ENVIRONMENTAL ASSESSMENT

Managing Damage Caused by Canada Geese in the State of Mississippi

PREPARED BY:

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

IN COOPERATION WITH:

TENNESSEE VALLEY AUTHORITY

OCTOBER 2015

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ACRONYMS

AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
CBC	Christmas Bird Count
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWCS	Comprehensive Wildlife Conservation Strategy
DNC	4,4'-dinitrocarbanilide
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
EPP	Eastern Prairie Population
ESA	Endangered Species Act
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
FY	Fiscal Year
HDP	4,6-dimethyl-2-pyrimidinal
INAD	Investigational New Animal Drug
LD_{50}	Median Lethal Dose
LC_{50}	Median Lethal Concentration
MBTA	Migratory Bird Treaty Act
MDAC	Mississippi Department of Agriculture and Commerce
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MFGP	Mississippi Flyway Giant Population
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRP	Natural Resource Plan
NWRC	National Wildlife Research Center
SJBP	Southern James Bay Population
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TVA	Tennessee Valley Authority
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
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 Mississippi continues to receive requests for assistance or anticipates receiving requests for assistance to alleviate or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with Canada geese (*Branta canadensis*). The Tennessee Valley Authority (TVA) also continues to experience damage and threats of damage associated with geese at facilities or properties they own or manage in Mississippi. Therefore, the TVA could request the assistance of WS to manage damage or threats of damage at those facilities and properties. The goal of WS and the TVA would be to conduct a coordinated program to alleviate goose damage on properties that the TVA owns or manages in accordance with plans and objectives developed by both agencies. The plans and objectives would outline the actions of each agency.

All federal actions are subject to the National Environmental Policy Act (NEPA) (Public Law 9-190, 42 USC 4321 et seq.), including the actions of WS[2] and the TVA. The NEPA sets forth the requirement that all 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 Council of Environmental Quality (CEQ) regulates federal activities affecting the physical and biological environment through regulations in 40 CFR 1500-1508. The NEPA and the CEQ guidelines generally outline five broad types of activities that a federal agency must accomplish as part of projects they conduct. Those five types of activities are public involvement, analysis, documentation, implementation, and monitoring.

Pursuant to the NEPA and the CEQ regulations, WS and the TVA are preparing this Environmental Assessment (EA)[3] to document the analyses associated with proposed federal actions and to inform decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse effects. This EA will serve as a decision-aiding mechanism to ensure that WS and the TVA infuse the policies and goals of the NEPA and the CEQ into the actions of each agency. This EA will also aid WS and the TVA with clearly communicating the analysis of individual and cumulative impacts of proposed activities to the public. In addition, the EA will facilitate planning, promote interagency coordination, and streamline program management analyses between WS, the TVA, the United States Fish and Wildlife Service (USFWS), and the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP)[4].

Individual projects conducted by the WS program to manage goose damage could be categorically excluded from further analysis under the NEPA, in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003). However, the purpose of this EA is to evaluate cumulatively the individual projects that WS could conduct to manage the damage and threats that Canada geese cause, including those projects that WS could conduct at the request of the TVA. More specifically, the EA will assist WS and the TVA with determining if alternative approaches to managing Canada goose damage could potentially have significant individual and/or cumulative effects on the

[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).

[2]The WS program follows the 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.

[3]The CEQ defines an EA as documentation that "*...(1) briefly provides sufficient evidence and analysis for determining whether to prepare an* [Environmental Impact Statement]*; (2) aids an agency's compliance with NEPA when no environmental impact statement is necessary; and (3) facilitates preparation of an Environmental Impact Statement when one is necessary*" (CEQ 2007).

[4]Section 1.6 of this EA discusses the roles, responsibilities, and the authorities of each agency.

quality of the human environment that would warrant the preparation of an Environmental Impact Statement (EIS)[5] in compliance with the NEPA and CEQ regulations.

This EA will assist in determining if the proposed cumulative management of Canada goose damage could have a significant impact on the environment based on previous activities conducted by WS and based on the anticipation of conducting additional efforts to manage damage. WS' mission and directives[6] would be to provide assistance when the appropriate property owner or manager requests such assistance, within the constraints of available funding and workforce. Therefore, it is conceivable that additional damage management efforts could occur beyond those efforts conducted during previous activities. Thus, this EA anticipates those additional efforts and the analyses would apply to actions that may occur in any locale and at any time within Mississippi as part of a coordinated program.

The analyses contained in this EA are based on information derived from WS' Management Information System, data from the USFWS, published documents (see Appendix A), interagency consultations, public involvement, and other environmental documents.

The EA evaluates the need for action to manage damage associated with Canada geese in the State, the potential issues associated with managing damage caused by geese, and the environmental consequences of conducting alternative approaches to meeting the need for action while addressing the identified issues. WS and the TVA initially developed the issues and alternatives associated with managing damage in consultation with the USFWS and the MDWFP. The USFWS has the overall regulatory authority to manage populations of migratory bird species, while the MDWFP has the authority to manage wildlife populations in the State of Mississippi, including Canada geese. To assist with identifying additional issues and alternatives to managing damage, WS and the TVA will make this EA available to the public for review and comment prior to the issuance of a Decision[7].

WS has previously developed an EA that analyzed the need for action to manage damage associated with Canada geese in Mississippi[8]. That EA identified the issues associated with managing damage that geese cause in Mississippi and analyzed alternative approaches to meet the specific need identified in the EA while addressing the issues associated with managing damage. Changes in the need for action and the affected environment have prompted WS and the TVA to initiate this new analysis to manage Canada goose damage in the State. This new EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action. Since this EA will re-evaluate those activities conducted under the previous EA to address the new need for action and the associated affected environment, the analysis and the outcome of the Decision issued for this EA will supersede the previous EA that addressed the need to manage damage associated with Canada geese.

This new EA will assist in determining if the proposed management of damage associated with geese could have a significant impact on the environment for both people and other organisms. This EA will analyze several alternatives to address the need for action and the identified issues and document the environmental consequences of the alternatives to comply with the NEPA. In addition, this new EA will

[5]The EA process concludes with either a Finding of No Significant Impact or a determination to prepare an EIS. The CEQ states, "*A Federal agency must prepare an EIS if it is proposing a major federal action significantly affecting the quality of the human environment*" (CEQ 2007).

[6]At the time of preparation, WS' Directives could be found at the following web address: http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

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

[8]See Section 1.4 of this EA for further discussion on the previous EA developed by WS to manage damage caused by geese.

inform the public and coordinate efforts between WS, the TVA, the USFWS, the MDWFP, and other entities.

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and have thrived in human altered habitats, such as the Canada goose. Those species, in particular, are often responsible for the majority of conflicts between people and wildlife. Those conflicts often lead people to request assistance with reducing damage to resources and to reduce threats to human safety. Wildlife can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard wildlife as providing economic, recreational, and aesthetic benefits. Knowing that wildlife exists in the natural environment provides a positive benefit to some people; however, activities associated with wildlife may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values are required to balance the needs of people and the needs of wildlife. When addressing damage or threats of damage caused by wildlife, wildlife damage management professionals must consider not only the needs of those people directly affected by wildlife damage, but a range of environmental, sociocultural, and economic considerations as well.

Resolving wildlife damage problems requires consideration of both sociological and biological carrying capacities. The wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. The biological carrying capacity is the ability of the land or habitat to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). Those phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the biological carrying capacity of the habitat may support higher populations of wildlife; however, in many cases, the wildlife acceptance capacity is lower. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

Wildlife damage management is the alleviation of damage or other problems caused by or related to the behavior of wildlife and can be an integral component of wildlife management (The Wildlife Society 2015). The threat of damage or loss of resources is often sufficient for people to initiate individual actions and the need for damage management can occur from specific threats to resources. Those animals have no intent to do harm. They utilize habitats (*e.g*., reproduce, walk, 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 poses 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 many factors can influence when people request assistance (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to an individual person. What one individual person considers damage, another person may not consider as damage. 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). Many people define the term "*damage*" as economic losses to resources or threats to human safety; however, damage could also occur from a loss in the aesthetic value of property and other

situations where the behavior of wildlife was no longer tolerable to an individual person.

Canada geese can add an aesthetic component to wetlands, ponds, lakes, and other bodies of water, sometimes provide opportunities for recreational hunting, and like all wildlife, provide people with valued close contact with nature. Many people, even those experiencing damage, consider geese to be a charismatic and valuable component of their environment; however, tolerance differs among individuals (Smith et al. 1999). Because of their prolific nature, site tenacity, longevity, size, and tolerance of human activity, Canada geese are often associated with situations where damage or threats can occur. Geese are extremely adaptable and may use the resources provided by people in urban landscapes for nesting, rearing young, molting, feeding, and loafing. Increasing populations of resident geese are resulting in increasing numbers of conflicts with human activities (Conover and Chasko 1985, USFWS 2005, Dolbeer and Seubert 2006), and increasing concerns related to human health and safety (Ankney 1996, Seubert and Dolbeer 2004, USFWS 2005, Dolbeer and Seubert 2006).

As populations of resident Canada geese have increased, the amount of damage occurring to resources and threats posed by geese has also risen (USFWS 2005). During the development of the Final Environmental Impact Statement (FEIS) that evaluated the management of resident Canada goose populations, the resident Canada goose population in the Mississippi Flyway likely exceeded 1.5 million geese and the population had increased an average of 6% annually during the ten years prior to the development of the FEIS (USFWS 2005). Since 2003, the number of geese observed along routes surveyed during the breeding season in Mississippi has shown an annual increase (Sauer et al. 2014). In addition to the increases occurring in the resident Canada goose population, the close association of Canada geese with human activities has led to greater instances of situations where people consider the behavior of geese has risen to a level where damage to resources or unacceptable risks to human safety have occurred. Although most damage occurring in Mississippi happens during the spring and summer, damage and the threat of damage associated with geese can occur throughout the year.

Geese are a difficult species to manage because they are highly mobile, able to exploit a variety of habitat types within a given area, are difficult to exclude from large areas, and modifying habitat to discourage use of areas by geese could result in unacceptable alterations of habitat. It is rarely desirable or possible to remove or disperse all geese from an area, but with a proper management scheme, people can reduce the number of geese and the associated problems to a level that they can tolerate. Additionally, management of goose-related problems often exceeds the capabilities of single landowners. In Mississippi, problem situations associated with geese typically involve, but are not limited to, unacceptable accumulations of feces, aggression during the nesting season, grazing of landscaped vegetation, damage to agricultural and natural resources, and unacceptable safety hazards for vehicles (*e.g.*, automobiles, boats, airplanes). Those problems frequently occur on private properties, residential communities, apartment/condominium complexes, municipal parks, schools, hospitals, natural/habitat restoration sites, corporate and industrial sites, office complexes, roadways, airports, and other areas (USFWS 2005).

The need for action to manage damage and threats associated with Canada geese in Mississippi arises from requests for assistance[9] that WS receives. Requests for WS' assistance involve damage or threats of damage occurring to agricultural resources, natural resources, property, and human safety. In addition, the TVA often experiences damage and threats of damage to property, natural resources, electric system operational reliability, as well as, threats to human safety at their facilities. Table 1.1 lists WS' technical assistance projects involving Canada goose damage and threats of goose damage to those four major

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

resource types in Mississippi from the federal fiscal year[10] (FY) 2010 through FY 2014. Table 1.1 does not include direct operational assistance projects conducted by WS' personnel. Direct operational assistance projects are those projects where an entity requests that WS' personnel provide assistance through the direct application of methods. For example, an entity could request that WS' personnel harass geese on their property using pyrotechnics. In contrast, technical assistance projects only involve WS' personnel providing demonstration of methods and recommendations on alleviating damage but the requester would be responsible for implementing those methods. Chapter 3 of this EA further discusses technical assistance and direct operational assistance that WS could provide.

Table 1.1 – Canada goose technical assistance requests received by WS in Mississippi by year*

Fiscal Year	Resource Category					TOTAL
	Agriculture	Natural Resources	Property	Human Safety	General Info	
2010	4	0	35	4	0	**43**
2011	9	0	22	8	0	**39**
2012	2	0	34	10	1	**47**
2013	5	1	28	6	2	**42**
2014	5	1	44	4	0	**54**
TOTAL	**25**	**2**	**163**	**32**	**3**	**225**

* Table 1.1 does not include direct operational assistance projects conducted by WS' personnel

WS provides technical assistance to those people requesting assistance with resolving damage or the threat of damage by providing information and recommendations on damage management activities that a requester could conduct without WS' direct involvement in managing or preventing the damage. Further discussion of technical assistance occurs in Chapter 3 of this EA. The technical assistance projects conducted by WS are representative of the damage, actual threats, and perceived threats that geese can cause in Mississippi. From FY 2010 to FY 2014, WS has conducted 225 technical assistance projects involving Canada geese.

Most requests for assistance were associated with goose damage to property. Over 72% of the requests received by WS for technical assistance involved goose damage to property. Most requests for assistance are associated with urban and suburban areas where geese congregate on public or private ponds and forage on lawns or other mowed areas associated with parks, beaches, golf courses, schools, business campuses, and residences (Conover 1991, Powell et al. 2003, VerCauteren and Marks 2004, USFWS 2005). Damage or threats of damage are associated with feces and grazing damage to lawns and other areas (including sidewalks, driveways, swimming pools, beaches). Agricultural losses occur primarily in the winter and spring when geese forage on sprouting or emerged plants.

Table 1.2 shows the monetary damages associated with geese that entities requesting assistance reported to WS or that WS verified through site visits. The major problems associated with geese are associated with the impacts of goose feces in public-use areas, grazing damage to lawns, damages to property, and threats associated with aircraft striking geese at or near airports. Between FY 2010 and FY 2014, WS received reports of or verified $126,634 in damages to property in the State.

Damage to agricultural resources occurs from geese directly consuming crops or damages that occur from consuming the crop (*e.g.*, trampling of standing plants, disease introduction to damaged areas of the plant). Damages to agricultural resources occur primarily from geese foraging on crops, primarily winter wheat and soybeans in the State. When goose densities are high, the consumption of agricultural crops can lead to economic losses to agricultural resources. When economic losses occur, agricultural

[10] The federal fiscal year begins on October 1 and ends on September 30 the following year.

producers often seek assistance with resolving damage or the threat of damage. Since FY 2010, goose damage to agricultural resources that has been report to or verified by WS has totaled $110,934 in damages.

Table 1.2 –Economic loss due to Canada goose damage by resource reported or verified by WS in the Mississippi, FY 2010 - FY 2014.

Fiscal Year	Resource Type				TOTAL
	Agriculture	Property	Natural Resources	Human Safety	
2010	$41,000	$20,900	$0	$5,000	**$66,900**
2011	$25,000	$10,900	$0	$2,500	**$38,400**
2012	$30,410	$46,917	$0	$7,500	**$84,827**
2013	$2,500	$6,050	$0	$0	**$8,550**
2014	$11,484	$41,867	$7,802	$5,000	**$66,153**
TOTAL	**$110,394**	**$126,634**	**$7,802**	**$20,000**	**$264,830**

Although WS has received reports of or verified monetary damages to natural resources and human safety, requests for assistance often address the threats that geese can pose to human safety and natural resources for which monetary losses are difficult to determine. Since FY 2010, after receiving requests for assistance, WS has verified or those requesting assistance have reported over $27,802 in damages caused by geese to natural resources and costs involved with human safety. For human safety, WS often receives requests for assistance to reduce the threat of disease transmission and the threat of aircraft striking geese at airports. Most requests for assistance received by WS involving threats to human safety arise from the risks associated with disease transmission from fecal droppings left by geese in areas where the public may encounter goose feces or where fecal matter may contaminate public water sources or swimming areas. Aircraft striking geese can cause catastrophic failure of the aircraft, which has the potential to threaten passenger safety if the aircraft is unable to make a safe landing. The difficulties of placing a monetary value on reducing threats to human safety and natural resources are similar. WS has and likely will continue to receive requests to reduce threats to natural resources such as overgrazing vegetation.

Therefore, the need for action for WS is to respond to requests for assistance associated with Canada geese while the need for action for those persons seeking assistance is associated with damage to resources and threats to human safety occurring from geese. Geese can be found statewide throughout the year; therefore, damage or the threats of damage can occur wherever geese are present in the State if conditions occur where the tolerance of damage or threats of damage have exceeded the thresholds of individual people. Between FY 2010 and FY 2014, WS has received reports of or verified $264,830 in monetary damages to resources, which is likely only a portion of the actual damages occurring in the State since the reported or verified damage only reflects information that WS gathers based on requests for WS' assistance. Additional information on the need for action associated with resident Canada goose populations can be found in the resident Canada goose management FEIS developed by the USFWS in cooperation with WS (USFWS 2005). The following subsections of the EA discuss specific information on the need for action associated with goose damage or threats of goose damage.

Need to Alleviate Canada Goose Damage on TVA Properties and at TVA Facilities

The TVA is responsible for the management of 293,000 acres of public land and 11,000 miles of public shoreline along the Tennessee River system, which support TVA's goals of power generation and transmission, public recreational use, flood control, and economic development of the Tennessee River Valley. The TVA owns or maintains electrical power substations, switching stations, and the associated transmission lines and rights-of-way easements in Mississippi. In addition, the TVA operates public

recreation areas throughout the Tennessee River Valley region, including campgrounds, day-use areas, and boat launching ramps.

Canada goose damage and threats of damage occurring at facilities and properties owned or managed by the TVA have primarily affected property, human safety, and the operational reliability of the electrical system. Many of the lands the TVA owns or manages are public or recreational areas and people using those areas expect the TVA to manage wildlife populations and reduce the possibilities of disease transmission. All of those damage issues and others occur throughout TVA owned and managed properties. The TVA has requested assistance from WS to address wildlife damage in the past and may request assistance with additional damage issues in the future. As the populations of geese increase and thrive in those areas managed or owned by the TVA, both WS and TVA expect increases in the need for damage management in the future.

Need to Alleviate Canada Goose Damage to Agricultural Resources

Agriculture continues to be an important sector in the Mississippi economy. In 2012, the National Agricultural Statistics Service (NASS) reported that almost 11 million acres were devoted to agricultural production in Mississippi with a market value of agricultural products sold estimated at over $6.4 billion (NASS 2014). In 2014, agricultural producers planted over 2.2 million acres of soybeans with a production value of nearly $1.3 billion (NASS 2015). Agricultural producers also planted corn, cotton, rice, hay, wheat, sweet potatoes, sorghum, and peanuts (NASS 2015).

The most common damage to agricultural resources associated with geese is crop consumption (loss of the crop and revenue), but also consists of unacceptable accumulations of feces on pastures, trampling of emerging crops, and increased erosion and runoff from fields where the cover crop has been grazed (USFWS 2005). Canada geese graze a variety of crops, including alfalfa, barley, beans, corn, soybeans, wheat, rye, oats, spinach, and peanuts (Atlantic Flyway Council 1999, Nichols 2003, USFWS 2005, Haramis and Kearns 2006). A single intense grazing event by Canada geese in fall, winter, or spring can reduce the yield of winter wheat by 16% to 30% (Fledger et al. 1987), and reduce growth of rye plants by more than 40% (Conover 1988). In 2014, agricultural producers in Mississippi planted 230,000 acres of winter wheat in the State with a production value of nearly $72 million (NASS 2015). However, some studies have shown that grazing by geese during the winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). Grazing by Canada geese can negatively affect wild rice (*Zizania aquatica*) and a considerable reduction in the local goose population allowed the rice and other vegetation to recover (Haramis and Kearns 2006). The principal agricultural crops grown in Mississippi are soybeans, corn, forage (*e.g*., hay), and cotton (NASS 2015). The sales values of grains in the State exceeded $2.3 billion during 2012 (NASS 2015).

Resident Canada geese can also be a concern to livestock producers. Canada goose droppings in and around livestock ponds, hayfields, and pasture can affect water quality, contaminate feed, and could be a source of a number of different types of bacteria, creating concerns about potential disease interactions between Canada geese and livestock. The transmission of diseases through drinking water is one of the primary concerns for livestock. For example, the threat of disease transmission to poultry producers associated with Canada geese has been a concern in Maryland with many poultry companies advising producers to keep wild ducks and geese away from buildings housing chickens (USFWS 2005).

Fraser and Fraser (2010) provided a review of disease concerns to livestock from Canada geese, and highlighted 50 bacteria, viral, fungal diseases, and parasites that can infect livestock, including swine, cattle, and poultry. Goose droppings in and around livestock ponds can affect water quality and can be a source of a number of different types of bacteria. The transmission of diseases through drinking water is one of the primary concerns for a safe water supply for livestock. Bacteria levels for livestock depend on

the age of the animal since adults are more tolerant of bacteria than young animals (Mancl 1989). The bacteria guidelines for livestock water supplies are <1000 fecal coliform/100 ml for adult animals and < 1 fecal coliform/100 ml for young animals (Mancl 1989). Salmonella causes shedding of the intestinal lining and severe diarrhea in cattle. If undetected and untreated, salmonella can kill cattle and calves. Additionally, the contamination of feed by geese through droppings in pastures, crops, or harvested grasses can also be a method of disease transmission to livestock (Fraser and Fraser 2010).

Wild and domestic waterfowl, as well as a variety of other bird species, are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997, Alexander 2000, Stallknecht 2003, Pedersen et al. 2010). Avian influenza (AI) circulates among these birds without clinical signs and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997, Clark and Hall 2006); however, the potential for AI to produce devastating disease in domestic poultry makes its occurrence in waterfowl an important issue (Davidson and Nettles 1997, Clark and Hall 2006, Gauthier-Clerc et al. 2007). Although low pathogenic strains of AI can occur in wild birds (Stallknecht 2003, Pedersen et al. 2010), high pathogenic strains can also occur in wild waterfowl species (Brown et al. 2006, Keawcharoen et al. 2008). The ability for wild birds to carry these highly pathogenic strains increases the potential for transmission to domestic poultry facilities, which are highly susceptible to highly pathogenic AI (Nettles et al. 1985, Gauthier-Clerc et al. 2007, Pedersen et al. 2010). The potential impacts from a severe outbreak of highly pathogenic AI in domestic poultry could be devastating, and possibly cripple the multi-billion dollar industry through losses in trade, consumer confidence, and eradication efforts (Pedersen et al. 2010).

Need to Alleviate Threats that Canada Geese Pose to Human Health and Safety

Birds can play a role in the transmission of diseases where humans may encounter fecal droppings of those birds. Few studies are available on the occurrence of zoonotic diseases in wild birds and on the risks to humans from transmission of those diseases (Clark and McLean 2003). Canada geese can thrive in the urban habitats that people create. Urban habitats can offer a constant supply of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created food sources, readily available water supplies, and the few predators found in urban areas often increase the survival rates and carrying capacity of wildlife species that can adapt to those habitats. Often the only limiting factor to wildlife species in and around urban areas is the prevalence of diseases. The unlimited amount of food, water, and shelter found within urban habitats can congregate wildlife into a small area, which can confound the prevalence and transmission of diseases. Therefore, a common concern among those persons requesting assistance is the threat to human health from disease transmission, which has heightened from recent, widely publicized zoonoses events like the spread of the West Nile virus and avian influenza.

Disease-causing organisms do not originate with Canada geese (*i.e.*, geese do not produce disease-causing organisms) but those geese can act as reservoirs for disease causing organisms that are of concern to human safety. The presence of disease causing organisms in goose feces is a result of the pathogens being present in the environment in which the geese live. Of concern, is the ability of Canada geese to obtain disease causing organisms and transporting those organisms to other areas, especially to areas with a high amount of human activity. With the ability to fly and move from one location to another, geese can obtain a disease causing organism at one location and transfer the disease causing organism from that location to another location. The risk of disease transmission from birds to people is likely very low. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms can occur increases the likelihood of disease transmission. Canada geese can be closely associated with human habitation where interaction with geese or fecal droppings of geese can occur. Geese often exhibit gregarious behavior, which can lead to

accumulations of fecal droppings in areas where they forage or loaf. Accumulations of feces can be a threat to human health and safety due to the close association of geese with human activity. Accumulations of goose droppings in public areas are aesthetically displeasing and are often in areas where people may come in direct contact with fecal droppings.

Geese may affect human health through the distribution and incubation of various pathogens and through nutrient loading. For instance, a foraging Canada goose defecates between 5.2 and 8.8 times per hour (Bedard and Gauthier 1986). Kear (1963) recorded a maximum fecal deposition rate for Canada geese of 0.39 pounds per day (dry weight). Goose droppings can affect public swimming beaches, private ponds, and lakes. There are several pathogens involving geese that people may contract, but the risk of infection is likely low. The primary route of infection would be through incidental contact with contaminated material. Direct contact with fecal matter would not be a likely route of disease unless ingested directly. Although intentional contact with feces is not likely, transmission can occur when people unknowingly contact and ingest contaminated material. Therefore, the risk to human health from zoonoses carried by geese is low and a direct link of transmission from geese to people can be difficult to determine, especially given that many pathogens occur naturally in the environment or can occur from contamination associated with other sources. However, the presence of disease causing organisms in goose feces can increase the risk of exposure and transmission of zoonoses wherever people may encounter large accumulations of feces from geese. Fleming et al. (2001) reviewed the impacts of Canada geese on water quality by addressing pathogens and nutrient loading and identified a number of hazards that are associated with geese. The USFWS has documented threats to public health from geese and has authorized the take of geese to reduce this threat (USFWS 2005).

Cryptosporidiosis is a disease caused by a microscopic parasite (*Cryptosporidium* spp.) and the Centers for Disease Control and Prevention (CDC) reports that cryptosporidiosis is one of the most frequent causes of waterborne disease among people (CDC 2013). Exposure can occur from drinking contaminated water or by direct contact with the fecal material of infected animals (CDC 2013). Exposure can occur from ingestion of contaminated water while swimming in lakes, ponds, streams, and pools (Colley 1995, CDC 2013). *Cryptosporidium* can cause gastrointestinal disorders (CDC 2013) and can produce life-threatening infections, especially in people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis is also a disease with implications for human health (Smith et al. 1997). Samples of fecal droppings from Canada geese in the Chesapeake Bay area of Maryland found oocysts of *Cryptosporidium* spp. in goose feces at seven of the nine sites sampled (Graczyk et al. 1998). Graczyk et al. (1998) concluded that Canada geese could act as mechanical carriers of infectious *Cryptosporidium* spp. oocysts and can disseminate those oocysts in the environment, including drinking water supplies. Kassa et al. (2001) found that *Cryptosporidium* was the most common infectious organism found in 77.8% of goose fecal samples from sites comprised primarily of parks and golf courses, indicating that occupational exposure to this pathogen is very plausible although the risk to humans is relatively low.

Giardiasis (*Giardia lambia*) is an illness caused by a microscopic parasite that is one of the most common intestinal parasitic diseases affecting people in the United States (CDC 2011). People can contract giardiasis by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal or person. Symptoms of giardiasis include diarrhea, cramps, and nausea (CDC 2011). Graczyk et al. (1998) found cysts of *Giardia* spp. in goose feces at several locations in the Chesapeake Bay area of Maryland. Kassa et al. (2001) also found *Giardia* in goose feces at numerous urban sites.

The bacteria *Clostridium botulinum* type C, which occurs naturally in wild bird populations across North America, produces avian botulism. This disease most often affects ducks, but it can also affect Canada

geese. Avian botulism is the most common disease of waterfowl. Increased numbers of Canada geese using recreational areas increases the risk to the public (McLean 2003).

Chlamydiosis (*Chalmydiosis psitticai*) is a common infection in birds. However, when it infects people, people often refer to the infection as Psitticosis, which a variety of birds can transmit to people (Bonner et al. 2004). Canada geese can transmit this disease to people and the agent is viable in goose eggs (Bonner et al. 2004). Severe cases of Chlamydiosis have occurred among people handling waterfowl, pigeons, and other birds (Wobeser and Brand 1982, Locke 1987). Infected birds shed the bacteria through feces and nasal discharge (Locke 1987). Chlamydiosis can be fatal to people if not treated with antibiotics. People normally manifest infection by pneumonia (Johnston et al. 2000). However, unless people are working with Canada geese or involved in the removal or cleaning of bird feces, the risk of infection is quite low (Bradshaw and Trainer 1966, Palmer and Trainer 1969).

Campylobacteriosis is an infectious disease caused by bacteria of the genus *Campylobacter*. *Campylobacter jejuni* is a bacterium usually associated with food-borne pathogens (Center for Food Safety and Applied Nutrition 2012). Findings have demonstrated that geese can be important carriers of *C. jejuni* (Pacha et al. 1988, Fallacara et al. 2004, Rutledge et al. 2013). French et al. (2009) examined *Campylobacter* occurrences at playgrounds and found that 6% of dry and 12% of fresh feces contained this bacterium, indicating that there is a risk of transmission to young children, a population with higher than average susceptibility. Although it is unknown what role that wild birds play in the transmission of this bacterium, its presence in geese, which have increased contact with people, increases the potential for transmission. In persons with compromised immune systems, *Campylobacter* occasionally spreads to the bloodstream and causes a serious life-threatening infection, but normally causes diarrhea and is one of the most common diarrheal illnesses in the United States (CDC 2014). Canada geese have been found to be a carrier of *Campylobacter* and can spread the bacteria in their feces (Kassa et al. 2001).

Escherichia coli are fecal coliform bacteria associated with fecal material of warm-blooded animals. There are over 200 specific serological types of *E. coli* with the majority of serological types being harmless (Sterritt and Lester 1988). The serological type of *E. coli* that is best known is *E. coli* O157:H7, which is usually associated with cattle (Gallien and Hartung 1994). Research has demonstrated that Canada geese can disseminate *E. coli* into the environment, which can elevate fecal coliform densities in the water column (Hussong et al. 1979, Alderisio and DeLuca 1999, Cole et al. 2005). Many communities monitor water quality at swimming beaches and lakes, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards, the public authorities often temporarily close beaches, which can adversely affect the enjoyment of those areas by the public, even though the serological type of the *E. coli* is unknown. Unfortunately, linking the elevated bacterial counts to the frequency of use by geese and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link those animal sources of coliform bacteria to fecal contamination (Simmons et al. 1995, Jamieson 1998). For example, Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998, Alderisio and DeLuca 1999). In addition, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir. Cole et al. (2005) found that geese might serve as a vector of antimicrobial resistance genes, indicating that they not only harbor and spread zoonotic diseases like *E. coli* but also may spread strains that are resistant to current control measures.

Roscoe (1999) conducted a survey to estimate the prevalence of pathogenic bacteria and protozoa in resident Canada geese in New Jersey and found no *Salmonella* spp., *Shigella* spp., or *Yersinia* spp.

isolated from any of the 500 Canada goose samples. However, Roscoe (1999) did report finding *Cryptosporidium* spp. in 49 (10%) of the 500 geese, and *Giardia* spp. in 75 (15%) of the geese. Additionally, the United States Geological Survey (USGS) conducted field studies in New Jersey, Virginia, and Massachusetts to determine the presence of organisms that could cause disease in people exposed to feces of Canada geese at sites with a history of high public use and daily use by geese (USGS 2000). *Salmonella* spp., *Listeria* spp., *Chlamydia* spp., and *Giardia* spp. were isolated from goose feces collected in those States but occurred at low frequencies (USGS 2000). The USGS (2000) concluded that the low frequency of disease causing organisms found in goose droppings showed the risks of disease transmission to people was minimal at the four sites sampled in Massachusetts, New Jersey, and Virginia during the summer and early fall of 1999.

As discussed previously, wild and domestic waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997, Stallknecht 2003, Pedersen et al. 2010). However, avian influenza viruses can occur amongst a variety of other bird species (Alexander 2000, Stallknecht 2003). The most common strains of avian influenza found in wild birds are low pathogenic strains (Stallknecht 2003, Pedersen et al. 2010), but high pathogenic strains have also been found to exist in wild waterfowl species (Brown et al. 2006, Keawcharoen et al. 2008). Although avian influenza is primarily a disease of birds, there are concerns over the spread of the H5N1 high pathogenic strain that has shown transmission potential to people with potential for mortalities (Gauthier-Clerc et al. 2007, Peiris et al. 2007, Majumdar et al. 2011). Outbreaks of other avian influenza strains have also shown the potential to be transmissible to people during severe outbreaks when people handle infected poultry (Koopmans et al. 2004, Tweed et al. 2004). A pandemic outbreak of avian influenza could have impacts on human health and economies (World Health Organization 2005, Peiris et al. 2007).

While the risk of geese transmitting diseases or parasites to people is low, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blankespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000, Kassa et al. 2001). In some cases, infections may even be life threatening for people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting a disease from feces is likely to be small. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms occur increases the likelihood of disease transmission. Canada geese are closely associated with human habitation and they often exhibit gregarious roosting and nesting behavior. This gregarious behavior can lead to accumulations of fecal droppings in areas that some people may view as a threat to human health and safety. WS recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health.

WS can also receive requests for assistance associated with geese acting aggressively toward people. As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife, especially around urban areas, has led to a decline in the fear wildlife have toward people. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension occurs that can lead those species to exhibit threatening behavior toward people. This threatening behavior is likely to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although geese attacking people occurs rarely, aggressive behavior by geese does occur, especially during nest building and the rearing of eggs and chicks. Canada geese can aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Smith et al. 1999). Canada geese often nest in high densities in areas used by people for recreational purposes, such as industrial areas, parks, beaches, and sports fields (VerCauteren and Marks 2004). If people or their pets unknowingly approach geese or their nests at those locations, injuries could occur if geese react aggressively to the

presence of those people or pets (Conover 2002). Additionally, slipping hazards can occur from the buildup of feces from geese on docks, walkways, and other foot traffic areas. To avoid those conditions, regular cleanup is often required to alleviate threats of slipping on fecal matter, which can be economically burdensome. Accumulations of goose droppings in public areas can also be aesthetically displeasing and are often in areas where people may come in direct contact with fecal droppings.

Need to Alleviate Threats of Aircraft Striking Canada Geese at Airports and Military Bases

In addition to threats of diseases, geese can also pose a threat to human safety from aircraft striking geese at air facilities in the State. Collisions between aircraft and wildlife are a concern because wildlife strikes threaten passenger safety (Thorpe 1996), erode public confidence in the air transportation industry as a whole (Conover et al. 1995), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996). Aircraft strikes involving geese can cause structural damage to the aircraft resulting in costly repairs and aircraft downtime. In some cases, aircraft strikes involving geese, especially when ingested into engines, can lead to a catastrophic failure of the aircraft, which can lead to plane crashes. The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001).

Nationally, the resident Canada goose population probably represents the single most serious bird threat to aircraft safety (Alge 1999, Seubert and Dolbeer 2004, Dolbeer and Seubert 2006). Resident Canada geese are of particular concern to aviation because of their large size (typically 8 to 15 lbs which exceeds the 4-lb bird certification standard for engines and airframes), flocking behavior (which increases the likelihood of multiple bird strikes), attraction to airports for grazing, and year-around presence in urban environments near airports (Seubert and Dolbeer 2004). From 1990 through 2013, there were 1,470 reported strikes involving Canada geese in the United States, resulting in nearly 95,000 hours of aircraft downtime and over $118 million in damage to civil aircraft (Dolbeer et al. 2014). In Mississippi, the Federal Aviation Administration (2015) has received reports of five aircraft strikes involving Canada geese between 1993 and 2014. In addition to civil aviation, the United States Air Force (2015) reports that Canada geese have caused over $80 million in damage to aircraft.

In 1995, 24 lives were lost when a military aircraft struck a flock of Canada geese and crashed at Elmendorf, Alaska. In January 2009, United States Airways Flight 1549 made an emergency landing in the Hudson River after ingesting multiple Canada geese into both engines shortly after takeoff from New York's LaGuardia Airport (Dolbeer et al. 2009). The aircraft was destroyed after sinking in the river; however, all 150 passengers and five crewmembers survived (Wright 2010). Injuries can also occur to pilots and passengers from goose strikes. Between 1990 and 2013, 15 strikes involving Canada geese have resulted in injuries to 117 people (Dolbeer et al. 2014).

Need to Alleviate Canada Goose Damage Occurring to Property

Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Geese may cause damage to aircraft, landscaping, piers, yards, boats, beaches, shorelines, parks, golf courses, driveways, athletic fields, ponds, lakes, rafts, porches, patios, gardens, footpaths, swimming pools, playgrounds, school grounds, and cemeteries (USFWS 2005). Property damage most often involves goose fecal matter that contaminates landscaping and walkways, often at golf courses and water front property. Accumulations of fecal droppings and the overgrazing of vegetation can be aesthetically displeasing (*e.g.* see Fitzwater 1994, Gorenzel and Salmon 1994, Johnson 1994, Johnson and Glahn 1994, Williams and Corrigan 1994). Businesses may be concerned about the negative aesthetic appearance of their property caused by excessive droppings and excessive grazing, and are sensitive to comments by clients and guests. Costs associated with property damage include labor and disinfectants to clean and

sanitize fecal droppings, implementation of wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by geese, loss of customers or visitors irritated by walking in fecal droppings, repair of golf greens, and replacing grazed turf. As an example, the annual clean-up costs associated with removing goose fecal droppings from lawns, walkways, and beaches in Maryland and the efforts to prevent further accumulations of droppings likely exceeds $150,000 annually (USFWS 2005). Allan et al. (1995) estimated the costs of reestablishing overgrazed lawns and cleaning goose feces from sidewalks was more than $60 per bird.

Damage to property can occur from accumulations of droppings and feather debris associated with large concentrations of geese. Although damage and threats can occur throughout the year, damage can be highest during those periods when geese are concentrated into large flocks, such as migration periods and during winter months when food sources are limited. Geese that routinely nest, roost, and/or loaf in the same areas often leave large accumulations of droppings and feather debris, which can be aesthetically displeasing and can cause damage to property. The reoccurring presence of fecal droppings can lead to constant cleaning costs for property owners. Additionally, because the Migratory Bird Treaty Act (MBTA) protects active nests of geese, problems arise when geese nest in areas where new construction or maintenance could occur.

Need to Alleviate Canada Goose Damage Occurring to Natural Resources

Geese can also negatively affect natural resources through habitat degradation, competition with other wildlife, and by feeding directly on plant resources. Habitat degradation can occur when large concentrations of geese in a localized area negatively affect characteristics of the surrounding habitat, which can adversely affect other wildlife species and be aesthetically displeasing. Degradation of habitat can also occur when large concentrations of geese remove shoreline vegetation resulting in erosion (USFWS 2005). Severe grazing can result in the loss of turf that stabilizes soil on manmade levees. Heavy rains on the bare soil of levees can result in erosion, which would not have occurred if the levee had been vegetated. Competition can occur when two species compete (usually to the detriment of one species) for available resources, such as food or nesting sites.

Large concentrations of Canada geese can be sources of nutrients and pathogens in water. Canada geese can be attracted to waste water treatment plants because of the water and available vegetation. Coliform bacteria causes acidic pH levels in the water and lowers dissolved oxygen, which can kill aquatic organisms (Cagle 1998). In addition, fecal contamination increases nitrogen levels in the pond resulting in algae blooms. Oxygen levels are depleted when the algae dies resulting in the death of aquatic invertebrates and vertebrates.

Large concentrations of geese can affect water quality around beaches and in wetlands by acting as nonpoint source pollution. There are four forms of nonpoint source pollution: sedimentation, nutrients, toxic substances, and pathogens. Large concentrations of geese can remove shoreline vegetation, which can result in erosion. Rainwater can then carry the soil sediments from the eroded shoreline into lakes, ponds, and reservoirs (USFWS 2005). WS has assisted cooperators in the State with managing Canada geese damage at sites where excessive grazing on emergent vegetation necessitated re-planting of the site at significant costs. Overabundant resident Canada geese can negatively affect crops and habitats that people maintain as food and cover for migrant waterfowl and other wildlife.

Nutrient loading can increase in wetlands in proportion to increases in the numbers of roosting geese (Manny et al. 1994, Kitchell et al. 1999). In studying the relationship between bird density and phosphorus and nitrogen levels in Bosque Del Apache National Wildlife Refuge in New Mexico, Kitchell et al. (1999) found an increase in the concentration of both phosphorus and nitrogen correlated with an increase in bird density. Scherer et al. (1995) stated that waterfowl metabolize food very rapidly and

most of the phosphorus contributed by bird feces into water bodies probably originates from sources within the lake. In addition, assimilation and defecation converted the phosphorus into a more soluble form; therefore, the phosphorus from fecal droppings was a form of internal loading. Geese can contribute substantial amounts of phosphorus and nitrogen into lakes through feces, which can cause excessive aquatic macrophyte growth and algae blooms (Scherer et al. 1995) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for goose damage management to reduce threats to human safety and to resolve damage to property, natural resources, and agricultural resources on federal, state, tribal, municipal, and private land within the State of Mississippi wherever a cooperator requests such management. This EA discusses the issues associated with conducting damage management activities in the State to meet the need for action and evaluates different alternatives to meet that need while addressing those issues.

Appendix B discusses the methods available for use to manage Canada goose damage. The alternatives and Appendix B also discuss how WS' personnel would employ methods to manage damage and threats associated with Canada geese. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with geese from occurring when permitted by the USFWS pursuant to the MBTA.

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA occurs in 50 CFR 10.13.

The MBTA does allow for the lethal take of those bird species listed in 50 CFR 10.13 when depredation occurs through the issuance of depredation permits or the establishment of depredation orders. Under authorities in the MBTA, the USFWS is the federal agency responsible for the issuance of depredation permits or the establishment of depredation orders for the take of those protected bird species when damage or threats of damage are occurring. Information regarding migratory bird permits occurs in 50 CFR 13 and 50 CFR 21. When managing damage caused by migratory birds, including Canada geese, WS' employees would follow WS Directive 2.301.

Native American Lands and Tribes

The WS program in Mississippi 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), a work initiation document, or another comparable 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 Canada geese 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 WS' 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.

TVA Property

Activities under the relevant alternatives could occur at facilities owned or managed by the TVA when Canada geese damage or pose threats of damage to property, to natural resources, and to human safety. WS could conduct damage management activities at any of the three combustion turbine sites owned by the TVA in Mississippi known as the Caledonia, Southaven, and Kemper sites. The TVA also operates two solar facilities in Mississippi on the campuses of the University of Mississippi in Oxford, Mississippi and a location at Mississippi State University in Starkville, Mississippi. In addition, the TVA owns or manages 76 electrical substations and 2,038 circuit miles of transmission lines in Mississippi. WS could also conduct activities to reduce damage or threats of damage on recreational, natural, and cultural lands owned or managed by the TVA. The TVA owns 90 miles of public shoreline on Pickwick Reservoir in northeastern Mississippi that provides camping, fishing, boating, swimming, and other recreational opportunities. The TVA also owns and manages 1,700 acres of public land in Mississippi adjacent to Pickwick Reservoir.

Federal, State, County, City, and Private Lands

WS could continue to provide assistance on federal, state, county, municipal, and private land in Mississippi under two of the alternatives analyzed in detail when the appropriate resource owner or manager requested such assistance from WS. In those cases where another federal agency requests WS' assistance with managing damage caused by geese, 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 WS could take on federal lands.

Period for which this EA is Valid

If the preparation of an Environmental Impact Statement (EIS) is not warranted, based on the analyses associated with this EA, WS would conduct reviews of activities conducted under the selected alternative to ensure those activities occurred within the parameters evaluated in this EA. This EA would remain valid until WS and the TVA determined 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 TVA 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 Mississippi under the selected alternative, when requested.

Site Specificity

WS could take actions to reduce threats to human health and safety, reduce damage to agricultural resources, alleviate property damage, and protect natural resources in the State. In addition, the TVA could seek assistance with reducing damage or threats of damage on properties they own or manage. As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. WS' activities that could involve the lethal removal of geese under the alternatives would only occur when permitted by the USFWS, when required, and only at levels permitted pursuant to WS Directive 2.301.

This EA analyzes the potential effects of alternative approaches to managing damage associated with geese that WS could conduct on private and public lands in Mississippi where WS and the appropriate

entities have entered into an agreement through the signing of a MOU, work initiation document, or another comparable document. This EA also addresses the potential effects of conducting damage management approaches in areas where WS and an entity requesting assistance sign additional MOUs, work initiation documents, or another comparable document in the future. Because the need for action is to reduce damage and because the goals and directives of WS are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of such efforts as part of the alternatives.

Canada geese can occur statewide and throughout the year; therefore, damage or threats of damage associated with geese could occur wherever geese occur. Planning for the management of Canada goose 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 could predict some locations where Canada goose damage would occur, WS 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 from WS to manage damage associated with Canada geese is often unique to the individual; therefore, predicting where and when WS 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 goose damage occurs and WS and the TVA treat those issues as such in this EA.

Chapter 2 of this EA identifies and discusses issues relating to goose damage management in Mississippi. The standard WS Decision Model (Slate et al. 1992; see WS Directive 2.201) would be the site-specific procedure for individual actions conducted by WS 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 in any locale and at any time within the State of Mississippi. In this way, WS and the TVA believe the agencies meet the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS and the TVA to comply with the NEPA and still be able to address damage and threats associated with geese.

Summary of Public Involvement

WS and the TVA initially developed issues related to managing damage caused by Canada geese and the alternatives to address those issues in consultation with the USFWS and the MDWFP. WS and the TVA defined the issues and identified preliminary alternatives through the scoping process. As part of this process, and as required by the CEQ and APHIS' NEPA implementing regulations, WS and the TVA will notice this document to the public for review and comment. WS and the TVA will notice this EA to the public through legal notices published in local print media, through direct mailings to interested parties, and by posting the EA on the APHIS website.

WS and the TVA will make the EA available for a minimum of 30 days for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS and the TVA 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 TVA will fully consider new issues, concerns, or alternatives the public identifies during the public involvement period to

determine whether the two agencies should revisit the EA and, if appropriate, revise the EA prior to issuance of a Decision.

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

Environmental Impact Statement: Resident Canada Goose Management in the United States

The USFWS, in cooperation with WS, has issued a FEIS addressing the need for and potential environmental impacts associated with managing resident Canada goose populations (USFWS 2005). The FEIS also contains detailed analyses of the issues and methods used to manage Canada goose damage. The USFWS published a ROD and Final Rule on August 10, 2006 (71 FR 45964- 45993). On June 27, 2007, WS issued a ROD and adopted the FEIS (72 FR 35217). Activities conducted by WS pursuant to the alternative approaches to managing damage addressed in this EA would be consistent with the FEIS and the ROD issued by WS.

Environmental Assessment: Reducing Canada Goose Damage Throughout the State of Mississippi

WS previously developed an EA that analyzed the need for action to manage damage associated with Canada geese. The EA identified the issues associated with managing damage associated with geese in the State and analyzed alternative approaches to meet the specific need identified in the EA while addressing the identified issues.

Changes in the need for action and the affected environment have prompted WS 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 effects of program alternatives based on a new need for action. Since this EA will re-evaluate activities conducted under the previous EA to address the new need for action and the associated affected environment, the analysis and the outcome of the Decision issued based on the analyses in this EA will supersede the previous EA.

Environmental Assessment: Managing Damage and Threats Caused by Birds in the State of Mississippi

WS prepared an EA to evaluate potential impacts to the human environment from the implementation of a management program to address damage to agricultural resources, natural resources, property, and to reduce threats to human safety caused by several bird species in Mississippi. The EA evaluated the need for WS' activities and the relative effectiveness of three alternatives to meet that proposed need, while accounting for the potential environmental effects of those activities. After consideration of the analysis contained in the EA and review of public comments, WS issued a Decision and FONSI for the EA selecting an alternative that implemented an integrated damage management program using multiple methods to address the need to manage bird damage.

North American Waterfowl Management Plan

The United States signed a joint venture with Canada, and later Mexico, in an international effort to conserve declining populations of migratory waterfowl and to protect and restore sustainable habitat. The goals set forth by the North American Waterfowl Management Plan in the 2012 revision are to have 1) abundant and resilient waterfowl populations to support hunting and other uses without imperiling habitat, 2) wetlands and related habitats sufficient to sustain waterfowl populations at desired levels while providing ecological services and recreational benefits to society, and 3) growing numbers of waterfowl hunters, conservationists, and other citizens who enjoy and actively support waterfowl and wetlands conservation (USFWS 2012).

Mississippi Flyway Giant Canada Goose Management Plan

The Mississippi Flyway Council developed a management plan for resident Canada geese in the Mississippi Flyway to help manage harvest and manage human/goose conflicts. The Mississippi Flyway Giant Canada Goose Management Plan outlines the main goals relating to resident Canada geese in the Mississippi Flyway (Mississippi Flyway Council 1996). The Giant Canada goose plan outlines the main goal of all agencies involved "*...to manage the population…at a level that provides maximum recreational opportunities consistent with social acceptability*" (Mississippi Flyway Council 1996). There are three main subject areas covered in the Plan as those subject areas relate to population management focusing on population objectives, harvest management, and population control. Population objectives, as outlined in the management plan, are to maintain a population of approximately 1 million giant Canada geese, as measured by coordinated spring surveys, distributed in the Flyway in proportion to state and provincial objectives.

TVA Natural Resource Plan (NRP)

The TVA has developed an extensive plan to strategically evaluate both renewable and nonrenewable resources and fulfill the responsibilities associated with good stewardship of TVA lands and resources. The NRP is designed to integrate the objectives of six resource areas (biological, cultural, recreation, water, public engagement and reservoir lands planning); provide optimum public use benefit; and balance competing and sometimes conflicting resource uses (TVA 2011*a*).

TVA Environment Impact Statement Assessing the Natural Resource Plan

The TVA has also prepared an EIS to assess the impacts of the NRP and its reasonable alternatives on the environment. It specifically describes the ongoing stewardship programs of the TVA and evaluates future programs the TVA could implement as part of the NRP. The NRP also assesses the potential environmental impacts associated with implementing the various alternatives (TVA 2011*b*).

MDWFP Comprehensive Wildlife Conservation Strategy (CWCS)

The MDWFP has developed an extensive wildlife conservation plan that evaluates all species of plant and animal known to exist within the State. This plan identifies all of the species and habitats listed as endangered, threatened, or species of concern, both federally by the USFWS and at the state level by the MDWFP through the Mississippi Museum of Natural Science (Mississippi Museum of Natural Science 2005). The CWCS creates a comprehensive prioritized list of species in need of conservation and their habitats. WS and the TVA consulted the CWCS as part of this analysis.

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

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

WS' Legislative Authority

The primary statutory authorities for the WS program are 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 with managing animal damage and threats.

Tennessee Valley Authority

The TVA is a federal corporation created by an Act of Congress in May 18, 1933 [48 Stat. 58-59, 16 USC Sec. 831, as amended]. The TVA provides electricity to 9 million people, businesses, and industries and manages 293,000 acres of public land and 11,000 miles of reservoir shoreline in the 7-state Tennessee Valley region (Tennessee, Alabama, Mississippi, Kentucky, Georgia, North Carolina, and Virginia – an area of 80,000 square miles). The TVA operates 29 hydroelectric dams, 11 coal-fired power plants, three nuclear plants, 11 natural gas-fired power facilities, a pump-storage plant, as well as solar, wind, and other renewable energy production sites that can produce about 34,000 megawatts of electricity, delivered over 16,000 miles of high-voltage power lines. The TVA also provides flood control, navigation, land management, and recreation for the Tennessee River system and works with local utilities and state and local governments to promote economic development across the region. The TVA often requests assistance from WS to provide animal damage management on its land and at its facilities.

United States Fish and Wildlife Service Authority

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitats for the continuing benefit of the American people. The USFWS shares that responsibility 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.

The USFWS is responsible for managing and regulating take of many bird species under the MBTA and those species that meet the criteria of threatened or endangered under the ESA. The MBTA prohibits the take of migratory birds; however, the USFWS can issue depredation permits for the take of migratory birds when certain criteria occur pursuant to the MBTA. The USFWS can issue depredation permits to take migratory birds to alleviate damage and threats of damage. Under the permitting application process, the USFWS requires applicants to describe prior non-lethal damage management techniques that they have used to alleviate damage. In addition, the USFWS can establish depredation orders and control orders that allow for the take of migratory birds. Under depredation/control orders, lethal removal can occur when those bird species are causing damage or when those species are about to cause damage without the need for a depredation permit.

The USFWS authority for migratory bird management is based on the MBTA of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the former Soviet Union. Section 3 of this Act authorized the Secretary of Agriculture:

> *"From time to time, having due regard to the zones of temperature and distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, to determine when, to what extent, if at all, and by what means, it is compatible with the terms of the convention to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof, and to adopt suitable regulations permitting and governing the same, in accordance with such determinations, which regulations shall become effective when approved by the President."*

The authority of the Secretary of Agriculture, with respect to the MBTA, was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 FR 2731, 53 Stat. 1433.

United States Environmental Protection Agency (EPA)

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides, including avicides and repellents available for use to manage bird damage.

United States Food and Drug Administration (FDA)

The FDA is responsible for protecting public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping to speed innovations that make medicines and foods more effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health.

Mississippi Department of Wildlife, Fisheries, and Parks

The MDWFP authority in wildlife management occurs within the Mississippi Code Annotated Section 49-1-1 et seq., the official regulations of the Commission of Wildlife, Fisheries, and Parks and applicable federal laws. This legislation covers general provisions; licenses, permits and stamps; wildlife; fish; and wild animals.

Mississippi Department of Agriculture and Commerce (MDAC)

The Pesticide Program of the MDAC enforces state laws pertaining to the use and application of pesticides. Under the Mississippi Pesticide Application Act (Sections 69-23-101 through 69-23-133) this section monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under the Mississippi Pesticide Law (Section 69-23-1 through 69-23-27) the program licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the state of Mississippi.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise would affect the activities that the WS program and the TVA conduct. WS and the TVA would comply with those laws and statutes and would consult with other agencies as appropriate. WS would comply with all 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 TVA 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 and the TVA follow the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). In addition, WS follows the 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

regulates federal activities affecting the physical and biological environment through regulations in 40 CFR 1500-1508. In accordance with the CEQ and USDA regulations, APHIS guidelines concerning the implementation of the NEPA, as published in the Federal Register (44 CFR 50381-50384), provide guidance to WS regarding the NEPA process.

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

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; Public Law 92-583, October 27, 1972; 86 Stat. 1280).

This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. The Act authorized funds for cost-sharing grants to states to develop their programs and for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards requiring federal agencies to conduct activities in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. As appropriate, WS would conduct a consistency determination to assure management actions would be consistent with the State's Coastal Zone Management Program.

Migratory Bird Treaty Act of 1918 (16 USC 703-711; 40 Stat. 755), as amended

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA occurs in 50 CFR 10.13. The MBTA also provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entities, except as permitted by the USFWS[11]. Under permitting guidelines in the Act, the USFWS may issue depredation permits to requesters experiencing damage caused by bird species protected under the Act. Information regarding migratory bird permits occurs in 50 CFR 13 and 50 CFR 21. The Migratory Bird Treaty Reform Act of 2004 further clarified the law. Under the Reform Act, the USFWS published a list of bird species not protected under the MBTA (70 FR 12710-12716).

In addition to the issuance of depredation permits for the take of migratory birds, the Act allows for the establishment of depredation and control orders that allow people to take migratory birds without a depredation permit when certain criteria occur. Discussion on the depredation orders and control orders

[11]For the purposes of the MBTA, "*take*" has been defined as "*...to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess,...ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried,...any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof...*" (16 USC 703a).

established for resident Canada geese occurs under the subsection below. All actions conducted in this EA would comply with the regulations of the MBTA, as amended. Any actions taken by WS relating to migratory birds would comply with WS Directive 2.301.

Depredation/Control Orders for Canada Geese

As discussed previously, the USFWS developed an EIS to evaluate alternatives to address increasing resident goose populations across the United States and to reduce associated damage (USFWS 2005). In addition, the USFWS established several depredation and control orders to manage damage associated with resident Canada geese without a depredation permit from the USFWS when certain criteria are occurring. Under 50 CFR 21.49, managers (their employees and their agents) at commercial, public, and private airports, along with managers (their employees and their agents) at military air operations facilities can lethally take resident Canada geese without the need for a depredation permit when those geese are causing damage or posing a threat of damage to aircraft. The USFWS also established a Canada goose nest and egg depredation order that allows people to destroy the nests and eggs of those geese causing or posing a threat to people, property, agricultural crops, and other interests without the need for a depredation permit once the participant has registered with the USFWS (see 50 CFR 21.50). The USFWS established a similar depredation order to manage damage to agricultural resources associated with Canada geese. Under 50 CFR 21.51, agricultural producers and their designees can lethally take resident Canada geese without a permit from the USFWS in those states designated, including Mississippi, when geese are causing damage to agricultural resources. State and tribal wildlife agencies can address resident Canada geese using lethal and non-lethal methods when those geese pose a direct threat to human health under 50 CFR 21.52. Under the depredation orders and control orders for resident Canada geese, no individual federal depredation permit is required to take geese once the criteria of those orders occur. However, at the time WS and the TVA developed this EA, the MDWFP had not implemented the depredation/control orders in the State. Therefore, at this time, all entities must have a depredation permit issued by the USFWS to take geese in the State.

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)).

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

The NHPA and its implementing regulations (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 that could be available for use under the alternatives cause major ground disturbance; any physical destruction or damage to property; any alterations of property, wildlife habitat, or landscapes; nor involves 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 WS could use under the relevant alternatives are not generally 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 a site-specific consultation as required by Section 106 of the NHPA.

WS use of noise-making methods, such as firearms, at or in close proximity to historic or cultural sites for the purposes of hazing or removing geese have the potential for audible effects on the use and enjoyment of historic property. However, WS would only use such methods at the request of the owner or manager of the site to alleviate 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 consultations as required by the Section 106 of the NHPA as necessary in those types of situations.

Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal agencies must discontinue work until they make a reasonable effort to protect the items and notify the proper authority.

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA 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 EPA is responsible for implementing and enforcing the FIFRA. The EPA and the MDAC regulate pesticides that could be available to manage damage associated with Canada geese 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 FDA.

Investigational New Animal Drug

The FDA can grant permission to use investigational new animal drugs commonly known as Investigational New Animal Drugs (INAD) (see 21 CFR 511). The FDA has authorized WS to use alpha chloralose to capture waterfowl, coots, and pigeons as an INAD. Alpha chloralose is a sedative drug, which allows WS to live-capture waterfowl, coots, and pigeons. Chapter 4 and Appendix B provide additional information on the use of alpha chloralose by WS to capture geese.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "*Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected*." This standard includes birds that may cause safety and health concerns at workplaces.

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.

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. Federal agencies must make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. In addition, federal agencies must ensure agency policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

Responsibilities of Federal Agencies to Protect Migratory Birds - Executive Order 13186

Executive Order 13186 requires each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a MOU with the USFWS that shall promote the conservation of migratory bird populations. APHIS has developed a MOU with the USFWS as required by this Executive Order and WS would abide by the MOU.

1.7 DECISIONS TO BE MADE

The TVA owns and operates numerous electrical power generation sites and transmission structures within Mississippi, including electrical substations and transmission lines. In addition, the TVA manages lands within the State for recreational, natural, and cultural resources. Those sites could experience damage associated with Canada geese. The TVA would be the primary decision-maker for damage management activities occurring on sites owned or managed by the TVA. Management of migratory birds is the responsibility of the USFWS. As the authority for the overall management of bird populations, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The MDWFP is responsible for managing wildlife in the State of Mississippi, including Canada geese. The MDWFP establishes and enforces regulated hunting seasons in the State, including the establishment of hunting seasons that allow the harvest of Canada geese. For migratory birds, the MDWFP can establish hunting seasons for those species under frameworks determined by the USFWS.

WS' activities to reduce and/or prevent Canada goose damage in Mississippi would be coordinated with the USFWS and the MDWFP, which would ensure WS' actions were incorporated into population objectives established by those agencies for Canada goose populations in the State. The take of Canada geese could only occur when authorized by a depredation permit issued by the USFWS; therefore, the take of geese to alleviate damage or reduce threats of damage would only occur at the discretion of the USFWS. In addition, under some circumstances, the take of Canada geese can occur pursuant to depredation orders and a control order without the need for a depredation permit (see Section 1.6).

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the TVA, conduct Canada goose damage management to alleviate damage and threats of damage; 2) should WS conduct disease surveillance and monitoring in the Canada goose population when requested by the MDWFP, the USFWS, and other agencies; 3) should WS, in cooperation with the TVA, implement an integrated damage management strategy, including technical assistance and direct operational assistance, to meet the need for goose damage management; 4) if not, should WS and/or the TVA attempt to implement one of the other alternatives described in the EA; and 5) would the alternatives result in effects to the human 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 WS and the TVA did not consider in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter during the discussion of the issues. Additional descriptions of the affected environment occur during the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Canada geese occur throughout the year across the State of Mississippi (Mowbray et al. 2002) where suitable habitat exists for foraging, loafing, roosting, and breeding. Geese are capable of utilizing a variety of habitats in the State but generally use areas adjacent to or near bodies of water with relatively short vegetation. Nesting habitat could include wetlands, ponds, meadows, gravel bars along rivers, islands, agricultural fields, along irrigation ditches, reservoirs, sewage lagoons, city lakes, golf courses, subdivisions, highway medians, and on top of city buildings (Mowbray et al. 2002). Geese can also loaf, roost, and forage in similar habitat near water bodies preferring areas that are open with short vegetation, which allows geese to detect approaching predators (Mowbray et al. 2002). During the migration periods, geese often roost on or near bodies of water but can travel to other areas to forage, such as agricultural fields. Since geese can occur throughout the State, requests for assistance to manage damage or threats of damage could occur in areas occupied by geese. WS would only provide assistance when the appropriate landowner or manager requested such assistance and only on properties where WS and the appropriate landowner or manager has signed a MOU, work initiation document, or another similar document.

Upon receiving a request for assistance, WS could conduct activities to reduce Canada goose damage or threats of damage on federal, state, tribal, municipal, and private properties in Mississippi. The analyses in this EA would apply to actions taken under the selected alternative that could occur in any locale and at any time within the analysis area. This EA analyzes the potential impacts of Canada goose damage management and addresses activities in Mississippi that are currently being conducted under a MOU, work initiation document, or a similar document with WS where activities have been and currently are being conducted. This EA also addresses the potential impacts of Canada goose damage management in the State where WS and a requesting entity may sign additional agreements in the future. The USFWS would only issue a depredation permit for the take of geese when requested; therefore, this EA evaluates information from depredation permits issued previously by the USFWS to alleviate damage.

The affected environment could include areas in and around commercial, industrial, public, and private buildings, facilities and properties and at other sites where geese may roost, loaf, feed, nest, or otherwise occur. Examples of areas where WS could conduct damage management activities are, but would not necessarily be limited to residential buildings, golf courses, athletic fields, recreational areas, swimming beaches, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, cemeteries, public parks, bridges, industrial sites, hydro-electric dam

structures, reservoirs and reservoir shore lands, nuclear, hydro and fossil power plant sites, substations, transmission line rights-of-way, landfills, military bases, or at any other sites where geese may roost, loaf, or nest. WS could also conduct damage management activities at agricultural fields, vineyards, orchards, farmyards, dairies, ranches, and livestock operations where geese destroy crops or pose a disease risk. Additionally, activities could be conducted at airports and surrounding properties where geese represent a threat to aviation safety.

TVA Facilities

In addition, activities under the relevant alternatives could occur at facilities owned or managed by the TVA when geese cause damage or pose threats of damage to property, to natural resources, to human safety, or to the reliability of electric system transmission. WS could conduct damage management activities at any of the three combustion turbine sites owned by the TVA in Mississippi known as the Caledonia, Southaven, and Kemper sites. The Caledonia Plant occupies 120 acres near Steens, Mississippi. The Southaven Plant occupies 118 acres in Desoto County, Mississippi while the Kemper Plant occupies 197 acres in Kemper County, Mississippi near the City of DeKalb. The TVA also operates two solar facilities in Mississippi on the campuses of the University of Mississippi in Oxford, Mississippi and a location at Mississippi State University in Starkville, Mississippi. The TVA also owns or manages 76 electrical substations and 2,038 circuit miles of transmission lines in Mississippi.

WS could also conduct activities to reduce damage or threats of damage on recreational, natural, and cultural lands owned or managed by the TVA. The TVA owns 90 miles of public shoreline on Pickwick Reservoir in northeastern Mississippi that provides camping, fishing, boating, swimming, and other recreational opportunities. The TVA also owns and manages 1,700 acres of public land in Mississippi adjacent to Pickwick Reservoir.

Airports

Because geese are ubiquitous throughout the State, it is possible for geese to be present at nearly any airport or military airbase. WS could receive requests for assistance to address threats of aircraft strikes from airport authorities at any of the airports or airbases in the State where geese pose a threat to aircraft and passenger safety.

Federal Property

Many federal properties are controlled access areas with security fencing. Managers of federal properties are often unconcerned with the presence of geese until the number of geese reaches a level where damage occurs, such as geese negatively affecting the aesthetic value of the property or landscaping through overgrazing. In addition, threats to human safety can occur from accumulations of fecal matter in public-use areas or from geese acting aggressively to defend nests or young. Examples of those types of federal facilities include, but are not limited to, military bases, research facilities, and federal parks. Managers of those properties could request assistance from WS to manage goose damage at such facilities. In those cases where a federal agency requests WS' assistance with managing damage caused by geese, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA.

State Property

WS could also conduct activities on properties owned and/or managed by the state when requested, such as parks, forestland, historical sites, natural areas, scenic areas, conservations areas, and campgrounds. WS could also receive requests to conduct damage management activities on state highway right-of-ways and interstate right-of ways.

Municipal Property

WS could conduct activities under the alternatives on city, town, or other local governmental properties when requested by those entities. Those areas could include, but would not be limited to city parks, landfills, woodlots, cemeteries, greenways, treatment facilities, utilities areas, and recreational areas. Similar to other areas, geese can cause damage to natural resources, agricultural resources, property, and threaten human safety in those areas. Areas could also include properties in urban and suburban areas of the State.

Private Property

Requests for assistance to manage goose damage and threats could also occur from private property owners and/or managers of private property. Private property could include areas in private ownership in urban, suburban, and rural areas, which could include agricultural lands, timberlands, pastures, industrial parks, residential complexes, subdivisions, businesses, railroad right-of-ways, and utility right-of-ways.

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 its potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the federal action, but also the potential affects that occur or would occur from a non-federal entity conducting the action in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency (*e.g.*, the MDWFP).

State and/or federal laws protect most bird species and to address damage associated with those species, an entity must obtain a permit from the appropriate federal and/or state agency. However, in some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), some species can be managed without the need for a permit when they are causing damage (*e.g.*, take under depredation/control orders). For some bird species, take during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks that include the allowable length of hunting seasons, methods of harvest, and harvest limits, which a state agency, like the MDWFP, can implement. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with geese, when deemed appropriate. Under certain circumstances, people can also address resident Canada geese under several depredation/control orders (see Section 1.6). However, at the time WS and the TVA developed this EA, the MDWFP had not implemented the depredation/control orders in the State. Therefore, at this time, all entities must have a depredation permit issued by the USFWS to take geese in the State.

When a non-federal entity (*e.g.*, agricultural producers, health agencies, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action involving a bird species, the action is not subject to compliance with the NEPA due to the lack of federal involvement[12] in the action. Under such circumstances, the environmental baseline or status quo would be an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of a proposed federal action.

[12]If a federal permit were required to conduct damage management activities, the issuing federal agency would be responsible for compliance with the NEPA for issuing the permit.

Therefore, in those situations in which a non-federal entity has decided that a management action directed towards geese should occur and even the particular methods that should 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. Since take could occur during hunting seasons, under depredation/control orders, or through the issuance of depredation permits, an entity could take an action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requester had conducted the action in the absence of WS' involvement in the action.

In addition, most methods for resolving damage would be available to WS and to other entities; therefore, WS' decision-making ability would be restricted to one of three alternatives. Under those three alternatives, WS could provide technical assistance with managing damage only, take the action using the specific methods as decided upon by the non-federal entity, or take no action. If WS takes no action, the non-federal entity could take the action anyway either during the hunting season, under a depredation/control order, or through the issuance of a depredation permit by the USFWS. 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 has already made the decision to remove or otherwise manage geese to stop damage with or without WS' assistance, WS' participation in carrying out that action would not affect the environmental status quo.

2.2 ISSUES ASSOCIATED WITH CANADA GOOSE DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed activity. Federal agencies must consider such issues during the NEPA decision-making process. WS and the TVA also considered those issues identified in the management of resident Canada geese FEIS (USFWS 2005). WS and the TVA, in consultation with the USFWS and the MDWFP, developed issues related to managing damage associated with geese in Mississippi. WS and the TVA will also make this EA available to the public for review and comment to identify additional issues. Chapter 4 discusses the issues as those issues relate to the possible implementation of the alternatives. WS and the TVA analyzed the following issues in detail during the development of the EA.

Issue 1 - Effects of Damage Management Activities on Canada Goose Populations

Under certain alternatives, WS could employ methods available to resolve damage and reduce threats to human safety that target an individual goose or a group of geese after applying the WS Decision Model (Slate et al. 1992) to identify possible techniques. A common issue when addressing damage caused by animals is the potential impacts of management actions on the populations of target species. Lethal and non-lethal methods would be available to resolve goose damage or threats to human safety.

Non-lethal methods could disperse, translocate, or otherwise make an area unattractive to geese that were causing damage, which could reduce the presence of geese at the site and potentially the immediate area around the site where an entity employed those methods. Employing lethal methods could remove a goose or those geese 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 individual geese that WS could remove from the population using lethal methods would be dependent on the number of requests for assistance received, the number of individual geese involved with the associated damage or threat, the efficacy of methods employed, and the number of individuals the USFWS and the MDWFP authorizes WS to remove.

Another concern is that damage management activities conducted by WS would affect the ability of people to harvest geese during the regulated hunting seasons either by reducing local populations through the lethal removal of birds or by reducing the number of birds present in an area through dispersal techniques. People can harvest geese during annual hunting seasons that the MDWFP implements in the State under frameworks established by the USFWS. Therefore, any activities conducted by WS under the alternatives would be occurring along with other natural processes and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

The analysis will measure the number of individual geese lethally removed in relation to their abundance to determine the magnitude of impact to the populations 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 would be quantitative. Determinations based on population trends and harvest trend data, when available, would be qualitative. WS' personnel would only use lethal methods at the request of a cooperator seeking assistance. In addition, WS would only use lethal methods after the USFWS authorizes the take of geese pursuant to the MBTA.

After applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques, WS could employ or recommend methods available under the alternatives to alleviate damage and reduce threats to human safety that target an individual goose or a group of geese (see WS Directive 2.101, WS Directive 2.201). Chapter 4 analyzes the effects on the Canada goose population from implementation of the alternatives addressed in detail. Several sources can provide information on Canada goose populations and trends, including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), published literature, and harvest data. Further information on those sources of information occurs below.

Breeding Bird Survey

Entities often monitor bird populations by using trend data derived from data collected during the BBS. Under established guidelines, observers count birds at established survey points along roadways for a set duration along a pre-determined route. Routes are 24.5 miles long and occur once per year with the observers stopping every 0.5 miles along the route to conduct the survey. The observer records the number of birds observed and heard within 0.25 miles of each of the survey points during a 3-minute sampling period at each point. Surveys began in 1966 and occur in June, which is generally the period of time when those birds present at a location are likely breeding in the immediate area. The BBS occurs annually in the United States, across a large geographical area, under standardized survey guidelines. The BBS is a large-scale inventory of North American birds coordinated by the United States Geological Survey, Patuxent Wildlife Research Center (Sauer et al. 2014). The BBS is a combined set of over 3,700 roadside survey routes primarily covering the continental United States and southern Canada. The primary objective of the BBS has been to generate an estimate of population change for all breeding birds. Populations of birds tend to fluctuate, especially locally, because of variable local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend is statistically significant.

Current estimates of population trends from BBS data occur from hierarchical model analysis (Link and Sauer 2002, Sauer and Link 2011) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is also determined using BBS data (Sauer et al. 2014).

Christmas Bird Count

Under the guidance of the National Audubon Society, numerous volunteers conduct the CBC annually in December and early January. The CBC reflects the number of birds frequenting a location during the winter months. Participants count the number of birds observed within a 15-mile diameter circle around a central point (177 mi^2). The CBC data does not provide a population estimate, but the data can be an indicator of trends in a population over time. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (National Audubon Society 2010).

Annual Harvest Data

The Canada goose population is sufficient to allow for annual harvest seasons that occur during the fall migration period. Under frameworks developed by the USFWS, the MDWFP can implement migratory bird hunting seasons in the State, including seasons for Canada geese. For many migratory bird species considered harvestable during a hunting season, the USFWS and/or the MDWFP estimate the number of birds harvested during the season in published reports.

Issue 2 - Effects on the Populations of Non-target Animals, Including T&E Species

The potential for effects on non-target species and 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 animals. To reduce the risks of adverse effects to non-target animals, WS' personnel would select damage management methods that were as target-selective as possible or employees would apply such methods in ways to reduce the likelihood of dispersing, capturing, or killing non-target species. Before initiating management activities, WS would select locations that Canada geese used extensively. WS would also use SOPs designed to reduce the effects on populations of non-target species. Chapter 3 provides further discussion on the SOPs. Appendix B describes the methods available for use under the alternatives.

WS and the TVA have also identified concerns about the potential for adverse effects to occur to non-target animals from the use of chemical methods. Chemical methods that would be available to manage damage or threats of damage associated with Canada geese include alpha chloralose, nicarbazin, and taste repellents. Further discussion on those chemical methods occurs in Appendix B.

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)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)].

WS and the TVA make special efforts to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. As part of the scoping process to facilitate interagency cooperation, WS consulted with the USFWS pursuant to Section 7 of the ESA during the development of this EA (see discussion in Chapter 4).

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

An additional issue often raised is the potential risks associated with employing methods to manage damage. 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, selective for Canada geese, and were effective at resolving the damage associated with geese. Still, some concerns exist regarding the safety of methods despite their legality. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public and employees of WS. In addition to the potential risks to the public associated with methods, risks to employees of WS could occur from exposure to methods as well as workplace accidents. Selection of methods would include consideration for public and employee safety.

Safety of Chemical Methods Employed

Exposure could occur from people contacting the chemical directly or from animals exposed to the chemical. Under the alternatives identified, chemical methods would include alpha chloralose, nicarbazin, and repellents. The WS program would only employ those products registered with the EPA and the MDAC.

Several avian repellents are commercially available to disperse geese from an area or discourage geese from feeding on desired resources. The most common ingredients of those repellents are anthraquinone and methyl anthranilate. Nicarbazin is the only reproductive inhibitor currently registered with the EPA. People can use products containing nicarbazin to inhibit the reproduction of local populations of resident Canada geese by reducing or eliminating the hatchability of eggs that geese lay. Reproductive inhibitors containing the active ingredient nicarbazin could also be available under the alternatives. The EPA through the FIFRA, the MDAC, and WS' directives would regulate the use of chemical methods by WS' personnel. Appendix B further discusses chemical methods available.

Alpha chloralose is a sedative that could be available for use by WS' employees to manage damage associated with geese. Ingestion of alpha chloralose treated baits temporarily sedates geese. Sedation can lessen the stress to the animal from handling and transporting the animal from the capture site. Drugs delivered to immobilize geese would occur on site with close monitoring to ensure proper care of the animal. Alpha chloralose is reversible with a full recovery of sedated animals occurring. WS can use alpha chloralose to sedate target geese through an INAD registration with the FDA. Alpha chloralose would only be available for use by WS' employees.

Safety of Non-Chemical Methods Employed

Most methods available to alleviate damage and threats associated with geese are non-chemical methods. If misused, non-chemical methods employed to reduce damage and threats to safety caused by geese could potentially be hazardous to human safety. 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, or changes in crop rotations. Limited habitat modification would be practices that alter specific characteristics of a localized area, such as planting vegetation that was less palatable to geese. Animal behavior modification methods would include those methods designed to disperse geese from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, barriers, electronic distress calls, effigies, mylar tape, lasers, paintballs, eyespot balloons, or nest destruction. Other mechanical methods could include live-traps, cannon nets, net guns, shooting, or recommending that hunters reduce a local population of harvestable geese through hunting.

Many of the non-chemical methods available would only be activated when triggered by attending personnel (*e.g.*, cannon nets, firearms, pyrotechnics, lasers), are passive live-capture methods (*e.g.*, walk-in style live-traps), or are passive harassment methods (*e.g.*, effigies, exclusion techniques, electronic distress calls). The primary safety risk of most non-chemical methods occurs directly to the applicator or

those people 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 goose damage in Mississippi would be available for use under any of the alternatives and any entity could employ those methods, when permitted. Chapter 4 further evaluates the risks to human safety from the use of non-chemical methods as this issue relates to the alternatives.

Effects of Not Employing Methods to Reduce Threats to Human Safety

An issue that WS and the TVA identified was the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that geese can pose. The need for action in Chapter 1 addresses the risks to human safety from diseases associated with geese. The low risk of disease transmission from geese 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.

An additional concern is inadequately addressing threats to human safety associated with aircraft striking geese at airports in the State. Geese have the potential to cause severe damage to aircraft and can threaten the safety of flight crews and passengers. If the use of certain methods to address the threat of aircraft striking geese was limited or excluded from use, the unavailability of those methods could lead to higher risks to passenger safety. Chapter 4 evaluates this issue in relationship to the alternatives.

Issue 4 - Effects on the Aesthetic Values of Canada Geese

One issue is the concern that alternatives would result in the loss of aesthetic benefits of Canada geese to the public, resource owners, or neighboring residents in the area where damage management activities occur. People generally regard wildlife as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987). 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 has been well documented throughout history and started when people began domesticating animals. The American public shares a similar bond with animals and/or wildlife in general. In modern societies, many households have indoor or outdoor pets; however, some people may consider individual wild animals as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing and/or feeding wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between people and animals.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those benefits 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). People can derive direct benefits from a personal relationship with animals, which may take the form of direct consumptive use (*e.g.*, using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and can originate from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: 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 animals vary considerably. Some people directly affected by the problems caused by animals strongly support removal. Other people may advocate the capture and translocation of all animals that cause damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of animals from specific locations. Some people totally opposed to damage management want agencies to teach tolerance for damage and threats caused by animals, and that people should never kill animals. Some of the people who oppose removal of animals do so because of human-affectionate bonds with individual animals. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of animals 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."*

Suffering has previously been described by the American Veterinary Medical Association (AVMA) as a *"…highly unpleasant emotional response usually associated with pain and distress"* (AVMA 1987); however, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* because suffering carries with it the implication of occurring over time, 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 failing to take actions to alleviate the 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 obviously occurs 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 AVMA 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 AVMA accepted methods of euthanasia be used when killing all animals, including wild animals. The AVMA has previously stated that "[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 birds has both a professional and lay point of arbitration. Wildlife managers and the public should 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 can cause "*stress*" (Kreeger et al. 1990); 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).

The decision-making process can involve trade-offs 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 discusses the issue of humaneness and animal welfare concerns, as those concerns relate to the methods available for use, under each of the alternatives. Chapter 3 discusses the SOPs that WS' personnel would employ under the appropriate alternatives to alleviate pain and suffering.

Additional concerns occur over the potential separation of goose families through management actions. Generally, adult geese form pair bonds that they maintain until one of the pair dies; however, geese will form new pairs bonds even when their previous mate is still alive (MacInnes et al. 1974, Mowbray et al. 2002). Goose family units generally migrate together during the fall migration period and spend much of the fall and winter together (Raveling 1968, Raveling1969, Mowbray et al. 2002). The separation of family units could occur during damage management activities targeting geese. This could occur through translocation of geese, dispersal, or through removal and euthanasia.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

WS and the TVA identified additional issues during the scoping process for this EA. WS and the TVA considered the following issues; however, those issues will not receive detailed analyses for the reasons provided 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 and the TVA identified during the scoping process. Animal 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 animal 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 areas where it might occur without resorting to destruction of goose 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 damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the alternative approaches to managing damage would 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 of managing damage and threats to human safety associated with geese 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 and the TVA made a determination through this EA that the selected alternative could have a significant impact on the quality of the human environment, then WS and the TVA 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 Mississippi would continue to conduct damage management on a small percentage of the total land area of the State where damage was occurring or likely to occur.

WS' Impact on Biodiversity

WS and the TVA do not attempt to eradicate any species of native wildlife in the State. WS and the TVA operate in accordance with federal and state laws and regulations enacted to ensure species viability. WS would use available methods to target individual geese or groups of geese identified as causing damage or posing a threat of damage. Any reduction of a local population or group is frequently 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 Mississippi. In addition, WS would only target those geese identified as causing damage or posing a threat. WS would not attempt to suppress native wildlife populations across broad geographical areas at such intensity levels for prolonged durations that significant ecological effects would occur. The goal of WS would not be to manage Canada goose populations but to manage damage caused by specific individuals. The management of Canada goose populations in the State is the responsibility of the USFWS and the MDWFP and activities associated with geese require authorization from the USFWS and/or the MDWFP. Therefore, those factors would constrain the scope, duration, and intensity of WS' actions under the alternatives.

Often of concern with the use of certain methods is that geese that WS lethally removes would only be replaced by other geese after WS completes activities (*e.g.*, geese that relocate into the area) or by geese the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). The ability of an animal population to sustain a certain level of removal and to return to pre-management levels demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

Chapter 4 evaluates the environmental consequences of the alternatives on the populations of target and non-target species based on available quantitative and qualitative parameters. The permitting of lethal removal by the USFWS and the MDWFP would ensure cumulative removal levels would occur within allowable levels to maintain species' populations and meet population objectives for geese. Therefore, activities conducted pursuant to any of the alternatives would not adversely affect biodiversity in the State

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 animal 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 geese could lead to property damage and could threaten passenger safety if a catastrophic failure of the aircraft occurred because of the strike. Therefore, addressing the threats of 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 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.

Canada Goose 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. Cooperative service agreements with individual property owners or managers could also fund WS' activities. WS receives a minimal federal appropriation for the maintenance of a WS program in Mississippi. The remainder of the WS program would mostly be fee-based. WS would provide technical assistance to requesters as part of the federally funded activities; however, the majority of funding to conduct direct operational assistance in which WS' employees perform damage management activities associated with Canada geese would occur through cooperative service agreements between the requester and WS.

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 (2005) 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 people 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 TVA are considering. However, the methods determined to be most effective to reduce damage and threats to human safety caused by geese 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 geese were causing damage or posing a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. Therefore, the cost of methods can often influence the availability of methods to resolve damage, which can influence the effectiveness of methods. Discussion of cost effectiveness as it relates to the effectiveness of methods occurs in Chapter 4.

Impacts of Avian Influenza on Canada Goose Populations

A virus in the Orthomyxovirus group causes avian influenza. Viruses in this group vary in the intensity of illness (*i.e.*, virulence) they may cause. Wild birds, in particular waterfowl and shorebirds, are the natural reservoirs for avian influenza (Davidson and Nettles 1997, Alexander 2000, Stallknecht 2003, Pedersen et al. 2012). Most strains of avian influenza rarely cause severe illness or death in birds, although the H5 and H7 strains tend to be highly virulent and very contagious. However, even the strains that do not cause severe illness in birds are a concern for human and animal health officials because the viruses have the potential to become virulent and transmissible to other species through mutation and re-assortment (Clark and Hall 2006).

The two types of avian influenza viruses are low pathogenic avian influenza and high pathogenic avian influenza (USGS 2013). The low and high refer to the potential of the viruses to kill domestic poultry (USGS 2013). In wild birds, low pathogenic avian influenza rarely causes signs of illness and it is not an important mortality factor for wild birds (Davidson and Nettles 1997, Clark and Hall 2006). In contrast, high pathogenic avian influenza has sickened and killed large numbers of wild birds in China (USGS 2013). However, there have been reports of apparently healthy wild birds with high pathogenic avian

influenza (USGS 2013). High pathogenic strains have only been found to exist in wild waterfowl species in China (Brown et al. 2006, Keawcharoen et al. 2008, USGS 2013).

Recently, the occurrence of the H5N1 strain of the high pathogenic avian influenza has raised concerns regarding the potential impact on wild birds, domestic poultry, and human health should the introduction of the strain occur in the United States. Likely, a change occurred in a low pathogenic avian influenza virus of wild birds, allowing the virus to infect chickens, followed by further change into the H5N1 strain of the high pathogenic avian influenza. The H5N1 strain of high pathogenic avian influence has been circulating in Asian poultry and fowl resulting in death to those species. The H5N1 strain of the high pathogenic avian influenza virus likely underwent further change allowing infection in additional species of birds, mammals, and people. More recently, this virus moved back into wild birds resulting in mortality of some species of waterfowl and other birds. This is only the second time in history that the high pathogenic form of the avian influenza virus has occurred in wild birds. Numerous potential routes for introduction of the virus into the United States exists, including the illegal movement of domestic or wild birds, contaminated products, infected travelers, and the migration of infected wild birds. WS has been one of several agencies and organizations conducting surveillance for the avian influenza virus in migrating birds (USDA 2005). The nationwide surveillance effort has detected some instances of low pathogenic avian influenza viruses, as was expected given that waterfowl and shorebirds are the natural reservoirs for avian influenza. Despite testing tens of thousands of birds, there has been no evidence of the highly pathogenic form of the H5N1 virus in North America. Currently, there is no evidence to suggest avian influenza has negatively affected bird populations in North America, including Canada geese. As stated previously, most strains of avian influenza do not cause severe illnesses or death in bird populations.

Canada Goose Damage Should Be Managed By Private Nuisance Wildlife Control Agents

People experiencing damage caused by geese could contact animal control agents and private entities to reduce goose damage when deemed appropriate by the resource owner. 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 and would not respond to public bid notices. 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 geese lethally. 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). As part of the standard conditions of depredation permits issued pursuant to the MBTA for the lethal take of birds under 50 CFR 21.41, the Migratory Bird Permit Program within the USFWS requires all entities use non-toxic shot as defined under 50 CFR 20.21(j) when using shotguns. In addition, those persons acting under the authority of the depredation/control orders for Canada geese must also use non-toxic shot when using shotguns to alleviate damage. To alleviate concerns associated with lead exposure in wildlife, WS would only use non-toxic shot as defined in 50 CFR 20.21(j) when using shotguns. When using firearms to take geese, WS would primarily use shotguns; however, WS could use rifles and air rifles to remove geese when authorized in depredation permits.

To reduce risks to human safety and property damage from bullets passing through geese, the use of rifles and air rifles would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through the bird, and if the bullet does pass through or misses the target, it impacts in a safe location. Geese that were removed using rifles and air rifles would occur within areas where retrieval of all carcasses for proper disposal would be highly likely (*e.g.*, at airports). With risks of lead exposure occurring primarily from ingestion of bullet fragments and lead shot, the retrieval and proper disposal of bird carcasses would greatly reduce the risk of scavengers ingesting lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle or air rifle, the projectile passes through a bird, if misses occur, or if retrieval of the goose carcass was not possible. 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 generally stays within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could lead to contamination of ground water or surface water. Stansley et al. (1992) studied lead levels in water subject 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 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 EPA (*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 lead oxide deposits that form on the surface of bullets and shot serves to reduce the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead that WS could deposit and the concentrations that would occur from WS' activities to reduce goose 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.

The proficiency training received by WS' employees in firearm use and accuracy would increase the likelihood that geese 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 or from projectiles passing through carcasses. Based on current information, the risks associated with lead projectiles that WS could contribute to the environment due to misses, the projectile passing through the carcass, or from goose carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination. As stated previously, when using shotguns, WS would only use non-toxic shot pursuant to 50 CFR 20.21(j). Additionally, WS may utilize non-toxic ammunition in rifles and air rifles as the technology improves and ammunition become more effective and available.

Impacts of Dispersing Canada Geese on People in Urban/Suburban Areas

Another issue often raised is that the dispersal of a large number of geese to alleviate damage or conflicts at one site could result in new damage or conflicts by dispersing those geese to a new site. While the original complainant may see resolution to the problem after dispersing geese, the recipient of the goose damage may see the problem as imposed on them. Thus, overall, there is no resolution to the original goose problem (Mott and Timbrook 1988). Numerous harassment methods are available to disperse, including dogs, pyrotechnics, propane cannons, effigies, and electronic distress calls (Mott and Timbrook 1988, Booth 1994). A similar conflict could develop when using habitat alteration to disperse geese. In large metropolitan areas, the likelihood of dispersed geese finding a new location and not coming into conflict would be very low.

In urban areas, WS would often work with the community or municipal leaders to address goose damage involving large numbers of geese that would likely be affecting several entities; therefore, WS often consults not only with the property owner where geese occur but also with community leaders to allow for community-based decision-making on the best management approach. In addition, the municipality where the geese occur would often provide funding to alleviate damage or threats of damage. Therefore, activities to alleviate damage could occur within city limits wherever geese occurred. This would allow WS to address geese that relocated to other areas and often times, before geese become well established. A discussion of the community-based decision-making approach to damage management occurs under the description of Alternative 1 in Chapter 3; therefore, WS and the TVA did not analyze this issue further.

A Site Specific Analysis Should Be Made For Every Location Where Bird 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, were used to drive the analysis and determine the significance of the environmental impacts of the alternatives; therefore, the level of site specificity must be appropriate to the issues listed.

The issues raised during the scoping process of the EA drove the analysis in this 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 effects for the entire State would provide a more comprehensive and less redundant analysis compared with multiple EAs covering smaller areas. A single EA would also allow 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 effect 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 WS and the TVA developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. WS and the TVA developed the alternatives based on the need for action 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 the rationale behind alternatives considered but not analyzed in detail as well as the SOPs that WS would incorporate into the relevant alternatives.

3.1 DESCRIPTION OF THE ALTERNATIVES

WS and the TVA developed the following alternatives to meet the need for action and address the identified issues associated with managing damage caused by Canada geese in the State.

A**lternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)**

Alternative 1 would continue the current implementation of an adaptive approach utilizing non-lethal and lethal methods, as deemed appropriate using the WS Decision Model (Slate et al. 1992; see WS Directive 2.201), to reduce damage and threats caused by Canada geese in Mississippi. A major goal of the program would be to alleviate and prevent goose damage and to reduce threats to human safety[13]. To meet this goal, WS, in consultation the USFWS and the MDWFP, would continue to respond to requests for assistance with, at a minimum, technical assistance or, when funding was available, operational damage management.

Therefore, 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 geese, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. Funding for activities conducted by WS could occur through federal appropriations; however, in most cases, those entities requesting assistance would provide the funding for activities conducted by WS.

A key component of assistance provided by WS would be providing information to the requester about animals and animal damage. Education is an important element of activities because animal damage management is about finding balance and coexistence between the needs of people and needs of animals. This is extremely challenging as nature has no balance, but rather is in continual flux. When responding to a request for assistance, WS would provide those entities with information regarding the use of appropriate methods. WS' personnel would provide property owners or managers requesting assistance with information regarding the use of effective and practical techniques and methods. In addition to the routine dissemination of recommendations and information to individuals or organizations experiencing damage, WS could provide 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, WS' personnel could present technical papers at professional meetings and conferences to update other wildlife professionals and the public on recent developments in damage management technology, programs, laws and regulations, and agency policies. Providing information about Canada goose damage and methods would be a primary component of technical assistance and direct operational assistance available from WS under this alternative.

The WS program in Mississippi regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing Canada goose damage. Technical assistance includes collecting information about the species involved, the extent of the damage, and previous methods that the cooperator has employed to alleviate the problem. WS would then provide information on appropriate methods that the cooperator may consider to alleviate 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.

[13]All management actions conducted or recommended by WS would comply with appropriate federal, state, and local laws in accordance with WS Directive 2.210.

Between FY 2010 and FY 2014, WS has conducted 225 technical assistance projects in Mississippi associated with Canada geese. Technical assistance provided by WS would occur as described in Alternative 2 of this EA.

Direct operational damage management assistance would include damage management activities that WS' personnel would conduct directly or supervise. WS' employees may initiate operational damage management assistance when technical assistance alone could not effectively alleviate the damage or the threat of damage and when WS and the entity requesting assistance have signed a MOU, work initiation document, or another comparable document. The initial investigation would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to alleviate the problem.

Under this alternative, the WS program would follow the "*co-managerial approach*" to solve animal 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 Canada geese and effective, practical, and reasonable methods available to a local decision-maker(s) to reduce damage or threats. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available. Those entities requesting assistance could choose to use the services of private businesses, use volunteer services of private organizations, implement WS' recommendations on their own (*i.e.*, technical assistance), request direct assistance from WS (*i.e.*, direct operational assistance), or take no action. Generally, a decision-maker seeking assistance would be part of a community, municipality, business, governmental agency, and/or a private property owner.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on all 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, WS could present damage management recommendations to the appropriate decision-maker(s) 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 the decision-maker(s) to present information on damage management activities 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 often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentations by WS on activities to manage damage. This process allows WS to recommend and implement activities based on local input.

The decision-maker for the local community would be elected officials or representatives of the communities. The elected officials or representatives are people popularly elected by the local community or their 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 business owners may not indicate whether the business must manage animal damage themselves, or seek approval to manage animals 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 decision maker(s) for the local business community. WS could provide direct operational assistance if the local community decision-maker requests such assistance, if the local community provides funding, and if local community decision-maker agrees to WS' recommendations.

In the case of private property owners, the decision-maker would be the individual that owns or manages the affected property. The private property owner would have the discretion to involve others as to what occurs or does not occur on property they own or manage; 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. WS could provide direct operational assistance if the owner or manager requests such assistance, if the owner or manager provides funding, and if owner or manager agrees to WS' recommendations.

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. Similar to the other scenarios, WS could provide direct operational assistance if the appropriate official requests such assistance, if the appropriate official provides funding, and if the official agrees to WS' recommendations.

WS would work with those persons experiencing goose damage to address those geese responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as geese begin to cause damage. Damage that has been ongoing can be difficult to alleviate using available methods since geese are familiar with a particular location and tend to return to those locations to feed, roost, and loaf. Subsequently, making that area unattractive using available methods can be difficult to achieve once damage has been 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.

In general, the most effective approach to resolving damage would be to integrate the use of several methods simultaneously or sequentially. This adaptive approach to managing damage associated with geese would integrate the use of the most practical and effective methods as determined by a site-specific evaluation for each request after applying the WS Decision Model. The philosophy behind an adaptive approach would be to integrate the best combination of methods in a cost-effective[14] manner while minimizing the potentially harmful effects on people, target and non-target species, and the environment. Integrated damage management may incorporate cultural practices (*e.g.*, animal husbandry), habitat modification (*e.g.*, exclusion, vegetation management), animal behavior modification (*e.g.*, scaring, repellents), removal of individual geese (*e.g.*, trapping, shooting), and local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

The WS Decision Model (see WS Directive 2.201) described by Slate et al. (1992) depicts how WS' personnel would use a thought process for evaluating and responding to requests for assistance. 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, WS' employees would incorporate methods deemed practical for the situation into a damage management strategy. After WS' employees implemented this strategy, employees would continue to monitor and evaluate the strategy to assess effectiveness. If the strategy were effective, the need for further management would end. In terms of the WS Decision Model, most efforts to resolve animal 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.

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

The general thought process and procedures of the WS Decision Model would include the following steps.

1. **Receive Request for Assistance:** WS would only provide assistance after receiving a request for such assistance. WS would not respond to public bid notices.
2. **Assess Problem:** First, WS would make a determination as to whether the assistance request was within the authority of WS. If an assistance request were within the authority of WS, WS' employees would gather and analyze damage information to determine applicable factors, such as what species was responsible for the damage, the type of damage, the extent of damage, and the magnitude of damage. Other factors that WS' employees could gather and analyze would include the current economic loss or current threat (*e.g*., threat to human safety), the potential for future losses or damage, the local history of damage, and what management methods, if any, were used to reduce past damage and the results of those actions.
3. **Evaluate Management Methods:** Once a problem assessment was completed, a WS' employee would conduct an evaluation of available management methods. The employee would evaluate available methods in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors.
4. **Formulate Management Strategy:** A WS' employee would formulate a management strategy using those methods that the employee determines to be practical for use. The WS employee would also consider factors essential to formulating each management strategy, such as available expertise, legal constraints on available methods, costs, and effectiveness.
5. **Provide Assistance:** After formulating a management strategy, a WS employee could provide technical assistance and/or direct operational assistance to the requester (see WS Directive 2.101).
6. **Monitor and Evaluate Results of Management Actions:** When providing direct operational assistance, it is necessary to monitor the results of the management strategy. Monitoring would be important for determining whether further assistance was required or whether the management strategy resolved the request for assistance. Through monitoring, a WS' employee would continually evaluate the management strategy to determine whether additional techniques or modification of the strategy was necessary.
7. **End of Project:** When providing technical assistance, a project would normally end after a WS' employee provided recommendations or advice to the requester. A direct operational assistance project would normally end when WS' personnel stop or reduce the damage or threat to an acceptable level to the requester or to the extent possible. Some damage situations may require continuing or intermittent assistance from WS' personnel and may have no well-defined termination point.

Methods available to alleviate or prevent damage under this alternative would be either lethal methods or non-lethal methods. WS' personnel would give preference to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Non-lethal methods that would be available for use by WS would include, but would not be limited to, habitat/behavior modification, nest/egg destruction, lure crops, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, alpha chloralose, reproductive inhibitors, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS would include live-capture followed by euthanasia, the recommendation of take during hunting seasons, and firearms. Euthanasia of live-captured geese would occur in accordance with WS Directive 2.505. WS would employ cervical dislocation, carbon dioxide, or firearms to euthanize target geese once those birds were live-captured using other methods. The AVMA (2013) considers carbon dioxide, cervical dislocation, and firearms to be acceptable forms of euthanasia for free-ranging birds with conditions[15].

[15]The AVMA (2013) defines acceptable with conditions as "A *method considered to reliably meet the requirements of euthanasia when specified conditions are met."*

As discussed in Chapter 1, the MBTA prohibits the take of Canada geese. The take of geese can only legally occur through the issuance of a depredation permit by the USFWS and only at levels specified in the permit. Under certain circumstances outlined in several depredation/control orders, take of resident Canada geese can occur without the need for a depredation permit (see Section 1.6). Lethal take can also occur during a hunting season that the MDWFP implements. In most cases, the use of non-lethal dispersal methods and the destruction of inactive nests would not require a permit from the USFWS and/or the MDWFP.

The use of many lethal and non-lethal methods would be short-term attempts at reducing damage occurring at the time those methods were employed. Long-term solutions to managing goose damage would include limited habitat manipulations and changes in cultural practices that Chapter 4 addresses. Appendix B contains a discussion of the methods that would be available for use in an integrated approach under this alternative. The WS program also researches and actively develops methods to address bird damage through the National Wildlife Research Center (NWRC). The NWRC functions as the research unit of WS by providing scientific information and by developing methods to address damage caused by animals. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques. For example, research biologists from the NWRC were involved with developing and evaluating nicarbazin as a reproductive inhibitor. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving animals and methods.

The losses or risks potentially reduced or prevented defines the effectiveness of any damage management program, which is based on how accurately practitioners diagnose the problem; the species responsible for the damage; and how actions are implemented 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. An adaptive integrated approach calls 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[16]. 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 geese as requested and not to suppress/eliminate the statewide population. Localized population reduction could be short-term since new geese may immigrate to an area or new geese could be born to geese 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 population levels eventually does not mean individual management actions were unsuccessful, but that periodic management may be necessary. The return of animals to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

Based on an evaluation of the damage, WS' personnel would employ the most effective methods individually or in combination based on prior evaluations of methods or combinations of methods in other damage management situations using the WS Decision Model. Once employed, WS' personnel would continue to evaluate methods for effectiveness; therefore, WS' personnel would consider the effectiveness

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

of methods as part of the decision making-process under WS' use of the Decision Model for each damage management request based on continual evaluation of methods and results.

Alternative 2 – Canada Goose Damage Management by WS through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Technical assistance would provide those cooperators experiencing damage or threats of damage caused by geese with information, demonstrations, and recommendations on available and appropriate methods. Similar to Alternative 1, WS' personnel would recommend requesters use an integrated methods approach based on site visits or information provided by the requester, with preference given to the use of non-lethal methods. The implementation of methods and techniques to alleviate or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may loan supplies or materials that were of limited availability for use by private entities (*e.g*., loaning of propane cannons). Similar to Alternative 1, a key component of assistance provided by WS would be providing information to the requester about animals and animal damage. Educational efforts conducted under Alternative 1 would be similar to those conducted under this alternative.

Technical assistance would include collecting information about the species involved, the extent of the damage, and previous methods that the cooperator had used to alleviate the problem. WS would then provide information on appropriate methods that the cooperator may consider to alleviate 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.

Generally, WS' personnel would describe several management strategies to the requester for short and long-term solutions to managing damage based on the level of risk, need, and the practicality of their application. WS' personnel would recommend or loan only those methods legally available for use by the appropriate individual. Similar to Alternative 1, those methods described in Appendix B would be available to those people experiencing damage or threats associated with geese in the State, except for alpha chloralose, which is currently only available for use by WS.

Those entities seeking assistance with reducing damage could seek direct operational assistance from other governmental agencies, private entities, or conduct activities on their own. In situations where non-lethal methods were ineffective or impractical, WS could advise the property owner or manager of appropriate lethal methods to supplement non-lethal methods. In order for the property owner or manager to use lethal methods, they would be required to apply for their own depredation permit to take geese from the USFWS and/or the MDWFP, when a permit was required. WS could evaluate damage occurring or the threat of damage and complete a Migratory Bird Damage Report, which would include information on the extent of the damages or risks, the number of geese present, and a recommendation for the number of geese that should be taken to best alleviate damage or the threat of damage. Following review by the USFWS of a complete application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, the USFWS could issue a depredation permit to authorize the lethal take of a specified number of geese. If the MDWFP implements the depredation/control orders in the State, people would no longer need a depredation permit from the USFWS to remove geese lethally pursuant to the orders; however, a person taking action under a depredation/control order may still need a permit from the MDWFP.

This alternative would place the immediate burden of using methods to alleviate damage on the resource owner, other governmental agencies, and/or private businesses. Those entities could take action using

those methods legally available to alleviate or prevent goose damage as permitted by federal, state, and local laws and regulations or those persons could take no action.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

This alternative would preclude any activities by WS to reduce threats to human health and safety, and alleviate damage to agricultural resources, property, and natural resources. WS would not assist with any aspect of goose damage management in the State. WS would refer all requests for assistance to alleviate damage caused by geese to the USFWS, to the MDWFP, and/or to private entities. This alternative would not deny other federal, state, and/or local agencies, including private entities, from conducting damage management activities directed at alleviating damage and threats associated with geese in the State; therefore, under this alternative, entities seeking assistance with damage caused by geese could contact WS but WS would immediately refer the requester to other entities. The requester could then contact other entities for information and assistance, could take actions to alleviate damage without contacting any entity, or could take no further action.

Many of the methods listed in Appendix B would be available for use by other agencies and private entities to manage damage and threats associated with geese. All methods described in Appendix B would be available for use by those persons experiencing damage or threats, except for the use of alpha chloralose.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives analyzed in detail, WS and the TVA identified several additional alternatives. However, those alternatives will not receive detailed analyses for the reasons provided. Discussion of those alternatives considered but not analyzed in detail occurs below.

Non-lethal Methods Implemented by WS before Lethal Methods

This alternative would require that WS apply non-lethal methods or techniques described in Appendix B to all requests for assistance to reduce damage and threats to safety from geese in the State. If the use of non-lethal methods failed to alleviate the damage situation or reduce threats to human safety at each damage situation, WS could then use lethal methods to alleviate the damage or threat. WS' personnel would apply non-lethal methods 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 those people experiencing goose damage.

Those people experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine the diligence of the requester 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, WS could only evaluate the presence or absence of non-lethal methods. Alternative 1 would be similar to a non-lethal before lethal alternative because WS' personnel would consider the use of non-lethal methods before lethal methods (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in this EA.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would only implement non-lethal methods to alleviate damage caused by geese in Mississippi. WS' personnel would only employ those methods discussed in Appendix B that are non-lethal. No lethal take of geese would occur by WS. Other entities could continue to use lethal

methods under this alternative when authorized by the USFWS and when required. The non-lethal methods that WS' personnel could employ or recommend under this alternative would be identical to those methods identified in any of the alternatives. WS' personnel would use non-lethal methods in an integrated approach under this alternative.

Although some people may disagree, the destruction of active nests is often a non-lethal method. If considered a non-lethal method, the take of nests and eggs could occur under this alternative. Since the MBTA prohibits the destruction of nests and eggs, the USFWS would still be required to issue depredation permits for the take of goose nests under this alternative, when required. The USFWS and/or the MDWFP could continue to issue depredation permits to those people experiencing damage or threats associated with geese under this alternative. Therefore, the lethal take of geese could continue to occur under this alternative. The number of nests destroyed to address damage and threats under this alternative would likely be similar to the levels analyzed under Alternative 1.

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are fencing and wire grid lines. Exclusion is most effective when applied to small areas to protect high value resources; however, exclusionary methods are neither feasible nor effective for protecting human safety or agricultural resources across large areas. The non-lethal methods used or recommended by WS under this alternative would be identical to those methods identified in any of the alternatives. WS would not apply for a depredation permit from the USFWS under this alternative since no take of geese would occur unless WS' personnel destroyed nests or eggs.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the MDWFP, the USFWS, local municipalities, local animal control agencies, or private businesses or organizations. Under this alternative, however, property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods. The USFWS needs professional recommendations on individual damage situations before issuing a depredation permit for lethal methods, and the USFWS does not have the mandate or resources to conduct activities related to wildlife damage management. State agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits were to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a depredation permit from a property owner or manager to lethally take geese, the permit issuance procedures would follow that described under Alternative 1.

Property owners or managers could conduct management using any non-lethal or lethal method that was legal, once the USFWS and/or the MDWFP issued a permit for lethal take, when required. 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 methods 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 is necessary, which could then become hazardous and pose threats to the safety of people and non-target species. The USFWS may authorize more lethal take than was necessary to alleviate goose damages and conflicts because agencies, businesses, and organizations may have less technical knowledge and experience managing wildlife damage than WS.

Alternative 1, 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 could effectively alleviate damage caused by geese, WS' personnel would use or recommend those methods under Alternative 1. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses.

WS and the TVA did not analyze this alternative in detail since the take of geese and the destruction of nests could continue at the levels analyzed for Alternative 1. The USFWS and/or the MDWFP could permit the take, when required, despite WS' lack of involvement in the action. In addition, limiting the availability of methods under this alternative to only non-lethal methods could be inappropriate when attempting to address threats to human safety expeditiously, primarily at airports.

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with geese. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. In those situations where damage could be alleviated using exclusionary devices or other non-lethal methods deemed effective, WS' personnel would employ or recommend those methods as determined by using the WS Decision Model. Therefore, WS and TVA did not consider this alternative in detail.

Trap and Translocate Geese Only by WS

Under this alternative, WS' personnel would address all requests for assistance using live-capture methods or the recommendation of live-capture methods. Geese could be live-captured using alpha chloralose, live-traps, cannon nets, rocket nets, net guns, or hand-capture. All geese live-captured through direct operational assistance by WS would be translocated. Prior to live-capture, release sites would be identified and approved by the USFWS, the MDWFP, and/or the property owner where the translocated geese would be placed prior to live-capture and translocation.

Live-capture and translocation could be conducted as part of the alternatives analyzed in detail; however, the translocation of geese could only occur under the authority of the USFWS and the MDWFP; therefore, the translocation of geese by WS would only occur as directed by those agencies. When requested by the USFWS and/or the MDWFP, WS could translocate geese under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). However, other entities could translocate geese to alleviate damage under Alternative 3. WS does not have the authority to translocate geese in the State unless permitted by the USFWS and/or the MDWFP; therefore, WS and TVA did not consider this alternative in detail.

The translocation of geese causing damage or posing a threat of damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally ineffective because problem geese are highly mobile and can easily return to damage sites from long distances, geese likely already occupy suitable habitats in other areas, and translocation would most likely result in goose damage at the new location. In addition, WS' personnel may need to capture and translocate hundreds of geese to solve some damage problems; therefore, translocation would be unrealistic in those circumstances. Translocation of animals is also discouraged by WS policy (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, the potential for disease transmission, and the difficulties that translocated animals have with adapting to new locations or habitats (Nielsen 1988, Craven et al. 1998).

Reducing Damage Using Only Reproductive Inhibitors

Under this alternative, the only method available to alleviate requests for assistance would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in geese responsible for causing damage. Wildlife managers often consider the use of reproductive inhibitors where wildlife populations are overabundant and where traditional hunting or lethal control programs are

not publicly acceptable (Muller et al. 1997). 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 factors, along with other factors can often limit the use and effectiveness of reproductive control as a population management tool.

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

Population modeling indicates that reproductive control is more effective 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 geese, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproductive control technologies as the only management tool for geese.

WS and the TVA did not consider sterilization given the costs associated with live-capturing and performing sterilization procedures on geese. Currently, the only chemical reproductive inhibitor registered with the EPA is nicarbazin, which is available for use to manage local populations of Canada geese; however, the only reproductive inhibitor currently available in Mississippi is OvoControl P, a formulation of nicarbazin, which people can use to manage urban pigeon populations. Since the EPA has registered nicarbazin as a reproductive inhibitor for geese, WS and the TVA could consider the use of nicarbazin as a method to alleviate damage. However, since a product is not currently available for use to manage localized Canada goose populations in the State and the impracticality of using a reproductive inhibitor to manage damage during the non-breeding seasons, WS and the TVA did not consider this alternative in detail.

Compensation for Bird Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by goose damage. 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. Compensation would require large expenditures of money to investigate and validate all damage claims, and to determine and administer appropriate compensation. Compensation would most likely be below full market value and give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies. In addition, compensation would not be practical for reducing threats to human health and safety. For the above listed reasons, WS and the TVA did not consider this alternative in detail.

3.3 STANDARD OPERATING PROCEDURES FOR DAMAGE MANAGEMENT

WS' directives and SOPs improve the safety, selectivity, and efficacy of those methods available to alleviate or prevent damage. WS would incorporate program directives and SOPs into activities when addressing Canada goose damage and threats in the State.

Some key SOPs pertinent to the alternatives include the following:

- WS' employees would consistently use and apply the WS Decision Model when addressing Canada goose damage to identify effective strategies to managing damage and their potential impacts.

- WS' personnel would follow EPA-approved label directions for all pesticide use. The intent of the registration process for chemical pesticides is to assure minimal adverse effects occur to the environment when people use the chemicals in accordance with label directions.

- WS would provide Material Safety Data Sheets for pesticides and controlled substances to personnel involved with specific damage management activities.

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

- WS' personnel would release non-target animals captured in traps unless it was determined that the animal would not survive and/or that personnel could not release the animal safely.

- WS has consulted with the USFWS and the MDWFP to determine the potential risks to T&E species in accordance with the ESA and State laws.

- All personnel who use chemicals would receive training and certification to use such substances or trained or certified personnel would supervise the employee's use of those chemical methods.

- All personnel who use firearms would receive training according to WS' Directives.

- WS' personnel would consider the use of non-lethal methods prior to the use of lethal methods when managing goose damage.

- WS' personnel would direct management actions toward localized populations, individuals, or groups of geese. WS' personnel would not conduct generalized population suppression across Mississippi, or even across major portions of the State.

- WS' personnel would only use non-toxic shot when employing shotguns to remove geese in the State.

- The lethal removal of geese would only occur when authorized by the USFWS, when applicable, and only at levels authorized.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

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

Issue 1 - Effects of Damage Management Activities on Canada Goose Populations

- The WS program in Mississippi would report annual activities to the USFWS so the USFWS has the opportunity to evaluate population trends and the magnitude of WS' activities in the State.

- The WS program would monitor activities under the selected alternative to ensure activities continued to occur pursuant to the selected alternative. However, under the no involvement by WS alternative, no monitoring would occur by WS.

- WS would only conduct activities after WS received a request for such assistance.

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

- WS' personnel would use the WS Decision Model, designed to identify the most appropriate damage management strategies and their impacts, to determine strategies for resolving goose damage.

- WS would monitor damage management activities to ensure activities do not adversely affect goose populations in the State.

- WS' personnel would give preference to non-lethal methods, when practical and effective.

- WS would continue to recommend the use of legal hunting practices to address local populations in areas where laws and regulations allow hunting.

Issue 2 - Effects on the Populations of Non-target Animals, Including T&E Species

- When conducting removal operations via shooting, identification of the target would occur prior to application.

- As appropriate, WS' personnel would use suppressed firearms to minimize the noise associated with the discharge of a firearm.

- Personnel would use bait, trap placements, and capture devices that personnel would place strategically at locations likely to capture target geese and minimize the potential of non-target animal captures.

- Personnel would release any non-target animals captured in cage traps, nets, or any other restraining device whenever it was possible and safe to do so.

- Personnel would dispose of carcasses retrieved in accordance with WS Directive 2.515.

- WS has consulted with the USFWS and the MDWFP to evaluate activities to resolve goose damage and threats to ensure the protection of T&E species.

- WS' personnel would check methods in accordance with WS Directive 2.210 and WS Directive 2.450. Personnel would directly monitor most live-capture methods (*e.g.*, drops nets, cannon nets, immobilizing drugs), which ensures that personnel could release non-target species quickly, if captured. Directly monitoring methods would help ensure that personnel could release live-captured non-target species in a timely manner.

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

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

- WS' personnel would conduct damage management activities professionally and in the safest manner possible. Whenever possible, personnel would conduct damage management activities away from areas of high human activity. If this were not possible, then personnel would conduct activities during periods when human activity was low (*e.g.*, early morning).

- WS' personnel would conduct shooting during times when public activity and access to the control areas were restricted. Personnel involved in shooting operations would receive training in the proper and safe application of this method.

- All personnel employing chemical methods would receive proper training and certification in the use of those chemicals. All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS Directive 2.401 and WS Directive 2.430 outline WS' use of chemicals and training requirements to use those chemicals.

- The EPA, the FDA, and/or the MDAC would register the use of all chemical methods used by WS or recommended by WS for use, as appropriate.

- When using alpha chloralose for the capture of geese, WS would adhere to all established withdrawal times established through consultation with the MDWFP and veterinarian authorities. Although unlikely, in the event that WS was requested to immobilize geese during a time when harvest was occurring or during a time where the withdrawal period could overlap with the start of a harvest season, WS would euthanize those geese.

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

Issue 4 - Effects on the Aesthetic Values of Canada Geese

- WS' personnel would direct management actions to reduce or prevent damage caused by geese toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- WS and the entity requesting assistance would agree upon all methods or techniques applied to resolve damage or threats to human safety by signing a work initiation document, MOU, or comparable document prior to the implementation of those methods.

- WS' personnel would give preference to non-lethal methods, when practical and effective.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

- WS' personnel would receive training in the latest and most humane devices/methods for removing target geese causing damage.

- WS' personnel would check methods in accordance with WS Directive 2.210 and WS Directive 2.450. WS' personnel would be present during the use of most live-capture methods (*e.g.*, cannon nets, rocket nets) to ensure geese captured were 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 (*e.g.*, see WS Directive 2.401, WS Directive 2.430, WS Directive 2.505).

- WS' use of euthanasia methods would comply with WS Directive 2.505.

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

- WS' personnel would consider the use of non-lethal methods prior to the use of lethal methods when managing goose damage.

- When using live-capture methods that involve holding geese for extended periods (*e.g.*, being transported to translocation locations for release), WS' personnel would not overcrowd geese in containers and would place geese in shaded areas to reduce overheating, when applicable.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in 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 those alternatives relate to the issues identified. The WS program does not expect the alternatives to affect soils, geology, minerals, water quality/quantity, flood plains, wetlands, designated critical habitats, visual resources, air quality, prime/unique farmlands, aquatic resources, timber, and range significantly. Therefore, no further analysis associated with those resources occurs.

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 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, Alternative 1 (proposed action/no action alternative) 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 TVA, the USFWS, the MDAC, and the MDWFP.

Issue 1 - Effects of Damage Management Activities on Canada Goose Populations

A common issue is whether damage management actions would adversely affect the populations of geese, especially when WS' personnel employed lethal methods. WS would maintain ongoing contact with the USFWS and the MDWFP to ensure activities occurred within management objectives for geese. WS would submit annual activity reports to the USFWS. The USFWS would monitor the total take of geese from all sources and would factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the USFWS and the MDWFP would assure those agencies had the opportunity to consider local, state, and regional knowledge of Canada goose population trends.

As discussed previously, methods available to address goose damage or threats of damage in the State that would be available for use or recommendation by WS under Alternative 1 (technical and operational assistance) and Alternative 2 (technical assistance only) would be either lethal methods or non-lethal methods. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance but would provide no direct operational assistance. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods could be employed and/or recommended. Non-lethal methods would include, but would not be limited to habitat/behavior modification, lure crops, visual deterrents, lasers, live traps, translocation, alpha chloralose, nest/egg destruction, exclusionary devices, frightening devices, nets, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS to address goose damage include live-capture followed by euthanasia, shooting, and the recommendation of legal hunting practices, where appropriate. WS' personnel would euthanize target geese using cervical dislocation, carbon dioxide, or firearms once geese were live-captured using other methods. The AVMA (2013) considers cervical dislocation, carbon dioxide, and firearms conditionally acceptable forms of euthanasia for birds. No assistance would be provided by WS under Alternative 3, but many of those methods available to address goose damage would continue to be available for use by other entities under Alternative 3.

Non-lethal methods can disperse or otherwise make an area unattractive to geese causing damage; thereby, reducing the presence of geese at the site and potentially the immediate area around the site where non-lethal methods were employed. WS' personnel would give priority to non-lethal methods when addressing requests for assistance (see WS Directive 2.101) under Alternative 1 and Alternative 2. However, WS' personnel would not necessarily employ or recommend non-lethal methods to alleviate 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. Non-lethal methods would exclude, harass, and disperse target geese from areas where damage or threats were occurring. When effective, non-lethal methods would disperse geese from the area resulting in a reduction in the presence of those geese at the site where an entity employs those methods.

The use of non-lethal harassment methods would cause geese to move to other areas with minimal impact on their population. Harassment methods generally have minimal effects on overall populations of target geese since those geese are unharmed. WS' personnel and other entities would not employ harassment methods over large geographical areas or apply harassment methods at such intensity that essential resources (*e.g*., food sources, habitat) would be unavailable for extended durations or over such a wide geographical scope that a long-term adverse effect would occur to a species' population.

The continued use of non-lethal methods often leads to the habituation of birds to those methods, which can decrease the effectiveness of those methods (*e.g*., see Arhart 1972, Rossbach 1975, Zucchi and Bergman 1975, Shirota et al. 1983, Schmidt and Johnson 1984, Mott 1985, Summers 1985, Aubin 1990, Bomford 1990, Avery et al. 2008*a*, Chipman et al. 2008). For any management methods employed, the proper timing would be essential in effectively dispersing those geese causing damage. Employing methods soon after damage begins or soon after identifying threats would increase the likelihood that those damage management activities would achieve success in addressing damage; therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of goose damage. The use of non-lethal methods would not have adverse effects on the Canada goose population under any of the alternatives.

The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since entities would remove geese from the population. People often employ lethal

methods to reinforce non-lethal methods and to remove geese causing damage or posing a threat to human safety. People use lethal methods to reduce the number of geese present at a location since a reduction in the number of geese at a location leads to a reduction in damage, which would be applicable whether using lethal or non-lethal methods. The intent of most non-lethal methods is to harass, exclude, or otherwise make an area unattractive to geese, which disperses those geese to other areas; thereby, leading to a reduction in damage at the location where those geese were dispersed. Similarly, the intent of reproductive inhibitors would be to reduce the number of geese in a localized area, which would reduce damage and threats occurring at those locations. The intent of using lethal methods would be similar to the objective that people try to achieve when using non-lethal methods, which would be to reduce the number of geese in the area where damage was occurring; thereby, leading to a reduction in the damage occurring at that location.

Although the use of firearms can reduce the number of geese using a location (similar to dispersing geese), people most often use firearms to supplement and reinforce the noise associated with non-lethal methods (*e.g.*, pyrotechnics, propane cannons). The capture of geese using live-traps and subsequently euthanizing those geese would be available to reduce the number of geese using a particular area where damage was occurring. Similarly, people harvesting geese during the regulated hunting season for geese in the State could assist with managing those populations in an area where damage was occurring.

Often of concern with the use of lethal methods is that geese people lethally remove would only be replaced by other geese either during the application of those methods (from other geese that move into the area) or by geese the following year (increase in reproduction that could result from less competition for limited resources). This would assume geese only return to an area where damage was occurring if an entity used lethal methods; however, the use of non-lethal methods can also be temporary, which could result in geese returning to an area where damage was occurring once people no longer use those methods. The common factor when employing any method would be that geese could return if suitable conditions continue to exist at the location where damage was occurring and goose 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 geese to an area where damage was occurring.

Furthermore, any method that disperses or removes geese from areas would only be temporary if preferred characteristics continued to exist the following year when geese returned. Dispersing geese using non-lethal methods addressed in Appendix B often requires repeated application to discourage geese from returning to locations, which can increase costs, moves geese to other areas where they could cause damage, and can be temporary if conditions where damage was occurring remains unchanged. Dispersing and the relocating of geese could move a problem from one area to another, which would require addressing damage caused by those geese at another location. WS' recommendation of or use of techniques to modify existing habitat or making areas unattractive to geese is discussed in Appendix B. WS' objective under Alternative 1 and Alternative 2 would be to respond to requests for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model.

Cooper and Keefe (1997) divided goose damage management into short-term redistribution approaches and long-term population/habitat management approaches. Short-term approaches focus on redistribution and dispersal to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, hazing with vehicles, dogs, effigies, and adverse noise, erecting access barriers, such as wire grids or fences, and taste aversion chemicals. Population reduction by limiting survival or reproduction, removing geese, and habitat modifications would generally be long-term solutions to managing damage caused by geese.

People often employ redistribution methods to provide immediate resolution to damage occurring until people can implement long-term approaches or until methods have had time to reach the desired result. The USFWS has evaluated and implemented long-term approaches to managing resident Canada goose populations with the intent of reducing damage by enacting depredation and control orders (USFWS 2005). Dispersing geese is often a short-term solution that moves geese to other areas where damages or threats could occur (Smith et al. 1999). Non-lethal methods often require a constant presence at locations when geese are present and must be repeated every day until the desired results are achieved, which can increase the costs associated with those activities. The return of geese to areas where people previously employed damage management methods does not indicate previous use of those methods were ineffective since the intent of those methods would be to reduce the number of geese present at a site where damage was occurring at the time people employed those methods.

Cooper (1991) reported that the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and significantly reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. Jensen (1996) also reported that an integrated approach that incorporated the removal of geese, reduced goose-aircraft collisions by 80% during a two year period.

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

WS and other entities may recommend that people harvest geese during the regulated hunting season in an attempt to reduce the number of geese causing damage. Managing goose populations over broad areas could lead to a decrease in the number of geese causing damage. Establishing hunting seasons and the allowed harvest during those seasons is the responsibility of the MDWFP under frameworks that the USFWS develops. WS does not have the authority to establish hunting seasons or to set allowed harvest numbers during those seasons.

As discussed previously, evaluating the magnitude of impact from lethal take can occur either quantitatively or qualitatively. Population estimates, allowable harvest levels, and actual harvest data form the basis for quantitative determinations. Population trends and harvest trend data are the basis for qualitative determinations. Several sources of information on goose populations and trends can be available, including information from the BBS, the CBC, survey reports, published literature, and harvest data. Below is the discussion on the analysis of potential impacts of conducting each alternative on the Canada goose populations.

Alternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)

Alternative 1 would continue the current implementation of an adaptive approach by integrating non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and

threats associated with Canada geese in Mississippi. WS would work with those people experiencing goose damage to address those geese responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin before or as soon as geese begin to cause damage. Goose damage that has been ongoing could be difficult to alleviate using available methods since geese would be familiar with a particular location and conditioned to feed, roost, and loaf at the 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.

Under Alternative 1, WS' personnel would give priority to non-lethal methods when addressing requests for assistance (see WS Directive 2.101) and 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. However, WS could also use or recommend the use of lethal methods under this alternative. When employing lethal methods, a depredation permit may be required from the USFWS.

Under Alternative 1, WS could destroy nests and the associated eggs of geese as part of an integrated approach to managing damage. Nest and egg destruction methods are generally non-lethal when conducted before the development of an embryo. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, which may cause them to relocate and nest elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity generally has no long-term effect on breeding adult geese when conducted in limited situations. WS would not use nest and egg removal as a population management method. WS would use this method to inhibit nesting in an area experiencing damage due to the nesting activity and WS would destroy nests/eggs at the localized level only. As with the lethal take of geese, the USFWS must authorize the take of nests. Therefore, the number of nests that WS destroys would occur at the discretion of the USFWS.

WS could also address requests for assistance using live-capture methods and the subsequent translocation of geese. Geese could be live-captured using live-traps, cannon nets, rocket nets, or other methods and translocated. Translocation of geese could only occur under the authority of the USFWS and/or the MDWFP. Therefore, the translocation of geese by WS would only occur as directed by those agencies. WS and/or other entities would have to identify translocation sites and the USFWS, the MDWFP, and/or the property owner would have to approve of those release sites prior to WS capturing the geese. When authorized by the USFWS and/or the MDWFP, WS could translocate geese under this alternative and recommend translocation under Alternative 2. When releasing geese into appropriate habitat and when translocating geese during the migration periods, WS does not anticipate translocation to affect goose populations adversely or to affect individual geese adversely.

As part of translocating geese and for other purposes (*e.g.*, movement studies), WS could band geese for identification purposes using appropriately sized leg bands. Banding would occur pursuant to a banding permit issued by the USGS. Fair et al. (2010) stated "[w]*hen appropriate* [leg] *band sizes are used, the occurrence and rate of adverse effects on the subjects is ordinarily very low*". Therefore, WS does not expect the use of appropriately sized leg bands to affect populations or individual geese adversely.

CANADA GOOSE BIOLOGY AND POPULATION IMPACT ANALYSIS

Canada geese are the most widely distributed goose species in North America (Mowbray et al. 2002). Canada geese occur in a broad range of habitats including prairie, arctic plains, mountain meadows, agricultural areas, reservoirs, sewage lagoons, parks, golf courses, lawn-rich suburban areas, or other

similar areas not far from permanent sources of water (Mowbray et al. 2002). Their diet consists of grasses, sedges, berries, and seeds, including agricultural grain (Mowbray et al. 2002). Canada geese are highly social birds that often gather and feed in flocks, with some flocks exceeding 1,000 birds (Mowbray et al. 2002).

In the past, most authorities recognized one species of the Canada goose with 11 subspecies, which differed primarily in body size and color (Bellrose 1980). Today, there are generally two recognized, distinct species of geese instead of just a single species. Those two distinct species are the smaller cackling goose and the larger Canada goose (Mowbray et al. 2002, Willcox and Giuliano 2012). There are four recognized subspecies of cackling geese, which generally occur within western and northwestern North America. There are seven recognized Canada goose subspecies found in North America (Willcox and Giuliano 2012).

There are primarily four bird migration routes in North America with each having a Flyway Council governing migratory game bird management. Those councils are comprised of representatives from member states and Canadian provinces, which make recommendations to the USFWS on the management of bird populations. The flyway system consists of four administrative units: the Atlantic, Mississippi, Central, and Pacific Flyway Councils. The State of Mississippi is part of the Mississippi Flyway Council. The Mississippi Flyway is comprised of 14 states in the United States and three Canadian Provinces. One of the migratory game birds the Flyway Council governs is the Canada goose population.

Historically, the breeding range of Canada geese occurred along the northern portion of the United States and across most of Canada. Those breeding geese migrated south to spend the winter in more temperate climates (USFWS 2005). Canada geese did not historically breed in many of the states in the southern United States. Mississippi is one of the many states in the southern United States where Canada geese did not historically breed. Settlers nearly extirpated the native breeding populations of Canada geese in the United States following settlement in the 19th century (Mississippi Flyway Council 1996, USFWS 2005). In the mid-1900s, state and federal agencies began efforts to restore historic breeding populations and to establish breeding populations of Canada geese in new locations. Due to those restoration and pioneering efforts, Canada geese now breed and reside throughout the year in every state, including Mississippi (Mowbray et al. 2002, USFWS 2005). Today, many of the breeding populations of geese that state and federal agencies established do not migrate and generally occur in the same area throughout the year (USFWS 2005).

One of the Canada goose subspecies that historically occurred in the central United States and southern Canada during the breeding season was the giant Canada goose (*Branta canadensis maxima*). At the time of European settlement, the nesting range of the giant Canada goose subspecies probably extended from central Alberta, Saskatchewan, and Manitoba, south to central Kansas and Missouri, and east to the shores of Lake Erie (USFWS 2005). Most geese found in the Mississippi Flyway are of the giant Canada goose subspecies collectively referred to as the Mississippi Flyway Giant Population (MFGP). People nearly extirpated geese in the Flyway by the early 1930s through overexploitation and habitat loss. Canada goose restoration efforts began in the 1980s by federal, state, local, and private entities and those restoration efforts are the foundation of the increasing population trends observed currently (Mississippi Flyway Council 1996).

Other subspecies of Canada geese augment the breeding population of Canada geese in the State during the migration periods and during the winter. Therefore, depending on the time of year, there are two behaviorally distinct types of geese present in the State. The two distinct types of geese that could be present are "*resident*" and "*migratory*" geese. Discussion on resident and migratory geese that could be present in the State occurs below.

Resident Canada Geese

Canada geese are "*resident*" when they meet one of several criteria. Those criteria include geese that nest and/or reside on a year round basis within the contiguous United States. Those geese that nest within the lower 48 States during the months of March, April, May, or June and those geese that reside within the lower 48 States and the District of Columbia in the months of April, May, June, July, and August (see 50 CFR 21.11) (Rusch et al. 1995, Ankney 1996, USFWS 2005). The Mississippi Flyway Council defines resident Canada geese as geese nesting in states comprising the Mississippi Flyway as well as Canada south of latitude 50° N in Ontario and 54° N in Manitoba (Mississippi Flyway Council 1996). Therefore, during much of the year, the majority of Canada geese present in the State would be resident geese, not migratory. However, when migrant populations are present in the State, distinguishing a resident Canada goose from a migratory Canada goose by appearance can be difficult.

Resident Canada geese are not simply geese that stopped migrating but geese with very different population growth rates, management needs, and opportunities (Atlantic Flyway Council 2011). For example, most resident Canada geese in the Atlantic Flyway are reluctant to leave the areas in which they breed, moving less than 22 miles on average, when winter weather makes it necessary to find open water and food. These moves to wintering areas typically occur in late November or December, with birds returning to nest in March (Atlantic Flyway Council 2011). Resident Canada geese have a relatively high nesting success compared to migratory Canada geese (USFWS 2005). Resident Canada geese primarily nest from March through May each year. Resident Canada geese nest in traditional sites (*e.g.*, along shorelines, on islands and peninsulas, small ponds, lakes, and reservoirs), as well as on rooftops, adjacent to roadways, swimming pools, and in parking lots, playgrounds, planters, and abandoned property (*e.g.*, tires, automobiles).

Spring surveys conducted in 2015 indicated there were 1.62 million Canada geese in the Mississippi Flyway. The 2015 spring estimate was 11% higher than the estimate during the previous breeding season (USFWS 2015). The average annual growth rate has slowed down in recent years following many years of increasing trends (USFWS 2015). However, the USFWS (2014) considers the resident Canada goose population in the Flyway to be over-abundant.

The highest concentration of breeding Canada geese in Mississippi occurs along the Mississippi River Delta and along the southern coast, but resident geese occur throughout the State (Mississippi Flyway Council 1996). In Mississippi, the number of resident Canada geese observed along routes surveyed during the BBS have shown an increasing trend, estimated at 21.9% annually since 1966 and 27.6% annually from 2003 through 2013 (Sauer et al. 2014). In 1993, an estimated 9,000 resident geese were present in the State (Mississippi Flyway Council 1996). In 2008, an estimated 31,000 resident geese were present in the State (Mississippi Flyway Council 2008). The resident Canada goose population estimate in the State has increased 244% from the estimate in 1993 and the estimate in 2008. The population management goal for resident Canada geese in Mississippi is 20,000 geese (Mississippi Flyway Council 1996).

In Mississippi, resident Canada geese molt and are flightless from mid-June through mid-July each year. During the annual molting process, geese replace their primary and secondary flight (wing) feathers and become flightless (Welty 1982). Portions of a flock of geese can be flightless from about one week before until two weeks after the primary molt period because individual birds molt at slightly different times.

As resident goose populations have increased across the United States, including the resident population in Mississippi, the number of requests for assistance to manage damage associated with geese has also increased (USFWS 2005). Damage and the threat of damage associated with increasing populations of

resident Canada geese are well documented (*e.g.*, see Mississippi Flyway Council 1996, USFWS 2005, Atlantic Flyway Council 2011). Those potential impacts include damage to property, concerns about human health and safety, and impacts to agriculture and natural resources. Damage to property can occur when geese congregate on lawns or mowed areas, including athletic fields, golf courses, lawns, and parks, as well as beaches and marinas, depositing their droppings and feathers (Mississippi Flyway Council 1996, USFWS 2005, Atlantic Flyway Council 2011). Concerns to human health and safety from Canada geese can arise in several ways. At airports, geese can create a threat to aircraft and to human life (Mississippi Flyway Council 1996, USFWS 2005, Atlantic Flyway Council 2011, Dolbeer et al. 2014). In addition, during the nesting season, geese aggressively defend the area around their nests and goslings from other animals and people (Mississippi Flyway Council 1996, USFWS 2005, Atlantic Flyway Council 2011). Agricultural and natural resource impacts include losses to corn, soybeans, and winter wheat, as well as overgrazing of pastures and a degradation of water quality (Mississippi Flyway Council 1996, USFWS 2005, Atlantic Flyway Council 2011).

The Mississippi Flyway Council developed a management plan for resident Canada geese in the Mississippi Flyway during 1996 to help manage harvest and manage human/goose conflicts. The Mississippi Flyway Giant Canada Goose Management Plan outlines the main goals relating to resident Canada geese in the Mississippi Flyway (Mississippi Flyway Council 1996). The Giant Canada Goose plan outlines the main goal of all agencies involved "*...to manage the population…at a level that provides maximum recreational opportunities consistent with social acceptability*" (Mississippi Flyway Council 1996). There are three main subject areas covered in the Plan as those subject areas relate to population management focusing on population objectives, harvest management, and population control. Population objectives, as outlined in the management plan, are to maintain a population of approximately 1 million giant Canada geese, as measured by coordinated spring surveys, distributed in the Flyway in proportion to state and provincial objectives. During development of the management plan, the MFGP of geese was over 1 million geese (Mississippi Flyway Council 1996). The spring 2015 estimate for the MFGP resident Canada goose population was over 1.6 million geese, which was 11% higher than the 2014 estimate of 1.4 million geese (USFWS 2015), but still exceeded the population objective recommended by the Mississippi Flyway Council in their resident Canada goose management plan (Mississippi Flyway Council 1996).

Harvest objectives in the management plan are to provide maximum harvest opportunity for giant Canada geese that is consistent with the population objectives, the objectives for other Canada geese populations in the Flyway, and the control of over-abundant goose populations in areas with high human/goose conflicts. Population management objectives involving Canada geese were to manage local populations of giant Canada geese where they create conflicts, such as endangering human health or safety, damaging crops, damaging habitats important to other wildlife populations, or creating other injurious or nuisance situations (Mississippi Flyway Council 1996).

To address the increasing population of resident Canada geese and the personal and public property damage and public health concerns associated with this increase, the USFWS developed a FEIS that evaluated alternative strategies to reduce, manage, and control the population and related damages (USFWS 2005). During the development of the FEIS evaluating management strategies for the resident Canada goose population, the USFWS estimated the resident Canada goose population at 3.2 million birds in the United States. The population estimate was approximately 30% to 35% above the number of geese the States believed to be acceptable based on their needs to manage conflicts and problems caused by resident Canada geese (USFWS 2005). Under the selected alternative in the resident Canada goose FEIS, the USFWS established several mechanisms to allow the States to further manage resident goose populations and goose damage (USFWS 2005).

The selected alternative in the FEIS established regulations that created specific control and depredation orders designed to address resident Canada goose depredation, damage, and conflicts. The selected alternative also provided expanded hunting methods and opportunities to increase the number of resident Canada geese harvested during existing September seasons[17] and authorized the implementation of a resident Canada goose population control program. More specifically, the selected alternative in the FEIS modified existing regulations by including the definition of a resident Canada goose (see 50 CFR 20.11, 50 CFR 21.3). The FEIS also made modifications by allowing the use of shotguns holding more than three shells during resident Canada goose seasons, and by allowing the use of electronic calls during harvest seasons targeting resident Canada geese (see 50 CFR 20.21). The FEIS also added to the regulations a control order for resident Canada geese at airports (see 50 CFR 21.49), a depredation order for nests and eggs (see 50 CFR 21.50), a depredation order for resident Canada geese at agricultural facilities (see 50 CFR 21.51), and a public health control order for resident Canada geese (see 50 CFR 21.52). Finally, the FEIS added 50 CFR 21.61 to establish the resident Canada goose population control program.

Most requests for assistance received by WS to address damage caused by Canada geese occurs during those months when geese present in the State are resident geese. From FY 2010 through FY 2014, WS in Mississippi employed several different non-lethal techniques to capture or disperse nuisance Canada geese including alpha chloralose, firearms, nets, pyrotechnics, vehicles, and drive traps. Using non-lethal methods, the WS program in Mississippi dispersed 468 geese from FY 2010 through FY 2014 (see Table 4.1). In addition, WS employed firearms to take 205 geese in response to damage or threats of damage (see Table 4.2). Between FY 2010 and FY 2014, WS' personnel also live captured 4,166 geese using alpha chloralose, drive traps, nets, and padded foothold traps, which WS' personnel subsequently euthanized.

Table 4.1 – Canada geese addressed by WS in Mississippi using non-lethal methods, FY 2010 – FY 2014

Year	Method			TOTAL
	Firearms[1]	Pyrotechnics	Vehicle[2]	
2010	62	59	0	**121**
2011	116	0	0	**116**
2012	31	13	0	**44**
2013	14	45	35	**94**
2014	0	64	29	**93**

[1]Personnel used the noise associated with the discharge of a firearm to disperse geese

[2]Personnel used the approach of a vehicle to disperse geese

Based on the number of requests received for assistance previously and in anticipation of additional efforts to manage damage, WS anticipates lethally removing up to 3,000 Canada geese annually in the State to alleviate damage or threats of damage. Under Alternative 1, WS' personnel could also destroy the nests and/or eggs of resident Canada geese as part of an integrated approach to managing damage. WS could destroy up to 1,000 nests annually in the State to alleviate damage.

As stated previously, distinguishing between resident and migratory Canada geese is not possible through visual identification. Based on the type of damage that occurred, the locations where requests for assistance occurred, and the months that WS received those requests, the geese addressed by WS previously to alleviate damage were likely resident geese (*i.e.*, geese present in the State throughout the year). To evaluate a worst-case scenario, the analysis will evaluate the anticipated take of up to 3,000

[17]The September hunting season for Canada geese is intended to target resident geese before migratory geese arrive in the State

geese by WS annually as though all of those geese were resident geese. Most requests for assistance received by WS are associated with airports and urban areas where geese are present throughout the year. Therefore, WS anticipates future requests for assistance to involve primarily resident geese.

Table 4.2 – Canada geese addressed by WS in Mississippi using lethal methods, FY 2010 – FY 2014

Year	Method					TOTAL
	Firearms	Alpha Chloralose[1]	Drive Traps[1]	Nets[1]	Other[1]	
2010	132	32	814	50	0	**1,028**
2011	46	0	560	0	0	**606**
2012	11	0	906	0	2	**919**
2013	8	0	616	0	0	**624**
2014	8	0	1,186	0	0	**1,194**

[1]Geese were live-captured and subsequently euthanized

If the statewide goose population remained relatively stable from the 2008 estimate of 31,000 geese, the annual take of 3,000 geese by WS would represent 9.7% of the estimated statewide goose population in 2008. However, the resident goose population in the State has likely increased from the 2008 estimate based on the 27.6% annual increase observed from 2003 through 2013 in the State during the BBS.

People can also harvest Canada geese in the State during the regular hunting season for waterfowl and during a season open during September that targets the resident goose population. Figure 4.1 shows the harvest of geese in the State from 2010 through 2014 during the regular waterfowl season. From 2009 through 2014, people did not report harvesting geese during the September season in the State.

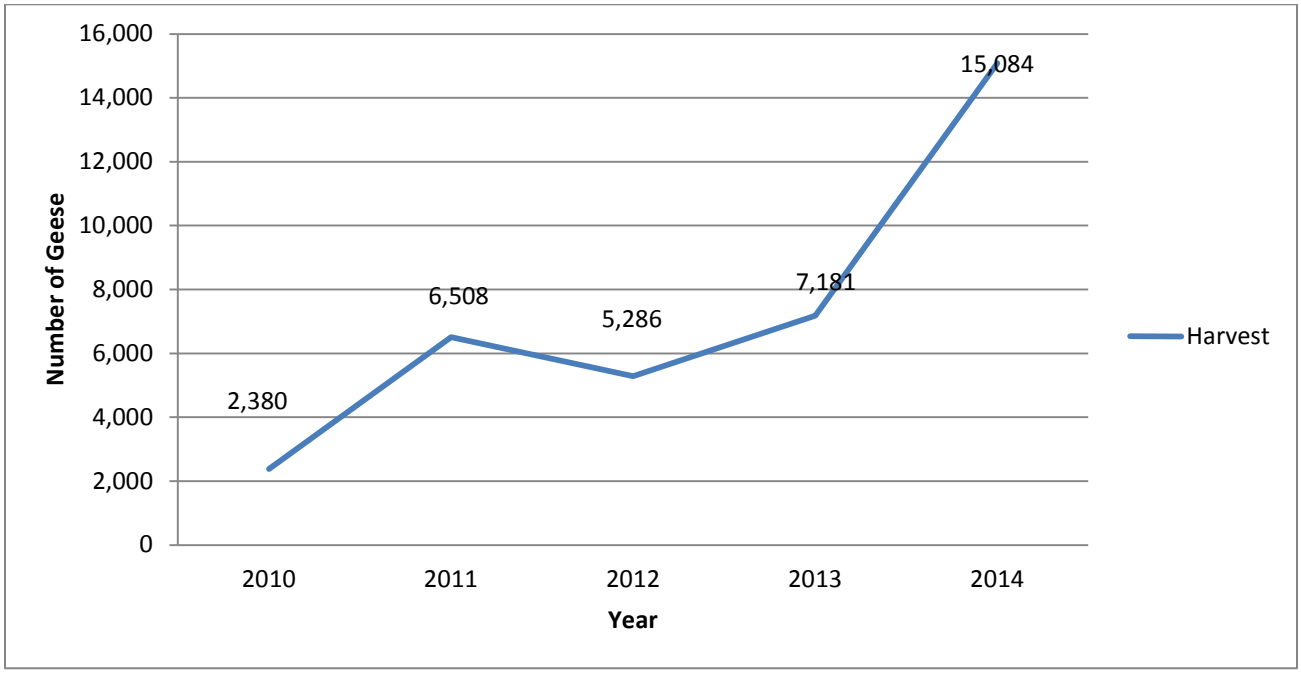

Figure 4.1 – Canada goose harvest in Mississippi from 2010 to 2014 (Raftovich et al. 2011, Raftovich et al. 2012, Raftovich et al. 2014, Raftovich et al. 2015)

From 2010 through 2014, hunters harvested 36,439 geese in the State during the regular hunting season for waterfowl, which is an average harvest of 7,288 geese per year from 2010 through 2014. The number of resident geese that hunters harvest during the regular hunting season in the State is unknown.

Considering the cumulative take of Canada geese in Mississippi for the past five years, WS' take of geese equaled 10.7% of the total estimated cumulative take by all entities. Despite the cumulative take of resident Canada geese occurring in the State, data from the BBS continues to indicate the resident goose population in the State is increasing. As stated previously, the population goal in Mississippi is 31,000 resident Canada geese. The take of 3,000 geese by WS would represent 9.7% of the population goal if the population reached the goal.

All take by WS occurs under depredation permits issued by the USFWS. WS' take of up to 3,000 geese annually would be dependent upon the USFWS authorizing the take at that level annually. Take by WS would not exceed the permitted take allowed under depredation permits issued by the USFWS. With management authority for migratory birds, the USFWS can adjust allowed take through the regulated harvest season and take under depredation permits and orders to meet population objectives. Therefore, the USFWS would authorize all take by WS and would have the opportunity to consider cumulative take as part of population objectives for geese.

In addition, WS could destroy the nests and/or eggs of resident Canada geese as part of an integrated approach to managing damage. In anticipation of addressing additional Canada geese, WS could destroy up to 1,000 nests (including eggs within the nests) annually. WS' take of nests and/or eggs would only occur when permitted by the USFWS through the issuance of depredation permits. WS' take of nests and/or eggs would not exceed 1,000 nests annually and would not exceed the level permitted under depredation permits.

Impacts due to nest and egg removal and destruction should have little adverse effect on the resident goose population in Mississippi. In general, nest and egg destruction methods are non-lethal when conducted before the development of an embryo. Additionally, geese are a long-lived species and have the ability to identify areas with regular human disturbance and low reproductive success, which causes them to relocate and nest elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individual geese affected, this activity has no long-term effect on breeding adult geese. WS would not use nest and egg removal as a population management method. WS would destroy nests (and eggs within the nest) in a localized area to inhibit nesting where the nests or the presence of nesting geese were causing damage or posing a threat of damage. Treatment of 95% of all Canada goose eggs each year would result in only a 25% reduction in the population over 10 years (Allan et al. 1995). The resident Canada goose management FEIS developed by the USFWS concluded that a nest and egg depredation order would have minimal impacts on goose populations with only localized reductions in the number of geese occurring (USFWS 2005).

The EPA has registered the reproductive inhibitor known as nicarbazin for use to manage Canada goose populations on a local scale by reducing the likelihood that eggs laid will hatch. Nicarbazin, as a reproductive inhibitor for geese and domestic waterfowl, has been registered with the EPA as a pesticide pursuant to the FIFRA under the trade name OvoControl® G (Innolytics, LLC, Rancho Sante Fe, California). Label requirements of OvoControl® G restrict the application of the product to urban areas, which limits the extent of the products use for reducing localized goose populations. Based on current information, WS' use or recommendation of nicarbazin formulated under the trade name OvoControl® G would not adversely affect Canada goose populations in Mississippi since WS' activities would not be additive to those activities that could occur in the absence of WS' use of the product. The resultant reduction in local Canada goose populations from the use of nicarbazin would be highly variable given the variability in the effectiveness of the product to reduce egg hatch in geese. However, given that the effects of nicarbazin are only temporary if birds do not eat an appropriate dose of nicarbazin daily, the reduction of a local population could be fully reversed if treated bait is no longer supplied and other conditions (*e.g.*, food, disease) are favorable for population growth. At this time, OvoControl® G is not available for use on Canada geese in Mississippi, but there is the possibility that it may be in the future.

Migratory Canada Geese

Migratory Canada geese nest across the arctic, subarctic, and boreal regions of Canada and Alaska that migrate south to winter in the United States and Mexico (Mowbray et al. 2002). Canada goose migrations may encompass up to 3,000 miles, like that of the Richardson's Canada goose (*B. c. hutchinsii*), which nests as far north as Baffin Island, Nunavut, Canada and winters as far south as the eastern States of Mexico. Migratory Canada geese that could occur in the State during the migration periods and during the winter occur primarily from three breeding populations. Those populations include the MFGP, the Eastern Prairie Population (EPP), and the Southern James Bay Population (SJBP). The wintering migratory population in Mississippi is mostly comprised of geese from the MFGP and the SJBP (USFWS 2015).

The SJBP of geese nest primarily on Akimiski Island and in the Hudson Bay Lowlands to the west and south of James Bay in Canada (USFWS 2015). The estimated number of breeding Canada geese in the SJBP during the spring of 2015 was 54,300 geese, which was 32% lower than the 2014 estimate of 79,500 geese. The total population index of 60,700 geese in 2015 was similar to the 2014 index of 82,600 geese. The index of breeding geese in the SJBP has decreased by 5% per year and the total goose index decreased by 7% per year over the 2006 to 2015 timespan (USFWS 2015). Historically, large numbers of geese from the SJBP have wintered in Alabama, Tennessee, Kentucky, North Carolina, and South Carolina, but there has been a drastic decline in the number of migrant geese arriving in this area in the past two decades, particularly at Wheeler National Wildlife Refuge in Alabama (Abraham and Warr 2003). Abraham and Warr (2003) suggested the widespread increase of resident Canada geese, mild winters, and changing farm practices are factors influencing the decline in the number of migrants arriving in the area (*i.e.*, migrants may not be travelling as far south as they did historically).

The Mississippi Flyway Council and the Atlantic Flyway Council jointly developed a similar management plan for the SJBP of migratory Canada geese with management objectives focused on population size, distribution, and habitat management (Abraham and Warr 2003). The purpose of this plan was "*…to establish management practices, determine research needs, and promote action to properly manage the Southern James Bay Population…of Canada geese…*" (Abraham and Warr 2003).

The MFGP of Canada geese nest across the Mississippi Flyway and some migratory movements likely occur. Based on surveys conducted in the spring of 2015, the USFWS (2015) estimated the MFGP of geese at 1.62 million geese, which was 11% higher than the 2014 estimate of 1.46 million geese. The USFWS (2014) considered the MFGP over-abundant in the Flyway and the population continues to exceed the population objective for the Flyway (Mississippi Flyway Council 1996, USFWS 2005).

As discussed previously, the MFGP and the SJBP of Canada geese can winter in the State or migrate through the State. The number of Canada geese observed in the State during the CBC has shown an overall increasing trend since 1966 with a relatively stable trend since 2001 (National Audubon Society 2010). The number of migratory Canada geese present in the State during the winter or during the spring and fall migration is unknown because both resident and non-resident geese are present in the State during those periods.

Based on increasing requests for assistance to manage geese, WS may receive requests to remove geese lethally during those months when migratory geese could be present in the State. WS anticipates that requests for the lethal take of geese during those months when geese present in the State may be migratory geese would occur primarily at airports where geese can pose a threat to human safety and to property. However, WS could receive requests to reduce damage or threats to other resources. From FY 2010 through FY 2014, WS lethally removed 134 Canada geese in the State from September through

March when geese present could be migratory. Based on an increase in the number of requests received for the lethal take of geese during those periods of time when geese present in the State may be migratory geese, WS may take up to 100 geese annually during those periods when geese present in the State could be migratory geese.

Under frameworks for the harvest of waterfowl developed by the USFWS, the MDWFP allows hunters to harvest Canada geese during regulated seasons in the State. From 2010 to 2014, hunters harvested an estimated 36,439 geese, or an average of 7,288 geese per year, in the State during the regular season when those geese present in the State could be migratory (see Figure 4.1). For example, Klimstra and Padding (2012) estimated that 38% of the geese harvested in the Atlantic Flyway during the regular waterfowl hunting seasons were migratory geese.

Cumulative impacts of Alternative 1 on migratory Canada geese could occur from WS' anticipated take, take by other entities under depredation permits, and hunter harvest. The number of migratory geese lethally removed by other entities in the State is unknown. From 2010 to 2014, hunters harvested an average of 7,288 geese during the regular hunting season. If 38% of those geese harvested during the regular season between 2010 and 2014 were migratory geese, hunters harvested 2,769 migratory geese per year on average in the State. WS' take of up to 100 geese that could be migratory would represent 3.6% of the average number of geese taken during the regular hunting season that could be considered migratory.

The number of migratory geese potentially removed by WS on an annual basis in Mississippi is likely to be relatively low. The majority of WS' lethal activities would occur when migratory geese were not present in the State (*i.e.*, from April through August). Most, if not all, of damage management activities that WS could conduct under Alternative 1 would involve the resident Canada geese population. WS' proposed take would be of low magnitude when compared with the number of geese that people harvest annually in the State. WS' limited proposed take would not limit the ability of people to harvest Canada geese in the State based on the limited portion of the overall take that could occur by WS. The take of migratory Canada geese could only occur when authorized through the issuance of depredation permits by the USFWS. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives for geese.

DISEASE SURVEILLANCE AND MONITORING

The ability to efficiently conduct surveillance for and detect diseases is dependent upon rapid detection of an introduced pathogen. Effective implementation of a surveillance system would facilitate planning and execution at regional and state levels and coordination of surveillance data for risk assessment. It would also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups.[18] Entities can use current information on disease distribution and knowledge of the mixing of birds in migratory flyways to develop a prioritized sampling approach based on the major North American flyways. Entities can incorporate the surveillance data from all of those areas into national risk assessments, preparedness, and response planning to reduce the adverse impacts of a disease outbreak in wild birds, poultry, or people.

To provide the most useful information and a uniform structure for surveillance, five strategies for collecting samples in birds could occur. Those strategies include:

[18]Data collected by organizations/agencies conducting research and monitoring will provide a broad species and geographic surveillance effort.

Investigation of illness/death in birds: A systematic investigation of illness and death in wild birds may occur to determine the cause of the illness or the cause of death in birds. This strategy offers the best and earliest probability of detection if migratory birds introduced a disease into the United States. Natural resource agencies and other entities often detect illness and death involving wildlife. This strategy capitalizes on existing situations of birds without additional birds being handled or killed.

Surveillance in live wild birds: This strategy involves sampling live-captured, apparently healthy birds to detect the presence of a disease. Bird species that represent the highest risk of being exposed to or infected with the disease because of their migratory movement patterns or birds that may be in contact with species from areas with reported outbreaks would be targeted. Where possible, this sampling effort would be coordinated with local projects that already plan on capturing and handling the desired bird species. Coordinating sampling with ongoing projects currently being conducted by state and federal agencies, universities, and others maximizes use of resources and minimizes the need for additional bird capture and handling.

Surveillance in hunter-harvested birds: Check stations for waterfowl hunting or other harvestable bird species would provide an opportunity to sample dead birds to determine the presence of a disease and supplement data collected during surveillance of live wild birds. Sampling of hunter-killed birds would focus on hunted species that are most likely to be exposed to a disease and have relatively direct migratory pathways from those areas to the United States.

Sentinel species: Waterfowl, gamefowl, and poultry flocks reared in backyard facilities may prove to be valuable for early detection and used for surveillance of diseases. Sentinel waterfowl may also be placed in wetland environments where they are potentially exposed to and infected with disease agents as they commingle with wild birds.

Environmental sampling: Many avian diseases are spread through the intestinal tract of waterfowl and can be detected in both feces and the water in which the birds swim, defecate, and feed. This is the principal means of introduction to naïve birds and potentially to poultry, livestock, and humans. Analysis of water and fecal material from habitats can help to identify specific types of diseases and the pathogenicity of those organisms. Environmental sampling is a reasonably cost effective, technologically achievable method to assess risks to humans, livestock, and other wildlife.

Under the disease sampling strategies listed above that could be implemented to detect or monitor avian diseases in the United States, WS' implementation of those sampling strategies would not adversely affect avian populations in the State. The sampling (*e.g.*, drawing blood, feather sample, fecal sample) and the subsequent release of live-captured birds would not result in adverse effects since those birds are released unharmed on site. In addition, sampling of sick, dying, or hunter-harvested birds would not result in the additive lethal take of birds that would not have already occurred in the absence of a disease sampling program; therefore, the sampling of birds for diseases would not adversely affect the populations of any of the birds addressed in this EA, nor would sampling of birds result in any take that would not have already occurred in the absence of disease sampling (*e.g.*, hunter harvest).

Alternative 2 - Canada Goose Damage Management by WS through Technical Assistance Only

Under a technical assistance only alternative, WS would recommend an integrated methods approach similar to Alternative 1; however, WS would not provide direct operational assistance under this alternative. WS' personnel would base their recommendation of methods and techniques on WS' Decision Model using information provided from the requester or from a site visit. In some instances, animal-related information provided to the requester by WS could result in tolerance or acceptance of the

situation. In other instances, personnel would discuss and recommend damage management options with the requester.

When personnel discussed damage management options, WS could recommend and demonstrate for use both non-lethal and lethal methods legally available for use to alleviate goose damage. Those persons 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. However, those persons requesting assistance would likely be those people that would implement methods.

Despite no direct involvement by WS in resolving damage and threats associated with geese in the State, those persons experiencing damage caused by geese could continue to alleviate damage by employing those methods legally available. Appendix B contains a discussion of the methods available for use in managing damage and threats associated with geese. With the exception of alpha chloralose, all methods listed in Appendix B would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods would only be available to those persons with pesticide applicators licenses[19]. Alpha chloralose would only be available for use by WS and therefore would be unavailable for use under this alternative. Management actions taken by non-federal entities would be the *environmental status quo*.

Under this alternative, those persons experiencing threats or damage associated with geese in the State could lethally take geese. In order for the property owner or manager to use lethal methods, they must apply for their own depredation permit to take geese from the USFWS. Lethal removal of geese could continue during hunting seasons, under depredation/control orders (if implemented), or through the issuance of depredation permits by the USFWS. WS' personnel could also provide technical assistance as part of the application process for issuing a depredation permit by the USFWS under this alternative, when deemed appropriate. WS could evaluate the damage and complete a Migratory Bird Damage Report for the requester, which would include information on the extent of the damages, the number of geese present, and a recommendation of the number of geese that entity should remove to best alleviate the damages. Following the USFWS review of a completed application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, the USFWS could issue a depredation permit to authorize the lethal take of a specified number of geese. Therefore, under this alternative, the number of geese lethally taken would likely be similar to the other alternatives. Take could be similar since take could occur through the issuance of a depredation permit, take could occur under depredation/control orders (if implemented), and take would continue to occur during the harvest season.

This alternative would place the immediate burden of resolving damage on the people requesting assistance. Those persons experiencing damage or were concerned with threats posed by geese could seek assistance from other governmental agencies, private entities, or conduct damage management on their own. Those persons experiencing damage or threats could take action using those methods legally available to alleviate or prevent goose damage as permitted by federal, State, and local laws and regulations or those persons could take no action. Therefore, any potential effects to goose populations in the State would not occur directly from a program implementing technical assistance only.

With the oversight of the USFWS and the MDWFP, it is unlikely that implementation of this alternative would adversely affect goose populations in the State. Under this alternative, WS would not provide direct operational assistance with damage management actions; however, direct operational assistance could be provided by other entities, such as the MDWFP, the USFWS, private entities, and/or municipal

[19]Pesticide applicators licenses can be obtained by people who meet MDAC requirements and successfully pass testing requirements

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 take, which could lead to real but unknown effects on other animal populations. People have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would not conduct technical or direct operational assistance to reduce threats to human health and safety, or alleviate damage to agricultural resources, property, and natural resources. WS would not provide assistance with any aspect of goose damage management in the State. WS' personnel would refer all requests for assistance with managing Canada goose damage to the USFWS, the MDWFP, the MDAC, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with geese in the State, those people experiencing damage caused by geese could continue to alleviate damage by employing both non-lethal and lethal methods. Similar to Alternative 2, with the exception of alpha chloralose, all methods listed in Appendix B would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those people with pesticide applicators licenses. Alpha chloralose would only be available for use by WS and therefore would be unavailable for use under this alternative. However, other live-capture methods would be available.

The lethal take of geese could continue to occur during hunting seasons or through the issuance of depredation permits by the USFWS. If the MDWFP implements the depredation/control orders for geese in the State, people experiencing damage associated with geese could take geese without the need for a depredation permit from the USFWS; however, people may be required to obtain authorization from the MDWFP. Management actions taken by non-federal entities would be the *environmental status quo*.

Under this alternative, property owners/managers may have difficulty obtaining permits to use lethal methods. As detailed above in Alternative 1, the USFWS requires that permittees contact WS to obtain a recommendation (*i.e.*, technical assistance) on how to address goose damage as part of the permitting process. When completing a Migratory Bird Damage Report for a requester, WS would evaluate the situation and then issue a recommendation describing the damage, species involved, number of individual geese involved, previous actions taken to address the problem, and recommendations on how to address the problem. Under this alternative, WS would not assist the requester in preparing the Migratory Bird Damage Report for submission to the USFWS. The USFWS does not have the mandate or the resources to conduct damage management activities. Therefore, State agencies with responsibilities for migratory birds would likely have to collect the information needed to complete the Migratory Bird Damage Report. If the MDWFP, MDAC, or another entity provided this information to the USFWS, they could review the application and issue a permit, if warranted.

The number of geese lethally removed under this alternative would likely be similar to the other alternatives. Take would be similar since lethal removal could continue to occur during hunting seasons or through the issuance of depredation permits by the USFWS. Lethal take without the need for a depredation permit from the USFWS could also occur if the MDWFP implements the depredation/control orders for geese. WS' involvement would not be additive to the lethal removal that could occur since the people requesting WS' assistance could conduct goose damage management activities without WS' involvement.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those people experiencing damage or threats could take action using those methods legally available to resolve or prevent goose damage as permitted by federal, state, and local laws and regulations, or those persons could take no action.

As previously stated, WS would not be involved with any aspect of addressing damage or threats of damage caused by geese under this alternative. A property owner or manager could take management actions themselves under this alternative. In addition, private entities, volunteer services of private individuals or organizations, or other entities, such as the USFWS and the MDWFP could provide assistance. If WS or other entities did not provide direct operational assistance and technical assistance, it is possible that frustration caused by the inability to reduce damage and threats, along with ignorance on how best to reduce damage and threats, could lead to the inappropriate use of legal methods and the use of illegal methods. This may occur if those people or organizations providing technical assistance have less technical knowledge and experience managing animal damage than WS. Illegal, unsafe, and environmentally unfriendly actions could lead to real but unknown effects. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (*e.g*., see White et al. 1989, USFWS 2001, FDA 2003).

Issue 2 - Effects on the Populations of Non-target Animals, Including T&E Species

As discussed previously, people often identify a concern about the potential impacts to non-target species, including T&E species, from the use of methods to alleviate damage caused by geese. Discussion of the potential effects on the populations of non-target wildlife species, including T&E species, occurs below.

Alternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)

Alternative 1 would continue the current implementation of an adaptive integrated methods approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats associated with geese in Mississippi. WS' personnel use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model (see WS Directive 2.201) and described by Slate et al. (1992). As part of that thought process, WS' employees would consider the methods available and their potential to disperse, capture, or kill non-targets based on the use pattern of the method.

Personnel from WS would have experience with wildlife identification to identify damage or recognize damage threats. In addition, WS' employees would be knowledgeable in the use patterns of methods to select the most appropriate methods to address target geese and exclude non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for geese, would employ the use of attractants that were as specific to geese as possible, and determine placement of methods to avoid exposure to non-targets. Discussion of SOPs to prevent and reduce any potential adverse effects on non-targets occurs in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse effects to 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, dispersal, and could include inadvertently live capturing non-target animals. Any exclusionary device erected to prevent access of geese also potentially excludes species that are not the primary reason for erecting the exclusion; therefore, excluding non-targets from areas may potentially affect those animals adversely if the area excluded was large enough. The use of auditory and visual

dispersal methods used to reduce damage or threats caused by geese would also likely disperse non-targets in the immediate area the methods were employed. Therefore, entities could disperse non-targets from an area while employing non-lethal harassment and dispersal techniques. However, the potential impacts on non-target species would likely be temporary with target and non-target species often returning after the cessation of dispersal methods. WS' personnel and other entities would not employ non-lethal dispersal and harassment methods over such large geographical areas or apply those methods 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 harassment and dispersal methods would generally have minimal impacts on overall populations of wildlife since individuals of those species would be unharmed. The use of non-lethal harassment and dispersal methods would not have adverse impacts on non-target populations in the State under any of the alternatives.

Other non-lethal methods available for use under this alternative include live traps, nets, nest/egg destruction, translocation, and repellents. Live traps (*e.g.*, walk-in traps) and nets (*e.g.*, cannon nets) restrain geese once captured and would be considered live-capture methods. Live traps and nets have the potential to capture non-target wildlife. Trap and net placement in areas where geese were active and the use of target-specific attractants would likely minimize the capture of non-targets. If personnel attend live traps and nets appropriately, they could release any non-targets captured on site unharmed.

Nets could include the use of net guns, net launchers, cannon/rocket nets, and drop nets. Nets would virtually be selective for target individuals since application would occur by attending personnel, with handling of wildlife occurring after deployment of the net or WS' personnel would check frequently to address any live-captured wildlife. Therefore, WS' personnel could immediately release any non-targets on site. Personnel would handle any potential non-targets captured using non-lethal methods 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, primarily from being struck by the net gun/launcher weights, or cannon/rocket assemblies during deployment. The likelihood of nets and assemblies striking non-targets is extremely low. Risks to non-target would only occur if non-target animals were present when activating the net and only if a non-target animal were in a position for the net and assemblies to strike the animal. Personnel would position nets to envelop wildlife upon deployment and to minimize striking hazards. Baiting of the areas to attract geese often occurs when using nets; therefore, personnel could abandon sites if non-target use of the area was high.

Nest/egg destruction would not adversely affect non-target species since identification of the nest and/or eggs would occur prior to efforts to destroy the nest and/or the eggs. Similarly, translocation of geese would not have a direct effect on non-targets since WS' personnel would identify target geese prior to live-capture. WS' personnel would be knowledgeable in the identification of Canada goose and their eggs and nests. When translocating geese, WS' personnel would release geese into appropriate habitat based on coordination with the MDWFP; therefore, indirect effects associated with the release of geese on non-targets (*e.g.*, competition) is not likely.

Personnel could employ non-lethal methods that use auditory and visual stimuli to elicit fright responses of geese. Therefore, any non-targets near those methods when employed would also likely disperse from the area when employing those methods to disperse or harass geese. Similarly, any exclusionary device constructed to prevent access by geese would also exclude access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas by both geese and non-target species where non-lethal methods were employed. Therefore, any use of non-lethal methods would have similar results on both non-target and target geese. Although non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods could restrict or prevent access of

non-targets to beneficial resources. 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.

WS' personnel would recommend and use only those repellents registered with the EPA pursuant to the FIFRA and registered with the MDAC for use in the State. Therefore, the use and recommendation of repellents would not have negative effects on non-target species when used according to label requirements. The active ingredients in many taste repellents for geese are naturally occurring chemicals that pose a very low risk to non-targets when exposed to or when ingested.

Two chemicals commonly registered with the EPA as bird taste repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes. Manufacturers use methyl anthranilate to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants, like aloe. People also use anthraquinone to make dye. Both chemicals claim to be unpalatable to many bird species. Several products available for use to reduce goose damage contain either methyl anthranilate or anthraquinone. Formulations containing those chemicals are liquids that people can apply directly to susceptible resources. Methyl anthranilate applied to alleviate goose damage was effective for about four days depending on environmental conditions, which was a similar duration experienced when applying anthraquinone as geese continued to feed on treated areas (Cummings et al. 1995, Dolbeer et al. 1998). Dolbeer et al. (1998) found that geese tended to loaf on anthraquinone treated turf at a lower abundance, but the quantity of feces on treated and untreated turf was the same; thus, the risk of damage was unabated.

The immobilizing drug alpha chloralose could be available to target geese. WS' personnel could apply alpha chloralose through hand baiting that would target specific individuals or groups of geese. Therefore, WS' personnel would only apply immobilizing drugs after identification of the target occurred prior to application. Pre-baiting and acclimation of geese would occur prior to the application of alpha chloralose, which would allow for the identification of non-targets that may visit the site prior to application of the bait. WS' personnel would retrieve all unconsumed bait after completing the application session. Since sedation occurs after consumption of the bait, personnel would be present on site at all times to retrieve geese. This constant presence by WS' personnel would allow for continual monitoring of the bait to ensure non-targets were not present. Based on the use pattern of alpha chloralose by WS, the program does not expect any adverse effects to occur to non-targets from the use of alpha chloralose.

Since products containing the active ingredient nicarbazin could be commercially available and purchased by people with a certified applicators license, the use of the product could occur under any of the alternatives discussed in the EA. Therefore, the effects from the use of nicarbazin would be similar across all the alternatives if people used the product according to label instructions. Under Alternative 1, WS could use or recommend products containing nicarbazin as part of an integrated approach to managing damage associated with geese if products were registered for use in Mississippi. A product containing the active ingredient nicarbazin is currently available for use in the State to manage local pigeon populations. Products containing nicarbazin are not currently available in the State for use to manage local goose and domestic waterfowl populations. WS' use of nicarbazin under Alternative 1 would not be additive since the use of the product could occur from other sources, such as private pest management companies or those people experiencing damage could become a certified applicator and apply the bait themselves when the appropriate depredation permits were received[20].

[20]A depredation permit would only be required when managing localized Canada goose populations. A depredation permit would not be required to manage pigeon or domestic waterfowl populations.

Exposure of non-target wildlife to nicarbazin could occur from direct ingestion of the bait by non-target animals or from secondary hazards associated with animals consuming geese that have eaten treated bait. The intent of several label restrictions of products containing nicarbazin is to reduce risks to non-target wildlife from direct consumption of treated bait (EPA 2005). The label requires an acclimation period that habituates target geese to feeding in one location at a certain time. During baiting periods, the applicator must be present on site until the target geese consume all of the bait. Following label requirements can further minimize risks to non-target by restricting where an applicator can place baits. In addition, an applicator must retrieve all unconsumed daily, which further reduces threats of non-targets consuming treated bait.

In addition, nicarbazin is only effective in reducing the hatch of eggs when blood levels of 4,4'-dinitrocarbanilide (DNC) are sufficiently elevated in a bird species. When consumed by birds, nicarbazin is broken down into the two base components of DNC and 2-hydroxy-4,6-dimethylpyrimidinal (HDP), which are then rapidly excreted. To maintain the high blood levels required to reduce egg hatch, birds must consume nicarbazin daily at a sufficient dosage that appears to be variable depending on the bird species (Yoder et al. 2005, Avery et al. 2006). For example, to reduce egg hatch in Canada geese, geese must consume nicarbazin at 2,500 ppm compared to 5,000 ppm required to reduce egg hatch in pigeons (Avery et al. 2006, Avery et al. 2008*b*). In pigeons, consuming nicarbazin at a rate that would reduce egg hatch in Canada geese did not reduce the hatchability of eggs in pigeons (Avery et al. 2006). With the rapid excretion of the two components of nicarbazin (DNC and HDP) in birds, non-targets birds would have to consume nicarbazin daily at sufficient doses to reduce the rate of egg hatching.

Secondary hazards also exist from wildlife consuming geese, domestic waterfowl, or pigeons that have ingested nicarbazin. As mentioned previously, once consumed, nicarbazin is rapidly broken down into the two base components of DNC and HDP. DNC is the component of nicarbazin that limits egg hatchability while HDP only aids in absorption of DNC into the bloodstream. DNC is not readily absorbed into the bloodstream and requires the presence of HDP to aid in absorption of appropriate levels of DNC. Therefore, to pose a secondary hazard to animals, ingestion of both DNC and HDP from the carcass would have to occur and an animal would have to ingest HDP at a level to allow for absorption of the DNC into the bloodstream. In addition, a non-target animal would have to ingest an appropriate level of DNC and HDP from a carcass daily to produce any negative reproductive effects to other animals since current evidence indicates a single dose does not limit reproduction. To be effective, target geese must ingest nicarbazin (both DNC and HDP) daily during the duration of the reproductive season to limit the hatchability of eggs. Therefore, to experience the reproductive effects of nicarbazin, a non-target animal would have to consume geese, domestic waterfowl, or pigeons daily that had consumed nicarbazin and a high enough level of DNC and HDP would have to be available in the carcass and consumed to affect reproduction. Based on the risks and likelihood of animals consuming a treated carcass daily and receiving the appropriate levels of DNC and HDP daily to negatively impact reproduction, secondary hazards to animals from the use of nicarbazin are extremely low (EPA 2005).

Although some risks to other non-target species besides bird species does occur from the use of products containing nicarbazin, those risks would likely be minimal given the restrictions on where and how bait could be applied. Although limited toxicological information for nicarbazin exists for wildlife species besides certain bird species, available toxicology data indicates nicarbazin is relatively non-toxic to other wildlife species (World Health Organization 1998, EPA 2005, California Department of Pesticide Regulation 2007). Given the use restriction of nicarbazin products and the limited locations where people can apply bait, the risks of exposure to non-targets would be extremely low.

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 take would occur. Non-lethal methods would

be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. Impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be low.

WS would also employ and/or recommend lethal methods under Alternative 1 to alleviate damage. Lethal methods available for use to manage damage caused by geese under this alternative would include shooting. In addition, WS' personnel could also euthanize target geese once live-captured by other methods. Appendix B further discusses the available methods and the application of those methods to alleviate goose damage. In addition, people could continue to remove geese during the regulated harvest season and through the issuance of depredation permits under this alternative. If the MDWFP implements the depredation/control orders for geese, people experiencing damage would not need a depredation permit from the USFWS to take geese; however, the MDWFP could require people obtain a permit from the MDWFP before conducting activities pursuant to the orders.

The use of firearms would essentially be selective for target geese since the user would identify target geese prior to application; therefore, WS does not anticipate any adverse effects to non-targets from the use of this method. WS' personnel would euthanize geese in accordance with WS Directive 2.505. Chemical methods used for euthanasia would be limited to carbon dioxide administered in an enclosed chamber after geese were live-captured. Since live-capture of geese using other methods would occur prior to the administering of carbon dioxide, no adverse effects to non-targets would occur under this alternative. WS' recommendation that people harvest geese during the regulated season to alleviate damage would not increase risks to non-targets. Shooting would essentially be selective for geese and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method. Additionally, when appropriate, WS would use suppressed firearms to minimize noise and the associated dispersal effect that could occur from the discharge of a firearm.

While WS' personnel would take precautions to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by geese, the use of such methods can result in the incidental take of unintended species. Those occurrences would be rare and should not affect the overall populations of any species under Alternative 1. WS' take of non-target species during activities to reduce damage or threats to human safety associated with geese in Mississippi would be expected to be extremely low to non-existent. WS' personnel have not lethally removed non-targets during prior activities targeting geese in the State. WS would monitor the take of non-target species to ensure program activities or methodologies used in goose damage management do not adversely affect non-targets. Methods available to alleviate and prevent goose damage or threats when employed by trained, knowledgeable personnel would be selective for geese. WS would annually report to the USFWS and/or the MDWFP any non-target take to ensure those agencies have the opportunity to consider take by WS as part of management objectives established. The potential impacts to non-targets would be similar to the other alternatives and are minimal to non-existent.

T&E SPECIES EFFECTS

WS would make special efforts to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. Chapter 3 of this EA describes those SOPs that WS' employees would implement to avoid effects.

Canada geese can occur statewide in Mississippi; therefore, damage or threats of damage caused by geese could occur statewide in Mississippi wherever they occur. However, WS would only conduct activities to alleviate or prevent damage when a landowner or manager requests such assistance and only on properties where WS and a cooperating entity sign a MOU, work initiation document, or another comparable

document. Therefore, WS has defined the action area as the State of Mississippi, which encompasses the known areas occupied by all of the T&E species listed within the State.

Federally Listed Species – WS reviewed the current list of species designated as threatened or endangered in Mississippi as determined by the USFWS and the National Marine Fisheries Service during the development of this EA. Appendix C contains the list of species currently listed in the State along with common and scientific names.

No take of threatened or endangered species by WS has occurred previously in the State during the implementation of activities and the use of methods to manage the damage that geese cause. WS reviewed the status, critical habitats designations, and current known locations of all T&E species listed as threatened or endangered within Mississippi. In addition, WS reviewed the methods available to manage goose damage, the use patterns of those methods, and the areas where previous requests for assistance associated with geese have occurred 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.

Pursuant to Section 7 of the ESA, WS consulted with the USFWS on the effects analysis and determinations. The USFWS concurred with the effects determination made by WS (K. Lunceford, USFWS pers. comm. 2015). The WS' program in Mississippi would also consider the following recommendations made by the USFWS when conducting activities to alleviate the damage that Canada geese cause in the State:

- Avoid working in ponds where dusky gopher frogs are known to occur, avoid working in streams with listed mussels, fish, or turtles, avoid Mississippi sandhill crane nesting areas, avoid sea turtle and piping plover nesting areas (unless conducting activities to protect those species)
- When conducting ground-disturbing activities, the project site should be surveyed for potential roosting locations of T&E bat species, such as culverts, underpasses, caves, abandoned mines and buildings, wells, and snags. Because methods can disturb roosting bats offsite and result in abandonment of an area, activities should be conducted 500 yards away from any identified or potential roosting areas
- In vegetated wetland areas, surveys for Mitchell's satyr butterflies, Price's potato bean, pondberry, and Louisiana quillwort should be conducted, if suitable habitat were present
- Forested areas with suitable habitat for red-cockaded woodpeckers should be surveyed
- Areas with suitable soils and vegetation should be surveyed for gopher tortoises
- Louisiana black bear breeding areas have been documented along the Mississippi River and no activities should take place during the breeding season in those locations
- Areas with suitable nesting/roosting trees within 0.5 miles of large water bodies, such as lakes, reservoirs, or rivers should be surveyed for wood storks and bald eagle activity
- Chemical repellents should not be used in locations with protected species or their habitats

As described previously, methods available to resolve goose damage in Mississippi involve resource management methods, physical exclusion methods, and population management methods. The actual methods applied to resolve requests for assistance would be based on the use of WS' Decision Model (Slate et al. 1992), which allows for an adaptive approach to managing damage or threats of damage. The Decision Model allows WS' personnel to apply site-specific factors into determining the appropriate methods for addressing damage or threats of damage while considering other known factors, such as the likely presence of T&E species in the area where methods would be employed.

State Listed Species – WS has reviewed the current list of State listed species designated as endangered or threatened by the MDWFP (see Appendix D). As part of the development process associated with this

EA, WS initiated consultation with the MDWFP. The MDWFP reviewed the EA and did not provide any concerns relating to threatened or endangered species listed by the MDWFP (C. Dacus, MDWFP pers. comm. 2015). Based on the review by the MDWFP, the use patterns of the methods available, and the locations where activities could occur, Alternative 1 would not adversely affect those species listed as threatened, endangered, or of special concern by the MDWFP. No take of state-listed threatened or endangered species has occurred by WS previously in the State during the implementation of activities and the use of methods to manage the damage that geese cause.

Alternative 2 – Canada Goose 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. Those people requesting assistance could employ methods that WS' personnel recommend or that personnel provide through loaning of equipment. Personnel would use information provided by the person requesting assistance or through site visits to make recommendations using the WS Decision Model. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods that personnel recommend or loan. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations. The only method that would not be available under a technical assistance only alternative would be alpha chloralose, which would only be available for use by WS' employees.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If people employed methods as recommended by WS, the potential impacts to non-targets would likely be similar to Alternative 1. If recommended methods and techniques are not followed or if other methods are employed that were not recommended, the potential impacts on non-target species, including T&E species is likely higher compared to Alternative 1.

The potential impacts of harassment and exclusion methods to non-target species would be similar to those described under Alternative 1. Harassment and exclusion methods are easily obtainable and simple to employ. Since identification of targets would occur when employing shooting as a method and if people were familiar with the identifying characteristics of geese, the potential impacts to non-target species would likely be low under this alternative.

Those people experiencing damage from geese may 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. Potential impacts from providing only technical assistance could be greater than those described in Alternative 1 if those people experiencing damage do not implement methods or techniques correctly. Methods or techniques recommended by WS that were implemented incorrectly could lead to an increase in non-target take.

If requesters were provided technical assistance but do not implement any of the recommended actions and take other actions, the potential impacts to non-targets could be higher compared to Alternative 1. If those people requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to Alternative 1. Methods or techniques that were not implemented as recommended or were used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

It is possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of geese, which could lead to unknown effects on local non-target species populations, including some T&E species. When those people experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have

resorted to using chemical toxicants that are illegal for use on the intended target species (*e.g.*, see White et al. 1989, USFWS 2001, FDA 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.

Those persons requesting assistance would likely be those people who would use lethal methods since a damage threshold had been met for that individual requester that triggered seeking assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose goose damage problems were not effectively alleviated by non-lethal methods could resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than Alternative 1.

The ability to reduce negative impacts caused by geese to wildlife species and their habitats, including T&E species, would be variable 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 3 since WS would be available to provide information and advice.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would not provide assistance with managing damage caused by geese in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Geese could continue to be taken under depredation permits issued by the USFWS, take could continue to occur during the regulated harvest season, and if implemented by the MDWFP, people could lethally remove geese under the depredation/control orders. 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 the other federal, state, and private entities. Although some risks would occur from those people that implement goose damage management in the absence of any involvement by WS, those risks would likely be low, and would be similar to those under the other alternatives.

The ability to reduce damage and threats of damage caused by geese would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. The risks to non-targets and T&E species would be similar across the alternatives since most of those methods described in Appendix B would be available across the alternatives. If those methods available were applied as intended, risks to non-targets would be minimal to non-existent. If methods available were applied incorrectly or applied without knowledge of wildlife behavior, risks to non-target wildlife would be higher under this alternative. If frustration from the lack of available assistance caused those persons experiencing goose damage to use methods that were not legally available for use, risks to non-targets would be higher under this alternative. People have resorted to the use of illegal methods to alleviate wildlife damage that have resulted in the lethal take of non-target wildlife (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003).

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

A common concern is the potential adverse effects that available methods could have on human health and safety. An evaluation of the threats to human safety of methods available occurs below by each of the alternatives.

Alternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)

The MOU, work initiation document, or a similar document signed by the cooperator requesting assistance would include those methods the cooperator has agreed to allow WS' personnel to use on the property the cooperator owns or manages. Therefore, prior to the initiation of any project, the cooperator would be aware of the methods that WS' personnel could use on the property they own or manage, which would assist with identifying any risks to human safety associated with the use of those methods.

Under Alternative 1, WS' personnel could use those methods discussed in Appendix B in an integrated approach to alleviate and prevent damage associated with geese in the State. WS would use the Decision Model to determine the appropriate method or methods that would effectively alleviate the request for assistance. WS' personnel would continue to evaluate those methods for effectiveness and if necessary, WS' personnel could employ additional methods that the cooperator has agreed to. WS' personnel could use non-lethal and lethal methods under Alternative 1. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from geese. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under Alternative 2. The use of non-lethal methods by WS' personnel as part of an integrated approach to managing damage would be similar to those risks addressed in the other alternatives.

Although hazards to human safety from non-lethal, non-chemical methods exist (*e.g*., pyrotechnics, propane cannons, exclusion), those methods would generally be regarded as safe when used by trained individuals who were experienced in their use. Although some risk of fire and bodily harm would exist from the use of pyrotechnics, lasers, and propane cannons, when used appropriately and in consideration of those risks, WS' personnel and others can use those methods with a high degree of safety.

Lethal methods available under Alternative 1 would include the use of firearms, live-capture followed by euthanasia, and the recommendation that people harvest geese during the regulated hunting season established by the USFWS and the MDWFP. Those lethal methods available under Alternative 1 would also be available under the other alternatives.

WS' employees who conduct activities would be knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. WS' personnel would incorporate that knowledge into the decision-making process inherent with the WS' Decision Model that they would apply when addressing threats and damage caused by geese. Prior to and during the utilization of methods, WS' employees would consider risks to human safety based on location and method. Risks to human safety from the use of methods would likely be greater in urban areas when compared to rural areas that were less densely populated. Personnel would also consider the location where they would conduct damage management activities based on property ownership. If locations where personnel could employ methods occurred 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 occurred at or near public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety would increase. WS' personnel would generally conduct activities when human activity was minimal (*e.g*., early mornings) or in areas where human activities was minimal (*e.g*., in areas closed to the public).

WS has also identified the use of live-capture traps as a potential concern. Live-capture traps available for geese are typically walk-in style traps, such as drive traps, where geese enter but are unable to exit. Other types of live traps could include padded foothold traps. Traps would typically be set in situations where human activity was minimal to ensure public safety. Traps rarely cause serious injury and only

trigger through direct activation of the device. Human safety concerns associated with live traps used to capture geese require direct contact to cause bodily harm. If people leave live-traps undisturbed, risks to human safety would be minimal. The use of live-traps for geese requires the presence of personnel on site to address any geese live-captured; therefore, WS' personnel would be present on site to warn and/or prevent the public from accessing the traps.

Other live-capture devices, such as net guns and net launchers, pose minor safety hazards to the public since activation of the device occurs by trained personnel after observing geese in the capture area of the net. Lasers also pose minimal risks to the public since application occurs directly to geese by trained personnel, which limits the exposure of the public to misuse of the method.

Certain safety issues can arise related to misusing firearms and the potential human hazards associated with firearm use when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearm safety-training course and to remain certified for firearm use, WS' employees must attend a re-certification safety-training course in accordance with WS Directive 2.615. WS' employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they have not been convicted of a misdemeanor crime of domestic violence. WS' personnel would assess each request for assistance before deeming firearms appropriate to alleviate or reduce damage and threats to human safety when conducting activities. WS would work closely with cooperators requesting assistance to ensure employees consider all safety issues before deeming the use of firearms appropriate. The cooperator requesting assistance must agree to the use of all methods, including firearms, to ensure the safe use of methods.

The recommendation by WS that people harvest or allow other people access to their property to harvest geese during the regulated hunting season, which is established by the MDWFP under frameworks determined by the USFWS, would not increase risks to human safety above those risks already inherent with hunting geese. Recommendations to allow hunting on property owned or managed by a cooperator to reduce local goose densities in order to alleviate damage or threats would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting season would further minimize risks associated with hunting. Although hunting accidents do occur, the recommendation of allowing hunting to reduce localized populations of geese would not increase those risks.

Of additional concern is the use of chemical methods and their potential risks to human safety. All WS' personnel who handle and administer chemical methods would receive proper training in the use of those methods. Training and adherence to agency directives would ensure the safety of employees applying chemical methods. All euthanasia would occur in the absence of the public to minimize risks. In addition, the WS program in Mississippi would not donate geese to charitable organizations for human consumption. WS' personnel would dispose of lethally removed geese in accordance with WS Directive 2.515.

The recommendation of repellents or the use of those repellents registered for use to disperse geese in the State could occur under Alternative 1 as part of an integrated approach to managing goose damage. WS' employees would only use and/or recommend those repellents that the EPA and the MDAC have registered for use. Those chemical repellents that would be available to recommend for use or directly used by WS under this alternative would also be available under any of the alternatives. Therefore, risks to human safety from the recommendation of repellents or the direct use of repellents would be similar across all the alternatives. WS' involvement, either through recommending the use of repellents or the direct use of repellents, would ensure that label requirements of those repellents were discussed with those persons requesting assistance when recommended through technical assistance or would be specifically adhered to by WS' personnel when using those chemical methods. Therefore, the risks to

human safety associated with the recommendation of or the direct use of repellents could be lower because of WS' participation.

Threats to human safety from the use of nicarbazin would likely be minimal when following the directions on the label. The use pattern of nicarbazin would also ensure threats to public safety were minimal. The label requires an acclimation period before placing treated bait, which assists with identifying risks, requires the presence of the applicator at the location until target geese have consumed all bait, and requires the applicator to retrieve any unconsumed bait. The EPA has characterized nicarbazin as a moderate eye irritant. Based on the use pattern of the nicarbazin and when following label instructions, risks to human safety would be low with the primary exposure occurring to those handling and applying the product. When WS and other entities follow the safety procedures required by the label, risks to handlers and applicators would be minimal.

Alpha chloralose is a chemical immobilizing agent available only for use by WS. The FDA has approved the use of alpha chloralose as an INAD (INAD #6602) for use by trained WS' personnel to immobilize and capture certain species of birds. Alpha chloralose is available as a tablet that WS' employees can place inside a small ball of bread and as a liquid solution that personnel can place on bread balls or mix on whole kernel corn. Baiting occurs by hand with applicators present on site for monitoring. Application of the tablet or liquid solution form in bread baits occurs by hand and targets individual or small groups of geese. Personnel using alpha chloralose formulated on whole corn place the bait on the ground in designated areas where personnel have pre-conditioned target geese to feed using a pre-bait. WS' employees must retrieve all unconsumed bait. Since applicators would be present at all times during application of alpha chloralose, the risks to human safety would be low. All WS' employees using alpha chloralose complete a training course on the proper use and handling of alpha chloralose. All WS' employees who use alpha chloralose would wear the appropriate personal protective equipment required to ensure the safety of employees.

Of additional concern with the use of immobilizing drugs and reproductive inhibitors would be the potential for human consumption of meat from geese that have been immobilized using alpha chloralose or have consumed nicarbazin. Since hunters could harvest geese during a regulated harvest season and consume harvested geese, the use of immobilizing drugs and nicarbazin would also be a concern.

The FDA has characterized nicarbazin as a veterinary drug since 1955 for use in broiler chickens to treat outbreaks of coccidiosis. The FDA has established a tolerance of nicarbazin residues of four parts per million allowed in uncooked chicken muscle, skin, liver, and kidney (see 21 CFR 556.445). The EPA characterized the risks of human exposure as low when used to reduce egg hatchability in Canada geese. The EPA also concluded that if human consumption occurred, a person would have to consume a prohibitively large amount of nicarbazin to produce toxic effects (EPA 2005). In addition, nicarbazin is restricted to use in urban area, such as office parks, recreational parks, airports, golf courses, schools, hospitals, restaurants, and commercial/industrial sites, and airports in rural areas. In urban areas, where WS' personnel could use nicarbazin, hunting, and therefore, the harvesting of geese, does not generally occur due to prohibitions on discharging firearms within city limits and other city ordinances. However, geese could disperse from breeding areas in urban areas to areas where hunting occurred. Geese generally lay eggs from early-April through mid-May (Mowbray et al. 2002). In general, hunting seasons for geese and other harvestable bird species occur in the fall; therefore, the use of nicarbazin has likely ended several months prior to the onset of the hunting seasons, which would further minimize any risks to human safety from consuming geese that have ingested nicarbazin.

The intended use of alpha chloralose is to live-capture geese. Primarily geese in urban areas where hunting and the harvest of geese does not occur or is unlikely to occur (*e.g.*, due to city ordinances preventing the discharge of a firearm within city limits) would be targeted with immobilizing drugs or

reproductive inhibitors. Prebaiting procedures when using alpha chloralose can condition geese to feed during a period in the day when consumption of treated bait ensures geese do not disperse from the immediate area where the bait is applied. Approximately 45 minutes after consuming treated bait, geese can be hand captured and removed from the location. However, it could be possible for target geese to leave the immediate area where baiting was occurring after consuming bait and enter areas where hunting could occur. To mitigate this risk, withdrawal times are often established. A withdrawal time is the period established between when the animal consumed treated bait to when it is safe to consume the meat of the animal by people. In compliance with FDA use restrictions, WS' personnel cannot use alpha chloralose for 30 days prior to and during the hunting season on geese and other game birds that people can hunt. In the event that WS receives a request to immobilize geese using alpha chloralose during a period when harvest of geese was occurring or during a period where a withdrawal period could overlap with the start of a harvest season, WS would not use alpha chloralose. In those cases, WS' personnel would use other methods.

WS could also use paintball guns to disperse geese. Paintballs do not actually contain paint, but are marking capsules that consist of a gelatin shell filled with a non-toxic glycol and water-based coloring that rapidly dissipates and is not harmful to the environment. Although the ingredients may vary slightly depending on the manufacturer, paintball ingredients may include polyethylene glycol, gelatin, glycerine (glycerol), sorbitol, water, ground pigskin, dipropylene glycol, mineral oil, and dye as the colorant (Donaldson 2003). Paintballs are considered non-toxic to people and do not pose an environmental hazard, as described on product labeling and Material Safety Data Sheets. However, consumption may cause toxicosis in dogs, which is potentially fatal without supportive veterinary treatment (Donaldson 2003). Little is known about the mechanism of action and lethal dose for dogs that consume paintballs, but it is suspected that there is an osmotic diuretic effect resulting in an abnormal electrolyte and fluid balance (Donaldson 2003). Most affected dogs recovered within 24 hours (Donaldson 2003).

Chapter 3 of the EA further describes SOPs that WS' personnel would incorporate into activities to minimize risks to human safety. No adverse effects to human safety have occurred from WS' use of methods to alleviate goose damage in the State from FY 2010 through FY 2014. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, would be considered low. As stated previously, WS would only use legal, effective, and environmentally safe methods, tools, and approaches. The EPA, through FIFRA, the FDA, the MDAC, MOUs with land managing agencies, and WS' Directives would regulate how WS' personnel use chemical methods. 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 people or populations. In contrast, two of the alternatives analyzed in detail may benefit minority or low-income populations by reducing threats to public health and safety and property damage when WS receives requests for assistance. In addition, WS and the TVA make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS and the TVA have 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 would adversely affect children. For those reasons, WS and the TVA conclude that it would not create an environmental health or safety risk to children from implementing this alternative or any of the other alternatives. Based on the use patterns of methods available to address damage caused by geese, this alternative would comply with Executive Order 12898 and Executive Order 13045.

Alternative 2 - Canada Goose 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 alleviate damage. WS would only provide technical assistance to those people requesting assistance with goose damage and threats. The only methods that would not be

available under this alternative would be alpha chloralose. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. 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 can be used with a high degree of safety.

The use of chemical methods that are non-lethal would also be available under this alternative. Chemical methods available would include repellents and nicarbazin (if registered for use in the State). There are few chemical repellents registered for use to manage goose damage in the State. Most repellents require ingestion of the chemical to achieve the desired effects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources (*e.g.*, vegetation) and to disperse geese from areas where the repellents are applied. The active ingredients of repellents that are commonly registered for use to disperse geese include methyl anthranilate, polybutene, and anthraquinone. Methyl anthranilate (grape derivative) and anthraquinone (plant extract) are naturally occurring chemicals. Repellents, when used according to label directions, are generally regarded as safe especially when the ingredients are considered naturally occurring. Some risk of exposure to the chemical occurs to the applicator and to others from the potential for drift as the product is applied. Some repellents also have restrictions on whether application can occur on edible plants, with some restricting harvest for a designated period after application. All restriction on harvest and required personal protective equipment would be included on the label and if followed properly, would minimize risks to human safety associated with the use of those products.

Threats to human safety from the recommendation of nicarbazin and the potential subsequent use of nicarbazin by requesters would likely be minimal if the requester followed the labeled directions. The use pattern of nicarbazin would also ensure threats to public safety were minimal. The label requires an acclimation period that assists with identifying risks, requires the presence of the applicator at the location until all bait is consumed, and requires any unconsumed bait to be retrieved. Based on the use pattern of the nicarbazin and if label instructions were followed, risks to human safety would be low with the primary exposure occurring to those handling and applying the product. Safety procedures required by the label, when followed, would minimize risks to handlers and applicators.

The recommendation by WS that geese be harvested during the regulated hunting season, which is established by the MDWFP, would not increase risks to human safety above those risks already inherent with hunting geese. Recommendations to allow hunting on property owned or managed by a cooperator to reduce local goose densities, which could then reduce goose damage or threats would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting season would further minimize risks associated with hunting. Although hunting accidents do occur, the recommendation of allowing hunting to reduce localized goose populations would not increase those risks.

The recommendation of shooting with firearms as a method of direct lethal take could occur under this alternative. Safety issues can 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 are minimal. If firearms were employed inappropriately or without regard to human safety, serious injuries or loss of life 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 goose damage would be available under any of the alternatives and the use of firearms by those persons experiencing goose damage 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 Alternative 1. 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.

The cooperator requesting assistance would also be made aware of threats to human safety associated with the use of those methods. SOPs for methods are discussed in Chapter 3 of this EA. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available. If misused or applied inappropriately, any of the methods available to alleviate goose damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under the no involvement by WS alternative, WS would not be involved with any aspect of managing damage associated with geese in the State, including technical assistance. Due to the lack of involvement in managing damage caused by geese, no impacts to human safety would occur directly from WS. This alternative would not prevent those entities experiencing threats or damage from geese from conducting damage management activities in the absence of WS' assistance. Many of the methods discussed in Appendix B would be available to those persons experiencing damage or threats and could be used to take geese if permitted by the USFWS and/or the MDWFP. The direct burden of implementing permitted methods would be placed on those experiencing damage.

Non-chemical methods available to alleviate or prevent damage associated with geese generally do not pose risks to human safety. Since most non-chemical methods available for goose damage management involve the live-capture or harassment of geese, those methods would generally be regarded as posing minimal risks to human safety. Habitat modification and harassment methods would also generally be regarded as posing minimal risks to human safety. Although, some risks to safety would likely occur from the use of pyrotechnics, propane cannons, and exclusion devices, those risks would be minimal when those methods were used appropriately and in consideration of human safety. The only methods that would be available under this alternative that would involve the direct lethal taking of geese would be shooting and nest destruction. Under this alternative, shooting and nest destruction would be available to those persons experiencing damage or threats of damage when required and permitted by the USFWS and/or the MDWFP. Firearms, when handled appropriately and with consideration for safety, pose minimal risks to human safety.

Similar to the technical assistance only alternative, alpha chloralose would not be available under this alternative to those people experiencing damage or threats from geese. Chemical methods that would be available to the public would include repellents and if a person obtained the appropriate restricted use pesticide license, nicarbazin, if registered in the State, could be applied. Since most methods available to alleviate or prevent goose damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. However, methods employed by those people not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Effects on the Aesthetic Values of Canada Geese

People often enjoy viewing, watching, and knowing geese exist as part of the natural environment and gain aesthetic enjoyment in such activities. Those methods available to alleviate damage are intended to

disperse and/or remove geese. Non-lethal methods are intended to exclude or make an area less attractive, which disperses geese to other areas. Similarly, lethal methods are intended to remove those geese identified as causing damage or posing a threat of damage. The effects on the aesthetic value of geese as it relates to the alternatives are discussed below.

Alternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)

Under Alternative 1, methods would be employed that would result in the dispersal, exclusion, or removal of individuals or small groups of geese to alleviate damage and threats. In some instances where geese were dispersed or removed, the ability of interested persons to observe and enjoy those geese would likely temporarily decline.

Even the use of exclusionary devices could lead to the dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant was removed or made unavailable, the geese would likely disperse to other areas where resources were more vulnerable.

The use of lethal methods could result in temporary declines in local populations resulting from the removal of geese to address or prevent damage and threats. The goal under Alternative 1 would be to respond to requests for assistance and to manage those geese responsible for the resulting damage. Therefore, the ability to view and enjoy geese would remain if a reasonable effort were made to locate geese outside the area in which damage management activities occurred. Those geese removed by WS would be those geese that could be removed by the person experiencing damage in the absence of assistance by WS.

Activities would only be conducted on properties where a request for assistance was received and activities would only be conducted after an agreement for such services had been agreed upon by the requester. Some aesthetic value would be gained by the removal of geese and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high goose densities.

Since those geese removed by WS under this alternative could be removed by other entities, WS' involvement in removing those geese would not likely be additive to the number of geese that could be taken in the absence of WS' involvement. Geese could be removed by other entities with a depredation permit issued by the USFWS and the MDWFP, under depredation/control orders (if implemented), or during the regulated hunting seasons.

WS' take of geese from FY 2010 through FY 2014 has been of low magnitude when compared to the population estimates, trending data, and other available information. WS' activities would not likely be additive to the geese that would be taken in the absence of WS' involvement. Although geese removed by WS would no longer be present for viewing or enjoying, those geese would likely be taken by the property owner or manager if WS were not involved in the action. Given the limited take proposed by WS under this alternative, when compared to the known sources of mortality of geese and their population information, damage management activities conducted by WS pursuant to Alternative 1 would not adversely affect the aesthetic value of geese. The impact on the aesthetic value of geese and the ability of the public to view and enjoy geese under Alternative 1 would be similar to the other alternatives and would likely be low.

Alternative 2 - Canada Goose Damage Management by WS through Technical Assistance Only

If those people seeking assistance from WS were those persons likely to conduct goose damage management activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of geese in the State similar to Alternative 1. Geese could be lethally taken under this alternative by those entities experiencing goose damage or threats, which could result in localized reductions in the presence of geese at the location where damage was occurring. The presence of geese where damage was occurring could be reduced where damage management activities were conducted under any of the alternatives. Even the recommendation of non-lethal methods would likely result in the dispersal of geese from the area if those non-lethal methods recommended by WS were employed by those people receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of geese since any activities conducted to alleviate goose damage could occur in the absence of WS' participation in the action, either directly or indirectly.

Under this alternative, the effects on the aesthetic values of geese would be similar to those addressed for Alternative 1. When people seek assistance with managing damage from WS or another entity, the damage level has often reached an unacceptable threshold for that particular person. Therefore, in the case of goose damage, the social acceptance level of those geese has reached a level where assistance has been requested and those persons would likely apply methods or seek those entities that would apply those methods based on recommendations provided by WS or by other entities. Based on those recommendations, methods would likely be employed by the requester that would result in the dispersal and/or removal of geese responsible for damage or threatening safety. If those geese causing damage were dispersed or removed by those people experiencing damage based on recommendations by WS or other entities, the potential effects on the aesthetic value of those geese would be similar to Alternative 1.

The impacts on aesthetics from a technical assistance program would only be lower than Alternative 1 if those individuals experiencing damage were not as diligent in employing those methods as WS would be if conducting an operational program. If those people experiencing damage abandoned the use of those methods, then geese would likely remain in the area and available for viewing and enjoyment by those people interested in doing so. Similar to the other alternatives, the geographical area in which damage management activities occurs would not be such that geese would be dispersed or removed from such large areas that opportunities to view and enjoy geese would be severely limited.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under the no goose damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of geese in the State. Those people experiencing damage or threats from geese would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown, but likely lower compared to damage management activities that would occur where some level of assistance was provided. Geese could still be dispersed or removed under this alternative by those persons experiencing damage or threats of damage. The potential impacts on the aesthetic values of geese could be similar to Alternative 1 if similar levels of damage management activities are conducted by those people experiencing damage or threats or is provided by other entities. If no action was taken or if activities were not permitted by the USFWS and/or the MDWFP, then no impact on the aesthetic value of geese would occur under this alternative.

Geese could continue to be dispersed and lethally taken by other entities under this alternative. Lethal take would continue to occur when permitted by the USFWS and the MDWFP through the issuance of depredation permits. Take could also occur during the regulated harvest season for certain species,

pursuant to depredation/control orders, pursuant to depredation permits, and in the case of some species, take could occur any time without the need for a depredation permit.

Since other entities could continue to take geese under this alternative despite WS' lack of involvement, the ability to view and enjoy geese would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of geese dispersed or taken since WS has no authority to regulate take or the harassment of geese in the State. The USFWS and the MDWFP, with management authority over geese, would continue to adjust all take levels based on population objectives for geese in the State. Therefore, the number of geese lethally taken annually through hunting, depredation permits, and under the depredation/control orders would be regulated and adjusted by the USFWS and/or the MDWFP.

Those people experiencing damage or threats would continue to use those methods they feel appropriate to alleviate goose damage or threats, including lethal take. Therefore, WS' involvement in goose damage management would not be additive to the geese that could be lethally removed in the State. The impacts to the aesthetic value of geese would be similar to the other alternatives.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

Humaneness and animal welfare concerns associated with methods available for use to manage goose damage have been identified as an issue. As described previously, most of those methods available for use to manage goose damage would be available under any of the alternatives, when permitted by the USFWS and/or the MDWFP, when required. The humaneness and animal welfare concerns of methods available for use in Mississippi, as the use of those methods relates to the alternatives, is discussed below.

Alternative 1 - Using an Adaptive Integrated Methods Approach by WS to Manage Canada Goose Damage (Proposed Action/No Action)

Under Alternative 1, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under Alternative 1 could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, WS would use non-lethal methods that were generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, reproductive inhibitors, immobilizing drugs, nest/egg destruction, cage traps, nets, and repellents.

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 people believe any use of lethal methods to alleviate damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Other people 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 address 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 animals addressed when attempting to alleviate 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, many members of the public would consider a cage trap to be a "*humane*" method. Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately. Some concern arises from the use of live-capture methods causing stress on the animal, but if used appropriately, the stress is minimal and only temporary. Overall, many people consider the use of non-lethal management methods as humane when used appropriately.

Although some concerns of humaneness and animal welfare could occur from the use of cage traps, nets, immobilizing drugs, reproductive inhibitors, and repellents, 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 could occur from injuries to animals while restrained, 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 geese were to be live-captured by WS, WS' personnel would be present on-site during capture events or WS' employees would check methods at least once every 24 hours to ensure WS' employees addressed geese captured quickly to prevent injury. Although stress could occur to an animal restrained in a live-capture device, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

Under Alternative 1, lethal methods could also be employed to alleviate or prevent goose damage and threats, when requested. Lethal methods would include shooting, the recommendation that geese be harvested during the regulated hunting seasons, and euthanasia after geese were live-captured. WS' use of euthanasia methods under Alternative 1 would follow those methods required by WS' directives (see WS Directive 2.430, WS Directive 2.505).

The euthanasia methods being considered for use under Alternative 1 for live-captured geese would be cervical dislocation and carbon dioxide. The AVMA guidelines on euthanasia list cervical dislocation, carbon dioxide, and gunshot as conditionally acceptable, methods of euthanasia for free-ranging birds that can lead to a humane death (AVMA 2013). The use of cervical dislocation, carbon dioxide, or gunshot for euthanasia would occur after the animal had been live-captured and away from public view. Although the AVMA guidelines list cervical dislocation and gunshot as conditionally acceptable methods of euthanasia for free-ranging wildlife, there is greater potential those methods may not consistently produce a humane death (AVMA 2013). WS' personnel that employ methods to euthanize live-captured geese would be trained in the proper use of those methods to ensure a timely and quick death.

The use of nicarbazin would generally be considered as a humane method of managing local populations of geese. Nicarbazin reduces the hatchability of eggs laid by geese and appears to have no adverse effects on geese. Consuming bait daily did not appear to adversely affect those chicks that hatched from parents fed nicarbazin (Avery et al. 2006, Avery et al. 2008*b*). Nicarbazin has been characterized as a veterinary drug since 1955 by the FDA for use in broiler chickens to treat outbreaks of coccidiosis with no apparent ill effects to chickens. Based on current information and research, the use of nicarbazin would generally be considered humane.

Alpha chloralose could be used by WS as a sedative to live-capture geese and other waterfowl. Although overdosing geese with alpha chloralose can cause death, WS would employ alpha chloralose as a non-lethal method only. When using alpha chloralose, WS' personnel would be present on site to retrieve geese that become sedated. Some concern occurs that geese may drown if sedation occurs while they are loafing on water. WS would ensure that a boat and/or a canoe were available for quick retrieval of geese that become sedated while in the water.

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 are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Those methods discussed in Appendix B to alleviate goose damage and/or threats in the State, except for alpha chloralose, could be used under any of the alternatives by those people experiencing damage regardless of WS' direct involvement. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives. 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 are used by WS as humanely as possible are listed in Chapter 3.

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 are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Alternative 2 - Canada Goose Damage Management by WS through Technical Assistance Only

The issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed for Alternative 1. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not 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. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to Alternative 1.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing geese and to ensure methods are 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 person using the methods to resolve the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of geese or improperly identifying the damage caused by geese along with inadequate knowledge and skill in using methodologies to alleviate the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed for Alternative 1.

Those people requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not addressed timely, could experience distress. The amount of time an animal is restrained under Alternative 1 would be shorter compared to a technical assistance alternative if

those requesters implementing methods were not as diligent or timely in checking methods. Similar to Alternative 3, it can be difficult to evaluate the behavior of individual people and determining what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative since determining human behavior can be difficult. If those persons seeking assistance from WS apply methods recommended by WS through technical assistance as intended and as described by WS, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of geese would likely be higher.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would not be involved with any aspect of goose damage management in Mississippi. Those people experiencing damage or threats associated with geese could use those methods legally available and permitted by the USFWS, the MDWFP, and federal, state, and local regulations. 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. A method considered inhumane, would still be perceived as inhumane regardless of the person or entity applying the method. However, even methods generally regarded as being humane could be employed in inhumane ways. Methods could be employed inhumanely by those people inexperienced in the use of those methods or if those people were not as diligent in attending to those methods.

The efficacy and, therefore, the humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of geese 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 the public for use to alleviate damage and threats caused by geese. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing goose damage apply those methods considered humane as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If persons employ humane methods in ways that are inhumane, the issue of method humaneness could be greater under this alternative if those persons experiencing goose damage are not provided with information and demonstration on the proper use of those methods. However, the level at which people would apply humane methods inhumanely under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives.

4.2 CUMULATIVE IMPACTS OF ALTERNATIVE 1 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 1 and Alternative 2, WS would address damage associated with geese either by providing technical assistance (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 1) in the State. WS would be the primary agency conducting direct operational goose damage management in the State under Alternative 1. However, other federal, state, and private

entities could also be conducting goose damage management in the State. The take of native migratory bird species, including Canada geese, requires a depredation permit from the USFWS pursuant to the MBTA, which requires permit holders to report all take occurring under the permit. People can also harvest geese during the annual regulated harvest season.

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct damage management activities at adjacent sites within the same period. In addition, commercial pest control companies may 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 combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the USFWS, and the MDWFP, activities of each agency and the take of geese would be available. Damage management activities in the State would be monitored to evaluate and analyze activities to ensure they are within the scope of analysis of this EA.

Issue 1 - Effects of Damage Management Activities on Canada Goose Populations

Evaluation of activities relative to geese indicated that program activities would likely have no cumulative adverse effects on goose populations when targeting those species responsible for 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 are not limited to

- Natural mortality of geese
- Human-induced mortality through vehicle strikes, aircraft strikes, and illegal take
- Human-induced mortality of geese through private damage management activities
- Human-induced mortality through regulated 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 goose populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate goose populations or place geese at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to 1) evaluate damage occurring (including other affected elements and the dynamics of the damaging species); 2) to determine appropriate strategies to minimize effects on environmental elements; 3) applies damage management actions; and 4) subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on the goose population.

With management authority over goose populations, the USFWS and/or the MDWFP could adjust take levels, including the take by WS, to ensure population objectives for geese were achieved. Consultation and reporting of take by WS would ensure the USFWS and/or the MDWFP considered any activities conducted by WS.

As stated previously, WS would not use those lethal methods available as population management tools over broad areas. WS would use lethal methods to reduce the number of geese present at a location where damage was occurring by targeting those geese causing damage or posing threats; therefore, the intent of lethal methods would be to manage those geese causing damage and not to manage the entire goose population.

WS' take of geese in Mississippi from FY 2010 through FY 2014 was of a low magnitude when compared to the total known take and when compared to available population information. The USFWS and the MDWFP considers all known take when determining population objectives for geese and could adjust the number of geese that could be taken during the regulated hunting season and the number of geese taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the USFWS and the MDWFP. Any goose population declines or increases induced through the regulation of take would be the collective objective for goose populations established by the USFWS and the MDWFP. Therefore, the cumulative take of geese annually or over time by WS would occur at the desire of the USFWS and/or the MDWFP as part of management objectives for geese in the State. No cumulative effects to goose populations would be expected from WS' damage management activities based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

Damage management activities 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 are identified and addressed. WS would work closely with state and federal resource agencies to ensure damage management activities would not adversely affect goose populations and that WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage geese in Mississippi have not reached a magnitude that would cause adverse impacts to goose populations in the State.

SOPs built into the WS program

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

Issue 2 - Effects on the Populations of Non-target Animals, Including T&E Species

Potential effects on non-target species from conducting goose 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 geese has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the lethal take of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion does not involve lethal take, cumulative impacts on non-target species from the use of exclusionary methods would not occur, but would likely disperse those individuals to other areas. Exclusionary methods often require constant maintenance or application to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small, high-value areas and not used to the extent that non-targets are excluded from large areas that would cumulatively impact populations from the inability to access a resource (*e.g.,* food sources or nesting sites). The use of visual and auditory harassment and dispersal methods would generally be temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the lethal take of non-target species and, similar to exclusionary methods, are not 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 geese followed by euthanasia) also have the potential to affect non-target wildlife through the lethal take or capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by a target individual. Capture methods are 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 are 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 geese that would be subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured can be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods would essentially be selective for geese since identification of an individual is made prior to the application of the method. Euthanasia methods are applied through direct application to target wildlife. Therefore, the use of those methods would not affect non-target species.

Chemical methods available for use under Alternative 1 would be taste repellents, nicarbazin, and alpha chloralose, which are described in Appendix B. Except for repellents that would be applied directly to the affected resource, all chemical methods would be employed using baits that would be highly attractive to geese and would be used in areas where exposure to non-targets would be minimal. The use of those methods requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals would be used according to the product label, which would ensure that proper use would minimize non-target threats. WS' adherence to directives and SOPs governing the use of chemicals also ensures non-target hazards would be minimal.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according with WS' Directives and relevant federal, state, and local regulations. The amount of chemicals used or stored by WS would be minimal to ensure human safety. Based on this information, WS' use of chemical methods, as part of Alternative 1, would not have cumulative effects on non-targets.

All label requirements of nicarbazin would be followed to minimize non-target hazards. As required by the label, all potential bait sites are pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets were observed feeding on the pre-bait, the plots would be abandoned and no baiting would occur at those locations. Once sites were baited, sites would be monitored to observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be abandoned.

Only those repellents registered for use in the State by the EPA and the MDAC would be used or recommended by WS as part of an integrated approach to managing damage and threats associated with geese. The recommendation and/or use of repellents would also follow all label instructions approved by the EPA. Repellents would be registered in accordance with the FIFRA through a review process administered by the EPA. The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. Repellents available for use to disperse geese from areas of application must be registered with the EPA according to the FIFRA. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and the applicator. When repellents that were registered for use by the EPA in accordance to the FIFRA were applied according to label requirements, no adverse effects to non-targets would be expected.

The active ingredient in numerous commercial repellents is methyl anthranilate, which is a derivative of grapes and sometimes used as a flavoring in food and as a fragrance in cosmetics. Other repellents available contain the active ingredient polybutene, which, when applied, creates a sticky surface intended to prevent perching. Other goose repellents commonly registered contain the active ingredient anthraquinone, which is a naturally occurring plant extract. Characteristics of those chemicals and potential use patterns indicate that WS use of those products in Mississippi would have no significant cumulative impacts related to environmental fate when WS uses those products according to label requirements.

The use of immobilizing chemicals, reproductive inhibitors, and euthanasia methods are essentially selective for geese since identification of an individual is made prior to the application of the method. Immobilizing chemicals and reproductive inhibitors would be applied using hand baiting, which targets individuals or groups of geese that have been acclimated to feeding on the bait in a certain location. With immobilizing drugs and reproductive inhibitors, all unconsumed bait must be retrieved after each application, which further limits non-target exposure. With immobilizing chemicals, the applicator would be present on-site at all times to retrieve sedated geese, which allows for constant monitoring for non-targets in the area of application. Euthanasia methods require the target bird species to be restrained before application, which allows for any non-targets to be released if captured. Therefore, the use of immobilizing chemicals, reproductive inhibitors, or euthanasia methods would not affect non-target species.

The methods described in Appendix B have a high level of selectivity and can be employed using SOPs to ensure minimal effects to non-target species. Non-targets were not taken by WS in Mississippi during activities to alleviate goose damage from FY 2010 through FY 2014. Based on the methods available to alleviate goose 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. Therefore, take of non-targets under Alternative 1 would not cumulatively affect non-target species. WS' has reviewed the T&E species and re-initiated consultation with the MDWFP, the TDEC, and the USFWS. WS would abide by the outcome associated with 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

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods would be used after careful consideration of the safety of those people employing methods and to the public. Capture methods would be employed where human activity was minimal to ensure the safety of the public, whenever possible. Capture methods also require direct contact to trigger, ensuring 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 another comparable document between WS and the cooperating entity. SOPs would also ensure the safety of the public from those methods used to capture or take wildlife. Firearms used to alleviate or prevent damage, though hazards do exist, are employed to ensure the safety of employees and the public.

Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods to ensure the safety of the applicator and the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively affect human safety.

Repellents to disperse geese from areas of application are available. All repellents must be registered with the EPA according to the FIFRA and registered for use in the State with the MDAC. Many of the

repellents currently available for use have active ingredients that are naturally occurring and are generally regarded as safe. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and the applicator. When repellents were applied according to label requirements, no adverse effects to human safety would be expected.

Chemical methods available for use under Alternative 1 are repellents, reproductive inhibitors, immobilizing drugs, and euthanasia chemicals described in Appendix B. Repellents are commercially available to the public and can be applied over large areas to discourage geese from feeding in an area. The active ingredients of those repellents available for geese are methyl anthranilate and anthraquinone. Methyl anthranilate, which has been classified by the FDA as a product that is "*generally recognized as safe*", is a naturally occurring chemical found in grapes, and is synthetically produced for use as a grape food flavoring and for perfume (see 21 CFR 182.60). The EPA exempts methyl anthranilate from the requirement of establishing a tolerance for agricultural applications (see 40 CFR 180.1143). The final ruling published by the EPA on the exemption from the requirement of a tolerance for methyl anthranilate concludes with reasonable certainty that no harm would occur from cumulative exposure to the chemical by the public, including infants and children, when applied according to the label and according to good agricultural practices (see 67 FR 51083-51088). Based on the use patterns of methyl anthranilate and the conclusions of the FDA and the EPA on the toxicity of the chemical, WS' use of methyl anthranilate and the recommendation of the use the chemical would not have cumulative impacts.

Additional repellents could contain the active ingredient anthraquinone. Overall, the EPA considers the toxicological risk from exposure to anthraquinone to be negligible (EPA 1998). The EPA also considers the primary cumulative exposure is most likely to occur to handlers and/or applicators from dermal, oral, and inhalation exposure but consider the exposure risks, when appropriate measures are taken, to be negligible (EPA 1998). Therefore, the EPA concluded that cumulative effects were not expected from any common routes of toxicity (EPA 1998). Based on the known use patterns and the conclusions of the EPA, no cumulative effects are expected from WS' use of anthraquinone or the recommendation of the use of anthraquinone.

WS would only use the immobilizing drug alpha chloralose to capture geese. To capture geese, WS would insert alpha chloralose tablets into a dough ball made out of bread or WS would mix the powder form onto whole kernel corn or into bread baits. After an acclimation period where geese were habituated to feeding on a certain bait, being fed at a certain time, and at a certain location, treated baits are substituted for the pre-bait. As required by WS' use of alpha chloralose under the INAD, all unconsumed bait must be retrieved. Since target wildlife are habituated to feed at a certain location and a certain time on a similar pre-bait, a general estimate of the needed bait can be determined and bait is readily consumed by geese which limits the amount of time bait is exposed. Application of alpha chloralose is limited in duration given that baiting ceases once the target geese are removed. Through acclimation, the majority of target geese can be conditioned to feed at a certain time and location, which allows for the majority of target geese to be removed after an initial application of alpha chloralose treated baits. Some follow-up baiting could occur to remove any remaining geese that were not captured during the initial baiting efforts. In compliance with FDA use restrictions, the use of alpha chloralose is prohibited for 30 days prior to and during the hunting season on geese and other game geese that could be hunted. Given the use patterns of alpha chloralose described, no cumulative impacts from the use of alpha chloralose to capture geese would be expected.

WS' personnel would be required to attend training courses on the proper use of alpha chloralose and employees using alpha chloralose must be certified in the application of alpha chloralose. Training would ensure proper care and handling occurred, ensure that proper doses were administered, and ensure human safety.

Direct application of chemical methods would ensure that there are no cumulative impacts to human safety. All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according to FDA regulations, including the directives of the cooperating agencies. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on this information, the use of chemical methods as part of Alternative 1 by WS and cooperating agencies would not have cumulative impacts on human safety.

The only euthanasia chemical proposed for use by WS is carbon dioxide, which is an approved method of euthanasia for birds by the AVMA. Carbon dioxide is naturally occurring in the environment ranking as the fourth most abundant gas in the atmosphere. However, in high concentrations, carbon dioxide causes hypoxia due to the depression of vital centers. Carbon dioxide is considered a moderately rapid form of euthanasia (AVMA 2013). Carbon dioxide is commercially available as a compressed bottled gas. Carbon dioxide is a colorless, odorless, non-flammable gas used for a variety of purposes, such as in carbonated beverages, dry ice, and fire extinguishers. Although some hazards exist from the inhalation of high concentrations of carbon dioxide during application for euthanasia purposes, when used appropriately, the risks of exposure are minimal. Since carbon dioxide is a common gas found in the environment, the use of and/or recommending the use of carbon dioxide for euthanasia purposes will not have cumulative impacts.

No cumulative effects from the use of those methods discussed in Appendix B would be expected given the use patterns of those methods for resolving goose damage in the State. For these reasons, WS concludes that the use of methods would not create an environmental health or safety risk to children from implementing Alternative 1. It is not anticipated that Alternative 1 or the other alternatives would result in any adverse or disproportionate environmental impacts to minorities or persons and populations of low-income people.

Issue 4 - Effects on the Aesthetic Values of Canada Geese

The activities of WS would result in the removal of geese from those areas where damage or threats were occurring. Therefore, the aesthetic value of geese in those areas where damage management activities were being conducted would be reduced. However, for some people, the aesthetic value of a more natural environment would be gained by reducing goose densities, including the return of native plant species that may be suppressed or killed by accumulations of fecal droppings by high goose densities found under roost areas.

Some people experience a decrease in the aesthetic enjoyment of wildlife because they feel that overabundant species are objectionable and interfere with their enjoyment of wildlife in general. Continued increases in numbers of individuals or the continued presence of geese may lead to further degradation of some people's enjoyment of any wildlife or the natural environment. The actions of WS could positively affect the aesthetic enjoyment of wildlife for those people that are being adversely affected by geese.

Goose population objectives are established and enforced by the USFWS and the MDWFP through the regulating of take after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of the goose population since all take by WS occurs at the discretion of the USFWS and the MDWFP. Since those people seeking assistance could remove geese from areas where damage was occurring with or without a permit from the USFWS and/or the MDWFP, WS' involvement would have no effect on the aesthetic value of geese in the area where damage was occurring. When damage caused by geese has occurred, any removal of geese by the property or resource owner would likely occur whether WS was involved with taking the geese or not. Therefore, the activities of WS would not be

expected to have any cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

WS continues to seek new methods and ways to improve current technology 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.

All methods not requiring direct supervision during employment (*e.g.*, live traps) would be checked and monitored to ensure any wildlife confined or restrained are addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured geese would be applied according to AVMA guidelines for free-ranging wildlife. Shooting would occur in limited situations and personnel would be trained in the proper use of firearms to minimize pain and suffering of geese 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 geese in the State, the cumulative impacts on the issue of method humaneness are minimal. All methods would be evaluated to ensure SOPs were adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured are addressed in a timely manner to minimize distress.

CHAPTER 5 - LIST OF PREPARERS AND/OR PERSONS CONSULTED

5.1 LIST OF PREPARERS, REVIEWERS, AND PERSONS CONSULTED

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APPENDIX A
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APPENDIX B

METHODS AVAILABLE FOR RESOLVING OR PREVENTING CANADA GOOSE DAMAGE

In selecting damage management techniques for specific damage situations, consideration would be given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of Canada goose damage. Consideration would also be given to the status of target and potential non-target species, 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 the WS program in Mississippi relative to the management or reduction of damage from geese. Various federal, state, and local statutes and regulations and WS directives would govern WS' 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 in Mississippi. Many of the methods described would also be available to other entities in the absence of any involvement by WS.

NON-LETHAL WILDLIFE DAMAGE MANAGEMENT METHODS

Non-lethal methods consist primarily of tools or devices used to disperse or capture a particular goose or a local population of geese to alleviate damage and conflicts. Most of the non-lethal methods available to WS would also be available to other entities within the State and could be employed by those entities to alleviate goose damage.

Habitat alteration can be the planting of vegetation unpalatable to wildlife or altering the physical habitat (Conover and Kania 1991, Conover 1992). Conover (1991) found that even hungry Canada geese refused to eat some ground covers such as common periwinkle (*Vinca minor*), English ivy (*Hedera helix*) and Japanese pachysandra (*Pachysandra terminalis*). Planting less preferred plants or grasses to discourage geese from a specific area could work more effectively if good alternative feeding sites are nearby (Conover 1985); however, the manipulation of turf grass varieties in urban/suburban heavy use situations such as parks, athletic fields, and golf courses is often not feasible. Varieties of turf grass that grow well and can withstand regular mowing and regular/heavy human use include Kentucky blue grass, red fescue, perennial bent grass, perennial rye grass, and white clover. All of these grasses are appealing to most waterfowl. The turf grass varieties that are not appealing to geese, such as tall fescue, orchard grass, and timothy, do not withstand regular mowing and/or regular/heavy human use.

Fences, hedges, shrubs, boulders, and other structures can be placed at shorelines to impede goose movements. Restricting a bird's ability to move between water and land could deter them from an area, especially during molts (Gosser et al. 1997); however, people are often reluctant to make appropriate landscape modifications to discourage waterfowl activity (Breault and McKelvey 1991, Conover and Kania 1991). Unfortunately, both people and geese appear to find lawn areas near water attractive (Addison and Amernic 1983) and conflicts between people and geese would likely continue wherever this interface occurs.

Habitat modification can be an integral part of goose damage management. Wildlife production and/or presence are often directly related to the type, quality, and quantity of suitable habitat; therefore, habitat

can be managed to reduce or eliminate the production or attraction of geese or to repel geese. In most cases, the resource or property owner would be responsible for implementing habitat modifications and WS would only provide advice on the type of modifications that would provide the best chance of achieving the desired effect. Habitat management would most often be a primary component of damage management strategies at or near airports to reduce aircraft strike problems by eliminating nesting, roosting, loafing, or feeding sites. Generally, many problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat modification would be available to all entities.

Supplemental feeding and lure crops are food resources planted or provided to attract wildlife away from more valuable resources (*e.g.*, crops). Food is provided so that the animals 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. This method can be ineffective if other food sources are available. For example, lure crops would largely be ineffective for geese since food resources (*e.g.*, turf) are readily available. For lure crops to be effective, the ability to keep geese from surrounding fields would be necessary and the number of alternative feeding sites must be minimal (Fairaizl and Pfeifer 1988). Additionally, lure crops reduce damage for only a short time (Fairaizl and Pfeifer 1988) and damage by geese is generally continuous. The resource owner would be limited in implementing this method contingent upon ownership of or ability to manage the property. Supplemental feeding and the planting of lure crops would be available to other entities within the State.

Modifying human behavior would be methods recommended by WS when providing technical assistance. Recommendations would include modifying the behavior of people that may be attracting or contributing to the damage being caused by geese. For example, artificial feeding of geese by people can attract and sustain more geese in an area than could normally be supported by natural food supplies. This unnatural food source can result in an increase in damage caused by geese. The elimination of feeding of geese is a primary recommendation made by WS, and many local municipalities and homeowners associations have adopted policies and ordinances prohibiting it. Some parks have posted signs, and there may have been efforts made to educate the public on the negative aspects of feeding geese. However, sometimes people do not comply, and the policies are poorly enforced in some areas.

Recommendations may include altering planting dates so that crops are less vulnerable to damage when geese may be present. Modifying human behavior could include recommending people plant crops that are less attractive or less vulnerable to damage. Those recommendations made by WS would be available for implementation by other entities.

Alterations to aircraft flight patterns or schedules could be recommended in cases where the presence of geese at or near airports results in threats to human safety and when such problems cannot be resolved by other means. However, altering operations at airports to decrease the potential for strike hazards would generally not be feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities generally make this practice prohibitive. Some military airbases can restrict flights for short periods of time when this type of management action does not impact mission critical operations. Altering flight schedules at military airbases could be implemented to decrease the potential hazard caused by flocking species of birds such as geese.

Removal of domestic waterfowl could be recommended or implemented by WS and other entities to alleviate damage. Flocks of urban/suburban domestic waterfowl are known to act as decoys and attract other migrating waterfowl (Crisley et al. 1968, Woronecki 1992). Avery (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of domestic waterfowl from water bodies removes birds that act as decoys in attracting other waterfowl. Domestic and feral

waterfowl could also carry diseases, which can threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of the enjoyment of their presence.

Electric fencing could be recommended or implemented by WS and others to alleviate damage caused by geese. The application of electrified fencing would generally be limited to rural settings, due to the possibility/likelihood of interaction with people and pets. Limits of this application arise where there are multiple landowners along a wetland, pond, or lake, the size of the area, and its proximity to bodies of water used by geese. Perceptions from Minnesota on the effectiveness of electric fences were high (Cooper and Keefe 1997). While electric fencing may be effective in repelling geese in some urban settings, its use is often prohibited in many municipalities for human safety reasons. Problems that typically reduce the effectiveness of electric fences include vegetation on fence, flight capable geese, fencing knocked down by other animals (*e.g.*, white-tailed deer and dogs), and poor power. Electric fencing would generally be available to all entities.

Barrier fencing could also be recommended or implemented by WS and others. The construction or placement of physical barriers has limited application for geese and would primarily be recommended or employed to alleviate goose damage. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles, boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing could all be used to limit the movement of Canada geese. The application of this method would be limited to areas that could be completely enclosed and do not allow geese to land inside enclosures. Similar to most abatement techniques, this method has been most effective when dealing with small numbers of breeding geese and their flightless young along wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit goose nesting has entrapped young and resulted in starvation (Cooper 1998). The preference for geese to walk or swim, rather than fly, during this time period contributes to the success of barrier fences. Geese that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing. Exclusion adequate to stop bird movements can also restrict movements of livestock, people, and other wildlife (Fuller-Perrine and Tobin 1993). Barrier fencing would generally be available to all entities.

Surface coverings could be recommended or employed by WS and others to discourage geese from using areas. For example, plastic balls approximately five inches in diameter can be used to cover the surface of a pond and prevent access by geese. A "*ball blanket*" renders a pond unusable for boating, swimming, fishing, and other recreational activities. This method can be very expensive depending on the area covered.

Overhead wire grids consist of wire (*e.g.*, fishing line) grid that is stretched taught over a resource to prevent access by geese. The geese apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. Johnson (1994) found that wire grids could deter crow use of specific areas where they are causing a nuisance. Waterfowl may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993) and are most applicable on ponds of two acres or less. Exclusion may be impractical in most settings (*e.g.*, commercial agriculture, large lakes). Some people could find exclusionary devices, such as wire grids, unsightly and a lowering of the aesthetic value when used. Wire grids generally render an area unusable by people. The cost of constructing and maintaining wire grids could be burdensome for some people.

Visual scaring techniques such as Mylar tape (highly reflective surface produces flashes of light that startles birds), eyespot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, and/or effigies (scarecrows) sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et. al. 1988). Reflective tape has been used successfully to repel some birds from crops when spaced at three to five

meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrich and Craven 1990). Other studies have shown reflective tape ineffective (Bruggers et al. 1986, Dolbeer et al. 1986, Tobin et al. 1988, Conover and Dolbeer 1989). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics. Visual scaring techniques can be impractical in many locations and has met with some concerns due to the negative aesthetic appearance presented on the properties where those methods are used.

Dogs can be effective at harassing geese and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift and Felegy 2009). Although dogs can be effective in keeping geese off individual properties, they do not contribute to a solution for the larger problem of overabundant goose populations (Castelli and Sleggs 2000). Swift and Felegy (2009) reported that when harassment with dogs ceases, the number of geese returns to pre-treatment numbers. WS has recommended and encouraged the use of dogs where appropriate.

Scarecrows and effigies often depict predator animals (*e.g.*, alligators, owls), people, or mimic distressed target species (*e.g.*, dead geese) and they are intended to elicit a flight response from target geese, which disperses those geese from the area. While Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada geese use of agricultural fields in rural areas, their effectiveness in scaring geese from urban/suburban areas was severely limited because geese were not afraid of humans as a result of nearly constant contact with people. In general, scarecrows would be most effective when they were moved frequently, alternated with other methods, and were well maintained; however, scarecrows tend to lose effectiveness over time and become less effective as populations increase (Smith et al. 1999). In general, those methods would be available to all entities.

Alarm or distress calls are electronic devices that mimic the sounds exhibited when target species are in distress, which is intended to cause a flight response and disperse target animals from the area. Alarm calls are given by birds when they detect predators while distress calls are given by birds when they are captured by a predator (Conover 2002). When other birds hear these calls, they know a predator is present or a bird has been captured (Conover 2002). Recordings of both calls have been broadcast in an attempt to scare birds from areas where they are unwanted. Recordings have been effective in scaring starlings from airports and vineyards, gulls from airports and landfills, finches from grain fields, herons from aquaculture facilities, and American crows from roosts (Conover 2002). Aguilera et al. (1991) found distress calls ineffective in causing migratory and resident geese to abandon a pond.

The effectiveness of alarm or distress calls can be reduced as birds become accustomed to the sounds and learn to ignore them. Because alarm or distress calls are given when a bird is being held by a predator or when a predator is present, birds should expect to see a predator when they hear these calls. If they do not, they may become accustomed to alarm or distress calls more quickly. In general, birds tend to habituate to hazing techniques (Zucchi and Bergman 1975, Summers 1985, Aubin 1990). For this reason, scarecrows or effigies should be paired with alarm or distress calls (Conover 2002), pyrotechnics (Mott and Timbrook 1988), or other methods to achieve maximum effectiveness. In some situations, the level of volume required for this method to be effective may disturb local residents or be prohibited by local noise ordinances. Although Mott and Timbrook (1988) reported distress calls were effective at repelling resident geese 100 meters from the distress unit, the geese would return shortly after the calls stopped. The repellency effect was enhanced when pyrotechnics were used with the distress calls. Heinrich and Craven (1990) found that an electronic device was ineffective at repelling migrant waterfowl.

Birds hazed from one area where they were causing damage frequently move to another area where they continue to cause damage (Brough 1969, Conover 1984, Summers 1985, Swift and Felegy 2009). Smith

et al. (1999) noted that others have reported similar results, stating "*biologists are finding that some techniques (e.g., habitat modifications or scare devices) that were effective for low to moderate population levels tend to fail as flock sizes increase and waterfowl become more accustomed to human activity*". Whitford (2003) used a combination of noise harassment, dogs, nest displacement, and visual harassment to chase geese from an urban park during the nesting season. Birds responded by dispersing and continued harassment with alarm calls prevented recolonization of the site during the nesting season.

Lasers and lights are management methods that have been evaluated for a number of species (Glahn et al. 2000*a*, Glahn et al. 2000*b*, Blackwell et al. 2002). For best results and to disperse numerous birds from a roost, a laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallards with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002).

Research on this potential tool has been conducted in a replicated format for double-crested cormorants (Glahn et al. 2000*b*). Moving the laser light through the tree branches rather than touching birds with the laser light elicited an avoidance response from cormorants (Glahn et al. 2000*b*). During pen trials with lasers, the cormorants were inconsistent in their response with some birds showing no response to the laser (Glahn et al. 2000*b*). The lack of overt response by cormorants to lasers is not clearly understood, but suggests laser light is not a highly aversive agent (Glahn et al. 2000*b*). Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing starlings and cowbirds (Blackwell et al. 2002). Lasers were found to be only moderately effective for harassing geese, with significant reduction in night roosting, but little to no reduction in diurnal activity at the site pre- and post-use (Sherman and Barras 2004). In experimental situations, Canada geese have exhibited avoidance reactions to lasers under low light conditions (Blackwell et al. 2002). A field test of lasers at a Pennsylvania site demonstrated effectiveness of lasers in dispersing large flocks of geese off of a lake, with nearly no habituation to the technique (Cepek et al. 2001). Similar to the use of lasers, application of spotlights to haze birds from night roosts has proven to be a moderately effective method. It is a method that can be incorporated with other methods in integrated management plans (VerCauteren et al. 2003).

Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15 mm screamer shells effective at reducing resident and migrant Canada geese use of areas in Colorado. However, Mott and Timbrook (1988) and Aguilera et al. (1991) doubted the efficacy of harassment and believed that moving the geese simply redistributed the problem to other locations. These devices are sometimes effective but usually only for a short period before birds become accustomed and learn to ignore them (*e.g.*, see Arhart 1972, Rossbach 1975, Shirota et al. 1983, Schmidt and Johnson 1984, Mott 1985, Bomford 1990).

Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban areas required continuous harassment throughout the day with frequent discharges of pyrotechnics, but the waterfowl usually returned within hours. A minority of resident Canada goose flocks in Virginia showed no response to pyrotechnics, while some flocks showed quick response to pyrotechnics during winter months, suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Schultz et al. (1988) reported fidelity of resident Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics was partially dependent on availability of alternative loafing and feeding areas. Although one of the more effective methods of frightening geese away, more often than not pyrotechnics simply move geese to other areas. There are

also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, trigger dogs to bark incessantly, and annoy and possibly injure people. Use of pyrotechnics in certain municipalities would be constrained by local firearm discharge and noise ordinances.

Paintballs and recreational paintball equipment may be used to supplement other harassment methods. Paintballs consist of a gelatin shell filled with a non-toxic glycol and water-based coloring that rapidly dissipates and is not harmful to the environment. A paintball marker (or gun) uses compressed CO_2 to propel paintballs an average of 280 feet per second, though they are not very accurate. The discharge of the paintball marker combined with the sound of paintballs hitting the ground or splashing in water may be effective in dispersing birds, especially when combined with other harassment techniques. Although paintballs break easily and velocity rapidly decreases with distance, firing at close range is discouraged to avoid harming birds. As with pyrotechnics, use of paintballs may be restricted in some areas by local ordinances.

Propane cannons produce a noise that is intended to represent a firearm discharge. Cannons are attached to a propane tank and regulated to discharge at certain intervals. Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for geese in agricultural settings, resident geese in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

Methyl anthranilate has been used as an artificial grape flavoring in foods and soft drinks for human consumption. Methyl anthranilate could be used or recommended by WS as a bird repellent and would be available for use by other entities. Methyl anthranilate has been shown to be a promising repellent for many bird species, including waterfowl (Dolbeer et al. 1993). Cummings et al. (1995) found the effectiveness of methyl anthranilate declined significantly after 7 days. Belant et al. (1996) found methyl anthranilate ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. Methyl anthranilate has also been investigated as a livestock feed additive (Mason et al. 1984, Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[21]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[22]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers (Dolbeer et al. 1992). It has been listed as "*Generally Recognized as Safe*" by the FDA (Dolbeer et al. 1992).

Water surface and turf applications of methyl anthranilate are generally considered expensive. A potentially more cost effective method of methyl anthranilate application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated three to five times after the initial treatment before the birds abandon a treatment site.

Nicarbazin is an EPA registered reproductive inhibitor that can be used to reduce egg production and viability in Canada geese and rock pigeons. Nicarbazin is available to certified pesticide applicators and is not restricted to use by WS. Use of baits containing nicarbazin would allow the numbers of small to

[21] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

[22] An LC_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

moderate sized groups of Canada geese to be controlled by reducing the hatchability of eggs laid by treated birds without requiring the location of each individual nest to be determined (as is the case for egg oiling/addling/destruction).

Nicarbazin is thought to induce infertility in birds by two main mechanisms. Nicarbazin may disrupt the membrane surrounding the egg yolk, resulting in intermixing of egg yolk and white (albumin) components, and creating conditions in which the embryo cannot develop. Nicarbazin may also inhibit incorporation of cholesterol into the yolk, a step that is necessary for yolk formation; thereby, limiting energy for the developing embryo. If the yolk does not provide enough energy, the embryo will not completely form and the egg will never hatch. Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming. Nicarbazin is undetectable in the plasma of Canada geese, mallards, and chickens by four to six days after consumption of Nicarbazin bait has stopped. The levels of active ingredient in the blood are reduced by half within one day after bait consumption stops. If the level of active ingredient falls by approximately one-half its peak levels, no effects on egg formation can be seen. This is reached after the second day without bait consumption. Consequently, the bait must be offered to the birds each day of the nesting period to effectively limit reproduction.

Alpha chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl, and other birds. It is labor intensive and in some cases may not be cost effective (Wright 1973, Feare et al. 1981). Alpha chloralose is typically delivered in a well contained bait, in small quantities, and with minimal hazards to pets and humans. Single bread or corn baits are fed directly to the target birds. WS' personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. The solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Alpha chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about 2 to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990) but the compound is not generally soluble in water and, therefore, should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential include the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

Other chemical repellents have shown bird repellent capabilities. Anthraquinone is a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism. Anthraquinone has shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998).

Live traps generally allow target bird species to enter inside the trap but prevent them from exiting the trap. Birds live-captured in traps could be translocated or euthanized. Live traps include:

Drop nets could be suspended over a pre-baited site and manually or remotely triggered to drop on target animals or manually dropped on target birds from a site that overlooks the net, such as a bridge or rooftop. Decoys may also be used to enhance the effectiveness of drop nets.

Cannon nets are normally used for larger birds, such as geese, and require mortar projectiles or compressed air to propel a net up and over birds that have been baited to a particular site.

Padded foothold traps could be employed to live-capture geese. The use of padded foothold traps would occur infrequently but WS' personnel could use them in situations where other methods were impractical or in cases where geese had habituated to other methods. Personnel would place traps on the ground in areas frequently used by the target geese and would be set so the trap caught the target goose by the leg when they stepped on the trap pan, which would trigger the trap. When caught, the weight of the trap and the trap anchor prevents the geese from flying off. WS' personnel would only use foothold traps with padded jaws, which would help prevent injuries when the jaws close on the leg. In addition, personnel would only use traps that closed with enough force to hold geese but would not close with enough force to cause injuries. As an example, Johnson (1994) found that trapping with modified foothold traps could be effective in areas where a small resident crow population is present. No. 0 or 1 foothold traps with padded jaws were used to trap individual birds in areas habitually used by crows. Personnel would monitor traps continuously to quickly address any geese captured.

Net guns/launchers are normally used for flocking birds such as waterfowl and European Starlings. They use a firearm blank or compressed air to propel a weighted net up and over birds, which have been baited to a particular site or birds that do not avoid people. Net guns are manually discharged, while net launchers are remotely discharged from a nearby observation site.

Drive traps could be used to live-capture geese. Corral traps can be effectively used to live capture Canada geese during the annual molt when birds are unable to fly. Each year for a few weeks in the summer, geese are flightless as they are growing new flight feathers and can be slowly guided into corral-traps. Panel nets as described by Costanzo et al. (1995) are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround geese into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces, and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways).

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas that may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations.

Egg addling/destruction are methods of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them or by oiling or spraying the eggs with a liquid, which covers the entire egg and prevents the egg from obtaining oxygen (see egg oiling below).

Egg oiling is a method for suppressing reproduction of nuisance birds by spraying a small quantity of food grade vegetable oil or mineral oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos. This method has been found to be 96-100% effective in reducing hatchability (Pochop et al. 1998*a*, Pochop et al. 1998*b*). The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under FIFRA. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a

nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling.

Live-capture and translocation could be accomplished using methods to live-capture some bird species for translocating and releasing those birds in other areas. WS could employ those methods in Mississippi when the target animal(s) can legally be translocated, captured, and handled with relative safety by WS' personnel.

Smith (1996) reported that groups of juvenile geese relocated from urban to rural settings could effectively eliminate these geese from urban areas, retain them at the release site, include them in the sport harvest, and expose them to higher natural mortality. Smith (1996) also reported that multiple survival models indicated that survival estimates of relocated juveniles were half of those of urban captured and released birds. The relocation of resident geese from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997), and translocating geese has generally been accepted by the public as a method of reducing goose populations to socially acceptable levels (Fairaizl 1992, Powell et al. 2003). In areas where interest in hunting is high, the potential exists for moving nuisance geese to areas more accessible to hunters. In addition, the removal of geese posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local geese and decrease the number of birds flying through the airport operations airspace, resulting in increased air safety at the Minneapolis-St. Paul International Airport (Cooper 1991).

Live capture and handling of birds poses an additional level of human health and safety threat if target birds are aggressive, large, or extremely sensitive to the close proximity of humans. For that reason, WS may limit this method to specific situations and certain species. In addition, moving damage-causing individuals to other locations can typically result in damage at the new location or the translocated individuals can move from the relocation site to areas where they are unwanted. Locating a release site for a large number of birds can prove to be a challenge as well. In addition, translocation can facilitate the spread of diseases from one area to another. High population densities of some animals may make this a poor wildlife management strategy for those species. Translocation would be evaluated by WS on a case-by-case basis. Translocation would only occur with the prior authorization of the USFWS and the MDWFP.

LETHAL WILDLIFE DAMAGE MANAGEMENT METHODS

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally, shooting is conducted with shotguns, rifles, or air rifles. Shooting is a very individual specific method and is typically used to remove a single offending bird; however, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required. It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and centerfire rifles is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. WS' firearm use and safety would comply with WS Directive 2.615.

Sport hunting is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted. A valid hunting license and other licenses or permits may be required by the MDWFP and the USFWS for certain species. This method provides sport and food for hunters and requires no cost to the landowner. Sport hunting is occasionally recommended if it can be conducted safely.

Cervical dislocation is sometimes used to euthanize birds that are captured in live traps. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA considers this technique as a conditionally acceptable method of euthanasia and states that cervical dislocation when properly executed may be a humane technique for euthanasia of poultry and other small birds (AVMA 2013). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

Carbon dioxide is sometimes used to euthanize birds that are captured in live traps. Live birds are placed in a container, such as a plastic 5-gallon bucket or chamber, and sealed shut. Carbon dioxide gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (AVMA 2013). Carbon dioxide gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is released as a gas by dry ice. The use of carbon dioxide by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

APPENDIX C

FEDERAL THREATENED AND ENDANGERED SPECIES IN MISSISSIPPI

Listed species believed to or known to occur in Mississippi
Notes:

- This report shows listed species or populations believed to or known to occur in Mississippi
- This list does not include experimental populations and similarity of appearance listings.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.

Animals	
Status	**Species/Listing Name**
E	Bat, gray (*Myotis grisescens*)
E	Bat, Indiana (*Myotis sodalis*)
T	Bat, Northern long-eared (*Myotis septentrionalis*)
T	Bear, Louisiana black (*Ursus americanus luteolus*)
E	Beetle, American burying (*Nicrophorus americanus*)
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Clubshell, black (*Pleurobema curtum*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, Cumberlandian (*Epioblasma brevidens*)
E	Combshell, southern (*Epioblasma penita*)
E	Crane, Mississippi sandhill (*Grus canadensis pulla*)
T	Darter, bayou (*Etheostoma rubrum*)
C	Darter, pearl (*Percina aurora*)
E	Frog, dusky gopher (*Rana sevosa*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
T	Knot, red (*Calidris canutus rufa*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Pearlymussel, slabside (*Pleuronaia dolabelloides*)
E	Pigtoe, flat (*Pleurobema marshalli*)
E	Pigtoe, heavy (*Pleurobema taitianum*)
C	Pipit, Sprague’s (*Anthus spragueii*)
E	Plover, piping (*Charadrius melodus*)
E	Pocketbook, fat (*Potamilus capax*)
T	Rabbitsfoot (*Quadrula cylindrica cylindrica*)
E	Sawfish, smalltooth (*Pristis pectinata*)

Status	Species/Listing Name
T	Sea turtle, green (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
T	Snake, black pine (*Pituophis melanoleucus lodingi*)
T	Snake, Eastern indigo (*Drymarchon corais couperi*)
E	Stirrupshell (*Quadrula stapes*)
T	Stork, wood (*Mycteria americana*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
T	Sturgeon (Gulf subspecies)(*Acipenser oxyrinchus (=oxyrhynchus) desotoi*)
E	Sturgeon, pallid (*Scaphirhynchus albus*)
E	Tern, least (*Sterna antillarum*)
T	Tortoise, gopher (*Gopherus polyphemus*)
E	Turtle, Alabama red-belly (*Pseudemys alabamensis*)
T	Turtle, ringed map (*Graptemys oculifera*)
T	Turtle, yellow-blotched map (*Graptemys flavimaculata*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)
	Plants
Status	**Species/Listing Name**
E	Chaffseed, American (*Schwalbea americana*)
C	Orchid, white fringeless (*Platanthera integrilabia*)
E	Pondberry (*Lindera melissifolia*)
T	Potato-bean, Price's (*Apios priceana*)
E	Quillwort, Louisiana (*Isoetes louisianensis*)

APPENDIX D

STATE LISTED THREATENED AND ENDANGERED SPECIES IN MISSISSIPPI

MISSISSIPPI NATURAL HERITAGE PROGRAM
Listed Species of Mississippi
- 2015 -

SPECIES NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
BIVALVIA					
Actinonaias ligamentina	Mucket	G5	S1		LE
Cyclonaias tuberculata	Purple Wartyback	G5	S1		LE
Elliptio arctata	Delicate Spike	G3G4	S1		LE
Elliptio dilatata	Spike	G5	S1		LE
Epioblasma brevidens	Cumberlandian Combshell	G1	S1	(LE,XN)	LE
Epioblasma penita	Southern Combshell	G1	S1	LE	LE
Epioblasma triquetra	Snuffbox	G3	S1	LE	LE
Hamiota perovalis	Orange-Nacre Mucket	G2	S1	LT	LE
Medionidus acutissimus	Alabama Moccasinshell	G2	S1	LT	LE
Plethobasus cyphyus	Sheepnose	G3	S1	LE	LE
Pleurobema curtum	Black Clubshell	G1	SX	LE	LE
Pleurobema decisum	Southern Clubshell	G2	S1	LE	LE
Pleurobema marshalli	Flat Pigtoe	GH	SX	LE	LE
Pleurobema perovatum	Ovate Clubshell	G1	S1	LE	LE
Pleurobema rubrum	Pyramid Pigtoe	G2	S1		LE
Pleurobema taitianum	Heavy Pigtoe	G1	SX	LE	LE
Pleuronaia dolabelloides	Slabside Pearlymussel	G2	S1	LE	LE
Potamilus capax	Fat Pocketbook	G1	S1	LE	LE
Potamilus inflatus	Inflated Heelsplitter	G1G2Q	SH	LT	LE
Ptychobranchus fasciolaris	Kidneyshell	G4G5	S1		LE
Quadrula cylindrica cylindrica	Rabbitsfoot	G3T3	S1	LT	LE
Quadrula metanevra	Monkeyface	G4	SX		LE
Quadrula stapes	Stirrupshell	GH	SX	LE	LE
MALACOSTRACA					
Fallicambarus gordoni	Camp Shelby Burrowing Crawfish	G1	S1	C	LE
INSECTA					
Nicrophorus americanus	American Burying Beetle	G2G3	SX	LE	LE
Neonympha mitchellii mitchelli	Mitchell's Satyr	G2T2	S1	LE	LE
OSTEICHTHYES					
Acipenser oxyrinchus desotoi	Gulf Sturgeon	G3T2	S1	LT	LE
Scaphirhynchus albus	Pallid Sturgeon	G1	S1	LE	LE
Scaphirhynchus suttkusi	Alabama Sturgeon	G1	SH	LE	LE
Notropis boops	Bigeye Shiner	G5	S1		LE
Notropis chalybaeus	Ironcolor Shiner	G4	S1		LE
Phenacobius mirabilis	Suckermouth Minnow	G5	S1		LE
Phoxinus erythrogaster	Southern Redbelly Dace[1]	G5	S2		LE

Crystallaria asprella	Crystal Darter	G3	S1		LE
Etheostoma blennioides	Greenside Darter	G5	S1		LE
Etheostoma rubrum	Bayou Darter	G1	S1	LT	LE
Percina aurora	Pearl Darter	G1	S1	C	LE
Percina phoxocephala	Slenderhead Darter	G5	S1		LE
Noturus exilis	Slender Madtom	G5	S1		LE
Noturus munitus	Frecklebelly Madtom	G3	S2		LE
Noturus gladiator	Piebald Madtom	G3	S1		LE
AMPHIBIA					
Rana sevosa	Dusky Gopher Frog	G1	S1	LE	LE
Amphiuma pholeter	One-Toed Amphiuma	G3	S1		LE
Cryptobranchus alleganiensis	Hellbender	G3G4	S1	(PS)	LE
Aneides aeneus	Green Salamander	G3G4	S1		LE
Eurycea lucifuga	Cave Salamander	G5	S1		LE
Gyrinophilus porphyriticus	Spring Salamander	G5	S1		LE
REPTILIA					
Drymarchon corais couperi	Eastern Indigo Snake	G3	SX	LT	LE
Farancia erytrogramma	Rainbow Snake	G5	S2		LE
Heterodon simus	Southern Hognose Snake	G2	SX		LE
Pituophis melanoleucus lodingi	Black Pine Snake	G4T3	S2	C	LE
Caretta caretta	Loggerhead; Cabezon	G3	S1B,SNA	LT	LE
Chelonia mydas	Green Turtle	G3	SNA	(LE,LT)	LE
Eretmochelys imbricata	Hawksbill; Carey	G3	SNA	LE	LE
Lepidochelys kempii	Kemp's Or Atlantic Ridley	G1	S1N	LE	LE
Dermochelys coriacea	Leatherback; Tinglar	G2	SNA	LE	LE
Graptemys flavimaculata	Yellow-Blotched Map Turtle	G2	S2	LT	LE
Graptemys nigrinoda	Black-Knobbed Map Turtle	G3	S2		LE
Graptemys oculifera	Ringed Map Turtle	G2	S2	LT	LE
Pseudemys alabamensis	Alabama Redbelly Turtle	G1	S1	LE	LE
Gopherus polyphemus	Gopher Tortoise	G3	S2	(PS:LT)	LE
AVES					
Charadrius nivosus	Southeastern Snowy Plover	G4T3Q	S2		LE
Charadrius melodus	Piping Plover	G3	S2N	(LE,LT)	LE
Sternula antillarum athalassos	Interior Least Tern[3]	G4T2Q	S2B	(PS:LE)	LE
Calidris canutus	Red Knot	G5	S2N	LT	
Mycteria americana	Wood Stork	G4	S2N	(PS:LT)	LE
Falco peregrinus	Peregrine Falcon	G4	S1N		LE
Grus *canadensis pulla*	Mississippi Sandhill Crane	G5T1	S1	LE	LE
Vermivora bachmanii	Bachman's Warbler	GH	SXB	LE	LE
Thryomanes bewickii	Bewick's Wren	G5	S2B,S3N		LE
Pelecanus occidentalis	Brown Pelican	G4	S1N		LE
Campephilus principalis	Ivory-Billed Woodpecker	GH	SX	LE	LE
Picoides borealis	Red-Cockaded Woodpecker	G3	S1	LE	LE

SPECIES NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
MAMMALIA					
Puma concolor coryi	Florida Panther	G5T1	SX	LE	LE
Ursus americanus	Black Bear	G5	S1	(PS)	LE
Ursus americanus luteolus	Louisiana Black Bear	G5T2	S1	LT	LE
Myotis grisescens	Gray Myotis	G3	S1	LE	LE
Myotis sodalis	Indiana Or Social Myotis	G2	S1B	LE	LE
Trichechus manatus	Manatee	G2	SZ	LE	LE
PLANTS [3]					
DICOTYLEDONEAE					
Apios priceana	Price's Potato Bean	G2	S1	LE	
Lindera melissifolia	Pondberry	G2	S2	LE	
Schwalbea americana	Chaffseed	G3	SH	LE	
ISOETOPSIDA					
Isoetes louisianensis	Louisiana Quillwort	G3	S2	LE	

[1] *West Mississippi disjunct populations only.*

[2] *Interior populations nesting along the Mississippi River only.*

[3] *Mississippi has no status concerning endangered plants.*