ENVIRONMENTAL ASSESSMENT

FERAL SWINE DAMAGE MANAGEMENT BY THE OKLAHOMA WILDLIFE SERVICES PROGRAM

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ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FLIR	Forward Looking Infrared
FR	Federal Register
FSIS	Food Safety and Inspection Services
FY	Fiscal Year
IV	Intravenous
IC	Intracardiac
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
ODAFF	Oklahoma Department of Agriculture, Food and Forestry
ODWC	Oklahoma Department of Wildlife Conservation
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program in Oklahoma continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with feral swine (*Sus scrofa*). Individual wildlife damage management projects conducted by the WS program could be categorically excluded from further analysis under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003).

The purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual projects that WS could conduct to manage damage and threats of damage caused by feral swine. This EA will assist in determining if the proposed cumulative management of damage could have a significant impact on the human environment based on previous activities conducted by WS and based on the anticipation of conducting additional efforts to manage damage caused by feral swine. Because the goal of WS would be to conduct a coordinated program to alleviate damage in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives would be to provide assistance when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within Oklahoma as part of a coordinated program. This EA analyzes the potential effects of feral swine damage management when requested, as coordinated between WS, the Oklahoma Department of Agriculture, Food and Forestry (ODAFF), and the Oklahoma Department of Wildlife Conservation (ODWC). The ODAFF regulates the sale of feral swine, feral swine held in enclosures, the import and transport of feral swine into and within the State, and conducts feral swine damage management through the ODAFF State Wildlife Services Division, as directed by the State Legislature and State Board of Agriculture. The ODWC regulates the hunting and trapping of wildlife in the state, which can coincide with the pursuit of feral swine.

WS and the ODAFF, in consultation with the ODWC, are preparing this EA to evaluate the need for managing damage caused by feral swine and to evaluate a range of alternatives to meet that need while addressing the issues associated with implementing the different approaches. This EA will assist in determining if implementation of the alternatives could potentially have significant or cumulative effects on the human environment. More specifically, WS and the ODAFF will use this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities, 5) evaluate and determine if there would be any potentially significant or cumulative effects from the alternative approaches developed to meet the need for action, and 6) document the analyses of the environmental consequences of the alternatives to comply with the NEPA. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, and public involvement.

WS and the ODAFF previously developed an EA that addressed activities to manage damage associated with feral swine. Based on the analyses in that EA, a Decision and Finding of No Significant Impact were signed selecting the proposed action alternative. The proposed action

[1]The WS program is authorized to protect agriculture and other resources from damage caused by wildlife through the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c).

alternative implemented a damage management program using a variety of methods in an integrated approach. Changes in the need for action and the affected environment have prompted WS and the ODAFF to initiate this new analysis to address feral swine damage in the State. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action, primarily a need to address damage and threats of damage associated with increasing feral swine populations in the State.

This EA evaluates the need for action to manage damage associated with feral swine in the State, the potential issues associated with managing damage caused by feral swine, and the environmental consequences of conducting different alternatives to meet the need for action while addressing the identified issues. WS and the ODAFF initially developed the issues and alternatives associated with managing damage in consultation with the ODWC. To assist with identifying additional issues and alternatives to managing damage associated with feral swine, this EA will be made available to the public for review and comment prior to the issuance of a Decision[2].

1.2 NEED FOR ACTION

In 2008, to address increasing feral swine populations within the State and the damages associated with feral swine, the Oklahoma legislature passed the Feral Swine Control Act (see Title 2, Chapter 1, Article 6, Section 6-602 of the Oklahoma Statutes). The purpose of the Feral Swine Control Act (see Section 6-602) is to "*…to provide aggressive measures to reduce the number of feral swine in Oklahoma*". The need for action to manage damage associated with feral swine in Oklahoma arises from requests for assistance[3] received by WS and the ODAFF to reduce and prevent damage associated with feral swine. Feral swine, also known as "*wild pigs*", "*wild boars*", and "*feral hogs*", are medium-size hoofed mammals that look similar to domestic swine. They usually have coarser and denser coats than their domestic counterparts and exhibit modified canine teeth called "*tusks*", which are usually 7.5 to 12.5 cm (3 to 5 inches) long, but could be up to 23 cm (9 inches) long. These tusks curl out and up along the sides of the mouth. Lower canines are also prominent but smaller. Young feral swine may have pale longitudinal stripes on the body until they are about six weeks of age. Adults of the species average 90 cm (3 feet) in height with a length of 1.32 to 1.82 m (4.5 feet to 6 feet). Males may attain a weight of 75 kg to 200 kg (165 lbs to 440 lbs), while females may weigh 35 kg to 150 kg (77 lbs to 330 lbs).

Feral swine breed any time of year but peak breeding times usually occur in the fall. Litters sizes usually range from one to 12 piglets (Mayer and Brisbin 2009). Feral swine are the most prolific wild mammal in North America. Given adequate nutrition, a feral swine population can reportedly double in just four months (Barrett and Birmingham 1994). Feral swine may begin to breed as young as four months of age and sows can produce two litters per year (Mayer and Brisbin 2009). Feral swine are found in variable habitat in most of the United States, with the highest densities occurring in the southern United States. Populations are usually clustered around areas with ample food and water supplies. Evidence of the presence of feral swine may be rooted-up earth, tree rubs at ground level to 900 cm (36 inches) high, with clinging hair or mud, and muddy wallows.

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[2]After the development of the EA by WS and the ODAFF and after public involvement in identifying new issues and alternatives, WS will issue a Decision. Based on the analyses in the EA after public involvement, WS will make a decision to publish a Notice of Intent to prepare an Environmental Impact Statement or WS will issue notice a Finding of No Significant Impact to the public in accordance to the NEPA and the Council of Environmental Quality regulations.

[3]WS would only conduct feral swine damage management after receiving a request for assistance. Before initiating feral swine damage activities, a Memorandum of Understanding, work initiation document, or other comparable document would be signed between WS and the cooperating entity, which would list all the methods the property owner or manager would allow to be used on property they own and/or manage.

Swine are not a native species in North America, including Oklahoma (Mayer and Brisbin 1991). Domesticated swine were likely first introduced onto the North American continent by European explorers that used swine as a food source. Until the early 1900s, closed-range or fencing for livestock was not a common practice and allowing domesticated swine to range freely was common. As domestic swine were allowed to roam freely, many swine became feral. Until the 1930s, all feral swine originated from domesticated swine; however, starting in the 1930s, Russian wild boars, that are native to Europe and Asia, were imported into areas of the United States for sport hunting. As wild boars escaped or as boars were released to roam freely, crossbreeding occurred between feral swine and the Russian wild boar. Feral swine in Oklahoma and across North America include feral domestic swine and the wild boar, which have been released or escaped. Although morphologically distinct, both the domestic swine and the Eurasian wild boar are recognized as *S. scrofa*. When free roaming in North America, domestic swine and the wild boar are included in the term "*feral swine*", as are hybrids of the two types.

The earliest records of feral swine in Oklahoma occurred before 1970 from the south-central and southeastern part of the State (Stevens 2010). Prior to 1970, the feral swine distribution in the State was limited to 12 counties. Historically, the distribution of feral swine in the State was likely limited to the floodplains of the major river systems within the State. In 2007, feral swine were found in 74 of the 77 counties within the State, with their general distribution continuing to resemble the historical range of swine along the major river systems throughout the State, especially in the northern and western portion of the State (Stevens 2010). However, many of the counties in the north central and northwestern portion of the State have limited feral swine distribution and/or feral swine densities are considered low (Stevens 2010). Anecdotal evidence suggests that feral swine currently occur in all the counties of the State (Stevens 2010, Wild Hog Working Group 2012). The feral swine population has increased in Oklahoma since the 1980s as the range of the feral swine has spread from the southeastern portion of the State, especially along major river systems (Steven 2010).

The natural dispersal of feral swine, the unintentional release of domestic swine, and the release of swine by hunters is likely responsible for feral swine becoming established in Oklahoma where they were not found previously (Dr. Justin Roach, ODAFF, pers. comm. 2014). Based on survey responses and density estimates, Stevens (2010) estimated the statewide feral swine population to be 500,000 feral swine or less. As the feral swine population increased and expanded in the State, the damage associated with feral swine also increased (Stevens 2010). Feral swine are omnivorous (*i.e.*, eat both animal and plant matter) and they are opportunistic feeders (*i.e.*, taking advantage of available food sources) that feed primarily by rooting and grazing (Sweeney et al. 2003, Ditchkoff and Mayer 2009, West et al. 2009, Stevens 2010).

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1990). The imminent threat of damage or the loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Feral swine have no intent to do harm. They utilize habitats (*e.g.*, reproduce, travel, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or pose a threat to human safety, people often seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, how damage is defined is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where an individual person has determined the losses associated with wildlife is

actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety; however, "*damage*" could also be defined as a loss in the aesthetic value of property and other situations where the behavior of wildlife is no longer tolerable to an individual person.

Damage caused by feral swine occurs primarily from the consumption of resources and the destruction of habitat from their rooting and wallowing behavior. Feral swine can also pose threats to human safety and property from being struck by airplanes and by vehicles. Estimates have placed the agricultural and environmental damage caused by feral swine from $800 million per year (Pimentel et al. 2005) to $1.5 billion per year (Pimentel 2007) in the United States. In addition, Lowe et al. (2000) ranked feral swine as one of the 100 worst invasive species in the world. More specific information regarding feral swine damage to agricultural resources, natural resources, property, and threats to human safety are discussed in the following subsections of the EA.

Need to Manage Damage to Agricultural Resources Caused by Feral Swine

Agricultural damage and threats caused by feral swine can occur to a variety of crops, livestock, and other agricultural resources (Beach 1993, Seward et al. 2004, West et al. 2009, Hamrick et al. 2011). Damage occurs from direct consumption of agricultural resources and from trampling, rooting, and/or wallowing that are common activities of feral swine. Rooting is a common activity of feral swine during their search for food where they overturn sod and soil in the search for food (West et al. 2009, Stevens 2010, Hamrick et al. 2011). Feral swine also wallow in water and mud to regulate body temperature and to ward off skin parasites.

Damage and threats to livestock associated with feral swine can occur from predation on livestock and the risks associated with disease transfer from feral swine to domestic livestock (West et al. 2009, Hamrick et al. 2011). Feral swine can also cause damage to other agricultural resources. For example, feral swine can cause damage to pastures and land used for hay by rooting and wallowing, can cause damage to ponds and water sources for livestock, and can cause damage from the consumption of livestock feed. Feral swine feeding activities in agricultural crops can also lead to increased erosion from the removal of vegetation that leaves the soil bare along with the overturning of soil caused by rooting.

Feral swine can cause damage to a variety of agricultural crops through direct consumption but also from trampling, rooting, and wallowing (Beach 1993, West et al. 2009, Stevens 2010, Hamrick et al. 2011). In Oklahoma, numerous grain crops, forage crops, and vegetable crops are susceptible to feral swine damage, including corn, soybeans, cotton, peanuts, canola, sorghum, rye, sunflower, oats, wheat, milo, alfalfa, and watermelons. Of the grain crops grown in Oklahoma during 2012, wheat, soybeans, and corn ranked the highest in acres harvested. In 2012, there were 5.4 million acres of wheat planted in the State with a production value of nearly $1.2 billion while 420,000 acres of soybeans and 360,000 acres of corn were planted with a combined production value of nearly $285 million (USDA 2014). From April 1, 2005 through September 30, 2013, the WS program in Oklahoma documented approximately $1,093,380 in damages to field crops associated with feral swine. Stevens (2010) reported that one instance of feral swine damage in Oklahoma to peanut crops resulted in a monetary loss that exceeded $40,000. Stevens (2010) also reported feral swine rooting along recently planted rows of corn to consume the seed. A large percentage of the losses associated with feral swine are in addition to the loss resulting from the resource being eaten, such as replanting seed that feral swine consumed (Beach 1993).

Feral swine can also cause damage to pastures, land used for hay, and sod farms through rooting and wallowing activities (Beach 1993, West et al. 2009, Stevens 2010, Hamrick et al. 2011). During

2011, there were 2.5 million acres of hay harvested in the State with a production value of $255 million. From April 1, 2005 through September 30, 2013, the WS program in Oklahoma received requests for assistance involving $3,335,783 in damages to pastures and rangeland[4] associated with feral swine. Rooting activities can also lead to increased erosion and soil loss. Wallowing and rooting activities in watering areas for livestock can result in severely muddied water, algal blooms, oxygen depletion, bank erosion, soured water, and reduction in fish viability (Beach 1993). Since feral swine often travel in family groups, damage from rooting and wallowing can be extensive and often encompasses several acres.

Additional risks associated with feral swine are the potential for disease transmission from feral swine to domestic livestock, especially to domestic swine. Feral swine are potential reservoirs for several diseases that are known to be transmissible between feral swine and domestic livestock (Wood and Barrett 1979, Corn et al. 1986, Beach 1993). Corn et al. (1986) found feral swine tested in Texas were positive for pseudorabies, brucellosis, and leptospirosis. A study in Oklahoma found samples from feral swine tested positive for antibodies of porcine parvovirus, swine influenza, and porcine reproductive and respiratory syndrome virus (Saliki et al. 1998). Porcine reproductive and respiratory syndrome is a highly infectious virus that causes reproductive failure and respiratory disease in swine (USDA 2009). The total cost of productivity losses due to porcine reproductive and respiratory syndrome in the domestic swine herd in the United States was estimated at $664 million annually during 2011 and represented an increase from the $560 million annual cost estimated in 2005 (Holtkamp et al. 2013). A reported outbreak of porcine reproductive and respiratory syndrome in a northern Oklahoma domestic swine operation created losses, through high rates of illness and mortality in adult swine and neonates, of nearly 15,000 pigs, representing a financial loss in excess of $500,000 (D. Parrish, ODAFF, pers. comm. 2014).

Pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. An economic analysis estimated the cost of pseudorabies to pork producers in the United States at more than $30 million annually in lost production as well as testing and vaccination costs (USDA 2008). Brucellosis is a bacterial disease that can also have negative impacts on reproduction in swine.

Cholera, trichinosis, and African swine fever are additional diseases that can be transmitted between livestock and feral swine. Disease transmission is likely to occur where domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas. Although several diseases carried by swine are also transmissible to other livestock, the primary concern is the potential transmission of diseases from feral swine to domestic swine. Many of the diseases associated with feral swine also negatively affect the health and marketability of domestic swine that can lead to economic losses to a livestock producer. A disease outbreak not only has negative economic implications to an individual livestock producer but an outbreak also could cause economic losses that can negatively affect the statewide swine industry.

The United States is one of the world's largest producers of pork and is the second largest exporter of pork. Pork production in the United States accounts for about 10% of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports more than 600,000 jobs (USDA 2008). The annual statewide inventory of all domestic swine generally exceeds 2 million animals in Oklahoma. In December 2012, there were approximately 2.3 million domestic swine in Oklahoma (USDA 2014). Although the source of livestock disease outbreaks can be difficult to identify, a risk of transmission and the spreading of

[4]The amount of damage reported to WS or verified by WS accounts for only those incidents where WS' assistance was requested in dealing with feral swine damage and the damage reported to or verified by WS does not represent all damage that occurs in Oklahoma.

diseases to domestic swine and other livestock exists wherever feral swine and domestic livestock interact (Witmer et al. 2003). In addition to large-scale commercial operations, small-scale "*backyard*" swine operations where domestic swine could interact with feral swine are also at risk (Saliki et al. 1998). With the large number of domestic swine in the State, the potential exists for severe economic losses to occur because of the transmission of infectious diseases between feral and domestic swine.

The WS program in Oklahoma conducts disease surveillance as part of the National Wildlife Disease Surveillance Program. The number of disease samples collected from feral swine by WS during federal fiscal year (FY) 2007 through FY 2013 and the rate of disease prevalence from those samples collected are shown in Table 1.1. As part of the National Wildlife Disease Surveillance Program, the WS program in Oklahoma sampled feral swine for diseases in 14 counties during FY 2007, 18 counties during FY 2008, five counties during FY 2009, 13 counties during FY 2010, 18 counties during FY 2011, 16 counties during FY 2012, and 16 counties during FY 2013.

As shown in Table 1.1, of the 349 samples collected by WS and sent for leptospirosis testing, nearly 26% were sero-positive (*i.e.*, having a positive serum test for the presence of an antibody) for the disease. Surveillance activities conducted by the WS program have also confirmed the presence of pseudorabies, swine brucellosis, swine influence virus, *Toxoplasma gondii*, *Trichinella spiralis*, and Hepatitis E virus in the feral swine population within the State. As mentioned previously, feral swine are potential reservoirs for diseases that are known to be transmissible between feral swine and domestic livestock. In some cases, livestock producers and other entities can manage diseases within livestock (*e.g.*, treating animals, removing animals); however, the abundant and widely distributed disease reservoir among feral swine can complicate disease management since feral swine could represent a source of new transmission.

Table 1.1 – Feral swine samples collected by WS and sero-positive rates, FY 2007 – FY 2013

Disease	# of Samples	% Positive
Classical Swine Fever	1,254	0.0%
Leptospirosis	349	25.8%
Pseudorabies	1,303	17.7%
Swine Brucellosis	1,301	5.6%
Swine Influenza Virus	899	2.6%
Toxoplasma gondii	682	18.8%
Trichinella spiralis	710	1.8%
African Swine Fever	73	0.0%
Foot and Mouth Disease	49	0.0%
Hepatitis E Virus	482	9.5%

In addition to the potential for disease transmission, feral swine also predate livestock. Feral swine have been reported to kill considerable numbers of domestic livestock, especially young animals, in some areas (Barrett and Birmingham 1994). Feral swine can kill calves, kids (goats), lambs, and poultry (West et al. 2009, Stevens 2010). Predation occurs primarily on young livestock but feral swine can also kill weakened or injured livestock. If feral swine populations continue to increase, WS could receive requests for assistance to address localized predation by feral swine. Losses to livestock reported to or verified by WS in Oklahoma totaled $3,185 from FY 2006 to FY 2013, which only represents losses from agricultural producers requesting assistance from WS. Since feral swine so thoroughly consume young prey, there is often little evidence remaining to suggest that a birthing and subsequent predation occurred. If a landowner is not alert to the possibility of feral swine

predation, it is easy to overlook this as a cause for low production. Frequently, even when predation is considered, feral swine often escape suspicion because people generally underestimate their capabilities as a predator (Beach 1993).

In many parts of Oklahoma, ranchers rely on riparian habitat to provide shade and watering areas for their livestock. Riparian habitat can be destroyed by the rooting and wallowing behavior exhibited by feral swine. This is particularly true when drought conditions concentrate large numbers of feral swine into limited riparian areas (Beach 1993).

Since feral swine can cause damage and pose threats to agricultural resources, an increase in the statewide population of feral swine could lead to an increase in the number of requests for assistance received by WS to manage damage and threats.

Need to Manage Damage and Threats to Natural Resources caused by Feral Swine

Natural resources may be described as those assets belonging to the public and often managed and held in trust by government agencies for citizens. Such resources may be plants or animals, including threatened and endangered species, historic properties, or habitats in general. Examples of natural resources are historic structures and places; parks and recreational areas; natural areas, including unique habitats or topographic features; threatened and endangered plants or animals; and any plant or animal populations that have been identified by the public as a natural resource.

Damage in areas supporting feral swine populations can sometimes be a serious natural resource management concern for land managers. Substantial damage has occurred to natural resources, including destruction of fragile plant communities, killing, and destruction of tree seedlings, and erosion of soils (Barrett and Birmingham 1994, West et al. 2009, Hamrick et al. 2011). Food sources for feral swine includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation including roots, tubers, grasses, fruit, and berries, but feral swine also eat crayfish, frogs, snakes, salamanders, mice, eggs and young of ground nesting birds, young rabbits, and any other easy prey or carrion encountered (Ditchkoff and Mayer 2009). Feral swine have been known to kill and eat fawns of white-tailed deer (*Odocoileus virginianus*) (Hellgren 1993, Ditchkoff and Mayer 2009).

Feral swine can cause damage to natural flora and fauna on private lands along with designated natural areas, such as parks and wildlife management areas in Oklahoma. Those sites suffer erosion and local loss of critical ground plants and roots as well as destruction of seedlings because of their feeding and other activity (Barrett and Birmingham 1994). Many experts in the fields of botany and herpetology have observed notable declines in some rare species of plants, reptiles, amphibians, and soil invertebrates in areas inhabited by feral swine (Singer et al. 1982). Many state and federal natural resource managers are now in the process of controlling swine numbers because of their known impact to endangered plants and animals (Thompson 1977). Feral swine can disturb large areas of vegetation and soils through rooting, and feral swine inhabiting coastal, upland, and wetland ecosystems can uproot, damage, and feed on rare native species of plants and animals (Means 1999). Feral swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fishes), and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986).

One of the more important seasonal food resources used by feral swine is wild fruit and nut crops, especially oak mast (Wood and Roark 1980). Mast crops, such as beechnut (*Fagus* spp.), acorns (*Quercus* spp.), and hickory nuts (*Carya* spp.), are an important food source for deer, wild turkey

(*Meleagris gallopavo*), black bear (*Ursus americanus*), and squirrels (*Sciurus* spp.) (Knee 2011). Oak mast is an important food source for white-tailed deer and wild turkey. Each adult feral swine can consume up to 1,300 pounds of mast per year (Knee 2011). When feral swine actively compete for mast, resident deer and wild turkey may enter the winter with inadequate fat reserves; thus, threatening the viability of these native wildlife species (Beach 1993). They can also compete for acorns and hickory nuts with native wildlife during years of poor mast production (Campbell and Long 2009). In years of poor mast production, feral swine were found to have negative effects on white-tailed deer populations due to competition for acorns (Wood and Roark 1980). Due to their acute sense of smell, feral swine more rapidly and efficiently consume fallen mast crop (Beach 1993). Feral swine also have the ability to change to other food sources when acorns were depleted, which deer are often unable to do (Beach 1993). Consumption of hard mast by feral swine in forests also reduces the potential for forest regeneration, further affecting the food chain necessary to maintain species diversity and stable populations (Campbell and Long 2009).

Feral swine compete with over 100 species of native wildlife for important and limited natural food supplies, and will consume animal material year round, including earthworms, arachnids, crustaceans, insects, gastropods, fish, amphibians, reptiles, birds, and mammals (Mayer and Brisbin 2009). The rooting behavior of feral swine has been identified as the cause of the near extirpation of northern short-tailed shrews (*Blarina brevicuada*) and southern red-backed voles (*Clethrionomys gapperi*) in areas with intensive rooting due to the removal of leaf litter, which is crucial for the survival of those two species (Singer et al. 1984). Feral swine will often search out and excavate food caches used by small mammals, potentially affecting their ability to survive (Campbell and Long 2009).

Feral swine can cause direct mortality through predation on native wildlife species. Feral swine are known to feed on many smaller animals (some threatened or endangered), and will consume voles, shrews, turtles, amphibians, and shrub- or ground-nesting birds (Campbell and Long 2009). Many species, including quail, turkey, and shorebirds, are at risk of predation by nest destruction and the consuming of eggs (Campbell and Long 2009). A study conducted in northern Texas found that feral swine consumed 23.5% and 11.5 % of simulated Northern bobwhite (*Colinus virginianus*) nests in each of the study areas. Researchers concluded feral swine nest predation could be a contributing factor in Northern bobwhite population declines (Timmons et al. 2011).

Mayer and Brisbin (2009) found that of the 40 studies they reviewed, 86% listed vertebrates consumed by feral swine. In New Zealand, feral swine have been implicated in local extinctions of the endangered Hutton's Shearwater (*Puffinus huttoni*) (Campbell and Long 2009). Feral swine were found to be a common nest predator to re-introduced Eastern wild turkeys (*M. g. silvestris*) at a 10,782-acre Texas wildlife management area. In 1998, researchers removed 68 swine during the first year of a study and estimated the turkey nesting success rate was 0% in the study area (Timmons et al. 2011). The following year, researchers removed 313 feral swine from the study area and the nesting success rate for turkeys increased to 25%. Timmons et al. (2011) concluded that feral swine were a contributing factor to turkey nest depredation in the wildlife management area. Feral swine have also been documented preying on turkey poults (Wood and Lynn 1977). A 20-year study on woodcock found that feral swine were one of the main causes in the decline of this species in West Germany (Nyenhuis 1991).

Plant forage makes up approximately 88% of a feral swine's dietary composition and is consumed year-round (Mayer and Brisbin 2009). This high dependence on vegetation may be why feral swine can cause the greatest damage to environmentally sensitive areas (Campbell and Long 2009). Feral swine can reduce recruitment of saplings, increase the spread of invasive plants, prevent forest regeneration, reduce seedlings and seedling survival, and eliminate understory (Campbell and Long 2009). Rooting behavior by feral swine in beech forest understory was found to be so severe that

recovery was unlikely to occur (Bratton 1975). Where feral swine reduced herbaceous and belowground vegetation, recovery time was expected to take more than three years (Howe et al. 1981). Feral swine reduce the amount of vegetative ground cover and leaf litter, reducing the critical microclimatic conditions necessary for seedling establishment and growth in forests (Chavarria et al. 2007).

In terrestrial plant communities, disturbance can threaten native communities by promoting the spread of invasive, exotic plant species (Tierney and Cushman 2006). Following disturbance through feeding activities by feral swine, percent cover of native perennial grasses recovered at a consistently slower rate than exotic grasses (Tierney and Cushman 2006). Tierney and Cushman (2006) also found that removing or reducing the size of feral swine populations is an effective technique for restoring native perennial grasses.

Habitat damage by feral swine is most pronounced in wet environments (Engeman et al. 2007). Wet soils may make it easier for feral swine to obtain the foods they favor, such as the roots, tubers, and bulbs that are characteristic of many wetland plants. Choquenot et al. (1996) found that there appeared to be a strong correlation between soil moisture and rooting damage. Aquatic macrophytes are a key component of habitat in wetlands, providing both an important food resource and structural complexity to the waterscape for associated biota (Thomaz et al. 2008). Macrophytes are an aquatic plant that grows in or near water and are emergent, submergent, or floating. The destruction of wetland vegetation by feral swine was also found to alter production and respiration regimes causing anoxic (depleted of dissolved oxygen) conditions (Doupe et al. 2010). Lower dissolved oxygen levels caused chronic sub-lethal effects for the associated biota.

Feral swine can affect lakes, ponds, streams, and wetlands, since their rooting and wallowing activities near water sources may increase water turbidity in streams and wetlands, and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986). Increases in water turbidity reduce water quality and can affect native fishes (DeBenedetti 1986). Doupe et al. (2010) found that feral swine foraging in wetland floodplains disrupted physical, chemical, and biological environments by increasing turbidity, destroying aquatic macrophytes, and by causing the proliferation of bare ground and open water.

Feral swine spend considerable time in aquatic habitat foraging or wallowing (Mersinger and Silvy 2007). They are known to forage both in and out of water to obtain wetland roots and bulbs (Doupe et al. 2010). Due to their foraging behavior, feral swine are more likely to disturb the wetland substrate and water body.

Kaller and Kelso (2003) found that feral and free-ranging swine were linked to increased levels of fecal coliform and other potentially pathogenic bacteria in a watershed. Kaller et al. (2007) used DNA fingerprinting to determine that feral swine contribute detectable *E. coli* into aquatic ecosystems. Additionally, some species of freshwater mussels and aquatic insects were negatively affected by feral swine fecal coliforms within the watershed (Kaller and Kelso 2006).

Need to Manage Damage to Property associated with Feral Swine

Feral swine can damage landscaping, golf courses, roads, drainage ditches and cause erosion by feeding in these areas. Feral swine dig or root in the ground with their nose in search of desired roots, grubs, earthworms, and other food sources. This activity turns sod and grass over, which often leaves the area bare of vegetation and susceptible to erosion. In 2005, feral swine overturned, and moved a number of gravestones in a cemetery near Thackerville, Oklahoma (Tommy Vinson, ODAFF, pers. comm. 2014).

Feral swine also pose a threat to property from being struck by motor vehicles (Miller 1993, Mayer and Johns 2007) and aircraft. Mayer and Johns (2007) collected data on 179 feral swine-vehicle collisions involving 212 feral swine. Mayer and Johns (2007) suggested that vehicular accidents with feral swine are costly due to their mass; and that potentially, the total annual cost of feral swine-vehicle collisions in the United States can be as high as $36 million, roughly $1,173 per vehicle (Mayer and Johns 2007). Swine could also be struck by aircraft at air facilities in the State.

Hunting dogs are susceptible to disease exposure from feral swine. In 2011, pseudorabies infection was diagnosed in three dogs that were used to hunt feral swine. The dogs developed clinical signs, including facial pruritus with facial abrasions, dyspnea, vomiting, diarrhea, ataxia, muscle stiffness, and death. Two were euthanized immediately, and one died within approximately 48 hours after onset of clinical signs (Cramer et al. 2011). In Coal County, Oklahoma, four hunting dogs from one pack contracted pseudorabies after pursuing feral swine during 2013, and all infected dogs died (W. Starry, US Army, MCAAP, pers. comm. 2014).

Need to Reduce Threats to Human Safety associated with Feral Swine

Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from being struck by vehicles and aircraft. Feral swine are potential reservoirs for approximately 30 viral and bacterial diseases (Davidson and Nettles 1997, Samuel et al. 2001, Williams and Barker 2001) and 37 parasites (Forrester 1991) that are transmissible to people. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the zoonotic diseases (*i.e.*, diseases that could be transmitted to people) that can be carried by feral swine (Hubalek et al. 2002, Seward et al. 2004, Stevens 2010); however, actual transmission of diseases to people is thought to be rare (Amass 1998).

Over 200 people in the United States became ill and three deaths were reported after people ate spinach leaves that were contaminated with *E. coli* that was identified as originating from feral swine feces deposited in California spinach fields (United States Food and Drug Administration 2007, Rouhe and Sytsma 2007). Vehicle collisions are also a human health and safety threat due to the potential for injury or death when striking feral swine, which can weigh up to 400 pounds or more (Mayer and Johns 2007). In 2013, an auto accident involving feral swine on Hwy 817 in Jefferson County, Oklahoma left the passenger of the vehicle in critical condition (National Broadcast Company News 2013).

Swine can serve as major reservoirs of H1N1 and H3N2 influenza viruses, which are endemic in swine populations worldwide and are responsible for one of the most prevalent respiratory diseases in swine (Brown 2004). The maintenance of these viruses in swine and the frequent exchange of viruses between swine and other species are facilitated directly by swine husbandry practices. Following interspecies transmission to swine, some influenza viruses may be extremely unstable genetically, giving rise to many virus variants (Brown 2004). It is a concern of public health officials that swine will be the organism in which a re-assortment of the H5N1 virus changes into one that is easily transmitted between people (Hutton et al. 2006).

In many circumstances, assistance with a wildlife conflict is requested because of a perceived risk to human health or safety associated with wild animals living near people or acting abnormally in human-inhabited areas. Under the proposed action, WS could assist in resolving those types of problems. In the majority of cases in which human health concerns were a major reason for requesting assistance with feral swine damage, there may have been no actual cases of transmission of disease to people to prompt the request. Thus, the primary reason people request assistance from

WS would be the potential for disease transmission. In addition to threats from disease transmission, is the threat that feral swine can pose from aggressive behavior. Feral swine can be very aggressive toward people, especially when threatened.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA documents the need to manage damage caused by feral swine, the issues associated with meeting that need, and alternative approaches to address those issues and to meet the need for action. The mission of WS would be to provide federal leadership with managing damage and threats of damage associated with animals (see WS Directive 1.201). WS would only provide assistance when the appropriate property manager or property owner requested assistance. WS could receive a request for assistance from a property owner or manager to conduct activities on property they own or manage, which could include federal, state, tribal, municipal, and private land within the State of Oklahoma. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

Appendix B of this EA discusses the methods available for use or recommendation under each of the alternative approaches evaluated[5]. The alternatives and Appendix B also discuss how WS, the ODAFF, and other entities could recommend or employ methods to manage damage and threats associated with feral swine in the State. Therefore, the actions evaluated in this EA are the use or recommendation of those methods available under the alternatives and the employment or recommendation of those methods by WS and the ODAFF to manage or prevent damage and threats associated with feral swine from occurring when requested by the appropriate resource owner or manager. Activities that could involve the lethal removal of feral swine under the alternatives would only occur when agreed upon by the requester.

Native American Lands and Tribes

The WS program in Oklahoma would only conduct damage management activities on Native American lands when requested by a Native American Tribe. WS would only conduct activities after WS and the Tribe requesting assistance signed a Memorandum of Understanding (MOU), work initiation document, or a similar document. Therefore, the Tribe would determine what activities would be allowed and when WS' assistance was required. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would likely occur. Those methods available to alleviate damage associated with feral swine on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the Tribe requesting assistance approved the use of those methods. Therefore, the activities and methods addressed under the alternatives would include those activities that WS could employ on Native American lands, when requested and when agreed upon by the Tribe and WS.

[5]Appendix B contains a complete list of methods available for use under the identified alternatives. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

Federal, State, County, City, and Private Lands

WS and the ODAFF could continue to provide damage management activities on federal, state, county, municipal, and private land in Oklahoma when receiving a request for such services by the appropriate resource owner or manager. In those cases where a federal agency requests assistance with managing damage caused by feral swine on property they own or manage, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA could cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, the scope of this EA analyzes actions that could occur on federal, state, county, municipal, and private lands, when requested.

Period for which this EA is Valid

If the preparation of an Environmental Impact Statement (EIS) is not warranted based the analyses associated with this EA, WS would review activities conducted under the selected alternative to ensure those activities occurred within the parameters evaluated in the EA. This EA would remain valid until WS and the ODAFF, in consultation with the ODWC, determines that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, WS and the ODAFF would supplement this analysis or conduct a separate evaluation pursuant to the NEPA. Under the alternative analyzing no involvement by WS, no review or additional analyses would occur based on the lack of involvement by WS. The monitoring of activities by WS would ensure the EA remained appropriate to the scope of damage management activities conducted by WS in Oklahoma under the selected alternative, when requested.

Site Specificity

As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. This EA analyzes the potential impacts of managing damage caused by feral swine based on previous activities conducted on private and public lands in Oklahoma where WS and the appropriate entities entered into a MOU, work initiation document, or other comparable document. The EA also addresses the potential impacts of managing feral swine damage in areas where WS and a cooperating entity sign additional agreements in the future. Because the need for action would be to reduce damage and because the program's goals and directives would be to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of those efforts as part of the alternatives.

Feral swine occur in a variety of habitats in Oklahoma; therefore, damage or threats of damage could occur wherever feral swine occur. Planning for the management of feral swine damage must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire departments, police departments, emergency clean-up organizations, and insurance companies. Although WS and the ODAFF could predict some locations where feral swine damage would occur, WS and the ODAFF could not predict every specific location or the specific time where such damage would occur in any given year. In addition, the threshold triggering an entity to request assistance to manage damage associated with feral swine is often unique to the individual; therefore, predicting where and when WS or the ODAFF would receive such a request for assistance would be difficult. This EA emphasizes major issues as those issues relate to

specific areas whenever possible; however, many issues apply wherever feral swine damage and the resulting management actions occurs and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to managing feral swine damage in Oklahoma. The standard WS Decision Model (Slate et al. 1992; see WS Directive 2.201) would be the site-specific procedure for individual actions that WS could conduct in the State (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in this EA, as well as relevant laws and regulations.

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

Summary of Public Involvement

WS and the ODAFF initially developed the issues associated with conducting feral swine damage management in consultation with the ODWC. WS defined the issues and identified the preliminary alternatives through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS implementing regulations for the NEPA, WS and the ODAFF will make this document available to the public for review and comment. WS and the ODAFF will make the document available to the public through legal notices published in local print media, through direct notification of parties that have requested to be notified, or that WS and the ODAFF have identified as having a potential interest in the reduction of threats and damage associated with feral swine in the State. In addition, WS will post this EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml for review and comment.

WS and the ODAFF will provide for a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS and the ODAFF will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. WS and the ODAFF would fully consider new issues, concerns, or alternatives the public identifies during the public involvement period to determine whether WS and the ODAFF should revisit the EA and, if appropriate, revise the EA prior to issuance of a Decision.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

Draft Environmental Impact Statement: Feral Swine Damage Management: The APHIS and cooperating agencies are in the process of preparing a programmatic EIS to address feral swine damage management in the United States, American Samoa, Mariana Islands, United States Virgin Islands, Guam, and Puerto Rico. When the EIS is completed, WS would review this EA for consistency with the material in the EIS and Record of Decision and supplement this EA, if needed, pursuant to the requirements of the NEPA, and the NEPA implementing regulations of the USDA and the APHIS.

***Feral Swine Damage Management EA*:** WS and the ODAFF have previously developed an EA that analyzed the need for action to manage damage associated with feral swine. Changes in the need for action and the affected environment have prompted WS and the ODAFF to initiate this new analysis to address damage management activities in the State. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new

need for action, primarily a need to address damage and threats of damage associated with an increasing feral swine population, the expanding range of feral swine in the State, and changes in State laws in regard to managing feral swine damage. Since activities conducted under the previous EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA that addressed feral swine will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA.

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

Below are brief discussions of the authorities of WS, the ODAFF, and other agencies, as those authorities relate to conducting wildlife damage management.

WS' Legislative Authority

The primary statutory authority for the WS program is the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with animals. WS' directives define program objectives and guide WS' activities when managing damage.

Authority of the United States Fish and Wildlife Service

The United States Fish and Wildlife (USFWS) is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitats. The USFWS mission is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Responsibilities are shared with other federal, state, tribal, and local entities. However, the USFWS has specific responsibilities for the protection of threatened and endangered (T&E) species under the Endangered Species Act (ESA), migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources, such as the National Wildlife Refuge System. Under 50 CFR 30.11, feral animals without ownership that have reverted to the wild from a domestic state may be taken by authorized federal or state personnel or by private persons operating under permit in accordance with applicable provisions of federal or state law or regulation on National Wildlife Refuges.

United States Environmental Protection Agency

The Environmental Protection Agency is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act, which regulates the registration and use of pesticides.

Oklahoma Department of Agriculture, Food and Forestry

The ODAFF is authorized by Title 2, O.S.2001,§12-1, A, to independently enter into cooperative agreements for the purpose of "*…conducting wildlife damage management for…other wildlife species causing destruction to livestock, poultry, crops, range land, forests and other resources, including human health and safety*". It further states that "*Wildlife damage management of …other wildlife species causing damage shall include but not be limited to hunting, trapping, or other practical methods for the control of wildlife damage*." These wildlife damage management authorizations are carried out through the ODAFF Wildlife Services Division and through cooperation with WS. The ODAFF also issues permits for transport and holding of feral swine, and permits for aerial hunting (ORS Title 29, §4-135).

Oklahoma Department of Wildlife Conservation

The ODWC has the responsibility to manage all protected and classified wildlife in Oklahoma, except federally listed T&E species, regardless of the land class on which the animals are found (Title 29, §5-412, 412.1). The ODWC is authorized to cooperate with WS and ODAFF for wildlife damage management (ORS Title 29, §3-103,105, §4-135). A Memorandum of Understanding (MOU) with WS and ODAFF Wildlife Services further defines this level of cooperation.

Oklahoma State Department of Health

The Oklahoma State Department of Health has the authority to enter into an agreement with WS for conducting wildlife damage management for the protection of human health from wildlife threats.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes would authorize, regulate, or otherwise affect the activities of WS and the ODAFF under the alternatives. WS would comply with applicable federal, state, and local laws and regulations in accordance with WS Directive 2.210. Below are brief discussions of those laws and regulations that would relate to damage management activities that WS and the ODAFF could conduct in the State.

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities that federal agencies must accomplish as part of any project: public involvement, analysis, documentation, implementation, and monitoring. The NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. In part, the CEQ, through regulations in 40 CFR, Parts 1500-1508, regulate federal activities that could affect the physical and biological environment. In accordance with regulations of the CEQ and the USDA, the APHIS has published guidelines concerning the implementation of the NEPA (see 44 CFR 50381-50384).

Pursuant to the NEPA and the CEQ regulations, this EA documents the analyses resulting from proposed federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that WS infuses the policies and goals of the NEPA into agency actions. WS prepared this EA by integrating as many of the natural and social sciences as warranted, based on the potential effects of the alternatives, including the potential direct, indirect, and cumulative effects of the alternatives.

Endangered Species Act

Under the ESA, all federal agencies will seek to conserve T&E species and will 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 will use the best scientific and commercial data*

available" (Sec.7 (a) (2)). Evaluation of the alternatives in regards to the ESA will occur in Chapter 4 of this EA.

National Historic Preservation Act (NHPA) of 1966, as amended

The NHPA and its implementing regulations (see 36 CFR 800) require federal agencies to initiate the Section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under Section 106. None of the methods described in this EA would cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor would 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 available under the alternatives would not generally be the types of methods that would have the potential to affect historic properties. If WS planned an individual activity with the potential to affect historic resources under an alternative selected because of a decision on this EA, WS would conduct the site-specific consultation, as required by Section 106 of the NHPA, as necessary.

The use of noise-making methods, such as firearms, at or in close proximity to historic or cultural sites for the purposes of removing feral swine have the potential for audible effects on the use and enjoyment of historic property. However, WS would only use such methods at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use, would be to the benefit of the historic property. A built-in minimization factor for this issue is that virtually all the methods involved would only have temporary effects on the audible nature of a site and could be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. WS would conduct site-specific consultation as required by the Section 106 of the NHPA as necessary in those types of situations.

Environmental Justice in Minority and Low Income Populations - Executive Order 12898

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. This EA will evaluate activities addressed in the alternatives for their potential impacts on the human environment and compliance with Executive Order 12898.

WS would use only legal, effective, and environmentally safe damage management methods, tools, and approaches. The Environmental Protection Agency through the Federal Insecticide, Fungicide, and Rodenticide Act, the ODAFF, the United States Drug Enforcement Administration, MOUs with land managing agencies, and WS' Directives would regulate chemical methods that could be available for use by WS pursuant to the alternatives. WS would properly dispose of any excess solid or hazardous waste. WS does not anticipate the alternatives would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In

contrast, the alternatives may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

Protection of Children from Environmental Health and Safety Risks - Executive Order 13045

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS has considered the impacts that this proposal might have on children. The proposed activities would occur by using only legally available and approved methods where it is highly unlikely that activities conducted pursuant to the alternative would adversely affect children. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing the alternatives. Additionally, the need for action identified a need to reduce threats to human safety, including risks to children; therefore, cooperators could request WS' assistance with reducing threats to the health and safety of children posed by feral swine.

Invasive Species - Executive Order 13112

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species. The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act (Public Law 101-106, 25 USC 3001) requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal agencies are to discontinue work until the agency has made a reasonable effort to protect the items and notify the proper authority.

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act and its implementing regulations (Public Law 110-426, 7 USC 136 et. seq.) require the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act. The Environmental Protection Agency and the ODAFF regulate chemical methods that could be available to manage damage associated with feral swine in the State.

Federal Food, Drug, and Cosmetic Act (21 USC 360)

This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the United States Food and Drug Administration.

Controlled Substances Act of 1970 (21 USC 821 et seq.)

This law requires an individual or agency to have a special registration number from the United States Drug Enforcement Administration to possess controlled substances, including some chemical methods used for wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those animal drugs used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing drugs and euthanasia chemicals. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (*e.g.*, use of ear tags) and labeled with appropriate warnings.

Airborne Hunting Act

The Airborne Hunting Act, passed in 1971 (Public Law 92-159), and amended in 1972 (Public Law 92-502) added to the Fish and Wildlife Act of 1956 as a new section (16 USC 742j-l) that prohibits shooting or attempting to shoot, harassing, capturing or killing any bird, fish, or other animal from aircraft except for certain specified reasons. Under exception [16 USC 742j-l, (b)(1)], state and federal agencies are allowed to protect or aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops using aircraft.

Oklahoma State Laws

Current Oklahoma law regards feral swine as an invasive species that can be hunted on public and private lands with few restrictions. The use of aircraft to shoot feral swine requires a permit from the ODAFF. Night shooting, or any pursuit, including shooting from aircraft, during regular hunting seasons requires approval from the ODWC. Persons may locate feral swine using an electronic telemetry pig tagging system, also known as a "*Judas Pig*" system, which is a technique where previously captured feral swine are radio-collared and released into an area and allowed to join with other feral swine. The tagged animal is electronically tracked to locate other feral swine.

Management of feral swine in Oklahoma is regulated by the Feral Swine Control Act (Title 2, Chapter 1, Article 6 of the Oklahoma Statutes), and the Feral Swine Control Act – Administrative Rules (Title 35, Chapter 15, Subchapter 34 of the Oklahoma Administrative Code).

A summary of the Feral Swine Control Act and Administrative rules include:

- "*Feral swine*" means any hog, pig, or swine species (*S. scrofa*) including, but not limited to, Russian and European wild boar that are running at large, free roaming, or wild upon public or private lands in the State
- Except as otherwise specified in the Feral Swine Control Act, any person with permission of the owner may remove feral swine from private or public property during daylight hours.

- Any person who intends to kill or attempt to kill feral swine at night shall obtain a permit issued by the ODWC pursuant to Section 4-135 of Title 29 of the Oklahoma Statutes and promulgated rules.
- All persons that transport live feral swine in the State shall be required to obtain a transporter license from the ODAFF. Live feral swine shall only be transported to either a licensed sporting facility, a licensed handling facility, or directly to an approved slaughter facility.
- No person shall intentionally or knowingly release or engage in, sponsor, instigate, assist, or profit from the release of any hog, boar, swine, or pig to live in a wild or feral state upon public or private lands, except for: Release into a licensed sporting facility pursuant to the Feral Swine Control Act; or when utilizing the Judas pig tagging system, with the release onto the same private land on which the feral hog was trapped or caught, within twenty-four (24) hours of the capture.
- Any person who knowingly releases feral swine into the wild in Oklahoma is guilty of a felony, and subject to a maximum punishment of two (2) years in prison, a fine of $2,000, or both fine and imprisonment.

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The ODAFF enforces provisions involving the licensing of feral swine facilities and the transport of feral swine in the State. The ODAFF also conducts feral swine damage management through the ODAFF State Wildlife Services Division. The ODWC is responsible for managing wildlife in the State of Oklahoma. The ODWC establishes and enforces regulated hunting seasons in the State, including the establishment of seasons that allow the harvest of feral swine. WS' activities to reduce and/or prevent feral swine damage in the State would be coordinated with the ODWC, which would ensure the ODWC has the opportunity to incorporate any activities WS' conducts into population objectives established for feral swine populations in the State.

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the ODAFF, conduct feral swine damage management when requested, 2) should WS conduct disease surveillance and monitoring in the feral swine population when requested, 3) should WS implement an integrated methods approach, including technical assistance and direct operational assistance, to meet the need for feral swine damage management in Oklahoma, 4) if not, should WS attempt to implement one of the alternatives to an integrated methods strategy, and 5) would the proposed action or the other alternatives result in significant effects to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that WS did not consider in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues. Additional descriptions of the affected environment occur during the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Feral swine occur throughout the year in at least 74 counties of the State (Stevens 2010); however, feral swine likely currently occur in all 77 counties (Stevens 2010, Wild Hog Working Group 2012). The highest densities of feral swine in the State occur primarily in the southeastern and south central portion of the State. Populations in the north central and northwestern portion of the State occur primarily along major river drainages (Stevens 2010). In general, feral swine prefer moist bottomlands or riparian areas along streams and rivers, along with other areas associated with aquatic habitats (West et al. 2009, Stevens 2010, Hamrick et al. 2011). However, feral swine are capable of utilizing a variety of habitats in the State. Therefore, damage or threats of damage caused by feral swine could occur statewide in Oklahoma wherever feral swine occur. Damage management activities would only be conducted by WS when requested by a landowner or manager and only on properties where a MOU, work initiation document, or another comparable document were signed between WS and the cooperating entity.

Upon receiving a request for assistance, WS could conduct activities to reduce feral swine damage or threats on federal, state, tribal, municipal, and private properties in Oklahoma. Areas where damage or threats of damage could occur include, but would not be limited to agricultural fields, orchards, farmyards, ranches, livestock operations, aquaculture facilities, industrial sites, natural areas, government properties and facilities, private properties, corporate properties, schools, parks, woodlots, recreation areas, communally-owned homeowner/property owner association properties, wildlife refuges, levees, dikes, and wildlife management areas. The area would also include airports and military airbases where feral swine were a threat to human safety and to property; areas where feral swine were negatively affecting wildlife, including T&E species; and public property where feral swine were negatively affecting historic structures, cultural landscapes, and natural resources.

Environmental Status Quo

As defined by the NEPA implementing regulations, the "*human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment*" (40 CFR 1508.14). Therefore, when a federal action agency analyzes their potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the proposed federal action, but also the potential impacts that would occur or could occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

Unprotected wildlife species, such as most non-native invasive species, are not protected under state or federal law. Most state managed wildlife species are managed under state authority or law without any federal oversight or protection. In some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), unprotected wildlife species, and certain resident wildlife species are managed with little or no restrictions allowing them to be killed or taken by anyone at any time when they are committing damage. Feral swine in Oklahoma are considered an invasive species (see Title 2, Chapter 1, Article 6, Section 6-602 of the Oklahoma Statutes). A private landowner, or persons with the landowner's permission, my lethally remove feral swine throughout the year during daylight hours using legally available methods. In addition, property owners may request a permit from their local game warden to shoot feral swine at night. Feral swine can also be harvested on public lands during designated hunting seasons.

When a non-federal entity (*e.g.*, agricultural producers, counties, private companies, individuals, or any other non-federal entity) takes an action to alleviate feral swine damage or threat, the action is not subject to compliance with the NEPA due to the lack of federal involvement in the action. In

addition, methods available for resolving damage associated with feral swine would also be available for use by other entities. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards feral swine will occur and even the particular methods that will be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement.

A non-federal entity, including the ODAFF, could lethally removal feral swine on private property to alleviate damage at any time with few exceptions. In addition, most methods available for resolving damage associated with feral swine would be available for public use. Therefore, WS' decision-making ability would be restricted to one of three alternatives. WS could take the action using the specific methods as decided upon by the non-federal entity, provide technical assistance only, or take no action. If no action were taken by WS, a non-federal entity could take the action anyway using the same methods. Under those circumstances, WS would have virtually no ability to affect the environmental status quo since the action would likely occur in the absence of WS' direct involvement.

Therefore, based on the discussion above, in those situations where a non-federal entity conducts activities to alleviate damage caused by feral swine and has already made the decision to remove or otherwise manage feral swine to stop damage with or without WS' assistance, WS' participation in carrying out the action would not affect the environmental status quo.

2.2 ISSUES ASSOCIATED WITH FERAL SWINE DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns raised regarding potential adverse effects that might occur from a proposed action. Agencies must consider such issues during the NEPA decision-making process. Initially, WS and the ODAFF developed the issues related to managing damage associated with feral swine in consultation with the ODWC. In addition, WS and the ODAFF will invite the public to review and comment on the EA to identify additional issues.

Chapter 4 discusses the issues, as those issues relate to the possible implementation of the alternatives, including the proposed action. WS and the ODAFF evaluated, in detail, the following issues:

Issue 1 - Effects of Damage Management Activities on Feral Swine Populations

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Lethal and non-lethal methods would be available to resolve wildlife damage or threats to human safety (see Appendix B).

Non-lethal methods could disperse or otherwise make an area unattractive to feral swine, which would reduce their presence at the site and potentially the immediate area around the site where an entity employed those methods. Employing lethal methods could remove a single feral swine or those feral swine responsible for causing damage or posing threats to human safety. Therefore, the use of lethal methods could result in local population reductions in the area where damage or threats were occurring. The number of feral swine removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of individual feral swine involved with the associated damage or threat, and the efficacy of methods employed.

The analysis will measure the number of individuals lethally removed in relation to the abundance of feral swine to determine the magnitude of impact to the feral swine population from the use of lethal methods. Magnitude may be determined either quantitatively or qualitatively. Determinations based on population estimates, allowable harvest levels, and actual harvest data are quantitative. Determinations based on population trends and harvest trend data, when available, are qualitative.

In addition, other entities can harvest feral swine in the State during hunting seasons and other entities could lethally remove feral swine using available methods when those swine cause damage or pose threats of damage. Therefore, any damage management activities conducted by WS under the alternatives addressed would be occurring along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from harvest during hunting seasons, and human-induced alterations of wildlife habitat. Feral swine are considered an invasive species in Oklahoma; therefore, maintaining a local and/or statewide population at the lowest level, including extirpation, could be the goal of the ODWC and/or the ODAFF. As stated previously, the purpose of the Feral Swine Control Act (see Section 6-602) passed by the Oklahoma legislature is to "*…to provide aggressive measures to reduce the number of feral swine in Oklahoma*".

Under certain alternatives, WS could employ methods available to resolve damage and reduce threats to human safety that target an individual feral swine or a group of individuals after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. Chapter 4 analyzes the possible effects on the feral swine population in the State from implementation of the alternatives addressed in detail, including the proposed action.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species, arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. Appendix B describes the methods available for use under the alternatives.

There are also concerns about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods that would be available for use to manage damage or threats associated with feral swine include immobilizing drugs and euthanasia chemicals. Chapter 4 and Appendix B further discuss those methods.

The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. The ESA requires that federal agencies consult with the appropriate implementing agency prior to undertaking any action that may take listed endangered or threatened species or their critical habitat. Chapter 4 discusses the potential effects of the alternatives on this issue.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

An additional issue often raised is the potential risks to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees would use and recommend only those methods that were legally available under each of the alternatives. Still, some concerns exist regarding the safety of methods available despite their legality and selectivity. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public. In

addition to the potential risks to the public associated with the methods available under each of the alternatives, risks to WS' employees would also be an issue. Selection of methods, under the alternatives, would include consideration for public and employee safety.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure to the chemical from direct contact. Another concern would be the potential for immobilizing drugs used in animal capture and handling to cause adverse health effects in people that hunt and consume the species involved. Under the alternatives identified, the use or recommendation of chemical methods would include immobilizing drugs and euthanasia chemicals. The United States Drug Enforcement Administration and the United States Food and Drug Administration regulate immobilizing drugs and euthanasia chemicals. In addition, the use of all chemical methods by WS would be subject to Oklahoma laws and WS' Directives.

Immobilizing drugs that could be available include ketamine and Telazol, which are anesthetics (*i.e.*, general loss of pain and sensation) used during the capture of wildlife to eliminate pain, calm fear, and reduce anxiety in wildlife when handling and transporting wildlife. Xylazine is a sedative that wildlife professionals often use in combination with ketamine to calm nervousness, irritability, and excitement in wildlife during the handling and transporting of wildlife. Euthanasia chemicals could include sodium pentobarbital and potassium chloride, all of which WS would administer after anesthetizing an animal.

Most methods available to alleviate damage and threats associated with feral swine are non-chemical methods. Non-chemical methods may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, changes in crop rotations, or conducting structural repairs. Limited habitat modification would be practices that alter specific characteristics of a very localized area, such as removing bushes to eliminate shelter locations or planting vegetation that was less palatable to feral swine. Animal behavior modification methods would include those methods designed to disperse feral swine from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, barriers, electronic distress calls, effigies, and Mylar tape. Other mechanical methods could include cage traps, snares, foothold traps, cannon nets, shooting, or the recommendation that a local population of feral swine be reduced using hunting.

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, or pyrotechnics. Most of the non-chemical methods available to address feral swine damage in Oklahoma would be available for use under any of the alternatives and by any entity, when permitted. Chapter 4 further discusses the risks to human safety from the use of non-chemical methods as this issue relates to the alternatives. Appendix B provides a complete list of non-chemical methods available to alleviate damage associated with feral swine.

Another concern is the threat to human safety from not employing methods or not employing the most effective methods to reduce the threats that feral swine can pose. The need for action in Chapter 1 addresses the risks to human safety from diseases associated with feral swine. The low risk of disease transmission from feral swine does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concerns occur when inadequately addressing threats to human safety associated with aircraft striking feral swine at airports in the State. Feral swine have the potential to cause severe damage to aircraft, which can threaten the safety of passengers. Limiting or preventing the use of certain methods to address the potential for aircraft striking feral swine could lead to higher risks to passenger safety. Chapter 4 further evaluates those concerns in relationship to the alternatives.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that people can interpret in a variety of ways. Schmidt (1989) indicated that vertebrate 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.*"

The American Veterinary Medical Association (1987) has previously described suffering as a "*…highly unpleasant emotional response usually associated with pain and distress*." However, suffering "*…can occur without pain…*" and "*…pain can occur without suffering…*". 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 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when a person does not take action to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain can obviously occur in animals. Altered physiology and behavior can be indicators of pain. However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The American Veterinary Medical Association has previously stated "*...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 using American Veterinary Medical Association accepted methods of euthanasia when killing all animals, including wild and invasive animals. The American Veterinary Medical Association has stated, "[f]*or 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 terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

Pain and suffering, as it relates to methods available for use to manage feral swine has both a professional and lay point of arbitration. Wildlife managers and the public must recognize the complexity of defining suffering, since *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (California Department of Fish and Game 1991). Research suggests that some methods, such as restraint in foothold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (Kreeger et al. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991, Sharp and Saunders 2008, Sharp and Saunders 2011).

The decision-making process can involve tradeoffs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and 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. Chapter 4 further discusses the issue of humaneness and animal welfare. Chapter 3 discusses SOPs intended to alleviate pain and suffering.

Issue 5 - Effectiveness of Feral Swine Damage Management Methods

Defining the effectiveness of any damage management activities often occurs in terms of losses or risks potentially reduced or prevented. Effectiveness can also be dependent upon how accurately people diagnose the problem, the species responsible for the damage, and how people implement actions to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible. The most effective approach to resolving any wildlife damage problem would be to use an adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on people, target and non-target species, and the environment[6]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' directives and policies.

The goal would be to reduce damage, risks, and conflicts with feral swine as requested and not to reduce/eliminate populations. Localized population reduction could be short-term with new individuals immigrating into the area or born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to return to pre-management levels eventually does not mean individual management actions were unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels would also demonstrate that limited, localized damage management methods have minimal impacts on species' populations.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

WS and the ODAFF, in consultation with the ODWC, identified additional issues during the scoping process of this EA. WS considered those additional issues but a detailed analysis did not occur for the reasons provided. Discussion of those additional issues and the reasons for not analyzing those issues in detail occur below.

Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area

The appropriateness of preparing an EA instead of an EIS was a concern WS identified during the scoping process. Wildlife damage management falls within the category of actions in which the exact timing or location of individual activities can be difficult to predict well enough ahead of time to describe accurately such locations or times in an EA or even an EIS. Although WS could predict some of the possible locations or types of situations and sites where some kinds of wildlife damage would occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem had become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all

[6]The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). WS' intent in developing this EA has been to determine if the proposed action or the other alternatives could potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA addresses impacts for managing damage and threats to human safety associated with feral swine in the State to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If WS made a determination through this EA that the proposed action or the other alternatives could have a significant impact on the quality of the human environment, then WS would publish a notice of intent to prepare an EIS and this EA would be the foundation for developing the EIS. Based on previous requests for assistance, the WS program in Oklahoma would continue to conduct feral swine damage management in a very small area of the State where damage was occurring or likely to occur.

The Impact on Biodiversity from Damage Management Activities

Feral swine in Oklahoma are a non-native species that can cause damage to a variety of resources, including causing damage to native ecosystems. The need for action in Chapter 1 of this EA describes the potential adverse effects that feral swine could have on natural resources within the State. Any reduction in feral swine populations in Oklahoma could provide some benefits to native animals and native plants. Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. In addition, the Feral Swine Control Act (see Oklahoma Statutes, Title 2, Chapter 1, Article 6) was "*…to provide aggressive measures to reduce the number of feral swine in Oklahoma*."

The WS program does not attempt to eradicate any species of native wildlife in the State. WS operates in accordance with federal and state laws and regulations enacted to ensure the viability of native species. WS would use available methods to target individual feral swine or groups of feral swine identified as causing damage or posing a threat of damage. Any reduction of a local population or group would frequently be temporary because immigration from adjacent areas or reproduction replaces the animals removed. As stated previously, WS would only provide assistance under the appropriate alternatives after receiving a request to manage damage or threats. Therefore, if WS provided direct operational assistance under the alternatives, WS would provide assistance on a small percentage of the land area of Oklahoma. In addition, WS would only target those feral swine identified as causing damage or posing a threat. The goal of WS would not be to manage feral swine populations but to manage damage caused by feral swine based on requests received for assistance. The management of wildlife populations in the State is the responsibility of the ODWC. Therefore, those factors would constrain the scope, duration, and intensity of WS' actions under the alternatives. Given the non-native status of feral swine in Oklahoma and the associated damage that feral swine can cause to natural resources, any activities that reduce the density of feral swine in specific areas

would likely provide some benefits to the biodiversity in the area by reducing habitat destruction, competition, and predation.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that WS or other entities should establish a threshold of loss before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. In some cases, cooperators likely tolerate some damage and economic loss until the damage reaches a threshold where the damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations. For example, aircraft striking feral swine can lead to property damage and can threaten passenger safety if a catastrophic failure of the aircraft occurs because of the strike. Therefore, addressing the threats of feral swine strikes prior to an actual strike occurring would be appropriate.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied the plaintiffs' motion for a preliminary injunction. In part, the court determined that a forest supervisor could establish a need for wildlife damage management if the supervisor could show that damage from wildlife was threatened (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for damage management actions.

American Indian and Cultural Resource Concerns

The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "*undertakings*" that could result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Activities conducted by WS on Tribal lands would only occur at the Tribe's request and under a signed agreement; thus, the Tribes would have control over any potential conflict with cultural resources on Tribal properties. In addition, this EA will be made available to all Tribes in the State to solicit their review and comment prior to issuing a Decision.

Feral Swine Damage Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that WS should not provide assistance at the expense of the taxpayer or that activities should be fee-based. Funding for WS' activities could occur from federal appropriations, through state funding, and through cooperative funding. Funding for WS' activities could occur through cooperative service agreements with individual property owners or managers. Additionally, damage management activities are an appropriate sphere of activity for government programs, since managing wildlife is a government responsibility. Treves and Naughton-Treves (2005) and the International Association of Fish and Wildlife Agencies (2004) discuss the need for wildlife damage management and that an accountable government agency is best suited to take the lead in such activities because it increases the tolerance for wildlife by those being impacted by their damage and has the least impacts on wildlife overall.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives WS and the ODAFF are considering. However, the methods determined to be most effective to reduce damage and threats to human safety caused by feral swine and that prove to be the most cost effective would likely receive the greatest application. As part of an integrated approach and as part of the WS Decision Model, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstance where feral swine were causing damage or posing a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs.

Feral Swine Damage Should Be Managed By Private Companies or Local Entities

Wildlife control agents and private entities could be contacted to reduce feral swine damage when deemed appropriate by the resource owner. The ODAFF maintains a website of feral swine hunters and trappers in the State[7]. In addition, WS could refer persons requesting assistance to agents and/or private individuals under all of the alternatives fully evaluated in the EA.

WS Directive 3.101 provides guidance on establishing cooperative projects and interfacing with private businesses. WS would only respond to requests for assistance received. When responding to requests for assistance, WS would inform requesters that other service providers, including private entities, might be available to provide assistance.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to remove feral swine. As described in Appendix B, the lethal removal of feral swine with firearms by WS to alleviate damage or threats could occur using a handgun, rifle, or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996).

The removal of feral swine by WS using firearms in the State would occur primarily from the use of shotguns. However, the use of rifles or handguns could be employed. To reduce risks to human safety and property damage from bullets passing through feral swine, the use of firearms would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through feral swine. However, deposition of lead into soil could occur if, during the use of a firearm, the projectile passes through feral swine, if misses occur, or if the carcass was not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches).

In addition, concerns occur that lead from bullets deposited in soil from shooting activities could contaminate ground water or surface water from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study

[7]The website can be accessed at http://www.ag.ok.gov/ais/feralswinehuntersdir.pdf; accessed February 10, 2014.

did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "*action level*" of 15 parts per billion as defined by the Environmental Protection Agency (*i.e.*, requiring action to treat the water to remove lead). The study found that the dissolution (*i.e*., capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape was reduced once the bullets and shot formed crusty lead oxide deposits on their surfaces, which served to reduce naturally the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities to reduce feral swine damage using firearms, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

Since those feral swine removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement, WS' assistance with removing those animals would not be additive to the environmental status quo. The amount of lead deposited into the environment could be lowered by WS' involvement in damage management activities due to the proficiency training received by WS' employees in firearm use and accuracy. The training of WS' employees in proficient firearms use would increase the likelihood that feral swine were lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses and the need for multiple shots. Based on current information, the risks associated with lead projectiles that could be deposited into the environment from WS' activities would be below any level that would pose any risk from exposure or significant contamination of water.

Donation of Feral Swine Taken Through Management Activities for Human Consumption

Under the Federal Meat Inspection Act, all swine must be inspected prior to entering into any establishment in which they are to be slaughtered. Inspections are carried out under the Food Safety and Inspection Services (FSIS) under the USDA. The FSIS has ruled that all swine are amenable to the Federal Meat Inspection Act and even if donated, are considered to be in commerce; therefore, all animals must be processed under inspection at an official establishment. This would entail examining the animal alive, at rest and in motion from both sides before passing the animal for slaughter.

In most instances, it would be difficult to trace the origins of feral swine or determine fitness for human consumption due to the potential for feral swine to carry disease (Wyckoff et al. 2009). Transporting live feral swine to slaughter facilities also increases the potential for spreading disease to domestic swine at facilities were swine are being held prior to slaughter. Therefore, feral swine would not be donated to food banks.

Potential for Feral Swine to Disperse to Other Areas Due to Management Activities

Feral swine likely occur statewide in Oklahoma. Methods involving the exclusion, pursuit, shooting, and/or harassment of feral swine could lead to the abandonment of localized areas traditionally used by swine. If feral swine were dispersed by WS under the alternatives, damages and threats could arise in other areas.

Under the alternatives where WS would be involved with managing damage, WS would evaluate the damage or threat situation to determine the appropriate methods. Activities conducted under the alternatives would be coordinated between WS, the ODAFF, the ODWC, and local entities to monitor feral swine populations in areas where dispersal may occur. The potential for methods to disperse feral swine would be considered as part of the evaluation of the damage situation and would be incorporated into the decision-making process associated with the alternatives to determine the methods to employ and/or recommend. The use of methods that would likely result in the exclusion, harassment, or dispersal of feral swine (*e.g.*, shooting, propane cannons, pyrotechnics) could be used in those situations where damage, threats of damage, and/or threats to human safety would require immediate resolution.

WS is considering the use of aircraft to aid in alleviating or preventing feral swine damage. Under the proposed action alternative, aerial operations could include the use of aircraft for surveillance and monitoring, as well as, WS' employees shooting feral swine from aircraft. Surveillance and monitoring activities could use aircraft to locate feral swine, to determine the size of a local population, and when using radio telemetry, to locate radio collared swine.

The use of aircraft could rapidly reduce feral swine densities in an area (Saunders 1993, Choquenot et al. 1999, Campbell et al. 2010). Studies conducted in Australia found that shooting feral swine from an aircraft reduced local populations of swine by 65 to 80% and surviving feral swine could continue to cause damage and pose disease risks (Hone 1990, Saunders 1993, Saunders and Bryant 1988). Choquenot et al. (1999) found the efficiency of aerial gunning was influenced by feral swine density in the area. Saunders and Bryant (1988) found feral swine "*...became attuned to the significance of a hovering helicopter and* [feral swine] *modified their behaviour* [sic] *to avoid detection*." Dexter (1996) concluded that harassment caused by the use of aircraft in New South Wales, Australia had little effect on the movements of surviving swine since no statistically significant differences were observed in the hourly distanced moved by surviving feral swine, the home ranges of surviving feral swine, and their positions within their home ranges. Campbell et al. (2010) stated the use of aircraft to shoot feral swine "*...had only minor effects on the behavior of surviving swine...*" and the use of aircraft to remove feral swine "*...should be considered a viable tool...*" when managing disease outbreaks. Based on available information, feral swine are not likely to disperse long-distances due to damage management activities. In addition, feral swine likely occur statewide in Oklahoma; therefore, if dispersal occurred from WS' activities, the likelihood of feral swine inhabiting naïve locations would be limited.

Individual feral swine may also be radio collared to locate and monitor movements of feral swine by WS, by the ODAFF, by the ODWC, or another entity. Radio collaring would allow WS and other entities to track movements and locations of feral swine. The tracking of feral swine in relationship to damage management activities would also provide the ability to monitor movements and potential dispersal to other areas. Feral swine often form large groups that allow one individual of the group to be captured, collared, released, and allowed to return to the group. By collaring one individual, the movement and location of an entire group can be monitored. Radio telemetry would allow WS and other entities to monitor movements of feral swine and to respond to swine potentially dispersing to other areas, as necessary.

Coordination between agencies and local entities would ensure any dispersing feral swine were identified and addressed when they cause damage or threaten human safety. The limited use of methods that disperse feral swine should further ensure they would not disperse to other areas within Oklahoma. The passiveness of the primary methods proposed for use (*e.g.*, cage traps, foothold traps) should limit dispersal of feral swine.

Effects of Damage Management Activities on the Harvest of Feral Swine by Hunters

Another issue identified is a concern that damage management activities conducted by WS would affect the ability of persons to harvest feral swine during the hunting seasons either by reducing local populations through the lethal removal of target animals or by reducing the number of animals present in an area through dispersal techniques. Excluding, dispersing, or lethally removing feral swine from areas where damage was occurring or could occur may limit the ability of those people interested to harvest feral swine.

Many people in the State enjoy harvesting feral swine. Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to alleviate damage caused by feral swine could reduce swine densities through dispersal in areas where damage or the threat of damage was occurring. Similarly, lethal methods used to reduce damage associated with feral swine could lower densities in areas where damage was occurring, which could result in a reduction of the number of feral swine present in an area.

As stated previously, WS would only conduct activities or make recommendations when requested by the appropriate property owner or manager. When receiving a request for assistance, preference would be given to the use and recommendation of non-lethal methods, when those methods were determined to be practical and effective using the WS Decision Model. In addition, if direct operational assistance was requested under the proposed action alternative and lethal methods were requested by the appropriate property owner or manager, WS would only target those feral swine responsible for cause damage. WS could also recommend to property owners that feral swine be harvested during hunting seasons for other wildlife as part of managing damage caused by feral swine.

Based on available information and evaluation of activities that could occur pursuant to the alternatives, the removal of feral swine by WS would not affect the overall statewide population of feral swine because of the high reproductive rates feral swine exhibit (Barrett and Birmingham 1994). Feral swine are the most prolific wild mammal in North America. Given adequate nutrition, a feral swine population can reportedly double in just four months (Barrett and Birmingham 1994). Feral swine may begin to breed as young as four months of age and sows can produce two litters per year (Mayer and Brisbin 2009). Litters sizes usually range from one to 12 piglets (Mayer and Brisbin 2009).

For example, Timmons et al. (2012) was able to model population growth rates for the feral swine population in Texas using demographic parameters gathered from feral swine in the southeastern United States. Using those demographic parameters, Timmons et al. (2012) estimated that an annual harvest of 66% of the feral swine population was needed to hold the population stable in Texas (Timmons et al. 2012). In another example, the South Carolina Wild Hog Task Force (2012) estimated that 50 to 75% of the statewide feral swine population in South Carolina would have to be removed annually to stabilize or reduce the population.

Activities that could be conducted by WS under the alternatives would occur within the goals and strategies outlined for the statewide feral swine population by the ODWC. Therefore, activities that could be conducted by WS and the ODAFF under the alternatives would not adversely affect the ability to harvest feral swine in the State.

Effects on the Economic and Aesthetic Values of Feral Swine

One issue is the concern that the proposed action or the other alternatives would result in the loss of economic and aesthetic benefits of feral swine to the public, resource owners, or neighboring residents. People generally regard wildlife 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.

The human attraction to animals likely started when people began domesticating animals. The public today share a similar bond with animals and/or wildlife in general and in modern societies, a large percentage of households have indoor or outdoor pets or raise domesticated swine. However, some people may consider individual feral swine as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction can be 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/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (*i.e*., using parts of or the entire animal) or non-consumptive use (*e.g*., viewing the animal in nature or in a zoo, photographing) (Decker and Goff 1987).

Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and originate from experiences, such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals (*e.g*., their use in research) (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Public attitudes toward wildlife vary considerably. Some people believe that WS should capture and translocate all animals to another area to alleviate damage or threats those animal pose. In some cases, people directly affected by the problems that wildlife could cause strongly support lethal 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 wildlife damage management want WS to teach tolerance for damage and threats caused by wildlife, and that people should never kill wildlife. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

In some cases, the presence of overabundant species or non-native species offends people, such as feral swine. To such people, those species represent pests that are nuisances, which upset the natural order in ecosystems, and are carriers of diseases transmissible to people or other wildlife, which can

diminish their overall enjoyment of other animals by what they view as a destructive presence of such species. They are offended because they feel that those species proliferate in such numbers and appear to remain unbalanced.

However, Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to reduce invasion of those species and the associated damages to the extent practicable and permitted by law. Some loss of aesthetic value would be gained by the removal of an invasive species and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by the presence of feral swine.

A Site Specific Analysis Should be made for Every Location Where Feral Swine Damage Management Could Occur

The underlying intent for preparing an EA is to determine if a proposed action might have a significant impact on the human environment. WS' EA development process is issue driven, meaning issues that were raised during the interdisciplinary process and through public involvement that were substantive, would be used to drive the analysis and determine the significance of the environmental impacts of the proposed action and the alternatives. Therefore, the level of site specificity must be appropriate to the issues listed.

The analysis in this EA was driven by the issues raised during the scoping process during the development of the EA. In addition to the analysis contained in this EA, WS' personnel use the WS Decision Model (Slate et al. 1992) described in Chapter 3 as a site-specific tool to develop the most appropriate strategy at each location. The WS Decision Model is an analytical thought process used by WS' personnel for evaluating and responding to requests for assistance.

As discussed previously, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis that allows for a better cumulative impact analysis. If a determination were made through this EA that the alternatives developed to meet the need for action could result in a significant impact on the quality of the human environment, then an EIS would be prepared.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives that were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the need for action and issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs for feral swine damage management in Oklahoma are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to meet the need for action and address the identified issues associated with managing damage caused by feral swine in the State:

Alternative 1 – No Feral Swine Damage Management Conducted by WS

This alternative would preclude all activities by WS to alleviate damage in the State associated with feral swine. WS would not be involved with any aspect of feral swine damage management in the

State. WS would refer all requests for assistance with managing feral swine damage to the ODAFF, other governmental agencies, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with feral swine in the State, those people experiencing damage caused by feral swine or other entities, including the ODAFF State Wildlife Services Division, could continue to resolve damage by employing those methods legally available. All methods described in Appendix B could be available for use by those people experiencing damage or threats under this alternative; however, immobilizing drugs, euthanasia chemicals, and snares would not be available or would have limited availability to the public and other entities under this alternative and Alternative 2. Immobilizing drugs and euthanasia chemicals would only be available to appropriately licensed veterinarians or people under their supervision. Snares would not be available for use under this alternative.

Under this alternative, those people experiencing damage or threats of damage could contact WS; however, WS would immediately refer the requester to the ODAFF State Wildlife Services Division, the ODWC, and/or to other entities. The requester could contact other entities for information and assistance with managing damage, could take actions themselves to alleviate damage without contacting another entity, or could take no further action.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Similar to Alternative 1, WS could receive requests for assistance from community representatives, private individuals/businesses, or from public entities. Technical assistance would provide those people experiencing damage or threats caused by feral swine with information, demonstrations, and recommendations on available and appropriate methods. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that were of limited availability for use by private entities (*e.g.*, loaning of propane cannons, loaning of live-traps). Technical assistance could be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, WS would describe several management strategies to the requester that would provide short and long-term solutions to managing damage. Those strategies would be based on the level of risk, need, and the practicality of their application. WS would use the Decision Model to recommend those methods and techniques available to the requester to manage damage and threats of damage. Those people receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action.

Under a technical assistance only alternative, WS would recommend an integrated approach similar to the proposed action alternative (Alternative 3) when receiving a request for assistance; however, WS would not provide direct operational assistance under this alternative. WS would give preference to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). WS would base method and technique recommendations on information provided by the individual seeking assistance using the WS Decision Model. In some instances, wildlife-related information provided to the requestor by WS would result in tolerance/acceptance of the situation. In other instances, WS would discuss and recommend damage management options. WS would recommend or loan only those methods legally available for use by the appropriate individual. Similar to the other alternatives, those methods described in Appendix B would be available to those people experiencing damage or threats associated with feral swine in the State except for immobilizing drugs, euthanasia chemicals, and snares. Immobilizing drugs and euthanasia chemicals would only be available to appropriately licensed veterinarians or people under the supervision of a veterinarian.

The public could not legally use snares to manage damage caused by feral swine under this alternative.

The WS program in the State regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing feral swine damage. Technical assistance would include collecting information about the species involved, the extent of the damage, and previous methods that the cooperator had attempted to resolve the problem. WS would then provide information on appropriate methods that the cooperator could consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups, such as homeowner associations or civic leagues.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those persons experiencing damage or were concerned with threats posed by feral swine could seek assistance from other governmental agencies, private entities, or conduct damage management on their own. Those people experiencing damage or threats could take action using those methods legally available to resolve or prevent feral swine damage as permitted by federal, state, and local laws and regulations or those persons could take no action.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, when requested, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by feral swine in Oklahoma. A major goal of the program would be to resolve and prevent damage caused by feral swine and to reduce threats to human safety. To meet this goal, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing damage associated with feral swine would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by a site-specific evaluation to reduce damage or threats to human safety for each request. WS would provide city/town managers, agricultural producers, property owners, and others requesting assistance with information regarding the use of appropriate non-lethal and lethal techniques.

Under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by feral swine, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage.

When WS provides property owners or managers information regarding the use of effective and practical methods, preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private individuals, use the services of WS (*i.e.*, direct operational assistance), take the management action themselves, or take no further action.

WS would work with those persons experiencing damage to address those feral swine responsible for causing damage as expeditiously as possible. To be most effective, damage management activities

should occur as soon as feral swine begin to cause damage. Damage that has been ongoing can be difficult to resolve using available methods since feral swine would be conditioned to an area and would be familiar with a particular location. Subsequently, making that area unattractive using available methods could be difficult to achieve once damage was ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

WS' Decision Model would be the implementing mechanism for a damage management program under the proposed action alternative that could be adapted to an individual damage situation that allows for the broadest range of methods for WS to use and/or to recommend. Using the Decision Model, WS' employees would address damage or the threat of damage in the most effective, most efficient, and most environmentally conscious way available. When WS received a request for direct operational assistance, WS would conduct site visits to assess the damage or threats, would identify the cause of the damage, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to resolve or prevent damage. The use of the Decision model by WS' employees under the proposed action is further discussed below. In addition, preference would be given to non-lethal methods when practical and effective (see WS Directive 2.101).

Non-lethal methods that would be available for use by WS under this alternative include, but are not limited to minor habitat modification, behavior modification, lure crops, visual deterrents, live traps, exclusionary devices, frightening devices, dogs, foot snares, and immobilizing drugs (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS under this alternative include neck snares, the recommendation of harvest during hunting seasons, euthanasia chemicals, and shooting, including the use of firearms from aircraft. WS could euthanize feral swine live-captured using non-lethal methods (*e.g.*, live-traps) using euthanasia chemicals or by shooting. The lethal control of feral swine would comply with WS Directive 2.505.

Discussing methods does not imply that all methods would be used or recommended by WS to resolve requests for assistance and does not imply that all methods would be used to resolve every request for assistance. 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. For example, if an entity requesting assistance had already attempted to alleviate damage using non-lethal methods, WS would not necessarily employ those same non-lethal methods, since those methods were proven ineffective at reducing damage or threats to an acceptable level to the requester.

Many lethal and non-lethal methods are intended to be short-term attempts at reducing damage occurring at the time those methods were employed. Long-term solutions to managing feral swine damage would include limited habitat manipulations, barriers, and changes in cultural practices, which are addressed further below and in Appendix B.

Non-lethal methods can disperse or otherwise make an area unattractive to feral swine causing damage; thereby, reducing the presence of those animals at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially when the requesting entity had used non-lethal methods previously and found those methods to be inadequate to resolving the

damage or threats of damage. Non-lethal methods would be used to exclude, harass, and disperse feral swine from areas where damage or threats were occurring. When effective, non-lethal methods would disperse feral swine from an area resulting in a reduction in the presence of those animals at the site where those methods were employed. For any management methods employed, the proper timing would be essential in effectively dispersing those feral swine causing damage. Employing methods soon after damage begins or soon after threats were identified, increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of damage.

Under the proposed action alternative, WS could employ only non-lethal methods when determined to be appropriate for each request for assistance to alleviate damage or reduce threats of damage using the WS Decision Model. In some situations, a cooperating entity has tried to employ non-lethal methods to resolve damage prior to contacting WS for assistance. In those cases, the methods employed by the requester were either unsuccessful or the reduction in damage or threats had not reached a level that was tolerable by the requesting entity. In those situations, WS could employ other non-lethal methods, attempt to apply the same non-lethal methods, or employ lethal methods. In many situations, the implementation of non-lethal methods, such as exclusion-type barriers, would be the responsibility of the requestor, which means that, in those situations, the only function of WS would be to implement lethal methods, if determined to be appropriate using the WS Decision Model.

Lethal methods could be employed to resolve damage associated with those feral swine identified by WS as responsible for causing damage or threats to human safety under this alternative; however, WS would only employ lethal methods after receiving a request for the use of those methods. The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since feral swine would be removed from the population. Lethal methods would often be employed to reinforce non-lethal methods and to remove feral swine that were identified as causing damage or posing a threat to human safety. The use of lethal methods could result in local reductions of feral swine in the area where damage or threats were occurring. The number of feral swine removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of feral swine involved with the associated damage or threat, and the efficacy of methods employed.

Often of concern with the use of lethal methods is that feral swine that were lethally removed would only be replaced by other swine either after the application of those methods (*e.g.*, feral swine that relocate into the area) or by feral swine the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, the use of lethal methods would not be used as population management tools over broad areas. The use of lethal methods would be intended to reduce the number of feral swine present at a specific location where damage was occurring by targeting those animals causing damage or posing threats. The intent of lethal methods would be to manage only those individuals causing damage and not to manage entire feral swine populations.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing damage. The use of those methods would be intended to reduce damage occurring at the time those methods were employed but do not necessarily ensure feral swine would not return once those methods were discontinued. Long-term solutions to resolving damage would often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing, or other practices that would not be costly or difficult to implement, such as removing spill grain. When addressing feral swine damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to feral swine. To ensure

complete success, alternative sites in areas where damage was not likely to occur would often be required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive to feral swine would likely result in the dispersal of those animals to other areas where damage could occur or could result in multiple occurrences of damage situations.

As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those people experiencing damage associated with feral swine.

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting assistance with managing damage as part of an integrated approach. Technical assistance would occur as described in Alternative 2 of this EA.

Direct Operational Assistance

Operational damage management assistance would include damage management activities that were directly conducted by or supervised by personnel of WS. Operational damage management assistance could be initiated when the problem could not be effectively resolved through technical assistance alone and there was a written MOU, work initiation document, or other comparable document signed between WS and the entity requesting assistance. The initial investigation by WS' personnel would define the nature, history, and extent of the problem, species responsible for the damage, and methods available to resolve the problem. The professional skills of WS' personnel could be required to resolve problems effectively, especially if chemical methods were necessary or if the problems were complex.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of 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, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates with other entities in education and public information efforts. Additionally, technical papers have been and would continue to be presented at professional meetings and conferences so that other wildlife professionals and the public were periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods for wildlife damage management, which are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques for managing wildlife damage. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving wildlife and methods.

WS' Decision Making Procedures

WS' personnel would use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model (see WS Directive 2.201) and described by Slate et al. (1992). WS' personnel would assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed practical for the situation would be incorporated into a damage management strategy. After this strategy was implemented, monitoring would be conducted and evaluation would continue to assess the effectiveness of the strategy. If the strategy were effective, the need for further management would be ended. In terms of the WS Decision Model, most efforts to resolve wildlife damage consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

Community-based Decision Making

WS could receive requests for assistance from community leaders and/or representatives. In those situations, the WS program in Oklahoma under this alternative would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of feral swine and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources were available. Under this approach, resource owners and others directly affected by feral swine damage or conflicts would have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request direct operational assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision was made. By involving decision-makers in the process, damage management actions could be presented to allow decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in this EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage damage caused by feral swine often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) would be able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on damage management activities. This process would allow decisions on damage management activities to be made based on local input. The community leaders could implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Community Decision-Makers

The decision-maker for the local community would be elected officials or representatives of the communities. The elected officials or representatives would be popularly elected residents of the local community or appointees who oversee the interests and business of the local community. This person or persons would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision-making. Identifying the decision-maker for local business communities can be more complex because building owners may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS could provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Direct assistance could be provided by WS only if requested by the local community decision-maker, funding was provided, and if the requested direct control was compatible with WS' recommendations.

Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy concerns, WS cannot disclose cooperator information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others were involved in the decision-making process would be a decision made by that individual. Direct operational assistance could be provided by WS if requested, funding was provided, and the requested management was in accordance with WS' recommendations.

Public Property Decision-Makers

The decision-maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS could provide technical assistance to this person and recommendations to reduce damage. Direct control could be provided by WS if requested, funding was provided, and the requested actions were within the recommendations made by WS.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

In addition to those alternatives analyzed in detail, WS, the ODAFF, and the ODWC identified several additional alternatives. However, those alternatives will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from feral swine in the State. If the use of non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by other entities or by those persons experiencing feral swine damage but would only prevent the use of those methods by WS until non-lethal methods had been employed.

Those people experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS for assistance. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods could be evaluated. The proposed action (Alternative 3) and the technical assistance only alternative (Alternative 2) would be similar to a non-lethal before lethal alternative because WS would use or recommend non-lethal methods before lethal methods (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not contribute additional information to the analyses in the EA.

Use of Lethal Methods Only

This alternative would require the use of lethal methods only to reduce threats and damage associated with feral swine. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods could be effective in alleviating feral swine damage. For example, the use of a properly built fence could effectively prevent feral swine from accessing a resource. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Live Trapping and Translocation Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Feral swine would be live-captured using immobilizing drugs, live-traps, snares, or capture nets. All feral swine live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and have to be approved by the ODAFF and the property owner where the translocated feral swine would be placed prior to live-capture and translocation. However, it is unlawful to release or transport for release feral swine in an attempt to establish or supplement a free roaming population. Under current state law, a release of this type would be a felony act. Consequently, WS would not translocate any feral swine captured during direct operational assistance.

Translocation of wildlife is also discouraged by WS policy (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, threat of spreading diseases, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). Since WS does not have the authority to translocate feral swine in the State, this alternative was not considered in detail.

Use of Non-lethal Methods Only

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by feral swine in the State. Only those methods discussed in Appendix B that were considered non-lethal would be employed by WS. No intentional lethal removal of feral swine would occur by WS. The use of lethal methods could continue to be used under this alternative by other entities or by those persons experiencing damage. The non-lethal methods used or recommended by WS under this alternative would be identical to those non-lethal methods identified in any of the alternatives.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the ODAFF, the ODWC, local animal control agencies, private businesses, or private individuals.

Property owners or managers could conduct management using any method that was legal. Property owners or managers might choose to implement WS' non-lethal recommendations, implement lethal methods, or request assistance from a private or public entity other than WS. Property owners/managers frustrated by the lack of WS' assistance with the full range of feral swine damage management techniques may try methods not recommended by WS or use illegal methods (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what was necessary, which could then become hazardous and pose threats to the safety of people and non-target species.

The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage, those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses. Those feral swine that could be lethally removed by WS under any of the alternatives could be removed by those persons experiencing damage or threats even if WS was not involved. In addition, the Feral Swine Control Act was enacted to implement measures aggressively to reduce the feral swine population in the State. Reducing the feral swine population in localized areas would be difficult to achieve using only currently available non-lethal methods, especially in the absence of a registered reproductive inhibitor.

Reducing Damage by Managing Feral Swine Populations through the Use of Reproductive Inhibitors

Under this alternative, the primary method that would be available to resolve requests for assistance by WS would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in feral swine responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a tool for wildlife population management is limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Reproductive control for wildlife could be accomplished through sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Currently, chemical reproductive inhibitors are not available for use to manage most wildlife populations, including feral swine. Given the costs associated with live-capturing and performing sterilization procedures on feral swine and the lack of availability of chemical reproductive inhibitors for the management of feral swine populations, this alternative was not evaluated in detail. If a reproductive inhibitor becomes available to manage feral swine and if an inhibitor has been proven effective in reducing localized feral swine populations, the use of the inhibitor could be evaluated as a method available that could be used to managing damage.

Compensation for Feral Swine Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by feral swine damage and to seek funding for the program. Under such an alternative, WS would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. Evaluation of this alternative indicates that a compensation only alternative has many drawbacks. Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

Bounties

Payment of funds (bounties) for killing feral swine suspected of causing economic losses have not been supported by state agencies, as well as most wildlife professionals for many years (Latham 1960, Hoagland 1993). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective at controlling damage over a wide area, such as across the entire State. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring. In addition, WS does not have the authority to establish a bounty program.

3.3 STANDARD OPERATING PROCEDURES

SOPs improve the safety, selectivity, and efficacy of activities intended to resolve wildlife damage. The WS program in Oklahoma uses many such SOPs. Those SOPs would be incorporated into activities conducted by WS under the appropriate alternatives when addressing feral swine damage and threats in the State.

Some key SOPs pertinent to resolving feral swine damage in the State include the following:

- The WS Decision Model, which is designed to identify effective strategies to managing wildlife damage and their potential impacts, would be consistently used and applied when addressing feral swine damage.

- Immobilizing drugs and euthanasia chemicals would be used according to the United States Drug Enforcement Administration, United States Food and Drug Administration, and WS' directives and procedures.

- All controlled substances would be registered with the United States Drug Enforcement Administration or the United States Food and Drug Administration.

- WS' employees would follow approved procedures outlined in the WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).

- WS' employees that use controlled substances would be trained to use each material and would be certified to use controlled substances.

- WS' employees who use controlled substances would participate in State-approved continuing education to keep current of developments and maintain their certifications.

- Pesticide and controlled substance use, storage, and disposal would conform to label instructions and other applicable laws and regulations, and Executive Order 12898.

- Material Safety Data Sheets for controlled substances would be provided to all WS' personnel involved with specific damage management activities.

- All personnel who use firearms would be trained according to WS' Directives.

- WS' employees participating in any aspect of aerial wildlife operations would be trained and/or certified in their role and responsibilities during the operations. All WS' personnel would follow the policies and directives set forth in WS' Directive 2.620; WS' Aviation Operations Manual; WS' Aviation Safety Manual and its amendments; Title 14 CFR; and Federal Aviation Regulations, Part 43, 61, 91, 119, 133, 135, and 137.

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing feral swine damage.

- Management actions would be directed toward localized populations, individuals, or groups of feral swine.

- Non-target animals live-captured in traps would be released unless it was determined that the animal would not survive and/or that the animal could not be released safely.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs are applicable to the alternatives and the issues identified in Chapter 2 including the following:

Issue 1 - Effects of Damage Management Activities on Feral Swine Populations

- Lethal removal of feral swine by WS would be reported and monitored by WS and the ODWC to evaluate population trends and the magnitude of WS' activities in the State.

- WS would only target those individuals or groups of target species identified as causing damage or posing a threat to human safety.

- The WS' Decision Model, designed to identify the most appropriate damage management strategies and their impacts, would be used to determine feral swine damage management strategies.

- WS would monitor activities to ensure activities remain within the scope analyzed in this assessment.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

- When conducting feral swine damage management activities via shooting, identification of the target would occur prior to application.

- As appropriate, suppressed firearms would be used to minimize noise.

- When conducting nighttime activities, personnel would use night vision equipment, infrared devices, or red filtered spotlights to minimize disturbance that could occur from the use of high intensity spotlights.

- Personnel would use lures, trap placements, and capture devices that would be strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

- Tension devices for the underpan of foothold traps and trigger tension devices for foot snares would be used to reduce the capture of non-target animals that weigh less than feral swine.

- Any non-target animals live-captured in traps or any other restraining device would be released whenever it is possible and safe to do so.

- Personnel would monitor live-capture methods and would check traps in accordance with WS policy. This would help ensure non-target species were released in a timely manner or were prevented from being captured.

- Human presence at sites would be kept to the minimal time needed to accomplish the management action.

- As appropriate, capture devices would be equipped in such a manner to reduce the potential of capturing non-target animals (*e.g.*, rooter doors).

- Trap monitoring devices would be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife is removed promptly to minimize pain and distress.

- WS has consulted and would continue to consult with the USFWS and the ODWC to evaluate activities to resolve feral swine damage to ensure the protection of T&E species.

- WS would monitor activities conducted under the selected alternative, if activities were determined to have no significant impact on the environment and an EIS is not required, to ensure those activities do not negatively impact non-target species.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

- Damage management activities would be conducted professionally and in the safest manner possible. Whenever possible, damage management activities would be conducted away from

areas of high human activity. If this were not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early morning).

- Shooting would be conducted professionally and in the safest manner possible. Shooting, except from aircraft, would be conducted during periods when public activity and access to the control areas were minimal (*e.g.*, at night), whenever practical and possible. Personnel involved in shooting operations would be fully trained in the proper and safe application of this method in accordance with WS Directive 2.615.

- Aviation safety and the operation of aircraft would adhere to standards for the use of aircraft under WS Directive 2.620.

- All pilots, crewmembers, ground crews, and aircraft maintenance personnel will adhere to the WS Aviation Operations and Safety Manual, as amended, as well as, Title 14 CFR, and Federal Aviation Regulation, Part 43, 61, 91, 119, 133, 135, and 137.

- All personnel employing chemical methods would be properly trained and certified in the use of those chemicals by the ODAFF (ORS 2, §3-81). All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401 and WS Directive 2.430.

- All chemical methods used by WS or recommended by WS would be registered with the Environmental Protection Agency, the United States Drug Enforcement Administration, United States Food and Drug Administration, and/or the LDAF, as appropriate.

- In most cases, live-captured feral swine would be euthanized. In cases where feral swine would be chemically immobilized, fitted with radio telemetry equipment, and released for research or operational purposes, released animals would be identified with ear tags, PIT tags, or other similar devices that provide WS' contact information and a warning to the public not to eat the marked animal.

- Conspicuous, bilingual warning signs alerting people to the presence of traps may be placed at major access points to areas where active feral swine management operations were occurring, as required by WS Directive 2.450.

- Carcasses of feral swine retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

- Personnel would be trained in the latest and most humane devices/methods for removing feral swine.

- WS' personnel would check methods frequently to ensure feral swine captured would be addressed in a timely manner to minimize the stress of being restrained.

- When deemed appropriate using the WS' Decision Model, WS' use of lethal methods would comply with WS' directives (see WS Directive 2.505, WS Directive 2.430).

- WS' personnel would attempt to euthanize captured feral swine as quickly and humanely as possible. WS' use of euthanasia methods would follow those recommended by WS' directives (see WS Directive 2.505, WS Directive 2.430).

- Trap monitoring devices would be employed when applicable that indicate when a trap has been activated. Trap monitoring device would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured swine would be restrained. By reducing the amount of time feral swine would be restrained, pain and stress could be minimized, which would reduce the distress of captured swine.

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing feral swine damage.

- The NWRC would continually be conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

Issue 5 - Effectiveness of Feral Swine Damage Management Methods

- The appropriateness and effectiveness of methods and techniques would be applied based on the WS Decision Model using site-specific inputs.

- WS would continually monitor the results of methods employed to ensure those methods deemed appropriate and most effective were used to resolve feral swine damage.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions when selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. This chapter analyzes the environmental consequences of each alternative as that alternative relates to the issues identified. The following resource values in the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further.

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions, including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders, including the Clean Air Act and Executive Order 13514.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative (Alternative 3) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS, the ODAFF, and the ODWC.

Issue 1 - Effects of Damage Management Activities on Feral Swine Populations

A common issue is whether damage management actions would adversely affect the populations of target species, especially when lethal methods were employed. As discussed previously, the analysis for magnitude of impact from lethal removal can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. Information on populations and trends are often derived from several sources including published literature and harvest data.

Methods available to address feral swine damage or threats of damage in the State that would be available for use or recommendation under Alternative 3 (proposed action/no action alternative) and Alternative 2 (technical assistance only alternative) would either be lethal methods or non-lethal methods. Many of the methods would also be available to other entities under Alternative 1 (no involvement by WS alternative). The only methods that would not be available or would have limited availability for use by other entities under Alternative 1 and Alternative 2 would be immobilizing drugs, euthanasia chemicals, and snares. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 3 would address requests for assistance received by WS through technical and/or operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods that would be available under Alternative 3 would include habitat modification, frightening devices, lure crops, live traps, exclusionary devices, foot snares, dogs, and immobilizing drugs (see Appendix B for a complete list and description of potential methods).

Non-lethal methods that would be available under all the alternatives could disperse or otherwise make an area unattractive to feral swine causing damage; thereby, reducing the presence of feral swine at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance under Alternative 2 and Alternative 3 (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed or recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance had already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat.

Many non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse feral swine from the area resulting in a reduction in the presence of those feral swine at the site where those methods were employed. However, feral swine responsible for causing damage or threats would be dispersed to other areas with minimal effects on the population. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to the feral swine population. Non-lethal methods would generally be regarded as having minimal effects on overall populations of feral swine since individuals were unharmed. The use of non-lethal methods would not have adverse effects on feral swine populations in the State under any of the alternatives.

The continued use of non-lethal methods could often lead to the habituation of feral swine to those methods, which can decrease the effectiveness of those methods. For any management methods employed, the proper timing would be essential in effectively dispersing those feral swine causing damage. Employing methods soon after damage begins or soon after threats were identified, would

increase the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of feral swine damage.

In addition to non-lethal methods, lethal methods would also be available for use under all the alternatives by WS and/or by other entities. Lethal methods available to address feral swine damage include euthanasia chemicals (applied after live-capture), shooting (including shooting from aircraft), and the recommendation that feral swine be harvested during hunting seasons. Euthanasia chemicals would only be applied after feral swine were live-captured and appropriately immobilized. Most of those methods would be available for use by WS or for recommendation by WS under Alternative 3. However, immobilizing drugs, euthanasia chemicals, and snares would not be available to all entities or would have limited availability. Lethal methods could be employed by WS under Alternative 3 to resolve damage only after receiving a request for the use of those methods. Those same methods would also be available for WS to recommend and for other entities to use under Alternative 2, except for immobilizing drugs, euthanasia chemicals, and snares. Immobilizing drugs and euthanasia chemicals would be restricted to veterinarians and people under their supervision. The public could not legally use snares to manage damage caused by feral swine under any alternative. Under Alternative 1, those same lethal methods would continue to be available for use by other entities despite the lack of involvement by WS in damage management activities.

When live-captured target animals were to be lethally removed under Alternative 3, removal would occur pursuant to WS Directive 2.505 and WS Directive 2.430. Under Alternative 2, WS would recommend the use of methods to remove live-captured or restrained target animals in accordance with WS Directive 2.505; however, the people requesting assistance could euthanize live-captured feral swine, as they deem appropriate. WS would not provide assistance under Alternative 1; however, many of those methods available to lethally remove live-captured or restrained feral swine would continue to be available for use by other entities under Alternative 1. Immobilizing drugs and euthanasia chemicals would be restricted to veterinarians or people under their supervision. The public could not legally use snares to manage damage caused by feral swine under any alternative. Under Alternative 1, the person who live-captured the feral swine would determine the methods to lethally remove feral swine from live-capture devices.

The use of lethal methods by any entity could result in local population reductions in the area where damage or threats were occurring since feral swine would be removed from the population. Lethal methods could be employed or recommended to remove feral swine that have been identified as causing damage or posing a threat to human safety. Therefore, using lethal methods could result in local reductions of feral swine in the area where damage or threats were occurring. The number of feral swine removed from the population by WS using lethal methods under Alternative 3 would be dependent on the number of requests for assistance received, the number of feral swine involved with the associated damage or threat, and the efficacy of methods employed. The number of feral swine removed by other entities under Alternative 1 and Alternative 2 would be unknown but would likely be similar to the removal that could occur under Alternative 3.

The use of most lethal methods would be intended to reduce the number of feral swine present at a location since a reduction in the number of feral swine at a location could lead to a reduction in damage, which would be applicable whether using lethal or non-lethal methods. The intent of non-lethal methods would be to harass, exclude, or otherwise make an area unattractive to feral swine, which disperses those animals to other areas leading to a reduction in damage at the location where those feral swine were dispersed. The intent of using lethal methods would be similar to the objective trying to be achieved when using non-lethal methods, which would be to reduce the number of feral

swine in the area where damage was occurring; thereby, reducing the damage occurring at that location.

Often of concern with the use of lethal methods is that feral swine that were lethally removed would only be replaced by other feral swine either during the application of those methods (*e.g.*, feral swine that relocate into the area) or by feral swine the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, WS would not use lethal methods during direct operational assistance as population management tools over broad areas. Lethal methods would be employed under Alternative 3 to reduce the number of feral swine present at a location where damage was occurring by targeting those feral swine causing damage or posing threats. Since the intent of using lethal methods would be to manage those feral swine causing damage and not to manage entire populations, those methods would be considered effective when damage was reduced at the time it occurred despite the possibility that feral swine could be replaced by other feral swine later.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing feral swine damage. Those methods would be employed to reduce damage occurring at the time those methods were employed but do not necessarily ensure feral swine would not return once those methods were discontinued. Long-term solutions to resolving feral swine damage can often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing. When addressing feral swine damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to feral swine. To ensure complete success, alternative sites in areas where damage was not likely to occur would often times be required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive to feral swine would likely result in the dispersal of those feral swine to other areas where damage could occur or could result in multiple occurrences of damage situations.

The alternatives discussed in Chapter 3 were developed in response to the issues identified in Chapter 2, along with meeting the need for action that was identified in Chapter 1. The issues associated with conducting the alternatives on the feral swine population are analyzed for each alternative below.

Alternative 1 – No Feral Swine Damage Management Conducted by WS

Under this alternative, WS would not conduct damage management activities in the State. WS would have no direct involvement with any aspect of addressing damage caused by feral swine and would provide no technical assistance. No lethal removal of feral swine by WS would occur under this alternative. Feral swine could continue to be lethally removed to resolve damage and/or threats by other entities, including the property owner or manager. Management actions taken by non-federal entities to alleviate damage would be considered the *environmental status quo*.

Local feral swine populations could decline, stay the same, or increase depending on actions taken by those persons experiencing damage. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of feral swine out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action. Many of the methods listed in Appendix B would be available for use by other agencies and private entities, unless otherwise noted in the Appendix, to manage damage and threats associated with feral swine.

Under this alternative, WS would have no impact on feral swine populations in the State. Efforts by other federal, state, and local governments including private entities to reduce or prevent damage and

conflicts could increase, which could result in effects on the feral swine population to an unknown degree. Effects on the feral swine population under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by other governmental agencies and private persons.

Since feral swine could continue to be lethally removed under this alternative, the potential effects on the feral swine population in the State would be similar among all the alternatives for this issue. WS' involvement would not be additive to removal that could occur since the cooperator requesting WS' assistance could conduct feral swine damage management activities without WS' direct involvement. Therefore, any actions to resolve damage or reduce threats associated with feral swine could occur by other entities despite WS' lack of involvement under this alternative.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

WS would not directly affect feral swine populations in the State from a program implementing technical assistance only. However, persons experiencing damage or threats from feral swine could implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available to resolve feral swine damage. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. Requestors may implement WS' recommendations, implement other actions, or take no action. However, those persons requesting assistance are likely those people that would implement damage abatement methods in the absence of WS' recommendations.

Under a technical assistance only alternative, those persons experiencing threats or damage could lethally remove feral swine despite WS' lack of direct involvement in the management action. Therefore, under this alternative the number of feral swine lethally removed would likely be similar to the other alternatives since lethal removal could occur. WS' participation in a management action would not be additive to an action that could occur in the absence of WS' participation.

Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the ODAFF, private entities, and/or other authorities. If direct operational assistance was not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal removal, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (*e.g.*, see White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003).

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

Feral swine damage may be addressed by WS in response to requests by federal agencies, state agencies, or the public at any location in the State. Agricultural producers may request assistance with managing damage to standing crops or disease threats to domestic livestock. Natural resource managers may request assistance to protect natural areas, parks, recreation areas, or T&E species. Public health agencies may request assistance in reducing feral swine densities where disease threats to people exist. WS may use any legal methods among those outlined by Barrett and Birmingham (1994), West et al. (2009), and Hamrick et al. (2011) as suitable for feral swine damage management, including the use of aircraft to shoot feral swine.

In 1993, the Animal Industries Division of the ODAFF produced a distribution map for feral swine in Oklahoma. The distribution map indicated that feral swine were present in 26 Oklahoma counties. By 2004, a survey of WS' employees identified an increase in feral swine to 69 of 77 Oklahoma counties. In 2007, feral swine were found in 74 of the 77 counties within the State (Stevens 2010). In 2008, the Feral Swine Control Act was passed to address feral swine damage in the State. Today, evidence suggests that feral swine occur in all the counties of the State (Stevens 2010, Wild Hog Working Group 2012). However, many of the counties in the north central and northwestern portion of the State have limited feral swine distribution and/or feral swine densities are considered low (Stevens 2010). It is anticipated that feral swine populations in Oklahoma will continue to increase due to their prolific breeding behavior, adaptability, and additional swine being illegally released into the wild.

To address requests for assistance associated with feral swine, the WS program in Oklahoma has lethally removed 20,059 feral swine between FY 2008 and FY 2013, which is an average annual removal of 3,343 feral swine. The annual lethal removal has ranged from a low of 2,430 feral swine removed during FY 2011 to a high of 3,980 feral swine removed during FY 2008. Feral swine have been lethally removed primarily by shooting, including shooting from aircraft. WS also lethally removed feral swine using neck snares and live-capture methods (*e.g.*, corral traps). Feral swine captured using live-capture methods were subsequently euthanized by gunshot.

Removal of a small number of feral swine or a single individual will sometimes reduce damage considerably where natural resources, agriculture, or property is affected (Barrett and Birmingham 1994). However, damage may increase dramatically in areas where feral swine have ample resources and opportunity to expand. Damage management activities conducted by WS associated with feral swine would target single animals or local populations of feral swine at sites where their presence was causing unacceptable damage or threats to agriculture, human health and safety, natural resources, or property. WS expects the annual lethal removal of feral swine to remain similar to previous activities.

The removal of feral swine at previous levels would not be expected to affect the overall statewide population of feral swine because of the high reproductive rates exhibited by these animals (Barrett and Birmingham 1994). For example, Timmons et al. (2012) was able to model population growth rates for the feral swine population in Texas using demographic parameters gathered from feral swine in the southeastern United States. Using those demographic parameters, Timmons et al. (2012) estimated an average annual growth rate of 21% for feral swine populations in Texas. If the average annual harvest of feral swine in Texas represented 28% of the population, Timmons et al. (2012) expected the statewide population in Texas to double every five years. If annual harvest rates reached 41% of the statewide population in Texas, Timmons et al. (2012) predicted the population would continue to increase at a rate of 12% per year. The model determined that an annual harvest of 66% of the population was needed to hold the population stable in Texas (Timmons et al. 2012). In another example, the South Carolina Wild Hog Task Force (2012) estimated that 50 to 75% of the statewide feral swine population in South Carolina would have to be removed annually to stabilize or reduce the population in that State.

The statewide population of feral swine in Oklahoma was estimated to be 500,000 swine or below (Stevens 2010). If 3,343 feral swine were lethally removed by WS annually, which is the average annual removal by WS from FY 2008 through FY 2013, and the population remained at least stable in the State, the level of removal by WS would represent less than 1.0% of a stable population. If WS' annual lethal removal increased to 10,000 feral swine and the statewide feral swine population remained at least stable, the annual removal by WS would represent 2.0% of the population.

The total number of feral swine harvested in the State to alleviate damage and during other hunting activities is not currently known. There is no closed harvest season for feral swine on private property within the State and no limit on the number of feral swine that can be harvested (ODWC 2013). Based on recent findings by Stevens (2010) and the Wild Hog Working Group (2012) and based on the Feral Swine Control Act passed in 2008, current cumulative harvest levels in the State have not been sufficient to reduce feral swine populations in the State.

Based on the findings of the South Carolina Wild Hog Task Force (2012) and Timmons et al. (2012), the cumulative harvest of feral swine would likely not reach a magnitude that would cause a decline in the statewide feral swine population. Although the actual cumulative harvest of feral swine is unknown in the State, the combined harvest is not likely to reach a level where statewide population declines would occur based on the reproductive potential of swine. In addition, the goal of the Feral Swine Control Act is "*…to provide aggressive measures to reduce the number of feral swine in Oklahoma*." Activities conducted by WS under the proposed action alternative would occur within the goals and strategies outlined for the statewide feral swine population by the ODAFF and the ODWC. Maintaining a local and/or statewide feral swine population at the lowest level possible, including extirpation, could be the goal of the ODWC and/or the ODAFF.

Feral swine are not native to North America, including Oklahoma. Lowe et al. (2000) ranked feral swine as one of the 100 worst invasive species in the world. The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. Executive Order 13112 directs federal agencies to address invasive species to the extent practicable and permitted by law. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

As discussed previously, a concern is often raised about the potential impacts to non-target species, including T&E species, from the use of methods to resolve damage caused by feral swine. The potential effects on the populations of non-target wildlife species, including T&E species, are analyzed below.

Alternative 1 – No Feral Swine Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with damage management activities in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Feral swine could continue to be lethally removed by other entities within the State. Risks to non-targets and T&E species would continue to occur from those people who implement damage management activities on their own or through recommendations by other federal, state, and private entities. Although some risks occur from those people that implement damage management in the absence of any involvement by WS, those risks would likely be low and would be similar to those risks under the other alternatives.

The ability to reduce negative effects caused by feral swine to other wildlife species and their habitats, including T&E species, would be variable and would be based upon the skills and abilities of the person implementing damage management actions under this alternative.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be

employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS using the Decision Model and as permitted by laws and regulations.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods were employed, as recommended by WS, the potential impacts to non-targets would likely be similar to the proposed action. If recommended methods and techniques were not followed or if other methods were employed that were not recommended, the potential impacts on non-target species, including T&E species would likely be higher compared to the proposed action.

The potential impacts of harassment and exclusion methods on non-target species would be similar to those described under the proposed action. Harassment and exclusion methods would be easily obtainable and simple to employ. Since identification of targets would occur when employing shooting as a method, the potential impacts to non-target species would likely be low under this alternative.

Those people experiencing damage from feral swine could implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. If those people experiencing damage do not implement methods or techniques correctly, the potential impacts from providing only technical assistance could be greater than those potential impacts described in the proposed action. The incorrect implementation of methods or techniques recommended by WS could lead to an increase in non-target take when compared to the non-target take that could occur by WS under the proposed action alternative.

If people requesting assistance were provided technical assistance but do not implement any of the recommended actions and take no further action, the potential to remove non-targets would be lower when compared to the proposed action. If those people requesting assistance implemented recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. If WS made recommendations on the use of methods to alleviate damage but those methods were not implemented as recommended by WS or if those methods recommended by WS were used inappropriately, the potential for lethal removal of non-targets would likely increase under a technical assistance only alternative. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

If non-lethal methods recommended by WS under this alternative were deemed ineffective by those people requesting assistance, lethal methods could be employed by those people experiencing damage. Those persons requesting assistance would likely use lethal methods since a damage threshold has been met for that individual requestor that has triggered seeking assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose feral swine damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing methods and could lead to greater removal of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance was available, people have resorted to using chemical toxicants that are illegal for use on the intended target species. The illegal use of methods often results in loss of both target and non-target wildlife

(*e.g.*, see White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species.

The ability to reduce negative effects caused by feral swine to wildlife species and their habitats, including T&E species, would be variable under this alternative. The ability to reduce risks would be based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 1 since WS would be available to provide information and advice on appropriately employing methods and reducing the risk of non-target take.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The potential for adverse effects to non-targets occurs from the employment of methods to address feral swine damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The risks to non-targets from the use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives.

WS' personnel would be experienced with managing wildlife damage and would be trained in the employment of methods, which would allow WS' employees to use the WS Decision Model to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse effects on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target exposure to methods during program activities, the potential for WS to disperse or lethally remove non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that were not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely affected if the area excluded was large enough. Auditory and visual dispersal methods used to reduce damage or threats caused by feral swine would also likely disperse non-targets in the immediate area the methods were employed. Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets near those methods when employed would also likely be dispersed from the area. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods were employed of both target and non-target species. Therefore, non-targets could be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species would expect to be temporary with target and non-target species often returning after the cessation of dispersal methods. The use of non-lethal methods would have similar results on both non-target and target species. Although non-lethal methods do not result in lethal removal of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources.

Other non-lethal methods available for use under this alternative include live traps and immobilizing drugs. Live traps (*e.g.*, cage traps, walk-in traps, corral traps) and other live-capture methods (*e.g.*, foot snare, neck snares, foothold traps, nets) restrain wildlife once captured and are considered live-capture methods. Live traps have the potential to live-capture non-target species. Any potential non-targets captured using live traps would be handled in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist. Trap placement in areas where target species were active and the use of attractants as specific to the target species as possible would minimize the likelihood of capture of non-targets. If traps and nets were attended to appropriately, any non-targets captured could be released on site unharmed.

Immobilizing drugs would be applied after live-capture occurs through injection or through direct application to target individuals from a dart gun, blowgun, or jabstick. Therefore, immobilizing drugs would only be applied after identification of the target occurred prior to application. Immobilizing drugs would be administered in controlled situations where feral swine were confined inside a live-trap or after identification of the target occurs.

Foot snares are similar to neck snares except that they are intended to capture the target animal by the hoof instead of around the neck. Like neck snares, the foot snare consists of a flexible wire hoop made from aircraft cable. Foot snares are placed along the ground; loop pointed up, on active trails and/or bait sites. The smaller loop size prevents larger animals, such as black bears, from accidentally becoming caught. Non-target capture can be reduced through manipulation of the site (*e.g.*, brushing in the top of the trail, placing jump sticks), and by regularly checking snares.

Potential impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal removal would likely occur. Non-lethal methods would be available under all the alternatives analyzed; however, the use of immobilizing drugs would be restricted to use by veterinarians or people under their supervision under Alternative 1 and Alternative 2. In addition, the public could not legally use snares to live capture feral swine.

WS' involvement in the use of or recommendation of non-lethal methods would ensure the potential effects to non-targets were considered under WS' Decision Model. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal effects on overall populations of wildlife since individuals of those species are unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods would often be temporary and do not result in lethal removal. Potential impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods would likely be low.

WS could also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage, when those methods were deemed appropriate using the WS Decision Model. Lethal methods available for use to manage damage caused by feral swine under this alternative would include shooting (including shooting from aircraft), euthanasia chemicals (applied after live-capture), and the recommendation of hunting. Available methods and the application of those methods to resolve feral swine damage is further discussed in Appendix B.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse effects would be anticipated from use of this method. Similarly, the use of euthanasia methods would not result in the lethal removal of non-targets since identification would occur prior to euthanizing an animal.

An additional concern that WS has identified is the potential for low-level aircraft flights to potentially disturb wildlife, including T&E species. Low-level aircraft flights would be associated with the use of firearms from aircraft and from the use of aircraft for wildlife surveillance. Aerial operations would be an important method of damage management in Oklahoma when used to address damage or threats associated with feral swine in remote areas where access is limited due to terrain and habitat. Aerial operations would only occur in those areas where a MOU, work initiation document, or another similar document allowing the use of aircraft had been signed between WS and the cooperating landowner or manager. Aerial operations would typically be conducted with aircraft between the months of December and April when the foliage has fallen; however, aircraft could be used at any time of year. The amount of time spent conducting aerial operations varies depending on the severity of damage, the size of the area where damage or threats were occurring, and the weather, as low-level aerial activities would be restricted to visual flight rules and would be impractical in high winds or at times when animals were not easily visible.

Aircraft play an important role in the management of various wildlife species for many agencies. Resource management agencies rely on low flying aircraft to monitor the status of many animal populations including large mammals (Lancia et al. 2000), birds of prey (Fuller and Mosher 1987), waterfowl (Bellrose 1976), and colonial waterbirds (Speich 1986). Low-level flights could also be required when aircraft are used to track animal movements by radio telemetry (Gilmer et al. 1981, Samuel and Fuller 1994).

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed the effects of aircraft overflights on wildlife and suggested that adverse effects could occur to certain species. Some species will frequently or at least occasionally show an adverse response to even minor overflights. In general though, it appears that the more serious potential adverse effects occur when overflights are chronic (*i.e.*, they occur daily or more often over long periods). Chronic exposures generally involve areas near commercial airports and military flight training facilities. Aerial operations conducted by WS rarely occur in the same areas on a daily basis and little time is actually spent flying over those particular areas.

The effects on wildlife from military-type aircraft have been studied extensively (Air National Guard 1997), and were found to have no expected adverse effects on wildlife. Examples of species or species groups that have been studied with regard to the issue of aircraft-generated disturbance are as follows:

***Waterbirds and Waterfowl*:** Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no "*drastic*" disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990) observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50% the following day. They also observed that about 40% of the disturbances caused interruptions in feeding that would require an estimated 32% increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*),

American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the "*time-activity budgets*" of the species. Aerial operations conducted by WS would not be conducted over federal, State, or other governmental agency property without the concurrence of the managing entity. Those flights, if requested, would be conducted to reduce threats and damages occurring to natural resources and should not result in impacts to bird species. Thus, there is little to no potential for any adverse effects on waterbirds and waterfowl.

***Raptors*:** The Air National Guard (1997) analyzed and summarized the effects of overflight studies conducted by numerous federal and state government agencies and private organizations. Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (see Ellis 1981, Fraser et al. 1985, Lamp 1989, United States Forest Service 1992 as cited in Air National Guard (1997)). A study conducted on the impacts of overflights to bald eagles (*Haliaeetus leucocephalus*) suggested that the eagles were not sensitive to this type of disturbance (Fraser et al. 1985). During the study, observations were made of more than 850 overflights of active eagle nests. Only two eagles rose out of either their incubation or brooding postures. This study also showed that perched adults were flushed only 10% of the time during aircraft overflights. Evidence also suggests that golden eagles (*Aquila chrysaetos*) are not highly sensitive to noise or other aircraft disturbances (Ellis 1981, Holthuijzen et al. 1990). Finally, one other study found that eagles were particularly resistant to being flushed from their nests (see Awbrey and Bowles 1990 as cited in Air National Guard (1997)). Therefore, there is considerable evidence that eagles would not be adversely affected by overflights during aerial operations.

Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period; results showed similar nesting success between hawks subjected to overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but found that ferruginous hawks (*B. regalis*) were sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, nor did the hawks become alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that five species of hawks, two falcons (*Falco* spp.), and golden eagles (*Aquila chrysaetos*) were "*incredibly tolerant*" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and the overflights never limited productivity.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards, and from behind occupied cliff nests. Eagle courtship, nesting, and fledging were not adversely affected, indicating that no special management restrictions were required in the study location.

The above studies indicate raptors were relatively unaffected by aircraft overflights, including those by military aircraft that produce much higher noise levels. Therefore, we conclude that aerial operations would have little or no potential to adversely affect raptors.

***Passerines*:** Reproductive losses have been reported in one study of small territorial passerines ("*perching*" birds that included sparrows, blackbirds) after exposure to low altitude overflights (see Manci et al. 1988 as cited in Air National Guard (1997)), but natural mortality rates of both adults and young are high and variable for most of those species. The research review indicated passerine birds cannot be driven any great distance from a favored food source by a non-specific disturbance, such as military aircraft noise, which indicated quieter noise would have even less effect. Passerines avoid intermittent or unpredictable sources of disturbance more than predictable ones, but return rapidly to feed or roost once the disturbance ceases (Gladwin et al. 1988, United States Forest Service 1992). Those studies and reviews indicated there was little or no potential for aerial operations to cause adverse effects on passerine bird species.

***Pronghorn (antelope) and Mule Deer*:** Krausman et al. (2004) found that Sonoran pronghorn (*Antilocapra americana sonoriensis*) were not adversely affected by military fighter jet training flights and other military activity on an area of frequent and intensive military flight training operations. Krausman et al. (1986) reported that only three of 70 observed responses of mule deer (*Odocoileus hemionus*) to small fixed-wing aircraft overflights at 150 to 500 feet above ground level resulted in the deer changing habitats. The authors believed that the deer might have been accustomed to overflights because the study area was near an interstate highway that was followed frequently by aircraft. Krausman et al. (2004) also reported that pronghorn and mule deer do not hear noise from military aircraft as well as humans, which potentially indicates why they appeared not to be disturbed as much as previously thought.

When Weisenberger et al. (1996) evaluated the effects of simulated low altitude jet aircraft noise on desert mule deer (*Odocoileus hemionus crooki*) and mountain sheep (*Ovis canadensis mexicana*), they found that heart rates of the ungulates increased according to the dB levels, with lower noise levels prompting lesser increases. When they were elevated, heart rates rapidly returned to pre-disturbance levels suggesting that the animals did not perceive the noise as a threat. Responses to the simulated noise levels were found to decrease with increased exposure.

***Bison*:** Fancy (1982) reported that only two of 59 bison (*Bison bison*) groups showed any visible reaction to small fixed-winged aircraft flying at 200 to 500 feet above ground level. The study suggests that bison were relatively tolerant of aircraft overflights.

***Domestic Animals and Small Mammals*:** A number of studies with laboratory animals (*e.g.*, rodents [Borg 1979]) and domestic animals (*e.g.*, sheep [Ames and Arehart 1972]) have shown that these animals can become habituated to noise. Long-term lab studies of small mammals exposed intermittently to high levels of noise demonstrate no changes in longevity. The physiological "*fight or flight*" response, while marked, does not appear to have any long-term health consequences on small mammals (Air National Guard 1997). Small mammals habituate, although with difficulty, to sound levels greater than 100 dbA (United States Forest Service 1992).

Although many of those wildlife species discussed above are not present in Oklahoma, the information was provided to demonstrate the relative tolerance most wildlife species have of overflights, even those that involve noise at high decibels, such as from military aircraft. In general, the greatest potential for impacts to occur would be expected to exist when overflights were frequent, such as hourly and over many days that could represent "*chronic*" exposure. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. Even then, many wildlife species become habituated to overflights, which appear to naturally minimize any potential adverse effects where such flights occur on a regular basis. Therefore, it is logical to conclude that the aircraft used to shoot feral swine should have far less potential to cause any disturbance to wildlife than military aircraft. Military aircraft produce much louder noise and are

flown over certain training areas many more times per year, and yet, were found to have no expected adverse effects on wildlife (Air National Guard 1997).

The fact that WS would only conduct overflights on a very small percentage of the land area of the State indicates that most wildlife would not be exposed to overflights, In addition, such flights would occur infrequently throughout a year, which would further lessened the potential for any adverse effects.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by feral swine, the use of such methods could result in the incidental lethal removal of unintended species. The unintentional removal and capture of wildlife species during damage management activities conducted under the proposed action alternative would primarily be associated with the use of live-traps. Those occurrences would be infrequent and should not affect the overall populations of any species under the proposed action. The unintentional removal of non-target species by WS during activities to reduce damage or threats associated with feral swine would be extremely low to non-existent.

During activities conducted by WS that targeted feral swine, a total of 29 non-target animal species were captured by FSDM methods in Oklahoma from April 2005 through September 2013. Of these, 1 raccoon, 11 white-tailed deer, 1 striped skunk, 1 Porcupine, 1 beaver, 1 bobcat were killed, and 3 wild turkeys, 9 white-tailed deer, and 1 feral dog were released unharmed. The non-targets killed or live-captured and released in previous years by WS are representative of non-target species that could be taken by WS under the proposed action alternative. Although additional species of non-targets could be taken by WS, take of individuals from any species is not likely to increase substantively above the number of non-targets taken annually by WS during previous damage management activities.

As discussed previously, the use of non-lethal methods to address damage or threats would generally be regarded as having no effect on a species' population since those individuals addressed using non-lethal methods would be unharmed and no actual reduction in the number of individuals in a species' population would occur. Similarly, the live-capture and release of non-targets would generally be regarded as having no adverse effects on a species' population since those individuals would be released unharmed and no actual reduction in the number of individuals in a population occurs. Therefore, the live-capture and subsequent releasing of non-targets during damage management activities conducted under the proposed action alternative would not result in declines in the number of individuals in a species' population.

WS would monitor the take of non-target species to ensure program activities or methodologies used in feral swine damage management would not adversely affect non-targets. Methods available to resolve and prevent damage or threats when employed by trained, knowledgeable personnel would be selective for target species. WS would report to the ODWC any non-targets lethally removed to ensure removal by WS was considered as part of management objectives established for those species. The potential impacts to non-targets would be similar to the other alternatives and would be considered minimal to non-existent.

T&E Species Effects

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. Section 3.3 and Section 3.4 of this EA describe SOPs to avoid T&E effects.

Federally Listed Species – The list of species designated as threatened or endangered in the State of Oklahoma as determined by the USFWS was reviewed during the development of this EA. Based on the proposed activities and the use patterns of the methods available to address feral swine damage, when requested, and since feral swine occur statewide, the proposed activities could occur in areas where T&E species occur within the State. Additionally, the proposed action may benefit some listed species by removing competition for food and cover and possible improvement of water quality in some areas. The proposed action may also eliminate predation related losses of T&E species.

Based on the review of the proposed activities and the methods available to address feral swine damage, WS made effects determinations for those federally listed species found within the State (see Table 4.1 for a list of species and WS' determinations). Based on the use patterns of the methods and the removal activities, the proposed action alternative would have no effect on many T&E species listed in the State (see Table 4.1). For several species listed within the State, WS has determined that the proposed activities "*may affect*" those species but those effects would be solely beneficial, insignificant, or discountable, which would warrant a "*not likely to adversely affect*" determination.

Table 4.1 - Threatened or endangered species listed by the USFWS and present in Oklahoma

SPECIES	SCIENTIFIC NAME	Status	Locale	Habitat	FS Method	FS Removal
MAMMALS						
Bat, gray	*Myotis grisescens*	E	Northeast	CF	0	0
Bat, Indiana	*Myotis sodalis*	E	East	CF	0	0
Bat, Ozark big-eared	*Corynorhinus townsendii ingens*	E	Northeast	CF	0	0
BIRDS						
Crane, whooping	*Grus americana*	E,H	All	GW	0	0
Curlew, Eskimo	*Numenius borealis*	E	All	GW	0	0
Plover, piping	*Charadrius melodus*	T	All	LW	0	+
Prairie-chicken, lesser	*Tympanuchus pallidicinctus*	T	Northwest	G	0	+
Tern, Interior least	*Sterna antillarum*	E	All	LW	0	+
Vireo, black-capped	*Vireo atricapillus*	E	Central	FG	0	+
Woodpecker, red-cockaded	*Picoides borealis*	E	Southeast	F	0	0
Knot, Red	*Calidris canutus rufa*	PT	All	W	0	0
Pipit, Sprague's	*Anthus spragueii*	C	All	G	0	0
FISHES						
Cavefish, Ozark	*Amblyopsis rosae*	T	Northeast	C	0	0
Darter, Arkansas	*Etheostoma cragini*	C	North	LW	0	+
Darter, leopard	*Percina pantherina*	T,H	Southeast	W	0	+
Madtom, Neosho	*Noturus placidus*	T	Northeast	W	0	+
Shiner, Arkansas River	*Notropis girardi*	T,H	West	LW	0	+
INVERTEBRATES						
Beetle, American burying	*Nicrophorus americanus*	E	East	FG	0	+
Moth, Rattlesnake-Master Borer	*Papaipema eryngii*	C	Northeast	G	0	0
Mucket, Neosho	*Lampsilis rafinesqueana*	C	Northeast	LW	0	+
Mussel, scaleshell	*Arkansia wheeleri*	E	Southeast	W	0	+
Pocketbook, Ouachita rock	*Leptodea leptodon*	E	Southeast	LW	0	+
Rabbitsfoot	*Quadrula cylindrica cylindrica*	T	East	LW	0	+
Mapleleaf, winged	*Quadrula fragosa*	E	East	LW	0	+
PLANTS						
Orchid, Western prairie fringed	*Platanthera praeclara*	T	Northeast	G	0	+
Orchid, Eastern prairie fringed	*Platanthera leucophaea*	T	East	G	0	+
Harperella	*Ptilimnium nodosum*	E	East	W	0	+

STATUS
E *- Endangered*
T *- Threatened*
C *- Candidate*
H *– Design. Crit. Hab.*

HABITAT
C *- Caves*
F *- Forests/riparian borders*
G *- Grassland/range/meadow*
L *- Lakes, Rivers*
W *- Wetland/marsh/creek*

Feral swine Damage Management - Impacts
(-) *– Negative (not likely to adversely affect)*
0 *– none (no effect)*
(+) *– Positive (beneficial; not likely to adversely affect)*

In 1999, the WS program in Oklahoma entered into an informal consultation with the USFWS to address T&E species in Oklahoma. At that time, a Biological Assessment was prepared by WS to evaluate potential impacts to red-cockaded woodpeckers, Arkansas River shiners, American burying beetles, and scaleshell mussels. The USFWS concurred with WS' determination that the current program was "*…not likely to adversely affect any of the listed or proposed species*."

As part of the development process associated with this EA, WS has initiated consultation with the USFWS pursuant to Section 7 of the ESA. WS has met with the USFWS and is currently seeking concurrence from the USFWS on WS' effects determination. WS would abide by the outcome associated with the consultation process. WS would continue to consult with the USFWS to evaluate activities to resolve feral swine damage to ensure the protection of T&E species and to comply with the ESA.

State Listed Species - The current list of State listed species as endangered or threatened as determined by the ODWC was obtained and reviewed during the development of the EA. Based on the review of species listed in the State, WS has determined that the proposed methods would have no effect on those species listed and the removal of feral swine would not adversely affect those species currently listed by the State.

Table 4.2 - Threatened and endangered species listed by the ODWC and present in Oklahoma

SPECIES	SCIENTIFIC NAME	Status	Locale	Habitat	FS Method	FS Removal
FISHES						
Darter, Long-nosed	*Percina nasuta*	E	Northeast	L	0	+
Darter, Black-sided	*Percina maculata*	T	East	L	0	+
INVERTEBRATES						
Mucket, Neosho	*Lampsilis rafinesqueana*	E	Northeast	LW	0	+
Crayfish, Oklahoma Cave	*Cambarus tartarus*	E	Northeast	C	0	0

STATUS
E *- Endangered*
T *- Threatened*
C *- Candidate*
H *– Design. Crit. Hab.*
******* *- Believed extirpated*

HABITAT
C *- Caves*
F *- Forests/riparian borders*
G *- Grassland/range/meadow*
L *- Lakes, Rivers*
W *- Wetland/marsh/creek*

Feral swine Damage Management - Impacts
(-) *– Negative (not likely to adversely affect)*
0 *– none (no effect)*
(+) *– Positive (beneficial; not likely to adversely affect)*

Beneficial Effects on Non-target Species

Invasive species that are introduced into naïve environments often exploit resources and often compete with native plant and wildlife species. Competition for resources between invasive and native species often occurs (Pimentel et al. 2000). Of major concern are the impacts invasive species have on T&E species. Pimentel et al. (2000) estimated 400 of the 958 species listed as threatened or endangered in the United States at the time of publication were negatively affected by invasive species, primarily from competition for resources and predation based on published reports by The Nature Conservancy (1996) and Wilcove et al. (1998). Worldwide nearly 80% of wildlife populations at risk of extinction are threatened or negatively impacted by invasive species (Pimentel et al. 2005). Thus, invasive species have been identified as the primary cause of endangerment of at least 40% of the species listed as threatened or endangered in the United States (Wilcove et al. 1998, Pimentel et al. 2000, Pimentel et al. 2005).

The adverse effects that feral swine can have on native flora and fauna are discussed in Chapter 1 of this EA. Any reduction in the invasive feral swine populations in the State could be viewed as benefiting native wildlife and habitats.

Under this alternative, WS' would be allowed to integrated methods to achieve the most effective approach to resolve and prevent damage to native flora and fauna in the State. An integrated

approach allows the greatest amount of flexibility in the use of methods to ensure employment of methods either individual or in combination achieves the desired level of damage or threat reduction.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

A common concern is the potential adverse effects methods available could have on human health and safety. The threats to human safety of methods available under the alternatives are evaluated below by each of the alternatives.

Alternative 1 – No Feral Swine Damage Management Conducted by WS

Under the no involvement in damage management by WS alternative, WS would not be involved in any aspect of managing damage associated with feral swine, including providing any technical assistance. Due to the lack of involvement in managing damage caused by feral swine, no impacts to human safety would occur directly from WS. This alternative would not prevent those people experiencing threats or damage from feral swine from conducting damage management activities in the absence of WS' assistance. The direct burden of implementing permitted methods would be placed on those persons experiencing damage or require those persons to seek assistance from other entities.

Similar to the technical assistance only alternative, immobilizing drugs and euthanizing chemicals would have limited availability to people experiencing damage or threats from feral swine. In addition, use of snares would not be available under this alternative. Since most methods available to resolve or prevent damage or threats would be available to anyone, the threats to human safety from the use of those methods would be similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or by those persons that were not trained in their proper use, could increase threats to human safety. Overall, the methods available, when applied correctly and appropriately, pose minimal risks to human safety.

Threats to human safety often occur due to interactions between people and feral swine where a concern arises from transmission of zoonotic diseases, from physical interactions that result in injuries, and/or from threats of aircraft/vehicles striking feral swine. In the absence of an effective program to address human safety associated with feral swine, the risks associated with potential disease transmission and injuries would likely increase.

Under this alternative, no assistance would be provided by WS to those persons experiencing damage or threats associated with feral swine in Oklahoma. In the absence of any assistance by WS, those people experiencing damage or threats could contact other entities for assistance or those people could conduct damage management activities by employing those methods available. Therefore, the risks to human safety under this alternative would be variable and would be based on the knowledge and skills of those persons employing methods.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. WS would only provide technical assistance to those persons requesting assistance with feral swine damage and threats. The implementation of methods would then be the sole responsibility of the requester or the requester could contact other entities for direct operational assistance. Although hazards to human safety from non-lethal methods exist, those methods would generally be regarded as safe when used by trained individuals who were experienced in their use. Risks to human safety associated with non-chemical methods such as

resource management methods (*e.g*., limited habitat modification), exclusion devices, frightening devices, cage traps, and other live-capture methods would be considered low based on their use profile for alleviating damage associated with wildlife. Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they could be used with a high degree of safety.

Under a technical assistance only alternative, the availability of immobilizing drugs and euthanasia chemicals to those people experiencing damage or to other entities would be limited. Immobilizing drugs used in capturing and handling wildlife could be administered under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and other entities, such as the ODAFF. Without access to immobilizing drugs or euthanizing chemicals, those persons capturing feral swine using live-traps or other live-capture methods would be responsible for euthanizing or handling live-captured captive animals. Since the availability of immobilizing drugs and euthanizing chemicals would be limited under this alternative, a gunshot would likely be the primary method of euthanasia.

The recommendation of shooting with firearms as a method of direct lethal removal could occur by WS under this alternative. Safety issues do arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. When used appropriately and with consideration for human safety, risks associated with firearms would be minimal. If firearms were employed inappropriately or without regard to human safety, serious injuries could occur. Under this alternative, recommendations of the use of firearms by WS would include human safety considerations. Since the use of firearms to alleviate feral swine damage would be available under any of the alternatives and the use of firearms by those persons experiencing damage or other entities could occur whether WS was consulted or contacted, the risks to human safety from the use of firearms would be similar among all the alternatives.

If non-chemical methods were employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods were employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods. Since those non-chemical methods discussed in Appendix B would be similar across the alternatives, the risks to human safety under a technical assistance alternative would be similar to those discussed in the no involvement by WS alternative and the proposed action.

If resource owners felt the level of assistance available was inadequate to resolve damage or threats to an appropriate level, the illegal use of chemicals could increase. The illegal use of chemicals to resolve wildlife damage does occur and often has impacts to other wildlife species besides the targeted species (*e.g*., see White et al. 1989, USFWS 2001, United States Food and Drug Administration 2003). The extent of the illegal use of chemicals, if only technical assistance was provided, is unknown though it would likely increase if affected resources owners were unable to resolve damage or threats adequately with methods recommended or legally available. An increase in the illegal use of chemicals could increase threats to human safety depending on the chemical used and the extent of the chemical use.

Threats to human safety under the technical assistance alternative could be resolved by those persons implementing methods recommended by WS. The effectiveness in reducing threats would be based on the knowledge of the person to implement the methods effectively and knowledge of the behavior of the target species that would increase the likelihood of resolving the threat. The ability to resolve threats to human safety by those persons requesting technical assistance would also be dependent

upon the availability of methods and the effectiveness of those methods, and the ability of the requestor to acquire those methods.

Given the expertise of WS in the behavior of the target species and the knowledge in the effective use of available methods, the potential threats to human safety under this alternative would likely be higher than the proposed action. Under this alternative, those persons requesting assistance would be responsible for implementing and using methods to resolve damage or threats or contacting other entities for assistance, which could place the requester at a high risk of exposure to disease and injury if not trained appropriately. The degree in which the risk is higher is unknown and is likely highly variable.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

The cooperator requesting assistance would be made aware through a MOU, work initiation document, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator. Therefore, the cooperator would be made aware of the possible use of those methods on property they own or manage through the signing of a MOU, work initiation document, or similar document, which would assist with identifying any risks to human safety associated with the use of those methods.

Under the proposed action, those methods discussed in Appendix B, could be integrated to resolve and prevent damage associated with feral swine in the State. WS would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from feral swine. Risks to human safety associated with technical assistance conducted by WS would be similar to those risks addressed under Alternative 2. The use of non-lethal methods as part of an integrated approach to managing damage that could be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Lethal methods available under the proposed action would include the use of live-capture followed by euthanasia, shooting, and the recommendation of hunting. Those lethal methods available under the proposed action alternative would also be available under the other alternatives. None of the lethal methods available would be restricted to use by WS only, except for the use of snares. Euthanasia chemicals would be restricted to veterinarians or persons under their supervision. Euthanasia chemicals would not be available to the public but those feral swine live-captured could be killed using other methods.

WS' employees who conduct activities to manage damage caused by feral swine would be knowledgeable in the use of methods, feral swine behavior, and WS' directives. That knowledge would be incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing threats and damage caused by feral swine. When employing lethal methods, WS' employees would consider risks to human safety when employing those methods based on location and method. For example, risks to human safety from the use of methods would likely be lower in rural areas that were less densely populated. Consideration would also be given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property was controlled and monitored, the risks to human safety from the use of methods would

likely be less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases. Activities would generally be conducted when human activity was minimal (*e.g.*, early mornings, at night) or in areas where human activities were minimal (*e.g.*, in areas closed to the public).

The use of live-capture traps has been identified as a potential issue. Live-capture traps available for feral swine would typically be walk-in style traps where feral swine enter but are unable to exit. Live-traps would typically be set in situations where human activity was minimal to ensure public safety. Those methods rarely cause serious injury and would only be triggered through direct activation of the device. Therefore, human safety concerns associated with live-traps used to capture wildlife, including feral swine, would require direct contact to cause bodily harm. Therefore, if left undisturbed, risks to human safety would be minimal. Signs warning of the use of those tools in the area would be posted for public view at access points to increase awareness that those devices were being used and to avoid the area, especially pet owners.

Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use were issues identified. To help ensure safe use and awareness, WS' employees who use firearms during official duties are required to attend an approved firearm safety-training course and to remain certified for firearm use must attend a safety-training course in accordance with WS Directive 2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms were deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in the State. WS would work closely with cooperators requesting assistance to ensure all safety issues were considered before firearms would be deemed appropriate for use. The use of all methods, including firearms, would be agreed upon with the cooperator to ensure the safe use of those methods.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include immobilizing drugs and euthanasia chemicals. Immobilization of live-captured feral swine would occur to minimize stress and the likelihood of injury to the individual captured and for the safety of personnel handling the swine. Immobilizing drugs would be administered according to recommended methods and doses from published sources (*e.g.*, Kreeger et al. 2002) and with consultation from a wildlife veterinarian. Under this alternative, immobilizing drugs and euthanasia chemicals would be used infrequently. Immobilizing drugs would be limited to those requests where swine would be sedated to fit radio collars and/or to collect samples and then released. The use of immobilizing drugs would also be limited to those instances where euthanasia would occur from the use of euthanasia chemicals. When euthanasia chemicals were administered, immobilizing drugs would also be administered prior to the use of the euthanizing chemicals.

The use of immobilizing drugs would only be administered to feral swine that have been live-captured using other methods or administered through injection using a projectile (*e.g.*, dart gun). Immobilizing drugs used to sedate wildlife would be used to temporarily handle and transport animals to lessen the distress of the animal from the experience. Drug delivery to immobilize feral swine would be likely to occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs would be fully reversible with a full recovery of sedated animals

occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B.

Euthanizing chemicals would be administered under similar circumstances to immobilizing drugs. Euthanizing chemicals would be administered to animals that were immobilized after being live-captured using other methods. Euthanized animals would be disposed of in accordance with WS Directives; therefore, would not be available for harvest and consumption. If feral swine were immobilized for sampling or to be fitted with a radio collar and released, risks could occur to human safety if harvest and consumption occurred. SOPs employed by WS to reduce risks are discussed in Chapter 3 and in Appendix B.

Drugs used in capturing, handling, and euthanizing wildlife include ketamine, a mixture of ketamine/xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the AMDUCA should prevent any adverse effects on human health with regard to this issue (see Section 1.6). SOPs that would be part of the activities conducted would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.
- As determined on a state-level basis by those veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.
- Most feral swine administered drugs would be released well before typical hunting seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

By following those procedures in accordance with AMDUCA, wildlife management programs would avoid any adverse effects on human health with regard to this issue.

All WS' personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives (see WS Directive 2.430) would ensure the safety of employees applying chemical methods. Feral swine euthanized by WS or taken using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in the absence of the public, whenever possible, which would minimize risks. SOPs are further described in Chapter 3 of this EA.

Consequences of Aerial Wildlife Operations Accidents

Aerial wildlife operations, like any other flying, may result in an accident. Pilots and crewmembers would be trained and experienced to recognize the circumstances that lead to accidents. The national WS Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a WS Flight Training Center, and annual recurring training for all pilots. Still, accidents may occur and the environmental consequences should be evaluated.

***Major Ground or Wild/Forest Fires*:** Although fires could result from aircraft-related accidents, no such fires have occurred from aircraft incidents previously involving government aircraft and low-level flights.

Fuel Spills and Environmental Hazard from Aviation Accidents: A representative of the National Transportation Safety Board has stated previously that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (USDA 2005). Helicopters used for aerial wildlife operations carry less fuel than fixed-wing aircraft with 30 gallons the maximum for most helicopters. In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from unignited fuel spills.

Oil and Other Fluid Spills: With the size of aircraft used by WS, the quantities of oil (*e.g.*, 3 to 5 quarts in helicopters) capable of being spilled in any accident would be small and insignificant with respect to the potential for environmental damage. The greatest potential amount of oil that could be spilled in one accident would be about eight quarts.

Petroleum products biodegrade through volatilization and bacterial action, particularly when those products are exposed to oxygen (Environmental Protection Agency 2000). Thus, small quantity oil spills on surface soils can be expected to biodegrade readily. Even in subsurface contamination situations involving underground storage facilities that would generally be expected to involve larger quantities than would ever be involved in a small aircraft accident, Environmental Protection Agency guidelines provide for *"natural attenuation"* or volatilization and biodegradation in some situations to mitigate environmental hazards (Environmental Protection Agency 2000). Thus, even where oil spills in small aircraft accidents were not cleaned up, the oil does not persist in the environment or persists in such small quantities that no adverse effects would be expected. In addition, WS' accidents generally would occur in remote areas away from human habitation and drinking water supplies. Thus, the risk to drinking water appears to be exceedingly low to nonexistent.

For these reasons, the risk of ground fires or fuel/oil pollution from aviation accidents could be considered low. In addition, based on the history and experience of the program in aircraft accidents, it appears the risk of significant environmental damage from such accidents is exceedingly low. Shooting from aircraft has been utilized to some degree in Oklahoma since 1944. There have been no aerial accidents resulting in a crash or injury involving WS in Oklahoma since aerial hunting began in 1944 (J. Steuber, WS pers. comm. 2014). In 2013, the Oklahoma Legislature passed legislation that allows qualified individuals to obtain a permit from ODAFF that allows aerial hunting for feral swine statewide. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low.

This alternative would allow personnel from WS to address threats to human safety associated with feral swine that were trained in the use of appropriate methodologies for addressing threats and were trained in the appropriate handling methods to ensure the safety of the handler and the public. The other alternatives would place the immediate burden of resolving threats to human safety on those persons requesting assistance, which would not likely be trained in the proper use of methods.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

As discussed previously, a common issue often raised is concerns about the humaneness of methods available under the alternatives for resolving feral swine damage and threats. The issues of method humaneness relating to the alternatives are discussed below.

Alternative 1 – No Feral Swine Damage Management Conducted by WS

Under this alternative, WS would not be involved in any aspect of feral swine damage management in Oklahoma. Those persons experiencing damage or threats associated with feral swine could continue to use those methods legally available and permitted by the ODWC or could contact other entities for assistance. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods.

The humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to use to resolve damage and threats caused by feral swine. Under Alternative 1, those persons employing methods would determine the methods used to euthanize or kill feral swine.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

The issue of method humaneness under this alternative would be similar to humaneness issues discussed under the proposed action, since WS could recommend methods that some persons may consider inhumane. WS would not be directly be involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods or the requester seeking assistance from other entities. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action. Under Alternative 2, WS would recommend the use of euthanasia methods pursuant to WS Directive 2.505. However, the person requesting assistance or other entities would determine what methods to use to euthanize or kill a live-captured animal under Alternative 2.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing feral swine and to ensure methods were used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor or other entities in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of the feral swine or improperly identifying the damage caused by feral swine along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering would likely be regarded as greater than the pain and suffering that could occur under the proposed action alternative.

Those people requesting assistance would be directly responsible for the use and placement of methods or seeking the assistance of other entities and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could suffer and if not address timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requestors implementing methods were not as diligent or timely in checking methods.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS, which would generally be regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, limited habitat modification), exclusion devices, frightening devices, cage traps, foot snares, neck snares, foothold traps, and immobilizing drugs.

As discussed previously, 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.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS would be to use methods as humanely as possible to resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a cage trap would generally be considered by most members of the public as "*humane*", since the animal would be live-captured unharmed. Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

Therefore, the goal would be to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices would be regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of resource management methods, exclusion devices, frightening devices, cage traps, and immobilizing drugs, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be from injuries to animals while those animals were restrained and from the stress of the animal while being restrained or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

If feral swine were to be live-captured by WS, capture devices would be checked in accordance with State laws and regulations to ensure feral swine captured were addressed in a timely manner and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering; therefore, stress would likely be temporary. When live-capture

methods were employed, WS would euthanize feral swine live-captured pursuant to WS Directive 2.505.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to alleviate or prevent feral swine damage and threats. Lethal methods would include shooting, euthanasia chemicals, and the recommendation of harvest during hunting seasons. In addition, target species live-captured using non-lethal methods could be euthanized by WS. WS' use of lethal control methods under the proposed action would follow those required by WS' directives (see WS Directive 2.505, WS Directive 2.430).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods were used in situations where non-lethal damage management methods were not practical or effective. Personnel from WS would be experienced and professional in their use of management methods. Consequently, management methods would be implemented in the most humane manner possible. Many of those methods discussed in Appendix B to alleviate feral swine damage and/or threats in the State, could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. The only methods that would not be available to most people experiencing damage associated with feral swine would be immobilizing drugs, euthanasia chemicals, and snares. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives since those methods could be employed by other entities in the absence of WS' involvement. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods were used by WS as humanely as possible are listed in Chapter 3.

Issue 5 - Effectiveness of Feral Swine Damage Management Methods

A common issue when addressing wildlife damage is the effectiveness of the methods being employed to resolve the damage. When those persons experiencing wildlife damage request assistance from other entities, the damage occurring has likely reached or would reach an economic threshold that is unacceptable to those persons requesting assistance. Therefore, methods being employed to resolve damage must be effective at resolving damage or threats within a reasonable amount of time to prevent further economic loss. The issue of method effectiveness as it relates to each alternative analyzed in detail is discussed below.

Alternative 1 – No Feral Swine Damage Management Conducted by WS

The methods available to those persons experiencing damage under this alternative would be similar to those methods that would be available under the other alternatives. The only methods that would not be available or would have limited availability under this alternative would be the use of immobilizing drugs, euthanasia chemicals, and snares. WS would not be directly involved with application of any methods to resolve damage caused by feral swine in the State under this alternative. The recommendation of methods and the use of methods would be the responsibility of other entities and/or those persons experiencing damage. When available methods were employed as intended, a reasonable amount of effectiveness would be expected. If methods were employed incorrectly due to a lack of knowledge of the correct use of those methods or if methods were employed without consideration of the behavior of feral swine causing damage, those methods being employed would likely be less effective.

Since those methods available for resolving feral swine damage would be available to those persons experiencing damage or threats, the effectiveness of those methods when used as intended would be similar among the alternatives. Those non-lethal methods discussed in Appendix B would be available to those persons experiencing feral swine damage despite WS' lack of involvement under this alternative. The use of lethal methods under this alternative would continue to be available, except for the use of firearms from aircraft and euthanasia chemicals. Since WS would not be involved with any aspect of feral swine damage management under this alternative, the use of methods and the proper application of methods would occur as decided by the persons experiencing damage or by other entities providing assistance.

Alternative 2 – Feral Swine Damage Management by WS through Technical Assistance Only

With WS providing technical assistance but no direct management under this alternative, entities requesting assistance with feral swine damage management would either take no further action, which means conflicts and damage would likely continue or increase in each situation as feral swine numbers were maintained or increased, contact other entities for direct operational assistance, or implement WS' recommendations for non-lethal and lethal control methods. Individuals or entities that implement management based on WS' recommendations may not have the experience necessary to conduct actions efficiently and effectively.

Under this alternative, most of the methods described in Appendix B would be recommended and/or demonstrated. WS would recommend methods using the WS Decision Model based on information provided by those persons requesting assistance or through site visits. WS would describe and demonstrate the correct application of those lethal and non-lethal methods available. If those persons receiving technical assistance applied methods as recommended and demonstrated by WS, those methods, when employed to resolve feral swine damage, would reasonably be anticipated to be effective in resolving damage occurring. Under this alternative, those persons requesting assistance would be provided information on feral swine behavior to ensure methods were applied when the use of those methods was likely to be most effective.

The effectiveness of methods under this alternative would be similar to the other alternatives since many of the same methods would be available. If methods were employed as intended and with regard to the behavior of feral swine causing damage, those methods would likely be effective in resolving damage. The demonstration of methods and the information provided by WS through technical assistance under this alternative would likely increase the effectiveness of the methods employed by those persons requesting assistance. However, if methods were employed that were not recommended or if those methods were employed incorrectly by those persons requesting assistance, methods could be less effective in resolving damage or threats.

Alternative 3 - Continuing the Current Integrated Approach to Managing Feral Swine Damage (Proposed Action/No Action)

Under the proposed action, WS would continue the use of an adaptive approach using an integration of methods to resolve feral swine damage. WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance. WS would only provide assistance after a request had been received and a MOU, work initiation document, or another comparable document had been signed by WS and the requesting entity in which all methods used to address feral swine causing damage were agreed upon between WS and the entity requesting assistance. Methods employed to manage feral swine damage, whether non-lethal or lethal, would often temporary with the duration dependent on many factors, including feral swine densities in the

area, the availability of suitable habitat in the area, and the availability of methods. WS would employ only those methods agreed upon by the requestor after all available methods were discussed.

A common issue raised is that the use of lethal methods is ineffective because additional feral swine are likely to return either to the area after removal occurs or after the breeding season, which gives the impression of creating a financial incentive to continue the use of only lethal methods. This assumes feral swine only return to an area where damage was occurring if lethal methods were used. However, the use of non-lethal methods would often be temporary, which could result in feral swine returning to an area where damage was occurring once those methods were no longer used. The common factor when employing any method is that feral swine would return if suitable habitat continues to exist at the location where damage was occurring and feral swine densities were sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continued to exist that attracted feral swine to an area where damage was occurring.

Dispersing feral swine using pyrotechnics, aversive noise, effigies, or any other non-lethal method addressed in Appendix B would often require repeated application to discourage feral swine, which would increase costs, move feral swine to other areas where they could cause damage, and would be temporary if habitat conditions remained unchanged. Dispersing feral swine could be viewed as moving a problem from one area to another, which would require addressing damage caused by feral swine at another location. WS' recommendation of or use of techniques to modifying existing habitat or making areas unattractive to feral swine is discussed in Appendix B. WS' objective would be to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing feral swine damage that was agreed upon by the cooperator.

As part of an integrated approach to managing feral swine damage, WS would have the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when receiving a request for assistance under the proposed action would be to reduce damage and threats to human safety or to prevent damage from occurring using an integrated approach to managing feral swine damage. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

Managing damage caused by feral swine can be divided into short-term approaches and long-term approaches. Short-term approaches would focus on redistribution and dispersal of feral swine to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, hazing with vehicles, effigies, adverse noise, and erecting access barriers, such as fences. Population reduction by limiting survival or reproduction, removing feral swine, and habitat modification would be considered long-term solutions to managing damage caused by feral swine.

Redistribution methods are often employed to provide immediate resolution to damage occurring until long-term approaches can be implemented or have had time to reach the desired result. Dispersing feral swine can often be a short-term solution that moves those animals to other areas where damages or threats could occur. Some short-term methods may become less effective in resolving damage as the feral swine population increases, as feral swine become more acclimated to human activity, and as feral swine become habituated to harassment techniques. Non-lethal methods often require a constant presence at locations when feral swine are present and must be repeated every

day until the desired results are achieved, which can increase the costs associated with those activities.

Non-lethal methods may also require constant monitoring and maintenance to insure proper results. For example, fencing could be used to prevent access to a resource; however, constant monitoring of the fencing would be required and necessary repairs completed to ensure the use of fencing would be successful in preventing access to resources. Long-term solutions to resolving feral swine damage often require management of the population and identifying the habitat characteristics that attract feral swine to a particular location.

Often of concern with the use of lethal methods is that feral swine that were lethally removed would only be replaced by other feral swine either during the application of those methods (*e.g.*, from other swine that immigrate into the area) or by feral swine the following year (*e.g.*, increase in reproduction and survival that could result from less competition). As stated previously, the use of lethal methods to resolve damage or threats are not intended to manage populations over broad areas. The use of lethal methods would be intended to reduce the number of feral swine present at a location where damage was occurring by targeting those swine causing damage or posing threats. The intent of employing lethal methods would be to target those feral swine causing damage and not to manage entire populations; therefore, those lethal methods would not be ineffective because feral swine return.

Therefore, the use of both lethal and non-lethal methods may require repeated use of those methods. The return of feral swine to areas where damage management methods were previously employed does not indicated previous use of those methods were ineffective at reducing damage since the intent of those methods would be to reduce the number of feral swine present at a site where damage was occurring at the time those methods were employed.

Based on the evaluation of the damage situation, the most effective methods would be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods would be considered as part of the decision making-process during the use of the Decision Model described in Chapter 3 for each damage management request based on continual evaluation of methods and results.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternative 2 and Alternative 3, WS would address damage associated with feral swine either by providing technical assistance only (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 3) in the State. WS, in cooperation with the ODAFF, would be the primary federal agency conducting feral swine damage management in the State under Alternative 2 and Alternative 3. However, other federal, state, and private entities could also be conducting feral swine damage management in the State. The harvest of feral swine by hunters also occurs in Oklahoma.

WS does not normally conduct direct damage management activities in the same area concurrently with other entities that are conducting feral swine damage management, but could conduct damage management activities at adjacent sites within the same period. In addition, feral swine may be harvested in Oklahoma during regulated harvest seasons during periods when damage management activities could be occurring. Other federal, state, and private entities may also conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur because of WS' damage management program activities over time or because of the aggregate effects of those activities. Through ongoing coordination and collaboration between WS, the ODAFF, and the ODWC, activities of each agency and the take of feral swine would be available. Feral swine damage management activities in the State would be monitored to evaluate and analyze activities to ensure those activities remained within the scope of analysis of this EA.

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions, including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders, including the Clean Air Act and Executive Order 13514. Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources. The actions of WS would not be undertakings that could adversely affect historic resources.

Issue 1 - Effects of Damage Management Activities on Feral Swine Populations

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on feral swine populations in the State when targeting those feral swine responsible for causing damage or posing a threat of damage. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but would not be limited to:

- Natural mortality of feral swine
- Mortality through vehicle strikes and aircraft strikes
- Human-induced mortality of feral swine through other damage management activities
- Human-induced mortality through harvest
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

All those factors play a role in the dynamics of feral swine populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage would be constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS would use the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process would allow WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse effects on target species.

Feral swine are not native to Oklahoma. In 1993, the Animal Industries Division of the ODAFF produced a distribution map for feral swine in Oklahoma. The distribution map indicated that feral swine were present in 26 Oklahoma counties. By 2004, a survey of WS' employees identified an

increase in feral swine to 69 of 77 Oklahoma counties. In 2007, feral swine were found in 74 of the 77 counties within the State (Stevens 2010). In 2008, the Feral Swine Control Act was passed to address feral swine damage in the State. Today, evidence suggests that feral swine occur in all the counties of the State (Stevens 2010, Wild Hog Working Group 2012). However, many of the counties in the north central and northwestern portion of the State have limited feral distribution and/or feral swine densities are considered low (Stevens 2010). It is anticipated that feral swine populations in Oklahoma will continue to increase due to their prolific breeding behavior, adaptability, and additional swine being illegally released into the wild. Based on the removal that could occur by WS under the proposed action alternative, the cumulative removal of feral swine would likely be below the levels required to stabilize or lower current statewide feral swine populations (see Section 4.1). The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. Executive Order 13112 directs federal agencies to address invasive species to the extent practicable and permitted by law. WS Directive 2.320 provides guidelines for WS' actions in the management of invasive species in fulfillment of Executive Order 13112.

Historical outcomes of damage management activities on wildlife

Damage management activities associated with feral swine would be conducted by WS only at the request of a cooperator to reduce damage that was occurring or to prevent damage from occurring and only after methods to be used were agreed upon by all parties involved. WS would monitor activities to ensure any potential impacts were identified and addressed. WS would work closely with state and federal resource agencies to ensure WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage feral swine have not reached a magnitude that would cause adverse effects to populations in the State as populations continue to increase and expand in the State.

SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions, and have been tailored to respond to changes in wildlife populations that could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs would be defined through SOPs, and implementation would be insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992).

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

Potential effects on non-target species from conducting feral swine damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by feral swine has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods would often be temporary and often do not involve the removal (killing) of non-target wildlife species. When using exclusion devices, both target and non-target wildlife could be prevented from accessing the resource being damaged. Since exclusion does not involve lethal removal, cumulative impacts on non-target species from the use of exclusionary devices would not occur but would likely disperse those individuals to other areas. Exclusionary methods can often require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small, high-value resources and would not be used to the extent that non-targets would be excluded from large areas that would cumulatively affect populations from the inability to access a resource, such as potential food sources. The use of visual and auditory harassment and dispersion methods would generally be temporary with non-target species returning after the cessation of those activities.

Dispersal and harassment do not involve the removal (killing) of non-target species and similar to exclusionary methods would not be used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to affect non-target wildlife through the removal (killing) or capture of non-target species. Capture methods used would often be methods that would be set to confine or restrain target wildlife after being triggered by a target individual. Capture methods would be employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that were as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that would be employed to confine or restrain wildlife that would be subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife would be minimal during the use of methods to capture target wildlife.

The use of firearms, immobilizing drugs, and euthanasia chemicals would essentially be selective for target species since identification of an individual would be made prior to the application of the method. Firearms require the identification of the target before application, which essentially is selective with minimal risks to non-targets. Euthanasia methods would be applied through direct application to target wildlife. Therefore, the use of those methods would not affect non-target species.

The methods described in Appendix B have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-target species. Based on the methods available to resolve feral swine damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur (see Section 4.1). Therefore, take under the proposed action of non-targets would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the ODWC and the USFWS. WS has met with the USFWS and has initiated consultation pursuant to Section 7 of the ESA. WS would abide by the outcome resulting from the consultation process. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

Safety of Chemical Methods Employed

Chemical methods that would be available for use under the proposed action would be immobilizing drugs and euthanizing chemicals, which are described in Appendix B. Immobilizing drugs are administered to target individuals using devices or methods that ensure the identification of the target animal. The immobilizing drugs discussed in Appendix B require injection of the drug directly into an animal. Injection would occur through hand injection through a syringe, by jabstick, or by a pneumatically propelled dart that mechanically injects the drug into the animal upon impact. Immobilizing drugs temporarily sedate an animal to minimize stress of handling and reduces the risks to human safety. Immobilized animals may also be euthanized using a euthanizing chemical described in Appendix B. Euthanasia chemicals would only be administered after feral swine were properly restrained and immobilized and would occur through direct injection through a syringe. WS' personnel would be required to attend training courses and to be certified in the use of immobilizing drugs and euthanizing chemicals to ensure proper care and handling occurs, to ensure the proper doses were administered, and to ensure human safety.

Direct application of chemical methods to target species would ensure that there would be no cumulative impacts to human safety. All chemical methods would be tracked and recorded to ensure that proper accounting of used and unused chemicals occurred. All chemicals would be stored and transported according to United States Food and Drug Administration and United States Drug Enforcement Administration regulations, including the directives of WS. The amount of chemicals used or stored by WS would be minimal to ensure human safety. All feral swine euthanized by euthanasia chemicals would be disposed of by deep burial or by incineration to ensure the safety of the public. Based on this information, the use of chemical methods as part of the proposed action by WS would not have cumulative impacts on human safety.

Safety of Non-Chemical Methods Employed

All non-chemical methods described in Appendix B would be used within a limited time frame, would not be residual, and do not possess properties capable of inducing cumulative adverse effects on human health and safety. All non-chemical methods would be used after careful consideration of the safety of those persons employing methods and to the public. All capture methods would be employed in areas where human activity was minimal and warnings signs would be placed in conspicuous areas, when appropriate, to ensure the safety of the public. Capture methods would also require direct contact to trigger, which would ensure that those methods, when left undisturbed, would have no effect on human safety. All methods would be agreed upon by the requesting entities, which would be made aware of the safety issues of those methods when entering into a MOU, work initiation document, or other comparable document with WS. SOPs would also ensure the safety of the public from those methods used to capture or remove wildlife. Firearms used to alleviate or prevent damage, though hazards do exist, would be employed to ensure the safety of employees and the public. Based on the use of non-chemical methods, those methods would not cumulatively affect human safety.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

WS continues to seek new methods and ways to improve current technology and to improve the humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

As discussed in Chapter 2 and Chapter 4, the perception of humaneness and welfare varies among people. Generally, non-lethal methods involving habitat modification, harassment, and exclusion would be considered humane methods since wildlife would be displaced to other areas and would generally be unharmed. Restraining methods that result in live-capture are often viewed as inhumane when wildlife are held for long periods of time that can often lead to pain, stress, and ultimately, distress of the animal. Restraining devices used for the capture of feral swine (*e.g.*, corral traps, cage traps, foothold traps, foot snares) all require supervision of the methods, which allows for those feral swine captured to be addressed in a timely manner, which reduces the amount of time those individuals would be held. Trap monitoring devices could also be used, when appropriate, that indicate when traps have been triggered, which would allow for traps in remote location to be monitored daily and any wildlife captured to be addressed quickly. By limiting the amount of time wildlife were held in restraining devices and by timely addressing those animal captured in restraining devices, the pain, suffering, and distress of the animal can be minimized.

Immobilizing drugs could be used to sedate and anesthetize feral swine restrained inside a live-trap through injection either by hand, jab stick, or pneumatic dart gun. Applicators would be present on site during application, which ensures those swine would be addressed in a timely manner. The

effects of immobilizing drugs would be temporary with a full recovery occurring after drug was metabolized fully. If euthanasia chemicals were used, feral swine captured would be euthanized while anesthetized, which renders the swine unconscious and unresponsive. Therefore, euthanasia can occur with no pain or suffering.

Humaneness and animal welfare concerns can also arise from the use of euthanasia methods. The guidelines for euthanasia provided by the American Veterinary Medical Association lists barbiturates and potassium chloride in conjunction with general anesthesia as acceptable methods of euthanasia for swine (American Veterinary Medical Association 2013). Euthanasia by gunshot is a conditionally acceptable form of euthanasia (American Veterinary Medical Association 2013). WS' personnel would be trained in the proper use of firearms to minimize pain and suffering of feral swine taken by this method.

WS would employ methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of SOPs that guide WS in the use of methods to address damage and threats associated with feral swine, the cumulative impacts on the issue of method humaneness would be minimal. All methods would be evaluated during review of the EA to ensure SOPs were adequate, which would ensure those methods continue to be used to minimize suffering and that wildlife captured were addressed in a timely manner to minimize distress.

Issue 5 - Effectiveness of Feral Swine Damage Management Methods

As discussed in Chapter 2, the effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, which would be based on how accurately practitioner's diagnosis the problem, the species responsible for the damage, and how actions were implemented to correct or mitigate risks or damages. The most effective approach to resolving any damage problem would be to use an adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

Effectiveness is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' Directives and policies. The goal of the WS' program would be to reduce damage, risks, and conflicts with feral swine as requested. WS recognizes that localized population reduction could be short-term and that new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean individual management actions were unsuccessful, but that periodic management may be necessary.

Correlated with the effectiveness of methods at reducing or alleviating damage or threats is the costs associated with applying methods to reduce damage or threats. If methods were ineffective at reducing or alleviating damage or if methods required re-application after initially being successful, the costs associated with applying those methods increases. An analysis of cost-effectiveness in many situations relating to wildlife damage is difficult or impossible to determine because the value of benefits may not be readily calculable and personal perspectives differ about damage. For example, the potential benefit of removing feral swine near livestock facilities could reduce the risks associated with disease transmission from feral swine to domestic swine. Since some diseases are potentially fatal, or severely debilitating, the value of the benefit may be high. However, no studies of disease problems with and without damage management have been conducted, and, therefore, the number of cases prevented because of damage management would not possible to estimate. In

addition, it is rarely possible to prove conclusively that feral swine were responsible for individual disease cases or outbreaks.

The CEQ does not require a formal, monetized cost-benefit analysis to comply with the NEPA (40 CFR 1508.14) and consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. As part of an integrated approach to managing damage, WS would have the ability to adapt methods to damage situations to effectively reduce or prevent damage from occurring. Under the proposed integrated approach, all methods, individually or in combination, could be employed as deemed appropriate through WS' Decision Model to address requests for assistance. WS' objective when receiving a request for assistance under the proposed action would be to reduce damage and threats to human safety or to prevent damage from occurring using an integrated approach to managing feral swine damage. Therefore, under the proposed action, WS would employ methods adaptively to achieve that objective.

Concern is often raised that feral swine return to an area where damage was occurring if lethal methods were used, which creates a financial incentive to continue the use of only lethal methods. However, as stated throughout the EA, the use of non-lethal methods would often be temporary, which could result in feral swine returning to an area where damage was occurring once those methods were no longer used. Feral swine would return if suitable habitat continued to exist at the location where damage was occurring and feral swine densities were sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in this EA would be temporary if habitat conditions continued to exist. Any method that dispersed or removed feral swine from areas would only be temporary if habitat continued to exist. Dispersing feral swine using non-lethal method addressed in this EA often requires repeated application to discourage feral swine, which increases costs, moves feral swine to other areas where they could cause damage, and would often be temporary if habitat conditions remain unchanged. Dispersing feral swine could be viewed as moving problem swine from one area to another, which would require addressing damage caused by those feral swine at another location. WS' recommendation of or use of techniques to modifying existing habitat or making areas unattractive to feral swine was addressed in this EA and in Appendix B. Therefore, WS' objective would be to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to managing feral swine damage that is agreed upon by the cooperator.

CHAPTER 5: LIST OF PREPARERS, REVIEWERS, AND PERSONS CONSULTED

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APPENDIX A
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APPENDIX B
FERAL SWINE DAMAGE MANAGEMENT METHODS AVAILABLE

The most effective approach to resolving wildlife damage problems would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce damage by feral swine while minimizing effects of damage reduction measures on humans, other species, and the environment. An adaptive plan may incorporate resource management, physical exclusion, deterrents, and localized removal of target species, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration would be given to the magnitude, geographic extent, duration and frequency, and likelihood of feral swine damage. Consideration would also be given to the status of feral swine, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. Those factors would be evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods would potentially be available to WS relative to the management or reduction of damage from feral swine. Various federal, state, and local statutes and regulations and WS directives would govern use of damage management methods. WS would develop and recommend or implement strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by the WS program. Many of the methods described below would also be available to other entities in the absence of any involvement by WS.

Non-chemical Wildlife Damage Management Methods

Non-chemical management methods consist primarily of tools or devices used to repel, capture, or kill a particular animal or a local group of animals to alleviate damage and conflicts. Methods may be non-lethal (*e.g.*, fencing, frightening devices) or lethal (*e.g.*, firearms). If WS' personnel applied those methods, a MOU, work initiation document, or another similar document would be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods that could be used or recommended by WS include:

Exclusion pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals that cannot climb from entering areas of protected resources. Fencing installed with an underground skirt can prevent access to areas for feral swine that can root underneath fencing. Areas such as airports, yards, or hay meadows may be fenced. Electric fences of various constructions could be used effectively to reduce damage to various crops.

Cultural Methods and Habitat Management includes the application of practices that seek to minimize exposure of the protected resource to damaging animals through processes other than exclusion. They may include animal husbandry practices such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where feral swine might hide, manipulating the surrounding environment through barriers or fences to deter animals from entering a protected area, or planting lure crops on fringes of protected crops.

Feral swine in urban environments can be attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted feral swine. In addition, cleaning up spilled grain at agricultural facilities could reduce the attraction to the area by feral swine.

Supplemental feeding is sometimes used to reduce damage by wildlife, such as lure crops. Food would be provided so that the animal causing damage would consume it rather than the resource being protected. In feeding programs, target wildlife would be offered an alternative food source with a higher appeal with the intention of luring them from feeding on affected resources.

Animal behavior modification refers to tactics that deter or repel damaging feral swine and thus, reduce damage to the protected resource. Those techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ aversive noise or visual stimuli. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Conover 1982). Devices used to modify behavior in feral swine include electronic guards (siren strobe-light devices), propane exploders, pyrotechnics, laser lights, human effigies, and the noise associated with the discharge of a firearm.

Propane exploders operate on propane gas and they are designed to produce loud explosions at controllable intervals. They are strategically located (*e.g.*, elevated above the vegetation) in areas of high feral swine use to frighten them from the problem site. Because animals are known to habituate to sounds, exploders must be moved frequently and used in conjunction with other scare devices. Exploders can be left in an area after dispersal is complete to discourage animals from returning.

Pyrotechnics, shell-crackers, and scare cartridges, are commonly used to repel wildlife. Shell-crackers are 12 gauge shotgun shells containing firecrackers that are projected up to 75 yards in the air before exploding. They can be used to frighten feral swine and are most often used for scaring them to prevent crop depredations. The purpose is to produce an explosion between feral swine and their objective, the crop. Noise bombs, whistle bombs, racket bombs, and rocket bombs are fired from 15-millimeter flare pistols. They are used similarly to shell-crackers but are projected for shorter distances. Noise bombs are firecrackers that travel about 75 feet before exploding. Whistle bombs are similar to noise bombs, but whistle in flight but do not explode. They produce a noticeable response because of the trail of smoke and fire, as well as the whistling sound. Rocket bombs make a screaming noise in flight and do not explode. Rocket bombs are similar to noise bombs but may travel up to 150 yards before exploding.

Lights, such as strobe, barricade, and revolving units, are used with mixed results to frighten wildlife. Brilliant lights, similar to those used on aircraft, are most effective in frightening night feeding mammals. These extremely bright-flashing lights have a blinding effect, causing confusion that reduces the animal's ability to locate it food or roosting spot. However, most animals rapidly become accustomed to such lights and their long-term effectiveness is questionable. In general, the type of light, the number of units, and their location are determined by the size of the area to be protected and by the power source available.

Other scaring devices are available to scare wildlife. The Electronic Guard (siren strobe-light device), a battery-powered, portable unit that houses a strobe light and siren has been developed by the NWRC. The device activates automatically at nightfall and they are programmed to discharge periodically throughout the night. Efficacy of strobe-sirens is highly variable, but in certain situations, this device has been used successfully to reduce coyote and bear depredation on sheep. The technique has proven most successful when used at "*bedding grounds*" where sheep gather to sleep for the night. The device, however, is a short-term tool used to deter predation until livestock

can be moved to another pasture, brought to market, or other damage management methods are implemented. The effectiveness of Electronic Guards to dispersal feral swine is unknown.

Trapping can utilize a number of cage-type traps. Those techniques are implemented because of the technical training required to use such devices.

Cage traps come in a variety of styles to live-capture animals. The most commonly known cage traps are box traps and corral traps. Box traps are usually rectangular and are made from various materials, including metal, wire mesh, and wood. These traps are well suited for use in residential areas and work best when baited with foods attractive to the target animal. Box traps can be portable and easy to set-up.

Corral traps for feral swine are generally large circular traps consisting of panels anchored to the ground using steel posts with a door allowing entrance. Side panels are typically woven metal fencing referred to as hog panels or cow panels. The entrances into the traps generally consist of a door that allows entry into the trap but prevents exit. The doors are often designed to allow swine to enter the trap continually, which allows for the possibility of capturing multiple swine. Some variation in design is expected based on the soil type, brush and the number of swine expected to be captured. Corral traps may be monitored by remote camera and remote electronic triggering could occur.

The disadvantages of using cage traps are: 1) some individual target animals may avoid cage traps; 2) some non-target animals may associate the traps with available food and purposely get captured to eat the bait, making the trap unavailable to catch target animals; 3) cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions; and 4) some animals will fight to escape and may become injured; 5) expense of purchasing traps. Disadvantages associated with corral traps include: 1) the expense of purchasing the materials to construct trap, 2) once constructed, corral traps are not moveable until disassembled and transported, and 3) in remote areas, getting all the required equipment to the location can be difficult.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area.

Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring devices would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured target or non-targets would be restrained. By reducing the amount of time targets and non-targets are restrained, pain and stress can be minimized and captured wildlife can be addressed in a timely manner, which could allow non-targets to be released unharmed. Trap monitoring devices could be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife was removed promptly to minimize distress and to increase the likelihood non-targets could be released unharmed.

Foothold Traps can be effectively used to capture a variety of mammals. Foothold traps can be placed beside, or in some situations, in travel ways being actively used by the target species. Placement of traps is contingent upon the habits of the respective target species, habitat conditions,

and presence of non-target animals. Effective trap placement and adjustment and the use and placement of appropriate baits and lures by trained WS' personnel also contribute to the selectivity of foothold traps. An additional advantage is that foothold traps can allow for the on-site release of non-target animals since animals are captured alive. The use of foothold traps requires more skill than some methods. Foothold traps would generally be available for use by the public and other state or federal agencies.

Snares or cable restraints are typically made of wire or cable, and can be set to capture an animal by the neck, body, or foot. Cable restraints may be used as either lethal or live-capture devices depending on how or where they are set. Cable restraints set to capture an animal by the neck are usually lethal but stops can be attached to the cable to increase the probability of a live capture depending on the trap check interval. Snares positioned to capture the animal around the body can be a useful live-capture device, but are more often used as a lethal control technique. Snares can incorporate a breakaway feature to release non-target wildlife and livestock where the target animal is smaller than potential non-targets (Phillips 1996). Snares can be effectively used wherever a target animal moves through a restricted travel lane (*e.g.*, under fences or trails through vegetation). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held. Snares must be set in locations where the likelihood of capturing non-target animals is minimized.

The foot or leg snare can be set as a spring-powered non-lethal device, activated when an animal places its foot on the trigger or pan. Foot snares consist of a cable loop and a locking mechanism and are set to capture feral swine by the foot or leg. Foot snares employ a spring-loaded mechanism to elevate the snare and close it around the foot of the target animal. Foot snares can be selective for a certain weight of target animal using pan tension to increase the weight of the animal triggering the snare. Several types of foot snare are available commercially. In some situations, using snares to capture wildlife is impractical due to the behavior or morphology of the animal, or the location of many wildlife conflicts. Cable restraints would not be available to other entities to alleviate damage.

Catchpoles can be used to capture or safely handle problem animals. This device consists of a hollow pipe with an internal cable or rope that forms an adjustable noose at one end. The free end of the cable or rope extends through a locking mechanism on the end opposite of the noose. By pulling on the free end of the cable or rope, the size of the noose is reduced sufficiently to hold an animal. Catchpoles are used primarily to remove live animals from traps without danger to or from the captured animal.

Drop nets are available for capturing feral swine. Nets are supported by corner and center posts and are triggered remotely through electronic circuits. Most nets are held in place with magnets once activated and the releasing mechanism cuts power to the magnets allowing the net to drop. Drop nets have the advantage of being effective the first night when set, but require some time to set up and need to be attended and dropped by personnel in close proximity to the net. Feral swine captured in drop nets need to be handled or euthanized quickly to prevent extreme stress or escape.

Shooting with firearms is very selective for the target species and would be conducted with rifles, handguns, and shotguns. Methods and approaches used by WS may include use of vehicles or aircraft, illuminating devices, bait, firearm suppressors, night vision/thermal equipment, and elevated platforms. Shooting is an effective method in some circumstances, and can often provide immediate relief from the problem. Shooting may at times be one of the only methods available to effectively and efficiently resolve a wildlife problem.

Ground shooting is sometimes used as the primary method to alleviate damage or threats of damage. Shooting is limited to locations where it is legal and safe to discharge a weapon. A shooting program, especially conducted alone, can be expensive because it often requires many staff hours to complete.

Shooting can also be used in conjunction with an illumination device at night, which is especially useful for nocturnal mammals, such as feral swine. Spotlights may or may not be covered with a red lens, which nocturnal animals may not be able to see, making it easier to locate them undisturbed. Night shooting may be conducted in sensitive areas that have high public use or other activity during the day, which would make daytime shooting unsafe. The use of night vision and Forward Looking Infrared (FLIR) devices can also be used to detect and shoot feral swine at night, and is often the preferred equipment due to the ability to detect and identify animals in complete darkness. Night vision and FLIR equipment aid in locating wildlife at night when wildlife may be more active. Night vision and FLIR equipment could be used during surveys and in combination with shooting to remove target feral swine at night. WS' personnel most often use this technology to target feral swine in the act of causing damage or likely responsible for causing damage. Those methods aid in the use of other methods or allow other methods to be applied more selectively and efficiently. Night vision and FLIR equipment allow for the identification of target species during night activities, which reduces the risks to non-targets and reduces human safety risks. Night vision equipment and FLIR devices only aid in the identification of wildlife and are not actual methods of take. The use of FLIR and night vision equipment to remove target feral swine would increase the selectivity of direct management activities by targeting those feral swine most likely responsible for causing damage or posing threats.

Hunting: WS sometimes recommends that resource owners consider legal hunting as an option for reducing feral swine damage. Although legal hunting/trapping is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of feral swine.

Dogs: Dogs could be used to locate or pursue target swine. Training and maintaining suitable dogs requires considerable skill, effort, and expense. Dogs are commonly used to track and target wildlife species. Different breeds of dogs such as Blue Lacy, Catahoula, various Cur breeds, red-bone, and Walker are commonly used. They become familiar with the scent of the animal they are to track, and will strike (howl) when they smell them. Tracking dogs are trained to follow the scent of target species. If the track of the target species is not too old, the dogs can follow the trail and the animal, which will usually seek refuge in a thicket on the ground at bay, or in a hole. The dogs stay with the animal until the WS' employee arrives and dispatches, tranquilizes, or releases the "*bayed*" species, depending on the situation. A possibility exists that dogs would switch to a fresher trail of a non-target species while pursuing the target species. This sometimes occurs if the hounds being used are less experienced but running less-experienced hounds with more-experienced hounds reduces the likelihood of this occurrence.

Aerial Shooting or aerial hunting (*i.e.*, shooting from an aircraft) is a commonly used method to target feral swine. Aerial shooting is one of the preferred damage management methods for reducing feral swine damage as well, in that local swine populations can quickly be removed when weather and habitat conditions are favorable. Aerial hunting is mostly species-selective (there is a slight potential for misidentification) and can be used for immediate control to reduce damage if weather, terrain, and cover conditions are favorable. Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters with better maneuverability have greater utility and are safer over rugged terrain and timbered areas.

In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen. The WS program aircraft-use policy helps ensure that

aerial hunting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must be certified under established procedures and only properly trained employees of the WS program are approved as gunners. Ground crews are often used with aerial operations for safety reasons and to assist locating and recovering target animals, as necessary.

Aircraft overflights have created concerns about disturbing wildlife. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. Their report revealed that a number of studies documented responses by certain wildlife species that could suggest adverse impacts may occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts to wildlife populations, although the report stated it is possible to draw the conclusion that affects to populations could occur. It appears that some species will frequently, or at least occasionally, show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent, such as hourly, and over long periods of time, which represents chronic exposure. Chronic exposure situations generally occur in areas near commercial airports and military flight training facilities. WS spends relatively little time over any one area.

WS has used fixed-wing aircraft and helicopters for aerial hunting in areas inhabited by wildlife for years. WS conducts aerial activities on areas only under signed agreement and concentrates efforts during certain times of the year and to specific areas. WS' Predator Damage Management Environmental Assessments (*e.g.*, see USDA 2005) that have looked at the issue of aerial hunting overflights on wildlife have found that WS has annually flown less than 10 min/mi^2 on properties under agreements. WS flies very little over any one property under agreement in any given year. As a result, no known problems to date have occurred with WS' aerial hunting overflights on wildlife, nor are they anticipated in the future.

Aerial Surveying is a commonly used tool for evaluating and monitoring damage and establishing population estimates and locations of various species of wildlife. WS uses aerial surveying throughout the United States to monitor damages and/or populations of coyotes, fox, wolves, feral swine, feral goats, feral dogs, bobcats, mountain lions, white-tailed deer, pronghorn antelope, elk, big-horn sheep, and wild horses but any wildlife species big enough to see from a moving aircraft could be surveyed using this method. As with aerial shooting, the WS program aircraft-use policy helps ensure that aerial surveys are conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must also be certified under established WS program procedures and policies.

Aerial Telemetry is used in research projects studying the movements of various wildlife species. Biologists will frequently place radio-transmitting collars on selected individuals of a species and then monitor their movements over a specified period. Whenever possible, the biologist attempts to locate the research subject using a hand-held antennae and radio receiver, however, occasionally animals will make large movements that prevent biologists from locating the animal from the ground. In these situations, WS can utilize either fixed wing aircraft or helicopters and elevation to conduct aerial telemetry and locate the specific animal wherever it has moved to. As with any aerial operations, the WS program aircraft-use policy helps ensure that aerial surveys would be conducted in a safe and environmentally sound manner, in accordance with Federal and State laws.

"Pig Tagging" or ***"Judas Pig"*** is a technique where a radio-collar is affixed to live-captured feral swine. Once affixed to the swine, the animal is released into an area and, after a sufficient period, allowed to join with other feral swine. The radio-collared animal is monitored and located to using radio telemetry equipment from aircraft, vehicles, or hand-held units. Swine are often radio collared

and allowed to rejoin other swine to monitor movements and to locate swine when employing damage manage methods.

Chemical Wildlife Damage Management Methods

Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by the United States Food and Drug Administration and/or the United States Drug Enforcement Administration. The following chemical methods could be available under the alternatives.

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fears, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for those wild species (Fowler and Miller 1999). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are United States Drug Enforcement Administration restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with United States Drug Enforcement Administration and state regulations. All animals euthanized using sodium pentobarbital and all of its dilutions (*e.g.*, Beuthanasia-D, Fatal-Plus) are disposed of immediately through incineration or deep burial to prevent secondary poisoning of scavenging animals and introduction of these chemicals to non-target animals.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the American Veterinary Medical Association (2013). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and carcasses of euthanized animals are not toxic to predators or scavengers.

Beuthanasia®-D combines pentobarbital with another substance to hasten cardiac arrest.

Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia®-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a United States Drug Enforcement Administration registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

Fatal-Plus® combines pentobarbital other substances to hasten cardiac arrest. IV is the preferred route of injection; however, IC is acceptable as part of the two-step procedure used by WS. Animals are first anesthetized and sedated using a combination of ketamine/xylazine and once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered. Like Beuthanasia®-D, it is a Schedule III drug requiring a United States Drug Enforcement Administration registration for purchase and is subject to the security and record-keeping requirements of Schedule II drugs.