ENVIRONMENTAL ASSESSMENT

Reducing Aquatic Rodent Damage Through an Integrated Wildlife Damage Management Program In the State of Georgia

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ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

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ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
ARD	Aquatic Rodent Damage
ARDM	Aquatic Rodent Damage Management
AVMA	American Veterinary Medical Association
BCAP	Beaver Control Assistance Program
BO	Biological Opinion
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year
GADNR	Georgia Department of Natural Resources
GADOT	Georgia Department of Transportation
GFC	Georgia Forestry Commission
GPRA	Government Performance & Results Act
HSUS	Humane Society of the United States
IWDM	Integrated Wildlife Damage Management
MDOT	Mississippi Department of Transportation
MDWF&P	Mississippi Department of Wildlife Fisheries and Parks
MFC	Mississippi Forestry Commission
MIS	Management Information System
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NOA	Notices of Availability
NRCS	Natural Resource and Conservation Service
NWCO	Nuisance Wildlife Control Operator
NWP	Nationwide Permit
PETA	People for the Ethical Treatment of Animals
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

WS Wildlife Service

Chapter 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife which increases the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for all wildlife. This protection can create localized conflicts between human and wildlife activities. The Animal Damage Control (ADC) Program Final Environmental Impact Statement (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (USDA) 1997):

> *"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally 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 value 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."*

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and recognized as an integral part of wildlife management (The Wildlife Society 1992). Wildlife Services (WS) uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (WS Directive 2.105[1]). IWDM is described in Chapter 1:1-7 of the EIS (USDA 1997). Integrated Pest Management is a combination of methods which may be used or recommended for use to reduce wildlife damage. These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may require that the local populations of offending animal(s) be reduced through lethal means.

Biological carrying capacity is the land or habitat limit for supporting healthy populations of wildlife without degradation to animal health or the environment over an extended period of time (Decker and Purdy 1988). Wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations (Decker and Purdy 1988). These terms are especially

[1] WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

important in urban areas because they define the sensitivity of a local community to a specific wildlife species. For any given wildlife damage situation, there will be varying thresholds of tolerance by those directly and indirectly affected by the damage. This threshold of damage is a primary limiting factor in determining the wildlife acceptance capacity. While Georgia has a biological carrying capacity to support more than the current number of beaver (*Castor canadensis*) and muskrats (*Ondatra zibethicus*), the wildlife acceptance capacity is often much lower. Once the wildlife acceptance capacity is met or exceeded, people will begin to implement wildlife population management and damage reduction methods, including lethal management methods, to alleviate property damage and to protect public health and safety.

This environmental assessment (EA) documents the analysis of the potential environmental effects of a proposed Georgia WS beaver and muskrat damage management program to achieve a balance between biological carrying capacity and cultural carrying capacity. This analysis relies mainly on existing data contained in published documents (Appendix A), including the EIS (USDA 1997). USDA (1997) may be obtained by contacting the USDA, Animal and Plant Health Inspection Service (APHIS), WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS is the federal agency directed by law and authorized to protect American resources from damage associated with wildlife (Act of March 2, 1931, as amended 46 Stat. 1486; 7 United States Code (USC) 426-426c and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 USC 426C), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767). To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial, and natural resources, property, and public health and safety. WS' activities are conducted on private and public lands in cooperation with federal, state, and local agencies, private organizations and individuals. Wildlife damage management is not based on punishing offending animals; however, it is one means of reducing damage and used as part of the WS Decision Model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public.

Normally, according to APHIS procedures for implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions may be categorically excluded (7 Code of Federal Regulations (CFR) 372.5(c), 60 Fed. Reg. 6,000- 6,003, (1995)). WS has decided in this case to prepare this EA to facilitate planning, interagency coordination, and streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed and planned IWDM program. All wildlife damage management that would take place in Georgia would be undertaken according to relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). Notice of the availability of this document will be published in newspapers consistent with the agency=s NEPA procedures.

WS is a cooperatively funded, service-oriented program from which other governmental agencies and entities may request assistance. Before any wildlife damage management is conducted, Cooperative Agreements, Agreements for Control or other comparable documents are completed. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. WS' mission, developed through its strategic planning process, is: 1) *"to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety."* WS' Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- X Training of wildlife damage management professionals;
- X Development and improvement of strategies to reduce losses and threats to humans from wildlife;
- X Collection, evaluation, and dissemination of management information;
- X Informing and educating the public on how to reduce wildlife damage;
- X Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1999).

1.1 HISTORICAL AQUATIC RODENT DAMAGE MANAGEMENT

Historically, beaver populations were managed by subsistence, commercial hunting, and trapping (Hill 1976, Woodward 1983, Novak 1987a). Muskrat meat has been commonly used for human consumption and in some areas called by names such as "marsh rabbit." However, following the decimation of the beaver population in the late 1800's and early 1900's, number of beaver trappers declined. By the time trapping seasons were reopened, not only were beaver trappers scarce, but demands for short-haired fur were low. Consequently, little beaver trapping was done. Absence of an adequate beaver harvest in conjunction with insignificant non-human predation and an abundance of suitable habitat resulted in beaver populations reaching levels where the animals were considered pests (Woodward 1983, Woodward et al. 1985). Subsequent decline in fur prices in the early 1980's led to further increases in beaver populations, with beaver damage reaching epidemic proportions in some areas.

Beaver in Georgia have followed a similar trend. The entire area of Georgia was reported to be practically devoid of beaver in 1953, with minimal populations reported along the Chattahoochee, Flint, Ocmulgee and Altamahah Rivers. Populations began increasing, and by 1959 beaver were reported to be present across much of the state (GADNR Technical Bulletin WL 2). Increasing numbers of complaints regarding beaver damage prompted the Georgia Forestry Commission (GFC) to conduct damage surveys in 1960 and 1967. A GFC report in 1975 revealed significant economic losses to timber growers in the state (Godbee and Price, 1975).

A variety of attempts have been made to reduce damage caused by beaver in the southeastern

United States. For example, a Beaver Cooperative Association formed in Mississippi in 1977 showed promise for reducing beaver damage by increasing the marketability of beaver pelts, but eventually failed due to low pelt values on international markets (Woodward 1983). In North Carolina, a cooperative program between various agencies attempted to reduce beaver damage by allowing trappers to harvest more valuable furs (Woodward 1983). This cooperative program showed promise but failed due to the decline in the fur markets in the early 1980's. The North Carolina WS program has a cooperative beaver damage management program that includes North Carolina Wildlife Resource Commission, State highway department, soil and water conservation districts, municipalities, and private landholders, all who collectively funded 86% of the 2000 program. In 2000, North Carolina WS beaver damage management saved an estimated $8.5 million in forestry and agricultural resources, waterways, highway infrastructure, and other property (J. Heisterberg, USDA/APHIS/WS, personal communication).

Responding to constituent's complaints and requests in Mississippi, the 1989 Mississippi Legislature created the beaver control advisory board. This board is comprised of the heads of the cooperating state agencies and is mandated to develop a program that ensures the management of beaver damage. In cooperation with the USDA/APHIS/WS program, the advisory board developed the Beaver Control Assistance Program (BCAP). Mississippi WS BCAP is 68% collectively funded by Mississippi Department of Transportation (MDOT), Mississippi Department of Agriculture and Commerce, Mississippi Forestry Commission (MFC), County governments, and private landowners. Federally allocated funds make up the remaining 32% of the budget. Mississippi WS BCAP has saved a reported $24 million in state and county road infrastructures, timber, agricultural resources, and other property from 1993-2000 (B. Sloan, USDA/APHIS/WS, personal communication).

The Georgia Wildlife Services program currently has no large-scale beaver management contracts with state or county governments or GADOT, but rather conducts site-specific projects when requests for assistance are received and Agreements for Control are secured. All projects are 100% funded by the cooperator. Typical beaver damage management operations conducted by Georgia WS last between one to two weeks duration for the purpose of removing a localized population (or populations) of beaver causing site-specific damage. Cooperators requesting assistance with beaver damage abatement include timber companies, private landowners, homeowners, homeowners' associations, city and county governments, railroad companies, golf courses, military air bases and civilian airports. Data compiled from FY 2000 to FY 2002 under the Government Performance and Results Act reveals that the Georgia WS program's beaver damage management activities saved an estimated $1,281,210.00 in state and local road infrastructures, timber, agricultural resources and other property.

Requests for assistance with muskrat damage management in Georgia currently are minimal in number and sporadic in nature. Georgia WS muskrat projects are similar to beaver projects in that localized populations of animals causing site-specific damage are targeted. Cooperators requesting assistance typically include private landowners, homeowners, homeowners' associations and golf courses.

1.2 BEAVER AND MUSKRAT ACTIVITY IMPACTS TO THE ENVIRONMENT AND SOCIETY ATTITUDES

1.2.1 Benefits of Beaver

Beaver are found throughout most of North America including Canada, Alaska, all 48 contiguous states, and Northern portions of Mexico (Deems and Pursley 1978). Once considered an animal near extinction (Seton 1953, Hill 1976, Wesley 1978), its status has changed, and beaver are now viewed as a pest species in many southeastern states (Hill 1976, 1982, Jones and Leopold 2001). 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. 1967a, b, Reese and Hair 1976) and economic gains from fur production (Moore and Martin 1949, Hill 1974, Arner and Dubose 1978a, b) 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).

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, Pullen 1967). The resulting wetland habitat may be beneficial to some fish, reptiles, amphibians, waterfowl, shorebirds, and furbearers such as muskrats, otter and mink (Arner and DuBose 1982, 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 1982, Hill 1982, Arner and Hepp 1989, Medin and Clary 1990, Medin and Clary 1991). 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 threatened and endangered (T&E) species. The United States Fish and Wildlife Service (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 1982). 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 1987a).

1.2.2 Benefits of Muskrats

Muskrats are a native North American aquatic rodent and the largest microtine rodent in the United States. Muskrats live in aquatic habitats and are well adapted for swimming. Large hind feet of muskrats are partially webbed with stiff hairs aligning the toes. Tails are laterally flattened and almost as long as body length. Muskrats have a stocky appearance, with small eyes and very short, rounded ears. Front feet, which are much smaller than hind feet, are adapted primarily for digging and feeding. The overall length of adult muskrats is usually from 18 to 24 inches.

Muskrats are found scattered in suitable habitat throughout Georgia inhabiting creeks, rivers, lakes, ponds and drainage ditches. Muskrats prefer areas with a steady water level and feed primarily on cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), aquatic grasses and freshwater mussels. Historically, muskrats have been the most heavily utilized furbearer in North America with 6-20 million harvested annually since about 1935 (Boutin and Birkenholz 1987). Muskrats not only have economic value from the sale of their meat and pelt, but they are an indigenous species to North America that fill an important niche in the ecosystem. Muskrats provide opportunities for recreation and satisfaction to people that like to observe wildlife in a natural setting. In the prairie pothole region of the U.S. and Canada, 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.

1.2.3 Damage from Beaver Activities

Beaver are an important part of the wildlife heritage of Georgia. In Georgia, the reintroduced beaver population exhibited a growth pattern similar to many states and Canadian provinces. This beaver population expansion has created a negative economic impact in North America (Novak 1987a).

Identifying beaver damage is generally not difficult. Most of the damage caused by beaver is a result of dam building, bank burrowing, tree cutting and girdling, obstructing overflow structures and spillways and flooding. Some cases of beaver damage include state highways being flooded, reservoir dams being destroyed by bank dens and burrows, and train derailments being caused by continued flooding and burrowing (Miller and Yarrow 1994). Housing developments also have been threatened by beaver dam flooding and small bridges have even been destroyed because of beaver dam construction. Miller (1983) estimated that the annual damage in the United States was $75-$100 million. The value of beaver damage is perhaps greater than that of any other single wildlife species in the United States. Economic damage was estimated to have exceeded $4 billion in the southeastern United States over a 40-year period (Arner and Dubose 1979). In some southeastern states, losses from beaver damage have been estimated from $3 to 5 million annually (Miller and Yarrow 1994), with timber losses being reported as the most common type of damage (Hill 1982). Tracts of bottomland hardwood timber up to several thousand acres in size may be lost due to normal beaver activity (Miller and Yarrow 1994). Surveys in North Carolina and Alabama indicate the majority of landowners with beaver damage on their property desire damage management via beaver removal (Hill 1976, Lewis 1979, Woodward et al. 1985). Loker et al. (1999) found that suburban residents also may desire lethal management methods to resolve beaver damage conflicts. Such conflicts, which are viewed as "damage," result in adverse impacts that often outweigh benefits (Miller and Yarrow 1994).

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. Beaver dams may 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 Louisiana pearlshell (*Margaritifera hembeli*), which requires clear, free-flowing water to survive (D. LeBlanc, USDA/APHIS/WS, personal communication).

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). Evans (1948) suggested a continued increase in beaver populations in Minnesota would probably result in deterioration of streams for trout. 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.

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 have only a few natural predators aside from humans, including coyotes, bobcats, river otter, bears and mink, who prey on the young (Miller and Yarrow 1994). In some areas, mountain lions, wolves, and wolverines also may prey on beaver.

WS beaver damage management efforts in are primarily conducted for the purpose of minimizing damage to roadways (State and county), urban and suburban properties, agricultural and timber resources, and railroad infrastructures (Table 1.1). In some cases, efforts are aimed at protecting wildlife habitat which is degraded due to beaver related flooding and dam building. WS personnel use a variety of methods for reducing beaver damage which allows for greater flexibility and increased opportunity to formulate an effective strategy for each request (see Appendix D).

Table 1.1. Combined number of direct control (DC) and technical assistance (TA) projects involving beaver and muskrats conducted by Georgia WS.

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
# DC started	33	44	37	51	31	30	51	51	40	49
# TA projects	99	34	31	60	57	55	45	63	59	45

acreage worked	2,070	12,314	1,453	2,454	3,976	15,166	6,016	7,662	4,424	7,181
% acre of state	0.0056	0.0332	0.0039	0.0066	0.0107	0.0409	0.0162	0.0206	0.0119	0.0193

1.2.4 Damage from Muskrat Activities

Economic loss due to muskrat damage can be very high, particularly in aquaculture production areas. In some states damage may be as much as $1 million per year (Miller 1994). Elsewhere, economic losses caused by muskrats may be limited and confined primarily to burrowing in farm pond dams or feeding on desirable plants. In such areas where pond levee or dam integrity is threatened, cost of the damage often outweighs value of the muskrat population. Costs associated with replanting or loss of already established plants also have a higher value than muskrat populations.

Although muskrats are mainly herbivorous, other animals often comprise part of their diet (Perry 1982). Schwartz and Schwartz (1959), Neves and Odom (1989), and Miller (1994) reported muskrat diets consisting of mussels, clams, snails, crustaceans (i.e., crawfish) and young birds. Regular daily activities of muskrats result in much of the conflict with man and economic loss is often associated with muskrat feeding. Muskrats also cause damage by digging burrows into banks, levees or higher ground for denning (Perry 1982, Linzey 1998).

Damage caused by muskrats is usually not a major problem, but can be important in particular situations (Wade and Ramsey 1986). Aquaculture reservoirs often lack aquatic vegetation which makes muskrat runs and burrows, remains of mussels, crawfish and fish from muskrat feeding, and other muskrat sign easy to observe. Much of the damage caused by muskrats is due primarily to burrowing in dikes, dams, ditches, ponds and shorelines (Perry 1982, Miller 1994, Linzey 1998). Muskrats dig burrows with underwater entrances along the shoreline which may not be readily evident until serious damage has occurred. When the water level drops, muskrat holes are often expanded to keep pace with the retreating water level. Additionally, when water levels rise, muskrats expand the burrows upward. Muskrat burrows can collapse when walked upon by people or animals or crossed over with heavy equipment (i.e. mowers, tractors). Muskrat damage often can be more difficult to detect on farm ponds with heavy vegetation than on aquaculture ponds.

Where damage is occurring to crops, plant cutting is generally evident. Muskrats eat a variety of natural emergent vegetation (Linzey 1998) and cultivated crops (Perry 1982). Some of the cultivated crops eaten by muskrats include corn, alfalfa, carrots, rice and soybeans. When muskrats become over-populated, generally an "eat-out" occurs and the feeding area is ruined for a number of years (O'Neil 1949). An "eat-out" occurs when vegetation and soil-binding roots are consumed which results in loss of vegetation, food and cover for muskrats and other wildlife. Marsh damage from muskrats is inevitable

when areas heavily populated by muskrats are under-trapped (Lynch et al. 1947). "Eat-outs" are beneficial to some bird species; however, "eat-outs" result in stagnant water which predisposes the same birds to diseases (Lynch et al. 1947).

Muskrat burrowing activity can seriously weaken man-made dams and levees (Perry 1982). Burrowing activities can result in dams leaking or blowing out. Other common types of damage for which assistance is commonly requested include burrowing in waterfront lawns and yards, creating cave-ins, shoreline derogation and damage to dams used to hold water or to control water flow. Burrows can cause washouts which result in loss of water or flood damage. These situations can cause the loss of crops from the lack of water or flooding (Wade and Ramsey 1986). Restoring recreational fisheries and rebuilding damaged dams and levees can be extremely costly.

WS muskrat damage management efforts in Georgia are primarily conducted for the purposes of minimizing damage to urban and suburban properties, roadways (State and county), agricultural and timber resources and railroad infrastructures (Table 1.1).

1.2.5 Public Health and Safety Risks from Beaver and Muskrat Damage

Beaver and muskrat activity in certain situations can become a threat to public health and safety (e.g. 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 (DeAlmeida 1987, Loeb 1994). Beaver damming activity may also create conditions favorable to mosquitoes 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 encephalitis (Mallis 1982). In addition, beaver, which are carriers of the intestinal parasite *Giardia lamblia*, can contaminate human 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). Giardiasis is a disease caused by the intestinal parasite *Giardi lamblia*, which may be carried by beaver and muskrats and may cause disease in humans (Davidson and Nettles 1997, Beach and McCullough 1985, Miller and Yarrow 1994, Erlandsen et al. 1990). Although most outbreaks of giardiasis are attributable to the contamination of water supplies by human waste (Erlandsen et al. 1990), animals have also been incriminated as the source of the parasite in some outbreaks (Davidson and Nettles 1997). Beaver have specifically been linked with the occurrence of *G. lamblia* at some sites (Davidson and Nettles 1997). Beaver also 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). 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 Animal Control, personal communication). Furthermore, damming of streams sometimes increases the number of aquatic snakes, including the poisonous cottonmouth (*Agkistrodon piscivorus*) (Wade and Ramsey 1986).

1.3 SCOPE AND PURPOSE OF THIS EA

Scope and purpose of this EA is to evaluate the potential impact from Georgia WS aquatic rodent damage management (ARDM) to protect agricultural and natural resources, property, roads, bridges, railroads and public health and safety. Aquatic rodent damage problems can occur throughout the State which results in requests for WS assistance. Under the Proposed Action, aquatic rodent damage management could be conducted on private, federal, state, tribal, county and municipal lands in Georgia. Georgia encompasses 37,068,000 acres that is divided into 159 counties. WS anticipates that the proposed action would occur on no more than 1.0% of the total land in Georgia (Table1.1), and no more than 1,000 beaver and 250 muskrats would be lethally removed by Georgia WS annually. Currently Georgia WS has 8 Wildlife Specialists conducting IWDM to solve beaver and muskrat problems and to help alleviate damage throughout the state.

1.4 NEED FOR ARDM IN GEORGIA

The need for action in Georgia is based on the necessity of a program to protect: 1) agricultural and natural resources, 2) property, 3) roads, bridges, and railroads and 4) public health and safety from beaver and muskrat damage. Beaver and muskrat populations can have a negative economic impact in Georgia. State agencies in Georgia provide no direct assistance to landowners with beaver and muskrat damage management due to time and funding constraints and a lack of expertise. Similarly, private trappers and nuisance wildlife control operators (NWCO) may prove inadequate for reducing aquatic rodent damage due to potential high costs to landowners, low number of licensed trappers and NWCO's relative to the land area of Georgia, and lack of expertise in aquatic rodent damage management.

Conflicts between humans and wildlife are common throughout Georgia. Georgia WS tracks complaints through the Management Information System (MIS). MIS data is limited to information that is collected from people who have requested services or information from Wildlife Services. It does not include requests received or responded to by local, State or other Federal agencies, and it is not a complete database for all wildlife damage occurrences. The number of requests for assistance does not necessarily reflect the extent of need for action, but this data does provide an indication that needs exists.

A review of MIS data from 1993 to the present in Georgia shows that beaver have ranked in the top 3 wildlife species generating damage complaints each year during this 10-year period. White-tailed deer and Canada geese are the other species which consistently ranked in the top 3 annually. Evaluation of GADNR wildlife complaint data for the years 1993 to 1999 shows that

beaver consistently ranked 2nd in number of complaints generated annually (GADNR Technical Guidance Report). Recent comprehensive surveys of beaver and muskrat damage in Georgia have not been conducted. However, Georgia WS has compiled verified damage estimates and reported damage estimates caused by aquatic rodents. Damage estimates are reported as economic loss ($) perceived by property and resource owners or managers who requested WS assistance (Table 1.2).

Table 1.2. Combined aquatic rodent damage (ARD) verified by or reported to Georgia WS, Fiscal Years 1994-2002.

	Combined ARD Verified $ Damage	Combined ARD Reported $ Damage	TOTAL AMOUNT
1994	500	0	500
1995	10,000	0	10,000
1996	163,301	0	163,301
1997	78,900	2,200	81,100
1998	26,899	8,100	34,999
1999	67,000	9,100	76,100
2000	6,000	28,500	34,500
2001	7,007	43,115	50,122
2002	16,154	460,900	477,054

Damage data obtained from Management Information System (MIS) from 1994 through 2002 are summarized (Table 1.2). These data represent only a portion of the total damage caused by beaver and muskrats because not all people who experience such damage request assistance from WS (Loven 1985).

1.5 PROPOSED ACTION

The proposed action is for Georgia WS to continue the current integrated beaver and muskrat damage management program for the protection of agricultural and natural resources, property, public health and safety, roads, bridges and railroads on all lands in Georgia where a need exists and a request is received. An IWDM approach would be used, including technical assistance recommendations and operational damage management assistance, and would consider all legal and appropriate ARDM methods either used singly or in combination to meet the cooperator's needs for reducing damage. Non-lethal methods include environmental/habitat modification,

cultural practices, animal behavior modification and repellents. Lethal and non-lethal methods include shooting, zinc phosphide bait for muskrats, leg-hold traps, cage type traps, snares, colony traps, snap traps and body-gripping (e.g., Conibear) traps. Aquatic rodents captured in non-lethal devices (leg-hold traps, snares, cage traps, etc.) would subsequently be euthanized. Beaver dams would be breached/removed using binary explosives or by hand digging. Beaver and muskrat damage management would be conducted in the State, when requested, on private or public property after an *Agreement for Control* or other comparable document has been completed. Management actions would be consistent with other uses of the area and would comply with appropriate federal, state and local laws and in cooperation with other governmental agencies and tribal governments. (See Chapter 3 for a more detailed description of the current program and the proposed action).

1.6 OBJECTIVES FOR THE GEORGIA WS BEAVER AND MUSKRAT DAMAGE MANAGEMENT PROGRAM

1. Resolve as many beaver and muskrat damage problems that time and labor will allow.
2. Respond to individual damage complaints within a reasonable time period.
3. Maintain the take of non-target otters (*Lutra canadensis*) below 5% of the total annual take during beaver and muskrat damage management operations.

1.7 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

ADC Programmatic EIS

WS has issued a final EIS (USDA 1997) and Record of Decision on the National APHIS-WS program. Pertinent information available in the EIS has been incorporated by reference into this EA.

1.8 DECISIONS TO BE MADE

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

X Should WS continue to implement an IWDM strategy, including non-lethal and lethal damage management methods, to meet the objectives for beaver and muskrat damage management in Georgia?

X If not, should WS attempt to implement one of the alternatives to an IWDM strategy as described in the EA?

X Would the proposed action have significant impacts on the quality of the human environment requiring preparation of an EIS?

1.9 SCOPE OF THIS EA ANALYSIS

1.9.1 Actions Analyzed

This EA evaluates planned beaver and muskrat damage management to protect: 1) property, 2) agricultural and natural resources, 3) roads, bridges, railroads and 4) public health and safety in Georgia. Protection of other resources or other program activities will be addressed in other NEPA analyses, as appropriate.

1.9.2 Wildlife Species Potentially Protected by Georgia WS

Georgia WS assistance may be requested to achieve management objectives for wildlife, including T&E species. If other needs are identified, a determination would be made on a case-by-case basis if additional NEPA analysis is needed.

1.9.3 American Indian Lands and Tribes

There are no American Indian tribes currently registered in Georgia and as such WS has no MOU's or signed agreements with any American Indian tribe in Georgia. If WS enters into an agreement with a tribe for beaver or muskrat damage management, this EA would be reviewed and supplemented if appropriate to ensure compliance with NEPA.

1.9.4 Period for which this EA is Valid

This EA would remain valid until Georgia WS and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year to ensure that the EA is sufficient.

1.9.5 Site Specificity

This EA analyzes the potential impacts of beaver and muskrat damage management and addresses WS ARDM activities on all lands in Georgia under MOUs, Cooperative Agreements/and or agreements for control and in cooperation with the appropriate public land management agencies. It also addresses the impacts of ARDM on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested within the constraints of available funding and workforce, it is conceivable that additional wildlife damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of mammal damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area.

Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where mammal damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever beaver and muskrat damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Georgia (see Chapter 3 for a description of the Decision Model and its application).

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within the State of Georgia. In this way, APHIS-WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission.

1.9.6 Summary of Public Involvement

As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through a *Notice of Availability* (NOA) published in local media and through direct mailings of NOA 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.

1.10 PREVIEW OF THE REMAINDER OF THIS EA

The remainder of this EA is composed of four (4) chapters and seven (7) appendices. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, mitigation and SOPs. Chapter 4 analyzes consistency with environmental consequences and 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 used during the preparation of this EA, Appendix B is the authorities for conducting wildlife damage management in Georgia, Appendix C describes criteria for beaver dam breaching/removal and Appendix D is a detailed description of the methods used for ARDM. Appendix E is the USFWS list of Federal Threatened and Endangered Species occurring in Georgia. Appendix F is the GADNR list of State Protected Species. Appendix G is a copy of the letter of concurrence issued by USFWS Ecological Services in regards to the Biological Evaluation of potential effects of ARDM activities on Federally listed T&E species in Georgia.

Chapter 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues, including issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues used to develop mitigation measures and SOPs, and issues not considered in detail, with the rationale. Pertinent portions of the affected environment are included in this chapter in the discussion of issues used to develop mitigation. Additional affected environments are incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the current program in Chapter 3.

2.1 AFFECTED ENVIRONMENT

Upon request for assistance, aquatic rodent damage management could be conducted on private, federal, state, tribal, county and municipal lands in Georgia to protect agricultural and natural resources, property, roads, bridges, railroads and public health and safety. Areas of the proposed action could include state and interstate highways and roads, and railroads and their right-of-ways where beaver and muskrat activities cause damage. Areas may also include property in or adjacent to subdivisions, businesses and industrial parks where beaver impound water and gnaw or fell trees. Additionally, affected areas could include timberlands, croplands and pastures that experience financial losses from beaver flooding or gnawing. The proposed action also could include private and public property where beaver and muskrat burrowing causes damage to dikes, ditches, ponds and levees, and where feeding causes agricultural crop losses and negatively impacts wildlife, including T&E species.

2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

The following are issues that have been identified as areas of concern requiring consideration in this EA and were used to develop mitigation measures:

1. Effects on beaver and muskrat populations,
2. Effects on plants and other wildlife species, including T&E species,
3. Effects on public and pet health and safety,
4. Humaneness of methods to be used,
5. Effects on wetlands,
6. Economic losses to property, and
7. Impacts to stakeholders, including aesthetics.

2.2.1 Effects on Beaver and Muskrat Populations

Some citizens are concerned that the proposed action or any of the alternatives would result in the loss of local beaver and muskrat populations or could have a cumulative adverse impact on regional or statewide beaver and muskrat populations. The most

beaver and muskrat annually removed by Georgia WS were 334 beaver in fiscal year (FY) FY1997 and 61 muskrats in FY1999. Based upon current and anticipated increase of work, Georgia WS expects that no more than 1,000 beaver and 250 muskrats would be removed annually while conducting WS direct control activities within the state. The Georgia Department of Natural Resources (GADNR) has determined that there is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management will be detrimental to the survival of the beaver and muskrat populations in the state of Georgia (GADNR, letter to WS, 7/1/03).

2.2.2 Effects on Plants and other Wildlife Species, including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is that the proposed action or any of the alternatives would result in removing additional wildlife species beyond the scope of the particular project or adversely impact populations of plants or other wildlife, particularly T&E species.

To reduce the risks of adversely affecting non-target species, WS would select damage management methods that are as target-selective as possible or WS would apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating trapping or control, WS would select sites which are extensively used by the target species and use baits or lures which are preferred by the target species. WS' mitigation and SOPs are designed to reduce the effects on non-target species and are presented in Chapter 3.

The removal of beaver and muskrats and breaching/removing beaver dams on a site could be beneficial to some plant and wildlife species, including T&E species.

2.2.2.1 Effects on Non-target Wildlife Species (non-T&E Species)

Non-target species such as nutria, otters, raccoons, turtles and alligators may occasionally be captured in traps and snares. Muskrats are normally considered to be non-target species when conducting beaver damage management projects in Georgia unless the resource owner requests removal of muskrats. Healthy, uninjured non-target animals that are captured would be released unharmed at the capture site. A relatively small number of non-target animals may be captured and killed by Georgia WS annually (Table 2.1). As seen in Table 2.1, number of non-target furbearers incidentally taken by Georgia WS from FY 1993-2002 is far less than the number of furbearers harvested by licensed trappers during Georgia's regulated trapping season. WS does not expect the rate of WS non-target species take to substantially increase above current or past program levels under the proposed action or any of the alternatives. WS has concluded that non-target animals killed by the Georgia WS program would have no adverse effects on any native wildlife species population in Georgia. GADNR concurs that Georgia WS would have no adverse effects on native wildlife populations in Georgia (GADNR, letter to WS, 11/19/03.

Table 2.1. Estimated state harvest and Wildlife Services (WS) take of non-target animals in Georgia while conducting ARDM from 1993 through 2002.[1]

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Estimated state harvest of nutria	0	4	12	13	21	28	0	0	2	2
WS nutria (killed)	0	0	0	0	0	0	0	0	0	0
WS nutria (freed)	0	0	0	0	0	0	0	0	0	0
Estimated state harvest of muskrats	629	658	761	496	991	973	705	447	293	296
WS muskrats (killed)	0	0	0	0	0	3	2	0	1	0
WS muskrats (freed)	0	0	0	0	0	0	0	0	0	0
Estimated state harvest of river otters	380	559	909	1029	1101	1103	804	912	1218	833
WS river otters (killed)	0	0	0	0	0	3	4	3	1	9
WS river otters (freed)	0	0	0	0	0	0	0	0	0	0
Estimated state harvest of raccoons	3549	3971	5046	5937	8904	6646	5964	4666	6991	7089
WS raccoons (killed)	0	0	0	0	0	1	0	4	2	0
WS raccoons (freed)	0	0	0	0	1	0	0	2	0	1
Estimated state harvest of turtles	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
WS turtles (killed)	0	0	0	0	4	32	0	9	9	14
WS turtles (freed)	0	12	0	0	0	3	0	7	2	11
Estimated state harvest of American alligators	325	514	541	465	426	339	473	514	367	n/a
WS American alligators (killed)	0	0	0	0	0	0	0	0	0	0
WS American alligators (freed)	0	0	0	0	0	0	0	0	0	0

[1] WS takes presented in this table include only animals that were classified as unintentional take/non-target species incidentally captured during beaver damage management projects. Harvest numbers for WS intentional take/target species are listed in Table 4.1

2.2.2.2 Effects on T&E Species (Plants and Animals)

There are currently 64 federally listed T&E species in Georgia (42 animals and 22 plants) according to USFWS.

Beaver dams can adversely impact stream ecosystems by impounding habitat and increasing sedimentation and consequently affect wildlife that depend on clear water, such

as certain T&E species of fish and mussels. In Georgia, these species may include the Southern Acornshell, Southern Clubshell, Upland Combshell, Alabama Moccasinshell, Coosa Moccasinshell, Southern Pigtoe, Finelined Pocketbook, Triangular Kidneyshell, Amber Darter, Cherokee Darter, Etowah Darter, Goldline Darter, Snail Darter, Conasauga Logperch and Blue Shiner.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of wildlife damage management methods on T&E species and has obtained a Biological Opinion (BO). For the full context of the BO, see Appendix F of the ADC EIS (USDA 1997). WS also is in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed.

WS consulted with the USFWS concerning potential impacts of beaver and muskrat damage management methods on T&E species in Georgia. The USFWS concurred that Georgia WS beaver damage management methods are not likely to adversely affect threatened or endangered species or their critical habitats in Georgia (USFWS, letter to WS, 11/14/03). WS has obtained and reviewed the list of Georgia State listed protected species and has determined that the proposed WS ARDM program will not adversely affect any of the species listed in Georgia. The GDNR concurs with this determination (GADNR, letter to WS, 11/19/03).

2.2.2.3 Effects on Native Plant Species

Removal of beaver and muskrats and breaching/removing beaver dams would be beneficial to some native plant species that may be killed by foraging aquatic rodents and beaver related flooding and inundation. Increased soil moisture associated with excess flooding may result in reduced plant or timber growth and vitality and could be detrimental to some wildlife species through a decrease in mast (e.g., acorn, hickory nut) production.

2.2.3 Effects on Public and Pet Health and Safety

A common concern is whether the proposed action or any of the alternatives pose an increased threat to public and pet health and safety. In particular, there is concern that the lethal and non-lethal methods of beaver and muskrat removal (i.e., trapping, shooting, chemical toxicants) and explosives used in dam removal may be hazardous to people and pets. Another common concern is that continued increases in beaver and muskrat populations might threaten public and pet health or safety. WS' SOPs include measures intended to mitigate or reduce the effects on human and pet health and safety and are presented in Chapter 3.

Firearms and firearms misuse are very sensitive and raise public concern because of issues

relating to public safety and accidental injury or death. To ensure safe use and awareness of firearms, 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 2 years afterwards (WS Directive 2.615). WS employees who use firearms as a condition of employment are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

All chemicals used by APHIS/WS are regulated by the EPA through the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

WS personnel responsible for use of explosives are required to complete in-depth training and must demonstrate competence and safety with use of explosives. Employees adhere to WS policies as well as regulations from the Bureau of Alcohol, Tobacco, and Firearms, the Occupational Safety and Health Administration and the Department of Transportation with regards to explosives use, storage, safety, and transportation. WS uses binary explosives which require the mixing of two components before actuation. Binary explosives reduce the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives are not allowed. When explosives are being used by WS, warning signs are posted to restrict public entry. When beaver dams are near roads or highways, police or other road officials are used to help stop traffic and restrict public entry. GADOT crews often assist with traffic concerns to ensure public safety when WS removes beaver dams with explosives. Therefore, no adverse effects to public safety are expected from the use of explosives by WS under any alternative.

2.2.4 Humaneness of Methods to be Used

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.

The AVMA (Andrews et al. 1993) states, *AKill traps are practical and effective for animal collection when used in a manner that minimizes the potential for attraction and collection of non-target species.@* It appears the AVMA (Andrews et al. 1993) is not objecting to the use of kill traps. In addition, the American Society of Mammalogists recommends using kill traps for medium-sized animals in field investigations (Baker et al. 1987). Also, Conibear (kill traps) have passed the International Humane Trapping Standards for beaver and muskrat (Fur Institute of Canada 2000).

The basic problem associated with animal traps is a lack of defining *Ahumaneness@* as it relates to animal cruelty (Proulx and Barrett 1991). The definition of humaneness varies among people and cultures. Proulx (1999) reported on state of the art trap technology on the basis of the most stringent animal welfare performance criteria used to date. This criteria established that animals be rendered irreversibly unconscious in < 3 minutes; this standard was initially set for 10-minutes before being reduced to 3 minutes (FPCHT 1981). However, this later standard did not consider human safety. Initially, conibear traps were classified as state of the art trapping devices and later were judged to have failed state-of-the art trapping device standards (Proulx 1999). Novak (1981) found when the striking bars of 330 conibear traps were bent inward, the time to death for beaver was 7 - 9 minutes. However, this modification leaves no space between the striking bars. Proulx et al. (1995) modified 330 conibear traps by welding clamping bars to the striking bars. This results in a trap of similar appearance as Novak (1981) with its bent jaws. A trap modified with clamping bars strikes with 20% more force than a standard 330 conibear trap. Since people using the conibear trap occasionally catch their hands, the full force of the trap would strike the hand, and most likely cause injury. We consider this modification, while more beneficial for animal welfare considerations, a detriment to human safety. While WS is willing to use kill traps that more quickly kill animals, we are unwilling to put our employees or the public at risk for potentially serious injury.

In May 2000, the Canadian government determined standard and modified 330 Conibear traps met the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000) for beaver. They also determined that leg-hold traps with a submersion system, 110 Conibear traps in water and 120 Conibear traps on land meet the Agreement on International Humane Trapping Standards (Fur Institute of Canada 2000). In summary, the Canadian government has determined that standard and modified 330 Conibear traps, 110 and 120 Conibear traps, and leghold traps on submersion systems met international humane trapping standards, the American Society of Mammologists recommended kill traps for medium-sized animals, and the AVMA is not opposed to kill traps for wildlife.

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 the acceptance of 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.

2.2.5 Effects on Wetlands

Some people are concerned about the effects of the alternatives on the wetland ecosystem and removal of beaver or breaching/removing beaver dams from an area will result in the loss of wetland habitat and the plant and animal species included in those habitats.

Beaver build dams primarily in smaller riverine wetlands (intermittent and perennial streams and creeks) with dams consisting of mud, sticks and other vegetative materials. Dams obstruct the normal flow of water and typically change the preexisting wetland hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment. 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 public property such as roads, bridges and water management facilities. Activities also are conducted to enhance or reclaim wildlife and stream fishery/mussel habitats. Normal operations of WS routinely incorporate beaver removal with dam breaching/removing and/or installation of water control devices and beaver exclusion devices. Dams are breached /removed by hand when possible, or small charges of binary explosives are used as necessary. No heavy equipment such as backhoes or bulldozers are used by WS in these damage reduction and wildlife enhancement activities. Activities most often take place on small watershed streams, tributary drainages and ditches and can best be described as small, one-time 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. The United States Army Corps of Engineers (USACE) has criteria that are implemented by WS during dam breaching/removal activities to minimize any impacts to the water course basin, adjacent riparian areas, or surrounding vegetation (see Appendix C). Projects involving the use of binary explosives are conducted by trained WS certified explosive specialists. After a blast, any remaining fill material still obstructing 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 would be moved in each of these project activities.

Beaver dams in time can establish new, but different wetlands. The USACE and the 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.

Preexisting and altered habitat have different ecological values to fish and wildlife native to an area. Some species will abound by the addition of a beaver dam, while others will diminish. For example, some species of darters listed as federally endangered require fast moving waters over gravel or cobble beds which beaver dams can eliminate, thus reducing the habitat's value for these species. In general, it has been found that wildlife habitat values decline around bottomland beaver impoundments in the southern US, because hardwood trees are killed from flooding and mast production declines. On the other hand, beaver dams can potentially be beneficial to some species of wildlife such as river otters, neotropical birds and waterfowl.

If a beaver dam is not breached/removed and water levels remain constant, hydric soils and hydrophytic vegetation eventually form. This process can take anywhere from several

months to years depending on preexisting conditions. 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 have preexisted. 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. If these conditions are met, a wetland can develop that would have different wildlife habitat values than an area recently impounded by beaver dam activity.

The intent of most dam breaching/removal is not to drain established wetlands. With few exceptions, requests from public and private individuals and entities involve dam breaching/removal to return an area back to its preexisting condition. Hydric soils and wetland conditions usually take many years to develop, often greater than 5 years as recognized by Swampbuster provisions. Most beaver dam removal by WS is either exempt from regulation under Section 404 of the Clean Water Act (CWA) as stated in 33 CFR part 323 or may be authorized under the USACE Nationwide Permit System in 33 CFR part 330. However, breaching/removal of some beaver dams can involve certain portions of Section 404 to require landowners to obtain permits from the USACE. WS personnel determine the proper course of action upon inspecting a beaver dam impoundment. Appendix C describes the procedures used by WS to assure compliance with the pertinent laws and regulations.

2.2.6 Economic Losses to Property

Some people are concerned about the negative economic impacts that beaver and muskrats are having on property. These people are concerned as to whether the proposed action or any of the alternatives would reduce such damage to acceptable levels.

2.2.7 Impacts to Stakeholders, including Aesthetics

Human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and a large percentage of households have pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic and personal attitudes, values and opinions about the best ways to manage conflicts and problems between humans and wildlife.

Some concern exists that the proposed action or the alternatives would result in loss of aesthetic benefits to the public, resource owners or neighboring residents. Wildlife generally is regarded as providing economic, recreational and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an

observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g. wildlife-related recreation, observation, harvest, sale), indirect benefits derived from various wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: (1) bequest which is providing for future generations, and (2) pure existence which is merely knowledge that the animals exist (Decker and Goff 1987).

IWDM provides relief from damage or threats to public health or safety to people who would have no relief from such damage or threats. Many people directly affected by problems and threats to public health or safety caused by beaver or muskrats insist upon aquatic rodent removal from the property or public location when damage is apparent. Some people have an idealistic view and believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to public health or safety. Some directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to beaver or muskrat damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. Some who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Georgia WS only conducts beaver and muskrat damage management at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for beaver or muskrat damage management, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane and professional manner.

2.3 ADDITIONAL ISSUES USED TO DEVELOP MITIGATION

2.3.1 The Native American Graves and Repatriation Act of 1990.

The Native American Graves Protection and Repatriation Act require 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.

2.3.2 National Historic Preservation Act (NHPA) of 1966 as amended.

The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that has the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

Each of the CDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

2.3.3 Environmental Justice (Executive Order 12898) - *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*

Environmental Justice (EJ) has been defined as the pursuit of equal justice protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity or socioeconomic status. Fair treatment implies that no person or group should endure a disproportionate share of the negative environmental impacts resulting from this country's domestic and foreign policies or programs.

Executive Order 12898 requires federal agencies to make EJ 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. APHIS plans to implement Executive Order 12898 principally through the provisions of NEPA.

WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to insure EJ. WS personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by WS are regulated by the EPA through the FIFRA and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). 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. In contrast, WS beaver and muskrat damage management may provide for a safer environment for minority or low-income persons by reducing public health and safety risks.

2.3.4 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 development of physical and mental status. Because WS considers environmental health and safety risks that may disproportionally affect children as a high priority, impacts that this proposal might have been identified and assessed. The proposed beaver and muskrat damage management 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. In contrast, WS beaver and muskrat damage management may provide for a safer environment for children by reducing public health and safety risks.

2.3.5 Public Concern about the Use of Chemicals

Much of the public concern over the use of chemicals and toxicants for wildlife damage management is based on an erroneous perception that WS uses non-selective, outdated chemical methodologies. However, chemical methods used and proposed for use by WS have a high degree of selectivity. Currently, use of toxicants by WS in all instances is regulated by the EPA through the FIFRA, by MOUs with other agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemicals are used according to label directions, they are selective for target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). A decision to ban toxicants is outside of WS authority. WS could elect not to use toxicants, but those registered for use in Georgia are an integral part of IWDM and their selection for use would follow criteria in the Decision Model (Slate et al. 1992).

2.4 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.4.1 WS' Impact on Biodiversity

Georgia WS beaver or muskrat damage management is not conducted to eradicate a native wildlife population. WS operates according to international, federal and state laws and regulations enacted to ensure species viability. In addition, any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. The impacts of the current WS program on biodiversity are minor and not significant nationwide, statewide or regional (USDA 1997). WS operates on a relatively small percentage of the land area of the State (see Section 1.1), and WS' take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population (see Section 4.3).

2.4.2 No Wildlife Damage Management at Taxpayer Expense (wildlife damage management should be fee based)

Funding for Georgia WS comes from a variety of sources, in addition to federal appropriations. Georgia state agency funds, county funds, city funds, private funds and other federal agency funds are applied to the WS program under Cooperative Agreements. Federal, state and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to US citizens. Wildlife damage management is an appropriate sphere of activity for government programs, since aspects of wildlife damage management are a government responsibility and authorized and directed by law.

2.4.3 Beaver and Muskrat Damage should be Managed by Trappers and Nuisance Wildlife Control Agents

The jurisdiction for managing most resident wildlife rests with the GADNR. Currently, GADNR manages beaver and muskrats as furbearers. Beaver are also considered unprotected nongame wildlife.

The number of recreational fur trappers in Georgia has drastically declined in the past few decades. According to furbearer harvest data from the GADNR, number of trapping licenses sold annually decreased from a peak of 3,560 licenses in 1979 to a low of 346 in 1993. The average license sales for the period 1990 to 2001 was 416. There were 491 licenses sold for the 2001 – 2002 season (Greg Waters, GADNR, personal communication). Recreational fur trappers provide several societal services, including trapping beaver causing damage to property and assisting the GADNR to manage beaver populations. One cause for the decline in recreational trapping has been lower prices paid for raw fur since the early 1980's. Subsequently, an insufficient number of trappers is present to manage expanding beaver populations. In addition, many beaver and muskrat damage problems also occur in urban or developed areas where little or no recreational beaver trapping occurs.

Most private trappers cannot afford to provide year-round site-specific beaver or muskrat damage management. However, the option of using a private trapper remains open to landowners experiencing damage or threats of damage. Private trappers, nuisance wildlife control agents and landowners could trap beaver and muskrat to alleviate damage during the regulated trapping season or outside of the regulated season. However, some trappers are not willing to trap in urban areas for aesthetic reasons or fear of trap theft. Trappers may not be willing to trap beaver or muskrat outside of the regular trapping season because the furs lack quality and have little or no economic value. Furthermore, private trappers and nuisance wildlife control agents may not be willing or able to breach/remove beaver dams to achieve some property owners' objectives.

Site-specific damage management has been necessary to protect property, roads, bridges and agricultural and natural resources. It is the policy of WS to provide professional damage management upon request and verification of damage at site-specific locations. Assistance from Georgia WS may be requested to achieve management objectives. Typically, damage management involves removing a small number of beaver or muskrats from a localized area. WS is not involved in statewide or large scale beaver or muskrat population reduction (See Section 1.3). Targeted beaver and muskrat populations include those found near damage sites (i.e. site-specific areas, such as bridges, critical wildlife habitat, managed forests and ornamental trees and shrubs).

Some landowners may prefer that a government agency trap beaver or muskrats instead of using private trappers or nuisance wildlife control agents and large landowners with numerous damage sites (i.e. railroads or highway departments) may prefer to use WS because of reduced administrative burden. Some landowners may prefer to use private trappers or nuisance wildlife control agents instead of WS. Thus, WS beaver and muskrat damage management activities would not eliminate opportunities for private trappers or nuisance wildlife control agents.

2.4.4 Breaching/Removal of Dams or Use of Water Control Structures

This issue addresses attempts to alleviate flooding damage by controlling the water level at the site without removing beaver. Dams would either be breached/removed manually or with binary explosives, but these methods are usually ineffective because beaver will quickly repair or replace the dam (McNeely 1995). Installing and maintaining water control structures; or removing beaver dams on a daily or weekly basis, may be cost prohibitive. In addition the installation of water control structures or just removing dams would not alleviate damage from gnawing or felling of trees.

Water control devices and pond levelers have been used for many years in many different states, with varying degrees of success (USGAO 2001). Various types of beaver pond levelers have been described (Arner 1964, Roblee 1984, Laramie and Knowles 1985, Lisle 1996) and installation of beaver pond levelers can be effective in reducing flooding in certain situations (Miller and Yarrow 1994, Minnesota Department of Natural Resources

1994, Organ et al. 1996) if properly maintained. One study reported water drainage pipes in beaver dams to be effective in only about 5% of flooding situations (Anonymous 1999). Nolte et al. (2000) reported only 50% of installed pond levelers in Mississippi meet landowner objectives and found that pond levelers placed in sites with high beaver activity more frequently failed if installed without implementing population control measures. Ninety-five percent of the successful levelers in this study were at sites that had received some local population control measure either before, after, or before and after the leveler was installed (Nolte et al. 2000). Reasons for lack of success were described as blocking caused by debris or silt and nearby dam building (McNeely 1995). Wood et al. (1994) also acknowledged that pond levelers do not negate the need for reduction of local beaver populations. In Mississippi, beaver often build dams upstream and downstream of water control devices or block the device with mud and debris which renders this method ineffective (B. Sloan, USDA/APHIS/WS, personal communication). Suppression or eradication of the local beaver population usually is required for this method to be effective (E. Butler, USDA/APHIS/ WS, personal communication, B. Sloan, USDA/APHIS/WS, personal communication).

Pond levelers installed to manage wetlands for waterfowl habitat were more successful than levelers installed to provide water relief (Nolte et al. 2000). Water control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, personal communication), but may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). They may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device to handle, and debris is continuously carried to the site. Water control devices may not be effective during periods of unusually high rainfall or increased water flow, because the device cannot handle the increased volume of water (Anonymous 1999, Wood et al. 1994).

Use of pond levelers or water control devices may require frequent maintenance depending on the type of water control device. Continued maintenance is necessary for the device to remain operational because stream flow, leaf fall, floods and beaver activity will continuously bring debris to the intake of the water control device. Maintenance and upkeep of water control devices vary from site to site but can be expensive. The Maine WS program estimated annual maintenance costs to be approximately $350/water control device (E. Butler, USDA/APHIS/WS, personal communication). Mississippi WS reported the construction and installation cost of pond levelers to cost approximately $700 (T. Aderman, USDA/APHIS/WS, personal communication). Annual costs may also be associated with suppressing beaver populations to keep the devices operational (B. Sloan, USDA/APHIS/WS, personal communication).

The Beaver Deceiver is a relatively recent water control system that attempts to quiet, calm and deepen the water around culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). A critical part of the beaver deceiver strategy is to silence or prevent the sound of running water. The beaver deceiver is a water control system that has been evolving since 1996 and has been

effective at controlling beaver flooding in some situations. Preservation of the fur resource for recreational trapping is one of the benefits of using beaver deceivers (Lisle 1996).

WS could implement use of water control devices as part of an integrated beaver management program at appropriate sites. Maine WS program installed over 160 water control devices in 1998. Primary benefit of use of these devices in Maine is to minimize flooding damage while leaving beavers for fur trappers to remove during the regulated trapping season each year (E. Butler, USDA/APHIS/WS, personal communication). Mississippi WS program commonly installs water control devices at sites managed for waterfowl and for perpetual water flow (B. Sloan, USDA/APHIS/WS, personal communication). Thus, in both Maine and Mississippi, use of water control devices is supplemented by continual removal of beaver from the site, and an additional benefit is received which helps to justify the expense (i.e. reserving beaver for the fur harvest, providing waterfowl habitat). Also, the construction, installation, and maintenance costs of water control devices in Maine and Mississippi are funded, in part, by sources such as state wildlife agencies, county governments, USFWS, or private organizations (E. Butler, USDA/APHIS/WS, personal communication, B. Sloan, USDA/APHIS/WS, personal communication).

One benefit of water control devices is that the beaver created pond or area can be maintained or improved, along with the ecological and recreational benefits derived from these areas, while the damage from beaver flooding is alleviated or at least reduced. However, water control devices are not applicable or efficient in all damage situations. Landowners consider many factors in determining the course of action to resolve beaver damage problems. For example, landowners must consider the cost of control, the probability that the method will resolve the problem, the amount of maintenance required, and whether the method is consistent with objectives for the property (Nolte et al. 2000). Water control devices are most effective in specific types of terrains and sites (NYDEC 1997, Wood et al. 1994). Water control devices have required frequent maintenance and may be costly to install and maintain (Jensen et al.1999, NYDEC 1997). Jensen et al. (1999) reported that the initial costs for a Clemson Beaver Pond Leveler and a Pitchfork Guard/Grate in the first year, including the costs of materials, installation, and maintenance, were $1,542 and $3,688, respectively. The cost of a Beaver Deceiver may range from $150 - $1,500, and an additional cost would be applied if pipes were needed at the site (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

Water control devices could be used or recommended as part of the aquatic rodent program, if appropriate. Georgia WS commonly provides information on installation of water control devices to those persons requesting assistance. In these situations it is the responsibility of the person requesting assistance to construct and install the device. Georgia WS direct involvement in the construction and installation of water control devices has been limited with WS installing 2 such devices for landowners in the state in recent years. If a water control device is consistent with the landowner's objectives, will alleviate the damage, and if funding is available for installation, then WS would use or recommend

their use.

2.4.7 Appropriateness of Preparing an EA (instead of an EIS) for such a Large Area

Some individuals might question whether preparing an EA for an area as large as the state of Georgia (37,068,000 acres) would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EAs covering smaller zones. In addition, Georgia WS only conducts beaver and muskrat damage management in a very small proportion of the state where damage is occurring or likely to occur (see Section 1.3). However, damage may occur anywhere in the state (see Section 1.9.5).

Chapter 3: ALTERNATIVES

3.0 INTRODUCTION

This chapter consists of seven parts: 1) introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action (Alternative 3), 3) beaver and muskrat damage management approaches used by WS, 4) beaver and muskrat damage methods authorized for use or recommended, 5) methodologies recommended but deemed impractical, ineffective or unsafe at the present time, 6) a description of alternatives considered, but eliminated from detailed analysis, and 7) mitigation measures and SOPs. Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), Methods of Control (USDA 1997), and "*Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program*" (USDA 1997).

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and is a viable and reasonable alternative that could be selected and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the CEQ (CEQ 1981).

Five alternatives were recognized, developed, and analyzed in detail. Three alternatives were considered, but not analyzed in detail with supporting rationale. The five alternatives analyzed in detail are:

Alternative 1. No WS Beaver or Muskrat Damage Management in Georgia. This alternative would result in no assistance from WS in reducing beaver or muskrat damage in Georgia. WS would not provide technical assistance or operational damage management services.

Alternative 2. Only Lethal Beaver and Muskrat Damage Management. Under this alternative, only lethal operational damage management and technical assistance would be provided by WS.

Alternative 3. Fully Integrated Beaver and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action). This alternative is the proposed action and is the preferred alternative of WS. This alternative incorporates the use of both non-lethal and lethal methods to manage conflicts associated with beaver and muskrats in Georgia.

Alternative 4. Technical Assistance Only. Under this alternative, WS would not conduct operational beaver or muskrat damage management in Georgia. The entire program would consist of technical assistance.

Alternative 5. Non-lethal Beaver and Muskrat Damage Management. Under this alternative, only non-lethal operational damage management and technical assistance would be provided by WS.

3.1 ALTERNATIVES CONSIDERED, INCLUDING THE PROPOSED ACTION

3.1.1 Alternative 1. No WS Beaver or Muskrat Damage Management in Georgia.

This alternative would result in no assistance from WS in reducing beaver or muskrat damage in Georgia. WS would not provide technical assistance or operational damage management services.

All requests for beaver or muskrat damage management assistance would be referred to the GADNR, local animal control agencies, or private businesses or organizations. Assistance may or may not be available from any of these entities.

3.1.2 Alternative 2. Only Lethal Beaver and Muskrat Damage Management.

Under this alternative, only lethal operational beaver and muskrat damage management and technical assistance would be provided by WS. Non-lethal methods, such as snares, leg-hold traps and cage traps could be used under this alternative. However, all aquatic rodents captured in these non-lethal devices would subsequently be euthanized. Requests for information regarding non-lethal management approaches would be referred to GADNR, local animal control agencies, or private businesses or organizations. WS would not remove or breach beaver dams under this alternative. Individuals or agencies might choose to implement WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS damage management services, use contractual services of private businesses, use volunteer services or take no action.

3.1.3 Alternative 3. Fully Integrated Beaver and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action).

WS proposes to administer and continue the current beaver and muskrat damage management program in the state of Georgia. An IWDM approach, including technical assistance and operational damage management services, would be implemented to reduce damage associated with beaver and muskrat activities to property, roads, bridges, railroads, agricultural and natural resources, and public health and safety on all lands in Georgia where a need exists and requests are received. An IWDM strategy encompasses use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species and the environment. Non-lethal methods, such as physical exclusion or habitat modification, would be given first consideration in the formulation of each damage management strategy and would be recommended or implemented when practical and effective before recommending or implementing lethal and non-lethal methods, such as body-grip traps, snares, leg-hold traps, cage-type traps, colony traps, snap traps, shooting and zinc phosphide bait. Aquatic rodents captured in non-lethal devices (leg-

hold traps, snares, cage traps, etc.) would subsequently be euthanized. However, non-lethal methods would not always be applied as a first response to each damage problem. The most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. Beaver damage management would be conducted in the state, when requested, on private or public property after an *Agreement for Control* or other comparable document has been completed and cooperator funding has been secured. All beaver and muskrat damage management would be consistent with other uses of the area and would comply with appropriate federal, state and local laws. Unwanted beaver dams could be removed/breached by hand or with binary explosives under this alternative.

3.1.4 Alternative 4. Technical Assistance Only.

This alternative would only allow Georgia WS to provide technical assistance to individuals or agencies requesting beaver or muskrat damage management in Georgia. WS would not remove/breach beaver dams under this alternative. Property owners and land managers could implement their own aquatic rodent damage management program, use contractual services of private businesses, use volunteer services or take no action. This alternative would place the immediate burden of operational damage management work on the property owners and other federal, state or county agencies.

3.1.5 Alternative 5. Non-lethal Beaver and Muskrat Damage Management.

Under this alternative, only non-lethal operational damage management and technical assistance would be provided by WS. Request for information regarding lethal management approaches would be referred to GADNR, local animal control agencies, or private businesses or organizations. Individuals or agencies might choose to implement WS non-lethal recommendations, implement lethal methods or other methods not recommended by WS, contract for WS non-lethal damage management services, use contractual services or private businesses, use volunteer services or take no action. Unwanted beaver dams could be removed/breached by hand or with binary explosives under this alternative.

3.2 BEAVER AND MUSKRAT DAMAGE MANAGEMENT APPROACHES USED BY WS

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife (USDA 1997). The wildlife damage management approaches used by WS are described below:

3.2.1 Integrated Wildlife Damage Management (IWDM)

During more than 80 years of resolving wildlife damage problems, WS has considered,

developed, and used numerous methods of reducing damage problems (USDA 1997). WS' efforts have involved the research and development of new methods and the implementation of effective strategies to resolve and prevent wildlife damage.

Usually, the most effective approach to resolving wildlife damage is to integrate use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and reduction of damage caused by wildlife based on local problem analyses and the informed judgment of trained personnel. WS program applies IWDM, commonly known as Integrated Pest Management (WS Directive 2.105), to reduce damage through the WS Decision Model (Slate et al. 1992).

The philosophy behind IWDM is to implement effective management techniques in a cost-effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques for the specific situations. IWDM may incorporate cultural practices, habitat modification, animal behavior modification, removal of individual animals, local population reduction, or any combination of these methods depending on the characteristics of the specific damage problems.

3.2.2 Integrated Beaver or Muskrat Damage Management Strategies used by WS

Technical Assistance Recommendations (management decision and implementation is the responsibility of the requester). WS personnel provide information, instructional sessions, demonstrations and advice on available beaver and muskrat damage management techniques. Technical assistance includes demonstrations on the proper use of damage reduction devices (body-grip traps, leg-hold traps, tree guards, etc.) and information on water control devices, wildlife habits and biology, habitat management, and animal behavior modification. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. Bulletins and leaflets on beaver and muskrat biology could be sent to requesters to inform them about aesthetic values of aquatic furbearers, types of damage and damage management methods. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on factors such as need and practical application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual damage reduction work is the responsibility of the requester.

Operational Damage Management Assistance (management conducted or supervised by WS personnel). Operational damage management assistance is implemented when the problem cannot be resolved through technical assistance and when Cooperative Agreements provide for WS operational assistance. The initial investigation explores and 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

resolve problems effectively and safely, especially if restricted pesticides are required or if the problem requires 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 strategy(ies) may include any combination of preventive actions, generally implemented by the property owner, and corrective actions, generally implemented by WS. Corrective damage management is applying management techniques to stop or reduce current losses. As requested and appropriate, WS personnel may provide non-lethal and lethal information, conduct demonstrations, or take action to prevent additional losses from reoccurring.

Education. Education is an important element of WS program activities, because wildlife damage management is about finding "balance" or co-existence between the needs of people and wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies. WS provides informational leaflets about beaver and muskrat damage management, biology and ecology. Georgia WS program annually provides multiple beaver and muskrat leaflets and handouts to the public about ARDM. This information is disseminated by means of school programs, Georgia State Extension service programs, exhibits and calls from requesters.

3.2.3 WS Decision Making

The procedures used by WS personnel to determine management strategies or methods applied to specific damage problems can be found in USDA (1997). Additionally, the WS Decision Model (Figure 3.1) considers the following factors before selecting or recommending damage management methods and techniques:

- Species responsible for the damage,
- Magnitude, geographic extent, frequency, historical damage and duration of the problem,
- Status of target and non-target species, including T&E species,
- Local environmental conditions,
- Potential biological, physical, economic and social impacts,
- Potential legal restrictions, and
- Costs of damage management option.

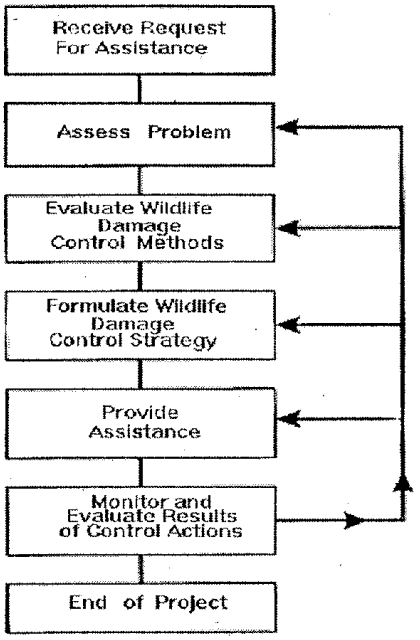

Figure 3.1. WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflict.

The decision-making process is a procedure for evaluating and responding to damage complaints. WS personnel are frequently contacted after requesters have tried non-lethal techniques and found them to be inadequate for reducing damage to an acceptable level. WS personnel assess the problem, evaluate different methods for availability (legal and administrative), and base biological, economic, and social considerations on suitability. Following this evaluation, methods deemed to be practical for the situations are formed into a management strategy. After the management strategy has been implemented, monitoring and evaluation of the strategy is conducted to assess effectiveness of the strategy. If the strategy is effective, the present need for management is ended.

When damage continues intermittently over time, WS personnel and the requester monitor and re-evaluate the situation. If one method or a combination of methods fails to stop damage, a different strategy is implemented. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of a continuous feedback loop between receiving the request and monitoring the results, with the damage management strategy re-evaluated and revised periodically if necessary. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions.

3.2.4 Local Decision Making Process

WS provides technical assistance to the requester regarding the biology and ecology of beaver and muskrats and effective, practical and reasonable methods to reduce wildlife damage. Technical assistance includes instructions on non-lethal and lethal methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available and make recommendations. In Georgia, resource owners and others directly affected by beaver or muskrat damage or conflicts have direct input into the resolution of such problems. Requesters may implement management recommendations provided by WS or others or request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local decision makers have the final decision on which available (legally and administratively) methods would be used to solve a human-wildlife conflict. Decision makers also may compare the benefits versus the damage when deciding which methods would be implemented including weighing the cost of implementing each methodology or a series of methodologies. Community leaders, private property owners/managers, and public property owners/managers are often the local decision makers.

3.3 ACTIVITIES BY WS TO ALLEVIATE BEAVER AND MUSKRAT DAMAGE IN GEORGIA

The Georgia WS program has assisted GADNR on numerous occasions with managing beaver problems on state lands. GA WS provided on site training to DNR personnel interested in maintaining a tract of land located in north Georgia which had been identified as valuable bog turtle (Clemmys muhlenbergii) habitat. Bog turtles are listed as Threatened on both state and federal lists. Additional work performed by WS includes annual use of explosives to clear water control structures regulating green tree reservoirs on several Wildlife Management Areas in the state.

In 2002, Georgia WS provided operational assistance to a [redacted] County landowner interested in maintaining one (1) mile of open stream to allow various species of sunfish to make their annual spawning migration from the Ogeechee River. WS implemented an IWDM approach including removal of beaver and breaching of beaver dams to return the streambed to its natural state.

Georgia WS has provided operational assistance to the Georgia DOT on several occasions, with the most recent efforts aimed at reclaiming a wetlands mitigation site in Muscogee County which had been flooded by beaver. Other work was conducted for the Cartersville District to combat flooding of state highways and interstates.

[redacted], one of the nation's largest railroad companies, utilized GA WS' operational beaver damage management services in 2002 and 2003 to combat beaver-related flooding threatening the structural integrity of bridges and railroad beds in south Georgia.

Robins Air Force Base, located in middle Georgia entered into an Interagency Agreement with GA WS in 1994 for the management of various wildlife species, beaver included. Since that time, WS has conducted operational beaver damage management activities to alleviate flooding on base property and remove beaver ponds located adjacent to runways which could attract species of birds known to pose threats to aircraft operations and human safety.

[redacted], one of the nation's largest timber companies, has utilized GA WS several times in the previous 10 years to alleviate beaver-induced flooding damage to roads; flooding damage to pine and hardwood timber; and gnawing/girdling/feeding damage to pine and hardwood timber. GA WS implemented an IWDM approach to remove beavers and breach beaver dams on sites located in [redacted], [redacted], [redacted] and [redacted] Counties.

A prominent public botanical garden contacted WS in 1991 regarding the management of beaver, muskrats and white-tailed deer. Beaver and muskrats had been allowed to go unmanaged and inhabited nearly all of the garden's numerous lakes and ponds. Concerns centered around landscape damage to ornamental trees and shrubs from feeding activity and possible damage to the integrity of roads and dams from burrowing activity. GA WS entered into a Cooperative Service Agreement with the gardens in 1991 and has continued ARDM activities to the present.

In 1988, GA WS entered into an agreement with one of the University of Georgia Agricultural Experiment Stations in middle Georgia for the purpose of managing beaver, muskrats and white-tailed deer. Muskrats inhabited all of the station's seven (7) ponds and had caused extensive burrowing damage in several ponds and threatened the integrity of one road. Beaver were present in several ponds and creeks on the station causing problems by burrowing into pond dams and roads, chewing/girdling research varieties of shrubs and trees and flooding property. The agreement has been renewed annually since its inception and GA WS responds to incidents of muskrat and/or beaver damage when problems arise.

Georgia WS has provided operational ARDM services to [redacted], a prominent winery and golf course suburban community in north Georgia numerous times in the previous 10 years to combat beaver and muskrat damage. Beaver damage has included gnawing/girdling of ornamental trees and shrubs; burrowing into pond dams and roads; and flooding of homeowners' property. Numerous golf course ponds offer attractive habitat to muskrats as well. Muskrat damage has included burrowing into pond dams and structures and damage to Bermuda grass sod from feeding activities.

In 1997, GA WS entered into an agreement with the Cobb County Water System, Stormwater Management Division for the control of beaver causing flooding damage to county property; impacting the flow of stormwater drainage systems and natural

watersheds; and flooding county sewer line systems. The agreement has been renewed annually since its inception. WS responds to beaver problems identified by county officials. An IWDM approach is used including removal of localized beaver populations and breaching of beaver dams to restore proper drainage.

GA WS has provided operational beaver damage management services to the City of LaFayette, Water and Sewer Utilities Division since 1999 for the purpose of alleviating flooding damage to city property; maintaining proper flow of water through the city; and prevention of flooding of city sewer line systems. An agreement with the city has been renewed annually. WS responds to localized problems when requested.

In 1995, GA WS entered into a Cooperative Service Agreement with the Oglethorpe County Board of Commissioners for the purpose of managing beaver populations causing flooding damage to county roads. WS has provided operational beaver damage management services to protect numerous roads and drainage structures since the inception of this agreement.

3.4 BEAVER OR MUSKRAT DAMAGE MANAGEMENT METHODS AUTHORIZED FOR USE OR RECOMMENDED BY WS

USDA (1997) describes methods currently used by WS. Several of these were considered in this EA because of their potential use in reducing beaver and muskrat damage to roads, bridges, railroads, property, natural and agricultural resources, and public health and safety. A listing and more detailed description of the methods used by Georgia WS for beaver and muskrat damage management is found in Appendix D of this EA.

3.4.1 Non-lethal Beaver or Muskrat Damage Management Methods

Habitat Management. Habitat management generally refers to riparian vegetation manipulation to reduce the carrying capacity for beaver or muskrats. Habitat management often involves the removal of all woody and aquatic vegetation to eliminate beaver and muskrat food sources. However, removal of all food sources would be an extreme and impractical method in most situations. Habitat management also may involve manipulating beaver impoundment water levels to reduce damage or conflict caused by flooding and inundation. Water control devices and pond levelers (beaver flow devices) may be installed to regulate the volume of water and can be effective in reducing flooding in certain situations (Minnesota Department of Natural Resources 1994, Arner 1964, Roblee 1984, Laramie and Knowles 1985, Lisle 1996, Miller and Yarrow 1994). Water control devices and pond levelers may also be utilized as a means of exclusion at road culverts.

Exclusion. Exclusion (tree wraps, fencing, and paint) involves exclusion of beaver or muskrats from protected resources or prevention of girdling and gnawing.

Beaver Dam Breaching/Removal. Beaver dam breaching/removal involves the removal of debris deposited by beaver that impedes water flow. Debris would be removed from beaver dams with binary explosives, mechanical equipment, or hand tools.

Leg-hold traps. Leg-hold traps can be effectively used to capture a variety of mammals. Generally, all leg-hold traps used to capture aquatic rodents are set near adequate water depth and rigged with a drowning mechanism that will immediately dispatch the animal. Effective trap placement, trap adjustment and selection/placement of appropriate lures contribute to the leg-hold trap's selectivity. All beaver and muskrats live-captured in leg-hold traps would be euthanized by shooting.

Snares. Snares are live-capture devices consisting of a cable loop and a locking device. Snares are placed in travel routes or areas of high aquatic rodent activity. Snares also are equipped with a swivel to minimize cable twisting and fraying, thus reducing snare breakage. Beaver live-captured in snares would be euthanized by shooting.

Colony traps. Colony traps are multiple-catch traps used mainly to capture muskrats. Colony traps are usually set at the entrance of a muskrat den and can be used for kill-trapping or live-trapping muskrats. All muskrats live-captured would be euthanized by shooting.

Hancock traps. Hancock or Bailey traps are designed to live-capture beaver. The trap is constructed of a hinged metal frame covered with chain-link fence. Large springs cause the trap to close when tripped. Trap appearance is similar to a large suitcase when closed. When set, the trap is opened into a flattened position to allow an animal to enter. When the trap is tripped, the sides of the trap close around the animal. Beaver live-captured in Hancock traps would be euthanized by shooting.

3.4.2 Lethal Damage Management Methods

These methods involve damage management specifically designed to lethally remove beaver or muskrat in certain situations to a level that stabilizes, reduces or eliminates damage. Amount of removal necessary to achieve a reduction of beaver or muskrat damage varies according to the resource protected, habitat, species population, effectiveness of other damage management strategies and other population factors.

Shooting. Shooting is the most selective method for removing target species and may involve the aid of a spotlight. Shooting is conducted with shotguns, rifles, or pistols.

Body-grip traps. Body-grip (e.g., Conibear) traps are designed to cause quick death of the animal that activates the trap. The appropriate size trap would be used for beaver (generally 330 Conibear) and are used in aquatic habitats. Body-grip traps are placed at various depths ranging from a few inches to several feet below the water surface. Smaller body-grip traps (generally 110 Conibear) would be used for muskrats and can be set

either in or out of water.

3.4.3 Chemical Management Methods

All chemicals used by Georgia WS are registered under FIFRA, administered by the EPA, and approved by the Food and Drug Administration (FDA) and the Georgia Department of Agriculture. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. There are currently no chemical methods available for beaver damage management.

Zinc phosphide is the only chemical method currently authorized for use in muskrat damage management in Georgia. Zinc phosphide is used to reduce muskrat damage by applying the chemical to bait. The maximum application rate is 10 lbs. of bait (0.6% active ingredient) (EPA Reg. No. 56228-6).

3.5 METHODOLOGIES CONSIDERED BUT DEEMED IMPRACTICAL, INEFFECTIVE, OR UNSAFE AT THE PRESENT TIME

3.5.1 Harassment Activities

Harassment has generally proven ineffective in reducing beaver or muskrat damage problems (Jackson and Decker 1993). Destroying beaver dams and lodges without removing resident beaver rarely resolves damage problems. Beaver usually rebuild dams and lodges in the same vicinity in a very short time. Removal of food supplies to discourage beaver or muskrat activity is generally neither feasible nor ecologically desirable.

3.5.2 Repellents

No effective repellents are registered for beaver or muskrat damage management. However, recent research from the USDA/APHIS/WS/National Wildlife Research Center has suggested that painting trees with a mixture of 1 quart of sand to 1 gallon of exterior latex paint may prevent beaver from gnawing and cutting painted trees. If this method is found to be effective, practical and classified as a "repellent," it will require registration under the FIFRA and state pesticide control laws. Once registered, WS would then consider using and recommending a paint/sand mixture to reduce damage.

3.5.3 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 (1987a). Although these methods were effective in reducing beaver reproduction by up to 50%, methods were not practical or too expensive for large-scale application. Additionally, reproductive control does not alleviate current damage problems (Organ et

al. 1996).

Reproduction control methods involve use of chemicals or surgical procedures to inhibit reproduction of beaver and muskrats, thus reducing population levels. Chemical sterilants can be classified into one of three types: chemosterilants, immunocontraceptives, and temporary, short term contraceptives. Several reproductive inhibitors have been proposed for use in beaver population reduction, including quinestrol (17-alpha-ethynyl-estradiol-3-cyclopentylether) and mestranol (Gordon and Arner 1976, Wesley 1978). Chemosterilants have been suggested as a means to manage beaver populations (Davis 1961, Arner 1964). However, while chemosterilants have been shown to reduce beaver reproduction in controlled experiments, no practical and effective method for distributing chemosterilants in a consistent way to wild, free ranging beaver populations has been developed or proven (Hill et al. 1977, Wesley 1978). No chemical reproductive inhibitors are currently registered for use on beaver or muskrat damage management in the United States.

As with chemical repellents and toxicants, a reproduction inhibitor could potentially affect non-target wildlife and the environment. Any inhibitor would have to be tested intensively and approved for use. Inhibition of reproduction also may affect behavior, physiological mechanisms, and colony integrity (Brooks et al. 1980). Additional research is needed to test the environmental effects, effects to overall populations, and effects to individual animals. If a technique or chemical becomes registered for use, WS could incorporate it into ARDM in Georgia.

Currently, no chemical reproductive inhibitors are legal for use for species covered by this EA. For these reasons, this method will not be considered further by Georgia WS.

3.6 ALTERNATIVES CONSIDERED BUT NOT IN DETAIL, WITH RATIONALE

3.6.1 Eradication and Suppression

An eradication and suppression alternative would direct all Georgia WS beaver and muskrat damage management efforts toward planned, total elimination or suppression of these species.

Eradication of beaver or muskrats in Georgia is not supported by Georgia WS or GADNR. This alternative was not considered in detail because:

- Georgia WS opposes eradication of any native wildlife species,
- GADNR opposes eradication of any native Georgia wildlife species,
- Eradication of a native species would be extremely difficult if not impossible to accomplish, and cost prohibitive, and
- Eradication of native species is not acceptable to most members of the public.

Suppression would direct Georgia WS program efforts and resources toward managed reduction of certain problem wildlife populations or groups. To consider large-scale population suppression as a goal of the Georgia WS program is not realistic, practical or allowable under present WS policy.

3.6.2 Population Stabilization through Birth Control

Under this alternative, beaver and muskrat populations would be managed through use of contraceptives. Beaver or muskrats would be sterilized or administered contraceptives to limit reproduction. However, chemical or biological contraceptive agents for beaver or muskrats do not exist. Beaver or muskrat contraceptives, chemosterilants or immunocontraceptives, if delivered to a sufficient number of individuals, could temporarily suppress local breeding populations by inhibiting reproduction. Reduction of local populations would result from natural mortality combined with reduced fecundity. No beaver or muskrats would be killed directly with this method; however, treated beaver and muskrats would continue to cause damage. Dispersing beaver and muskrat populations would probably be unaffected.

Contraceptive measures for mammals can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). These measures would require beaver or muskrats to receive either single, multiple, or possibly daily treatment to successfully prevent conception. Use of this method would be subject to approval by federal and state agencies. This alternative was not considered in detail because:

- Number of years of implementation before beaver or muskrat populations would decline would be large; therefore, damage would continue at the present unacceptable levels for an extended time period,
- Surgical sterilization would have to be conducted by licensed veterinarians; therefore, costs would be extremely expensive,
- Live-trapping and chemically treating an effective number of beaver or muskrats would be extremely difficult in order to produce an eventual decline in the population, and
- No chemical or biological agents for beaver or muskrat contraception have been approved for use by state and federal regulatory authorities.

Since no effective or legal methods of delivering contraceptives to beaver or muskrats exist at this time, use of contraceptives is not a realistic alternative.

3.6.3 Compensation for Wildlife Damage Losses

The compensation alternative would direct all Georgia WS program efforts and resources toward the verification of losses from beaver and muskrats, and to provide monetary compensation for the losses. Georgia WS activities would not include any operational

damage management or technical assistance.

This option is not currently available to Georgia WS because WS is directed and authorized by law to protect American agricultural and natural resources, property and public health and safety (Act of 1931, as amended; and the Rural Development, Agricultural and Related Agencies Appropriation Act of 1988, and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001). Analysis of this alternative in USDA (1997) shows that it has the following drawbacks:

- X Compensation would not be practical for public health and safety problems,
- X Larger expenditures of money to investigate and validate all losses, and determine and administer appropriate compensation would be required,
- X Timely responses to all requests to assess and confirm losses would be difficult, and many losses could not be verified,
- X Compensation would give little incentive to limit losses through other management strategies,
- X Not all resource managers/owners would rely completely on a compensation program; therefore, unregulated lethal control would probably continue and escalate, and
- X Neither Congress nor the State of Georgia has appropriated funds for a compensation program.

3.6.4 Bounties

Bounties can be defined as payments of funds for killing beaver or muskrats. Currently, no statewide bounties exist for aquatic rodents in Georgia. However, some counties provide cash bounties through local funding for the management of beaver damage.

Payment of funds for killing beaver or muskrats (bounties) suspected of causing economic loss is not supported by WS, and Georgia WS does not have authority to establish a bounty program. Bounties are not considered because:

- X Bounties are generally not effective in managing wildlife or reducing damage,
- X Circumstances surrounding take of animals is largely unregulated, and
- X No process exists to prohibit taking of animals from outside the damage management area for compensation purposes.

3.6.5 Live-trap and Relocate

There is currently no written policy/regulation concerning relocation of beaver or muskrats within the state of Georgia (G. Waters, GADNR, personal communication).

Relocation of problem wildlife species is a technique occasionally used to alleviate wildlife damage problems. However, success of relocation efforts depends on the potential for problem individuals to be captured efficiently and existence of an appropriate relocation site (Nielsen 1988). Relocation may be appropriate in some situations when the population is low. However, aquatic rodents are abundant in much of the suitable habitat in Georgia, and relocation is not necessary for the maintenance of viable populations. Because beaver are abundant in Georgia, animals relocated into suitable habitat are very likely to encounter other beaver with established territories. Beaver are highly territorial, and newly introduced beaver, which are disoriented and at a disadvantage, are often attacked viciously and oftentimes killed from these encounters (McNeely 1995). Survival of relocated animals is generally very poor due to stress of relocation, and in many cases released animals suffer mortality in a new environment (Craven 1992). Courcelles and Nault (1983) found that 50% (n=10) of radio-collared, relocated beaver died, probably from stress or predation resulting from the relocation.

Relocated beaver also may disperse long distances from the release site (Novak 1987*a*). Hibbard (1958) recorded an average dispersal distance by 17 relocated beaver to be approximately 9 miles in North Dakota, and Denney (1952) reported an average dispersal of 10.4 miles and a maximum dispersal of 30 miles for 26 transplanted beaver in Colorado. Beaver relocated on streams and later recaptured (n=200) moved an average distance of 4.6 miles, and in lake and pothole relocations (n=272) moved an average of 2 miles (Knudsen and Hale 1965). Only 12% of beaver relocated on streams and 33% of beaver relocated on lake and pothole areas remained at the release site (Knudsen and Hale 1965). Relocation of aquatic rodents causing damage could result in similar damage problems at the release site or dispersal site. In this case, the original damage problem has simply been shifted from one property to another. If Georgia WS relocated a problem animal, Georgia WS could possibly be held liable for any subsequent damage caused by that animal.

Live-trapping and relocating aquatic rodents is biologically unsound and not cost-efficient (Wade and Ramsey 1986). The AVMA, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists oppose the relocation of mammals because of disease transmission risks, particularly for small mammals (Center for Disease Control 1990).

For the above stated reasons, Georgia WS does not support the relocation of aquatic rodents for damage management and will not relocate aquatic rodents within Georgia.

3.6.6 Live-capture and Euthanasia Only

Live-capture and euthanasia of beaver and muskrats may be used as part of the IWDM approach to reduce aquatic rodent damage. Snares would be used to live-capture beaver. While snares are an effective, and at times efficient, tool for capturing beaver, use of

additional methods (e.g. body-grip traps, shooting, leg-hold traps) could be necessary to reduce damage in a cost-effective manner. Snares are inappropriate to use in moving water because the current closes or disables the snare. Muskrats could be live-captured in floating colony traps, but these traps are cumbersome and require more time to set than body-grip traps, leg-hold traps and standard colony traps.

3.7 MITIGATION AND SOPs FOR BEAVER AND MUSKRAT DAMAGE MANAGEMENT

3.7.1 Mitigation and SOPs

Mitigation is any feature of an action that serves to prevent, reduce or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Georgia, uses many mitigations. Mitigations are discussed in detail in Chapter 5 of USDA (1997). Mitigations incorporated into WS' SOPs and Alternatives 2, 3, 4, and 5 follow:

Alternative 1. No WS Beaver or Muskrat Damage Management in Georgia.
Alternative 2. Only Lethal Beaver and Muskrat Damage Management.
Alternative 3. Fully Integrated Wildlife Damage Management for all Land Classes (No Action/Proposed Action).
Alternative 4. Technical Assistance Only.
Alternative 5. Non-Lethal Beaver and Muskrat Damage Management.

Table 3.1. Mitigation measures and selected alternatives for beaver or muskrat damage management in Georgia.

Mitigation Measures	**Alternatives**				
	1	2	3	4	5
Animal Welfare and Humaneness of Methods Used by WS					
Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.		X	X	X	X
The Decision Model (Slate et al. 1992) would be used to identify effective biologically and ecologically sound beaver and muskrat damage management strategies and their impacts.		X	X	X	X
Captured non-target animals would be released unless it is determined by Georgia WS personnel that the animal would not survive.		X	X		
Use of traps and snares would conform to current laws and regulations administered by GADNR and Georgia WS policy.		X	X		
Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used for live animals.		X	X		
Use of newly-developed, proven, non-lethal methods would be encouraged when appropriate.			X	X	X
Safety Concerns Regarding WS' ARDM Methods					
All pesticides that are used by WS would be registered with the EPA.		X	X		
EPA-approved label directions would be followed by WS employees.		X	X		
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, would be used to determine beaver and muskrat damage management strategies.		X	X	X	X
Beaver and muskrat damage management conducted on public lands would be coordinated with the management agency.		X	X		X
WS employees that use pesticides would be trained to use each material and would be certified to use pesticides under EPA approved certification programs.		X	X		
WS employees who use pesticides would participate in approved continuing education to keep abreast of developments and maintain their certifications.		X	X		
Live-traps would be placed so that captured animals would not be readily visible from any road or public area.		X	X		
Pesticide use, storage, and disposal conforms to label instructions and other applicable laws and regulations, and Executive Order 12898.		X	X		

Material Safety Data Sheets for pesticides would be provided to all WS personnel involved with specific damage management activities.		X	X		
Concerns about Impacts of Damage Management on T&E Species, Species of Special Concern and Non-target Species.					
WS consulted with the USFWS regarding the nationwide program and the Georgia program and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.		X	X		X
Georgia WS take would be considered with the statewide "total harvest" (Georgia WS take and fur harvest) when estimating the impact on wildlife species.		X	X		
Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.		X	X		X
WS personnel would be trained and experienced to select the most appropriate method for taking targeted animals and excluding non-target species.		X	X		X
WS would initiate informal consultation with the USFWS following any incidental take of T&E species.		X	X		X

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

Chapter 4 provides information for making informed decisions about the beaver and muskrat damage management program outlined in Chapter 1 and the issues and affected environment discussed in Chapter 2. This chapter consists of: 1) analysis of environmental consequences, 2) analysis of each alternative against the issues considered in detail, and 3) summary of WS impacts.

4.1 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences using Alternative 3 (the current program) as the baseline when comparing the other alternatives to determine if real or potential impacts are greater, lesser, or the same (Table 4.4). The No Action Alternative is a procedural NEPA requirement (40 CFR 1502.14(d)). The No Action Alternative is a viable and reasonable alternative that could be selected to serve as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with the CEQ (CEQ 1981).

The following resource values within Georgia would not be adversely impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber and range. These resources will not be analyzed further.

4.1.1 Social and Recreational Concerns

Social and recreational concerns are discussed throughout the document as they relate to issues raised during public involvement. Additionally, they are discussed in USDA (1997).

4.1.2 Cumulative and Unavoidable Impacts

Impacts that are cumulative and unavoidable are discussed in relationship to each wildlife species and environmental impacts are analyzed in this chapter. This EA recognizes that the total annual removal of individual animals from wildlife populations from all sources is cumulative mortality. Analysis of Georgia WS takes from 1993-2002 and anticipated future WS take, in combination with other mortality, indicates that cumulative impacts are not adversely affecting the viability and health of wildlife populations. It is not anticipated that the Georgia WS program's beaver and muskrat damage management activities would result in any adverse cumulative impacts to T&E species, and do not jeopardize public health and safety.

4.1.3 Irreversible and Irretrievable Commitments of Resources

Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, no irreversible or irretrievable commitments of resources are apparent. Based on these estimates, the Georgia WS program produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.2 ISSUES ANALYZED IN DETAIL

This section presents the expected consequences of each alternative on each of the issues analyzed in detail.

4.2.1 Alternative 1. No WS Beaver or Muskrat Damage Management in Georgia.

Effects on beaver and muskrat populations. WS would have no impact on beaver and muskrat populations in Georgia. Impacts on beaver and muskrats would be variable dependent upon actions taken by affected resource owners. Some beaver and muskrat populations would continue to increase where trapping and shooting pressure was low and would decline or stabilize where trapping and shooting pressure was adequate. Some resource owners experiencing damage would trap or shoot beaver and muskrats, or hire private trappers to conduct the work. However, resource owners would receive no guidance from WS regarding these options. Other resource owners experiencing damage may take illegal or unsafe action against local populations of beaver and muskrats out of frustration of continued damage (USDA 1997). Results would be unknown impacts to populations of aquatic furbearers. Overall impacts on statewide beaver and muskrat populations would likely be similar to Alternative 3 if affected resource owners lethally removed the damaging beaver and muskrats that would no longer be removed by WS.

Effects on plants and other wildlife species, including T&E species. In the absence of WS assistance, some resource owners may attempt to trap beaver or muskrats or hire private trappers with little or no trapping experience. These resource owners or trappers would be more likely than WS personnel to trap non-target species and not report non-target take to regulatory authorities. Other resource owners experiencing damage may take illegal or unsafe action against local populations of beaver and muskrats out of frustration of continued damage resulting in unknown impacts to plant and wildlife populations.

One anticipated outcome of no WS beaver and muskrat damage management program is a likely increase in beaver and muskrat damage and associated beaver-created impoundments if resource owners did not remove beaver dams. Beaver impoundments would likely have an impact on other wildlife and plant species. Extent and nature of the impacts would depend upon the size of the beaver created impoundment and diversity of plant and animal species in the area. Some species would flourish in the newly created environment, while others would diminish. The positive effect of beaver activities, including affected species have been summarized in section 1.2.1. Negative effects of

beaver impoundments, including effected species, are described in section 1.2.4.

Aquatic rodent damage to native plant species may increase under this alternative unless affected resource owners implement their own aquatic rodent damage management program.

Effects on public and pet health and safety. If resource owners did not implement an effective beaver and muskrat damage management program in the absence of WS, potential for increased risks to public health and safety from unresolved damage situations is apparent. For example, burrowing into or flooding of roadways and railroad beds can result in serious accidents (Woodward 1983, Miller and Yarrow 1994). Beaver also are carriers of the intestinal parasite *Giardia lamblia*, which can contaminate water supplies and cause outbreaks of the disease Giardiasis in humans (Woodward 1983, Wade and Ramsey 1986, Miller and Yarrow 1994).

Additionally, resource owners inexperienced in the safe and proper use of management tools may attempt to resolve beaver and muskrat damage problems. Without professional assistance or proper training in the use of damage management tools, potential for increased risks to public and pet safety is possible. Increased risks are associated with the improper or inexperienced use of damage management methods such as trapping, shooting and dam removal with explosives.

Humaneness of methods to be used. This alternative would be considered humane by people that do not believe that WS should use lethal or non-lethal control methods. However, resource/property owners could use lethal and non-lethal methods to reduce beaver and muskrat damage in the absence of WS. Impacts on humaneness would depend on the experience of the person implementing the control method. Some people may perceive this method as inhumane, because they oppose all lethal methods of wildlife damage management. Some resource/property owners may take illegal action against localized populations of beaver or muskrats out of frustration of continued damage. Illegal actions may be less humane than methods used by experienced WS personnel.

Effects on wetlands. WS would have no impact on wetlands. Under this alternative, beaver dam breaching and removal needs 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 effects on wetland habitats in limited circumstances.

Economic losses to property. Beaver and muskrat damage would likely continue to increase unless an effective damage management program was implemented by non-WS personnel and would likely result in increased occurrences of flooding, gnawing and feeding damage to property.

Impact to stakeholders, including aesthetics. Impacts of this alternative to stakeholders would be variable depending on their values and compassion toward wildlife.

Resource/property owners receiving damage from beaver or muskrats would likely strongly oppose this alternative. Resource/property owners would bear the damage caused by beaver and muskrats under this alternative. Animal activists would prefer this alternative, because they have a strong moral belief regarding killing or using animals for any reason. Some people would support this alternative because of the enjoyment of seeing beaver or muskrats. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct damage management activities resulting in impacts similar to Alternative 3.

4.2.2 Alternative 2. Only Lethal Beaver and Muskrat Damage Management

Effects on beaver and muskrat populations. This alternative could result in a localized decrease in the beaver or muskrat populations at the specific site where the damage management occurs. Even if WS lethally removed beaver and muskrats at all project sites, it is not anticipated that more than 1,000 beaver and 250 muskrats would be taken annually by WS. Therefore, impacts on beaver populations are expected to be similar to those described in Alternative 3. New beaver or muskrats would likely replace removed animals and re-inhabit the site. The amount of time until new beaver or muskrats move into the area would vary depending on habitat type and quality, time of year and population densities in the surrounding area. In our experience in Georgia, some areas are re-colonized by beaver in times ranging from as little as 3 months to over 1 year.

Effects on plants and other wildlife species, including T&E species. Non-target species such as otter, raccoons, and turtles may occasionally be killed during beaver or muskrat damage management. Turtles may be caught in some traps and can generally be released alive. WS impacts on non-target species from capture methods would be similar to those described in Alternative 3.

Removal of beaver and muskrats may reduce gnawing and feeding on certain plants and mussels. Reduction in aquatic rodent damage to native plant species would be similar to Alternative 3 when lethal methods are effective in reducing such damage.

WS would not remove or breach beaver dams under this alternative. Impacts related to beaver dam breaching or removal on native plants and animals would be similar to Alternative 1.

Impacts of WS use of control methods on T&E species would be similar to Alternative 3.

Effects on public and pet health and safety. WS impacts on public and pet health and safety from the use of chemical and non-chemical control methods would be similar to Alternative 3.

WS impacts on public and pet health and safety resulting from the reduction of aquatic rodent health and safety risks would be similar to those described in Alternative 3, except in those situations where health and safety risks would be reduced by the use of non-

lethal methods, such as removal or breaching of beaver dams or installation of water control structures. Since WS would not implement or recommend non-lethal control methods under this alternative, impacts related to non-lethal methods would be similar to Alternative 1.

Humaneness of methods to be used. WS personnel are experienced and professional in using management methods and tools humanely and effectively. Under this alternative, beaver and muskrats would be humanely trapped or shot by experienced WS personnel using the best methods available. Beaver and muskrats live-captured in traps or snares would be euthanized by shooting. Some aquatic rodents may be removed through the use of drowning trap sets and registered toxicants. Some people could perceive these methods as inhumane, because they oppose all lethal methods of damage management.

Effects on wetlands. Under this alternative, WS would remove beaver and muskrats from a site; however, WS would not remove or breach beaver dams. Therefore, effects on wetlands from dam removal and breaching activities would be similar to Alternative 1.

Economic losses to property. Damage to property would be expected to decrease as beaver and muskrats are lethally removed from the site. Damage to property is expected to continue or increase in those situations where non-lethal methods, such as dam removal, would be necessary to reduce damage. In this case, damage would remain at unacceptable levels unless non-lethal methods are implemented by non-WS personnel.

Impacts to stakeholders, including aesthetics. Impacts of this alternative would be variable depending on each stakeholder's values and compassion toward wildlife. This alternative would likely be favored by resource/property owners who are receiving damage if lethal methods reduced damage to acceptable levels. Although, some owners would be saddened if the beaver or muskrats were removed. Animal activists would strongly oppose this alternative because of a strong moral belief regarding killing or using animals for any reason. Some people believe the benefits from aquatic rodents would outweigh the associated damage.

The ability to view and esthetically enjoy beaver or muskrats at a particular site could be limited if the animals are removed. However, new animals would most likely re-colonize the site in the future, although the length of time until new beaver or muskrats arrive is variable. Re-colonization depends on habitat type and quality, time of year and population densities of beaver and muskrats in surrounding areas. Opportunities to view beaver or muskrats are available if a person makes the effort to visit sites with adequate habitat outside of the damage management area.

4.2.3 Alternative 3. Fully Integrated Beaver and Muskrat Damage Management for all Public and Private Land (No Action/Proposed Action)

Effects on beaver and muskrat populations. The Georgia WS program removes a small number of beaver and muskrats from the statewide population (Table 4.1) (see Section

1.3). Unlike Alternative 2, the use of exclusion, habitat modification, beaver dam breaching/removal and water control devices could be used as part of an IWDM approach. Use of water control devices or removal/breaching of dams would have little or no effect on beaver populations.

The amount of time until new beaver or muskrats move into an area would vary depending on habitat type and quality, time of year and population densities in surrounding areas. From our experience in Georgia, some areas can be re-colonized by beaver in times ranging from as little as 3 months to over 1 year. The following is an analysis of potential impacts on beaver and muskrat populations in Georgia.

The authority for management of resident wildlife species in Georgia is the responsibility of the GADNR. Muskrats are classified as furbearers which have a regulated harvest season. While GADNR considers beaver a furbearer available for harvest during the annual statewide trapping season, beaver are classified by law as unprotected nongame wildlife that can be taken outside of established seasons. While GADNR does not regulate the harvesting of beaver, they do restrict methods of take to those currently allowable by law. GADNR compiles information on population trends and take, and uses this information to manage beaver and muskrat populations. Therefore, WS uses the best information available to generate a population range of beaver and muskrats in Georgia.

Table 4.1. Beaver and muskrats harvested and percentage take by WS in Georgia, 1993-2002.

	1993[1]	1994	1995	1996	1997	1998	1999	2000	2001	2002
# Beaver removed by WS	129	242	160	130	334	202	331	278	287	258
State Harvest of Beaver	4710	4256	3941	6074	5836	6172	4874	5398	6263	3957
Total Harvest of Beaver	4839	4498	4101	6204	6170	6374	5205	5676	6550	4215
% WS Take	2.6	5.3	3.9	2.0	5.4	3.1	6.3	4.8	4.3	6.1
# Muskrats removed by WS	10	44	4	47	10	11	61	4	1	3
State Harvest of Muskrats	629	658	761	496	991	973	705	447	293	296
Total Harvest of Muskrats	639	702	765	543	1001	984	766	451	294	299
% WS Take	1.5	6.2	0.5	8.6	0.9	1.1	7.9	0.8	0.3	1.0

[1]Year indicates the federal fiscal year (October 1 thru September 30) and the Georgia trapping season (December 1 thru February 15).

Beaver Population Information and Impact Analysis. Beaver occur mostly in family

groups that are comprised of 2 adult parents with 2-6 offspring from the current or previous breeding season (Novak 1987a). Average family group size has been documented as ranging from 3.0 to 9.2 beaver (Novak 1987a). Beaver abundance has been reported in terms of families/kilometer of stream or families/square kilometer of habitat. Novak (1987a) summarized reported beaver family abundance as ranging from 0.31 to 1.5 families/kilometer of stream, which converts to 0.5 - 2.4 families/mile of stream. Densities reported in terms of families/square kilometer have been reported to range from 0.15 to 3.9 (Novak 1987a) which is the same as 0.24 to 6.3 families/square mile. Additionally, Novak (1987a) indicates rates of beaver populations are density dependent, which means rates of increase generally increase as a population is reduced and decrease as a population reaches carrying capacity[2]. This is a natural function of most wildlife populations which helps to naturally mitigate population reductions. Studies have reported that beaver fecundity may be density dependent and that lower densities may cause an increase in litter size (Novak 1987a). However, density and dispersal are also reported as a function of many factors such as habitat (water quality, drought conditions, and food), mortality (trapping, predation, and disease), and behavior (territorial activities and intrafamily aggression) (Aleksiuk 1970 as cited in Novak 1987a, Tyurnin 1983 as cited in Novak 1987a, Novak 1987a). Logan et al. (1996) indicated that wildlife populations being held at a level below carrying capacity can sustain a higher level of harvest because of the compensatory mechanisms that cause higher rates of increase in such populations.

No population estimates were available for beavers in Georgia. Therefore the best available information was used to estimate statewide populations. There are over 7.7 million acres of wetlands in Georgia (Hefner et al. 1994) including an estimated minimum of 68,000 miles of streams and rivers (Southern Environmental Law Center 2003). Using the conservative estimate of 3 beavers per family group and an abundance of 0.5 families per stream mile provided by Novak (1987), the minimum statewide beaver population estimate for Georgia could be estimated at 102,000 beavers.

The total number of beaver taken by Georgia WS and fur trappers is shown in Table 4.1 (MIS 1993-2002 and GADNR). The FY97 take of 334 was the highest number ever removed by the Georgia WS program in one year and the second highest number of 331 beaver was taken in FY 99. Based upon current and anticipated increase in future work, it is anticipated that not more than 1,000 beaver would be killed annually by WS in Georgia. The ADC FEIS (USDA 1997) determined using qualitative information (population trend indicators and harvest data) that if WS beaver kill is less than or equal to 33% of the total harvest, the magnitude is considered low. Magnitude is defined as a measure of the number of animals killed in relation to their abundance. Using the harvest data and the annual take of 1,000 beavers by WS, the magnitude is considered low for WS take of beaver in Georgia. This limited take of beaver by WS should have minimal

[2]Carrying capacity is maximum number of animals the environment can sustain and is determined by food availability, water, cover, and tolerance of crowding by the particular species.

effects on the beaver population in Georgia.

GADNR reported the statewide beaver population is stable and determined there is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management will be detrimental to the survival of the beaver populations in the state of Georgia (GADNR letter to GA WS, 7/1/03; G. Waters, GADNR, personal communication).

Muskrat Population Information and Impact Analysis. Muskrats are considered abundant in Georgia and scattered in suitable habitat throughout the State. Muskrats can be found in marshes, ponds, sloughs, lakes, ditches, streams and rivers (Boutin and Birkenholz 1987). As described by Perry (1982), muskrat populations are cyclic with muskrats themselves greatly influencing their habitat and its carrying capacity. Population density varies widely and depends upon such factors as phase of population cycle, habitat type and condition, social pressures, competition, harvest, predation, and geographical area (Perry 1982). Muskrats are highly prolific and produce 3-4 litters/year and average 5-8 young/litter (Wade and Ramsey 1986) which are characteristics that make them relatively immune to over harvest (Boutin and Birkenholz 1987). Harvest rates of 3-8/acre have been reported to be sustainable in muskrat populations (Boutin and Birkenholz 1987). Muskrat home ranges have been shown to vary from 529 sq. ft to 11,970 sq. ft. (0.1 to 0.25 acres) with the size of home ranges occupied by muskrats depends on habitat quality and population density (Boutin and Birkenholz 1987).

No population estimates were available for muskrat in Georgia. Therefore the best available information was used to estimate statewide populations. There are over 7.7 million acres of wetlands in Georgia (Hefner et al. 1994) including an estimated minimum of 68,000 miles of streams and rivers (Southern Environmental Law Center 2003). Using the assumption that 50% of the wetlands support a muskrat population, an average home range of 0.25 acres per muskrat, only 1 muskrat occupies a home range, and no home ranges overlap, a conservative statewide muskrat population could be estimated at over 15.4 million muskrats.

Trapper harvest during the 1993-2002 regulated trapping seasons (Table 4.1) was estimated from GADNR mail survey responses. Muskrats do not cause substantial damage problems in Georgia and WS only removed 195 for depredation purposes from FY93 through FY2002. Additionally, 6 muskrats were taken as non-targets in beaver control activities during the same time period. Based upon current and anticipated increase in future work, it is anticipated that not more than 250 muskrats would be killed annually by WS in Georgia. This limited take of muskrats by WS should have minimal effects on the muskrat population in Georgia.

GADNR has determined that the current muskrat population within the state is stable and there is no evidence to suggest that human mediated mortality resulting from regulated fur harvest and damage management will be detrimental to the survival of the muskrat populations in the state of Georgia (GADNR letter to Georgia WS, 7/1/03; G. Waters,

GADNR, e-mail correspondence, 3/4/03).

Effects on plants and other wildlife species, including T&E species. Non-target species, such as otters, muskrats and raccoons may occasionally be taken during beaver damage management. Turtles also may be caught in some traps but can generally be released alive. WS personnel would minimize non-target takes with careful trap placement and variation in capture methods. Georgia WS has taken non-target animals during beaver and muskrat management activities during FY93 to FY02 (Table 2.1).

WS does not expect rate of non-target take to substantially increase above current program levels. ADC EIS (USDA 1997) determined using qualitative information (population trend indicators and harvest data) that if WS kill is less than or equal to 33% of the total harvest, magnitude is considered low. Magnitude is defined as a measure of number of animals killed in relation to abundance. Using available harvest data and annual take of non-target species commonly encountered by WS when conducting beaver and muskrat management activities, magnitude is considered, and expected to remain, extremely low for WS non-target take in Georgia. Therefore, cumulative take appears to be far beneath the level which would begin to cause decline in populations. Non-target takes of other less commonly encountered species are expected to be minimal (less than 10 individuals/year) and should have no adverse effect on statewide populations.

GADNR concurs that Georgia WS would have no adverse effects on native wildlife populations in Georgia, including state listed T&E species (GADNR, letter to GA WS, 11/19/03).

WS consulted with the USFWS concerning potential impacts of WS methods on T&E species in Georgia. The USFWS concurred that Georgia WS beaver and muskrat damage management methods "are not likely to adversely affect threatened or endangered species or their critical habitats" in Georgia (USFWS, letter to GA WS, 11/14/03).

Removal of beaver and muskrats may reduce gnawing and feeding on certain native plant and mussel species. This alternative would have the greatest likelihood of reducing such damage since all available methods could be used or recommended.

One anticipated outcome of this Alternative is a slight reduction in beaver and muskrat damage and associated beaver-created impoundments. Reduction in beaver-created impoundments would likely have an impact on other wildlife and plant species. Extent and nature of impacts would depend upon size of the impoundments and diversity of plant and animal species in surrounding areas. Some species would flourish, while others would diminish. Positive and negative impacts of aquatic rodents are discussed in section 1.2.

Effects on public and pet health and safety. WS may occasionally use binary explosives to breach or remove beaver dams. WS personnel that use explosives are required to take and pass in-depth explosives training and be able to demonstrate competence and safety

in use of explosives. Explosive specialists adhere to WS policies and regulations from the Bureau of Alcohol, Tobacco, and Firearms, the Occupational Safety and Health Administration and the U.S. Department of Transportation with regards to explosives use, storage and transportation. Binary explosives require two components to be mixed before actuation. The mixing requirement 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 and placards are placed to stop public entry. Where dams are near roads, police or other road officials are used to stop traffic and public entry. When WS uses explosives near major roadways GADOT crews are asked to assist in regulating traffic in the area. Therefore, no adverse effects to public safety are expected from use of explosives by WS.

WS methods of shooting and trapping pose minimal or no threat to public and pet health and safety. All firearms safety precautions are followed by WS when conducting ARDM, and WS complies with all laws and regulations governing the lawful use of firearms. Shooting with shotguns or rifles is sometimes used to reduce beaver and muskrat damage when lethal methods are determined to be appropriate. Shooting is selective for target species and may be used in conjunction with spotlights. WS uses firearms to humanely euthanize beavers and muskrats caught in live traps. Traps are strategically placed to minimize exposure to the public and pets. Appropriate signs are posted on all properties where traps are set to alert the public of trap presence. Body-grip (e.g., Conibear-type) traps used for beaver are restricted to water sets which further reduce threats to public and pet health and safety.

Firearms use is very sensitive and a public concern because of misuse. 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 three months of their appointment and a refresher course every two years afterwards (WS Directive 2.615). WS personnel who use firearms as a condition of their employment are required to meet criteria as stated in the *Lautenberg Amendment*.

All chemicals used by APHIS-WS are regulated by the EPA through the FIFRA and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions, chemicals are selective to target individuals or populations and such use has negligible impacts on the environment (USDA 1997).

This Alternative would allow WS to use or recommend all available and effective damage reduction strategies and methods to reduce threats to public health and safety caused by beaver and muskrats and beaver-created impoundments. This alternative would have the greatest possibility of successfully alleviating beaver damage such as flooding and burrowing, damage to roads and railroads, risks of Giardiasis outbreaks and possible mosquito borne disease outbreaks.

Humaneness of methods to be used. WS personnel are experienced and professional in

the use of management methods, and methods are applied humanely. Under this Alternative, beaver and muskrats would be trapped or shot by experienced WS personnel using the best method available. Beaver and muskrats live-captured in traps or snares would be euthanized by shooting. Some aquatic rodents may be removed through the use of drowning trap sets or the use of registered toxicants. Some people may perceive these methods as inhumane because they oppose all lethal methods of damage management. This Alternative allows WS to consider and use non-lethal methods for beaver and muskrat damage management when appropriate. Therefore, Alternative 3 would be preferred over Alternative 2 by those individuals that consider lethal control methods as inhumane.

Effects on wetlands. Beaver dams could be breached or removed by hand or with explosives for the purpose of returning streams, channels, dikes, culverts and irrigation canals to their original drainage pattern under this Alternative. Beaver dams are removed according to Section 404 of the Clean Water Act. WS breaches/ removes most beaver dams because of flooding areas such as yards, parks, roads, railroads, timberlands, croplands, pastures and other types of property or resources that were not previously flooded. Most dams that WS breaches or removes are created as a result of recent beaver activity. Dams are typically less than one year in age due to the fact that WS personnel receive most requests soon after resource/property owners discover damage. Recently flooded sites do not possess wetland characteristics, and wildlife habitat values are not the same as established wetlands. Appendix C describes the procedures used by WS to assure compliance with pertinent laws and regulations. For these reasons, WS beaver dam removal/breaching activities should have minimal impact on wetlands.

Economic losses to property. Property damage would be expected to decrease under this Alternative since all available damage management methods and strategies would be available for WS' use and consideration.

Impacts to stakeholders, including aesthetics. Impacts of this Alternative to stakeholders would be variable depending on values toward wildlife and compassion for neighbors. This Alternative would likely be favored by most resource owners who are receiving damage, because it allows for an IWDM approach to resolving damage problems. Most stakeholders without damage also would prefer this Alternative to Alternative 2, because non-lethal methods could be implemented when appropriate to resolve damage problems. Animal activists would strongly oppose this Alternative, because of strong moral beliefs regarding killing or using animals for any reason. Some people believe the benefits from aquatic rodents outweigh the associated damage. Possibilities of viewing and aesthetically enjoying beaver and muskrats at a particular site could be limited if these animals are removed. However, new animals would most likely re-colonize the site in the future. Length of time until new beaver and muskrats arrive is variable, and depends on habitat type and quality, time of year and population densities of beaver and muskrats in surrounding areas. Opportunities to view beaver and muskrats are available if efforts are made to visit sites with adequate habitat outside of the damage management area.

4.2.4 Alternative 4. Technical Assistance Only

Effects on beaver and muskrat populations. WS would have no impact on beaver and muskrat populations in Georgia. Impacts to beaver and muskrats would be variable dependent upon actions taken by affected resource owners. WS would provide technical advice to those persons requesting assistance. Resource/property owners could use information provided by WS or implement their own damage reduction program without WS technical assistance. Overall impacts would be similar to Alternative 1.

Effects on plants and other wildlife species, including T&E species. When WS technical advice is requested and followed, negative impacts to plants and wildlife species resulting from the improper use of control methods should be less than Alternative 1. Resource/property owners could use information provided by WS or implement their own damage reduction program without WS technical assistance.

Impacts from beaver dam breaching and removal activities would be similar to Alternative 1.

Aquatic rodent damage to native plant species may increase under this alternative unless affected resource owners implement their own aquatic rodent damage management program.

Effects on public and pet health and safety. WS would provide technical advice to those persons requesting assistance. Negative impacts to public and pet safety resulting from the improper use of control methods should be less than Alternative 1 when WS technical advice is followed. Resource/property owners could use information provided by WS or implement damage reduction methods without WS technical assistance.

Impacts to public and pet safety resulting from the reduction of aquatic rodent damage and conflicts would be similar to Alternative 1.

Humaneness of methods to be used. Issues of humaneness, as it relates to WS under this Alternative, are not applicable, because resource/property owners or others would be responsible for implementing damage management methods. WS would provide technical advice to those persons requesting assistance. Resource/property owners could use information provided by WS or implement a damage reduction program without WS technical assistance. Overall impacts should be less than Alternative 1 when WS technical advice is requested and followed.

Effects on wetlands. WS would have no direct impact on wetlands. WS would provide technical advice to those persons requesting assistance. Resource owners could use the information provided by WS or implement their own damage reduction program without WS technical assistance. Overall impacts should be less than Alternative 1 when WS technical advice is requested and followed.

Economic losses to property. WS would provide technical advice to those persons requesting assistance to reduce economic losses. Resource/property owners could use information provided by WS or implement a damage reduction program without WS technical assistance. Overall impacts would be similar to Alternative 1.

Impacts to stakeholders, including aesthetics. WS would provide technical advice to those persons requesting assistance. Resource/property owners could use information provided by WS or implement a damage reduction program without WS technical assistance. Overall impacts would be similar to Alternative 1.

4.2.5 Alternative 5. Non-lethal Beaver and Muskrat Damage Management

Effects on beaver and muskrat populations. No beaver or muskrats would be killed by WS under this Alternative. Beaver and muskrat populations could decrease, remain the same, or increase depending on actions taken by others. Use of water control devices or removal of dams by WS would have little or no effect on beaver or muskrat populations. If WS non-lethal methods and recommendations are effective in reducing beaver and muskrat damage to acceptable levels, beaver and muskrats would not likely be lethally removed by resource owners. However, in situations where damage is not reduced to acceptable levels by non-lethal methods, resource/property owners would likely implement a lethal damage management program resulting in impacts similar to Alternative 1.

Effects on plants and other wildlife species, including T&E species. WS lethal take of other wildlife species would not occur under this alternative. However, in the absence of an ARDM program by WS that includes the option of lethal removal of beaver and muskrats from damage sites, resource/property owners may attempt to trap and shoot beaver and muskrats or contract with private trappers having little or no trapping experience, resulting in impacts on other wildlife species similar to Alternative 1. Furthermore, in those situations where non-lethal methods do not effectively reduce aquatic rodent damage to plant and wildlife species impacts would be similar to Alternative 1.

Impacts of WS beaver dam removal and breaching activities would be similar to Alternative 3.

Impacts of WS use of non-lethal methods on T&E species would be similar to Alternative 3.

Effects on public and pet health and safety. Non-lethal methods, including exclusion and habitat modifications, would not be efficient or effective in resolving many beaver and muskrat damage situations. In situations where WS non-lethal methods and recommendations are ineffective at reducing damage to acceptable levels, impacts would

be similar to Alternative 1. In situations where non-lethal methods are effective, impacts would be similar to Alternative 3.

Potential risks to public and pet safety from the use of lethal control methods and non-lethal capture methods by WS would not occur under this alternative. However, in those situations where non-lethal methods do not reduce damage to acceptable levels, non-WS personnel may implement their own control program resulting in impacts similar to Alternative 1.

WS could use binary explosives to breach or remove beaver dams and reduce impacts caused by flooding. WS personnel that use explosives are required to take and pass in-depth training, and must be able to demonstrate competence and safety in use of explosives. Explosive specialists adhere to WS policies, regulations from the Bureau of Alcohol, Tobacco and Firearms, the Occupational Safety and Health Administration, and the Department of Transportation with regards to explosives use, storage, and transportation. Binary explosives require mixing of two components before actuation. Mixing virtually eliminates hazards of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not allowed. When explosives are used, signs or placards are placed to stop public entry. When explosives are used to remove beaver dams near roads, police or other road officials are used to stop traffic and restrict public entry. Stopping traffic is conducted to ensure public safety and similar to methods used by GADOT crews. Therefore, no adverse effects to public safety are expected from use of explosives by WS.

Humaneness of methods to be used. Under this Alternative, only non-lethal beaver and muskrat damage management methods would be implemented by WS. Some people may perceive this approach as humane because animals would not be taken lethally. However, when non-lethal methods are ineffective at reducing damage to acceptable levels, resource/property owners may implement a lethal damage management program or take illegal action against some local populations of beaver or muskrats resulting in impacts similar to Alternative 1.

Effects on wetlands. Beaver-created impoundments could be breached/removed by hand, with machinery, or with explosives by WS for the purpose of returning streams, channels, ditches and irrigation canals to the original drainage under this alternative. Overall impacts would be similar to Alternative 3.

Economic losses to property. This Alternative would not be favored by most resource/property owners who are receiving damage and when non-lethal methods do not reduce damage to acceptable levels. Damage to property would be expected to increase when non-lethal methods are ineffective. Beaver and muskrat damage would continue to increase unless an effective damage management program was implemented by people other than WS personnel and would likely result in increased occurrences of flooding, gnawing, burrowing and feeding damage to property.

Impacts to stakeholders, including aesthetics. While WS would provide non-lethal assistance under this Alternative, other individuals or entities could conduct lethal damage management. Impacts of this Alternative to stakeholders would be variable depending on effectiveness of WS non-lethal methods and resource/property owner actions. This Alternative would not be favored by most resource/property owners who are receiving damage and when non-lethal methods do not reduce damage. Most stakeholders without damage would prefer this Alternative to Alternative 2, because non-lethal methods would be implemented to resolve damage problems. Animal activists would strongly support this Alternative because of a strong moral belief regarding killing or using animals for any reason. Some people believe benefits from aquatic rodents outweigh associated damage. However, if resource/property owners do not accept WS non-lethal control methods and implement another type of control program, impacts would be similar to Alternative 1.

4.3 SUMMARY OF WS IMPACTS

Table 4.2 presents a summary of relative comparisons of the anticipated impacts of each of the alternatives as they relate to each of the major issues identified in Chapter 2.

4.3.1 Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the listed Alternatives (Table 4.2). With regard to Alternatives 2 and 3, Lethal Removal Only and the Proposed Action, respectively, lethal removal of beaver and muskrats by WS would have no adverse affect on beaver or muskrat populations in Georgia. No adverse risk to public or pet health and safety is expected from control methods implemented by WS under Alternatives 2, 3, and 5. However, some persons would likely oppose lethal removal of beaver and muskrats under any circumstance. Analyses in this EA indicate that such removals would result in no significant cumulative adverse impacts on the quality of the human environment.

Table 4.2. Summary of cumulative environmental impacts and Alternatives presented for ARDM conducted in Georgia.

	Alternative 1: No WS Beaver or Muskrat Damage Management in Georgia	Alternative 2: Only Lethal Beaver or Muskrat Damage Management	Alternative 3: Fully Integrated Beaver and Muskrat Damage Management for all Public and Private Land (No Action /Proposed Action)	Alternative 4: Technical Assistance Only	Alternative 5: Only Non-lethal Beaver or Muskrat Damage Management
Effects on Beaver and Muskrat Populations	No effects by WS. Populations could increase unless resource owners seek private help.	Possible reduction in local populations, no statewide effect.	Possible reduction in local populations, no statewide effect.	No effects by WS. Populations could increase unless resource owners seek private help.	No effects by WS. Populations could increase unless resource owners seek private help.
Effects on plants and other wildlife species, including T&E Species	No effects by WS. Impacts by non-WS personnel would be variable.	No adverse impact to plant and wildlife species, including T&E species populations.	No adverse impact to plant and wildlife species, including T&E species populations.	No effects by WS. Impacts by non-WS personnel would be variable.	No adverse impacts to plant and wildlife species, including T&E species populations
Effects on Public and Pet Health and Safety	No effects by WS. Continued risk from flooding, burrowing and diseases. Impacts from control methods by non-WS personnel would be variable.	No threat to public and pet safety from WS control methods. Reduction of risks from flooding, burrowing, and diseases.	No threat to public and pet safety from WS control methods. Reduction of risks from flooding, burrowing, and diseases.	No effects by WS. Continued risk from flooding, burrowing, and diseases. Impacts from control methods by non-WS personnel would be variable.	No threat to public and pet safety from WS control methods. Reduction of risks from flooding, burrowing, and diseases.
Humaneness of Methods to be Used	No effect by WS. Impacts by non-WS personnel would be variable.	Variable. WS uses the most humane methods available. Some people would oppose all lethal methods.	Variable. WS uses the most humane methods available. Some people would oppose all lethal methods.	No effect by WS. Impacts by non-WS personnel would be variable.	Variable. Probably considered more humane by most people than lethal methods.
Effects on Wetlands	No effect by WS	No effect by WS.	No probable effect by WS.	No effect by WS.	No probable effect by WS.
Economic Losses to Property	Losses would likely increase	Losses could be reduced or eliminated.	Losses could be reduced or eliminated.	Losses could be reduced or eliminated if resource owners take action.	Losses could be reduced; however, not to the level of Alternative 2 or 3.

Impacts to Stakeholders, including Aesthetics	No effects by WS. Variable, some people prefer this method. People receiving damage probably oppose this alternative.	Variable, those receiving damage would probably favor this alternative if damage could be reduced by lethal methods. Some people would oppose this alternative.	Variable, those receiving damage would probably favor this alternative. Some people would oppose this alternative.	No effects by WS. Variable, some people prefer this method. People receiving damage probably oppose this alternative.	Variable, those receiving damage would probably favor this alternative if damage could be reduced by non-lethal methods. Some people would favor this alternative.

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Appendix A
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Appendix B
Authority and Compliance

The USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the WS program is the Act of 1931 (7 USC 426-426c; 46 Stat. 1468), as amended in the FY2001 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."*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing *"bringing (damage) under control"*, rather than *"eradication"* and *"suppression"* of wildlife populations. In 1988, Congress strengthened the legislative mandate of WS with the Rural Development, Agriculture, and Related Agencies Appropriations 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 mammals and birds 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."*

Georgia Department of Natural Resources Legislative Mandate

The Georgia Department of Natural Resources' authority in wildlife management is given under Title 27, Chapters 1 – 5 of the Official Code of Georgia Annotated. This legislation covers general provisions; licenses, permits and stamps generally; wildlife generally; fish; and wild animals. GADNR, under the direction of the Board-appointed Commissioner and Commissioner-appointed Director, is specifically charged by the Legislature to conserve, manage, develop and protect natural resources and wildlife.

GADNR currently has a MOU with WS. The document establishes a cooperative relationship between WS and GADNR. Responsibilities include planning, coordinating, and implementing policies to address wildlife damage management and facilitating exchange of information.

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.

U.S. Army Corps of Engineers (COE)

The COE regulates and permits activities regarding waters of the United States including protection and utilization under Section 404 of the Clean Water Act.

U.S. Environmental Protection Agency (EPA)

EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) which regulates the registration and use of pesticides. The EPA is also responsible for administering and enforcing the Section 404 program of the Clean Water Act with the COE; this established a permit program for the review and approval of water quality standards that directly impact wetlands.

Compliance with Other Federal and State Statutes

Several federal laws, state laws, and state statutes regulate WS wildlife damage management. WS complies with these laws and statutes and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act. Environmental documents pursuant to NEPA must be completed before actions consistent with the NEPA decision can be implemented. WS also coordinates specific projects and programs with other agencies. 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.

Endangered Species Act. It is federal policy, under the 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 Section 7 consultations with the USFWS to use 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 or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec. 7(a)(2)).

Federal Insecticide, Fungicide, and Rodenticide Act. FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the Georgia WS program are registered with and regulated by the EPA and Georgia Department of Agriculture. All chemical methods used by WS would be in compliance with labeling procedures and

requirements.

Clean Water Act (Section 404). Section 404 (33 USC 1344) of the CWA prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE unless the specific activity is exempted in 33 CFR 323 or covered by a Nationwide Permit (NP) in 33 CFR 330. Breaching of most beaver dams is covered by these regulations (33 CFR 323 and 330). In addition, 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 breaching, may be considered "*incidental fallback*" which would not be governed by Section 404 and is allowed (Wayland and Shaeffer 1997).

Food Security Act. The Wetland Conservation provision (Swampbuster) of the 1985 (16 USC 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. Once cropland is considered abandoned, the cropland becomes a wetland subject to regulations under Swampbuster and Section 404 of the CWA. The Natural Resource Conservation Service (NRCS) is responsible for certifying wetland determinations according to this Act.

State of Georgia Animal Nuisance Control Program Agreement. This agreement authorizes Georgia WS employees and others under their supervision to control nuisance non-endangered and non-threatened wildlife using techniques proven and accepted in wildlife damage management.

The Official Code of Georgia Annotated 27-1-28 states: "Except as otherwise provided by law, rule, or regulation, it shall be unlawful to hunt, trap, fish, take, possess, or transport any nongame species of wildlife, except that the following species may be taken by any method except those specifically prohibited by law or regulation: Rats; Mice; Coyotes; Armadillos; Groundhogs; **Beaver**; Fresh-water turtles; Poisonous snakes; Frogs; Spring lizards; Fiddler crabs; Fresh-water crayfish; Fresh-water mussels; and Nutria."

Appendix C
Criteria for Beaver Dam Breaching/Removal

Beaver dam breaching/removal is generally conducted to maintain existing stream channels and drainage patterns and/or to reduce flood waters. Beaver dams are often made from natural debris such as logs, sticks and mud. Dams also might contain man-made materials such as tires, plastic pipe or plywood. Beaver are opportunistic when it comes to materials used for dam building. Approximately the center of the dam or area closest to the existing channel is dislodged during a beaver dam breaching operation. Impoundments that WS removes are normally from recent beaver activity and have not been in place long enough to take on the factors of a true wetland (i.e., hydric soils, hydrophytic vegetation, hydrology). Beaver dam breaching/removal by hand 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, dam breaching/removal is regulated under Section 404 of the CWA.

Wetlands are recognized by three characteristics: hydric soils, hydrophytic vegetation and general hydrology. Hydric soils are either composed of, or have a thick surface layer of, decomposed plant materials (muck); sandy soils have dark stains or streaks from organic material in the upper layer where plant material has attached to soil particles. Hydric soils may be bluish gray or gray below the surface or brownish black to black and have the common smell of rotten eggs. Wetlands also have hydrophytic vegetation present such as cattails, bulrushes, willows (*Salix* spp.), sedges (*Carex* spp.) and water plantains (Alismataceae). A final indicator is general hydrology which includes standing and flowing water or waterlogged soils during the growing season; high water marks often are present on trees and drift lines of small piles of debris are usually present. Beaver dams usually will develop a layer of organic material at the surface. Silt deposits can occur rapidly, but aquatic vegetation and high water marks (a new high water mark is created by the beaver dam) are usually not present. However, cattails and willows can show up rapidly if they are in the vicinity, but most hydrophytic vegetation takes time to establish.

In most beaver dam breaching/removal operations, the material that is displaced is exempt from permitting or included in a Nationwide Permit (NWP) in accordance with Section 404 of the CWA (33 CFR Part 323). A permit would be required if the impoundment caused by a beaver dam was not covered under a NWP or permitting exemption and was considered a true wetland. WS biologists and specialists survey the beaver dam site and impoundment to determine if conditions exist for classifying the site as a true wetland. If wetland conditions exist, the landowner or cooperator is asked the approximate age of the dam or how long he/she has known of its presence. This information is useful in determining if Swampbuster, Section 404 permit exemptions or nationwide permits will allow breaching/removal of the beaver dam. If it is determined that a dam cannot be removed or breached under provisions provided by Swampbusters, 404 permit exemption or NWP, the landowner or cooperator is responsible for obtaining a Section 404 permit before the dam could be breached/removed by WS.

The following explains Section 404 exemptions and conditions that pertain to the breaching/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 silvicultural practices 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 3 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 breached 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 breaching 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 breached without a permit where they have resulted in damage to roads, culverts, bridges, or levees if it is done in a reasonable amount of time.

33 CFR 330 - NWP Program. The USACE, Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment.

NWPs are listed in Appendix A of 33 CFR 330 and permittees must satisfy all terms and conditions established to qualify for their use. Individual beaver dam breaching 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 breaching/removal done under a specific NWP.

Nationwide permits can be used **except** in any component of the National Wild and Scenic River System such as waterways listed as an "*Outstanding Water Resource*", or any water body which is part of an area designated for *"Recreational or Ecological Significance"*.

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.

NWP 18 allows minor discharges of dredged and fill material, including the breaching 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 breached in a special aquatic area, but normally the aquatic site will be returned to normal. However, if a true wetland exists, and beaver dam breaching/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 notify the District Engineer according to "notification" procedures. On federal lands, including USACE 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 breaching/removal of a beaver dam would be allowed as long as it was not a true wetland. Non-federal public and private lands require the appropriate agreement, project documentation, or notification to be in place.

A quick response without delays resulting from permitting requirements can be critical to the

success of minimizing or preventing aquatic rodent damage. Exemptions contained in the above regulations or NWPs provide for the breaching/removal of the majority of beaver dams that Georgia 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 the site just a flooded area. Flexibility allowed by these exemptions and NWPs is important for the efficient and effective resolution of many beaver damage problems. Damage often escalates the longer an area remains flooded.

Appendix D
Methods Used or Recommended by Georgia WS For Beaver and Muskrat Damage Management

Resource owners and government agencies have used a variety of techniques to reduce beaver and muskrat damage. However, all lethal and non-lethal methods developed to date have limitations based on costs, logistics and effectiveness. Below is a discussion of beaver and muskrat damage management methods currently available to the Georgia WS program. If other methods are proven effective and legalized for use in Georgia, incorporation into the Georgia WS program would then be based upon NEPA compliance.

NON-LETHAL DAMAGE MANAGEMENT METHODS

Habitat Management

Habitat management for the reduction of beaver and muskrat damage refers to vegetation manipulation to reduce the carrying capacity for beaver and muskrats.

Beaver

Habitat alteration through forest type conversion might be the most effective long-term method of reducing beaver density in some areas (Payne 1989). Forest management practices that discourage the establishment of willow, sweet gum (*Liquidambar styraciflua*), and conifers and promote long-lived hardwoods within 200 - 400 feet of streams may reduce beaver populations on those streams. Payne (1989) suggested that reduced food availability might force beaver colonies to move more often. However, this increased movement could increase nuisance complaints. This type of management practice would be conducted by entities other than WS.

Physical factors may have a greater impact on beaver habitat use than food availability, and habitat alteration may have little effect on beaver populations (Beier and Barrett 1987). Habitat management to reduce or stabilize beaver populations has been a component of beaver management recommendations. Habitat management also may involve manipulating beaver impoundment water levels to reduce damage or conflict caused by flooding. Impoundments can be completely drained by breaching beaver dams by hand or with explosives. Water levels also may be lowered by use of a drain tube or leveler placed in a dam (Roblee 1983, Roblee 1984, Laramie and Knowles 1985, Roblee 1987, Miller and Yarrow 1994, Lisle 1996). However, application and success of this strategy has been limited (Nolte et al. 2000). Habitat management to reduce beaver populations has the greatest potential for application on federal, state, and county forest lands. At present, no large-scale and consistent programs exist to deal with this beaver damage management strategy.

Continual breaching of dams and removal of dam construction materials on a daily basis sometimes will cause beaver to move to other locations. Water control devices such as the three-

log drain (Roblee 1983), the T-culvert guard (Roblee 1987), wire mesh culvert (Roblee 1983), and the Clemson beaver pond leveler (Miller and Yarrow 1994) can sometimes be used to regulate water levels in beaver ponds. Additionally, the Beaver Deceiver is a water control system that attempts to quiet, calm, and deepen the water in front of culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). However, effectiveness of this method has not been evaluated in published documents.

Muskrat.

One of the best ways to reduce habitat for muskrats is to eliminate aquatic or other suitable foods preferred by muskrats. Habitat alterations to reduce cattail wetlands could reduce the density of muskrats. Where possible, constructing pond dams in a manner that discourage burrowing also will help protect resources. Preventing muskrats from burrowing into dams can be achieved by drawing water levels down in winter and filling burrows with rip-rap. These types of management practices would be conducted by entities other than WS.

Explosives

Explosives are defined as any chemical mixture or device which serves as a blasting agent or detonator. Explosives are generally used to breach beaver dams that are too large to remove by hand digging and after beaver have been removed from a damage situation. Binary explosives consist of ammonium nitrate and nitromethane and are not classified as explosives until mixed. Therefore, binary explosives are subject to fewer regulations and controls. However, once mixed, binary explosives are considered high explosives and subject to all applicable Federal requirements. Detonating cord and detonators are considered explosives and WS must adhere to all applicable State and Federal regulations for storage, transportation and handling. 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 closely supervised by professional wildlife biologists. Explosive handling and use procedures follow the rules and guidelines set forth by the Institute of Makers of Explosives which is the safety arm of the commercial explosive industry in the United States and Canada. WS also adheres to transportation and storage regulations from State and F
ederal agencies such as Occupational Safety and Health Association, Bureau of Alcohol, Tobacco, and Firearms and the Department of Transportation.

Beaver Dam Breaching/Removal

Dam breaching involves the removal of debris deposited by beaver that impedes the flow of water. Breaching a beaver dam is generally conducted to maintain existing stream channels, restore drainage patterns, and reduce flood waters that have negatively impacted silvicultural, agricultural, or ranching/farming activities. Beaver dams removed by WS are normally from

recent beaver activity, and sites have not had enough time to develop characteristics of a true wetland (i.e., hydric soils, hydrophytic vegetation, hydrological function). Unwanted beaver dams may be removed by hand or with explosives. Explosives are used only by WS' personnel specially trained and certified to conduct such activities. Only binary explosives are used (i.e., they are comprised of two parts that must be mixed before they can be detonated as an explosive material). Because beaver dams involve waters of the United States, removal is regulated under Section 404 of the CWA.

Beaver dam breaching does not affect substrate or natural course of streams. Breaching beaver dams often re-establishes preexisting conditions with similar flows and circulations. Most beaver dam breaching operations, if considered discharge, are covered under 33 CFR 323 or 330 and do not require a permit. A permit would be required if the beaver dam breaching/removal activity is not covered by a 404 permitting exemption or NWP and the area affected by the beaver dam was considered a true wetland. WS personnel survey the site and determine the apparent age of the dam by characteristics such as aquatic plant communities. If the site appears to have conditions over 3 years old or appears to meet the definition of a true wetland, the landowner or cooperator is required to obtain a permit before proceeding (See Appendix C for information that explains Section 404 permit exemptions and conditions for breaching/removing beaver dams).

Water Control Devices

Pond levelers and water control devices have been used in many different states with varying degrees of success (USGAO 2001). Various types of water control devices have been described (Arner 1964, Roblee 1984, Laramie and Knowles 1985, Lisle 1996). Clemson beaver pond levelers have proven effective in reducing flooding in certain situations if properly maintained (Miller and Yarrow 1994, Minnesota Department of Natural Resources 1994). Nolte et al. (2000) found Clemson beaver pond levelers to be 50% effective in meeting landowner objectives in Mississippi. The Beaver Deceiver is a relatively recent water control system that attempts to quiet, calm and deepen the water around culverts (to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). A critical part of the beaver deceiver strategy is to silence or prevent the sound of running water. The beaver deceiver is a water control system that has been evolving since 1996 and has been effective at controlling beaver flooding in some situations.

Water control devices generally are of two designs. One design is a perforated pipe passing through the beaver dam, and the second design is a fence erected 15 - 90 feet in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996, E. Butler, USDA/APHIS/WS, personal communication). Erection of a fence could be considered exclusion, but when used in conjunction with a pipe or culvert, is considered a water control device. The second design may have a perforated pipe going from the fence to the culvert to allow water to flow, because the fence may become clogged with debris.

Cost of water control devices is variable depending on number of devices/dam, type of device, materials, and labor. Large dams may need multiple devices to accommodate the volume of water in the flowage. Materials and installation of water control devices can be relatively modest for a three-log drain (Arner 1964), $500 - $750 for a single modified Clemson beaver pond leveler (B. Sloan, USDA/APHIS/WS, personal communication), $1050 - $2,300 for a single beaver stop (DCP Consulting, Calgary, Canada, 1996), or over $1,000 for a Beaver Deceiver. A modified Beaver Deceiver can be constructed for $250 -$300; however, annual maintenance costs were estimated at $350 (E. Butler, USDA/APHIS/WS, personal communication). Jensen et al. (1999) reported that the initial costs for a Clemson Beaver Pond Leveler and a Pitchfork Guard/Grate in the first year, including the costs of materials, installation, and maintenance, were $1,542 and $3,688, respectively. The cost of a Beaver Deceiver may range from $150 - $1,500, and an additional cost would be applied if pipes were needed at the site (S. Lisle, Penobscot Nation, letter to J. Cromwell, WS, September 7, 2000).

Use of pond levelers or water control devices may require frequent maintenance depending on the type of water control device. Continued maintenance is often necessary for the device to remain operational because stream flow, leaf fall, floods and continued beaver activity will continuously bring debris to the water control device. Maintenance and upkeep of water control devices vary from site to site but can be expensive. The Maine WS program estimated annual maintenance costs to be approximately $350/water control device (E. Butler, USDA/APHIS/WS, personal communication). Mississippi WS reported the construction and installation cost of pond levelers to cost approximately $700 (T. Aderman, USDA/APHIS/WS, personal communication). Annual costs may also be associated with suppressing beaver populations to keep the devices operational (B. Sloan, USDA/APHIS/WS, personal communication).

Water control devices are most effective in specific types of terrains and sites (NYDEC 1997, Wood et al. 1994). Water control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS, personal communication), and may be ineffective in beaver ponds in broad, low-lying areas (Organ et al. 1996). Water control devices may not be appropriate in streams or ditches with continuous flow, because the volume of water is too great for the device to handle. Streams and ditches with continuous flow often carry debris to the device and cause drainage problems. Periods of unusually high rainfall or increased water flow may render the devices less effective because of increased water volume (Wood et al. 1994, Anonymous 1999).

Exclusion Methods

Exclusion involves physically preventing beaver or muskrats from gaining access to protected resources through fencing or other barriers. Fencing of small critical areas such as around culverts and drain pipes can sometimes prevent plugging by beaver. Fencing can help protect valuable resources in situations where girdling or gnawing of trees or shrubs is a concern. In these situations hardware cloth, metal flashing, or sand/paint mixtures can be used to protect plants. Recent preliminary tests by NWRC suggest that sand mixed in paint may be an effective barrier against beaver gnawing and cutting of trees or other objects (D. Nolte,

USDA/APHIS/WS/NWRC, unpublished data). Construction of concrete spillways may reduce or prevent damage to dams. Rip-rap also can be used on dams or levees at times to deter burrowing. Electrical barriers have proven effective in limited situations for excluding mammals and birds. 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 excluding mammals and birds. Effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted, because beaver will continue to avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997).

Protecting ornamental or landscape trees from beaver, nutria, and muskrat damage by using hardware cloth or similar material, a sand/paint mixture, or chain-link fence is recommended frequently by WS. This method is used most frequently by property and homeowners. It is rarely, if ever, used to prevent large-scale timber or forest damage due to high material costs and labor required to wrap hundreds or thousands of trees in a managed forest. A variety of road culvert screens or fences have been used by county and local highway departments. In most cases the screens do not solve a damage problem, as workforce is still required to remove beaver dam materials from the screen or fence. The main benefit of this technique is preventing beaver dam materials from being deposited inside the culvert.

Live-capture Methods

Leg-hold traps can be effectively used to capture a variety of mammals. 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. Beaver and muskrats live-captured in leg-hold traps would be 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 body or leg and later euthanized by shooting.

Hancock traps (suitcase/basket type cage traps) are designed to live-capture 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-grip traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999). Beaver captured in Hancock traps would be euthanized by shooting.

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 1987b). 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.

LETHAL DAMAGE MANAGEMENT METHODS

Lethal damage management involves methods specifically designed to remove beaver and muskrats in certain situations to a level that stabilizes, reduces or eliminates damage. Level of removal necessary to achieve a reduction of beaver and muskrat 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 the beaver populations in limited areas (Hill 1976, Forbus and Allen 1981).

Specific control methods involve removing beaver, with body-grip (e.g., Conibear) and leg-hold traps, snares, and shooting. Muskrats may be removed with body-grip and leg-hold traps, colony or cage traps, snap traps, shooting or toxicants. However, WS does not relocate beaver and muskrats in Georgia. All live-captured target animals would be euthanized. Live-capture devices are described in the section above. These specific methods are described in USDA (1997). A formal risk assessment of all mechanical devices used by the WS program in Mississippi can be found in USDA (1997). These techniques are usually implemented by WS personnel because of technical training required to use such devices.

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 beaver or muskrats 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 utilized 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 beaver or muskrat damage management 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 2 years afterwards (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.

Body-grip (e.g., Conibear) traps are designed to cause quick death of the animal that activates the trap. The number 330 body-grip trap is generally used for beaver and the number 110 for muskrats. Body-grip 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 Conibear traps, such as those used for muskrats, can be set either in or out of the water. Placement is in travel ways or at 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-grip traps present a minor risk to non-target animals because of the selectivity of placement in aquatic habitats and below the water surface.

CHEMICAL MANAGEMENT METHODS

All chemicals used by Georgia WS are registered under FIFRA and administered by the EPA and the Georgia Department of Agriculture. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. The chemical method used and/or currently authorized for use in Georgia is zinc phosphide.

Zinc phosphide is a toxicant registered in Georgia for use in muskrat and nutria damage management. No toxicants are registered for use on beaver. Use of zinc phosphide on various types of fruit, vegetable, or cereal baits (e.g., apples, carrots, sweet potatoes, oats, barley) has proven to be effective at suppressing local populations. All chemicals used by WS are registered under FIFRA and administered by EPA and the Georgia Department of Agriculture. Zinc phosphide is federally registered by APHIS/WS. Specific bait applications are designed to minimize non-target hazards (Evans 1970). Zinc phosphide presents minimal secondary hazard to predators and scavengers. Zinc phosphide is an emetic; therefore, meat-eating animals such as mink, dogs, cats, and raptors regurgitate animals that are killed with zinc phosphide with little or no effect. No T&E species occurring in Georgia would be affected by use of this formulated product (USFWS, letter to WS, 11/14/03). WS personnel that use chemical methods are certified as pesticide applicators by the Georgia Department of Agriculture and are required to adhere to all certification requirements set forth in FIFRA and the Georgia pesticide application laws and regulations. No chemicals are used on federal or private lands without authorization from the land management agency or property owner/manager. A quantitative risk assessment, which evaluated potential impacts of WS use of chemical methods when used according to the label,

concluded that no adverse effects are expected from the above (USDA 1997).

APPENDIX E

Federally Listed Threatened and Endangered Species in Georgia

Status	Species
E	Acornshell, southern (*Epioblasma othcaloogensis*)
T(S/A)	Alligator, American (*Alligator mississippiensis*)
T	Bankclimber, purple (mussel) (*Elliptoideus sloatianus*)
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, upland (*Epioblasma metastriata*)
E	Darter, amber (*Percina antesella*)
T	Darter, Cherokee (*Etheostoma scotti*)
E	Darter, Etowah (*Etheostoma etowahae*)
T	Darter, goldline (*Percina aurolineata*)
T	Darter, snail (*Percina tanasi*)
T	Eagle, bald (*Haliaeetus leucocephalus*)
E	Kidneyshell, triangular (*Ptychobranchus greeni*)
E	Logperch, Conasauga (*Percina jenkinsi*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
E	Moccasinshell, Coosa (*Medionidus parvulus*)
E	Moccasinshell, Gulf (*Medionidus penicillatus*)
E	Moccasinshell, Ochlockonee (*Medionidus simpsonianus*)
XN	Mussel, oyster AL (*Epioblasma capsaeformis*)
E	Pigtoe, oval (*Pleurobema pyriforme*)
E	Pigtoe, southern (*Pleurobema georgianum*)
T	Plover, piping (*Charadrius melodus*)
T	Pocketbook, finelined (*Lampsilis altilis*)
E	Pocketbook, shinyrayed (*Lampsilis subangulata*)
XN	Riversnail, Anthony's AL; (*Athearnia anthonyi*)
T	Salamander, flatwoods (*Ambystoma cingulatum*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Shiner, blue (*Cyprinella caerulea*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Stork, wood (AL, FL, GA, SC) (*Mycteria americana*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
T	Tern, roseate (*Sterna dougallii dougallii*)
T(S/A)	Turtle, bog (=Muhlenberg) (southern) (*Clemmys muhlenbergii*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Woodpecker, red-cockaded (*Picoides borealis*)
T	Amphianthus, little (*Amphianthus pusillus*)
E	Rattleweed, hairy (*Baptisia arachnifera*)

E	Leather flower, Alabama (*Clematis socialis*)
E	Coneflower, smooth (*Echinacea laevigata*)
T	Pink, swamp (*Helonias bullata*)
E	Quillwort, black spored (*Isoetes melanospora*)
E	Quillwort, mat-forming (*Isoetes tegetiformans*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	Pondberry (*Lindera melissifolia*)
T	Button, Mohr's Barbara (*Marshallia mohrii*)
E	Dropwort, Canby's (*Oxypolis canbyi*)
E	Harperella (*Ptilimnium nodosum*)
E	Sumac, Michaux's (*Rhus michauxii*)
T	Water-plantain, Kral's (*Sagittaria secundifolia*)
E	Pitcher-plant, green (*Sarracenia oreophila*)
E	Chaffseed, American (*Schwalbea americana*)
T	Skullcap, large-flowered (*Scutellaria montana*)
E	Campion, fringed (*Silene polypetala*)
E	Torreya, Florida (*Torreya taxifolia*)
E	Trillium, persistent (*Trillium persistens*)
E	Trillium, relict (*Trillium reliquum*)
E	Grass, Tennessee yellow-eyed (Xyris tennesseensis)

T=Threatened
E=Endangered
S/A=similar in appearance to T/E

Appendix F

State Listed Threatened and Endangered Species in Georgia

Ambystoma cingulatum	Flatwoods Salamander	T
Amphiuma pholeter	One-toed Amphiuma	R
Aneides aeneus	Green Salamander	R
Cryptobranchus alleganiensis	Hellbender	R
Haideotriton wallacei	Georgia Blind Salamander	T
Notophthalmus perstriatus	Striped Newt	R
Plethodon petraeus	Pigeon Mountain Salamander	R
Acipenser brevirostrum	Shortnose Sturgeon	E
Alosa alabamae	Alabama Shad	U
Ameiurus serracanthus	Spotted Bullhead	R
Cyprinella caerulea	Blue Shiner	E
Cyprinella callitaenia	Bluestripe Shiner	T
Cyprinella gibbsi	Tallapoosa Shiner	R
Cyprinella xaenura	Altamaha Shiner	E
Enneacanthus chaetodon	Blackbanded Sunfish	R
Erimystax insignis	Blotched Chub	T
Etheostoma brevirostrum	Holiday Darter	T
Etheostoma chlorobranchium	Greenfin Darter	T
Etheostoma chuckwachatte	Lipstick Darter	E
Etheostoma ditrema	Coldwater Darter	T
Etheostoma duryi	Black Darter	I
Etheostoma etowahae	Etowah Darter	T
Etheostoma parvipinne	Goldstripe Darter	R
Etheostoma scotti	Cherokee Darter	T
Etheostoma tallapoosae	Tallapoosa Darter	R
Etheostoma trisella	Trispot Darter	T
Etheostoma vulneratum	Wounded Darter	E
Fundulus auroguttatus	Banded Topminnow	R
Fundulus bifax	Stippled Studfish	E
Fundulus catenatus	Northern Studfish	T
Hemitremia flammea	Flame Chub	E
Hybopsis amblops	Bigeye Chub	R
Ichthyomyzon bdellium	Ohio Lamprey	R
Lucania goodei	Bluefin Killifish	U

Lythrurus bellus	Pretty Shiner	T
Micropterus notius	Suwannee Bass	R
Moxostoma carinatum	River Redhorse	R
Moxostoma robustum	Robust Redhorse	E
Notropis ariommus	Popeye Shiner	T
Notropis harperi	Redeye Chub	R
Notropis hypsilepis	Highscale Shiner	T
Notropis photogenis	Silver Shiner	E
Notropis scepticus	Sandbar Shiner	R
Noturus eleutherus	Mountain Madtom	T
Noturus funebris	Black Madtom	R
Noturus munitus	Frecklebelly Madtom	E
Noturus nocturnus	Freckled Madtom	E
Percina antesella	Amber Darter	E
Percina aurantiaca	Tangerine Darter	T
Percina aurolineata	Goldline Darter	T
Percina jenkinsi	Conasauga Logperch	E
Percina lenticula	Freckled Darter	E
Percina sciera	Dusky Darter	R
Percina shumardi	River Darter	E
Percina sp. cf. macrocephela	Muscadine Darter	R
Percina squamata	Olive Darter	T
Percina tanasi	Snail Darter	T
Phenacobius crassilabrum	Fatlips Minnow	E
Phenacobius uranops	Stargazing Minnow	T
Pteronotropis euryzonus	Broadstripe Shiner	R
Pteronotropis welaka	Bluenose Shiner	R
Typhlichthys subterraneus	Southern Cavefish	R
Aimophila aestivalis	Bachman's Sparrow	R
Campephilus principalis	Ivory-billed Woodpecker	E
Charadrius melodus	Piping Plover	T
Charadrius wilsonia	Wilson's Plover	R
Corvus corax	Common Raven	R
Dendroica kirtlandii	Kirtland's Warbler	E
Elanoides forficatus	Swallow-tailed Kite	R
Falco peregrinus	Peregrine Falcon	E
Haematopus palliatus	American Oystercatcher	R

Haliaeetus leucocephalus	Bald Eagle	E
Mycteria americana	Wood Stork	E
Picoides borealis	Red-cockaded Woodpecker	E
Sterna antillarum	Least Tern	R
Sterna nilotica	Gull-billed Tern	T
Thryomanes bewickii	Bewick's Wren	R
Vermivora bachmanii	Bachman's Warbler	E
Amblema neislerii	Fat Threeridge	E
Elliptoideus sloatianus	Purple Bankclimber	T
Epioblasma metastriata	Upland Combshell	E
Epioblasma othcaloogensis	Southern Acornshell	E
Epioblasma penita	Southern Combshell	E
Fusconaia masoni	Atlantic Pigtoe Mussel	E
Lampsilis altilis	Fine-lined Pocketbook	T
Lampsilis perovalis	Orange-nacre Mucket	T
Lampsilis subangulata	Shinyrayed Pocketbook	E
Medionidus acutissimus	Alabama Moccasinshell	T
Medionidus parvulus	Coosa Moccasinshell	E
Medionidus penicillatus	Gulf Moccasinshell	E
Medionidus simpsonianus	Ochlockonee Moccasinshell	E
Pleurobema decisum	Southern Clubshell	E
Pleurobema georgianum	Southern Pigtoe	E
Pleurobema perovatum	Ovate Clubshell	E
Pleurobema pyriforme	Oval Pigtoe	E
Ptychobranchus greenii	Triangular Kidneyshell	E
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	R
Eubalaena glacialis	Northern Right Whale	E
Felis concolor coryi	Florida Panther	E
Felis concolor couguar	Eastern Cougar	E
Megaptera novaeangliae	Humpback Whale	E
Myotis grisescens	Gray Myotis	E
Myotis sodalis	Indiana Myotis	E
Neofiber alleni	Round-tailed Muskrat	T
Trichechus manatus	Manatee	E
Allium speculae	Flatrock Onion	T
Amphianthus pusillus	Pool Sprite, Snorkelwort	T
Arabis georgiana	Georgia Rockcress	T

Arnoglossum diversifolium	Variable-leaf Indian-plantain	T
Asplenium heteroresiliens	Wagner Spleenwort	T
Balduina atropurpurea	Purple Honeycomb Head	R
Baptisia arachnifera	Hairy Rattleweed	E
Calamintha ashei	Ohoopee Dunes Wild Basil	T
Carex baltzellii	Baltzell Sedge	E
Carex biltmoreana	Biltmore Sedge	T
Carex dasycarpa	Velvet Sedge	R
Carex manhartii	Manhart Sedge	T
Carex misera	Wretched Sedge	T
Carex purpurifera	Purple Sedge	T
Ceratiola ericoides	Rosemary	T
Chamaecyparis thyoides	Atlantic White-cedar	R
Clematis socialis	Alabama Leather Flower	E
Croomia pauciflora	Croomia	T
Cuscuta harperi	Harper Dodder	T
Cymophyllus fraserianus	Fraser Sedge	T
Cypripedium acaule	Pink Ladyslipper	U
Cypripedium parviflorum var. parviflorum	Small-flowered Yellow Ladyslipper	U
Cypripedium parviflorum var. pubescens	Large-flowered Yellow Ladyslipper	U
Draba aprica	Open-ground Whitlow-grass	E
Echinacea laevigata	Smooth Purple Coneflower	E
Elliottia racemosa	Georgia Plume	T
Epidendrum conopseum	Green-fly Orchid	U
Evolvulus sericeus var. sericeus	Creeping Morning-glory	E
Fimbristylis perpusilla	Harper Fimbry	E
Fothergilla gardenii	Dwarf Witch-alder	T
Gentianopsis crinita	Fringed Gentian	T
Gymnoderma lineare	Rock Gnome Lichen	E
Hartwrightia floridana	Hartwrightia	T
Helonias bullata	Swamp-pink	T
Hexastylis shuttleworthii var. harperi	Harper Heartleaf	U
Hydrastis canadensis	Goldenseal	E
Hymenocallis coronaria	Shoals Spiderlily	E
Illicium floridanum	Florida Anise-tree	E
Isoetes melanospora	Black-spored Quillwort	E

Isoetes tegetiformans	Mat-forming Quillwort	E
Isotria medeoloides	Small Whorled Pogonia	T
Jeffersonia diphylla	Twinleaf	E
Leavenworthia exigua var. exigua	Gladecress	T
Lindera melissifolia	Pondberry	E
Lindernia saxicola	Rock False Pimpernel	E
Litsea aestivalis	Pondspice	T
Lysimachia fraseri	Fraser Loosestrife	R
Lythrum curtissii	Curtiss Loosestrife	T
Marshallia mohrii	Coosa Barbara Buttons	T
Marshallia ramosa	Pineland Barbara Buttons	R
Matelea alabamensis	Alabama Milkvine	T
Matelea pubiflora	Trailing Milkvine	R
Melanthium woodii	Ozark Bunchflower	R
Myriophyllum laxum	Lax Water-milfoil	T
Nestronia umbellula	Indian Olive	T
Neviusia alabamensis	Alabama Snow-wreath	T
Oxypolis canbyi	Canby Dropwort	E
Panicum hirsutii	Hirst Panic Grass	E
Penstemon dissectus	Grit Beardtongue	R
Physostegia leptophylla	Tidal Marsh Obedient Plant, Narrowleaf Dragonhead	T
Pinguicula primuliflora	Clearwater Butterwort	T
Pityopsis pinifolia	Sandhill Golden-aster	T
Platanthera integrilabia	Monkeyface Orchid	T
Ptilimnium nodosum	Harperella	E
Quercus oglethorpensis	Oglethorpe Oak	T
Rhododendron prunifolium	Plumleaf Azalea	T
Rhus michauxii	Dwarf Sumac	E
Sabatia capitata	Cumberland Rose Gentian	R
Sageretia minutiflora	Tiny-leaf Buckthorn	T
Sagittaria secundifolia	Little River Water-plantain	T
Salix floridana	Florida Willow	E
Sanguisorba canadensis	Canada Burnet	T
Sarracenia flava	Yellow Flytrap	U
Sarracenia leucophylla	Whitetop Pitcherplant	E
Sarracenia minor	Hooded Pitcherplant	U

Sarracenia oreophila	Green Pitcherplant	E
Sarracenia psittacina	Parrot Pitcherplant	T
Sarracenia purpurea	Purple Pitcherplant	E
Sarracenia rubra	Sweet Pitcherplant	E
Schisandra glabra	Bay Starvine	T
Schwalbea americana	Chaffseed	E
Scutellaria montana	Large-flowered Skullcap	E
Scutellaria ocmulgee	Ocmulgee Skullcap	T
Sedum nevii	Nevius Stonecrop	T
Sedum pusillum	Granite Stonecrop	T
Senecio millefolium	Blue Ridge Golden Ragwort	T
Shortia galacifolia	Oconee Bells	E
Sibbaldiopsis tridentata	Three-tooth Cinquefoil	E
Sideroxylon thornei	Swamp Buckthorn	E
Silene polypetala	Fringed Campion	E
Silene regia	Royal Catchfly	R
Spiraea virginiana	Virginia Spirea	T
Spiranthes magnicamporum	Great Plains Ladies-tresses	E
Stewartia malacodendron	Silky Camellia	R
Stylisma pickeringii var. pickeringii	Pickering Morning-glory	T
Thalictrum cooleyi	Cooley Meadowrue	E
Thalictrum debile	Trailing Meadowrue	T
Tillandsia recurvata	Ball-moss	T
Torreya taxifolia	Florida Torreya	E
Trientalis borealis	Northern Starflower	E
Trillium persistens	Persistent Trillium	E
Trillium reliquum	Relict Trillium	E
Viburnum bracteatum	Limerock Arrow-wood	E
Waldsteinia lobata	Piedmont Barren Strawberry	T
Xerophyllum asphodeloides	Eastern Turkeybeard	R
Xyris tennesseensis	Tennessee Yellow-eyed Grass	E
Caretta caretta	Loggerhead	T
Chelonia mydas	Green Sea Turtle	T
Clemmys guttata	Spotted Turtle	U
Clemmys muhlenbergii	Bog Turtle	T
Dermochelys coriacea	Leatherback Sea Turtle	E
Drymarchon couperi	Eastern Indigo Snake	T

Eretmochelys imbricata	Hawksbill Sea Turtle	E
Gopherus polyphemus	Gopher Tortoise	T
Graptemys barbouri	Barbour's Map Turtle	T
Graptemys geographica	Map Turtle	R
Graptemys pulchra	Alabama Map Turtle	R
Lepidochelys kempii	Kemp's Or Atlantic Ridley	E
Macrochelys temminckii	Alligator Snapping Turtle	T

T=Threatened R=Rare
E=Endangered U=Unusual

Appendix G

[1] WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

[2]Carrying capacity is maximum number of animals the environment can sustain and is determined by food availability, water, cover, and tolerance of crowding by the particular species.