left up to the resource owners to conduct ARDM under this option. It is probable that many ARDM methods would be used unsafely and improperly such as the illegal use of pesticides and traps simply out of frustration by resource owners over the inability to reduce damage losses to a tolerable level. As an illustration, in 1997 a man was killed in Oklahoma when he and another man set fire to a beaver lodge and quickly were overcome with a dense cloud of smoke; the man suffered a heart attack while trying to escape (D. Dudley, WS, WDM comm. 1997). In addition, it is likely that inexperienced people using many of the ARDM methods could harm the environment, themselves, and result in the increased take of nontarget species.

3.2.3 Alternative 3 - Technical Assistance Only. This alternative would not allow WS to conduct operational ARDM in Colorado. WS would only provide technical assistance and make recommendations when requested. However, producers, state agency personnel, or others could conduct ARDM activities including the use of traps and snares, if properly permitted, shooting, and any nonlethal methods they deem effective. Methods and control devices could be applied by persons with little or no training and experience. This, in turn, could require more effort and cost to achieve the same level of problem resolution; and if resource owners become frustrated they are likely to resort to unconventional methods that could cause harm to the environment or result in greater take of nontarget animals.

3.2.4 Alternative 4 - Nonlethal Required Before Lethal Control. This alternative would not allow the use of lethal methods by WS as described under the proposed action until practical nonlethal methods had been attempted to relieve damage caused by aquatic rodents and found to be ineffective or inadequate. Resource owners or managers would still have the option of implementing nonlethal and lethal control measures and WS would continue to recommend them where practical, but no corrective lethal control by WS would be allowed. Personnel experienced in ARDM often already know when and where practical nonlethal control techniques would work. Therefore, this alternative could result in the use of methods that are known to be ineffective in particular situations.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered but not analyzed in detail. These were not considered because of problems associated with their implementation.

3.3.1 Compensation for Aquatic Rodent Damage Losses. Compensation would require the establishment of a system to reimburse resource owners for damages. This alternative was eliminated from

further analysis because no federal or state laws currently exist to authorize such action. Under such an alternative, WS would not provide any direct control or technical assistance. Aside from lack of legal authority, analysis of this alternative in the FEIS indicates that the concept has many drawbacks (USDA 1997) such as:

- It would require larger expenditures of money and manpower to investigate and validate all losses, and to determine and administer appropriate compensation. Based on data for damage prevented from other WS programs, compensation could be expected to cost 5-7 times as much as the current program (WS 2003).

- It would be difficult, if not impossible, to assess and confirm losses in a timely manner for all requests, and, therefore, many losses could not be verified and would go uncompensated.

- Compensation would give little incentive to resource owners to limit damage with ARDM strategies such as improved barriers.

- Not all resource owners would rely completely on a compensation program and ARDM activities including lethal control would likely continue as permitted by state law.

- Compensation would likely be below the full market value of the resource damaged.

3.3.2 Bounties. Payment of funds for killing aquatic rodents (bounties) suspected of causing economic losses has not been supported by Colorado State agencies such as CDOW and CDA as well as most wildlife professionals for many years (Latham 1960). WS concurs with these agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties, including:

- Bounties are generally ineffective at controlling damage, especially over a wide area such as Colorado.

- Circumstances surrounding the take of animals are typically arbitrary and completely unregulated.

- It is difficult or impossible to assure that the animals claimed for bounty were taken from the damage management area.

- WS does not have the authority to establish a bounty program.

3.3.3 Eradication and Long Term Population Suppression. An eradication alternative would direct all WS Program efforts toward total long term elimination of aquatic rodents in entire cooperating counties or larger defined areas in Colorado. In Colorado, the eradication of beaver and muskrat is not a desired goal of state agencies, although these species may be taken by the general public in areas where they are causing damage. Eradication as a general objective for ARDM will not be considered by WS in detail because:

- WS opposes eradication of any native wildlife species;

- CDOW and CDA oppose eradication of any native Colorado wildlife species;

- The eradication of a native species or local population would be extremely difficult, if not impossible to accomplish, and cost-prohibitive in most situations; and

- Eradication is not acceptable to most members of the public.

Suppression would direct WS Program efforts toward managed reduction of certain problem populations or groups. When a large number of requests for WDM are generated from a localized area, WS would consider suppression of the local population or groups of the offending species, if appropriate. However, it is not realistic, practical, or allowable under present WS policy to consider large-scale population suppression as the basis of the WS Program. Typically, WS activities in Colorado are conducted on a small portion of the area inhabited by aquatic rodents.

3.3.4 Reproduction Control. A review of research evaluating chemically induced and surgically induced reproductive inhibition as a method for controlling nuisance beaver populations is contained in Novak (1998a). Although these methods were found to be effective in reducing beaver reproduction by up to 50%, the methods were not found to be practical or were too expensive for large-scale application. At present, no chemical reproductive inhibitors are legal for use for beaver or muskrat. For these reasons, this method will not be considered further by WS.

3.3.5 Biological Control. The introduction of a species or disease to control another species has occurred throughout the world. Unfortunately many of the introduced species become pests themselves. For example, in Hawaii, the Indian mongoose (*Herpestes auropunctatus*) was brought in to control rats (*Rattus spp.*), but wound up causing declines in many native Hawaiian bird species. The only biological control that has been tried for managing aquatic rodents is the introduction of alligators (*Alligator mississippiensis*) (Wade and Ramsey 1986). Although alligators can and do sometimes prey on aquatic rodents, they would be unreliable in reducing numbers to the point that damage no longer occurred. In addition, alligators themselves can become problems, and could present hazards to people and pets. Because alligators are not native to Colorado, this method will not be considered further by WS.

3.4 MITIGATION AND SOPs FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Mitigation in SOPs. Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS Program, nationwide and in Colorado, uses many such mitigation measures which are discussed in detail in Chapter 5 of the FEIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's SOPs include the following.

- The WS Decision Model, which is designed to identify effective WDM strategies and their impacts, is consistently used.

- Nontarget animals captured in leghold traps or snares are released if it can be done safely, unless it is determined by WS Specialists that they will not survive.

- Conspicuous, bilingual warning signs alerting people to the presence of traps and snares are placed at major access points to areas where they are set in the field.

- Reasonable and prudent alternatives and measures are established through consultation with USFWS and implemented to avoid adverse impacts to T&E species.

Some additional mitigating factors specific to the current WS ARDM program include the following.

- Management actions are directed toward localized populations or groups of target aquatic rodent species or individual offending members of those species. Generalized population suppression across Colorado will not be conducted.

- Although hazards to the public from ARDM devices and activities are low according to a formal risk assessment (USDA 1997, Appendix P), hazards to the public and their pets are even further reduced by the fact that ARDM activities are primarily conducted on private or other properties in Colorado where public access is highly restricted or denied.

3.4.2 Additional Mitigation Specific to the Issues. The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

3.4.2.1 Effect on Target Aquatic Rodent Species Populations.

- ARDM activities to resolve damage problems are directed at taking action against individual problem animals, or local populations or groups, and not by attempting to eradicate populations in the entire area or region.

- WS take is monitored to maintain the magnitude within levels desired or authorized by the State agencies that represent the State's interests in terms of managing or controlling affected species (See Chapter 4).

3.4.2.2 Effects on Nontarget Species Populations Including T&E Species.

- WS personnel are highly experienced and trained to select the most appropriate method(s) for taking problem animals with little impact to nontarget animals.

- To avoid the taking of river otter, trapping in the following four areas is prohibited in water, except with: a) padded-jaw leghold traps; b) Conibear® type traps less than 220 in size; or c) land or water set snares with a closure size of 16 inch circumference or larger. In addition, padded-jaw traps and snares may not be used in drowning sets and padded jaw traps and land set snares may only be set in accordance with the provisions of 33-6-205 CRS, 33-6-206 CRS, or 33-6-207 CRS; and that water set snares and Conibear® traps may only be set in accordance with the provisions of 33-6-205, CRS, or 33-6-207, CRS. The prohibitive areas include:

1) That portion of the Gunnison River and five (5) miles upstream along each of its tributaries in Montrose and Delta Counties from the Black Canyon of the Gunnison National Monument downstream to that point where the river meets Highway 92; and all lands within 100 yards of the high water line of this portion of the Gunnison River and all tributaries thereof.

2) That portion of the Piedra River upstream from Navajo Reservoir to the headwaters including East Fork and Middle Fork of the Piedra River in Hinsdale and Archuleta counties and 9 miles upstream on the First Fork. This restriction includes the following tributaries: Sand Creek, Weminuche Creek, Little Sand Creek, Williams Creek, and all lands within 100 yards of the high water mark line of the above waters.

3) The Dolores River from the McPhee Reservoir downstream to Bed Rock within 100 yards of the high water line.

4) The San Juan River from Pagosa Springs downstream to the New Mexico state line within 100 yards of the high water line.

- WS also mitigates impacts on otter populations by watching for otter sign where WS personnel are conducting ARDM activities

- The nationwide WS program engaged in formal consultation with the USFWS pursuant to Section 7 of the Endangered Species Act and received a Biological Opinion in 1992 (see USDA 1997, Appendix F and P). That opinion is incorporated herein by reference. However, it did not cover the potential effects of beaver dam removal on listed species. To address these other concerns, WS consulted with USFWS and CDOW about the potential impacts of ARDM activities on T&E species in Colorado (Appendices B and C).

- WS determined that the T&E species that could potentially be negatively impacted by WDM, as discussed in the formal consultation of 1992 (USDA 1997), in Colorado are the bald eagle and whooping crane. However, it was determined by the USFWS that the whooping crane would not be adversely affected by current WS ARDM activities. Reasonable and prudent alternatives and mitigation measures and their terms and conditions from the 1992 Biological Opinion (USDA 1997, Appendix F) for bald eagles as related to the proposed action and alternatives described in this EA are as follows.

  - WS personnel will contact either the local CDOW office or the appropriate USFWS regional or field office to determine nest and roost locations for bald eagles.

  - The appropriate USFWS office shall be notified within five days of the finding of any dead or injured bald eagle. Cause of death, injury, or illness, if known, would be provided to those offices.

- If a bald eagle is incidentally taken from the Southwest population, use of the control method will be halted immediately, and WS will reinitiate consultation.

- When bald eagles are in the immediate vicinity of a proposed WDM program, WS personnel will conduct daily checks for carcasses or trapped individuals.

- Potential impacts on other T&E species in Colorado have been assessed (Appendix B and C) and no adverse impacts are likely to occur from WS actions with the exception of potentially the Southwestern willow flycatcher (*Empidonax traillii extimus*) a species not discussed in the 1992 Biological opinion (USDA 1997). The WS Program is currently in consultation with the USFWS regarding the Southwestern willow flycatcher. The Colorado WS Program will abide by any restrictions agreed to by WS and USFWS as a result of that consultation. Currently, the consultation will make recommendations for use of binary explosives, and limit their use during the nesting season except for emergencies. It has been found that newly established beaver ponds could actually be detrimental to the flycatcher by cutting down nest trees and flooding flycatcher habitat. Removal of dams that have become wetlands would have different implications.

- If WS is requested to remove a beaver dam along the Front Range in the range of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) that does have dense vegetation associated with it, a site-specific consultation with USFWS will be requested and the landowners will be required to request the necessary Section 404 permit should it be required.

- To avoid accidental take or harassment from this method during the nesting season, beaver dams will be removed with binary explosives from October through March in riparian areas where yellow-billed cuckoos *(Coccyzus americanus)* are suspected to be present (cottonwood-willow tracts). If dams need to be removed, especially due to an emergency such as a house being flooded from beaver activity, during the nesting season, USFWS will be consulted on a site-specific basis to determine if the area has an active nest. This minimizing measure will insure that WS will have no or little potential to affect this species. WS ARDM could potentially have a positive effect on this species if the focus of the ARDM activity was on removing beavers that were cutting down willows that had nests in them. It is WS' conclusion, that ARDM will have "no effect" on the cuckoo with the one minimizing measure in place.

- The Colorado Wildlife Services Program does not currently conduct dam removal projects in areas where the boreal toad (*Bufo boreas boreas*) would be located, therefore there will be "no effect". If a request is received in areas where boreal toads could be present, consultation will be initiated on a case-by-case basis. These areas would be in central Colorado in the toad's historic range in spruce-fir forests above 7,000 feet.

- The greenback cutthroat trout (*Oncorhynchus clarki stomias*) is a species that could be found in beaver ponds if built in streams that they inhabit, and therefore, could be impacted

by beaver dam removal with binary explosives. However, the 58 reservoirs where this species currently lives, are typically not associated with areas where WS would conduct beaver dam removal. WS will consult further with USFWS when removing beaver dams in the range of the trout.

3.4.2.3 Humaneness of Control Techniques

- WS personnel attempt to kill captured target animals that are slated for lethal removal as quickly and humanely as possible. In most field situations, a shot to the brain with a small caliber firearm is performed which causes rapid unconsciousness followed by cessation of heart function and respiration. This is in concert with the AVMA's definition of euthanasia.

- Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.

- The WS Decision Model (Slate et al. 1992) is used to identify effective biologically and ecologically sound aquatic rodent damage management strategies and their impacts.

- WS personnel are trained and experienced to select the most appropriate method for taking targeted animals, excluding nontarget species, and on all trapping devices. WS specialists use trap lures and set traps in locations that are conducive to capturing the target animal, but minimize potential impact to nontarget species.

- WS specialists recommend the use of various nonlethal methods such as exclusion and pond levelers where these are applicable.

- The use of traps and snares conform to current laws and regulations administered by CDOW, CDA, and WS policy (ADC Directive 2.450).

- WS use of ARDM capture devices is consistent with internationally recognized humane trap standards.

3.4.2.4 Effects of Beaver Dam Removal on Wetlands

- WS ARDM activities do not affect "wetlands" as defined in Swampbuster or CWA. Most ARDM activities involve removal of beaver dams from recent beaver activity which has flooded areas for a short time or man made structures including culverts under roads and irrigation structures. In neither case are wetlands affected.

- Beaver dam removals do not alter the existing drainage system. Hand removal and removal of dams using binary explosives only serve to restore existing drainage to small streams, creeks, and irrigation systems. Dam removals are not necessary nor conducted on mainstream rivers.

- WS would not conduct ARDM activities requiring a section 404 permit without the necessary permit obtained by the project proponent.

- WS Specialists remove beaver dams in accordance with federal and state laws and regulations for environmental protection. Beaver dam removal is conducted to restore drainage or the stream channel for an area. It is also conducted for areas that have established silvicultural, agricultural, or ranching activities and where such an area has not become an established wetland. These activities will have no impact on wetland wildlife habitat because wildlife habitat often takes several years to develop.

- Property owners will be required to obtain dam removal permits from the Corps for areas determined to be wetlands, for dams that have more than 10 cubic yards of fill associated with them, or if the project would alter the waters into a use it was previously not subject, and also where the flow or circulation of waters would be impaired or the reach of the waters reduced.

- Binary explosives are used by WS technicians trained and certified in beaver dam removal. Policies and training emphasize using the minimum amount of explosives necessary to remove the dam. The intent of removal by explosives is to loosen the dam and allow the force of impounded water to wash away the dam itself. This practice minimizes disturbance to adjacent habitat, prevents fill from relocating off-site, and minimizes stream born particles within the water.

- Policies provide hand removal of dams is the first choice when practical. Explosives are used as a last choice for dam removal.

- Wildlife habitat, including T&E species, can be benefitted by ARDM. In low gradient streams, beaver dams increase siltation above the dam, choking out aquatic insect habitat and nesting habitat for trout. Coordinated resource management would recognize the benefits of dam removals along with short-term changes in site specific hydrology.

- ARDM does not remove habitat for fish species, but removal of dams does return the water course to its original state. This can benefit fish by protecting streamside vegetation, removing siltation of stream bottoms and reducing vulnerability to predators.

- Professional removal of dams with explosives by trained and certified WS employees rarely kill fish. Binary explosives are placed within the dam to create a vortex of energy within the dam itself. Shock waves associated with the explosion are directed away from the water to maximize the impact. Silt loads associated with dam removal are of short duration and generally do not exceed silt levels associated with spring run-off.

- Several of the T&E fish in Colorado (Razorback Sucker, Bonytail Chub, Colorado Pikeminnow, Humpback Chub, Pallid Sturgeon) are associated primarily with mainstream rivers where little, if any, ARDM activities occur. One T&E species, though, the greenback

cutthroat trout, prefers sandy to gravel bottoms in streams where ARDM would be conducted, and therefore, would benefit from beaver dam removal.

3.4.2.5 Effects of ARDM Methods on Public Safety

- WS ARDM methods are implemented by trained professionals. WS policies regarding use of specific methods minimize exposure of these methods to the public. Warning signs are placed where traps or snares are used to further reduce public safety concerns.

- ARDM on public lands is coordinated with the public land management agency to identify areas of concern. Projects which might expose the public to safety risks are modified accordingly.

- ARDM on private lands is conducted with signed Agreements for Control which notify the landowner/manager of any possible risks.

- Binary explosives are used by the WS program for beaver dam removal. These explosives pose few risks during transportation and storage. Bureau of Alcohol, Tobacco, and Firearms, Department of Transportation and Agency regulations, as well as industry standards, are followed regarding use and storage of all explosive materials.

- Only trained and certified explosive specialists are authorized to transport and store explosive components. WS policies regarding explosive use are mandated. Recertification occurs every 2 years.

- WS uses firearms to shoot aquatic rodents and euthanize animals caught in traps. WS personnel are trained and given refresher courses to maintain awareness of firearm safety and handling as prescribed by WS policy. Therefore, no adverse impacts to public safety are expected from the use of firearms by WS in Colorado.

- WS Specialists will be trained and supervised in the use of ARDM methods, including firearms, watercraft, explosives, traps, and vertebrate pesticides to ensure that they are used properly and according to policy.

- WS Specialists using restricted-use vertebrate pesticides will be certified according to EPA and Colorado State laws.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides the information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. This chapter analyzes the environmental consequences of each alternative discussed in Chapter 3 in relation to the issues identified for detailed analysis in Chapter 2.

4.1 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences of each alternative in comparison with the proposed action to determine if the real or potential impacts are greater, lesser or the same.

4.1.1 Cumulative and Unavoidable Impacts. Cumulative and unavoidable impacts will be discussed in relationship to each of the potentially affected species analyzed in this chapter.

4.1.2 Nonsignificant Impacts. The following resource values within Colorado are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, floodplains, visual resources, air quality, or prime and unique farmlands. These resources will not be analyzed further.

4.1.3 Irreversible and Irretrievable Commitments of Resources. No irreversible or irretrievable commitments of resources are expected, other than minor uses of fuels for motor vehicles and other similar materials. These will not be discussed further.

4.2 ISSUES ANALYZED IN DETAIL

4.2.1 Effects on Target Aquatic Rodent Populations. NEPA requires federal agencies to determine whether their actions have a "significant impact on the quality of the human environment." A declining population of a resident wildlife species does not necessarily equate to a "significant impact" as defined by NEPA if the decline is collectively condoned or desired by the people that live in the affected human population. It is reasonable and proper to rely on the representative form of government within a state as the established mechanism for determining the "collective" desires or endorsements of the people of a state. WS abides by this philosophy and defers to the collective desires of the people of the State of Colorado by complying with State laws and regulations that govern the take or removal of resident wildlife. Although the analysis herein indicates aquatic rodent populations are not being impacted to the point of causing a decline, if at some point in the future they are, then such a decline would not constitute a "significant" impact as defined by NEPA so long as the actions that cause the decline are in accordance with State law, and concomitantly, with the collective desires of the people of the State.

4.2.1.1 Alternative 1 - Continue the Current Federal ARDM Program. To adequately determine the impacts that this alternative would have on aquatic rodents, their populations need to be analyzed. The authority for management of resident wildlife species has traditionally been a responsibility left to the states. CDOW is the state agency with management responsibility over animals classified by state law as protected furbearers. CDOW provided statistics on population trends and take, but was unable to provide any definitive estimates of population sizes for purposes

of the following analyses on impacts to the population. Therefore, WS used the best available information to produce reasonable estimates. CDOW provided trend information for these species, though, and commented on the validity of the estimates.

Beaver and muskrat historically have been significant furbearers that generated income for trappers in Colorado (Figure 2). Beaver were still rebounding in Colorado when a season reopened for them in 1955. As the population increased, harvest followed. In the 1968-69 season, over 10,000 pelts were sold. The total harvest would have actually been much higher than that because only a percentage of the beaver taken are sold. For example, in 1981-82 1,036 beaver pelts were sold, but 7,516 were harvested, and 25,000 muskrat pelts were sold, but 54,000 were harvested. Muskrats were heavily exploited furbearers in Colorado and the United States and second only to raccoons in the value of the pelts sold nationally. In the 1945-46 season, 278,000 were sold in Colorado, the highest number on record. However, trapping harvest dropped as the price of fur declined as seen in Figure 2. Colorado did not allow a fur season on beaver until the 1955 and then Amendment 14 curtailed the methods that could be used to harvest beaver and muskrat starting in the 1997-98 season. Figure 3 gives the harvest for beaver and muskrat from 1982 to 2003. These figures give a good indication of the harvest pressure that the beaver and muskrat populations can sustain. The drop in numbers harvested reflect the drop in fur prices and the number of trappers/hunters in the field that target these species. Some of the drop in the number of muskrat taken, though, reflects the loss of wetlands in Colorado to development along the Front Range, where most muskrats in the 1940-50s were taken.

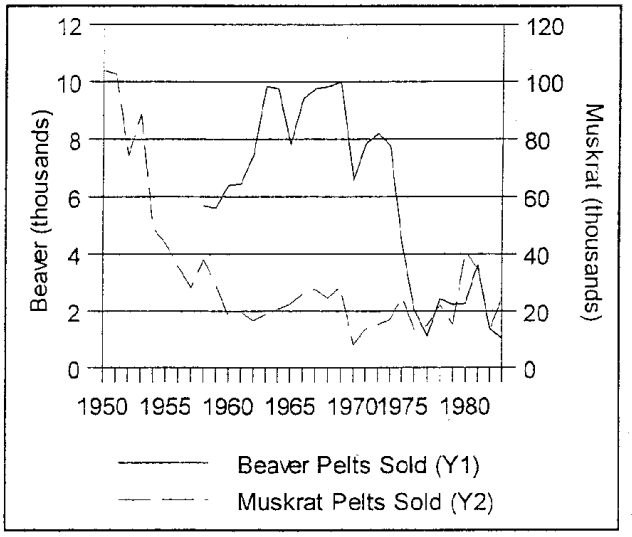


Figure 2. The number of beaver and muskrat pelts sold in Colorado from 1950 to 1982. A fur season for beaver did not open until 1955, but data on harvest was not available until 1957-58.

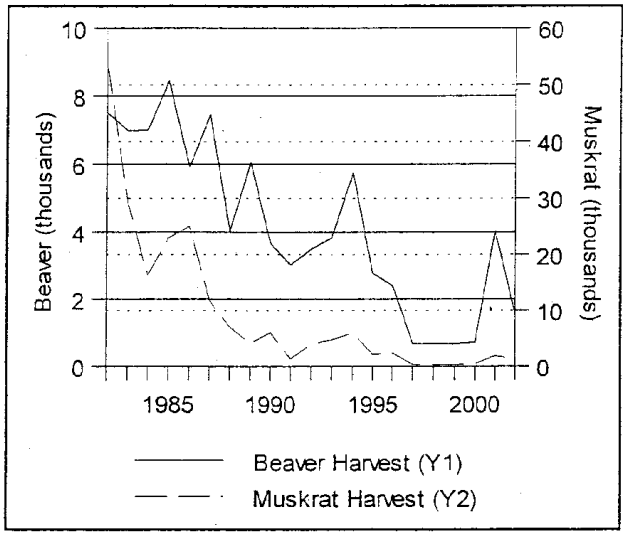


Figure 3. Beaver and muskrat harvest in Colorado from 1982 to 1996. With a drop in fur prices, harvest for both species along with the number of hunters has dropped significantly.

Beaver Population Impact Analysis. To discuss the impacts of various environmental constraints and external factors on beaver population and density, it is essential to understand the basic mechanisms that play a role in the beaver's response to constraints and actions. This wildlife species is often characterized by biologists and managers as having the unique ability to modify its environment to create habitat to meet its own needs. As mentioned, beaver damage and requests for assistance have increased since 1994 in Colorado. Beaver damage management is a major focus of WS ARDM efforts in Colorado.

Beavers occur mostly in family groups that are comprised of 2 adult parents with 2-6 offspring from the current or previous breeding season (Novak 1998a). Average family group size has been documented as ranging from 3.0 to 9.2 (Novak 1998a). Beaver abundance has been reported in terms of families per kilometer of stream or per square kilometer surface area for bodies of water. Novak (1998a) summarized reported beaver family abundance as ranging from 0.31 to 1.5 families per kilometer of stream, which converts to 0.5 - 2.4 families per mile of stream. Densities reported in terms of families per square kilometer for bodies of water have been reported to range from 0.15 to 3.9 (Novak 1998a) which is the same as 0.24 to 6.3 per square mile. Colorado, probably has densities for beaver per km of streams and km^2 of surface water at the middle to high end (L. Stevens, CDOW, pers. comm. 2002) of those summarized by Novak (1998a).

The professional opinion of wildlife biologists at CDOW (L. Stevens, pers. comm. 2002) and WS suggests that the present beaver population in Colorado is at least close to the middle of the range for streams and lakes reported by Novak (1998a). The number of beavers per family to be used for a population estimate will be the midpoint given by Novak (1998a) or 6.1 beavers per family which is considered to be a conservative to fairly accurate estimate for beavers per family in Colorado. Using the middle estimates for beaver density for lakes and streams, again considered conservative to realistic, the beaver population would range 1.5 families/mile of stream and 3.3 families/mi^2 surface area of impoundments.

Colorado has a limited supply of water resources and ranks 46th among the 50 states in surface acres of water. A GIS database maintained by the Colorado Water Conservation Board shows that at the 1:100,000 level, Colorado has a total of 110,705 miles of flowing water ways which includes rivers, perennial streams, aquaducts, ditches, and intermittent streams, creeks, and ditches (L. Torikai, Colo. Water Cons. Board, pers. comm. 2001). Though much of this area provides beaver habitat, they will not be considered for providing an estimate of the beaver population because some of these could potentially dry out during part of the year. Colorado, though, does have approximately 31,470 miles of perennial (*yearround*) rivers and streams (D. Litke, USGS, pers. comm. 2001). In addition, Colorado has about 260 mi^2 in bodies of water including the larger reservoirs and lakes. With these assumptions, the beaver population would be estimated to be about 293,000 which is considered to be fairly realistic. The following formula for the mean of each variable was used:

*(beavers/family * # beaver families/mile of stream * miles of streams in CO) + (beavers/family * # beaver families/mi^2 of impoundments * surface mi^2 in CO)*

or

*(6.1 * 1.5 * 31,470) + (6.1 * 3.3 * 260) = 293,184*

Using the low (3.0 beavers/family; 0.5 families/mi stream and .24 families/mi^2 surface water) and high ranges (9.2 beavers/family; 2.4 families/mi stream and 6.3 families/mi^{2}surface water) from Novak (1998a) with the above formula to determine the population boundaries for beaver in Colorado would result in a range from 47,000 to 710,000. However, to be conservative, the low and middle figures will be used for the population analysis and be considered the low and high range of beaver in Colorado (Table 2). Included in Table 2 is WS' take and the Statewide harvest which includes sportsman harvest, and private and WS' depredation take.

Table 2 summarizes the analysis of WS and cumulative impacts on the beaver population. WS killed 466 beavers in FY00, 190 in FY01, and 238 in FY02. The number taken in FY00 was the highest number ever taken in one year by the Colorado WS Program. Private harvest of beaver as reported by the CDOW was 664 during the 1999-2000 season, 713 in the 2000-01 season, and 4,033 in the 2001-02 season. CDOW reported that 336, 174, and 255 permits were issued for depredation complaints in Calendar Year 1999, 2000, and 2001. L. Stevens (CDOW, 2002 pers. comm.) reported that because take data is not obtained from all permittees, the number of permits multiplied by 3 provides a fairly accurate estimate of the beaver take under their depredation permits. The sum of the 3 harvests gives total take in Colorado.

Table 2. Analysis of cumulative beaver take in Colorado for depredation take by the WS Program and private permittees, and sportsman harvest for FY00, FY 01, and FY02.

Beaver Pop.	Conservative Estimate	Realistic Estimate	Conservative Estimate	Realistic Estimate	Conservative Estimate	Realistic Estimate
Fiscal Year	FY00		FY01		FY02	
Est. Pop.	47,000	293,000	47,000	293,000	47,000	293,000
WS Kill	466	466	190	190	238	238
% Pop. WS Take	1.0%	0.2%	0.4%	0.1%	0.5%	0.1%
Total Take	1,466	1,466	1,077	1,077	4,526	4,526
% Pop. Total Take	3.1%	0.5%	2.3%	0.4%	9.6%	1.5%
Impact	Low	Low	Low	Low	Low	Low

USDA (1997) determined that beaver populations can withstand harvest rates of up to 30% without declining. The estimated total kill of beavers during FY02 was 4,526, the highest cumulative take (depredation and sportsman), or 9.6% of the minimum population estimate of 47,000 beavers. This level of take represents a low impact to the estimated beaver population. An allowable harvest for the low population estimate would be over 14,000. Thus, cumulative take appears to be a third of the allowable harvest, well beneath the level that would begin to cause a decline in the population. The highest take by WS was in FY00 and represented 1.0% of the estimated beaver population. This is well below a level of significance. Therefore, WS' take and the cumulative impact on the beaver population is considered to be of extremely low magnitude. CDOW biologists have concurred with this conclusion (L. Stevens, pers. comm. 2002). Therefore, WS concludes that beaver have not been impacted by the WS program. Additionally, this combined take of beaver does not exceed the beaver

harvest in the late 1960s which maintained that level while fur prices were high and beaver populations were recently reestablished in Colorado.

Muskrat Population Information and Impact Analysis. Muskrats are considered abundant, but scattered in suitable habitat throughout Colorado. They can be found in marshes, ponds, sloughs, lakes, ditches, and slow moving streams and rivers (Boutin and Birkenholz 1998). Muskrats do not cause substantial damage problems in Colorado. Occasionally they may damage crops or weaken levees from burrowing activities. Muskrats are highly prolific and produce 2 to 4 litters per year that average 5-8 young per litter (Wade and Ramsey 1986) which makes them relatively immune to overharvest (Boutin and Birkenholz 1998). Harvest rates of from 3 to 8 per acre have been reported to be sustainable in muskrat populations (Boutin and Birkenholz 1998). Clearly, any mortality as a result of fur harvest or damage control would have a virtually imperceptible impact on the population; CDOW concurs with this conclusion (L. Stevens, pers. comm. 2002).

CDOW does not estimate muskrat populations in Colorado, but considers the population to be stable. The muskrat population is probably much higher than the beaver population in Colorado and could withstand heavier harvest rates. However, muskrat harvest typically falls below the beaver harvest. WS only took one muskrat in FY00, 2 in FY01, and 2 in FY02. Private depredation harvest as reported by CDOW during the 2000-2002 seasons was very minimal; only about 5 private permits were issued for muskrat (L. Stevens, pers. comm. 2002). Sportsman harvest was 338, 405, and 1,870 in the 1999-2000, 2000-01, and 2001-02 seasons and almost entirely reflects the total harvest in Colorado. This level of harvest is well within the level of take muskrat populations could withstand and therefore, WS concludes that it has not impacted the muskrat population. WS will likely continue at the same take in the foreseeable future and would not take more than a few muskrats per year. However, if WS increased its take a thousand-fold under the proposed action as a result of special projects (ie. remove all the muskrats from a 20 acre stock reservoir where the dam was being weakened from muskrat burrows), the overall muskrat population in Colorado would still not be impacted. The highest fur harvest in Colorado exceeded 200,000, and harvest dropped as fur prices declined.

4.2.1.2 Alternative 2 - No Federal WS ARDM. Under this alternative, WS would have no impact on target aquatic rodent species populations in Colorado. However, CDA or CDOW would probably still provide some level of direct control assistance with ARDM but without federal supervision. Also, private efforts to reduce or prevent damage might increase which could result in impacts on target species populations. Impacts on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by CDA, CDOW, and by private persons. For the same reasons shown in the population impacts analysis in section 4.2.1.1 it is highly unlikely that aquatic rodent populations would be impacted significantly by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of methods and chemical toxicants which could lead to unknown impacts on aquatic rodents, but these would only likely impact populations in small areas.

4.2.1.3 Alternative 3 - Technical Assistance Only. Under this alternative, WS would have no impact on target aquatic rodent populations directly. CDA or CDOW would probably provide some level of direct control assistance with ARDM but without federal supervision, and private efforts to reduce or prevent damage could increase which would result in impacts on those populations. For the same reasons shown in the population impacts analysis in section 4.2.1.1, it is highly unlikely that aquatic rodent populations would be impacted significantly by implementation of this alternative. Impacts and hypothetical risks of illegal chemical toxicant use under this alternative would probably be about the same or less than those under Alternative 2.

4.2.1.4 Alternative 4 - Nonlethal Required Before Lethal Control. Under this alternative, WS take of target aquatic rodent species would probably be less than that of the proposed action because lethal actions by WS would be restricted to situations where nonlethal controls had been tried, in most cases by the requestor, but also by WS, without success. For many individual damage situations, this alternative would be similar to the current program because many producers have tried one or more nonlethal methods such as dam removal or barriers without success or have considered them and found them to be impractical in their particular situations prior to requesting WS's assistance. Without WS conducting control activities prior to implementation of nonlethal methods, damage could be expected to rise significantly before nonlethal means failed or could take effect. Therefore, it is likely that private efforts at ARDM would increase, leading to potentially similar cumulative impacts as those of Alternative 2. For the same reasons shown in the population impacts analysis in section 4.2.1.1, it is highly unlikely that statewide beaver or muskrat populations would be impacted significantly by implementation of this alternative. Impacts and hypothetical risks of illegal chemical toxicant use under this alternative would be less than Alternative 2 and 3, but probably more than under Alternative 1.

4.2.2 Effects on Nontarget Species Populations, Including T&E Species

4.2.2.1 Alternative 1 - Continue the Current Federal WS ARDM Program. Nontarget species taken in Colorado are recorded as Target - Unintentional (i.e., they were listed on the cooperative agreement with the landowner or agency agreement as target species but were taken unintentionally during efforts to take other target species) or Nontarget (i.e., they were not listed as target species on the agreement and were taken unintentionally during efforts to take target species). WS personnel try to minimize the take of nontargets by placing traps in areas conducive to trapping only the target animal, using the appropriate traps, and using lures likely to attract the target animals and not nontargets. However, nontargets are occasionally taken in ARDM. WS did not take any nontargets in FY00, 2 raccoons and 1 muskrat in FY01, and 2 raccoons in FY02. No other known effects to nontargets occurred as a result of ARDM activities. The take of non-target raccoons and muskrats is very minimal and, intuitively, this level of take would have no impact on the population. The potential does exist for WS to take other nontargets that could be seen as significant; nontarget T&E species would cause the greatest concern.

T&E Species. ARDM in Colorado under the current program Alternative would have minimal potential impacts on either T&E species or their habitat. In FY 00, 62% of all beaver requests were for protection of irrigation structures and an additional 17% were for

protection of man-made resources (houses, landscaping, and roads). These cases involve artificial habitats not conducive to T&E species. Mitigation or minimizing measures that serve to avoid adverse impacts on T&E species were described in Chapter 3 (section 3.4.2.2). Those measures should assure that the proposed action would not adversely impact T&E species. WS did address T&E impacts in a Biological Assessment (Appendix B). Table 1 in the Biological Assessment lists Colorado's state and federally listed T&E species and discusses minimizing measures to reduce potential impacts to these species. USFWS and CDOW have concurred with WS that WS ARDM activities will either not affect or are not likely to adversely affect any federal or state listed T&E species in Colorado (Appendix B and C).

Of the T&E species that could be potentially affected by ARDM, the river otter, a State threatened species, could be impacted greatest because it is similar in habitat preference to the beaver. In addition, they are close in size to the beaver and methods used to take beaver will also take otter. The otter is found in western Colorado where transplants from other states have started several populations. Population densities are greatest in areas where lowland marshes and swamps interconnect with meandering streams and small lakes. CDOW professional biologists do not estimate river otter populations, but do believe that the otter population is stable to increasing statewide (L. Stevens, pers. comm. 2002). In fact, it was downlisted from endangered to threatened in 2003 as a result of its population increase.

Otter density information is not available in Colorado, however Melquist and Dronkert (1998) summarized studies that estimated river otter densities in Texas which showed that densities were about 1 per 175-262 acres in coastal marshes, and ranged from 1/1.8 to 1/3.6 miles of waterway (stream or river). If WS began taking nontarget otters, this information could be used to determine impacts to their population. WS has outlined mitigation measures to reduce the number of otter taken, summarized in section 3.4.2.2 and Appendix B.

Colorado has several other T&E species that could potentially be negatively impacted by ARDM. The southwestern willow flycatcher, yellow-billed cuckoo, boreal toad, and greenback cutthroat trout could potentially be impacted, but not likely to be adversely affected, by beaver dam removal. Minimizing measures to reduce potential take of these species has been discussed in section 3.4.2.2 and Appendix B.

4.2.2.2 Alternative 2 - No Federal WS ARDM. Alternative 2 would not allow any WS ARDM in Colorado. Nontarget and T&E species would not be affected by WS activities under this alternative. However, private efforts to reduce or prevent depredations could increase which could result in less experienced persons implementing control methods and could lead to greater take of nontarget wildlife than the proposed action. CDA or CDOW would probably still provide some level of direct control assistance with aquatic rodent damage problems but without federal supervision and would continue to take nontargets but probably in lesser numbers proportionate to the decreased direct control efforts. Private individuals may trap aquatic rodents year round with the appropriate permits and would not be restricted to WS's self-imposed mitigation measures. Hazards to otters and other nontargets could therefore be greater under this alternative. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could impact local nontarget species populations, including T&E species.

4.2.2.3 Alternative 3 - Technical Assistance Only. Alternative 3 would not allow any WS direct operational ARDM in the area. There would be no impact on nontarget or T&E species by WS activities from this alternative. Technical assistance or self-help information would be provided at the request of resource owners and others. CDA or CDOW would probably still provide some level of direct control assistance with aquatic rodent damage problems but without federal supervision and would continue to take nontargets but probably in lesser numbers proportionate to the decreased direct control. Although technical support might lead to more selective use of control methods by private parties than that which could occur under Alternative 2, private efforts to reduce or prevent damage could result in less experienced persons implementing control methods, including the hypothetical illegal use of toxicants, leading to greater take of nontarget wildlife and T&E species, similar to Alternative 2.

4.2.2.4 Alternative 4 - Nonlethal Required Before Lethal Control. Under this alternative, WS take of nontarget animals would probably be less than that of the proposed action because fewer lethal control actions would be taken by WS. In addition, aquatic rodents could relocate during the time that it would take to implement control techniques. Mitigation measures to avoid T&E impacts were described in Chapter 3. Those measures should assure that adverse impacts are not likely to occur to T&E species by implementing Alternative 4. However, if cooperators were not satisfied by corrective control operations by WS, private efforts to reduce or prevent depredations could increase, similar to Alternative 2. This could result in less experienced persons implementing control methods including the hypothetical use of illegal toxicants and could lead to greater take of nontarget wildlife than the proposed action.

4.2.3 Humaneness of Control Techniques

4.2.3.1 Alternative 1 - Continue the Current Federal WS ARDM Program. Under this alternative, methods viewed by some persons as inhumane would be employed. Despite SOPs designed to maximize humaneness as described in sections 3.4.2.4 and 2.2.3, the perceived stress and trauma associated with being held in leghold traps or snares until the WS specialist arrives at the trap or snare site to dispatch the animal, or, as in the case of an unharmed nontarget, to release it, is unacceptable to some persons. In addition, some methods are used in "drown sets" where the animal drowns shortly after being caught which is also considered inhumane by some persons. Other ARDM methods used to take target animals including body-gripping traps (i.e., Conibears®), cage traps with shooting and shooting alone result in a relatively humane death because the animals die instantly or within seconds to a few minutes; over 95% of the aquatic rodents taken by WS in Colorado were with these methods in FY00 to FY02.

4.2.3.2 Alternative 2 - No Federal WS ARDM. Under this alternative, leghold and body-gripping traps, cage traps, snares, and shooting would not be used by WS. Use of such methods by private individuals and state agencies would probably increase. This could result in less experienced persons implementing use of traps and snares without modifications such as pan tension devices which exclude smaller nontarget animals from leghold traps. Greater take and suffering of nontarget wildlife could result. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which might result in increased animal suffering.

4.2.3.3 Alternative 3 - Technical Assistance Only. Impacts regarding the issue of humaneness under this alternative would likely be similar to those under Alternative 2, except that technical assistance would lead to better training for the general public on the appropriate procedures for using different methods. Thus, this Alternative might be a little more humane then under Alternative 2, but likely less than under Alternative 1.

4.2.3.4 Alternative 4 - Nonlethal Required Before Lethal Control. The amount of suffering by target and nontarget wildlife taken in ARDM by WS under this alternative would likely be less than under the proposed action since nonlethal control activities would need to be implemented first. However, in agricultural areas the use of leghold traps, snares, and conibears and for other resources shooting by less professional private individuals would probably increase if nonlethal techniques were required by WS to be used and methods were not acceptable by the landowner. This could result in similar impacts as Alternative 2, although they would likely be less severe. The hypothetical risk of frustration leading to illegal pesticide use and its associated animal suffering is probably less than under Alternatives 2 and 3 but more than under the proposed action.

4.2.4 Effects of Beaver Dam Removal on Wetland Wildlife Habitat

4.2.4.1 Alternative 1 - Continue the Current Federal WS ARDM Program. Under this alternative, beaver impounded areas would be removed by hand or with explosives for the purpose of returning streams, channels, dikes, culverts, and irrigation canals to their original function. WS removes most beaver impoundments because they have flooded areas such as roads, crops, merchantable timber, pastures, and other types of property or resources that were not previously flooded. The majority (59%) of complaints addressed by WS combining data from FY 00 through FY02 involved damage to irrigation ditches, dikes, roads, and bridges where "wetlands" would not be involved. Another 25% of projects involved damage to man-made structures, (houses, utilities, and landscaping), again not affecting wetland wildlife habitat. About 14% of WS projects involve agricultural crops, pasture or range that recently became flooded. Finally, the remaining 2% involves flooded timber. The dams that are removed were almost invariably created as a result of recent beaver activity because WS personnel receive most requests soon after affected resource owners discover damage or become aware of the WS program. Dams are removed in accordance with exemptions from permit requirements established by regulation or as allowed under NWPs granted under Section 404 of the Clean Water Act (see Sections 2.2.3 and 3.2.1). The majority of impoundments that WS removes have been in existence but a few months, and possibly a year. These are not considered true wetland habitats and, therefore, do not possess the same wildlife habitat values that established wetlands have. The terrestrial habitat and wetland existing prior to the establishment of the beaver dam are restored following the removal of a newly established dam.

In FY00 to FY02, WS removed 163, 82, and 35 dams with binary explosives, respectively, in Colorado. Considering the acreage of wetlands in Colorado, this would be minimal in terms of percent. The majority of beaver dams removed by WS have less than a surface acre or two of water held in them and are not part of the 260 mi^2 of water bodies in Colorado. In addition, the impoundments removed by WS are not considered "true" wetlands and WS would require a Section 404 permit to remove those that were. WS consulted with the Corps and they determined that WS

activities are conducted in accordance with the Clean Water Act. Thus, significant impacts on established wetland wildlife habitat are avoided. Therefore, it is concluded that WS has minimal impact on wetland wildlife habitat.

4.2.4.2 Alternative 2 - No Federal WS ARDM. Under this alternative, needs for beaver dam removal would be met by private, state, or local government entities. Some beaver impounded areas that WS would advise against draining might be drained under private or local government management, which could have adverse impacts on wetland habitats in limited circumstances. Additionally, private persons may use heavy equipment such as backhoes to remove dams because they do not have access to binary explosives, and heavy equipment could potentially damage the integrity of the previous stream channel.

4.2.4.3 Alternative 3 - Technical Assistance Only. Reduced effectiveness would cause many local governments or individuals to discontinue federally supervised ARDM programs. ARDM needs would then be met by private individuals and local governments, and adverse impacts on wetland habitat areas would be similar to Alternative 2, although probably to a lesser degree since many individuals might act in accordance with advice given by WS.

4.2.4.4 Alternative 4 - Nonlethal Required Before Lethal Control. Reduced effectiveness might cause local governments and individuals to drop out of federally supervised ARDM programs, but this would be less likely than under Alternatives 2 and 3. There would be an increase in ARDM and dam removal by state agencies and by less trained and less experienced private individuals, potentially with heavy equipment. The potential for adverse impacts to wetlands would be slightly more than the current program but less than under Alternatives 2 and 3.

4.2.5 Effects of ARDM Methods on Public Safety

4.2.5.1 Alternative 1 - Continue the Current Federal WS ARDM Program. Some ARDM methods could pose risks where they are not used by professionals. Methods used in ARDM that could present risks are the use of explosives, firearms, and Conibear® traps. However, no accidents resulting in harm to any persons have occurred under the current program.

WS uses binary explosives to remove beaver dams. WS Specialists who use explosives are certified through in-depth training and must be able to demonstrate competence and safety in their use of explosives. They adhere to WS policies as well as regulations with regards to explosives use, storage, and transportation from the Bureau of Alcohol, Tobacco and Firearms, the Occupational Safety and Health Administration, and the Department of Transportation. Binary explosives require two components to be mixed before they can be actuated which virtually eliminates the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not allowed. When explosives are used, signs are placed to deter public entry. In addition to signs, WS personnel watch for people, vehicles, and other indicators to ensure no one is present in the vicinity when explosives are used. Where dams are near roads, police or other road officials stop traffic and public entry. Therefore, no adverse impacts to public safety are expected from the use of explosives by WS in Colorado. Risks to employees are minimized through safety training and certification.

WS uses firearms to shoot aquatic rodents and euthanize animals caught in traps. WS personnel are trained and given refresher courses to maintain awareness of firearm safety and handling as prescribed by WS policy. Therefore, no adverse impacts to public safety are expected from the use of firearms by WS in Colorado.

WS uses body-gripping traps (e.g. Conibear® traps, leghold traps, and snares) to take target aquatic rodents under permits from CDA or CDOW. Traps are strategically placed to minimize nontarget take and minimize exposure to the public. Signs are used to post properties where traps are set to alert the public of their presence. In addition, body-gripping traps are restricted to water sets by WS policy, which further reduces threats to public safety and nontarget take. From FY00 to FY02, beaver take with body-gripping traps averaged 40% of the total take of beaver. This shows that this method is relied upon, but in the same time period, WS did not have any reportable incidents with the method.

Under this alternative, the risk of adverse impacts to the public from ARDM methods would continue to be low as discussed. Risk to members of the public from use of explosives to remove beaver dams, firearms, and body-gripping traps to take aquatic rodents would remain low due to adherence to WS policies, required safety precautions, and training.

4.2.5.2 Alternative 2 - No Federal WS ARDM. There would be no potential for adverse impacts to humans from federal use of ARDM methods. However, state agency and private use of ARDM methods would probably rise which would increase risks to human safety because of lack of training and knowledge of the proper use of ARDM methods. Body-gripping traps can cause injuries to persons who try to use them without proper training. Private persons who use explosives to remove beaver dams are far less likely to be adequately trained in safety or to be held accountable for safe practices. In addition, the potential exists for illegal activities to occur such as the misuse of poisons, especially from frustrated resource owners that cannot manage damage situations. Public safety risks under this alternative would, therefore, likely increase.

4.2.5.3 Alternative 3 - Technical Assistance Only. The effects of implementing this alternative on public safety would be similar to, but somewhat less than, Alternative 2. Although there would be no potential for adverse impacts to humans from federal use of ARDM methods, risks would likely increase because of increased use of ARDM methods by untrained and less experienced persons. However, the increased risks under this Alternative would be somewhat less than under Alternative 2 since many individuals might receive technical assistance from WS and act in accordance with the safety advice given.

4.2.5.4 Alternative 4 - Nonlethal Required Before Lethal Control. Reduced effectiveness might cause local governments and individuals to drop out of federally supervised ARDM programs and result in similar impacts as described under Alternative 2. However, this would be less likely than under Alternatives 2 and 3 because some ARDM needs would be met by WS. Risk of adverse impacts to the public from the use of ARDM methods would be greater than the current program, but probably less than Alternatives 2 and 3.

4.3 ALTERNATIVE IMPACTS

Each of the 4 analyzed Alternatives would have varying impacts in the 5 issue areas. Alternative 1 would probably have the overall lowest impacts on the environment (Table 3). Alternative 2, followed closely by Alternative 3 would probably have the highest impacts to the environment.

Table 3. Alternative Impacts on Issues Compared.

Issues	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Target Species	Low	Low	Low	Low
Nontarget Spp. Pops.	Low	Low to High	Low to High	Low to Moderate
T&E Species	Low	Low to High	Low to High	Low to Moderate
Humaneness	Low	Low to High	Low to High	Low to Moderate
Wetland Habitat	Low	Moderate	Moderate	Low to Moderate
Public Safety	Low	Moderate	Moderate	Low to Moderate

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 List of Preparers

Michael J. Bodenchuck, Wildlife Biologist/Utah State Director

Hody Ewing, Wildlife Biologist/Assistant District Supervisor, USDA-APHIS-WS

Thomas C. Hall, Wildlife Biologist/Environmental Coordinator, USDA-APHIS-WS

Gary A. Littauer, Wildlife Biologist/Environmental Coordinator, USDA-APHIS-WS

Mike Tamllos, Wildlife Specialist, USDA-APHIS-WS

Jennifer A. Lynch, Wildlife Biologist, USDA-APHIS-WS

Michael A. Yeary, Wildlife Biologist/Colorado State Director, USDA-APHIS-WS

5.2 List of Persons and Agencies Consulted

Mark Leslie, Colorado Division of Wildlife

Lynn Stevens, Furbearer Biologist, Colorado Division of Wildlife

Jim Miller, Director, Policy and Communications, Colorado Department of Agriculture

Van Truan, Biologist/Regulatory Specialist, U.S. Army Corps of Engineers, Pueblo, CO

Lee Carlson, U.S. Fish and Wildlife Service

Allan Pfister, U.S. Fish and Wildlife Service

APPENDIX A

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APPENDIX B

Biological Assessment for the Management of Damage by Aquatic Rodents in Colorado

ANALYSIS OF POTENTIAL IMPACTS ON THREATENED AND ENDANGERED SPECIES

U.S. Department of Agriculture (USDA)
Animal and Plant Health Inspection Service (APHIS)
Wildlife Services (WS)
Lakewood, CO

INTRODUCTION

Section 7 of the Endangered Species Act of 1973, as amended ((ESA) 16 USC 1531-1543) requires each Federal agency to ensure that its actions will not jeopardize the continued existence of listed species or destroy or modify such species' critical habitat. If one or more protected species are found within the area of a proposed action, then the agency must determine whether and how the action will affect such species. If a "may affect" determination is made, the agency must consult with the U.S. Fish and Wildlife Service (USFWS) to determine whether the action is likely to adversely affect or jeopardize the continued existence of the species and, if so, to avoid or mitigate the action to avoid or minimize adverse impacts.

DESCRIPTION OF PROPOSED ACTION

The proposed action is to continue an ongoing management program for the protection of agriculture and other resources from damage caused by beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*). Among resources being protected are crops, pastures, timber, roads, drainage systems, human health and safety, personal property, natural resources, and aquaculture. The proposed action is part of the ongoing nationwide WS program, which has been previously reviewed under a formal consultation between WS and USFWS (USDA 1997, Appendix F). The Biological Opinion (BO) provided by the USFWS in 1992 as a result of that consultation evaluated the impacts of methods of taking aquatic rodents including the use of body-gripping (e.g., Conibear) and leghold traps. That consultation did not evaluate any "may affect" determinations for habitat management methods, which are addressed in this evaluation.

WS presently uses an Integrated Wildlife Damage Management approach, using a variety of methods for managing aquatic rodent damage. This allows WS personnel greater flexibility and more opportunity to tailor an effective damage management strategy for each specific problem that is encountered. In selecting control techniques, consideration is given to the type, magnitude, duration, frequency, and location of damage. Consideration is also given to the status of potential nontarget species. The decision-making steps taken by WS personnel when conducting aquatic rodent damage management (ARDM) are described in the "WS Decision Model" which is discussed in great detail in USDA (1997).

Requests for assistance may be handled through technical assistance or direct control. Technical assistance may include providing advice, information, recommendations, and materials to others for use in resolving aquatic rodent-caused damage. Most WS direct control efforts for aquatic rodent damage management utilize site-specific lethal control measures. Lethal control is achieved through the use of traps (leghold, body gripping, and snares) and shooting. USDA (1997) did a risk assessment which addressed the use of these tools and their associated risks. In situations where nonlethal control is determined to be effective, WS uses physical exclusion: such as barriers, baffles, and shields; water level management devices; and beaver dam removal, either by hand or with binary explosives. Exclusion including barriers and shields is usually used to prevent gnawing damage. Water levelers and beaver baffles are used to protect

water flow through culverts or to maintain water levels in beaver ponds at a certain flow through small ditches and natural drainages. Explosives are used to remove dams; only the portion of the dam blocking the drainage is breached and the natural course of the stream is undisturbed. In other situations lethal control measures are used such as traps and snares. Traps are set to maximize beaver and muskrat catches and minimize catches of nontarget animals. This is accomplished through the selection of specific trap types and trap placement. In general, many of the aforementioned methods are used concomitantly as part of a comprehensive aquatic rodent management program. Some of the methods are used to resolve the short term problem such as trapping while others are used to resolve the problem over a long term such as water levelers.

Some ARDM tools are not used by WS because they are biologically unsound, legally questionable, or ineffective (e.g., toxicants, ultrasonic devices, and frightening). Others are more appropriately used by the person experiencing an aquatic rodent problem rather than by WS and are given as recommendations.

ANALYSIS OF POTENTIAL IMPACTS ON THREATENED AND ENDANGERED SPECIES

Of the species and subspecies currently listed as threatened or endangered (T&E) under provisions of the ESA, 31 are Federally listed as threatened or endangered within the State of Colorado (USFWS 2002). This biological assessment also includes a species that is proposed for listing as threatened and 11 species currently listed as candidates for the Federal T&E species list that may be listed in the future (USFWS 2002). It also includes a species, the California condor that while from an experimental population released in Arizona, is endangered in Colorado and has been seen near Grand Junction. Additionally, Colorado maintains lists of wildlife (Colorado Division of Wildlife 2002) and rare plants (Colorado Rare Plant Technical Committee 2002). Excluding the rare plants that are not federally listed, this adds 15 more species not listed by USFWS. Information from both State and Federal lists results in a combined list of 9 mammals, 14 birds, no reptiles, 1 amphibian, 15 fish, 2 invertebrates, and 19 plants. Table 1 provides a list of these species, their listing, status in Colorado, habitat preference, diet, and the effects that ARDM would have on them.

Table 1. Colorado Threatened and Endangered Species.

SPECIES	Scientific Name	Listing	Status	Habitat	Diet**	ARDM
MAMMALS						
Bear, grizzly	*Ursus arctos*	SE	H	FR	LSG	0
Ferret, black-footed	*Mustela nigripes*	FE SE	R	R	S	0
Fox, kit	*Vulpes macrotis*	SE	R	R	S	0
Lynx, Canada	*Lynx canadensis*	FT SE	R	F	SI	0
Mouse, Preble's meadow	*Zapus hudsonius preblei*	FT ST	HR	W	Gi	-,+
Otter, river	*Lontra canadensis*	SE	R	W	F	-
Prairie dog, black-tailed	*Cynomys ludovicianus*	FC	HR	R	G	0
Wolf, gray	*Canis lupus*	SE	R	FR	LSc	0
Wolverine	*Gulo gulo*	SE	R	F	SC	0
BIRDS						
Chicken, lesser prairie	*Tympanuchus pallidicinctus*	FC ST	R	R	Gi	0
Condor, California	*Gymnogyps californianus*	FXE	V	FR	C	0
Crane, whooping	*Grus americana*	FE SE	M	R	Gis	0
Cuckoo, Western yellow-billed	*Coccyzus americanus*	FC	S	F	I	-
Curlew, Eskimo	*Numenius borealis*	FE	M	R	I	0
Eagle, bald	*Haliaeetus leucocephalus*	FT ST	SM	FW	FCs	-, 0
Flycatcher, Southwestern	*Empidonax traillii extimus*	FE SE	S	FW	I	-, +
Grouse, Plains sharp-tailed	*Tympanuchus phasianellus jamesii*	SE	R	R	GI	0
Owl, burrowing	*Athene cunicularia*	ST	S	R	IS	0
Owl, Mexican spotted	*Strix occidentalis lucida*	FT ST	R	F	S	0
Plover, mountain	*Charadrius montanus*	FPT	S	F	I	0
Plover, piping	*Charadrius melodus*	FT ST	S	W	I	0
Sage-grouse, Gunnison	*Centrocercus minimus*	FC	R	R	GI	0
Tern, least	*Sterna antillarum*	FE SE	S	W	Fs	0

SPECIES	Scientific Name	Listing	Status	Habitat	Diet**	ARDM
AMPHIBIANS						
Toad, boreal	*Bufo boreas boreas*	FC SE	R	W	AI	-, +
FISHES						
Bonytail	*Gila elegans*	FE SE	R	L	AI	+
Chub, Humpback	*Gila cypha*	FE ST	R	Lg	AI	0
Chub, lake	*Couesius plumbeus*	SE	R	LSgm	AI	-, +
Dace, northern redbelly	*Phoxinus eos*	SE	R	LSgm	A	-, +
Dace, southern redbelly	*Phoxinus erythrogaster*	SE	R	LSgm	A	-, +
Darter, Arkansas	*Etheostoma cragini*	FC	R	LSg	A	-, +
Minnow, brassy	*Hybognathus hankinsoni*	ST	R	LSg	A	-, +
Minnow, Plains	*Hybognathus placitus*	SE	R	LSg	A	+
Minnow, suckermouth	*Phenacobius mirabilis*	SE	R	Sg	A	+
Pikeminnow, Colorado	*Ptychocheilus lucius*	FE ST	R	Lg	A	0
Shiner, Common	*Luxilus cornutus*	ST	R	LSg	A	+
Sturgeon, pallid	*Scaphirhynchus albus*	FT SE	R	Lgm	A	0
Sucker, razorback	*Xyrauchen texanus*	FE SE	R	Lg	A	0
Sucker, Rio Grande	*Catostomus plebeius*	SE	R	Sg	A	+
Trout, greenback cutthroat	*Oncorhynchus clarki stomias*	FT ST	R	LSg	AI	-, +
INVERTEBRATES						
Butterfly, Uncompahgre	*Boloria acrocnema*	FE	H	F	-	0
Skipper, Pawnee montane	*Pseudocopaeodes eunus obscurus*	FT	H	G	-	0
PLANTS						
Milk-vetch, Mancos	*Astragalus humillimus*	FE	R	R	-	0
Milk-vetch, Osterhout	*Astragalus osterhoutii*	FE	R	R	-	0
Milk-vetch, Sleeping Ute	*Astralagus tortipes*	FC	R	FW	-	0, +
Moonwart, slender	*Botrychium lineare*	FC	R	R		0
Wild-buckwheat, clay-loving	*Eriogonum pelinophilum*	FE	R	R	-	0
Mustard, Penland alpine fen	*Eutrema penlandii*	FT	R	RW	-	0, +
Butterfly plant, Colorado	*Gaura neomexicana spp. coloradensis*	FT	R	RW	-	0, +
Bladderpod, Dudley Bluffs	*Lesquerella congesta*	FT	R	R	-	0
Cactus, Knowlton	*Pediocactus knowltonii*	FE	R	R	-	0
Beardtongue, Parachute	*Penstemon debilis*	FC	R	R	-	0
Beardtongue, Graham	*Penstemon grahamii*	FC	R	R	-	0
Beardtongue, Penland	*Penstemon penlandii*	FE	R	R	-	0
Beardtongue, White River	*Penstemon scariosus var. albifluvis*	FC	R	R	-	0
Phacelia, North Park	*Phacelia formosula*	FE	R	R	-	0
Phacelia, DeBeque	*Phacelia submutica*	FC	R	R	-	0
Twinpod, Dudley Bluffs	*Physaria obcordata*	FT	R	R	-	0
Cactus, Uinta Basin hookless	*Sclerocactus glaucus*	FT	R	R	-	0
Cactus, Mesa Verde	*Sclerocactus mesae-verdae*	FT	R	R	-	0
Ladies'-tresses, Ute	*Spiranthes diluvialis*	FT	R	RW	-	0, +

**Diet - Capitals = large proportion of diet - Lower case = small proportion of diet.

LISTING	STATUS	HABITAT	DIET	ARDM - Impacts
F - Federal	H - Hibernate/estivate	F - Forests/riparian borders	A - Aquatic-sm fish/inverts/plants	(-) - Negative
S - State	M - Migrant	R - Rangeland/sage/grass/agric.	C- Carrion	0 - none
E - Endangered	R - Resident	W - Wetlands/marshes	F- Fish	(+) - Positive
T - Threatened	S - Summer/nests	L - Lakes, Rivers	G - Grains/grass/seeds/mast	
P - Proposed	V - Vagrant	S - Small rivers/creeks/springs	I - Invertebrates/insects	
C - Candidate		g - Gravel/flowing water	S - Small vertebrates (i.e. rodents, birds)	
X - Exp. nonessential pop.		m - mud bottoms/pools	L - Large Vertebrates	

ARDM would have very different potential effects on T&E species, primarily dependent upon the species' distribution in Colorado, seasonality, habitat preference, and diet. In addition, the different methods used in ARDM by WS would also have varying affects.

Mammals

Three species of mammals are Federally listed as T&E species in Colorado and a fourth species is a candidate for the list. In addition, five species, not on the Federal list, are listed as endangered by the State of Colorado.

Grizzly Bear and Gray Wolf. These two State listed endangered species were once found in Colorado. However, few grizzlies and wolves have been documented in Colorado since the 1940s and it is very likely that grizzlies and wolves have been extirpated from Colorado. ARDM conducted by WS will have no effect on the grizzly or gray wolf considering their habitat preference for remote wilderness areas, and the lack of confirmed sightings in Colorado. In addition, ARDM methods employed by WS would have minimal, if any, chance of capturing these species. Therefore, WS concludes that ARDM will have "no effect" on either species.

Black-footed Ferret and Black-tailed Prairie Dog. The black-footed ferret, a Federally listed endangered species, was once found in Colorado among black- and white-tailed prairie dog colonies, its principal food source. Ferrets were likely always scarce, but declined with the westward expansion of people. The last confirmed ferret sighting in Colorado, not including those from the experimental population, was in the 1940s. The black-tailed prairie dog, a federal candidate species, occupied much of the eastern half of Colorado. Prairie dogs declined as much of their habitat was converted into farmland. Both species live in dry upland prairies and other sites that are mostly unaffected by ARDM activity. In addition, the ARDM methods employed by WS pose virtually no risk to these species considering that most methods are used in the water. Therefore, WS concludes that ARDM will have "no effect" on these species.

Kit Fox. This State listed endangered species is found in southwest Colorado in desert scrub and open pinyon-juniper woodlands. Because the kit fox prefers areas with sandy soils in desert areas where ARDM activity is unlikely to occur, WS concludes that ARDM will have "no effect" on this species.

Canada Lynx and Wolverine. These species tend to occupy similar habitats in remote "back-country" forests and alpine areas of Colorado. Both species were believed to be extirpated from Colorado, but Canada lynx have since been "reintroduced" into remote high country areas. Their habitat preference for wilderness forests makes it highly unlikely that they would be affected by ARDM. Therefore, WS concludes that ARDM activities will have "no effect" on these species.

Preble's Meadow Jumping Mouse. This Federally listed threatened species lives in densely vegetated, shrub-dominated, riparian habitats along the Front Range of Colorado from Colorado Springs north into Wyoming. ARDM methods, with the exception of beaver dam removal, will have no effect on this species, mostly as a result of their size. Beaver dam removal is generally conducted because an area flooded that previously was not and is done soon after the beaver dam was built, but prior to the area being established into a true wetland. Flooding from a newly established beaver dam could jeopardize jumping mouse habitat by inundating it with water. However, if the beaver dam were in place for several years, jumping mouse habitat could form along with a true wetland as the flooded vegetation above the previous high water mark is replaced with vegetation above the new high water mark . Beaver dams, in time, can establish new wetlands that meet 3 requirements, per federal definition (40 CFR 232.2), including hydric soils, wetland hydrology, and hydrophytic vegetation. For the jumping mouse, hydrophytic vegetation and associated vegetation above the high water mark are the most important. If a beaver dam had been in place for several years, vegetation in the general area, especially along the Front Range, could benefit and develop into dense stands providing habitat for this species. However, these beaver ponds could not be removed without the appropriate permits or exemption per Section 404 of the Clean Water Act. It is WS' conclusion that the indiscriminate removal of beaver dams from streams with associated dense vegetation above the high water mark occupied by this mouse species could adversely affect the mouse's long-term survival. Because aquatic rodent damage management, and in particular beaver dam removal, typically does not eliminate wetland habitat, this species would not be impacted. If WS is requested to remove a beaver dam along the Front Range in the range of the Preble's meadow jumping mouse that does have dense vegetation associated with it, a site-specific consultation with USFWS will be requested and the landowners will be required to request the necessary

Section 404 permit should it be required. These minimizing measures will ensure that WS does not have an effect on the Preble's meadow jumping mouse.

River Otter. River otters were presumed to be extirpated from Colorado by the early 1900s, but they had occurred in all the major waterways. In 1976, reintroduction efforts began and otters were released at several sites in Colorado. Otters have apparently survived from these releases, but the eventual goal of the program is to establish viable populations in many areas of the State. Several ARDM methods, especially those targeting beaver, do have the potential to take nontarget otters. This includes leghold, body-gripping, and cage traps, and snares. Colorado trapping regulations under Amendment 14 were adopted by WS which has minimized the possibility of take.

To avoid the taking of river otter, trapping in the following four areas is prohibited in water, except with: a) padded-jaw leghold traps; b) Conibear® type traps less than 220 in size; or c) land or water set snares with a closure size of 16 inch circumference or larger. In addition, padded-jaw traps and snares may not be used in drowning sets and padded jaw traps and land set snares may only be set in accordance with the provisions of 33-6-205 CRS, 33-6-206 CRS, or 33-6-207 CRS; and that water set snares and Conibear® traps may only be set in accordance with the provisions of 33-6-205, CRS, or 33-6-207, CRS. The prohibitive areas include:

1) That portion of the Gunnison River and five (5) miles upstream along each of its tributaries in Montrose and Delta Counties from the Black Canyon of the Gunnison National Monument downstream to that point where the river meets Highway 92; and all lands within 100 yards of the high water line of this portion of the Gunnison River and all tributaries thereof.

2) That portion of the Piedra River upstream from Navajo Reservoir to the headwaters including East Fork and Middle Fork of the Piedra River in Hinsdale and Archuleta counties and 9 miles upstream on the First Fork. This restriction includes the following tributaries: Sand Creek, Weminuche Creek, Little Sand Creek, Williams Creek, and all lands within 100 yards of the high water mark line of the above waters.

3) The Dolores River from the McPhee Reservoir downstream to Bed Rock within 100 yards of the high water line.

4) The San Juan River from Pagosa Springs downstream to the New Mexico state line within 100 yards of the high water line.

WS also mitigates impacts on otter populations by watching for sign where WS personnel are conducting ARDM activities and by making sets conducive for taking beaver and not otter . If WS catches a nontarget otter, CDOW will be notified. WS has not taken a nontarget otter in the past 3 FYs.

Birds

Colorado currently has 7 Federally listed T&E bird species, a proposed species and 2 candidates. In addition, one species that has been found in Colorado, the California condor, was from an experimental population released in Arizona, but was an endangered species in Colorado. Finally, Colorado lists two additional species that are not on the Federal list.

Lesser Prairie Chicken, Plains Sharp-tailed Grouse, and Gunnison Sage-grouse. These species tend to prefer fairly open grasslands and sagebrush habitat in Colorado. The prairie chicken favors the sandsage bluestem sandy grasslands in southeastern Colorado. Sharp-tailed grouse are found on the Plains in the rolling hills and scrub oak thickets just southeast of Denver. The sage-grouse can be found in a variety of habitats, but tend to favor sagebrush and grasslands in eight isolated areas of southwest Colorado. Declines in these species have primarily been as a result of the loss of habitat. ARDM activities are rarely conducted in the areas that these species inhabit. However, ARDM may be

potentially conducted at these species watering sites. ARDM methods, pose no or a very minimal threat to these species. Beaver dam removal with binary explosives is the only ARDM method that has a potential of affecting these species. The potential, though, is extremely low to non-existent. When WS personnel use binary explosives at beaver dams, debris from the blast travels into the air and to the sides up to 100 feet and could accidentally kill a grouse should it be in the areas. However, the presence of WS personnel at a dam would likely be detected by grouse and they would leave the area while the dam was being prepared for detonation. In addition, grouse are more likely to water at the shallow end of a pond, typically opposite the dam side away from the blast. Therefore, WS concludes that ARDM will have "no effect" on these species.

California Condor. The California condor is a scavenger, eating carrion such as cattle, sheep, deer, and ground squirrel carcasses. The condor finds carrion by sight and not smell, unlike a turkey vulture which relies as much, or more, on odor to locate dead animals as it does sight. The California condor was extirpated over most of its range by the late 1970s and all wild condors were taken into captivity in 1980s. The propagation program was a success and they were reintroduced back into the wild in California. In addition, a "nonessential/experimental population" under section 10(j) of the Endangered Species Act was been established at the Vermillion Cliffs of northern Arizona. The experimental range included Arizona, Utah, and Nevada. Some concern has arisen about the potential of wildlife damage management activities to affect condors from the reintroduced nonessential/experimental population along the Colorado River in Arizona that venture out of the projected range into Colorado. The designated experimental range of the condors does not include areas in Colorado, but reports indicate that several of these condors have temporarily migrated outside of their experimental population zone and one into Colorado. In Colorado, the status of the condor is endangered because it outside the experimental population boundary.

The 1992 USFWS BO (USDA 1997) addressed the California condor and suggested minimizing measures to avoid the possibility of take. However, no ARDM tool was considered to have the potential to negatively affect California condors. Therefore, it is WS' conclusion that ARDM will have "no effect" on the condor, especially considering the rare potential for it to be in Colorado.

Whooping Crane. This species breeds in northern Canada and winters in Texas. In eastern Colorado, they are only occasionally found during migration in October-November and March-April. They associate with large open wetlands, croplands, and pastures. One ARDM method, body gripping traps, was considered to have a potential negative impact on the whooping crane in the USFWS 1992 B.O., when used on land. However, these traps were also determined to have a positive impact by removing beavers flooding valuable foraging areas. The USFWS 1992 BO concluded, though, that no aspect of the WS program under current policy (no land sets with beaver kill-traps are allowed) would adversely affect this species, including any methods used by WS to take aquatic rodents (USDA 1997, Appendix F). Therefore, WS concludes that ARDM activities will have "no effect" on this species.

Western Yellow-billed Cuckoo. The western yellow-billed cuckoo, a Federal Candidate, has become fairly rare throughout the West, including the western half of Colorado, but still can be found in several lowland riparian areas where it lives in dense willow-cottonwood forested tracts. It is primarily an insectivorous bird often foraging high in the canopy of cottonwoods. It will also sometimes take small vertebrates. Their nests are primarily found in nearby willows. Loss of habitat has been cited as the primary reason for its decline. ARDM activities, with the exception of beaver dam removal, will have no negative effect on this species. Beaver dam removal with binary explosives in willow-cottonwood tracts known to be active cuckoo habitat could have the potential to affect this species from May through September when the cuckoo is present. To avoid accidental take or harassment from this method during the nesting season, beaver dams will be removed with binary explosives from October through March in riparian areas where cuckoos are suspected to be present (cottonwood-willow tracts). If dams need to be removed, especially due to an emergency such as a house being flooded from beaver activity, during the nesting season, USFWS will be consulted on a site-specific basis to determine if the area has an active nest. This minimizing measure will insure that WS will have no or little potential to affect this species. WS ARDM could potentially have a positive effect on this species if the focus of the ARDM activity was on removing beavers that were cutting down willows that had nests in them. It is WS' conclusion, that ARDM will have "no effect" on the cuckoo with the one minimizing measure in place.

Eskimo Curlew. This is an extremely rare bird, potentially extinct, that winters on natural grasslands, prairies, pastures, plowed land, and intertidal zones. It primarily traveled through the central United States, including eastern Colorado, during migration. The USFWS 1992 BO concluded that no aspect of the WS program would adversely affect this species, including any methods used by WS to take aquatic rodents (USDA 1997, Appendix F). Therefore, WS concludes that ARDM activities will have "no effect" on this species.

Bald Eagle. Bald eagles generally occur in riparian habitat associated with coasts, rivers, and lakes and usually nest near bodies of water where they feed on fish. ARDM generally is conducted only in small drainages unlikely to be used by eagles. The USFWS 1992 BO stated there is no evidence that WS trapping activities are having significant adverse impacts on bald eagles (USDA 1997, Appendix F). Because there is at least a slight risk of take from use of traps and trapping devices, and the potential from harassment incidental to trapping activities, WS received an incidental take statement from the USFWS in 1992 which covers all WS use of ARDM methods of take. However, such methods are extremely unlikely to result in any adverse impacts on bald eagles. Therefore, WS concludes that ARDM activities will have "no effect" on this species, with the exception of possible unintentional harassment of bald eagles at nest sites. To minimize this possibility, USFWS will be requested to provide bald eagle nest site locations in Colorado so that WS personnel can avoid these areas during the nesting season. If ARDM in a nesting area is requested, WS will request a site-specific consultation with USFWS. Therefore, WS concludes that ARDM activities are not likely to adversely affect the bald eagle in Colorado with the minimizing measures being used.

Southwestern Willow Flycatcher. This flycatcher, a Federal and State listed endangered species, occurs in cottonwood riparian habitats with dense vegetation such as willows or Russian olives. It has been found in southcentral and southwestern Colorado from spring into summer. This species is highly insectivorous, taking insects on the wing or gleaning them from vegetation. The WS Program is currently in consultation with the USFWS regarding the Southwestern willow flycatcher. The Colorado WS Program will abide by any restrictions agreed to by Wildlife Services as a result of that consultation.

Burrowing Owl. The burrowing owl lives in abandoned rodent, mainly prairie dog, and rabbit burrows in sparsely vegetated areas of Colorado. Because of this species habitat preference for grassland areas, it is highly unlikely that they would be in close proximity to ARDM activities. Therefore, WS concludes that ARDM will have "no effect" on this species.

Mexican Spotted Owl. The spotted owl lives in heavily forested canyon areas of southern Colorado and the Front Range on the periphery of its primary range and are fairly uncommon. They feed on small rodents in the forests they inhabit and are unlikely to be affected by ARDM methods used by WS personnel. Therefore, WS concludes that ARDM will have "no effect" on this species.

Mountain Plover. This species breeds in dry upland prairies and plains of eastern Colorado and likely migrates through similar areas throughout Colorado to their wintering grounds. Because of habitat preference for upland areas in semi-desert conditions, this species would not be affected by ARDM activities. Therefore, WS concludes that ARDM will have "no effect" on this species.

Piping Plover. Piping plovers migrate through much of eastern Colorado in the spring and fall. They can be found along lake and river mudflats, sandy beaches, and sandbars during migration. Although this species is associated with wetlands, they would not be affected by ARDM in Colorado because of habitat preference for larger rivers and lakes. Mudflats are typically not associated with recently flooded areas associated with beaver dam building activity. The USFWS 1992 BO concluded that no aspect of the WS program would adversely affect this species, including any methods used by WS to take aquatic rodents (USDA 1997, Appendix F). Therefore, WS concludes that ARDM will have "no effect" on this species.

Interior Least Tern. This species of tern prefers sandy shorelines and sand bars along lakes and rivers. Its habitat preference for sandy shorelines make it unlikely that it would be impacted by WS ARDM activities because these are not associated with beaver dams. The USFWS 1992 BO concluded that no aspect of the WS program would adversely affect this species, including any methods used by WS to take aquatic rodents (USDA 1997, Appendix F). Therefore, WS concludes that ARDM will have "no effect" on this species.

Reptiles and Amphibians

Colorado has one Federal candidate amphibian species which is a State endangered species.

Boreal Toad. This Federal candidate species is found in the Colorado high country from 7,000 to 12,000 feet in elevation. Once common, the species declined rapidly from the 1970s to the 1990s and its distribution was drastically reduced. The decline of this species is not well understood, but a deadly fungus may be the primary culprit. The toad inhabits spruce-fir forests and alpine meadows that have lakes, marshes, ponds, and bogs with quiet, shallow waters and a sunny exposure. Beaver ponds at higher elevations in the spruce -fir zone are considered ideal habitat for them. As a result, beaver dam removal of established ponds could have an adverse impact on them. Other ARDM methods would not have an effect on them.

The Colorado Wildlife Services Program does not currently conduct dam removal projects in areas where the boreal toad (*Bufo boreas boreas*) would be located. If a request is received in areas where boreal toads could be present, consultation will be initiated on a case-by-case basis. These areas would be in central Colorado in the toad's historic range in spruce-fir forests above 7,000 feet. Beaver are not found in the alpine areas where this species could be found. This will not include beaver dam removal from irrigation ditches, canals, structures such as culverts, or other areas where recent beaver activity has hampered water flow from one site to another. These areas are not likely to have toads associated with them.

WS concludes that ARDM, specifically beaver dam removal, may affect the boreal toad. However, WS will not remove beaver dams from 7,000 feet to 12,000 feet in the range of the boreal toad without consulting with USFWS. Therefore, barring beaver dam removal, WS will have "no effect" on the boreal toad.

Fish

Colorado has 6 species and subspecies of fish that are on the Federal T&E species list and one Federal candidate. In addition, Colorado lists 8 additional species on their T&E list. These T&E fish species occur in riverine systems, lakes, and springs throughout Colorado. The 1992 USFWS BO stated that fish species would not likely be affected by any wildlife damage management activity (USDA 1997), except that beaver dam removal with binary explosives was not addressed. ARDM activities conducted by WS will have "no effect" on the T&E fish species in Colorado, with the possible exception of beaver dam removal.

Bonytail Chub, Humpback Chub, Colorado Pikeminnow, Razorback Sucker, and Pallid Sturgeon. The first four Federally listed species occupy the larger channels of the Colorado River system, in swift water or deep pools with silt to rocky runs. They occur in western Colorado along the main channel of the Colorado River. The fifth species, the pallid sturgeon, was historically found in the Platte River in northeast and north-central counties of Colorado. The sturgeon prefers large turbid rivers with diverse depths and flow. The five species populations declined primarily as a result of the loss of habitat and instream flows because of dams, and competition with or predation from non-native species. ARDM activities will have "no effect" on these species because of their habitat preference for flowing, deep waters.

Lake Chub. The Lake chub is a common species in the United States, but rare in Colorado and likely always has been. However, a few populations have been found in small reservoirs in the St. Vrain River and Cache La Poudre River basins. This species can survive in a wide variety of habitats including lakes, ponds, rivers and streams. Water conditions also

can vary from standing to flowing and shallow to deep. However, this species is most common in lakes along gravel shorelines and streams with a gravel substrate. ARDM activities other than beaver dam removal will have "no effect" on this species. Since this species will occupy a wide variety of aquatic habitats including small ponds such as those behind beaver dams, beaver dam removal with binary explosives does have the potential to take a few during blasting. However, considering the location of known populations (currently confined to 4 reservoirs), it is not likely that WS would be requested to conduct ARDM activities at those sites. Therefore, WS concludes that beaver dam removal with binary explosives is not likely to adversely affect the lake chub.

Northern Redbelly Dace, Southern Redbelly Dace, Arkansas Darter, Brassy Minnow, Plains Minnow, Suckermouth Minnow, Common Shiner, and Rio Grande Sucker. These eight State listed species, the darter also a Federal candidate, are found, with the exception of the sucker, in eastern Colorado from the Front Range east in the South Platte, Arkansas, Republican, and the Saint Vrain River basins. The Rio Grande Sucker is found in southern Colorado streams associated with the Rio Grande River basin. Most of these species tend to be associated with small shallow tributary streams with cool runs over substrates of sand or gravel. The Plains minnow, though, prefers river mainstem channels over sandy bottoms. The dace, darter and shiner require streams or pools with brush and vegetation along the banks, or abundant rooted aquatic vegetation. Most are intolerant, especially the shiner and sucker, of areas with siltation, such as that found in an older beaver pond. Because they prefer gravel or sandy runs in flowing cool water and are intolerant of siltation, ARDM will have no adverse effect on these species, including beaver dam removal. Under some circumstances, beaver dam removal could have a positive effect on these species by restoring runs and reducing siltation. In addition, pond construction by beavers in seep areas and springs could destroy breeding habitat for many of these species where they breed in the headwaters of creeks. In addition, the removal of forest cover such as willows and cottonwoods along stream banks could be detrimental to the darter and shiner. Overall, ARDM activities would not have any adverse effects on these species. Removal of beaver dams could have positive impact depending on the location and timing. Under most circumstances, beaver pond removal would have a positive effect because beaver ponds could disrupt flow and create areas of siltation. However, ARDM activities are unlikely to occur where these species are present. WS concludes that, in general, ARDM will cause "no adverse impacts" on these species, but some could potentially be affected positively.

Greenback Cutthroat Trout. The greenback cutthroat trout, a Federally listed threatened species occurred in much of the Front Range foothills and mountain lakes and streams in the Arkansas and South Platte River systems. Unfortunately, their populations were drastically reduced and they now occupy a small percentage of their original range, in 9 counties from central Colorado to Wyoming in the Platte and Arkansas River systems. This species tends to prefer cold, clear gravelly streams or mountain lakes with an abundance of invertebrates such as freshwater shrimp and insects. This species could be found in beaver ponds if built in streams that they inhabit, and therefore, could be impacted by beaver dam removal with binary explosives. However, the 58 reservoirs that this species currently lives, are typically not associated with areas where WS would conduct beaver dam removal. WS will consult further with USFWS when removing beaver dams in the range of the trout.

Invertebrates

Colorado has 2 invertebrates, butterflies, that are Federally listed T&E species.

Uncompahgre Fritillary Butterfly and Pawnee Montane Skipper. These two butterfly species have very limited ranges in Colorado. The fritillary is found in Hinsdale County at high elevations and is associated with the snow willow. The skipper is found in sparsely wooded grasslands to open pine forests in a four county area along a 12 mile section of the South Platte River near Deckers. Aquatic rodents are not likely to be found in the range of the fritillary, but potentially could be in the range of the skipper. However, habitat selection by these species and small geographic distribution fairly well exclude them from being near ARDM activities. Therefore, WS concludes that ARDM activities will have "no effect" on these species.

Plants

Colorado has 14 Federally listed T&E plants and 5 Federal candidates. Colorado lists about 200 plants as rare, but are not included in this Biological Assessment. The 1992 USFWS Biological Opinion stated that plant species would not likely be affected by any wildlife damage management (WDM) activities with the exception of habitat modifications (USDA 1997). However, beaver damage management, primarily the removal of beaver dams, was not considered in the Biological Opinion and will be discussed here. Declines in many of the listed species has been as a result of habitat modification such as urbanization and recreational activities such as off-road vehicle use.

Mancos Milk-vetch, Osterhout Milk-vetch, Sleeping Ute Milk-vetch, Clay Loving Wild Buckwheat, Dudley Bluffs Bladderpod, Knowlton Cactus, Parachute Beardtongue, Graham Beardtongue, Penland Beardtongue, White River Beardtongue, North Park Phacelia, DeBeque Phacelia, Dudley Bluffs Twinpod, Uinta Basin Hookless Cactus, and Mesa Verde Cactus. These 15 western Colorado species are all mostly associated with sparsely vegetated desert shrub, sagebrush, or pinyon-juniper woodlands growing on steep to moderate slopes of shale talus or clay. Because of these species habitat preference, ARDM will have "no effect" on them.

Slender Moonwart, Colorado Butterfly Plant, and Ute Ladies'-tresses. These Federally listed species are found at various locations in Colorado and are all associated with wetland areas. ARDM activities with the exception of dam removal would not affect these species. Dam removal, either by hand or with explosives, could have a positive or negative impact on these species depending on the timing. If dam removal were associated with restoring pre-existing flows prior to an area becoming an established wetland (about 3-5 years), removal of a dam could be positive because a new dam may flood critical habitat. However, if the dam were removed after an area became an established wetland, it may dry out adjacent soils of the area and, therefore, dry up habitat for these; however, dam removal at this stage would require a Section 404 permit under the Clean Water Act from the Army Corps of Engineers. Currently, WS requires landowners to obtain a permit for established wetlands prior to WS conducting dam removal. WS removes only beaver dams that are "relatively new" (usually less than 5 years old) and have not yet become an established wetland. In addition, the streams, drainage ditches or other waterway is returned to its original function and flow rate. Therefore, WS concludes that current ARDM practices, including dam removal, are "not likely to adversely affect" these species.

Penland Alpine Fen Mustard. This species is found in alpine tundra areas in the Mosquito Range of Park and Summit Counties. This species is associated with wetlands in the alpine tundra as it is typically rooted in mosses of stream banks. However, aquatic rodents are not usually found in alpine tundra areas and, therefore, WS concludes that ARDM activities will have "no effect" on this species.

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