ENVIRONMENTAL ASSESSMENT

Managing Damage to Resources and Threats to Human Health and Safety Caused by Birds in the Commonwealth of Virginia

Prepared by:

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Animal and Plant Health Inspection Service
Wildlife Services

In consultation with:
United States Department of Interior
United States Fish and Wildlife Service
Migratory Bird Program
Region 5

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ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AQDO	Aquaculture Depredation Order
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
CBC	Christmas Bird Count
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CY	Calendar Year
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	U.S. Department of Transportation, Federal Aviation Administration
FDA	U.S. Department of Health and Human Services, Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
FY	Fiscal Year
MA	Methyl anthranilate
MANEM	Mid-Atlantic / New England / Maritimes Region Waterbird Working Group
MBTA	Migratory Bird Treaty Act
MIS	Management Information System
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services**,** National Wildlife Research Center
PBCR	Pelagic Bird Conservation Region
PBR	Potential Biological Removal
PRDO	Public Resource Depredation Order
USGS	U.S. Department of the Interior, Geological Survey
USDA	U.S. Department of Agriculture
USFWS	U.S. Department of the Interior, U.S. Fish and Wildlife Service
SOPs	Standard Operating Procedures
VDACS	Virginia Department of Agriculture and Consumer Services
VDGIF	Virginia Department of Game and Inland Fisheries
WS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with the needs of wildlife which increases the potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS involvement in bird damage management in Virginia. Wildlife damage management is the science of reducing damage or other problems associated with wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 2010). The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the federal agency authorized to protect American resources from damage associated with wildlife (the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c)). Human/wildlife conflict issues are complicated by the wide range of public responses to wildlife and wildlife damage. What may be unacceptable damage to one person may be a normal cost of living with nature to someone else. The relationship in American culture of wildlife values and wildlife damage can be summarized in this way:

Wildlife has either positive or negative values, depending on varying human perspectives and circumstances (Decker and Goff 1987). Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well.

WS' activities are conducted to prevent or reduce wildlife damage to agricultural, industrial, and natural resources, and to property, livestock, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, tribes, private organizations, and individuals. The WS program uses an integrated approach (WS Directive 2.105) in which a combination of methods may be used or recommended to reduce wildlife damage. Program activities are not based on punishing offending animals but are conducted to reduce damage and risks to human and livestock health and safety, and are used as part of the WS Decision Model (Slate et al. 1992).

WS is a cooperatively funded, service-oriented program that receives requests for assistance with wildlife damage management from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies.

WS chose to prepare this EA to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed damage management program. Pursuant to the NEPA and the Council on Environmental Quality (CEQ) regulations, WS and the United States

Fish and Wildlife Service (USFWS) are preparing this EA[1] 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 significant effects. This EA will also serve as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into the actions of each agency.

1.2 PURPOSE

WS and the USFWS[2] continue to receive requests for assistance or anticipate receiving requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, property, and reduce or prevent threats to human health and safety associated with several bird species, including double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), cattle egret (*Bubulcus ibis*), turkey vulture (*Cathartes aura*), black vulture (*Coragyps atratus*), osprey (*Pandion haliaetus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), Northern harrier (*Circus cyaneus*), red shouldered hawk (*Buteo lineatus*), broad-winged hawk (*Buteo platypterus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), bald eagle (*Haliaeetus leucocephalus*), American kestrel (*Falco sparverius*), merlin (*Falco columbarius*), peregrine falcon (*Falco peregrinus*), wild turkey (*Meleagris gallopavo*), killdeer (*Charadrius vociferus*), upland sandpiper (*Bartramia longicauda*), sanderling (*Calidris alba*), Bonaparte's gull (*Chroicocephalus philadelphia*), laughing gull (*Leucophaeus atricilla*), ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*), rock pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), monk parakeet (*Myiopsitta monachus*), barn owl (*Tyto alba*), short-eared owl (*Asio flammeus*), great horned owl (*Bubo virginianus*), snowy owl (*Nyctea scandiaca*), barred owl (*Strix varia*), American crow (*Corvus brachyrhynchos*), fish crow (*Corvus ossifragus*), common raven (*Corvus corax*), horned lark (*Eremophila alpestris*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), American robin (*Turdus migratorius*), Northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), Eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quisalus quiscula*), boat-tailed grackle (*Quiscalus major*), brown-headed cowbird (*Molothrus ater*), and house sparrow (*Passer domesticus*) in Virginia. In addition to those species, WS and the USFWS also receives requests for assistance to manage damage and threats of damage associated with several other bird species. Damages and threats of damages associated with those species would occur primarily at airports where those species pose a threat of aircraft strikes. Appendix B contains a list of additional species that WS could address in low numbers and/or infrequently when those species cause damage or pose a threat of damage.

This EA will assist in determining if the proposed management of bird damage could have a significant impact on the human environment based on previous activities conducted and based on the anticipation of receiving additional requests for assistance. Because the goals of WS and the USFWS are to conduct a coordinated program in accordance with plans and objectives developed to reduce damage, and because those goals and objectives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within Virginia as part of a coordinated program.

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[1] 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" (Council on Environmental Quality 2007).

[2] The USFWS is responsible for managing and regulating bird species under the Migratory Bird Treaty Act (MBTA). The take of migratory birds is prohibited by the MBTA. However, the USFWS can issue depredation permits for the take of protected birds when certain criteria are met pursuant to the MBTA. Depredation permits are issued to take migratory birds to alleviate damage and threats of damage.

Changes in the need for action and the affected environment have prompted WS and the USFWS to initiate this new analysis to manage bird damage in the Commonwealth. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action, primarily a need to address damage and threats of damage associated with several additional species of birds.

1.3 NEED FOR ACTION

Some species of wildlife have adapted to and have thrived in human altered habitats. 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.

Both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. 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. The available habitat may have a biological carrying capacity to support higher populations of wildlife; however, in many cases, the wildlife acceptance capacity is lower or has been met. 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.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 2010). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species have no intent to do harm. They utilize habitats (e.g., reproduce, 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.

The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (e.g., economic, social, aesthetics). Therefore, how damage is defined can often be unique to an individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "damage" is consistently used to describe situations where an individual person has determined the losses associated with wildlife is actual damage requiring assistance (i.e., has reached an individual threshold). The term "damage" is most often defined as economic losses to resources or threats to human safety. However, damage could also include

a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

Wildlife management is often based on balancing wildlife populations and human perceptions, in a struggle to preserve rare species, regulate species populations, oversee consumptive uses of wildlife, and conserve the environment that provides habitat for wildlife resources. Increasingly, cities, towns, parks, airports, and private properties have become sites of some of the greatest challenges for wildlife management (Adams et al. 2010). When the presence of a prolific, adaptable species is combined with human expansion, land management conflicts often develop. Birds are generally regarded as providing ecological, educational, economic, recreational, and aesthetic benefits (Decker and Goff 1987), and there is enjoyment in knowing wildlife exists and contributes to natural ecosystems (Decker et al. 2001).

Birds add an aesthetic component to the environment, sometimes provide opportunities for recreational hunting, and like all wildlife, provide people with valued close contact with nature. Many people, even those people experiencing damage, consider those species of birds addressed in this EA to be a charismatic and valuable component of their environment; however, tolerance differs among individuals. Because of their prolific nature, site tenacity, longevity, size, and tolerance of human activity, many bird species are often associated with situations where damage or threats can occur.

Birds are difficult to manage because they are highly mobile, able to exploit a variety of habitat types within a given area, and cannot be permanently excluded from large areas. It is rarely desirable or possible to remove or disperse all problem birds from an area, but with a proper management scheme, the number of birds and associated problems may be reduced to a level that can be tolerated. Additionally, management of bird-related problems often exceeds the capabilities of individual people to reduce damage to tolerable levels. In Virginia, problem situations associated with birds typically involve, but are not limited to, unacceptable accumulations of feces in public-use areas, damage to agricultural and natural resources, and unacceptable safety hazards (e.g., aircraft striking birds). Those problems frequently occur on private properties, in residential communities, apartment/condominium complexes, municipal parks, schools, hospitals, natural/habitat restoration sites, corporate and industrial sites, office complexes, roadways, airports, and other areas.

The need for action to manage damage and threats associated with birds in Virginia arises from requests for assistance[3] received by WS to reduce and prevent damage from occurring to four major categories of resources. Those four categories are agricultural resources, property, natural resources, and threats to human safety. WS has identified those bird species most likely to be responsible for causing damage to those four categories based on previous requests for assistance and assessments of the threat of bird strike hazards at airports. Table 1.1 lists the number of WS' technical assistance projects involving bird damage or threats of bird damage to those four major resource types in Virginia from the federal fiscal year[4] (FY) 2007 through FY 2012. Table 1.1 does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

[3] WS only conducts bird damage management after receiving a request for assistance. Before initiating bird damage activities, a Memorandum of Understanding, cooperative service agreement, 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.

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

Table 1.1 –Technical assistance projects conducted by WS in Virginia, FY 2007–2012.

Species	Projects	Species	Projects
double-crested cormorant	**10**	great horned owl	**7**
great blue heron	**33**	barred owl	**2**
great egret	**5**	chimney swift	**5**
yellow-crowned night-heron	**2**	yellow-bellied sapsucker	**3**
turkey vulture	**329**	red-bellied woodpecker	**4**
black vulture	**1,121**	downy woodpecker	**28**
Osprey	**52**	hairy woodpecker	**23**
sharp-shinned hawk	**1**	pileated woodpecker	**20**
Cooper's hawk	**13**	Northern flicker	**12**
red shouldered hawk	**26**	blue jay	**3**
broad-winged hawk	**1**	American crow	**95**
red-tailed hawk	**65**	fish crow	**2**
bald eagle	**19**	common raven	**1**
American kestrel	**2**	barn swallow	**15**
wild turkey	**7**	Eastern bluebird	**1**
laughing gull	**33**	American robin	**8**
ring-billed gull	**71**	Northern mockingbird	**5**
herring gull	**29**	European starling	**153**
great black-backed gull	**7**	Northern cardinal	**8**
lesser black-backed gull	**2**	red-winged blackbird	**1**
rock pigeon	**146**	common grackle	**4**
mourning dove	**19**	boat-tailed grackle	**2**
Monk parakeet	**1**	house sparrow	**27**
barn owl	**1**	house finch	**1**
		TOTAL	**2,425**

Technical assistance has been provided by WS to those people requesting assistance with resolving damage or the threat of damage by providing information and recommendations on damage management activities that could be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA. The technical assistance projects conducted by WS are representative of the damage and threats that could be caused by birds in Virginia. Many of the projects involved multiple resources and multiple species.

Table 1.2 lists those bird species and the resource types that those bird species can cause damage to in Virginia. In addition, Appendix B lists bird species that WS could be requested to address in small number and/or infrequently. Those species would primarily be associated with threats of aircraft strikes at airports. Many of the bird species addressed in this EA can cause damage to or pose threats to a variety of resources. In Virginia, most requests for assistance received by WS are related to threats associated with those bird species being struck by aircraft at or near airports. Bird strikes can cause substantial damage to aircraft requiring costly repairs. In some cases, bird strikes can lead to the catastrophic failure of the aircraft, which can threaten passenger safety.

Many of the species addressed in this assessment are gregarious (i.e., form large flocks) species especially during the fall and spring migration periods. Although damage and threats can occur throughout the year, damage or the threat of damage is often highest during those periods when birds are concentrated into large flocks such as migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists, such as swallows, cormorants, and gulls. The flocking behavior of many bird species during migration periods can pose increased risks when those species occur near or on airport

properties. Aircraft striking multiple birds not only increases the damage to the aircraft but can also increase the risk that a catastrophic failure of the aircraft might occur, especially if multiple birds are ingested into aircraft engines.

Table 1.2 – Primary bird species addressed in the EA and resources affected by these bird species[1].

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
double-crested cormorant	X	X	X	X	herring gull	X	X	X	X
great blue heron	X		X	X	great black-backed gull	X	X	X	X
great egret	X		X	X	rock pigeon	X	X	X	X
cattle egret	X		X	X	mourning dove			X	X
turkey vulture			X	X	monk parakeet		X	X	X
black vulture	X	X	X	X	barn owl			X	X
osprey	X		X	X	short-eared owl			X	X
sharp-shinned hawk			X	X	great horned owl	X	X	X	X
Cooper's hawk	X		X	X	snowy owl			X	X
Northern harrier			X	X	barred owl	X		X	X
red shouldered hawk			X	X	American crow	X	X	X	X
broad-winged hawk			X	X	fish crow	X	X	X	X
red-tailed hawk	X		X	X	common raven	X	X	X	X
rough-legged hawk			X	X	horned lark			X	X
bald eagle	X		X	X	tree swallow	X		X	X
American kestrel			X	X	barn swallow	X		X	X
merlin			X	X	American robin			X	X
peregrine falcon			X	X	Northern mockingbird			X	X
wild turkey	X		X	X	European starling	X	X	X	X
killdeer			X	X	Eastern meadowlark			X	X
upland sandpiper			X	X	red-winged black bird	X		X	X
sanderling			X	X	common grackle	X	X	X	X
Bonaparte's gull	X		X	X	boat-tailed grackle	X		X	X
laughing gull	X	X	X	X	brown-headed cowbird	X	X	X	X
ring-billed gull	X		X	X	house sparrow	X	X	X	X

[1]A=Agriculture, N=Natural Resources, P=Property, H=Human Safety

Need to Resolve Bird Damage to Agricultural Resources

According to the National Agricultural Statistics Service (NASS), approximately 8.1 million acres were devoted to agricultural production in Virginia in 2007 (NASS 2009). In the same year, agricultural products sold in the Commonwealth had a market value estimated at $2.9 billion (NASS 2009). A total of 70.4% of these sales were in livestock and 29.5% were in crops (NASS 2009). The top grossing livestock industries in 2007 included poultry and egg ($971 million), cattle ($574 million), milk and dairy ($330 million), hog and pig ($56 million), aquaculture ($53 million) and horse and equine ($46 million) (NASS 2009). The top grossing crop industries in 2007 included greenhouse, nursery and floriculture products ($248 million), oilseed and grain crops ($269 million), vegetables and melons ($93 million), tobacco ($68 million) and fruit and tree nuts ($68 million) (NASS 2009).

A variety of bird species can cause damage to agricultural resources. Damage and threats of damage to agricultural resources are often associated with bird species that exhibit flocking behaviors (*e.g.*, red-winged blackbirds) or colonial nesting behavior (*e.g.*, pigeons). Damage occurs through direct consumption of agricultural resources, the contamination of resources from fecal droppings, or the threat of disease transmission to livestock from contact with fecal matter.

Damage to Aquaculture Resources

Damage to aquaculture resources occurs primarily from the economic losses associated with birds consuming fish and other commercially raised aquatic organisms. Damage can also result from the death of fish and other aquatic wildlife from injuries associated with bird predation as well as the threat of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as birds move between sites. The aquaculture products propagated at facilities in Virginia include catfish, trout, other food fish (e.g. tilapia), baitfish, crustaceans (e.g. shrimp), mollusks, ornamental fish, and sport or game fish (NASS 2009).

Of those birds shown in Table 1.2 associated with damage to agriculture, of primary concern to aquaculture facilities in Virginia are, double-crested cormorants, gulls, osprey, herons, egrets, great horned owls, crows, and common grackles.

Double-crested cormorants can feed heavily on fish being raised for human consumption, and on fish commercially raised for bait and restocking (USFWS 2003, USFWS 2009a). The frequency of cormorant occurrence at a given aquaculture facility can be a function of many interacting factors, including: (1) size of the regional and local cormorant population; (2) the number, size, and distribution of aquaculture facilities; (3) the size distribution, density, health, and species composition of fish populations at facilities; (4) the number, size, and distribution of wetlands in the immediate area; (5) the size distribution, density, health, and species composition of free-ranging fish populations in the surrounding landscape; (6) the number, size, and distribution of suitable roosting habitat; and (7) the variety, intensity and distribution of local damage abatement activities. Cormorants are adept at seeking out the most favorable foraging and roosting sites. As a result, cormorants are rarely distributed evenly over a given region, but are rather highly clumped or localized. Damage abatement activities can shift bird activities from one area to another; thereby, not eliminating predation but only reducing damage at one site while increasing damage at another location (Aderman and Hill 1995, Reinhold and Sloan 1999, Tobin et al. 2002). Thus, some aquaculture producers in a region suffer little or no economic damage from cormorants, while others experience exceptionally high losses.

Price and Nickum (1995) concluded that the aquaculture industry has small profit margins so that even a small percentage reduction in the farm gate value due to predation is an economic issue. The magnitude of economic impacts that cormorants have on the aquaculture industry can vary dependent upon many different variables including, the value of the fish stock, number of depredating birds present, and the time of year the predation is taking place.

In addition to cormorants, great blue herons are known to forage at aquaculture facilities (Parkhurst et al. 1987). During a survey of aquaculture facilities in the northeastern United States, 76% of respondents identified the great blue heron as the bird of highest predation concern (Glahn et al. 1999*a*). Glahn et al. (1999*a*) found that 80% of the aquaculture facilities surveyed in the northeastern United States perceived birds as posing an economic threat due to predation which coincided with 81% of the facilities surveyed having birds present on aquaculture ponds. Great blue herons were found at 90% of the sites surveyed by Glahn et al. (1999*b*). Loss of trout in ponds with herons present ranged from 0% to 39.4% in a study conducted in Pennsylvania and New York with an estimated loss in production ranging from $8,000 to nearly $66,000 (Glahn et al. 1999*b*). The stomach contents of great blue herons collected at trout producing facilities in the northeastern United States contained almost exclusively trout (Glahn et al. 1999*b*).

In 1984, a survey of fish producing facilities identified 43 species of birds as foraging on fish at those facilities, including brown pelican, double-crested cormorant, great-blue heron, little blue heron, black-crowned night-heron, great egret, cattle egret, bald eagle, osprey, red-tailed hawk, Northern harriers,

yellowlegs, gulls, terns, great horned owl, barred owl, crows, common raven, common grackle, and brown-headed cowbird (Parkhurst et al. 1987).

During a survey of aquaculture facilities in 1984, osprey were ranked third highest among 43 species of birds identified as foraging on fish at aquaculture facilities in the United States (Parkhurst et al. 1987). Fish comprise the primary food source of osprey (Poole et al. 2002). Parkhurst et al. (1992) found that when ospreys were present at aquaculture facilities over 60% of their mean time was devoted to foraging. The mean length of trout captured by osprey was 30.5 centimeters leading to a higher economic loss per captured fish compared to other observed species (Parkhurst et al. 1992).

Predation at aquaculture facilities can also occur from American crows (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey of ten aquaculture facilities in Pennsylvania in 1985 and 1986, American crows were observed at eight (Parkhurst et al. 1992). The mean size of trout captured by crows was 22.5 centimeters with a range of 15.2 to 31.7 centimeters and crows consumed a mean of 11,651 trout per year per site (Parkhurst et al. 1992). Since crows selected for larger fish classes at fish facilities, Parkhurst et al. (1992) determined economic losses from foraging by crows led to a higher mean economic impact at facilities compared to other avian foragers based on the value of larger fish classes.

Although primarily insectivorous during the breeding season and granivorous during migration periods (Peer and Bollinger 1997), common grackles have been observed feeding on fish (Hamilton 1951, Beeton and Wells 1957, Darden 1974, Zottoli 1976, Whoriskey and Fitzgerald 1985, Parkhurst et al. 1992). During a study of aquaculture facilities, Parkhurst et al. (1992) found grackles feeding on trout fry at nine of the ten facilities observed. The mean length of trout captured by grackles was 7.6 centimeters with a range of 6.0 to 7.9 centimeters. Once fish reached a mean size of 14 centimeters, grackles switched to alternative food sources at those facilities (Parkhurst et al. 1992). Among all predatory bird species observed during the study conducted by Parkhurst et al. (1992), grackles captured and removed the most fish per day per site, which was estimated at 145,035 fish captured per year per site.

Also of concern to aquaculture facilities is the transmission of diseases by birds between impoundments and from facility to facility. Given the confinement of aquatic organisms inside impoundments at aquaculture facilities and the high densities of those organisms in those impoundments, the introduction of a disease could result in substantial economic losses. Although the actual transmission of diseases through transport by birds is difficult to document, birds have been documented as having the ability to spread diseases through fecal droppings and possibly through other mechanical means such as on feathers, feet, and regurgitation.

Damage and Threats to Livestock Operations

Damage to livestock operations can occur from several bird species in Virginia. Economic damage can occur from birds feeding on livestock feed, from birds feeding on livestock, and from the increased risks of disease transmission associated with large congregations of birds. Although individual or small groups of birds can cause economic damage to livestock producers, such as a vulture or group of vultures killing a newborn calf, most economic damage occurs from bird species that congregate in large flocks at livestock operations.

Although damage and disease threats to livestock operations can occur throughout the year, damage can be highest during those periods when birds are concentrated into large flocks, such as during migration periods and during winter months when food sources are limited. For some bird species, high concentrations of birds can be found during the breeding season where suitable nesting habitat exists such as barn swallows. Of primary concern to livestock feedlots and dairies in Virginia are vultures, pigeons, European starlings, red-winged blackbirds, common grackles, brown-headed cowbirds, house sparrows,

and to a lesser extent crows and swallows. The flocking behavior of those species either from roosting and/or nesting behavior can lead to economic losses to agricultural producers from the consumption of livestock feed and from the increased risks associated with the transmission of diseases from fecal matter being deposited in feeding areas and in water used by livestock.

Economic damages associated with starlings and blackbirds feeding on livestock rations has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968, Dolbeer et al. 1978, Glahn and Otis 1981, Glahn 1983, Glahn and Otis 1986). Starlings damage an estimated $800 million worth of agricultural resources per year (Pimentel et al. 2000). Diet rations for cattle contain all of the nutrients and fiber that cattle need, and are so thoroughly mixed that cattle are unable to select any single component over others. Livestock feed and rations are often formulated to ensure proper health of the animal. Higher fiber roughage in livestock feed is often supplemented with corn, barley, and other grains to ensure weight gain and in the case of dairies, for dairy cattle to produce milk. Livestock are unable to select for certain ingredients in livestock feed, while birds often can selectively choose to feed on the corn, barley, and other grains formulated in livestock feed. Livestock feed provided in open troughs is most vulnerable to feeding by birds. Birds often select for those components of feed that are most beneficial to the desired outcome of livestock. When large flocks of birds selectively forage for components in livestock feeds, the composition and the energy value of the feed can be altered which can negatively affect the health and production of livestock. The removal of this high-energy source by starlings is believed to reduce milk yields, and weight gains, which is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, freezing temperatures, and the number of livestock on feed.

The economic significance of feed losses to starlings and blackbirds has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 starlings during the winter of 1967. Forbes (1995) reported European starlings consumed up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems of which 6.3% experienced considerable economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily brown-headed cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000. Depenbusch et al. (2011) estimated that feed consumption by European starlings increases the daily production cost $0.92 per animal.

Certain bird species are also known to prey upon livestock, resulting in economic losses to livestock producers. Most direct damage to livestock occurs primarily from vultures. Predation by black vultures on livestock has been reported since the 1930s, including domestic pigs in Kentucky (Lovell 1947, Lovell 1952) and Texas (Parmalee 1954), lambs in West Virginia (Roads 1936) and Ohio (Sprunt 1946), and cattle in Texas (Parmalee 1954). Black vultures are gregarious (*i.e.*, form large flocks) and groups averaging 20 to 60 individuals can attack prey animals (Lowney 1999). Vultures can cause injuries and death to newborn lambs and calves during the birth of the animals. Vultures often attack the soft tissue areas of newborns as they are being expunged from the female. During the birthing process, newborns and mothers are vulnerable and often unable to prevent attacks by large groups of vultures. Vultures often attack the eyes and rectal area of newborns during delivery that results in serious injury to the lamb or calf which often leads to the death of the animal.

Livestock producers in the United States reported the loss of 11,900 head of cattle and calves from vultures in 2010 valued at $4.6 million (NASS 2011). Livestock producers in Virginia reported that, of those cattle and calves lost due to predators in 2010, 7.8% of the cattle and 12.9% of the calves were lost due to vultures (NASS 2011). Of all the cattle and calves reported as lost due to predators in Virginia during 2010, vultures were identified as the second leading cause of predation by predators behind only

the coyote (*Canis latrans*) (NASS 2011). While both turkey vultures and black vultures have been documented harassing expectant cattle, livestock predation is generally restricted to black vultures.

In a study conducted by Milleson et al. (2006), Florida ranchers were surveyed to the extent and severity of cattle losses associated with vultures. Respondents of the survey reported that 82.4% of all livestock lost attributed to vultures were newborn calves, which exceed the reported predation of all other livestock species and livestock age classes (Milleson et al. 2006). Ranchers reported during the survey period a total loss of 956 calves, 25 yearlings (cattle), and 101 adult cattle with a total value estimated at $316,570 and a mean value lost estimated at $2,595 (Milleson et al. 2006). Predation associated with vultures was reported to occur primarily from November through March, but predation was reported to occur throughout the year (Milleson et al. 2006).

Direct damage can also result from raptors, particularly red-tailed hawks, Cooper's hawks, and great-horned owls preying on domestic fowl such as chickens and waterfowl (Hygnstrom and Craven 1994). Free-ranging fowl or fowl allowed to range outside of confinement for a period are particularly vulnerable to predation by raptors.

Damage and threats to livestock operations can also occur from the risk of or actual transmission of diseases from birds to livestock. Agricultural areas provide ideal habitat for many bird species, which can be attracted often in large numbers to these locations. Large concentrations of birds feeding, roosting, or loafing in these areas increases the possibility of and the concern over the transmission of diseases from birds to livestock. This concern can have far-reaching implications (Daniels et al. 2003, Fraser and Fraser 2010, Miller et al. 2012). Birds feeding alongside livestock in open livestock feeding areas or feeding on stored livestock feed can leave fecal deposits, which can be consumed by livestock. Fecal matter can also be deposited in sources of water for livestock, which increases the likelihood of disease transmission and can contaminate other surface areas where livestock can encounter fecal matter deposited by birds. Many bird species, especially those encountered at livestock operations, are known to carry infectious diseases which can be excreted in fecal matter and pose not only a risk to individual livestock operations, but can be a source of transmission to other livestock operations as birds move from one area to another.

A number of diseases that affect livestock have been associated with rock pigeons, European starlings, and house sparrows (Weber 1979, Carlson et al. 2010). Pigeons, starlings, and house sparrows have been identified as carriers of erysipeloid, salmonellosis, pasteurellosis, avian tuberculosis, streptococcosis, vibrosis, and listeriosis (Weber 1979, Gough and Beyer 1981). Weber (1979) also reported pigeons, starlings, and house sparrows as carriers of several viral, fungal, protozoal, and rickettsial diseases that are known to infect livestock and pets. Numerous studies have focused on starlings and the transmission of *Escherichia coli* (E. coli) (Gaulker et al. 2009, LeJeune et al. 2008, Cernicchiaro et al. 2012). LeJeune et al. (2008) found that starlings could play a role in the transmission of E. coli between dairy farms. Carlson et al. (2010) found *Salmonella enterica* in the gastrointestinal tract of starlings at cattle feedlots in Texas and suggested starlings could contribute to the contamination of cattle feed and water. Salmonella contamination levels can be directly related to the number of European starlings present (Carlson et al. 2010, Carlson et al. 2011a). Poultry operations can be highly susceptible to diseases spread by wild birds, including those from starlings and house sparrows. Starling and house sparrows with access to poultry operations have the potential to transmit pathogens to poultry, including salmonella, campylobacter, and clostridium (Craven et al. 2000).

Starlings and gulls, as well as other species, have been documented as transferring species-specific diseases like transmissible gastroenteritis and Johne's (Faulkner 1966, Gough et al. 1979). Many bird species that use barn areas, pastures, manure pits, or carcass disposal areas can directly or indirectly become exposed to a disease and transfer it to another farm or to healthy animals at the same farm. In some cases, if carcasses are not disposed of correctly, then scavenging birds, such as vultures and crows,

could infect healthy animals though droppings or by the transfer of disease carrying particles on their bodies. Given the ability of these species to move large distances and from one facility to another, farm-to-farm transmission can be of concern.

Wild and domestic waterfowl, as well as a variety of other 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 circulates among those birds without clinical signs and is not an important mortality factor in wild birds (Davidson and Nettles 1997, Stallknecht 2003, Clark and Hall 2006). However, the potential for avian influenza to produce devastating disease in domestic poultry makes its occurrence in wild birds an important issue (Davidson and Nettles 1997, Clark and Hall 2006, Gauthier-Clerc et al. 2007).

Damage to Agricultural Crops

Besser (1985) estimated damage to agricultural crops associated with birds exceeded $100 million annually in the United States. Bird damage to agricultural crops occurs when birds consume sprouting crops or fruit, damage fruit while feeding, trample emerging crops, or contaminate crops with fecal material. In 2007, the sale of crops accounted for 29.5% of the market value of agricultural products sold in the Commonwealth or an estimated $858 million (NASS 2009). The top grossing crop industries in 2007 included greenhouse, nursery and floriculture products ($248 million), oilseed and grain crops ($269 million), vegetables and melons ($93 million), tobacco ($68 million) and fruit and tree nuts ($68 million) (NASS 2009).

Fruit and nut crops can be damaged by various bird species, including crows, American robins, European starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds. Besser (1985) estimated bird damage to grapes, cherries, and blueberries exceed $1 million dollars annually in the United States. In 1972, Mott and Stone (1973) estimated that birds caused $1.6 to $2.1 million in damage to the blueberry industry in the United States, with starlings, robins, and grackles causing the most damage. Red-winged blackbirds, cowbirds, woodpeckers, and crows are also known to cause damage to blueberries (Besser 1985). This type of damage to blueberries typically occurs from birds plucking and consuming the berry (Besser 1985). Birds can also feed on numerous other types of fruits such as, figs, apricots, nectarines, peaches, plums, persimmons, strawberries and apples (Weber 1979). Damage to apples occurs when bird's beaks puncture the skin of the apple, making the apple unmarketable (Besser 1985). Crows and robins have also been documented as causing damage to apples (Mitterling 1965).

Additionally, birds are responsible for damaging corn crops. Large flocks of red-winged blackbird are responsible for most sweet corn damage although common grackles and European starlings are also responsible (Besser 1985). Most bird damage occurs during the developmental stage known as the milk and dough stage when the kernels are soft and filled with a milky liquid. Damage occurs when birds rip or pull back the husk exposing the ear and puncturing the kernels to ingest the milky liquid. Once punctured, the area of the ear damage often discolors and is susceptible to disease (Besser 1985). Damage usually occurs at the tip of the ear as the husk is ripped and pulled back but can occur anywhere on the ear (Besser 1985). Economic losses to producers of sweet corn are often amplified as damage caused by birds makes ears of corn unsightly and unmarketable to the consumer (Besser 1985).

Damage can also occur to sprouting corn as birds pull or dig the sprout out of the ground to feed on the seed kernel (Besser 1985). Damage to sprouting corn occurs primarily from common grackles and crows but red-winged blackbirds and common ravens are known to cause damage to sprouting corn (Stone and Mott 1973). Additionally, European starlings may pull sprouting grains and feed on planted seed (Johnson and Glahn 1994). Damage to sprouting corn is likely localized and highest in areas where breeding colonies of common grackles exist in close proximity to agricultural fields planted with corn

(Stone and Mott 1973, Rogers and Linehan 1977). Rogers and Linehan (1977) found common grackles damaged two corn sprouts per minute on average when present at a field planted near a breeding colony.

Need to Resolve Threats that Birds Pose to Human Safety

Several bird species listed in Table 1.2 can be closely associated with human habitation and often exhibit gregarious roosting behavior (i.e. roosts in large numbers). These species include vultures, colonial waterbirds, gulls, pigeons, crows, swallows, European starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds. The close association of these bird species with human activity can pose threats to human safety from the transmission of disease, the safety of air passengers if birds are struck by aircraft and aggressive behavior.

Threat of Disease Transmission

Birds can play an important role in the transmission of zoonotic diseases (i.e., diseases that can be transmitted between humans and animals) (Conover 2002). As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and house sparrows (Weber 1979). However, few studies are available on the occurrence and transmission of zoonotic diseases in wild birds. Study of this issue is complicated by the fact that diseases which are associated with birds may also be contracted from other sources. Although many people are concerned about disease transmission from birds, the probability of contracting a disease indirectly (when no physical contact occurs) is believed to be small. However, direct contact with birds, nesting material, fecal droppings or the inhalation of fecal particles from accumulations of droppings increases the likelihood of disease transmission. Different species of birds carry different diseases and some bird species are more likely to have or be reservoirs of disease. Birds acquire diseases through contact with other birds or through ingestion of pathogens in the environment. Areas inhabited by birds can also create environments where pathogens or parasites can live. With the ability to fly and move long distances, birds have the potential to transport diseases from one location to another location.

Fecal droppings that accumulate from large communal bird roosts can facilitate the growth of disease organisms, which grow in soils enriched by bird excrement. One example of this is the fungus *Histoplasma capsulatum*, which causes the disease histoplasmosis in humans (Weeks and Stickley 1984). The disturbance of soil or fecal droppings under bird roosts where fecal droppings have accumulated can cause *Histoplasma capsulatum* to become airborne and if inhaled may cause lung irritations, and flu like symptoms in individuals who are repeatedly exposed or classified as high risk of developing asthma, chronic lung problems, and severe health problems.

Chlamydiosis (a.k.a. Psitticosis) is a common infection in birds. However, when it infects people is called Psitticosis. Its official name is *Chalmydiosis psitticai* and is transmitted to humans via a variety of birds (Bonner et al. 2004). Severe cases of chlamydiosis have occurred among people handling pigeons, and other birds (Wobeser and Brand 1982, Locke 1987). Infected birds shed the bacteria through feces and nasal discharge. Chlamydiosis can be fatal to humans if not treated with antibiotics. Humans normally manifest infection by pneumonia (Johnston et al. 2000). However, unless people are involved in the removal or cleaning of bird feces, the risk of infection is quite low (Bradshaw and Trainer 1966, Palmer and Trainer 1969).

Escherichia coli, commonly known as E. coli, is a fecal coliform bacteria associated with the fecal material of warm-blooded animals. Multiple studies have found that birds can be a source of E. coli contamination of both land and water sources (Fallacara et al. 2001, Kullas et al. 2002, Hansen et al. 2009, Silva et al. 2009). Communities monitor drinking water as well as the water at swimming facilities for the presence of fecal coliform bacteria. However, a lack of financial resources often prohibits the

ability to pinpoint the source of elevated levels of fecal coliform bacteria. When levels of these bacteria exceed established standards, swimming areas must be temporarily closed or the drinking water must be treated until the levels are reduced. Linking the elevated bacterial counts to the presence and use of the area by birds 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, sources of fecal coliform bacteria in water supplies have been linked to gulls roosting at the source reservoir (Klett et al. 1998, Alderisio and DeLuca 1999). Additional sources of E. coli can be found in pigeons. Silva et al. (2009) found four strains of diarrheagenic E. coli in urban pigeons, with an overall detection rate of over 12%, with 37.9% showing signs of drug resistance. European starlings have also been found to harbor various strains of *E. coli* (Gaulker et al. 2009), including O157:H7, a strain that has been documented as causing human mortalities (LeJeune et al. 2008, Cernicchiaro et al. 2012). Although most *E. coli* strains are harmless, there are strains that have been found to cause human health concerns, ranging from minor to severe diarrhea, urinary tract infections, respiratory illness, pneumonia, and on rare occasions death.

Salmonellosis is an infection with a bacterium called *Salmonella*. Most persons infected with *Salmonella* develop diarrhea, fever, and abdominal cramps 12 to 72 hours after infection. The illness usually lasts 4 to 7 days, and most persons recover without treatment. Numerous bird species have been documented as reservoirs for this bacterium (Friend and Franson 1999, Tizard 2004). Reilly et al. (1981) and Monaghan et al. (1985) both suggested that gulls were the source of contamination for cases of human salmonellosis. Tizard (2004) identified multiple studies showing direct and indirect transmission of *salmonella* to humans from birds occurring outside the United States. Pedersen and Clark (2007) identified multiple concerns related to *salmonella* infections as it relates to wild birds, humans, and livestock. Due to birds' mobility, flocking behavior and affinity for various sites, there is a strong potential for transmission of this bacteria to humans from a variety of species and sources.

Campylobacter jejuni is a bacterium usually associated with food-borne pathogens (Center for Food Safety and Applied Nutrition 2012). French et al. (2009) examined camphlobacter occurrence at playgrounds and found that 6% of dry and 12% of fresh feces contained this bacteria, indicating that there is a risk of transmission to young children, a population with higher than average susceptibility. In the mid-Atlantic, Keller et al. (2011) found campylobacter in multiple bird species, with gulls and crows having prevalence rates over 20%. Although it is unknown what role that wild birds play in the transmission of this bacterium, its presence in bird species, especially crows and gull species, which all have increased contact with humans, increases potentials for transmission.

Cryptosporidium and *Giardia* are intestinal parasites that infect a wide range of vertebrate hosts, including birds. In humans, these organisms can cause persistent diarrhea for 1 to 3 weeks. One of the most common modes of transmission of these parasites is consumption of feces-contaminated water. It is estimated that 80 to 96% of surface waters in the United States are contaminated with *Cryptosporidium* and *Giardia* (Hansen and Ongerth 1991, Moore et al. 1994).

West Nile virus is a mosquito-borne zoonotic arbovirus belonging to the genus Flavivirus in the family Flaviviridae. Although West Nile virus is transmitted by mosquitos it is often associated with a variety of bird species due to their relationship as a reservoir for the virus (Peterson et al. 2003). Corvids and raptor species are the most susceptible species to the virus and have a high mortality probability if infected however the disease has been documented as infecting over 250 avian species. Other species often show no ill-effects of infection but populations may have high infection rates. Although birds do not directly infect humans with West Nile virus, there is concern that in areas where West Nile virus occurs, birds can provide a source for mosquito populations to become infected increasing the spread of the disease.

Additionally the observation of dead birds found in an area may alarm local populations (Mostashari et al. 2003).

Wild and domestic waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997, Pedersen et al. 2010). However, avian influenza viruses can be found in a variety of other species (Alexander 2000, Stallknecht 2003). Avian influenza circulates among these birds without clinical signs and is not an important mortality factor in wild waterfowl or other species (Davidson and Nettles 1997, Clark and Hall 2006). However, the potential for avian influenza to produce devastating disease in domestic poultry makes its occurrence in wild birds an important issue (Davidson and Nettles 1997, Clark and Hall 2006, Gauthier-Clerc et al. 2007). 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 HP strain that has shown transmission potential to humans 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 humans 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 transmission of diseases or parasites from birds to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blankespoor and Reimink 1991, Hatch 1996, Graczyk et al. 1997, Saltoun et al. 2000, Kassa et al. 2001). In some cases, infections may even be life threatening for immunocompromised and immunosuppressed people (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 believed to be small. Financial costs related to human health threats involving birds include testing of water for coliform bacteria, cleaning and sanitizing public-use areas, contacting and obtaining assistance from public health officials, and implementing wildlife damage management to reduce risks of disease transmission. 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.

Threat of Aircraft Striking Wildlife at Airports and Military Bases

In addition to threats of zoonotic diseases, birds also pose a threat to human safety from being struck by aircraft. When birds are struck by aircraft, and especially when birds enter or are ingested by engines, structural damage to the aircraft and catastrophic engine failure can occur. 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). Collisions between aircraft and wildlife are a concern because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996). Aircraft collisions with wildlife can also erode public confidence in the air transportation industry as a whole (Conover et al. 1995). While bird strikes that result in human fatalities are rare, the consequences can be catastrophic. The worst strike on record for loss of human lives in the United States occurred in Boston in 1960 when 62 people were killed in the crash of an airliner that collided with a flock of European Starlings (Dolbeer and Wright 2008). Globally, wildlife strikes have killed more than 250 people and destroyed over 229 aircraft since 1988 (Dolbeer et al. 2013).

It is more common for wildlife-aircraft strikes to result in expensive repairs, flight delays, or aborted aircraft movements than in injury or loss of human life. Wildlife strikes result in millions of dollars in direct and indirect damages annually. Direct costs include damage to aircraft, aircraft downtime and

medical expenses of injured personnel and passengers. Indirect costs can include lost revenue from the flight, cost of housing delayed passengers, rescheduling aircraft and flight cancellations. During the period of 1990 to 2012, FAA records indicate total reported losses from bird strikes cost the civil aviation industry over $577.4 million in monetary losses and 517,391hours of aircraft downtime. These figures are an underestimate of total damage (Dolbeer et al. 2013) because the number of actual bird strikes is likely to be much greater than that reported. An estimated 80% of civil bird strikes may go unreported (Linnell et al. 1999, Wright and Dolbeer 2005). Not all reports provide notation as to whether or not there was damage and some strike reports to the FAA that indicate there was an adverse impact on the aircraft from the strike do not include a monetary estimate of the damage caused. Additionally, most reports indicating damage to aircraft report direct damages and do not include indirect damage such as lost revenue, cost of putting passengers in hotels, rescheduling aircraft and flight cancellations.

A high percentage of bird strikes occur during peak migration periods, but dangerous situations can develop during any season. Aircraft are most vulnerable to bird strikes while at low altitudes, generally related to landing and taking off. Seventy-two percent of commercial aircraft strikes and 74% of general aviation aircraft strikes occurred at less than 500 feet above ground level (Dolbeer et al. 2013), which is why management of the area immediately surrounding taxiways, runways, and runway approaches is important. From 1990 to 2012, the most common bird species involved in strikes reported to the FAA (when identification of the bird species occurred), were gulls (15%), followed by pigeons/doves (15%), raptors (13%), and waterfowl (7%) (Dolbeer et al. 2013). Gulls and pigeons/doves were responsible for the greatest number of strikes involving more than one bird (Dolbeer et al. 2013).

Gulls were involved in more reported strikes in the United States from 1990 to 2012 than any other bird species except pigeons/doves but were responsible for 22% of the total damage (Dolbeer et al. 2013). Their large body size, flocking behavior, and behavioral tendency to loaf in open areas, including on airport runways, makes them a primary hazard. From 1990 to 2010, a total of 194 Bonaparte's, laughing, ring-billed, herring and great black-backed gulls were struck by aircraft in the Commonwealth (FAA 2013). However an additional 432 gulls that were struck by aircraft during this period were not identified to species, so it is likely that more species may have been struck (FAA 2013). One of the more serious instances in Virginia occurred in 1998 at Langley Air Force Base when an F-15 engine ingested a herring gull resulting in $775,000 dollars in damages (Olexa 2013).

Pigeons and doves comprised 15% of the total reported strikes in the United States from 1990 through 2012 (Dolbeer et al. 2013). In Virginia, a total of 74 pigeons and mourning doves were struck during this period (FAA 2013). Mourning doves and pigeons present risks when they roost in large numbers and loaf in flocks on or adjacent to runways. Mourning doves prefer open habitat and rock pigeons are closely associated with human structures and activity making airports attractive locations for both species.

Raptors, as well as vultures present a risk to aircraft because of their large body mass and slow-flying or soaring behavior. Of the total known birds struck in the United States from 1990 through 2012, raptors accounted for 13% of reported strikes and 20% of the damage (Dolbeer et al. 2013). Numerous species of raptors were struck in the Commonwealth from 1990 to 2010 including American kestrel, bald eagle, Cooper's hawk, osprey, peregrine falcon, red-shouldered hawk, and red-tailed hawk (FAA 2013). Most raptors have a large body size making them capable of causing substantial damage to aircraft. In Virginia, in 2000 an osprey was stuck by an F-15 during takeoff resulting in $750,000 in engine damages (Olexa 2013). Vultures are considered the most hazardous bird for an aircraft to strike based on the frequency of strikes, effect on flight, and amount of damage caused by vultures throughout the country (Dolbeer et al. 2012).

Additional Human Safety Concerns Associated with Birds

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 humans. 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 continues 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 birds attacking people occurs rarely, aggressive behavior by birds does occur, especially during nest building and the rearing of eggs and chicks. Raptors can aggressively defend their nests, nesting areas, and young, and may swoop and strike at pets, children, and adults. Additionally, slipping hazards can be created by the buildup of feces from birds 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.

Need to Resolve Bird Damage Occurring to Property

As shown in Table 1.2 and in Appendix B, all of the bird species addressed in this assessment are known to cause damage to property in Virginia. Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Bird damage to property occurs through direct damage to structures, through roosting behavior, and through their nesting activities. One example of direct damage to property occurs when woodpeckers excavate holes in the wood siding of a building. Vultures will tear roofing shingles and pull out latex caulking from around windows. Direct damage can also result from birds that act aggressively toward their reflection in mirrors and windows, which can scratch paint and siding. Accumulations of fecal droppings under areas where birds roost can cause damage to goods, equipment, buildings and statues. Aircraft striking birds can also cause substantial damage requiring costly repairs and aircraft downtime.

Gulls, pigeons/doves, and raptors, and waterfowl, are the bird groups most frequently struck by aircraft in the United States (Dolbeer et al. 2013). When struck, 42% of the reported waterfowl strikes resulted in damage, compared to 24% of strikes involving raptors and 14% of the reported gull strikes resulted, and 5% of strikes involving pigeons and doves (Dolbeer et al. 2013). In total, aircraft strikes involving birds have resulted in $571.4 million in reported damages to aircraft and 68 million in other monetary losses including lost revenue, cost of putting passengers in hotels, re-scheduling aircraft and flight cancelations since 1990 in the United States (Dolbeer et al. 2013).

Damage to property associated with large concentrations of birds including blackbirds, double-crested cormorants, crows, gulls, rock pigeons, vultures and swallows occurs primarily from accumulations of droppings and feather debris. Birds that routinely roost and loaf in the same areas often leave large accumulations of droppings and feather debris which can cause damage to property and be aesthetically displeasing (e.g. Fitzwater 1994, Gorenzel and Salmon 1994, Hygnstrom and Craven 1994, Johnson 1994, Johnson and Glahn 1994, Williams and Corrigan 1994). Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on automobiles, can occur because of uric acid from bird droppings (Johnson and Glahn 1994). Businesses may be concerned about the negative aesthetic appearance of their property caused by excessive droppings which result in comments by clients and guests. Costs associated with accumulations of droppings and feather debris include labor and disinfectants to clean and sanitize effected areas, implementation of wildlife damage management methods, loss of property use, loss of aesthetic value, and loss of customers or visitors irritated by walking in fecal droppings. The reoccurring presence of fecal droppings can lead to constant cleaning costs for property owners.

In addition to damage caused by the accumulation of droppings, damage can also occur in other ways. Damage from vultures can include tearing and consuming latex window caulking or rubber gaskets sealing window panes, asphalt roof shingles or rubber roof liners, vinyl seat covers from boats, patio furniture, and other equipment. Similarly, damage to structures can occur when birds, including gulls nest on rooftops and peck at spray-on-foam roofing and rubber roofing material, including caulking. Birds, including wild turkeys can also cause damage to windows, siding, vehicles and other property when they mistake their reflection as another bird and attack the image. Gulls pick up refuse at landfills and carry it off the property to feed, depositing garbage on buildings, equipment, and vehicles, in neighboring areas. Additionally, woodpeckers also cause direct damage to property when they chisel holes in the wooden siding, eves or trim of buildings (Evans et al. 1984, Marsh 1994).

When gulls, European starlings, house sparrows, raptors, rock pigeons, swallows and other birds nest on or in buildings or other structures they transport large amounts of nest material and food debris to the area. These materials can obstruct roof drainage systems and lead to structural damage or roof failure if clogged drains result in rooftop flooding (Vermeer et al. 1988, Blokpoel and Scharf 1991, Belant 1993). Nesting material and feathers can also clog ventilation systems or fall onto or into equipment or goods (Gorenzel and Salmon 1994, Hygnstrom and Craven 1994). Electrical utility companies frequently have problems with bird nests causing power outages when they short out transformers and substations (Avery et al. 2002, U.S. Geological Survey 2005, Pruett-Jones et al. 2007). Nesting material can also be aesthetically displeasing or in the case of some species can cause a fire hazard (Fitzwater 1994). Additionally, because the active nests of many species are protected under the Migratory Bird Treaty Act of 1918, problems arise when birds nest in areas where new construction or maintenance is scheduled to occur (Coates et al. 2012). Many bird species included in this EA, including double-crested cormorants, egrets, gulls, herons, and swallows are colonial nesters meaning they nest together in large numbers, exacerbating the problem.

Need to Resolve Bird Damage Occurring to Natural Resources

Birds can also negatively affect natural resources through habitat degradation, competition with other wildlife, direct depredation on natural resources, and other factors. Habitat degradation occurs when large concentrations of birds in a localized area negatively affect characteristics of the surrounding habitat, which can then adversely affect other wildlife species. Competition occurs when species compete for available resources, such as food or nesting sites. Direct depredation occurs when predatory bird species feed on other wildlife species, which can negatively influence those species' populations, especially when depredation occurs on threatened and endangered species.

Virginia's coastal areas provide critically important habitat for nesting colonial waterbirds and shorebirds including the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii*) which are listed and protected under the Endangered Species Act (Watts and Paxton 2014, Wilke et al. 2005). However, threats including habitat loss and degradation, sea level rise, severe weather events, human disturbance, competition with other species and predation jeopardize these populations (Davis et al. 2001, Erwin et al. 2011). Managing variables that are controllable (predator and competitor species, human disturbance) helps offset variables that are not within our control (weather, sea level rise). Predation continues to be a significant and manageable factor limiting recovery of many species of birds nesting on the barrier islands of Virginia. There is a general inverse relationship between the number of predators removed and the productivity of beach nesting birds in any given year (USFWS 2014). Therefore, reducing predation is an important action identified for the recovery of species which are threatened, endangered or otherwise imperiled (USFWS 1996*a*).

Threats Caused by Habitat Degradation

Degradation of habitat primarily occurs from the continuous accumulation of fecal droppings under nesting colonies of birds or under areas where birds consistently roost. Over time, the accumulation of fecal droppings under these areas can lead to loss of vegetation from the ammonium nitrogen found in the fecal droppings of birds. Hebert et al. (2005) noted that ammonium toxicity caused by an accumulation of fecal droppings from double-crested cormorants might be an important factor contributing to the declining presence of vegetation on some islands in the Great Lakes. Similarly, a study conducted in Oklahoma found fewer annual and perennial plants in locations where crows roosted over several years (Hicks 1979). Damage to vegetation can also occur when birds strip leaves for nesting material or when the weight of many nests, especially those of colonial nesting waterbirds breaks branches (Weseloh and Ewins 1994). In some cases these impacts are so severe on islands where these birds nest that all woody vegetation is eliminated (Cuthbert et al. 2002). Additionally, degradation of vegetation can reduce nesting habitat for other birds (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including threatened and endangered species (Korfanty et al. 1999). Wires et al. (2001) identified vegetation die off as an important threat to 66% of colonial waterbird nesting sites designated as conservation sites of priority in the Great Lakes.

Threats Caused By Competition

Non-native invasive European starlings and house sparrows are aggressive and often out-compete native species, destroying their eggs, and killing nestlings (Cabe 1993, Lowther and Cink 2006). Nest competition by European starlings has also been known to affect American kestrels (Bechard and Bechard 1996), purple martins (Allen and Nice 1952), wood ducks (Grabill 1977, Heusmann et al. 1977) and bats (Mason et al. 1972). Somewhat unique in their breeding habits, brown-headed cowbirds are known as brood parasites, meaning they lay their eggs in the nests of other bird species (Lowther 1993). Female cowbirds can lay up to 40 eggs per season with eggs reportedly being laid in the nests of over 220 species of birds (Lowther 1993). No parental care is provided by cowbirds with the raising of cowbird young occurring by the host species (Lowther 1993). Due to this, brown-headed cowbirds have substantial impacts on the reproductive success of other species (Lowther 1993) and can threaten the viability of a population or even the survival of a host species (Trial and Baptista 1993). Double-crested cormorants are known to displace other colonial nesting waterbird species such as black-crowned night-herons, egrets, and great blue herons through competition for nest sites (USFWS 2003). Cuthbert et al. (2002) examined potential impacts of cormorants on great blue herons and black-crowned night-herons in the Great Lakes and found that cormorants have not negatively influenced breeding distribution or productivity of either species at a regional scale, but did contribute to declines in heron presence and increases in site abandonment in certain site-specific circumstances. Cormorants have the potential to negatively impact other colonial nesting waterbird species (Master 2001, Gross and Haffner 2011).

Similarly, gulls will also displace other colonial nesting birds (USFWS 1996*b,* USFWS 2014). The presence of nesting gulls can often make an area unsuitable for terns (Kress and Hall 2004). Gulls tend to nest earlier and exclude terns from preferred nesting sites (Nisbet 1973, USFWS 1996*a*, USFWS 1998, USFWS 2014). Additionally, laughing gulls actively steal fish from terns returning to nesting areas to feed chicks or their mates incubating the nest (Hatch 1970). In a series of studies conducted in the Gulf of Maine laughing gulls were successful in stealing fish from terns between 32 and 57 percent of the time (USFWS 2014). This behavior (kleptoparasitism) not only reduces the growth rate of tern chicks but also increases the energetic demands placed on adult birds which combined have the potential to reduce the overall nesting productivity of the tern colony (USFWS 2008). Both herring and great-blacked gulls have contributed to declines in tern populations (Cavanagh and Griffin 1993). This is due partially to competition for nest sites (Morris and Hunter 1976). Brinker et al. (2007) stated that great black-back gulls were responsible for driving common terns (*Sterna hirundo*) and other sensitive species from former

nesting areas in the greater Chesapeake Bay. Once gulls are removed from nesting areas historically occupied by nesting terns, terns returned often in the same year (Kress 1983, Blodget and Henze 1991, USFWS 2014). "When …great black-backed and herring gulls were removed from potential tern nesting areas and gull-free areas were identified and maintained for terns, (it) marked the beginning of nesting tern population increases that have been largely sustained for the last 15 years…" (USFWS 2014). Nesting common terns increased from just a few hundred pairs to more than 10,000 pairs in under a decade (USFWS 2014). This same effect has been observed elsewhere (Kress 1983, Guillemette and Brousseau 2011 see additional examples in Kress and Hall 2004). Gulls will also displace piping plovers or cause them to abandon breeding areas (Cross 1988 as cited in Boettcher et al. 2007) and plovers continue to either occur in low numbers or be completely absent from islands with established gull colonies in Virginia (Boettcher et al. 2007).

Threats Caused by Predation

The presence of even a single avian predator at a nest site can result in the direct mortality of adult birds, chicks and eggs or cause birds to abandon active nests and the nesting site entirely (Erwin et al. 2011, Kress and Hall 2004, Shealer and Kress 1991). Gulls, crows, grackles and raptors are known or suspected to reduce breeding success of piping plovers (Boettcher et al. 2007, Daisey 2009, Smith et al. 2009, Wilke et al. 2011, Wilke et al. 2012), American oystercatchers (*Haematopus palliates*) (Daisey 2009, Denmon and Chapman 2012, Denmon and Tarwater 2011, Denmon et al. 2013, Nol 1989, Wilke et al. 2007, Wilke et al. 2011), black skimmers (*Rynchops niger*) (Daisey 2009, O'Connell and Beck 2003), terns (*Sterna* spp.) (Daisey 2009, Erwin et al. 2011, O'Connell and Beck 2003) and other seabirds (Brinker et al. 2007, Wilke et al. 2012) in Virginia and predation is the primary threat facing the recovery of the piping plover in Virginia (Boettcher et al. 2007). Avian predation can be solely responsible for the failure (100% of nests predated) of a colony of nesting terns during a given year (Burger and Lesser 1979). Management efforts in Virginia have been credited with reducing populations of predators that are reducing breeding success; and are believed responsible for increases in piping plover (Boettcher et al. 2007) and tern (Erwin et al. 2011) breeding success.

Black-crowned night herons are nocturnal predators of tern chicks and eggs (Collins 1970, Hunter and Morris 1976, Holt 1994, Kress and Hall 2004, Shealer and Kress 1991). However, night herons will also take the eggs of laughing gulls, black skimmers and American oystercatchers as well as American oyster catcher chicks (USFWS 2014) and are a suspected predator of plover chicks (Blodget and Melvin 1996). Individual night-herons have been identified as specialist predators of tern chicks (Blodget and Melvin 1996). When individual specialist black crowned night herons are removed tern productivity can increase significantly (Hall and Kress 2008). Another nocturnal predator of terns (Blodget and Melvin 1996, Erwin et al. 2011, Holt 1994) and piping plovers (Catlin et al. 2011) is the great horned owl. These owls are primarily responsible for the predation of adults and large chicks but small chick predation has also been reported (Blodget and Melvin 1996, Erwin et al. 2011, Holt 1994, Nisbet and Welton 1984). Great Horned Owl predation and presence has been cited as the cause of tern nesting colony failure (Fisk 1974, Nisbet 1975, Nisbet and Welton 1984, Morris and Wiggins 1986). Short-eared owls are also known to predate adults and large chicks (Holt 1994).

Diurnal raptors are also known predators of shorebirds (Kress and Hall 2004, USFWS 2014). Over the course of two nesting seasons, northern harriers were thought responsible for 15 adult piping plover mortalities at a single sight in Massachusetts (USFWS 2014). Northern Harriers (Burger and Gochfield 1991, Butchko and Small 1992, Jenks-Jay 1982, Nisbet 1975), American kestrels (Fisk 1974, Jenks-Jay 1982), and peregrine falcons (Meehan and Nisbet 2002) can also severely impact a population by predating adult terns or their chicks.

Both American and fish crows are known predators of the eggs and chicks of terns (Blodget and Melvin 1996, Burger and Gochfeld 1991), plover eggs (Barber et al. 2010, Daisey 2009, Melvin et al. 1992), and American oystercatcher nests (Denmon and Tarwater 2011, Denmon et al. 2013, Schulte et al. 2010, Wilke et al. 2011). Crows depredated 100% of the least tern chicks at one site in New York in both 1984 and 1985 (Burger and Gochfeld 1991). Common grackles are another known predator of piping plover eggs (Daisey 2009, USFWS 2014) and likely chicks (Ivan and Murphy 2005) while boat-tailed grackles are a known predator of American oystercatcher eggs (Denmon et al. 2013). Both crows and grackles are intelligent and nesting sites have had problems with these birds associating fencing and staff monitoring piping plovers in Virginia (Daisey 2009) and elsewhere with a food resource (Blodget and Melvin 1996, USFWS 2014).

Historically, herring and great black-backed gulls did not nest in Virginia (Rottenbaum et al. 2007, Watts and Paxton 2014). Increases in the population and distribution of both of these gull species has contributed to declines in tern populations (Cavanagh and Griffin 1993, Nocera and Kress 1996, O'Connell and Beck 2003, Williams et al. 1990) with predation being a partial cause of this decline (Morris and Hunter 1979). Like black-crowned night herons, individual gulls have been identified as specialist predators of seabirds (Donehower et al. 2007, Hatch 1970). Herring gulls have been documented taking the eggs and/or chicks of; terns (Burger and Lesser 1978, Donehower et al. 2007, Guillemette and Brousseau 2001, Hatch 1970), oystercatchers (Schulte et al. 2010), and piping plovers (Rimmer and Deblinger 1990). Herring gulls have also been documented taking adult terns (Donehower et al. 2007). Great black-backed gulls are also well known predators of the eggs, chicks or adults of several species of seabirds including terns (Guillemette and Brousseau 2001, Hatch 1970, Kress and Hall 2004, oystercatchers (Schulte et al. 2010, Wilke et al. 2007), piping plovers (Daisey 2009, Smith et al. 2009), and black skimmer (Daisey 2009). Similarly, laughing gulls are also predators of terns and oystercatchers although this predation is less common than predation by the larger gull species (Burger and Lesser 1978, Dohehower et al. 2007, Holt 1994, Kress and Hall 2004, Schulte et al. 2010, USFWS 2014). In the greater Chesapeake Bay region, terns and black skimmer colonies have been abandoned as a result of black-backed and herring gull predation (Brinker et al. 2007). On a Massachusetts National Wildlife Refuge, increases in the nesting gull population were matched with the decline in the number of both common and roseate terns (USFWS 2014). The beginning of a program to remove these and maintain gull free areas marked the beginning of increases in the number of nesting terns which has been sustained over 15 years (1996-present) (USFWS 2014). Similarly, a study which compared predation at tern colonies with and without adjacent herring gull colonies found that tern colonies with adjacent herring gull colonies had much higher nest predation rates (Burger and Lesser 1978). Guillemette and Brousseau (2011) and Donehower et al. (2007) also found that in years that predatory gulls were removed tern predation rates were lower than in years that they were not removed.

Terns react to gulls, crows, raptors and other diurnal avian predators by mobbing them (Burger and Lesser 1978, Kress and Hall 2004, Meehan and Nisbet 2002). Several authors have suggested that when this behavior occurs frequently enough it could in itself be responsible for reduced productivity because it reduces the time adult birds spend incubating eggs, brooding chicks and foraging (Holt 1994). Terns react more strongly to the presence of nocturnal predators. Adults will completely abandon the nesting colony for the night following owl or black-crowned night heron predation events leaving eggs and chicks exposed to inclement weather and other predators (Cavanagh and Griffin 1993, Fisk 1974, Holt 1994, Hunter and Morris 1976, Kress and Hall 2004, Morris and Wiggins 1986, Nisbet and Welton 1984, Shealer and Kress 1991). This results in prolonged egg incubation periods and reduced productivity (Nisbet and Cohen 1975, Nisbet and Welton 1984). The presence of short-eared owls is reported to have a similar effect (Holt 1994).

1.4 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. 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 USFWS is responsible for managing migratory birds in Virginia while the VDGIF manages resident bird populations. The VDGIF establishes and enforces regulated hunting seasons under frameworks determined by the USFWS, including the establishment of seasons that allow the take of some of the bird species addressed in this assessment. This ensures WS' actions are incorporated into population objectives established by those agencies.

The take of many of the bird species addressed in this EA can only occur when authorized by a depredation permit issued by the USFWS and/or the VDGIF; therefore, the take of those bird species by WS to alleviate damage or reduce threats of damage would only occur at the discretion of those agencies. In addition, WS' annual take of birds to alleviate damage or threats of damage would only occur at levels authorized by those agencies as specified in depredation permits.

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

- How can WS best respond to the need to reduce bird damage in Virginia?
- Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

1.5 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed agricultural resources, natural resources, property, and threats to human safety.

This EA evaluates the need for bird damage management to reduce threats to human safety and to resolve damage or threats of damage to agricultural resources, property and natural resources on federal, Commonwealth, tribal, municipal, and private land within the Commonwealth of Virginia, wherever such management is requested by a cooperator. This EA discusses the issues associated with conducting damage management activities to meet the need for action and evaluates different alternatives to meet that need while addressing those issues.

The methods available to manage bird damage are discussed in Appendix C. The alternatives and Appendix C also discuss how methods would be employed to manage damage and threats associated with birds. 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 birds from occurring when permitted by USFWS, pursuant to the Migratory Bird Treaty Act (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 U.S.C 703-711). A list of bird species protected under the MBTA can be found 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 can be found in 50 CFR 13 and 50 CFR 21. The USFWS has jurisdiction over the management of migratory birds and has specialized expertise in identifying and quantifying potential adverse effects to the human environment from bird damage management activities. Under the proposed action, alternative, WS' take of birds would only occur when permitted by the USFWS through the issuance of a depredation permit or pursuant to depredation orders, when applicable. WS would not be directly involved with bird damage management activities under the technical assistance alternative nor the no involvement by WS alternative; therefore, no take would occur under those alternatives.

Native American Lands

The WS program in Virginia would only conduct damage management activities on Native American lands when requested by a Native American Tribe. Activities would only be conducted after a Memorandum of Understanding (MOU) or cooperative service agreement had been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance was required and what activities would be allowed. 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 be anticipated. Those methods available to alleviate damage associated with birds on federal, Commonwealth, 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 use of those methods had been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon between the Tribe and WS.

Federal, Commonwealth, County, City, and Private Lands

Under two of the alternatives analyzed in detail, WS could continue to provide assistance on federal, state, county, municipal, and private land in Virginia when a request was received for such services by the appropriate resource owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by birds, 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, actions taken on federal lands have been analyzed in the scope of this EA.

Period for which this EA is Valid

If the analyses in this EA indicates an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS determines that new needs for action, changed conditions, new issues, or new alternatives having different potential environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and, if appropriate, supplemented pursuant to the NEPA. Review of the EA would be conducted to ensure that activities implemented under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no involvement in damage management activities by WS were selected, no additional analyses by WS 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 activities conducted by WS under the selected alternative.

Site Specificity

This EA analyzes the potential impacts of alternative approaches to managing damage and threats associated with birds that could be conducted on private and public lands in Virginia where WS and the appropriate entities have entered into an agreement through the signing of a MOU, cooperative service agreements (CSAs), or other comparable document. WS would only conduct damage management activities when requested by the appropriate resource owner or manager. This EA also addresses the potential impacts of conducting damage management activities in areas where additional MOUs, CSAs or other comparable documents may be signed 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.

Many of the bird species addressed in this EA can be found across the Commonwealth and throughout the year; therefore, damage or threats of damage associated with those bird species could occur wherever those birds occur. Planning for the management of bird 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, such as natural disasters, for which the actual site 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. Some of the sites where bird damage could occur can be predicted; however, all specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS to manage damage associated with birds is often unique to the individual; therefore, predicting where and when such a request for assistance will be received by WS would be difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever bird damage or the threat of damage could occur and those issues are treated as such in this EA.

Chapter 2 of this EA identifies and discusses issues relating to bird damage management in Virginia. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would occur in accordance with WS' directives and Standard Operating Procedures (SOPs) as described in Chapter 3 of this EA, as well as relevant laws and regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Virginia. In this way, WS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with the NEPA and still be able to address damage and threats associated with birds.

Summary of Public Involvement

Issues related to bird damage management and the alternatives to address those issues were initially developed by WS and the USFWS in consultation with the VDGIF. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. This EA will be noticed 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 at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS will make the EA available for a minimum of 30 days comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. New issues or alternatives identified after publication of notices announcing the availability of the EA will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a Decision.

1.6 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

Final Environmental Assessment: Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act:

Developed by the USFWS, this EA evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the "take" of bald eagles and golden eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EA evaluated the authorization of disturbance take of eagles, the removal of eagle nests where necessary to reduce threats to human safety, and the issuance of permits authorizing the lethal take of eagles in limited circumstances, including authorizing take that is associated with, but is not the purpose of, an action (USFWS 2009*b*). A Decision and Finding of No Significant Impact (FONSI) was made for the preferred alternative in the EA. The selected alternative in the EA established new permit regulations for the "take" of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27). The USFWS published a Final Rule on September 11, 2009 (74 FR 46836-46879).

Waterbird Conservation Plan: Mid-Atlantic / New England / Maritimes Region:

The Mid-Atlantic/New England/Maritime (MANEM) Working Group developed a regional waterbird conservation plan for the MANEM region of the United States and Canada (MANEM 2006). The MANEM region consists of Bird Conservation Region (BCR) 14 (Atlantic Northern Forest) and BCR 30 (New England/Mid-Atlantic Coast) along with the Pelagic Bird Conservation Region 78 (Northeast United States Continental Shelf) and Pelagic Bird Conservation Region 79 (Scotian Shelf). The plan consists of technical appendices that address: (1) waterbird populations including occurrence, status, and conservation needs, (2) waterbird habitats and locations within the region that are critical to waterbird sustainability, (3) MANEM partners and regional expertise for waterbird conservation, and (4) conservation project descriptions that present current and proposed research, management, habitat acquisition, and education activities (MANEM 2006). Information in the Plan on waterbirds and their habitats provide a regional perspective for local conservation action.

Waterbird Conservation Plan: Southeast Region:

The Southeast Working Group developed a regional waterbird conservation plan for the southeast region which consists of BCR 20 (Edwards Plateau), BCR 21 (Oaks and Prairies), BCR 25 (West Gulf Coastal Plain/Ouachitas), BCR 26 (Mississippi Alluvial Valley), BCR 27 (Southeastern Coastal Plain), BCR 28 (Appalachian Mountains), BCR 29 (Piedmont), BCR 31 (Peninsular Florida), BCR 36 (Tamaulipan Brushlands) and BCR 37 (Gulf Coastal Prarie) (Hunter et al. 2006). The plan includes information on occurrence and status and identifies priority species, major threats, and conservation actions. Information included in this document provides a regional perspective for local conservation.

WS' Environmental Assessments:

WS has previously developed EAs that analyzed the need for action to manage damage associated with pigeons, European starlings, and house sparrows (USDA 2000*a*), crows (USDA 2000*b*), vultures (USDA 2002, USDA 2004, USDA 2012), and to manage predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas (USDA2005). Those EAs identified the issues associated with managing damage associated with birds in the Commonwealth and analyzed alternative approaches to meet the specific need identified in those EAs while addressing the identified issues.

Since activities conducted under the previous EAs will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EAs that addressed birds will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA.

1.7 AUTHORITY OF FEDERAL AND STATE AGENCIES

The authorities of WS and other agencies as those authorities relate to conducting activities to alleviate wildlife damage are discussed by agency below:

Wildlife Services (WS):

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 wildlife. WS' directives define program objectives and guide WS' activities with managing animal damage and threats.

United States Fish and Wildlife Service (USFWS):

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitat. The USFWS has specific responsibilities for the protection of migratory birds, threatened and endangered species, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters managed by the agency in the National Wildlife Refuge System. The USFWS has statutory authority for enforcing the Fish and Wildlife Improvement Act of 1978 (16 USC 7.12), the Fish and Wildlife Act of 1956 (16 USC 742 a-j), and the Migratory Bird Treaty Act (16 USC 703-711).

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the Migratory Bird Treaty Act (MBTA). For more on the MBTA see the next section (Section 1.6). 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. Although, the MBTA makes it unlawful to take birds listed as migratory, Section 3 of this Act authorized the Secretary of Agriculture[5]:

> *"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*

[5] 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.

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."

United States Geological Survey (USGS):

The U.S. Geological Survey (USGS) is a federal agency with diverse responsibilities including the authorization of permits to capture and band migratory birds protected under the Migratory Bird Treaty Act (MBTA) (50 CFR 21.11).

United States Environmental Protection Agency (EPA):

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

United States Food and Drug Administration (FDA):

The U.S. Food and Drug Administration (FDA) is responsible for protecting the 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.

Virginia Department of Game and Inland Fisheries (VDGIF):

The VDGIF, under the direction of the Governor-appointed Board of Directors, is specifically charged by the General Assembly with the management of the Commonwealth's wildlife resources. Although many legal mandates of the Board and the Department are expressed throughout the Code of Virginia, the primary statutory authorities include wildlife management responsibilities (VAC§§29.1-103), public education charges (VAC§§29.1-109), law enforcement authorities (VAC§§29.1-109), and regulatory powers (VAC§§29.1-501). The mission of the VDGIF is:

- To manage Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth;
- To provide opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation and to work diligently to safeguard the rights of the people to hunt, fish and harvest game as provided for in the Constitution of Virginia;
- To promote safety for persons and property in connection with boating, hunting and fishing;
- To provide educational outreach programs and materials that foster an awareness of and appreciation for Virginia's fish and wildlife resources, their habitats, hunting, fishing, and boating opportunities.

The VDGIF is responsible for establishing and enforcing hunting seasons for bird species such as wild turkey that are not listed under the Migratory Bird Treaty Act (MBTA) (Title 29.1, Chapter 5, sections 506, 508, 513, 514). It is also responsible for establishing and enforcing hunting seasons for migratory game birds listed under the MBTA under frameworks developed by the USFWS (Title 29.1, Chapter 5, Section 515). Additionally, the Board of Directors is responsible for adding or changing the classification of wild birds (Title 29.1, Chapter 5, Sections 563, 564, 566, 568).

Virginia Department of Agriculture and Consumer Services (VDACS):

The VDACS may provide assistance to persons in the Commonwealth in order to reduce damage to agricultural resources and property, and to protect public health and safety from damage involving nuisance birds (VAC § 3.2-901). VDACS currently has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife conflicts in Virginia. Under Title 3.2, Chapter 1, Section 102A, the Commissioner of Agriculture and Consumer Services is charged with regulating pesticides. The VDACS has the authority to classify restricted pesticides (Title 3.2, Chapter 39, Section 3904), certify and register pesticide applicators (Title 3.2, Chapter 39, Section 3906), and license pesticide dealers, businesses and consultants (Title 3.2, Chapter 39, Section 3906), conduct investigations and enforce these measures (Title 3.2, Chapter 39, Section 3906). Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act.

1.8 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise would affect WS' activities. WS would comply with all applicable federal, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations relevant to managing bird damage in the Commonwealth are addressed below:

National Environmental Policy Act (NEPA) (42 USC 4321 et seq.), as amended:

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). 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 to be accomplished 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. Federal activities affecting the physical and biological environment are regulated in part by the CEQ 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 capable of avoiding or minimizing significant effects, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions. This EA was prepared by integrating as many of the natural and social sciences as warranted, based on the potential effects of the alternatives. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

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

The Migratory Bird Treaty Act (MBTA) makes it unlawful to, "to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase" some migratory bird species, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13. The law was further clarified to include only those birds afforded protection from take in the United States by the Migratory Bird Treaty Reform Act of

2004. Under the Reform Act, a list of bird species not protected under the MBTA was published (70 FR 12710-12716). The law prohibits "take" of those migratory bird species listed in the Act except as permitted. Wild turkey, rock pigeon, Eurasian collared dove, monk parakeet, European starling, and house sparrow addressed in this EA are not protected under the MBTA (70 FR 12710-12716). The MBTA provides the Secretary of the Interior with the statutory authority for issuing permits to capture and band birds. Under this authority the USGS may issue permits to capture and band birds, as described in Section 1.5. Also as mentioned in Section 1.5, the MBTA provides the Secretary of the Interior with statutory authority for enforcing the MBTA. Under this authority, the USFWS may issue depredation orders or depredation/control permits to resolve damage caused by bird species protected under the Act. Information regarding permits can be found in 50 CFR 13 and 50 CFR 21. Additionally, the Act grants the USFWS the authority to establish hunting seasons for migratory game birds and crows (50 CFR 20). All actions conducted in this EA comply with the regulations of the MBTA, as amended.

- ***Depredation Order for Blackbirds, Cowbirds, Grackles, Crows, and Magpies (50 CFR 21.43)*** Pursuant to the MBTA under 50 CFR 21.43, a depredation permit is not required to lethally take blackbirds, cowbirds, grackles, crows, and magpies when individuals of those species are, *"found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance."* Those bird species addressed in this EA that can be lethally taken under this depredation order include American crows, fish crows, red-winged blackbirds, common grackles, and brown-headed cowbirds. As of 2010, rusty blackbirds (*Euphagus carolinus*) cannot be lethally taken under this order (Sobeck 2010).

Bald and Golden Eagle Protection Act (16 USC 668-668c), as amended:

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as "endangered" under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The "endangered" status was extended to all populations of bald eagles in the lower 48 states, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as "threatened" in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as "threatened". In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of bald eagles is prohibited without a permit from the USFWS. Under the Act, the definition of "take" includes actions that "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb" eagles. The regulations authorize the United States Fish and Wildlife Service to issue permits for the take of bald eagles and golden eagles on a limited basis (see 74 FR 46836-46837, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

Endangered Species Act (ESA) (16 USC 1531-1544):

The Endangered Species Act (ESA) recognizes that our natural heritage is of *"esthetic, ecological, educational, recreational, and scientific value to our Nation and its people*." The purpose of the Act is to protect and recover species that are in danger of becoming extinct. It is administered by the USFWS and the Department of National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater species while the NMFS is primarily responsible for marine organisms. Under the ESA, species may be listed as endangered or threatened. Endangered is defined as a species that is in danger of becoming extinct throughout all or a significant portion of its range while threatened is defined as a species likely to become endangered in the foreseeable future. Under the ESA, *"all federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* (Sec.2(c)). Additionally, the Act requires that, *"each Federal agency shall in consultation with and with the assistance of the Secretary, insure 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 or result in the destruction or adverse modification of habitat of such species……each agency will use the best scientific and commercial data available"* (Sec.7 (a) (2)). WS consults with the USFWS or the NMFS to ensure that the agencies actions, including the actions proposed in this EA, are not likely to jeopardize the existence of endangered or threatened species or their habitat.

National Historic Preservation Act (NHPA) (16 USC 470 et seq.), as amended:

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on such undertakings if an agency determines that the agency's actions are "*undertakings*". Undertakings are defined in Sec. 800.16(y) as a *"project, activity, or program funded in whole or part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license or approval"*. 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 would 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 were used that could result in effects on the character or use of historic properties. Therefore, the methods that could be used by WS under the relevant alternatives are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources were planned under an alternative selected because of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted, as necessary.

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

Federal Actions to Address Environmental Justice in Minority Populations 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 minorities and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with the NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS would only use or recommend legal, effective, and environmentally safe methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income.

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

Children may suffer disproportionately for from environmental health and safety risks because their physical and mental systems are still developing. Each federal agency must therefore, *"make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children"* and *"ensure that its policies, programs, activities and standards address disproportionate risks to children"*. WS would only employ and/or recommend legally available and approved methods under the alternatives where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

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, is directed to develop and implement, a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations"*. APHIS and USFWS developed a MOU which was signed on August 2, 2012. WS would abide by this MOU.

Invasive Species - Executive Order 13112:

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. The Order states that, *"each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species"*.

The Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq.):

The Native American Graves Protection and Repatriation Act (NAGPRA) establishes procedures for federal agencies when Native American "*cultural items*" are inadvertently discovered on federal or tribal lands. Cultural items may include human remains, funerary objects, sacred objects, and objects of cultural patrimony. In part, the NAGPRA requires federal agencies making such discoveries to notify the Secretary of the Department that manages the federal lands or the tribal leaders on tribal lands on which the discovery was made. Additionally, once a discovery is made, work must be stopped and reasonable efforts must be made to protect the item.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC 136 et seq.):

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods described in Appendix C, are registered with and regulated by the EPA and used or recommended by WS in compliance with labeling procedures and requirements.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33):

The Coastal Zone Management Act established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded 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 for requiring that federal actions be conducted 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, a consistency determination would be conducted by WS to assure management actions would be consistent with the state's Coastal Zone Management Program.

Occupational Safety and Health Act (29 USC 651):

The Occupational Safety and Health Act 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.

Nuisance Birds (Code of Virginia (Title 3.2, Chapter 9, Section 900 and 901)):

Not to be confused with the Virginia Administrative Code, the Code of Virginia is the Commonwealth's statutory law. It consists of 67 Titles.

This section of the Code states that, *"the Commissioner* (of Agriculture and Consumer Services) *shall conduct investigations and surveys to determine economic losses or public nuisances caused by nuisance birds and may develop a plan of action when he has determined that they are causing or about to cause economic losses in the Commonwealth, are detrimental to the public health and welfare, or otherwise create a public nuisance".* It also states that the Commissioner may, *"provide technical assistance to*

persons for the suppression of nuisance birds", "appoint an advisory committee to evaluate facts in any particular situation and to make recommendations to him on the course of action", "upon receipt of complaint…make an investigation…(and if necessary) *recommend acceptable means and methods", "provide assistance and cooperate with federal agencies, other state agencies…in the exercise of the duties imposed".* In this Chapter "*Nuisance Birds*" are defined as "*blackbirds, red-winged blackbirds, grackles, cowbirds, pigeons, and starlings or any other species so declared …when causing or about to cause economic losses in the Commonwealth; becoming detrimental to the public health and welfare; defacing or defiling public or private property or otherwise creating a public nuisance."*

The VDACS may provide assistance to persons in the Commonwealth in order to reduce damage to agricultural resources and property, and to protect public health and safety from damage involving nuisance birds (VAC § 3.2-901). VDACS currently has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife conflicts in Virginia.

Rules and Regulations for Enforcement of the Virginia Pesticide Law (The Virginia Administrative Code (Title 2, Agency 5, Chapter 670, 680, 685)):

Not to be confused with the Code of Virginia (Statutory Law), the Virginia Administrative Code is an official publication of the Commonwealth of Virginia which contains State agency rules. It consists of 24 Titles.

Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act. Chapters 670, 680 and 685 of Title 2, Agency 5 of the Virginia Administrative code contain the implementing regulations of the Act. These regulations include the classification and registration of pesticides, the handling, storage and application of pesticides, as well as the certification and registration of sellers and users. Additionally, Chapter 670, Section 140, elaborates on the definition of pest as a *"deleterious organism"* in the Act to include *"English sparrows, crows, and blackbirds"* are defined as pests.

Possession, Transportation and Release of Wildlife by Authorized Persons (The Virginia Administrative Code (Title 4, Agency 15, Chapter 30, Section 50)):

Title 4, Agency 15, Chapter 30, Section 50(a) states *"…U.S. government agencies' employees whose responsibility includes fisheries and wildlife management…..in the performance of their official duties related to public health concerns of problem wildlife removal…will be permitted pursuant to this section to capture, temporarily hold or possess, transport, release, and when necessary humanely euthanize wildlife.."* Under section 50(d) these persons in their official duties may also, "*temporarily possess, transport, and dispose of carcasses of wild animals killed by vehicles, except for state or federal threatened and endangered species, and federally protected migratory bird species*".

Endangered and Threatened species; adoption of federal list; additional species enumerated (The Virginia Administrative Code (Title 4, Agency 15, Chapter 20, Section 130)):

This section of the Administrative code adopts the Federal Endangered and Threatened Species List and gives the director of the VDGIF the authority to propose adoption of modification and amendments to the federal list. Subsection b lists those species declared endangered or threatened in the Commonwealth. These species are listed in the Appendix D. Finally, subsection c makes it unlawful to, *"take, transport, process, sell or offer for sale…any threatened or endangered species of fish or wildlife".*

Nuisance Species Designated (The Virginia Administrative Code (Title 4, Agency 15, Chapter 20, Section 160)):

In this section of the Code, the VDGIF designates the following species addressed in this EA as nuisance species; *"European starling (Sturnus vulgaris), English (house) sparrow (Passer domesticus); and Pigeon (Rock Dove) (Columba livia), other nonnative species as defined in the Migratory Bird Treaty Reform Act of 2004 and regulated under 50 CFR 10.13"*. Section b goes on to state that *"it shall be unlawful to take, possess, transport or sell all other wildlife species not classified as game, furbearer or nuisance, or otherwise specifically permitted by law or regulation"*.

Poisoning of Wild Birds and Wild Animals Prohibited; certain control programs excepted (The Virginia Administrative Code (Title 4, Agency 15, Chapter 40, Section 50)):

"It shall be unlawful to put out poison at any time for the purpose of killing any wild birds and wild animals, provided that rats and mice may be poisoned on one's own property. The provisions of this section shall not apply to the Commissioner of Agriculture and Consumer Services, the United States Department of Agriculture, or their representatives or cooperators, and those being assisted in a control program authorized by those agencies."

Unauthorized Feeding of Wildlife (The Virginia Administrative Code (Title 4, Agency 15, Chapter 40, Section 286)):

"It shall be unlawful for any person …to place, distribute, or allow the placement of food, minerals, carrion, trash, or similar substances when it attracts any species of wildlife in such numbers or circumstances to cause property damage, endanger any person or wildlife, or create a public health concern....This section shall not be construed to restrict bona fide agronomic plantings (including wildlife food plots), bona fide distribution of food to livestock, or wildlife management activities conducted or authorized by the department or U.S. government agencies with wildlife management responsibilities."

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 standard operating procedures (SOPs), and issues that were identified but will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter during the discussion of issues used to develop the SOPs. Additional descriptions of affected environments will be incorporated into the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Bird damage or threats of damage can occur in Virginia wherever birds occur. However, assistance would only be provided by WS when requested by a landowner or manager and WS would only provide direct operational assistance on properties where a MOU, cooperative service agreement, or other comparable document had been signed between WS and the cooperating entity. Most species of birds addressed in this EA can be found throughout the year across the Commonwealth where suitable habitat exists for foraging, loafing, roosting, and breeding. Those bird species addressed in this EA are capable of utilizing a variety of habitats. Since birds can be found throughout the Commonwealth, requests for assistance to manage damage or threats of damage could occur in areas occupied by those bird species.

Upon receiving a request for assistance, the proposed action alternative or those actions described in the other alternatives could be conducted on private, federal, Commonwealth, tribal, and municipal lands in Virginia to reduce damages and threats associated with birds to agricultural resources, natural resources, property, and threats to human safety. The analyses in this EA are intended to 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 bird damage management and addresses activities in Virginia that are currently being conducted under a MOU or cooperative service agreement with WS. This EA also addresses the potential impacts of bird damage management in the Commonwealth where additional agreements may be signed in the future. The USFWS would only issue depredation permits for the take of birds 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 birds may roost, loaf, feed, nest, or otherwise occur. Examples of areas where bird damage management activities could be conducted are: residential buildings, golf courses, athletic fields, recreational areas, swimming beaches, marinas, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, cemeteries, public parks, bridges, industrial sites, urban/suburban woodlots, hydro-electric dam structures, reservoirs and reservoir shore lands, nuclear, hydro and fossil power plant sites, substations, transmission line rights-of-way, landfills, on ship fleets, military bases, or at any other sites where birds may roost, loaf, or nest. Damage management activities could be conducted at agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, grain mills, and grain handling areas (e.g., railroad yards) where birds destroy crops, feed on spilled grains, or contaminate food products for human or livestock consumption. Additionally, activities could be conducted at airports and surrounding properties where birds represent a threat to aviation safety.

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 agency analyzes its potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the proposed federal action, but also the potential impacts that could 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, invasive species, or unprotected wildlife species.

Most bird species are protected under Commonwealth and/or federal law. To address damage associated with those species, a permit must be obtained from the appropriate Commonwealth and / or Federal 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 orders, unprotected bird species). For some bird species, harvest during the hunting season is regulated pursuant to the MBTA by the USFWS through the issuance of frameworks, that includes the allowable length of hunting seasons, methods of harvest, and harvest limits, which are implemented by the VDGIF. Under the blackbird depredation order, blackbirds can be lethally removed by any entity without the need to obtain a depredation permit when those species identified in the order are found committing damage, when about to commit damage, or when posing a human safety threat. Pursuant to the MBTA, the USFWS can issue depredation permits to those entities experiencing damage associated with birds, when deemed appropriate. Some species of birds, including wild turkey, are not protected from take under the MBTA and are instead protected under Commonwealth law and their removal requires a permit from the VDGIF.

If a bird species is not afforded protection under the MBTA (see 50 CFR 10.13), then a depredation permit from the USFWS is not required to address damage or threats of damage associated with those species. Pigeons, Eurasian collared doves, monk parakeets, European starlings, and house sparrows are not protected under the MBTA or by Commonwealth law and therefore no permit would be required from the USFWS or the VDGIF to resolve damage or to lethally take those species.

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, the action is not subject to compliance with the NEPA due to the lack of federal involvement[6] in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed.

Therefore, in those situations in which a non-federal entity has decided that a management action directed towards birds 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, through the issuance of depredation permits, or for some species take can occur at any time without the need for a depredation permit, an entity could take an action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement 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 no action were taken by WS, the non-federal entity could take the action anyway either without the need for a permit, 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 birds to stop damage with or without WS' assistance, WS' participation in carrying out that action would not affect the environmental status quo.

In some situations, however, certain aspects of the human environment may actually benefit more from WS' involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to manage damage when compared to other entities, WS' management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. The concern arises from those persons experiencing damage caused by birds often have no knowledge of bird behavior and no prior experience with managing damage or threats associated with birds. This could lead to the continuation of damage, and could lead to the use of inappropriate methods in an attempt to resolve damage. WS' personnel would be trained in the use of methods, which increases the likelihood that damage management methods would be employed appropriately, which could increase effectiveness, humaneness, minimize non-target take, and reduce threats to human safety from those methods. Thus, in those situations, WS' involvement may actually provide some benefit to the human environment when compared to the environmental status quo in the absence of such involvement.

[6] 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.

2.2 ISSUES ADDRESSED IN THE ANALYSIS OF THE ALTERNATIVES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues related to managing damage associated with birds in Virginia were developed by WS in consultation with the USFWS and the VDGIF. This EA will also be made available to the public for review and comment to identify additional issues.

The issues as those issues relate to the possible implementation of the alternatives, including the proposed action alternative, are discussed in Chapter 4. The issues analyzed in detail are the following:

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Methods available to resolved damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. Lethal methods remove individuals of target species causing the damage, thereby reducing the presence of those species in the area and reducing the local population. The number of target species lethally removed under the alternatives is dependent upon the magnitude of the damage occurring, the level of damage acceptable to individual persons experiencing the damage, the numbers of individual birds involved, and the efficacy of methods employed. Under certain alternatives, both non-lethal and lethal methods could be recommended, as governed by federal, state, and local laws and regulations.

The analysis for the magnitude of impact on the populations of those species addressed in the EA is based on a measure of the number of individuals from each species removed in relation to that species' abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data, when available.

The analysis to determine the magnitude of impacts on the populations of those species addressed in this EA from the use of lethal methods would be based on a measure of the number of individuals lethally removed in relation to that species' abundance. Take would be monitored by comparing the number of birds lethally removed with overall populations or trends. Lethal methods would only be used by WS at the request of a cooperator seeking assistance. Lethal take of birds can occur either without a permit if those bird species are non-native, during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS pursuant to the MBTA, when required. Any activities conducted by WS and permitted by the USFWS under the alternatives addressed would occur along with other natural process 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.

Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), and the Partners in Flight Landbird Population database, the Virginia Breeding Bird Atlas Project (VBBAP), published literature, and harvest data. Further information on those sources of information is provided below.

Breeding Bird Survey

Bird populations can be monitored by using trend derived from data collected during the BBS. The BBS is conducted annually in the United States and Canada, 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 (USGS), 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 are derived 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).

United States Shorebird Conservation Plan

The United States Shorebird Conservation Plan is a plan for stabilizing and maintaining populations of shorebird species. It was developed by a wide array of state and federal agencies, non-governmental conservation organizations, and individual researchers throughout the country. The plan set conservation goals at regional, national and hemispheric scales, identified critical habitat conservation needs and key research needs, and proposed education and outreach programs to increase awareness of shorebirds and the threats they face. The partnership created during the development of the Plan remains active, working to improve and implement the Plan's recommendations (Brown et al. 2001).

Population information for the species included in the plan were obtained from a variety of sources including: "1) count data accumulated from volunteer survey networks, such as the International Shorebird Survey, the Maritimes Shorebirds Survey, and the Pacific Flyway Project; 2) compilation of data from a variety of sources, including the major summary of data from the interior of North America, and regional inventories of wetlands in Latin America; 3) aerial survey data from various projects and areas, including James Bay, Delaware Bay, Pacific northwest Mexico, and the Canadian Wildlife Service "atlas" projects to determine wintering numbers and distribution in South America, Panama and Mexico; 4) data from projects directed towards particular species, such as piping plover, mountain plover, black turnstone, and bristle-thighed curlew; 5) investigations from breeding areas in temperate North America; 6) investigations from Arctic breeding areas, including both historical studies and more recent work using remote sensing to assess habitats and populations over particular regions; and 7) estimates based on extrapolations from schemes such as the Breeding Bird Survey and Christmas Bird Counts" (Brown et al. 2001). This data was then assembled separately for each species by season and region in order to avoid overlap or duplication of records for the same individual birds. Since detectability and "countability" varies by species and habitat and because geographic coverage of survey information is often incomplete, the maximum number of birds observed across all seasons was used as the basis for the current population estimate (Brown et al. 2001).

North American Waterbird Conservation Plan

Much like the Shorebird Conservation Plan, the Waterbird Conservation Plan is a plan for stabilizing and maintaining populations of waterbird species including seabirds, coastal waterbirds, wading birds and marsh birds. Also like the Shorebird Conservation Plan, it was developed by a wide array of state and federal agencies, non-governmental conservation organizations, and individual researchers. Together these organizations and individuals compose the Waterbird Conservation for the Americas partnership.

The plan provides a framework for the conservation of waterbirds by: determining the population status of species; initiate monitoring systems; define sustainable population goals; identify, protect and restore habitat; ensure information on waterbirds is widely available; increase awareness of waterbirds and the threats they face; and ensure that coordinated efforts for waterbirds in the Americas are ongoing (Kushlan et al. 2002). Additionally, the plan identified regions to allow for planning at a scale that is practical and takes into consideration both political and ecological factors. Three such regional plans relevant to this EA are the Mid-Atlantic / New England / Maritimes Region Plan, which includes Bird Conservation Regions (BCR) 14 and 30 as well as Pelagic Bird Conservation Regions (PBCR) 78 and 79 (MANEM 2006), the Southeast Region Plan which includes BCR 27 (Southeastern Coastal Plain), BCR 28 (Appalachian Mountains), and BCR 29 (Piedmont) (Hunter et al. 2006) and the Upper Mississippi Valley / Great Lakes Waterbird Conservation Plan which includes BCR 13 (Wiers et al. 2010). See ***Bird Conservation Regions*** section below for a detailed description of Bird Conservation Regions (BCR). Population information for the species included in the plans were obtained from a variety of sources outlined by Brown et al. (2001) and described above.

The Virginia Breeding Bird Atlas Project (VBBAP)

In 1983, the Virginia Society of Ornithology appointed a committee to facilitate and direct a Breeding Bird Atlas in the Commonwealth (Virginia Society of Ornithology 1989). After a one year trial period, data for the atlas was collected from January 1, 1985 through December 31, 1989 (Trollinger and Reay 2001). During this period, volunteer observers recorded the species, location, date and category of breeding behavior observed for all species under a standard methodology. All unusual sightings were verified. All occurrences or breeding behavior observed (1985–1989) was then consolidated and geographically displayed by species (Trollinger and Reay 2001).

Virginia Colonial Waterbird, Peregrine Falcon and Bald Eagle Surveys

The Center for Conservation Biology at William and Mary – Virginia Commonwealth University in cooperation with the USFWS, USGS, U.S. Department of Defense Army Corps of Engineers, U.S. Department of the Interior National Park Service, National Aeronautics and Space Administration, VDGIF, Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Transportation, The Nature Conservancy, Virginia Society of Ornithology and Dominion Power conducts a variety of surveys within the state to monitor species of concern including colonial waterbirds, peregrine falcon and bald eagle. The colonial waterbird survey used fixed-wing aircraft and follow-up ground counts to map colonies and estimate populations. Population estimates were based on counts of active nests and when this was impractical, the number of adults present. In 1993 and 2003, comprehensive colonial water bird surveys of 24 species were conducted. A third survey was conducted in 2008, however, due to financial constraints; the survey did not examine widely distributed great blue heron and great egret colonies (Watts 2004, Watts and Paxton 2009). In contrast, The Center for Conservation Biology and its partners conduct a series of surveys annually for both peregrine falcon and bald eagle. Annual peregrine falcon monitoring begins with surveys of nesting structures by foot or boat for the presence of adults or nesting activity. Sites with confirmed activity are then surveyed 2–5 more times to document breeding activity, band young and document fledging success (Mojica et al. 2012). Similarly, annual bald eagle monitoring begins with aerial surveys for active nests. Sites with confirmed activity are mapped and then surveyed a second time to monitor productivity (Watts and Byrd 2011).

Christmas Bird Count

The CBC is conducted on an annual basis, in December and early January by numerous volunteers under the guidance of the National Audubon Society. 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 count can be used as an indicator of trends in the population of a particular bird species 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).

Partners in Flight Landbird Population Estimate

The BBS data are intended for use in monitoring bird population trends, but it is also possible to use BBS data to develop a general estimate of the size of bird populations (Rich et al. 2004, Blancher et al. 2013). Using relative abundances derived from the BBS conducted between 1998 and 2007, the Partners in Flight Science Committee (2013) extrapolated population estimates for many bird species in North America as part of the Partners in Flight Landbird Population Estimate database. The Partners in Flight system involves extrapolating the number of birds in the 50 quarter-mile circles (total area/route = 10 mi^2) surveyed during the BBS to an area of interest. The model used by Rich et al. (2004) and updated by the Partners in Flight Science Committee (2013) makes assumptions on the detectability of birds, which can vary for each species (Blancher et al. 2013). Some species of birds that are more conspicuous (visual and auditory) are more likely to be detected during bird surveys compared to bird species that are more secretive and do not vocalize often. Information on the detectability of a species is combined to create a detectability factor, which may be combined with relative abundance data from the BBS to yield a population estimate (Rich et al. 2004, Blancher et al. 2013).

Annual Hunter Harvest Estimates

The populations of some species of migratory birds are sufficient to allow for annual harvest seasons. Hunting seasons for game birds classified as migratory under the MBTA are established under frameworks developed by the USFWS and implemented by the VDGIF. Species that fall into this category that are addressed in this EA include; Wilson's snipe, mourning dove, American crow and fish crow. Crows can also be taken under the Depredation Order for Blackbirds, Cowbirds, Grackles, Crows, and Magpies (50 CFR 21.43), established by the USFWS pursuant to the MBTA. One species of non-migratory game bird, the wild turkey, is not protected under the MBTA but are protected by the Commonwealth of Virginia can be harvested during regular hunting seasons established and enforced by the VDGIF.

The USFWS and state wildlife agencies have in place a program whereby licensed migratory game bird hunters must register annually in the state in which they hunt. Each state wildlife agency is responsible for collecting the name, address, and date of birth from each migratory bird hunter, asking them general questions about their harvest and sending this information to the USFWS. The USFWS then utilizes this data to conduct detailed surveys to estimate and prepare reports on the number of birds harvested (Raftovich et al. 2009, 2010, 2011, 2012, 2013). The VDGIF also conducts periodic surveys to estimate the number of birds harvested (e.g., see Jagnow et al. 2008*a*).

Bird Conservation Regions

Bird Conservation Regions (BCR) are areas in North America that are characterized by distinct ecological habitats and that have similar bird communities and resource management issues. The Commonwealth of Virginia lies within the Southeastern Coastal Plain (BCR 27), Appalachian Mountains (BCR 28), Piedmont (BCR 29) and the New England / Mid-Atlantic Coast (BCR 30) regions (USFWS 2000; see Figure 2.1).

The eastern part of the Commonwealth lies within the Southeastern Coastal Plain (BCR 27). This Region is characterized by extensive riverine swamps and marsh complexes along the Atlantic coast and longleaf, slash and loblolly pine forest (USFWS 2000). This region was modified by the North American Waterbird Conservation Plan for the purposes of the regional shorebird plans (see ***North American Waterbird Conservation Plan***). In those plans, BCR 27 excludes those watersheds draining into the Chesapeake Bay (Hunter et al. 2006).

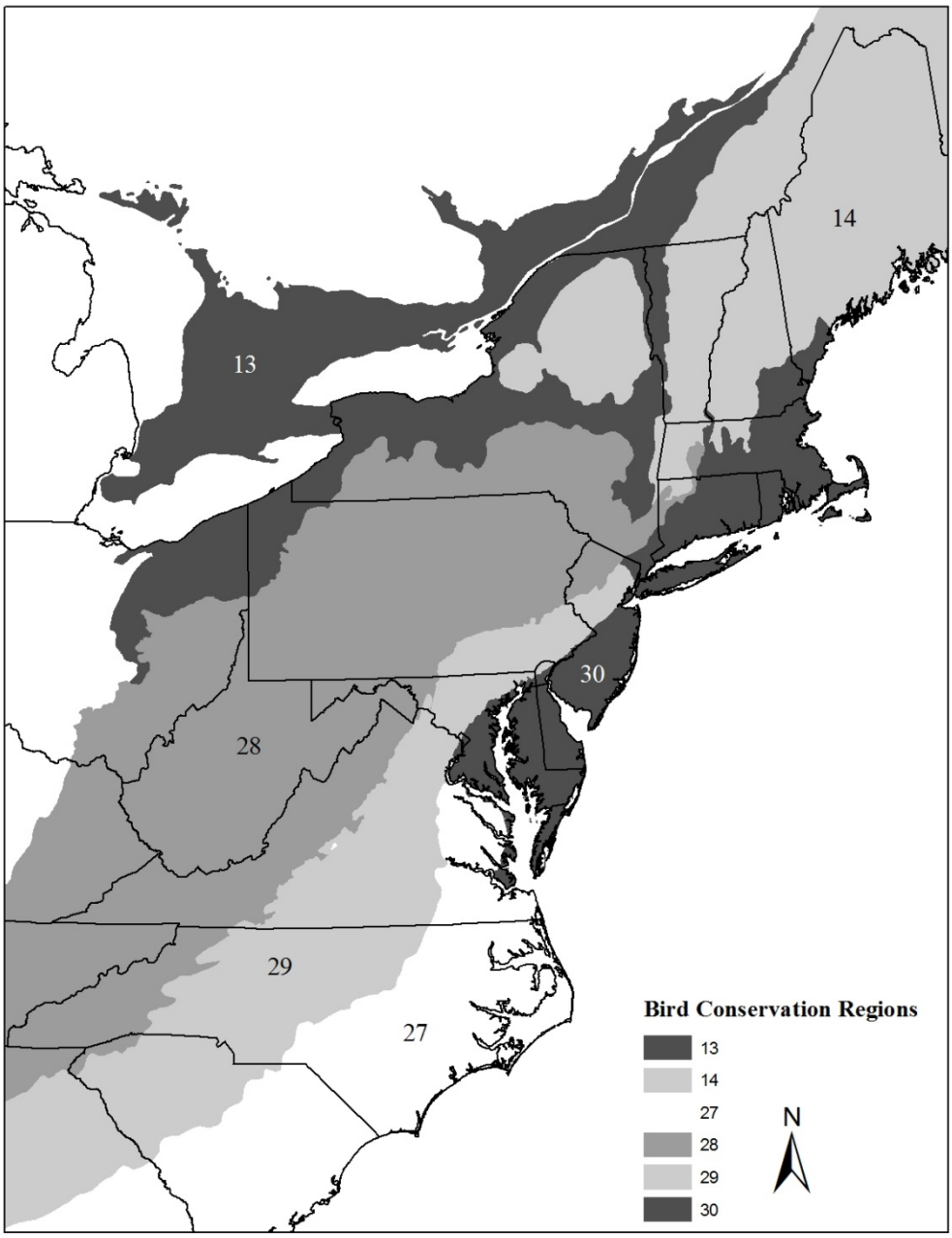
The Appalachian Mountains region (BCR 28) is characterized by rugged terrain that includes the Blue Ridge, the Ridge and Valley Region, the Cumberland Plateau, the Ohio Hills, and the Allegheny Plateau. In Virginia, the Appalachian Mountains region covers the portion of the state that lies west of the Blue Ridge Mountains.

The central portion of the Commonwealth lies within the Piedmont region, also known as (BCR 29). This region is characterized as a transitional area between the Appalachian Mountains (in this case the Blue Ridge Mountains) and the flat coastal plain of the Atlantic Ocean (USFWS 2000).

BCR 30, or the New England/Mid-Atlantic Coast region, overlaps a small portion of the northeastern part of the Commonwealth. This region is characterized by coastal wetland and beach habitats (USFWS 2000). This region was modified by the North American Waterbird Conservation Plan for the purposes of the regional shorebird plans (see ***North American Waterbird Conservation Plan***). In those plans, BCR 30 includes those watersheds draining into the Chesapeake Bay (Hunter et al. 2006).

Other Bird Conservation Regions that dominate the northeast are the Atlantic Northern Forest region (BCR 14) and the Lower Great Lakes / St. Lawrence Plain region (BCR 13). Although these regions do not include any of the land area of Virginia, several of the bird species addressed in this EA have breeding colonies that occur within the region. Those bird species with nesting colonies in the Atlantic Northern Forest region cause damage or pose a threat of damage in Virginia during the non-breeding season. For example, several of the gull species addressed in this EA do not have breeding colonies in the Commonwealth; however, those species often cause damage or pose threats of damage in Virginia. Several of the analyses in Chapter 4 of this EA will address birds with breeding populations that occur primarily in BCR 14 and/or BCR 13.

Figure 2.1: Map of Bird Conservation Regions Relevant to the EA as defined by USFWS 2000



Issue 2 - Effects of Damage Management Activities on Non-target Wildlife Populations, Including Threatened and Endangered Species

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on non-target species, including threatened and endangered species. Methods available to resolve damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. However, non-lethal methods also have the potential to inadvertently disperse non-target wildlife. Lethal methods remove individuals of the

species (target species) causing the damage, thereby reducing the presence of those species in the area and the local population. However, lethal methods also have the potential to inadvertently capture or kill non-target wildlife.

The Endangered Species Act (ESA) makes it illegal for any person to '*take*' any listed endangered or threatened species or their critical habitat. The ESA defines take as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1531-1544). Critical habitat is a specific geographic area or areas that are essential for the conservation of a threatened or endangered species. The Act requires that federal agencies conduct their activities in a way to conserve species. It also requires that federal agencies consult with the appropriate implementing agency (either the USFWS or the NMFS) prior to undertaking any action that may take listed endangered or threatened species or their critical habitat pursuant to Section 7(a)(2) of the ESA. 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, which is further discussed in Chapter 4.

There may also be concerns that WS' activities could result in the disturbance of eagles that may be near or within the vicinity of WS' activities. Under 50 CFR 22.3, the term "disturb", as it relates to take under the Bald and Golden Eagle Act, has been defined as "to agitate or bother a bald and golden eagles to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The environmental consequences evaluation conducted in Chapter 4 of this EA will discusses the potential for WS' activities to disturb eagles as defined by the Act.

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

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage caused by birds. Both chemical and non-chemical methods have the potential to have adverse effects on human health and safety. Risks can occur to persons employing methods and to persons coming into contact with methods. Risks can be inherent to the method itself or related to the misuse of the method.

Safety of Chemical Methods Employed

Potential risks to human health and safety associated with chemical methods are related to the potential for human exposure either through direct or indirect contact with the chemical. Under the alternatives analyzed in detail, chemical methods could include avicides, reproductive inhibitors, and repellents. All of these chemical methods except for the repellent Mesurol (EPA No. 56228-33) would be available to all entities under all the alternatives analyzed in detail.

Avicides are chemicals used to lethally take birds. The chemical 3-chloro-p-toluidine hydrochloride available in two formulations, DRC-1339 and Starlicide™ Complete, are the only two avicides currently available for use in the Commonwealth. In Virginia, DRC-1339 is registered for use by WS only while Starlicide™ Complete is registered for use by persons registered with the VDACS as pesticide applicators. Avicides would be available for use under any of the alternatives.

Nicarbazin is a reproductive inhibitor that has been registered with the EPA and is commercially available under the trade name OvoControl™. Nicarbazin is the only reproductive inhibitor currently registered with the EPA for birds and is only available to manage local populations of resident Canada geese, domestic waterfowl, and pigeons by reducing or eliminating the hatchability of eggs. Nicarbazin is

registered for use by persons registered with the VDACS as pesticide applicators. Nicarbazin would be available for use under any of the alternatives analyzed in detail.

Several chemical repellents are commercially available for use in dispersing birds from an area or discouraging them from feeding on a potential food resource. Repellents being considered for use in this EA include: Avitrol, Mesurol (EPA No. 56228-33), and products listed under a variety of trade names containing the chemicals polybutene, anthraquinone and methyl anthranilate. Such repellents available include Bird Shield®, 4 the birds®, and Flight Control® and are available for use by persons registered with the VDACS as pesticide applicators and therefore would be available for use under any of the alternatives. Avitrol is another avian repellent available for use to manage damage associated with birds. Avitrol is registered for use by persons registered with the VDACS as a pesticide applicator. Finally, the repellent Mesurol (EPA No. 56228-33) is not currently registered for use in Virginia. If it were to be registered for use in Virginia, it could only be used by WS and therefore would only be available under the proposed action alternative.

The use of chemical methods is strictly regulated by the EPA, FDA and VDACS. These chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. Each of the chemical methods listed above have specific requirements for their handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code. Additional information about these methods can be found in Appendix C.

Safety of Non-Chemical Methods Employed

Most methods available to manage damage and threats associated with birds are considered non-chemical methods. Non-chemical methods available can be grouped into two categories resource management as well as physical exclusion and deterrents. Examples of resource management methods include changes in animal husbandry practices, changes in crop rotations, pruning trees to discourage birds from roosting or planting vegetation that is unpalatable to birds. Examples of physical exclusion or deterrents include scarring techniques such as pyrotechnics, propane cannons, electronic distress calls, effigies, mylar tape, lasers, eye-spot balloons, fencing, bird proof barriers, nest destruction or live traps. All of these methods are designed to disperse birds or make the area where damage is occurring unattractive to the birds which are associated with the damage. Non-chemical lethal methods include shooting, capture and euthanasia, or the reduction of a local population by hunting. All of these non-chemical methods available to address bird damage in Virginia would be available for use under any of the alternatives and could be employed by any entity, when permitted.

Like chemical methods, non-chemical methods, if misused, could potentially be hazardous to human health and safety. The primary safety risk of most non-chemical methods occurs directly to the person employing the method. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, or pyrotechnics. All of the non-chemical methods available to address bird damage in Virginia would be available for use by any entity, when permitted, under all of the alternatives analyzed in detail.

Effects of Not Employing Methods to Reduce Threats to Human Health and Safety

An issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that birds can pose. Potential risks to human health and safety associated with not employing methods are related to the potential for human exposure to zoonotic diseases or the threat of birds to aircraft. These risks were addressed previously in Section 1.2 of Chapter

1. If the methods used to address the threats associated with potential zoonosis or the threat of aircraft striking birds was limited it could lead to increased risks of injury, illness or loss of human life.

Issue 4 – Humaneness and Animal Welfare Concerns

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted 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), suffering is described 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 action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain 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 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 would be better served to 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.

The issue of humanness and animal welfare concerns, as those concerns relate to the methods available for use, will be further discussed under the alternatives in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

Issue 5 – Effects of Bird Damage Management Activities on the Aesthetic Values of Birds

An additional issue raised is that bird damage management activities would result in the loss of the aesthetic benefits of target birds to persons in the area where damage management activities occur.

Wildlife is generally regarded as providing utilitarian, monetary, recreational, scientific, ecological, existence and historic values (Conover 2002). These benefits can be tangible, or intangible. Both recreational and existence values are related in part to aesthetics. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature and dependent upon what an observer regards as beautiful.

Many people enjoy watching and interacting with birds and take pleasure from knowing they exist. In modern societies a large percentage of households have pets. However, some people may consider individual wild animals including birds as "pets" and exhibit affection towards these animals.

The values people place on wildlife is unique to the individual and can be based on many factors. Because these values differ, public attitudes toward wildlife vary considerably. To alleviate damage caused by wildlife, some people support removal, some people believe that all wildlife should be captured and relocated to another area while others strongly oppose any management and want wildlife agencies to teach tolerance. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife similar to attitudes of a pet owner. Attitudes can also differ significantly depending upon if the individual is affected by the damage or threats of damage.

As stated previously, methods available to alleviate damage or reduce threats either disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, or alternatively lethally removes individuals of the species causing the damage. These activities reduce the presence of target species in the area where damage is occurring. Therefore, these activities have the potential to affect the aesthetic values of wildlife depending upon the values, philosophies, attitudes and opinions of individuals.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest

Another issue commonly identified as a concern is that damage management activities conducted by WS could affect the ability of hunters to harvest species targeted by management activities. Potential impacts could arise from both lethal and non-lethal damage management methods. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. If the target species is also a harvestable bird species, the presence of these species could be reduced in the area where damage management activities are occurring. Lethal methods remove individuals of the species (target species) causing the damage, thereby reducing the local population and the presence of those species in the area. Therefore, if the target species is also a harvestable bird species, lethal methods could reduce the local population and the presence of harvestable bird species in the area where damage management activities are occurring.

Often, bird damage management activities are conducted in areas where hunting is restricted (e.g., airports) or has been ineffective (e.g., urban areas). Because both non-lethal and lethal methods disperse birds from areas where damage is occurring, birds may move from areas where hunting is restricted to areas more accessible to hunters. Individual birds not directly removed by lethal methods may disperse from an area due to secondary effects of the method (*e.g.,* noise created by firearms).

Species addressed in this EA which are harvestable during regulated hunting seasons in the Commonwealth include: wild turkey, Wilson's snipe, mourning dove, American crow and fish crow.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL, WITH RATIONALE

Additional issues were identified by WS, the USFWS, and the VDGIF during the scoping process of this EA. Those issues were considered by WS, the USFWS, and the VDGIF during the development of this EA. However, those issues will not be analyzed in detail for the reasons provided. The following issues will not be analyzed in detail in this EA:

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

The issue was raised that an EA for an area as large as the Commonwealth of Virginia would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. Although WS, the USFWS, and the VDGIF could predict some of the possible locations or types of situations where some type of bird damage would occur, the agencies cannot predict the specific locations or times at which affected persons determine a damage or threat of damage caused by birds has become intolerable to the point that they request assistance. In addition, WS, the USFWS, and the VDGIF would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe vs. Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the proposed action 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 the potential individual and cumulative impacts of managing damage and threats associated with birds. In terms of cumulative impacts, a single EA that analyzes impacts for the entire Commonwealth will provide a more comprehensive and less redundant analysis than multiple EAs which cover smaller areas. If a determination were made through this EA that the proposed action alternative or the other alternatives might have a significant impact on the quality of the human environment, an EIS would be prepared.

Effects of Bird Damage Management Activities on Biodiversity

Another issue identified as a concern is that managing bird damage could affect biodiversity or the diversity of species. When managing damage caused by birds, WS, the USFWS and the VDGIF do not attempt to eradicate any species of native wildlife. The purpose of wildlife damage management is to reduce or alleviate the damage or threats of damage by targeting individual or groups of wildlife identified as causing damage or posing a threat of damage. All native bird species addressed in this EA are protected by either the MBTA or the Commonwealth of Virginia. Any take of native bird species can only occur at the discretion of the USFWS or the VDGIF which ensures that take occurs within allowable take levels to achieve desired population objectives for these birds. Any reduction of a local population would be temporary because immigration from adjacent areas or reproduction would replace those animals removed. Therefore, wildlife damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

An issue commonly identified as a concern is that a threshold of damage or economic loss should be established and reached before lethal methods can be used to resolve damage and that damage caused by wildlife should be a cost of doing business. For any given damage situation, there are varying thresholds of tolerance exhibited by those people affected. The point at which people begin to implement damage management methods are often unique to the individual and can be based on many factors (e.g., economic, social, aesthetics). How damage is defined is also often unique to the individual and damage occurring to one individual may not be considered damage by another individual. Therefore the threshold of damage or economic loss that can be tolerated is also unique to the individual. Additionally, establishing thresholds of damage or economic loss is difficult or inappropriate in situations where human health and safety are at risk (*e.g.,* at airports).

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 found that a forest supervisor only needed to show that damage from wildlife was threatened, to establish a need for wildlife damage management (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.

Cost Effectiveness of Management Methods

A formal, monetary cost benefit analysis is not required to comply with the NEPA and consideration of this issue is not essential to selecting an alternative. However, methods that are not only the most effective in reducing damage or threats but are also the most cost effective are likely to receive the greatest application in any effective damage management program. As part of any damage management program, methods should continually be evaluated for their cost effectiveness. However, damage management is often constrained by the financial means of those persons experiencing damage. The cost effectiveness of methods and the effectiveness of methods are therefore linked.

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. Under any of the alternatives, birds causing damage or posing threats could be lethally removed with firearms. Lead is a metal that can be poisonous to animals. Risk of lead exposure to animals occurs primarily when they ingest lead shot or bullet fragments. To address this problem, the USFWS requires that non-toxic shot be used to take birds under depredation permits issued pursuant to the MBTA and under the blackbird depredation order. However, lead shot may be used by persons implementing wildlife damage management methods with rifles or air rifles, during annual hunting seasons or for unprotected non-native birds at any time. If lead shot is used, birds should be retrieved to alleviate the risk to animals that may scavenge and consume these lethally removed birds and the lead shot or bullet fragments that they may contain. Furthermore, lead shot should not be used in areas frequented by waterbirds as the feeding behavior of these birds makes them particularly vulnerable to consumption of lead shot. Given these precautions, the low amounts of lead that could be deposited from damage management activities and ingested by wildlife would have minimal effects.

Deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a bird, if misses occur, or if the bird carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns have been raised that lead from bullets introduced into the environment from shooting activities could lead to the contamination of either

ground water or surface water from runoff. Stansley et al. (1992) studied lead levels in water that was directly subjected to high concentrations of lead shot because of intensive target shooting at shooting ranges. Lead did not appear to "*transport*" readily in surface water when soil at the shooting ranges were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Stansley et al. (1992) did however detect elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at one shooting range, although the study did not find higher lead levels in a lake into which the stream drained, with the exception of 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. Stansley et al. (1992) also indicated that even when lead shot has accumulated in high levels in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water downstream. Muscle samples from two species of fish collected in water bodies with high levels of lead shot had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992). Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "*action level*" of 15 parts per billion as defined by the Environmental Protection Agency (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 transport of lead from bullets or shot distributed across the landscape is reduced once the bullets and shot form crusty lead oxide deposits on their surfaces, which serves to further reduce the potential for ground or surface water contamination (Craig et al. 1999). These studies suggest that the very low amounts of lead that could be deposited from damage management activities would have minimal effects on lead levels in soil and water.

Since the take of birds could occur by other entities during regulated hunting seasons, through the issuance of depredation permits, under depredation/control orders, or without the need to obtain a depredation permit, WS' assistance with removing birds would not be additive to the environmental status quo. The amount of lead deposited into the environment may be lowered by WS' involvement in activities due to efforts by WS to ensure projectiles do not pass through, but are contained within the bird carcass, which would limit the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that birds are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which would further reduce the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement would ensure efforts were made to retrieve bird carcasses lethally removed using firearms to prevent the ingestion of lead in carcasses by scavengers. WS' involvement would also ensure carcasses were disposed of properly to limit the availability of lead. Based on current information, the risks associated with lead bullets that would be deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from bird 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, only non-toxic shot would be used by WS 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 a Bird Roost on People in Urban / Suburban Areas

Another issue often raised is that using non-lethal methods to disperse birds from a roost location to alleviate damage or threats could result in new damage and threats when birds establish a new roost location. While the persons originally experiencing damage or threats may see resolution of the problem when the roost is dispersed, persons at the new bird roost may see the bird problem as imposed on them. Thus, overall there is no resolution to the original bird problem (Mott and Timbrook 1988).

This concern is heightened in large metropolitan areas where the likelihood that birds dispersed from a roost will find a new roost location where damage and threats will not occur is very low. In these situations where multiple people are affected, the problem can be mitigated by utilizing a community level decision making process where community or municipal leaders as well as property owners decide on the best management approach. In these instances, funding for damage management activities is often provided by the municipality where the bird roost is located. This allows bird damage management activities to move with the roost as long as it remains within the municipality.

Bird Damage Should Be Managed by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contracted by those persons experiencing damage or threats caused by birds to reduce damage and threats caused by birds, under any of the alternatives. In addition, WS could refer persons requesting assistance to private nuisance wildlife control agents 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 only responds to requests for assistance received. When responding to requests for assistance, WS would inform requesters that other service providers, including private entities, might be available to provide assistance.

Bird Damage Management Should Not Occur at Taxpayer Expense

An issue was raised that wildlife damage management should not be provided at the expense of the taxpayer. Activities conducted by WS to manage damage or threats associated with birds in Virginia are primarily funded by cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Virginia. Technical assistance is provided to those persons experiencing damage or threats of damage caused by birds, when requested, as part of this federal appropriation. However, all assistance in which WS' directly performs management activities is funded by cooperative service agreements.

Global Climate Change / Greenhouse Gas Emissions

The WS program activities that may result from 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 as a result of the proposed action. The proposed action would meet requirements of applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives developed to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed analysis in Chapter 4. Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. Standard operating procedures (SOPs) for bird damage management in Virginia are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to address the identified issues associated with managing damage caused by birds:

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats associated with birds in Virginia. Under this alternative, WS could respond to requests for assistance for managing damage and threats associated with birds by: 1) taking no action, if warranted, 2) providing technical assistance to property owners or managers on actions they could take to reduce damage or threats of damage, or 3) provide technical assistance and direct operational assistance to a property owner or manager experiencing damage or threats of damage. Technical assistance is the provision of recommendations, information or materials for use in managing damage. Direct operational assistance is the implementation of management activities by WS personnel. Direct operational assistance could be provided when funding is available through federal appropriations or cooperative funding. However, WS response to requests for assistance is dependent upon on those persons initiating the request. Those persons receiving technical assistance can 1) take no action, 2) choose to implement WS' recommendations on their own, 3) use the services of a private nuisance wildlife control agent, 4) use volunteer services of private individuals or organizations, or 5) use the services of WS (direct operational assistance) when available. Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.

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). After receiving a request for assistance, a determination is made as to whether the problem is within the authority of WS. If it is, information about the damage is gathered and analyzed (e.g., what species is responsible for the damage, the type of damage is occurring, magnitude of the damage occurring, previous actions taken to address the problem). WS then evaluates the appropriateness of strategies and methods based on their availability (i.e., legal and administrative) and suitability based on biological, environmental, social and economic factors (see WS Directive 2.101). Methods deemed practical for the situation are then developed into a management strategy and this information is provided to the requestor in the form of technical assistance. WS would continue to monitor and evaluate the situation as assistance is provided, modifying the strategy and methods used to reduce the damage to an acceptable level.

The most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach that may call for the use of several methods simultaneously or sequentially. This approach, used by WS for providing both technical assistance and direct operational assistance, is commonly known as integrated management (see WS Directive 2.105). The philosophy behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment[7]. Integrated damage management may incorporate both non-lethal and lethal methods depending upon the circumstances of the specific damage problem. Non-lethal methods disperse or otherwise make an area where the damage is occurring unattractive to the species causing the damage, thereby reducing the presence of those species in the area. Lethal methods remove individuals of the species causing the damage, thereby reducing the presence of those species in the area and the local population. Appendix C contains a thorough discussion of the methods available for use in managing damage and threats associated with birds under this alternative. All of the methods listed in the Appendix would be available under this alternative although not all methods would be available for direct implementation by all persons. Mesurol (EPA No. 56228-33) and

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

DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicator licenses. To be effective, management activities should begin as soon as birds begin to cause damage or threats. Bird damage that has been ongoing can be difficult to resolve since birds have established feeding, roosting, loafing and nesting locations.

The WS program in Virginia follows the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, when numerous people are being affected by damage or threats associated with birds, and a request for assistance is made to WS, WS advocates providing technical assistance to the local decision-maker(s). Requests for assistance often originate from community representatives who have been notified by community members concerned about damage and threats associated with birds. By involving decision-maker(s) in the process, damage management actions can be presented to allow decisions on damage management to involve those individuals that the decision maker(s) represent. Local decision-maker(s) could be elected officials or appointees who oversee the interests and business of the local community. Local decision-maker(s) could represent the local community's interest and make decisions for the community or they could relay technical assistance information to a higher authority or the community for discussion and decision-making. Local decision-maker(s) could also request that WS present technical assistance information at public meetings to allow for involvement of the community. Involving the appropriate representatives of the community ensures a community-based decision is made. In the case of private property, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy issues, WS cannot disclose information about who receives technical or direct operational assistance. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others are involved in the decision-making process is a decision made by that individual.

Technical Assistance

Technical assistance is the provision of information, recommendations, and demonstrations on available and appropriate methods. It may also include the provision of supplies or materials not readily available. The implementation of these methods to resolve damage and threats associated with birds is entirely the responsibility of the requester with no direct involvement by WS. Technical assistance involves collecting information about the nature and extent of the damage, the species involved, the number of individual birds involved and previous actions taken to address the problem. Using the WS Decision Model, WS then provides information on appropriate methods that the requestor may consider to resolve damage or threats. This process may include visits to the location where damage or threats are occurring, written information, telephone conversations, presentations or demonstrations. Generally, several management strategies are described to the requestor for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. In some instances, the provision of information about the wildlife results in tolerance and / or acceptance of the situation. In other instances, management options are discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommended by WS.

Education

An important component of technical assistance is education. Education is important because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the dissemination of information and recommendations to those persons requesting assistance with reducing damage or threats, WS provides lectures, courses, and demonstrations to producers, homeowners, Commonwealth and county agents, colleges and universities, and other interested groups on wildlife damage management. Additionally, technical

papers are presented at professional meetings and conferences so that other natural resource professionals are kept up to date on recent developments in damage management technology, programs, agency policies, laws and regulations.

Research and Development
Another important component of technical assistance is the development of new methods. The National Wildlife Research Center (NWRC) functions as the research unit of WS. NWRC uses scientific expertise to develop methods to resolve conflicts between humans and wildlife while maintaining the quality of the human environment. NWRC research biologists work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected worldwide for their expertise in wildlife damage management.

Depredation Permits
Lethal take of birds can occur either: without a permit (if those species are non-native), during hunting seasons, under depredation orders or through the issuance of depredation permits by the USFWS or the VDGIF. Currently, as part of the application process, the USFWS requires that permittees contact WS to obtain a recommendation (technical assistance) for how to address the wildlife damage problem. WS would evaluate the situation and then issue a recommendation that describes the damage, species involved, number of individual birds involved, previous actions taken to address the problem and recommendations for how to address the problem. Recommendations can include non-lethal actions and when appropriate, the recommendation that USFWS issue a depredation permit for lethal actions. However, the USFWS requires that available non-lethal actions were used where possible and practical and shown ineffective prior to issuing a permit for lethal actions. USFWS then reviews the application completed by the property owner or manager and the recommendation issued by WS and makes a determination to issue or not issue a depredation permit. Upon a receipt of a depredation permit, the property owner or manager or an appropriate designated sub-permittee may then commence the authorized activities. Permittees must submit a written report of their activities upon expiration of the permit. Permits may be renewed annually as needed to resolve continuing damage or threats of damage.

Direct Operational Assistance

Direct operational assistance can only commence after technical assistance has been provided (see WS Directive 2.101, WS Directive 2.201) and those persons requesting assistance have been informed of their options (see WS Directive 3.101). Those persons receiving technical assistance can 1) take no action, 2) choose to implement WS' recommendations on their own, 3) use the services of a private nuisance wildlife control agent, 4) use volunteer services of private individuals or organizations, or 5) use the services of WS (direct operational assistance) when available. Direct operational assistance could be provided when funding is available through federal appropriations or cooperative funding. Direct operational assistance would only be conducted by WS after a Memorandum of Understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager has agreed could be used on property they own and/or manage has been signed by both parties.

To address the anticipated needs of all property owners or managers with bird damage in Virginia that may request WS' assistance with lethal methods to alleviate their damages, WS would annually submit an application for a depredation permit(s) to the USFWS estimating the maximum number of birds of each species to be lethally taken as part of an integrated approach. The USFWS would conduct an independent review of the application, and if acceptable, issue a permit as allowed under the depredation permit regulations. WS could request an amendment of their permit to increase the number of birds that would

be taken to address unpredicted and emerging bird damages or conflicts. Each year, WS would submit an application for renewal of their permit, and using adaptive management principles would adjust the number of birds to meet anticipated needs based upon management actions in the previous year and anticipated damages and conflicts in the next year. The USFWS would review these applications annually and issue permits as allowed pursuant to the MBTA. Wild turkeys are not protected from take under the MBTA and are instead protected under Commonwealth law. .

Under this alternative, an annual review of this EA would be conducted to ensure that activities conducted occur within the parameters evaluated in the EA. Monitoring of activities would ensure the EA remains appropriate to the scope of damage management activities conducted by WS. If changes in the scope occur or could occur, the EA would be reviewed and supplemented, if appropriate, to ensure compliance with the NEPA.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Technical assistance would be provided as described above under Alternative 1, including recommendations as described in *Depredation Permits*. Direct operational assistance provided by WS as described above would not be available. Appendix C contains a thorough discussion of the methods available for use in managing damage and threats associated with birds. With the exception of Mesurol (EPA No. 56228-33) and DRC-1339, all methods listed in the Appendix could 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 persons with pesticide applicators licenses. Although DRC-1339 is only available for use by WS, a product containing the same active ingredient, Starlicide, is commercially available as a restricted-use pesticide for managing damage associated with starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds at livestock and poultry operations.

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

Alternative 3 – WS Would Not Address Bird Damage

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 be involved with any aspect of bird damage management. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities. This alternative would not deny other federal, Commonwealth, and/or local agencies, including private entities from conducting damage management activities directed at alleviating damage and threats associated with birds. Similar to Alternative 2, with the exception of Mesurol (EPA No. 56228-33) and DRC-1339, all methods listed in the Appendix could be available under this alternative.

Under this alternative, property owners or managers may have difficulty obtaining permits to use lethal bird damage management methods. The USFWS requires professional recommendations on individual damage situations before issuing depredation permits for lethal take, as described above in *Depredation Permits* under Alternative 1. The USFWS does not have the mandate or the resources to conduct bird damage management activities. Commonwealth agencies with responsibilities for migratory birds would

likely have to provide this information if depredation permits are to be issued. If this information were provided to the USFWS along with an application completed by the property owner or manager for a depredation permit, the USFWS could review the application and make a determination to issue or not issue a depredation permit as described in Alternative 1. Upon a receipt of a depredation permit, the property owner or manager or an appropriate designated sub-permittee may then commence the authorized activities. Permittees must submit a written report of their activities upon expiration of the permit. Permits may be renewed annually as needed to resolve continuing damage or threats of damage.

Similar to Alternative 2, this alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent bird damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives analyzed in detail, several alternatives were identified by WS, the USFWS, and the VDGIF that will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

WS Would Implement Non-lethal Methods before Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix C be applied to all requests for assistance to reduce damage and threats associated with birds. If the use of all non-lethal methods fails to resolve the damage or threat, lethal methods would then be employed to resolve the damage. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the damage.

Those persons experiencing damage or threats associated with birds often employ non-lethal methods prior to contacting WS for assistance. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 1) described is similar to a non-lethal before lethal alternative because the use of non-lethal methods must be considered before lethal methods by WS (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 the EA.

WS Would Use Non-lethal Methods Only

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with birds would be the non-lethal methods described in Appendix C. The non-lethal methods recommended or used under this alternative would be identical to those identified under Alternative 1 because Mesurol (EPA No. 56228-33) is only available for use by WS and therefore would be unavailable under Alternatives 2 and 3. Additionally, similar to Alternative 1, the recommendation and use of nest and egg destruction could occur under this alternative, since the destruction of nests and eggs is considered a non-lethal method. Because the destruction of nests and eggs is prohibited by the MBTA without a depredation permit, WS would still obtain a permit from the USFWS as described in Alternative 1.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS would refer requests for information regarding lethal methods to the USFWS, the VDGIF, the VDACS and/or private entities. Although not recommended or used by WS, lethal methods could continue to be used by others in resolving damage or threats associated with birds under this alternative.

Under this alternative, property owners or managers may have difficulty obtaining permits to use lethal bird damage management methods as outlined under Alternative 3.

Additionally, property owners or managers frustrated by a lack of WS' assistance with the full range of bird management methods may try methods not recommended by WS (e.g., poisons). In some cases, property owners or managers may misuse methods or use methods in excess of what is necessary. In addition, the USFWS may authorize more lethal take than is necessary to alleviate damage and threats associated with birds because other agencies making depredation permit recommendations have less technical knowledge and experience managing wildlife damage than WS.

This alternative was not analyzed in detail since the take of birds could continue at the levels analyzed in Alternative 1, despite the lack of WS' involvement. In addition, limiting the availability of methods to only non-lethal methods would be inappropriate in situations where human health and safety are at risk (*e.g.,* at airports).

WS Would Use Lethal Methods Only

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with birds would be the lethal methods described in Appendix C. This is in direct conflict with WS Directive 2.101, which directs that WS must consider the use of non-lethal methods before lethal methods. Therefore, this alternative was not considered in detail.

WS Would Only Trap and Translocate Birds

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Birds would be live-captured using live-traps, cannon nets, rocket nets, mist nests or other methods. All birds live-captured through direct operational assistance by WS would be translocated. Translocation of wildlife could only occur under the authority of the USFWS. When authorized by the USFWS, WS could translocate birds under any of the alternatives analyzed in detail. Since WS does not have the authority to translocate birds unless permitted by the USFWS and since translocation of birds could occur under any of the alternatives analyzed in detail, this alternative was not considered in detail.

Translocation of birds causing damage to other areas following live-capture is generally ineffective because; birds are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation may result in bird damage problems at the new location. Additionally, hundreds or thousands of birds would need to be captured and translocated to solve some damage problems; therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (see WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties animals have in adapting to new locations or habitats (Nielsen 1988).

WS Would Compensate Those Effected by Bird Damage

This alternative would require WS and the USFWS to establish a system to reimburse persons impacted by bird damage. Under such an alternative, WS and or the USFWS would continue to provide technical assistance to those persons seeking assistance with managing damage and threats associated with birds.

In addition, WS would conduct site visits to verify damage. Prior analysis of this alternative indicated that a compensation only alternative had many drawbacks. Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) most likely be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

3.3 STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT

WS' directives and standard operating procedures (SOPs) improve the safety, selectivity, and efficacy of wildlife damage management activities. WS' directives and SOPs would be incorporated into activities conducted by WS when addressing bird damage and threats.

Some key SOPs pertinent to the proposed action and the alternatives include the following:

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

- All pesticides have to be registered with the Environmental Protection Agency (EPA) and the VDACS, and must have labels approved by the agency which details the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment as well as directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. WS would follow and use all pesticides according to their label.

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

- The presence of non-target species would be monitored before using DRC-1339 to reduce the risk of mortality of non-target species' populations.

- WS has consulted with the USFWS to determine the potential risks to federally listed threatened and endangered species in accordance with the ESA.

- All personnel who would use chemicals would be trained and certified to use such substances or would be supervised by trained or certified personnel.

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

- Damage management activities would be conducted professionally and in the safest manner possible.

- All chemical methods used by WS or recommended by WS would be registered with the EPA and the VDACS.

- The use of non-lethal methods would be considered prior to the use of lethal methods when providing technical assistance and direct operational assistance.

- Management actions would be directed toward specific birds or groups of birds posing a threat to human safety, causing agricultural damage, causing damage to natural resources, or causing damage to property.WS would only use non-toxic shot as listed in 50 CFR 20.21(j) to take migratory birds using shotguns.

- The take of birds 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 Target Bird Populations

- Lethal take of birds by WS would be monitored by the USFWS and the VDGIF to ensure cumulative take is considered as part of population management objectives.

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

Issue 2 - Effects of Damage Management Activities on Non-target Wildlife Populations, Including Threatened and Endangered Species

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

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

- WS' personnel would use bait, trap placements, and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

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

- WS would retrieve all dead birds to the extent possible following the use of bait treated with DRC-1339.

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

- Damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (e.g., early morning) whenever possible.

- All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401.

- Carcasses of birds retrieved after damage management activities have been conducted would be disposed of in accordance with WS Directive 2.515.

Issue 4 – Humaneness and Animal Welfare Concerns

- Personnel would be trained in the latest and most humane devices and methods for removing problem birds.

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

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

Issue 5 – Effects of Bird Damage Management Activities on the Aesthetic Values of Birds

- Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter provides the information needed for making an informed selection among the alternatives identified and described in Chapter 3; a selection which not only addresses the need for action identified in Chapter 1 but also addresses the issues identified in Chapter 2. Specifically, this chapter analyzes the environmental consequences of each of the alternatives as those alternatives relate to the issues identified in Chapter 2. It also analyzes the cumulative environmental consequences of the proposed action/no action alternative as it relates to the issues identified in Chapter 2.

The following resource values are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in threatened and endangered species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further. The activities proposed in the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

Cumulative Effects: Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

4.1 Environmental Consequences and Cumulative Impacts of Issues Analyzed in Detail

The 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 USFWS, the VDGIF and the VDACS.

Issue 1 - Effects of Damage Management Activities on Target Bird Populations

The issue of the potential impacts of conducting the alternatives on the populations of target bird species is analyzed for each alternative below.

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats associated with birds in Virginia.

The issue of the effects on target bird species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats; however, the primary concern would be from the use of lethal methods to address damage. The lethal take of birds would be monitored by comparing the number of each species of bird taken with that species' overall populations and/ or population trend(s) to assure the magnitude of take is maintained below the level that would cause adverse effects to the viability of species' populations. The potential impacts on the populations of target bird species from the implementation of the proposed action are analyzed for each species below.

Double-crested Cormorant Population Impact Analysis

With a widely distributed and expanding range, double-crested cormorants can be found in most of North America's coastal areas, major rivers and major river drainages (Hatch and Weseloh 1999). Although double-crested cormorants are migrants, birds can be found nesting (Watts and Paxton 2009) and overwintering in the Commonwealth (Rottenborn and Brinkley 2007). Habitat consists of coastal areas, rivers, ponds, lakes, estuaries and artificial impoundments (Hatch and Weseloh 1999). Cormorants nest in colonies which can exceed 1,000, on the ground on rocky or sandy islands, or in trees close to water, and will also nest on bridges, docks or other manmade structures (Hatch and Weseloh 1999). Nesting behavior may negatively impact other nesting colonial waterbirds (USFWS 2003). Their diet consists almost entirely of fish, but cormorants will also eat other aquatic animals (Hatch and Weseloh 1999). Highly social birds, double-crested cormorants not only nest but also feed, travel, and roost in flocks which can number more than 1,000 birds (Hatch and Weseloh 1999).

Double-crested cormorant breeding populations are showing statistically significant increasing trends across the U.S. (estimated at 4.6% annually since 1966), in the Eastern BBS region (estimated at 3.9% annually since 1966) (Sauer et al. 2014). The BBS has also shown an increasing trend in Virginia, estimated at 12.1% annually since 1966 (Sauer et al. 2014). The number of double-crested cormorants overwintering in the Commonwealth has also shown an increasing trend since 1966 (National Audubon Society 2010). Flocks as large as 10,000-20,000 birds have been observed during the fall on the Commonwealth's coastal plain (Brinker et al. 2007). The total population of double-crested cormorants in the U.S. and Canada is estimated at between 2 and 2.4 million birds (USFWS 2003). The population of double-crested cormorants in BCR 14 and 30 is estimated at 173,074 birds (MANEM 2006) while the population in BCR 27 is estimated at 4,120 birds (Hunter et al. 2006). A rapid expansion of breeding birds has occurred in the Commonwealth (Brinker et al. 2007, Watts and Paxton 2009, Watts and Paxton

2014). Between 1993 and 2013 the population of nesting pairs in the Commonwealth increased by 712% to 2,876 pairs nesting in eight colonies (Watts and Paxton 2014).

Impacts caused by increasing double-crested cormorant populations are well documented and include: adverse effects on other bird species (habitat destruction, exclusion, nest competition); declines in fish populations; destruction of vegetation; predation on federally listed fish species; economic losses to aquaculture facilities, commercial fisheries, and fishing-related businesses as well as compromised water quality (USFWS 2003). To reduce depredation on aquaculture stock at private fish farms and state and federal fish hatcheries, the USFWS established an Aquaculture Depredation Order (AQDO) which allows double-crested cormorants to be taken in 13 states without a depredation permit (50 CFR 21.47). However, impacts caused by double-crested cormorants at aquaculture facilities and to other resources were not adequately being addressed by the AQDO. As a result the USFWS, in cooperation with WS, prepared a final environmental impact statement (FEIS) that evaluated strategies to manage double-crested cormorant populations in the United States (USFWS 2003). The selected alternative in the FEIS modified the existing AQDO to include additional types of hatcheries and allow the take cormorants at roost sites during the winter (USFWS 2003). The FEIS also established a Public Resource Depredation Order (PRDO) that allows for the take of double-crested cormorants without a depredation permit in 24 states when cormorants cause or pose a risk of adverse effects to public resources (e.g., fish, wildlife, plants, and their habitats) (50 CFR 21.48). In 2009, the USFWS published an EA and subsequently a final rule, extending the management of double-crested cormorants under 50 CFR 21.47 and 21.48 for an additional five years (USFWS 2009*a*). All other take of double-crested cormorants to alleviate damage requires a depredation permit issued by the USFWS. Virginia is not one of the states covered by the AQDO or the PRDO, and therefore a depredation permit is required to take double-crested cormorants.

The number of double-crested cormorants taken or dispersed by WS and the total number of cormorants taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.1.

Table 4.1 – Number of double-crested cormorants addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits					
		Adults			Nests		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	21	215	6	36	25	0	0
2008	188	375	26	65	500	24	24
2009	773	344	36	107	500	0	0
2010	766	594	100	116	500	5	5
2011	2,228	795	139	157	500	0	0
2012	3,071	795	186	259	500	4	4
TOTAL	**7,047**	**3,118**	**493**	**740**	**2,525**	**33**	**33**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

WS anticipates the number of requests for assistance to manage damage caused by double-crested cormorants will increase based on the increasing number of double-crested cormorants observed in the Commonwealth. Additional requests for assistance are likely to involve property damage and impacts to fish at aquaculture facilities. To address request for assistance to manage damage associated with double-crested cormorants in the future, up to 1,000 cormorants and 1,000 nests could be taken annually by WS to alleviate damage and threats.

The double-crested cormorant management FEIS developed by the USFWS predicted the number of double-crested cormorants taken by authorized entities under the selected alternative would increase (USFWS 2003). The FEIS developed by the USFWS authorizes the lethal take of up to 8.0% of the continental double-crested cormorant population or 159,636 birds annually (USFWS 2003). The USFWS determined in the FEIS analysis that this level of take would have no significant impact on regional or continental populations of cormorants (USFWS 2003, USFWS 2009*a*). This analysis and determination included not only cormorants taken under PRDO and AQDO but also depredation permits (USFWS 2003, USFWS 2009*a*). Additionally, nest destruction is anticipated to have minimal effects on regional or continental cormorant populations (USFWS 2003, USFWS 2009*a*).

The total take of double-crested cormorants by all entities in the U.S. on an annual basis from 2004 through 2012 has not exceeded the predicted increased take evaluated and the total cumulative take authorized annually (159,636 birds) under the selected alternative in the FEIS (Table 4.1). WS' proposed take of up to 1,000 double-crested cormorants annually to address damage and threats combined with the average take occurring under PRDO, AQDO and other deprecation permits would not exceed this level of take (USFWS 2003). WS' proposed take of up to 1,000 double-crested cormorant nests is anticipated to have minimal effects on regional or continental cormorant populations (USFWS 2003).

Additionally, the removal and destruction of nests should have little adverse impact on the population. Although this method may reduce the fecundity of individual birds, nest destruction has no long term effect. The destruction of up to 1,000 double-crested cormorant nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on cormorant populations would occur. As with the lethal take of adults, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Great Blue Heron Population Impact Analysis

Great blue herons are a common large wading bird that can be found throughout most of the U.S. year-around (Vennesland and Butler 2011). In Virginia, great blue herons can be found across the state year round although they are more numerous during migration (Rottenborn and Brinkley 2007). Great blue herons are most often observed in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM 2006). Great blue herons are generally colonial nesters, nesting in trees, on rock ledges, and on coastal cliffs, up to 30 km from foraging areas (MANEM 2006).

Most nesting great blue heron colonies in the region occur along the coastal areas located in BCR 14, BCR 27 and BCR 30. In the 1970's the breeding population of great blue herons in BCR 30 and 14 was 6,824 birds distributed among 37 nesting colonies (MANEM 2006). By the 1990's the breeding population of great blue herons in BCR 30 and 14 had increased by 367% to 31,838 birds nesting in 232 colonies (MANEM 2006). The breeding populations of great blue herons in BCR 30 and BCR 14 have been given a conservation ranking of lowest concern (MANEM 2006). Great blue herons are showing a statistically significant increase across all survey routes of the BBS in the U.S. Since 1966, the number of great blue herons observed across the U.S. has increased at an annual rate of 1.2% which is a statistically significant increase (Sauer et al. 2014). In Virginia, herons observed on BBS routes are showing a statistically significant increase estimated at 3.6% annually from 1966 through 2012 and 4.7% annually from 2002–2012 (Sauer et al. 2014). Nesting surveys for great blue herons were conducted in coastal Virginia in 1993, 2003 and 2013 (Watts 2004, Watts and Paxton 2014). Although the number of colonies increased over the period of the three surveys from 156 to 202 to 258, the overall number of nesting birds only increased by 0.3% from 1993 to 2003 and then declined 14.5% from 2003 to 2013(Watts 2004,

Watts and Paxton 2014). Great blue herons observed overwintering in Virginia have also shown a general increasing trend since 1966 (National Audubon Society 2010).

The number of great blue herons taken or dispersed by WS and the total number of herons taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.2.

Table 4.2 – Number of great blue herons addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	95	121	20*	65
2008	75	156	55	90
2009	242	162	69	102
2010	234	200	50	96
2011	132	269	61	72
2012	180	224	75*	127
TOTAL	**958**	**1,132**	**330**	**552**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 1

Requests for WS' assistance with great blue herons arise at airports when these birds pose risks to aircraft and human safety or when fish at aquaculture facilities are damaged or consumed by these birds. To address requests for assistance to manage damage associated with great blue herons in the future, up to 150 herons and 50 heron nests could be taken annually by WS to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 through FY 2012 is in anticipation of an increase in requests to address threats to aircraft and human safety.

The number of great blue herons present in Virginia fluctuates throughout the year. Watts and Paxton 2014 estimated the breeding population of great blue herons in coastal Virginia at 15,618 birds in 2013. However, since these birds also nest in non-coastal areas of the state it is likely that the population of herons is greater. Those herons nesting in BCR 14, BCR 27 and BCR 30 are likely the same herons that either migrate through (BCR 14 and 30) and or are present in Virginia throughout the year (BCR 27 and BCR 30); therefore, the analyses for potential impacts will incorporate information from surveys conducted in those areas. Based on colonial waterbird surveys, an estimated 43,000 herons are known to nest in BCR 14 and BCR 30 (MANEM 2006). An additional 53,400 are estimated to nest in BCR 27 (Hunter et al. 2006). However, those estimates do not reflect non-breeding herons that may be present in those areas during the breeding season. The take of up to 150 herons to alleviate damage or threats of damage under the proposed action alternative would represent 0.15% of the estimated combined breeding population in BCR 14, BCR 27, and BCR 30 (96,200 herons) and 0.9 % of the breeding population in coastal Virginia in 2013. The average annual take by other entities in the Commonwealth has been 37 birds since 2007. If the average annual take by other entities is reflective of take that will occur in the future, the combined WS' take and take by other entities would represent 0.19% of the estimated breeding population in BCR 14, BCR 27, and BCR 30 and 1.19% of the breeding population in the Commonwealth. Given the increasing population trends observed for herons in the Commonwealth and the limited take proposed by WS when compared to the estimated breeding population, the magnitude of WS' take could be considered low. The take of great blue herons can 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 ensures take by WS and by other entities occurs within allowable take levels and not cause any adverse cumulative effects.

Additionally, the removal and destruction of nests should have little adverse impact on the population. Although this method may reduce the fecundity of individual birds, nest destruction has no long term effect. The destruction of up to 50 great blue heron nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on heron populations would occur. As with the lethal take of adults, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Great Egret Population Impact Analysis

Great egrets can be found across the United States along the Atlantic, Pacific, and Gulf coasts and in major river drainages wherever suitable habitat is available (Mccrimmon et al. 2011). Great egrets can be observed in a variety of wetland habitats including marshes, swamps, streams, rivers, ponds, lakes, lagoons, tidal flats, ditches, flooded agricultural fields and tidal areas (MANEM 2006). A colonial nester, great egrets can be found nesting with other wading birds in woody vegetation adjacent to open water or wetlands, often on islands (Mccrimmon et al. 2011). In Virginia, great egrets can be found nesting in scattered colonies in coastal areas as well as inland in the swamps of the Chickahominy, Blackwater, Nottoway and Meherrin River drainages (Rottenborn and Brinkley 2007). Outside of the nesting season, great egrets can be found wintering in low numbers in these same areas (MANEM 2006).

Most nesting great egret colonies in the region occur along the coastal areas located in BCR 14, BCR 27 and BCR 30. In the 1970's the breeding population of great egrets in BCR 14 and 30 consisted of 4,384 birds distributed among 52 nesting colonies (MANEM 2006). By the 1990's the breeding population of great egrets in BCR 14 and 30 had increased by 109% to 9,146 birds nesting in 101 colonies (MANEM 2006). The breeding populations of great egrets in BCR 30 and BCR 14 have been given a conservation ranking of lowest concern (MANEM 2006). Great egrets are showing a statistically significant increase across all U.S. BBS survey routes. Since 1966, the number of great egrets observed survey-wide has increased at an annual rate of 2.1% which is a statistically significant increase (Sauer et al. 2014). Similarly, the number of egrets observed on BBS routes in Virginia have increased at an annual rate of 8.5% since 1966 (Sauer et al. 2014). Nesting surveys for great egrets were conducted in coastal Virginia in 1993, 2003 and 2013 (Watts 2004, Watts and Paxton 2014). Although the number of colonies declined between 1993 and 2013 from 45 to 43, the population increased by an estimated 14.8% (Watts 2004, Watts and Paxton 2014). Great egrets observed overwintering in Virginia have shown a stable trend since 1984 (National Audubon Society 2010).

The number of great egrets taken or dispersed by WS and the total number of egrets taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.3.

Table 4.3 – Number of great egrets addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	11	87	1	10
2008	72	102	19	28
2009	334	102	25	33
2010	111	127	19	28
2011	46	94	14	25
2012	91	125	29	51
TOTAL	**665**	**637**	**107**	**175**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

To address requests for assistance to manage damage associated with great egrets in the future, up to 100 egrets and 50 nests could be taken annually by WS to alleviate damage and threats.

The number of great egrets present in Virginia fluctuates throughout the year. Watts and Paxton 2014) estimated the breeding population of great egrets in costal Virginia at 5,788 birds in 2013. No wintering population estimates are available for great egrets in Virginia. However, because those egrets nesting in BCR 14, BCR 27 and BCR 30 are likely the same egrets that either migrate through (BCR 14 and 30) and or are present in Virginia throughout the year (BCR 27 and BCR 30), the analyses for potential impacts will incorporate information from surveys conducted in those areas. Based on colonial waterbird surveys, an estimated 9,146 birds are known to nest in BCR 14 and BCR 30. An additional 56,488 are estimated to nest in BCR 27 (Hunter et al. 2006). Those estimates do not reflect non-breeding egrets that may be present in those areas during the breeding season. The take of up to 100 egrets to alleviate damage or threats of damage would represent 0.1% of the estimated breeding population in BCR 14, BCR 27 and BCR 30 (65,635 egrets) and 1.7% of the breeding population in coastal Virginia in 2013. The average annual take by other entities in the Commonwealth has been 11 birds since 2007. If the average annual take by other entities is reflective of take that will occur in the future, the combined WS' take and take by other entities would represent 0.16% of the estimated breeding population in BCR 14, BCR 27 and BCR 30 and 1.91% of the breeding population in the Commonwealth.

Given the limited magnitude of take proposed by WS when compared to the estimated breeding population in BCR 14, 27 and 30, the magnitude of WS' take could be considered low. The take of great egrets can 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 ensures take by WS and by other entities occurs within allowable take levels and not cause any adverse cumulative effects.

Additionally, the removal and destruction of nests should have little adverse impact on the population. Although this method may reduce the fecundity of individual birds, nest destruction has no long term effect. The destruction of up to 50 great egret nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on egret populations would occur. As with the lethal take of adults, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Cattle Egret Population Impact Analysis

Cattle egrets arrived in the western hemisphere during modern times with the first reports coming from South America in the late 1800s (Hunter et al. 2006, Telfair II 2006). Their population expanded northward and cattle egrets can now be found throughout the U.S. (Hunter et al. 2006, Telfair II 2006). Cattle egrets were first observed nesting in the Commonwealth in 1961 (Watts and Paxton 2009). They are a common transient and rare winter resident (Rottenborn and Brinkley 2007). Unlike other wading birds, cattle egrets are unusual in that they feed primarily in open fields, often alongside cattle or other livestock (Telfair II 2006). Preferred habitat includes wet pastures, freshwater and brackish marshes and agricultural fields (MANEM 2006). Cattle egrets are social birds which nest in colonies and roost, loaf and forage in groups ranging in size from 10s to 100s (Telfair II 2006). Cattle egrets nest alongside other wading birds in woody vegetation and there is concern that they are displacing little blue herons (*Egretta caerulea*) at these sites (Hunter et al. 2006).

Most nesting cattle egret colonies in the region occur along the coastal areas located in BCR 27 and BCR 30. In the 1970's the breeding population of cattle egrets in BCR 30 consisted of 13,174 birds distributed among 27 nesting colonies (MANEM 2006). By the 1990's, the breeding population of cattle egrets in BCR 30 had declined to 10,330 birds nesting in 34 colonies (MANEM 2006). The breeding populations

of cattle egrets in BCR 30 have been given a conservation ranking of lowest concern (MANEM 2006), while Hunter et al. (2006) states that cattle egret populations in BCR 27 should be reduced. Since 1966, the number of cattle egrets observed across the U.S. has decreased at an annual rate of -0.8% (Sauer et al. 2014). Similarly, the number of egrets observed on BBS routes in the Eastern BBS region have decreased at an annual rate of -3.1% since 1966, a statistically significant decrease (Sauer et al. 2014). Currently, there is no BBS information available for cattle egrets in Virginia (Sauer et al. 2014). However, colonial waterbird surveys were conducted in Virginia in 1993, 2003, 2008 and 2013 (Watts and Paxton 2009, 2014). Both the number of cattle egrets and the number of cattle egret colonies have declined since the mid-1970s (Watts and Paxton 2009, 2014). Cattle egrets are migratory and usually do not overwinter in the Commonwealth. However, they have been observed during the CBC in numbers of up to 47 birds (National Audubon Society 2010).

The number of cattle egrets taken or dispersed by WS and the total number of egrets taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.4.

Table 4.4 – Number of cattle egrets addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	1	220	0	0
2008	12	220	0	0
2009	22	220	10	10
2010	0	220	0	0
2011	0	200	2	2
2012	3	220	5	5
TOTAL	**38**	**1,300**	**17**	**17**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

To address request for assistance to manage damage associated with cattle egrets in the future, up to 30 egrets and 20 nests could be taken annually by WS to alleviate damage and threats.

The number of cattle egrets present in Virginia fluctuates throughout the year. Watts and Paxton (2014) estimated the breeding population of cattle egrets in the Commonwealth at 112 birds in 2013. No wintering population estimates are available for these birds in Virginia. Because those egrets nesting in BCR 27 and BCR 30 are likely the same egrets that either migrate through (BCR 30) and or are present in Virginia throughout the year (BCR 27 and BCR 30), the analyses for potential impacts will incorporate information from surveys conducted in those areas. Based on colonial waterbird surveys, an estimated 10,328 birds are known to nest in BCR 30 (MANEM 2006). An additional 60,000 are estimated to nest in BCR 27 (Hunter et al. 2006). Those estimates do not reflect non-breeding egrets that may be present in those areas during the breeding season. The take of up to 30 egrets to alleviate damage or threats of damage would represent 0.04% of the estimated breeding population in BCR 27 and BCR 30 (70,328 egrets) and 26.7% of the breeding population in the Commonwealth. If the average annual take by other entities is reflective of take that will occur in the future, the combined WS' take and take by other entities would remain the same. Given the limited magnitude of take proposed by WS when compared to the estimated breeding population in BCR 27 and 30, and the conservation rankings and classifications given by MANEM (2006) and Hunter et al. (2006), WS proposed take would not reach a level where it would cause a population decline. Additionally, the Southeast U.S. Regional Waterbird Conservation Plan states that the population of cattle egrets in the region should be reduced (Hunter et al. 2006). The take of cattle egrets can 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 ensures take by WS and by other entities

occurs within allowable take levels to achieve the desired population objectives for these birds in the Commonwealth. The take of up to 20 cattle egret nests to alleviate damage or threats of damage is not expected to adversely affect the population of egrets.

Black Vulture Population Impact Analysis

Historically in North America, black vultures occurred in the southeastern United States, Texas, Mexico, and parts of Arizona (Buckley 1999). However, black vultures are expanding their range northward in the eastern United States and now occur as far north as New Jersey, Ohio, Pennsylvania, and West Virginia (Buckley 1999). In Virginia, black vultures can be observed across the state and throughout the year (Rottenborn and Brinkley 2007). Black vultures can be found in virtually all habitats but are most abundant where forest is interrupted by open land (Buckley 1999). Black vultures are highly social, roosting communally with other black vultures and turkey vultures in trees, electric poles, and other structures (Buckley 1999) in groups of 20 or more individuals (Lowney 1999) where they can cause property damage. Roosts are often occupied for many years and in some cases decades (Buckley 1999). The diet of black vultures consists primarily of carrion; however, these birds are also predatory, killing and consuming domestic young livestock (pigs, lambs, calves), young birds, mammals, reptiles, and fish (Buckley 1999).

According to BBS trend data provided by Sauer et al. (2014), the number of black vultures observed in the Commonwealth during the breeding season has increased at an annual rate of 4.1% since 1966. Additionally, during the last decade, the number of black vultures observed in the eastern BBS region increased at an annual rate of 4.4%, which is a statistically significant increase (Sauer et al. 2014). Black vultures overwintering in the Commonwealth have also shown an increasing trend since 1966 (National Audubon Society 2010). The Partners in Flight Science Committee (2013) database, which is based on BBS data, does not give an estimate for the statewide black vulture population. BBS survey data is derived from surveyors identifying bird species based on visual and auditory cues at stationary points. However, vultures produce very few auditory cues that would allow for identification (Buckley 1999) and thus, surveying for vultures is reliant upon visual identification. For visual identification to occur during surveys vultures must be either flying or visible while roosting. Coleman and Fraser (1989) estimated that black and turkey vultures spend 12–33% of the day in summer and 9–27% of the day in winter flying. Most vultures counted during surveys are counted while flying since counting at roosts can be difficult due to visual obstructions and due to the methodology of the surveys. For example, in the BBS observers are limited to counting only those bird species within a quarter mile of a survey point. Bunn et al. (1995) reported vulture activity increased from morning to afternoon as temperatures increased. Therefore, surveys for vultures should occur later in the day to increase the likelihood of vultures being observed by surveyors. Observations conducted for the BBS are initiated in the morning since mornings tend to be periods of high bird activity. Since vulture activity tends to increase from morning to afternoon when the air warms and vultures can find thermals for soaring, vultures are probably under-represented in BBS data. Therefore, an estimate of the population of black vultures in Virginia derived solely from BBS data, if it was available, would be poor. Runge et al. (2009) used data from the BBS and other sources to estimate the black vulture population in Virginia in 2006 at 91,190 birds (95% credible interval = 44,520 – 212,100). Additionally, Runge et al. (2009) adapted a potential biological removal model to define a prescribed take level (PTL) and demonstrated this approach for the lethal take of black vultures in Virginia. Using a population estimate of 66,660 black vultures (the lower 60% credible interval) to account for uncertainty, Runge et al. (2009) found that conservatively the PTL, or allowable take of black vultures, in Virginia would be up to 3,533 birds annually and that a sustainable harvest strategy would be maintained with a take as high as 7,066 black vultures annually.

The number of black vultures taken or dispersed by WS and the total number of vultures taken by other entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.5.

Table 4.5. Number of black vultures addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	1,255	1,678	19	159
2008	4,886	1,863	32	221
2009	2,485	2,550	37	411
2010	1,539	2,355	235	510
2011	6,631	2,410	601	840
2012	3,480	3,139	269	471
TOTAL	**20,276**	**13,995**	**1,193**	**2,612**

[1]Data reported by federal fiscal year

[2]Permitted by USFWS; includes WS' authorized take

[3]Data reported by calendar year; includes WS' take

As the population of black vultures in the Commonwealth has increased, the number of requests for assistance to alleviate damage associated with black vultures has also increased. Therefore, based on previous requests for assistance and in anticipation of an increasing number of requests and the subsequent need to address more vultures under the proposed action alternative, up to 2,500 black vultures and 20 nests could be taken annually by WS to alleviate damage and threats.

The take of up to 2,500 black vultures annually by WS under the proposed action alternative would represent 2.7% of the statewide population derived by Runge et al. (2009) of 91,190 vultures. Using the population derived by Runge et al. (2009) estimated at 66,660 black vultures to account for uncertainty, the lethal take of up to 2,500 black vultures would represent 3.8% of the estimated population. From 2007 through 2012, the average annual take of black vultures by other entities was 232 vultures. If the number of black vultures taken by other entities in the Commonwealth remains stable and if 2,500 vultures were taken by WS, the annual take of vultures would be 2,732 vultures, which would be below the allowable take level estimated by Runge et al. (2009) of 3,533 vultures. The take of vultures can 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 ensures take by WS and by other entities occurs within allowable take levels to achieve the desired population objectives for black vultures in the Commonwealth. The take of up to 20 vulture nests to alleviate damage or threats of damage is not expected to adversely affect the population of vultures and is further addressed in additional detail below.

Turkey Vulture Population Impact Analysis

Turkey vultures can be found throughout Mexico, across most of the U.S., and along the southern tier of Canada (Kirk and Mossman 1998). In Virginia, turkey vultures can be found throughout the year across the state (Rottenborn and Brinkley 2007). Turkey vultures can be found in virtually all habitats but are most abundant where forest is interrupted by open land (Kirk and Mossman 1998). Turkey vultures are social and often roost in large groups in trees, on cliffs, power lines, or on homes or other buildings (Kirk and Mossman 1998) where they can cause property damage from droppings or by pulling and tearing shingles. Turkey vultures have been recorded in groups numbering up to 300 (Kirk and Mossman 1998). These birds generally feed on carrion but will eat virtually anything including insects, fish, reptiles, amphibians, baby birds, decayed fruit, and cow manure (Kirk and Mossman 1998, Wilson et al. 2012).

Trending data from the BBS indicates the number of turkey vultures observed along BBS routes in the Commonwealth have shown an increasing trend estimated at 3.2% annually since 1966 and 3.9% annually from 2002 through 2012, which is a statistically significant increase (Sauer et al. 2014). Similarly, the number of turkey vultures observed along all routes in the Eastern BBS Region has shown an increasing trend estimated at 3.6% annually since 1966 and 4.8% from 2002–2012, a statistically significant trend (Sauer et al. 2014). The numbers of turkey vultures observed during the CBC in the Commonwealth is also showing an increasing trend (National Audubon Society 2010). The Partners in Flight Science Committee (2013) estimated the statewide population of turkey vultures at 110,000 based on BBS survey data. BBS survey data is derived from surveyors identifying bird species based on visual and auditory cues at stationary points. However, vultures produce very few auditory cues that would allow for identification (Buckley 1999) and thus, surveying for vultures is reliant upon visual identification. For visual identification to occur during surveys vultures must be either flying or visible while roosting. Coleman and Fraser (1989) estimated that black and turkey vultures spend 12–33% of the day in summer and 9–27% of the day in winter flying. Most vultures counted during surveys are counted while flying since counting at roosts can be difficult due to visual obstructions and due to the methodology of the surveys. For example, in the BBS observers are limited to counting only those bird species within a quarter mile of a survey point. Bunn et al. (1995) reported vulture activity increased from morning to afternoon as temperatures increased. Therefore, surveys for vultures should occur later in the day to increase the likelihood of vultures being observed by surveyors. Observations conducted for the BBS are initiated in the morning since mornings tend to be periods of high bird activity. Since vulture activity tends to increase from morning to afternoon when the air warms and vultures can find thermals for soaring, vultures are probably under-represented in BBS data. Therefore, the population of turkey vultures in Virginia is likely higher than that derived by the Partners in Flight Science Committee (2013) using data from the BBS.

The number of turkey vultures taken or dispersed by WS and the total number of vultures taken by other entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.6.

Table 4.6 – Number of turkey vultures addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	1,656	757	21	101
2008	1,347	678	44	140
2009	886	905	35	83
2010	3,057	898	72	120
2011	3,758	1,043	92	125
2012	5,266	1,334	193	235
TOTAL	**15,970**	**5,615**	**457**	**804**

[1]Data reported by federal fiscal year

[2]Permitted by USFWS; includes WS' authorized take

[3]Data reported by calendar year; includes WS' take

Based on current population trends for turkey vultures in the Commonwealth, the number of requests for assistance with managing damage associated with turkey vultures and the number of vultures addressed to meet those requests is likely to increase. Therefore, based on previous requests for assistance and in anticipation of an increasing number of requests and the subsequent need to address more vultures up to 500 turkey vultures and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 500 turkey vultures annually by WS would represent 0.45% of the estimated population of turkey vultures in the Commonwealth. However, due to the limitations in survey protocols, the population is likely much higher and therefore the proposed level of take is likely much lower. From 2007 through 2012, an average of 134 turkey vultures was lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take of vultures by all entities would represent 0.6% of the estimated statewide population. Given the increasing number of turkey vultures observed in the Commonwealth and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on vulture populations. The take of vultures can 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 ensures take by WS and by other entities occurs within allowable take levels to achieve the desired population objectives for turkey vultures in the Commonwealth. The take of up to 20 vulture nests to alleviate damage or threats of damage is not expected to adversely affect the population of vultures and is further addressed in additional detail below.

Osprey Population Impact Analysis

Ospreys are large raptors most often associated with shallow aquatic habitats where they feed primarily on fish (Poole et al. 2002). Historically, nests of osprey were constructed on tall trees and rocky cliffs. Today, ospreys are most commonly found nesting on man-made structures such as power poles, cell towers, navigational aids and man-made nesting platforms (Poole et al. 2002, Watts et al. 2004, U.S. Geological Survey 2005). The world's largest breeding population of osprey is located in Virginia's Chesapeake Bay region (Watts and Paxton 2007).

The number of osprey observed in the Commonwealth and across the Eastern BBS region during the breading season has increased significantly at an estimated 4.7% and 3.3% annually, respectively, since 1966 (Sauer et al. 2014). In the Chesapeake Bay, the population more than doubled between the early 1970s and the mid-1990s and this increasing trend continues (Watts and Paxton 2007). The Partners in Flight Science Committee (2013) estimated the statewide population of osprey at 2,000 based on BBS data, although this estimation was rated as having a fair amount of uncertainty associated with it. A systematic survey estimated the population of birds in the Chesapeake Bay at 7,000 birds in the mid-1990's (Watts and Paxton 2007). Ospreys are migratory and depending on the severity of the winter may overwinter in the Commonwealth in small numbers (Rottenborn and Brinkley 2007). An average of 12 birds has been observed annually during the CBC since 2000–2001 (National Audubon Society 2010).

The number of osprey taken or dispersed by WS and the total number of osprey taken by all entities from 2007 to 2012 to alleviate damage or threats of damage associated with these birds are shown in Table 4.7.

Table 4.7 – Number of osprey addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits					
		Adults			Nests		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	161	108	33	33	103	4	6
2008	191	105	30	30	103	0	0
2009	263	103	14	15	58	0	0
2010	221	113	39	39	83	1	1
2011	133	108	24	24	65	3	3
2012	272	145	44	45	68	4	5
TOTAL	**1,241**	**682**	**184**	**186**	**480**	**12**	**15**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Previous requests for assistance received by WS to alleviate damage or the threat of damage associated with osprey involved threats to aircraft and human health and safety from strikes, damage to aquaculture facilities, and threats of damage associated with their nesting behavior. Osprey nests are constructed of large sticks, twigs, and other building materials that can cause damage and prevent access to critical areas when those nests are built on man-made structures (e.g., power lines, cell towers). Disruptions in the electrical power supply can occur when nests are located on utility structures and can inhibit access to utility structures for maintenance by creating obstacles to workers. WS anticipates that requests for assistance will increase as the osprey population continues to increase. To address these requests, WS could take up to 75 osprey and relocate up to an additional 35 osprey annually under the proposed action. Additionally, WS could take up to 50 nests annually under the proposed action alternative.

The number of osprey present in Virginia fluctuates throughout the year. The take of up to 75 osprey annually by WS would represent anywhere from 3.75% to 1.07% of the estimated population of osprey in the Commonwealth (2,000, Partners in Flight Science Committee 2013; 7,000 Watts and Paxton 2007). However, due to uncertainty in the Partners in Flight Science Committee's population estimate and the growing population trend of osprey, the 1.07% figure is likely a more realistic estimation of possible impact. If the take by other entities remains stable, the average annual cumulative take by all entities would remain similar. Given the increasing population trends for osprey and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on osprey populations. Additionally, as detailed in Appendix C, WS could relocate up to 35 osprey under the proposed action alternative. Osprey live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of osprey can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of osprey would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the osprey population. Although this method may reduce the fecundity of individual birds, nest destruction has no long term effect. The destruction of up to 50 osprey nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on osprey populations would occur. As with the lethal take of adults, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Sharp-shinned Hawk Population Impact Analysis

Sharp-shinned hawks are found throughout the U.S. (Bildstein and Meyer 2000). In Virginia, sharp-shinned hawks can be found throughout the year (Trollinger and Reay 2001). Large numbers of these raptors can be observed during migration. From 1989-2001, a total of 5,133 sharp-shinned hawks or an average of approximately 395 hawks per year were captured and banded at the Eastern Shore of Virginia National Wildlife Refuge during fall migration (Lukei and Byrd 2002). As many as 26,355 of these raptors have been observed during a single fall migration period by the Kiptopeke Hawkwatch (Rottenborn and Brinkley 2007). Sharp-shinned hawks are generally found in forested areas, but will use open areas with wooded vegetation interspersed or adjacent to old fields, pastures, or marshlands (Bildstein and Meyer 2000). The open habitat and abundant prey items at airports, locations where most requests for assistance to alleviate threats originate, makes them attractive locations for sharp-shinned hawks.

The number of sharp-shinned hawks observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 1.1% annually since 1966 (Sauer et al. 2014). A similar trend has been observed for the number of sharp-shinned hawks observed in the Eastern BBS region which has been estimated to be increasing 1.5% annually since 1966 (Sauer et al. 2014). The number of sharp-shinned hawks observed in the Commonwealth during the CBC has also shown an increasing trend since 1966, with observations tripling since the mid-1970s (National Audubon Society 2010). The best available information estimated the statewide breeding population of sharp-shinned hawks at 3,000 birds (Partners in Flight Science Committee 2013).

The number of sharp-shinned hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.8.

Table 4.8 – Number of sharp-shinned hawks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	41	1	1
2008	0	46	2	2
2009	0	48	0	0
2010	0	48	1	1
2011	2	20	6	6
2012	1	55	3	3
TOTAL	**3**	**258**	**13**	**13**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance to manage damage and threats associated with sharp-shinned hawks primarily originate from airports. WS anticipates the number of airports requesting assistance with managing damage and threats associated with sharp-shinned hawks to increase. To address these requests for assistance in the future, WS could take up to 20 sharp-shinned hawks and relocate up to an additional 20 sharp-shinned hawks annually under the proposed action. Additionally, WS could take up to 20 nests annually under the proposed action alternative.

The take of up to 20 sharp-shinned hawks annually by WS would represent 0.66% of the estimated population of these birds in the Commonwealth. From 2007 through 2012, no sharp-shinned hawks were lethally taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the increasing population

trends for sharp-shinned hawks and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on sharp-shinned hawk populations. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 sharp-shinned hawks under the proposed action alternative. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of sharp-shinned hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of sharp-shinned hawks would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 sharp-shinned hawk nests to alleviate damage and threats of damage is also not expected to adversely affect the population and is further addressed in detail below.

Cooper's Hawk Population Impact Analysis

Cooper's hawks can be found throughout the U.S. (Curtis et al. 2006). Although migratory, Cooper's hawks can be found year round across the state (Trollinger and Reay 2001). As many as 3,625 of these raptors have been observed during a single fall migration period by the Kiptopeke Hawkwatch (Rottenborn and Brinkley 2007). During fall migration Cooper's hawks are generally found in forested areas, but will use open areas with wooded vegetation interspersed or adjacent to old fields, pastures, or marshlands. However, Cooper's hawks are also tolerant of human disturbance and fragmentation (Curtis et al. 2006). Their populations have been increasing in suburban and urban areas in recent years (Curtis et al. 2006). The open habitat and abundant prey items such as European starlings and pigeons available at airports and in urban areas makes them attractive locations for Cooper's hawks.

In Virginia, the number of Cooper's hawks observed during the BBS has shown an increasing trend estimated at 6.8% annually since 1966 (Sauer et al. 2014). A similar trend has been observed for the number of Cooper's hawks observed in the Eastern BBS region where the population has increased at an estimated 3.8% annually since 1966, and an estimated 5.3% since 2002 (Sauer et al. 2014). The number of Cooper's hawks observed in the Commonwealth during the CBC has also shown an increasing trend since 1966, with observations tripling since the early-1980s (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of Cooper's hawks to be 12,000 birds.

The number of Cooper's hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.9.

Table 4.9 – Number of Cooper's hawks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	45	1	1
2008	1	40	2	2
2009	3	40	0	0
2010	3	45	0	0
2011	2	31	1	2
2012	1	51	2	2
TOTAL	**10**	**252**	**6**	**7**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance to manage damage and threats associated with Cooper's hawks primarily originate at airports although these raptors also pose a threat to chickens and other domestic fowl. WS anticipates the number of airports requesting assistance with managing damage and threats associated with Cooper's hawks to increase. To address these requests for assistance, up to 20 Cooper's hawks could be taken and an additional 20 hawks could be relocated annually. Additionally, 20 nests could be taken annually by WS under the proposed action alternative.

The take of up to 20 Cooper's hawks annually by WS would represent 0.16% of the estimated population of Cooper's hawks in the Commonwealth. From 2007 through 2012, an average of 1.16 Cooper's hawks per year was lethally taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 01.7% of the estimated statewide population. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could relocate up to 20 Cooper's hawks. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of Cooper's hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of Cooper's hawks would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 Cooper's hawk nests to alleviate damage or threats of damage is not expected to adversely affect the population of hawks and is further addressed in additional detail below.

Northern Harrier Population Impact Analysis

Northern harriers are a widespread but locally distributed raptor species in the U.S. (Smith and Wittenberg 2011). In Virginia, Northern harriers are most often observed nesting in the marshes of the Chesapeake Bay region (Wilson et al. 2007) often in remote areas (Watts and Rottenborn 2001) or migrating through in large numbers during the fall (Trollinger and Reay 2001). The Northern harrier is a medium-sized raptor commonly associated with saltwater marshes and open grassland habitat including reclaimed strip mines and agricultural fields (Smith and Wittenberg 2011). Like other harrier species, the Northern harrier nests on the ground, usually in tall, dense clumps of vegetation (Smith and Wittenberg 2011). The open grassland habitat associated with airports provides ideal foraging conditions for Northern harriers.

The number of Northern harriers observed in the along routes surveyed in the Eastern BBS Region during the BBS has shown a statistically decreasing trend estimated at -2.0% annually since 1966 and -0.7% from 2002 to 2012 (Sauer et al. 2014). The number of Northern harriers observed in the Commonwealth during the CBC has shown a cyclical and stable trend since 1966 (National Audubon Society 2010). Loss of habitat is seen as the primary reason for population decline. Using data from the BBS, Partners in Flight Science Committee (2013), estimated the breeding population of Northern harriers in BCR 27, 28, 29, and 30 (those BCRs in which Virginia lies) to be a total of 1,408 birds. However, the quality of these figures is poor because they are based on BBS surveys that have a high degree of variance, a low sample size or poor geographic coverage. Variance of these figures ranges from 95% confidence within 100% of the regional average to 95% within 200% of the regional average. The total estimated population of Northern harriers in the U.S. is estimated at 200,000 birds (Partners in Flight Science Committee 2013). This figure is more accurate than that of the regional BCR figures, having a 95% confidence limit within 50% of the regional average.

The number of Northern harriers taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.10.

Table 4.10 – Number of northern harriers addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	3	88	2	2
2008	85	93	3	11
2009	159	86	15	16
2010	292	116	28	59
2011	232	162	51	62
2012	255	167	53	71
TOTAL	**1,026**	**712**	**152**	**221**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with Northern harriers are received from airports where harriers are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with Northern harriers to increase. To address these requests for assistance, WS could take up to 100 Northern harriers and relocate up to an additional 50 harriers annually under the proposed action. Additionally, WS could take up to 20 nests annually under the proposed action alternative to alleviate damage and threats.

The take of up to 100 Northern harriers annually by WS would represent 7.10% of the estimated population of Northern harriers in BCR 27, 28, 29, and 30. However, the quality of the population estimate data for these birds in Virginia is poor and unreliable (Wilson et al. 2007). A more accurate estimate for Northern harriers is available on the national scale. WS proposed take would represent 0.05% of the estimated population in the U.S. From 2007 through 2012, an average of 11.5 Northern harriers per year was lethally taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.05% of the estimated U.S. population. Given the limited take proposed by WS, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 50 Northern harriers. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of northern harriers can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 Northern harrier nests to alleviate damage or threats of damage is also not expected to adversely affect the population of harriers and is further addressed in additional detail below.

Red-shouldered Hawk Population Impact Analysis

Red-shouldered hawks are found throughout the central and eastern portions of the U.S. (Dykstra and Hayes 2008). In Virginia, red-shouldered hawks can be found throughout the year with the largest number of nesting birds residing in the northeast and eastern parts of the state (Trollinger and Reay 2001). Peak observations of these raptors occur during fall migration in the western part of the Commonwealth (Rottenborn and Brinkley 2007). As many as 287 of these raptors have been observed during a single fall migration period by the Snickers Gap Hawkwatch (Rottenborn and Brinkley 2007). Red-shouldered hawks are generally found in forest and riparian habitat, although their increased use of urban areas has been documented (Dykstra and Hayes 2008). The abundant prey items available at airports and the hawk's increased use of urban and suburban areas indicate that airport environments would be attractive locations for red-shouldered hawks.

In Virginia, the number of red-shouldered hawks observed during the BBS has shown an increasing trend estimated at 4.9% annually since 1966 and 5.3% annually since 2012, which are statistically significant trends (Sauer et al. 2014). A similar trend has been observed for the number of red-shouldered hawks observed in the Eastern BBS region where the population has increased at an estimated 2.8% annually since 1966, which is a statistically significant trend (Sauer et al. 2014). The number of red-shouldered hawks observed in the Commonwealth during the CBC has also shown an increasing trend since 1966, with observations increasing dramatically since 1990 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of red-shouldered hawk to be 20,000 birds.

The number of red-shouldered hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.11.

Table 4.11 – Number of red-shouldered hawks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	2	30	5	5
2008	1	36	1	3
2009	7	36	9	9
2010	10	42	6	10
2011	10	36	7	7
2012	25	60	14	27
TOTAL	**55**	**240**	**42**	**61**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with red-shouldered hawks are received from airports where hawks pose an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with red-shouldered hawks to increase. To address these requests for assistance, up to 50 red-shouldered hawks could be taken and up to an additional 50 hawks could be relocated annually by WS. WS could also take up to 20 red-shouldered hawk nests annually under the proposed action.

The take of up to 50 red-shouldered hawks annually by WS would represent 0.25% of the estimated population of hawks in the Commonwealth. From 2007 through 2012, 19 red-shouldered hawks or an average of three birds each year were lethally taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.26% of the estimated statewide population. Given the limited take proposed by WS, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 50 red-shouldered hawks. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 red-shouldered hawks' nests to alleviate damage or threats of damage is not expected to adversely affect the population of hawks and is further addressed in additional detail below.

Broad-winged Hawk Population Impact Analysis

Broad-winged hawks are found throughout the central and eastern portions of the U.S. (Goodrich et al. 1996). In Virginia, broad-winged hawks can be observed during the breeding season across the majority of the state with highest concentrations of nesting birds occurring in the Appalachian Plateau, Ridge and Valley, Blue Ridge and Piedmont physiographic regions (Trollinger and Reay 2001). During fall migration, these birds can be observed in the highest numbers in these same regions (Rottenborn and Brinkley 2007). As many as 27,755 of these birds have been observed during a single fall migration period by the Rockfish Gap Hawkwatch (Rottenborn and Brinkley 2007). Broad-winged hawks are generally found in forested areas, but hunt near forest openings and bodies of water (Goodrich et al. 1996). Unlike other raptors, broad-winged hawks migrate in large groups, and have been documented in groups ranging from a few birds to thousands (Goodrich et al. 1996). The abundant prey items available at airports suggest that airport environments would be attractive locations for broad-winged hawks and would be where requests for assistance to alleviate threats are likely to originate. Additionally, broad-winged hawk's tendency to group together during migrations may increase their potential threat to aircraft.

In Virginia, the number of broad-winged hawks observed during the BBS has shown a declining trend estimated at -0.9% annually since 1966 and -0.7 since 2002 (Sauer et al. 2014). In contrast, an increasing trend has been observed for broad-winged hawks in the Eastern BBS region where the population has been estimated to be increasing at an annual rate of 1.0% since 1966 and 2.0% since 2002 (Sauer et al. 2014). Broad-winged hawks are not normally observed in the Commonwealth during the CBC (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of broad-winged hawk to be 30,000 birds.

The number of broad-winged hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.12.

Table 4.12 – Number of broad-winged hawk addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	2	1	1	1
2008	0	0	0	0
2009	7	5	1	1
2010	0	10	0	0
2011	0	10	0	0
2012	0	10	0	0
TOTAL	**9**	**35**	**2**	**2**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*In

Most requests for assistance associated with broad-winged hawks are received from airport authorities where hawks are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with broad-winged hawks to increase. To address these requests for assistance, WS could take up to 20 broad-winged hawks and relocate up to an additional 20 hawks annually under the proposed action. Additionally, WS could take up to 20 nests annually under the proposed action alternative to alleviate damage and threats.

The take of up to 20 broad-winged hawks annually by WS would represent 0.06% of the estimated population of broad-winged hawks in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 broad-winged hawks. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of broad-winged hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 broad-winged hawk nests to alleviate damage or threats of damage is also not expected to adversely affect the population of hawks and is further addressed in additional detail below.

Red-tailed Hawk Population Impact Analysis

Red-tailed hawks are one of the most widespread and recognizable raptors in North America (Preston and Beane 2009). Red-tailed hawks are generally found in open areas that are interspersed with patches of trees or other perching structures (Preston and Beane 2009). These raptors can be observed year-round across the Commonwealth (Rottenborn and Brinkley 2007, Trollinger and Reay 2001). However, large influxes of these birds can be observed during migration (Rottenbaum and Brinkley 2007). The open habitat and availability of perches makes airports attractive locations for red-tailed hawks and where most requests for assistance to alleviate threats occur. However, red-tailed hawks can also cause economic losses to agricultural producers when they feed on domestic fowl.

In Virginia, the number of red-tailed hawks observed during the BBS has shown an increasing trend estimated at 1.9% annually since 1966, which is statistically significant (Sauer et al. 2014). A similar trend has been observed for the number of red-tailed hawks observed in the Eastern BBS region which has been estimated to be increasing 1.1% annually since 1966, which is also a statistically significant trend (Sauer et al. 2014). Additionally, the number of red-tailed hawks observed in the Commonwealth during the CBC has also shown a general increasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of red-tailed hawks to be 8,100 hawks.

The number of red-tailed hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.13.

Table 4.13 – Number of red-tailed hawks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	94	80	3	4
2008	223	93	19	43
2009	466	127	51	58
2010	337	182	74	85
2011	258	227	91	92
2012	685	222	198	217
TOTAL	**2,063**	**931**	**436**	**499**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with red-tailed hawks are received from airport authorities where hawks are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with red-tailed hawks to increase. To address these requests for assistance, WS could take up to 250 red-tailed hawks and relocate up to an additional 125 red-tailed hawks. Additionally, WS could take up to 20 nests annually under the proposed action alternative to alleviate damage and threats.

The take of up to 250 red-tailed hawks annually by WS would represent 3.08% of the estimated population of red-tailed hawks in the Commonwealth. From 2007 through 2012, an average of 11 red-tailed hawks were lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 3.21% of the estimated statewide population. Given the increasing number of red-tailed hawks observed in the Commonwealth and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on hawk populations. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 125 red-tailed hawks. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 red-tailed hawk nests to alleviate damage or threats of damage is not expected to adversely affect the population of hawks and is further addressed in additional detail below.

Rough-legged Hawk Population Impact Analysis

An arctic breeder, rough-legged hawks can be found in both North America and Eurasia making them one of the most abundant species of raptors in the world (Bechard and Swen 2002). Rough-legged hawks can be observed during the winter months over most of the continental U.S., including Virginia (Bechard and Swen 2002). Preferred habitat consists of open treeless areas including prairie, pasture, plowed fields, marshlands, bogs, dunes, and coastal areas (Bechard and Swen 2002).

Because they are an arctic breeder, no BBS information is available for rough-legged hawks in Virginia. Trend data available from the CBC shows a cyclical and stable trend in Virginia 1966 (National Audubon Society 2010). The highest number of rough-legged hawks observed in the Commonwealth during the CBC occurred in 1981 when 37 birds were observed (National Audubon Society 2010). However, the average number of birds observed during the count over the past decade is 4.3 hawks (National Audubon Society 2010). The Partners in Flight Science Committee (2013) estimate the rough-legged hawk population in North America at 300,000 birds.

The number of rough-legged hawks taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.14.

Table 4.14 – Number of rough-legged hawks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	30	0	0
2008	0	30	0	0
2009	0	30	0	0
2010	0	30	0	0
2011	0	0	0	0
2012	0	30	0	0
TOTAL	**0**	**150**	**0**	**0**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with rough-legged hawks are received from airport authorities where hawks are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with rough-legged hawks to remain stable or increase. To address these requests for assistance, WS could take up to 20 rough-legged hawks and translocate up to an additional 20 rough-legged hawks annually under the proposed action alternative.

The take of up to 20 rough-legged hawks by WS would represent 0.006% of the estimated population of rough-legged hawks in North America. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 rough-legged hawks. Hawks live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of rough-legged hawks can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Bald Eagle Population Impact Analysis

The bald eagle is a large raptor easily identified by its distinctive white head and tail (Buehler 2000). During the migration period, eagles can be found throughout the U.S. (Buehler 2000). Bald eagles breed primarily in Alaska and Canada; however they have been documented nesting in all of the 48 contiguous states, except Rhode Island and Vermont (Buehler 2000). Approximately 95% of Virginia's bald eagle population breeds within the Chesapeake Bay region (Watts 2005). Eagles breeding in the Bay may either over-winter within the Bay or migrate to areas south (Watts 2005). In late fall, large congregations of bald eagles can be found in the Bay as eagles from breeding populations from the northeast migrate here to spend the winter with local breeders (Watts 2005). During this time of year, communal roosts form within the Bay. More than 100 communal roosts exist in the state, some supporting well over 100 birds each (Watts 2005). Bald eagles are primarily associated with aquatic habitats and open water in particular (Buehler 2000).

The number of bald eagles observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 7.0% annually since 1966, and 8.9% from 2002 to 2012 (Sauer et al. 2014). The number of bald eagles in the Eastern BBS region has also increased, by an estimated 8.6% since 1966 and 13.0% from 2002–2012 (Sauer et al. 2014). Similarly, the number of bald eagles observed in the Commonwealth during the CBC has shown a dramatic increasing trend since 1966 (National Audubon Society 2010). The greatest number of birds observed during the CBC in the Commonwealth was 943 in (2008–2009) with an average of 673 observed each year over the last decade.

Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of bald eagles was 0.10% of the global population but no figure was given. However, the Partners in Flight Science Committee (2013) does give an estimate of 300,000 for the global breeding population of bald eagles. During the 2011 breeding season aerial surveys conducted by the Center for Conservation Biology at the College of William and Mary and the Virginia Commonwealth University observed 726 pairs or 1,452 bald eagles nesting in Virginia (Watts and Byrd 2011).

Populations of bald eagles showed periods of steep declines in the lower U.S. during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail steep declining trends in bald eagles, the Bald Eagle Protection Act was passed in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act (see Chapter 1). Certain populations of bald eagles were listed as "*endangered*" under the Endangered Species Preservation Act of 1966 which was extended when the modern ESA was passed in 1973 (see Chapter 1). The "*endangered*" status was extended to all populations of bald eagles in the lower 48 States, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon which were listed as "*threatened*" in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as "*threatened*". In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act. In Virginia, the bald eagle population is quickly approaching saturation (Watts and Byrd 2011).

As was discussed in Chapter 1, under the Bald and Golden Eagle Protection Act, the definition of "*take*" includes actions that "*molest"* or *"disturb"* eagles. For the purposes of the Act, under 50 CFR 22.3, the term "*disturb"* as it relates to take has been defined as "*to agitate or bother a bald…eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."* The Bald and Golden Eagle Protection Act allows the USFWS to permit the take of eagles when "*necessary for the protection of...other interests in any particular locality*" after determining the take is "*...compatible with the preservation of the bald eagle*" (16 U.S.C. 668a). The USFWS developed an EA that evaluated alternatives and issues associated with regulations establishing new permits for the take of eagles pursuant to the Act (USFWS 2009*b*). Based on the evaluations in the EA and a FONSI, the selected alternative in the EA established new permit regulations for the "*take*" of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27).

From 2007 through 2012, WS used non-lethal methods to disperse 443 bald eagles in the Commonwealth. Additionally, in 2012, a bald eagle was captured in a walk-in vulture trap and released unharmed. This was the first capture of an eagle in a vulture trap since WS first began using the method in Virginia in 1998. Eagles may occur in or near areas where vulture damage management activities are conducted. The walk-in, live traps (as described in Appendix C) used to capture vultures are baited with animal carcasses and therefore may attract scavenging bald eagles. Eagles that walk into these traps would be released unharmed by opening the trap to allow the birds to fly out. Based on previous activities conducted by WS and the selective nature of walk-in traps employed to live-capture vultures, the USFWS determined that no Eagle Act permit would be required relating to the use of walk-in traps and the potential to live-capture and release bald eagles (S. Hoskin, USFWS, pers. comm. 2012). The USFWS did not issue depredation permits to WS or other entities during this period.

WS has previously received requests for assistance associated with bald eagles posing threats at or near airports. The large body size and soaring behavior of eagles can pose threats of aircraft strikes when eagles occur in close proximity to airports. In Virginia, 14 bald eagle-aircraft collisions have been reported since 2000, with seven of these strikes occurring since 2010 (FAA 2014). Given the definition of "*molest*" and "*disturb*" under the Act as described above, the use of harassment methods to disperse eagles posing threats at or near airports could constitute "*take*" as defined under the Act and therefore requires a permit from the USFWS.

WS would employ harassment methods to disperse bald eagles and remove up to 10 nests annually from airports or surrounding areas when authorized and permitted by the USFWS pursuant to the Act. Therefore, if no permit is issued by the USFWS to harass bald eagles or remove the nests of eagles that are posing a threat of aircraft strikes, no harassment or nest removal would be conducted by WS. Impacts due to nest removal and destruction should have little adverse impact on the population. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adults. The destruction of up to 10 nests by WS would not reach a level where adverse effects on eagle populations would occur. No lethal take of bald eagles would occur under this proposed action alternative. WS would abide by all measures and stipulations provided by the USFWS in permits issued for the harassment of bald eagles at airports to reduce aircraft strikes. The USFWS fully evaluated and determined that the issuance of permits for the harassment of eagles to WS or other entities would have no significant impacts in a separate analysis (USFWS 2009*b*).

American Kestrel Population Impact Analysis

American kestrels are the smallest and most common North American falcon (Smallwood and Bird 2002). Their range includes most of North America except the far northern portions of Alaska and Canada (Smallwood and Bird 2002). In Virginia, kestrels can be observed across the Commonwealth year-round (Trollinger and Reay 2001). Kestrels prefer open habitat with adequate perch sites from which to hunt, however, they will also hunt by hovering (Smallwood and Bird 2002). Nests are located in tree cavities, rock crevices or in the nooks of buildings (Smallwood and Bird 2002).

According to trend data available from the BBS, American kestrels are showing a declining trend in Virginia estimated at -1.3% annually since the BBS was initiated in 1966 (Sauer et al. 2014). Kestrels observed on BBS routes in the eastern U.S. and across the U.S. have also shown declining trends estimated at -2.1% and -1.3% annually respectively (Sauer et al. 2014). Trend data available from the CBC also indicates a decline in kestrel populations wintering in Virginia (National Audubon Society 2010). The population of kestrels in Virginia has been estimated at 7,000 (Partners in Flight Science Committee).

The number of American kestrels taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.15.

Table 4.15 – Number of American kestrels addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	107	150	21	29
2008	169	180	39	50
2009	431	237	79	80
2010	431	292	107	207
2011	523	437	196	196
2012	397	432	135	137
TOTAL	**2,058**	**1,728**	**577**	**699**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with American kestrels are received from airports where kestrels are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with American kestrels to increase. To address these requests for assistance, WS could take up to 250 American kestrels and relocate up to an additional 125 kestrels. Additionally, WS could take up to 10 American kestrel nests annually under the proposed action alternative to alleviate damage and threats.

The take of up to 250 American kestrels annually by WS would represent 3.57% of the estimated population of American kestrels in the Commonwealth. From 2007 through 2012, an average of 20 American kestrels were lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 3.86% of the estimated statewide population. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 125 American kestrels. Kestrels live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of American kestrels can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 American kestrel nests to alleviate damage or threats of damage is not expected to adversely affect the population of kestrels and is further addressed in additional detail below.

Merlin Population Impact Analysis

Merlin are small falcons characterized by their short dashing flights (Warkentin et al. 2005). They breed in the boreal and mixed conifer and deciduous forest of Canada and Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Washington, Wisconsin, Wyoming (Warkentin et al. 2005) and Pennsylvania (Wilson et al. 2012). In the winter merlin can be found from southern Canada south to Central America (Warkentin et al. 2005). In Virginia, merlins are rarely observed during the breeding season but are commonly observed during the non-breeding season (Trollinger and Reay 2011). From 1989-2001, a total of 1,507 merlin or an average of approximately 116 merlin per year were captured and banded at the Eastern Shore of Virginia National Wildlife Refuge during fall migration (Lukei and Byrd 2002) and as many as 2,780 birds have been observed during a single fall migration period by the Kiptopeke Hawkwatch (Rottenborn and Brinkley 2007). Merlins are generally found in open habitat which enables them to scan for and aerially pursue prey (Warkentin et al. 2005). The open

habitat and prey available at airports and the bird's increased use of urban and suburban areas (Warkentin et al. 2005) indicate that airport environments would be attractive locations for merlin.

In the Eastern BBS region, merlin populations have showed an increasing trend estimated at 2.5% annually since 1966 (Sauer et al. 2014). In Virginia, the number of merlin observed during the CBC has shown an increasing trend since 1966 (National Audubon Society 2010). From 2001 to 2011, a total of 10 years, an average of 23 birds were observed per year during the CBC in the Commonwealth (National Audubon Society 2010). There are currently no population estimates available for the number of merlin present in the Commonwealth. However, the breeding population of merlin in North America is estimated at approximately 1,300,000 birds (Partners in Flight Science Committee 2013).

The number of merlin taken or dispersed by WS and the total number taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.16.

Table 4.16 – Number of merlin addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	0	0	0
2008	0	0	0	0
2009	1	5	1	1
2010	4	10	0	0
2011	7	10	0	0
2012	0	10	0	0
TOTAL	**12**	**35**	**1**	**1**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Most requests for assistance associated with merlin are received from airports where these birds are posing an aircraft strike hazard. WS anticipates the number of airports requesting assistance with managing damage and threats associated with merlin to increase. To address these requests for assistance up to 20 merlin could be taken and 20 merlin could be relocated annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 20 merlin annually by WS would represent 0.001% of the estimated population of merlin in North America. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the increasing number of merlin observed and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on merlin populations. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 merlin. Merlin live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of merlin can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized and occurs at the discretion of the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Peregrine Falcon Population Impact Analysis

Formerly extirpated from eastern North America, and listed under Endangered Species Act (ESA), these falcons have made a dramatic recovery (White et al. 2002). In Virginia, peregrine falcons were believed to be extinct as a breeding species by the early 1960s (Mojica et al. 2012). However, a program which released 250 captive bred birds from 1978 to 1993 was successful in reestablishing a breeding population

in the state (Mojica et al. 2012). Suitable habitat consists of open landscapes for foraging with ledges on cliffs, tall buildings, bridges or other structures for nesting (White et al. 2002). In Virginia, peregrine falcons can be observed nesting in artificial peregrine nesting structures, towers, fishing shacks, bridges, power plants, high rise buildings and natural cliffs (Mojica et al. 2012). Peregrine falcons were officially de-listed from the Endangered Species Act (ESA) on August 25, 1999 (Mesta 1999). Because peregrines have not recovered as a nesting population in their historic mountain range in Virginia, they remain listed as threatened by the Commonwealth. To rectify this problem, since 2000, over 215 wild-reared birds have been moved from specific costal Virginia nest locations where fledging success is poor, to historic mountain range sites in the Commonwealth (Mojica et al. 2012).

The number of peregrine falcons observed during the BBS across the U.S. has increased by an estimated 1.9% annually since 1966 and 6.7% annually from 2002–2012 (Sauer et al. 2014). There is no other additional information from the BBS on peregrine falcon populations in the region or the Commonwealth (Sauer et al. 2014). Monitoring by the VDGIF and their partners has documented a steady recovery of this species with the population doubling every 5.4 years on average since 1982 (Mojica et al. 2012). In 2012, there were 22 known pairs (44 birds) nesting in the Commonwealth which successfully fledged 38 chicks (Mojica et al. 2012). The number of peregrine falcons observed in the Commonwealth during the CBC has shown increasing trend since 1966 (National Audubon Society 2010). In 2011, the most recent year for which CBC data is available, 27 peregrines were observed during the CBC in the Commonwealth (National Audubon Society 2010).

Under the Code of Virginia, and the Virginia Administrative Code, it is, unlawful to, *"take, transport, process, sell or offer for sale …any threatened, or endangered species of fish or wildlife"*. The definition of "*take*" is an *"intentional …act …which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering"*. The definition of *'take'* as defined by the code does not include the implementation of non-lethal harassment methods described above.

From 2007 through 2012, WS used non-lethal methods to disperse 12 peregrine falcons in the Commonwealth. The USFWS did not issue depredation permits to WS or other entities during this period.

WS has previously received requests for assistance associated with peregrine falcons posing threats at or near airports in the Commonwealth. WS would employ harassment methods to disperse peregrine falcons from airfields or surrounding areas. No lethal take of falcons would occur and non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over such a wide geographical scope that long-term adverse effects would occur to peregrine falcon populations.

Wild Turkey Population Impact Analysis

A non-migratory bird, wild turkeys can be found from southern Canada south across the U.S. (Eaton 1992). Once extirpated from two-thirds of the Commonwealth because of deforestation, burning, grazing and cultivation, wild turkeys can now be found statewide in suitable habitat (Virginia Department of Game and Inland Fisheries 2013*a*). In the eastern U.S., wild turkeys inhabit hardwood, mixed, and pine forests where they forage on a variety of fruit, seeds and insects (Eaton 1992). Ground nesters, turkeys can be found nesting at the base of a tree or underbrush (Eaton 1992). Wild turkeys are highly social and depending upon the time of year can be observed in large flocks (Eaton 1992).

The number of turkeys observed during the BBS has shown an increasing trend in the state estimated at 5.3% from 1966 through 2012 (Sauer et al. 2014). Similarly, the number of turkeys observed in the

Commonwealth during the CBC has shown an overall increasing trend since 1966 (National Audubon Society 2010). From 2008–2012, 95,485 turkeys (77,853 spring season, 17,632 fall season) or 19,097 turkeys per year on average were harvested in the Commonwealth (Gary Norman, VDGIF, personal communication 2013). The Commonwealth's turkey population could be estimated by assuming annual harvest is 10% of the total population. If an average of 19,097 turkeys is harvested annually, the Commonwealth's population could be estimated at 190,970 birds (Gary Norman, VDGIF, personal communication 2013).

The number of turkeys taken or dispersed by WS to alleviate damage and threats as well as the number harvested by hunters from 2007 to 2012 is shown in Table 4.17. The turkey population in the state is sufficient to allow for regulated hunting seasons. Male turkeys can be harvested during the annual spring hunting season and both male and female turkeys can be harvested during the annual fall hunting season. Although turkeys can be taken in either season, more turkeys are taken during the spring. Since 2007, the highest number of turkeys harvested in a single season occurred in the spring of 2009 when an estimated 16,611 turkeys were harvested (Gary Norman, VDGIF, personal communication 2013). The highest annual harvest from 2007 to 2012 also occurred in 2009 when 20,149 turkeys were harvested (Gary Norman, VDGIF, personal communication 2013). The average annual harvest from 2007 to 2012 was 19,055 turkeys.

Table 4.17 – Number of wild turkeys addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2]		
			Spring	Fall	Total Hunter Harvest
2007	31	6*	14,090	4,759	18,849
2008	45	3*	15,037	3,505	18,542
2009	76	9**	16,611	3,538	20,149
2010	89	10**	15,190	2,687	17,877
2011	232	19*	15,689	3,470	19,159
2012	75	7*	15,326	4,432	19,758
TOTAL	**548**	**54**	**91,943**	**22,391**	**114,334**

[1]Data reported by federal fiscal year
[2]Data obtained from Gary Norman, VDGIF, personal communication 2013.
*Includes non-target take of 1
**Includes non-target take of 2

Requests for assistance received by the WS program in Virginia to manage damage or threats of damage associated with wild turkeys occur primarily at airports where turkeys can pose strike risks to aircraft. Turkeys can also cause damage to windows, siding, vehicles and other property when turkeys, primarily males during the breeding season, mistake their reflection as another turkey and attack the image. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance as the turkey population increases, WS could take up to 100 wild turkeys and 20 nests annually.

Based on a population estimate of 190,970 birds, the take of up to 100 turkeys would represent 0.05% of the estimated population and 0.5% of the average number of turkeys (19,055) taken annually by hunters in the Commonwealth. Given the increasing population of turkeys observed in the Commonwealth and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on turkey populations. Most requests received by WS concerning turkeys in the Commonwealth were associated with airports. Although airports are restricted areas where hunting is not generally permitted, on some airports harvest of turkeys does occur during the regulated harvest season by approved personnel. However, this harvest can only occur where it is practical, and season length, bag limits, and sex restrictions prohibit effective management of turkeys at these facilities. WS' take of turkeys is likely to occur in locations where take will not limit the ability to harvest turkeys in areas that

can be hunted. WS' take would be a limited component of the overall take occurring within Virginia and could be considered of low magnitude when compared to the number of turkeys in Virginia. The take of turkeys can only occur when permitted by the VDGIF, and when applicable, the airport. All take, including take by WS, and take by airport employees is authorized by the VDGIF. WS would report turkey take annually, which ensures cumulative take is considered as part of VDGIF population management objectives for turkeys. The take of up to 20 turkey nests to alleviate damage and threats of damage is also not expected to adversely affect the population of turkeys and is addressed in additional detail below.

Killdeer Population Impact Analysis

Killdeer occur over much of North America from the Gulf of Alaska southward throughout the U.S. and to the Atlantic and Pacific coasts (Jackson and Jackson 2000). Killdeer can be found throughout the state during the breeding season (Trollinger and Reay 2001) and in the eastern part of the state in the winter (Rottenborn and Brinkley 2007). Killdeer are technically in the family of shorebirds; however, they are unusual shorebirds in that they do not need to be closely associated with water (Jackson and Jackson 2000). Killdeer are commonly found in a variety of open habitats and will nest in any open place including parking lots, ball fields, along roadways, on gravely rooftops and at airports (Jackson and Jackson 2000). Killdeer are social birds, forming pair bonds that are maintained year round, and migrating and wintering in flocks numbering up to 30 individuals (Jackson and Jackson 2000).

In Virginia, the number of killdeer observed during the BBS has shown an increasing trend estimated at 0.9% annually since 1966, and 0.7%, from 2002–2012 (Sauer et al. 2014). However, the number of killdeer observed in the Commonwealth during the CBC has shown a slightly declining trend since the mid-1970s (National Audubon Society 2010). Currently, no other data is available on killdeer populations in the Commonwealth from the BBS or the CBC (National Audubon Society 2010, Sauer et al. 2014). Based on broad-scale surveys, the U.S. Shorebird Conservation Plan estimated the population of killdeer in North America to be approximately 2,000,000 birds in 2001 (Brown et al. 2001).

The number of killdeer taken or dispersed by WS and the total number of killdeer taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.18.

Table 4.18 – Number of killdeer addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits					
		Adults			Nests		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	216	55	31	32	0	0	0
2008	538	145	145	145	0	0	0
2009	423	130	93	93	10	0	0
2010	450	180	131	162	20	0	1
2011	388	285	135	150	20	5	5
2012	553	345	122	152	20	0	0
TOTAL	**2,568**	**1,140**	**657**	**734**	**70**	**5**	**6**

[1] Data reported by federal fiscal year
[2] Permitted by USFWS; includes WS' authorized take
[3] Data reported by calendar year; includes WS' take

Requests for assistance associated with killdeer occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 250 killdeer and 20 nests could be taken annually.

The number of killdeer present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of killdeer in North America is approximately 2,000,000 birds (Brown et al. 2001). Based on this estimate, the removal of up to 250 killdeer by WS would represent 0.01% of the North American population. From 2007 through 2012, an average of 13 killdeer were lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.01% of the estimated North American population. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of killdeer can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of killdeer would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 killdeer nests to alleviate damage and threats of damage is also not expected to adversely affect the population of killdeer and is addressed in additional detail below.

Upland Sandpiper Population Impact Analysis

Upland sandpipers can be found during the breeding season across southern Canada and the northern U.S. east of the Rocky Mountains where suitable habitat occurs (Houston et al. 2011). These birds arrive in the Commonwealth in late March or early-to-mid April and usually depart by September although birds have been observed in November (Terwilliger 1991). Upland sandpipers nest in loose colonies feeding, resting, and flying in groups (Houston et al. 2011). As soon as hatchlings are able to fly, birds begin to form flocks of 10–25 individuals (Houston et al. 2011). Unlike most shorebirds which are associated with water, upland sandpipers are associated with grassland habitat including pasture, moist meadows, and airports (Trollinger and Reay 2001). Although not listed by the federal government under the Endangered Species Act, this species is listed as threatened by the Commonwealth of Virginia.

Since 1966, populations of upland sandpipers in the U.S. have exhibited statistically significant annual increases of 0.8% while populations in the Eastern BBS Region have exhibited statistically significant annual decreases of -3.6% (Sauer et al. 2014). Currently, no other data is available on upland sandpiper populations in the Commonwealth from the BBS or the CBC (National Audubon Society 2010, Sauer et al. 2014). During the Virginia Breeding Bird Project observation period (1985–1989) upland sandpiper were observed in just a few counties (Clarke, Fauquier, Frederick, Loudoun, Manassas, Pulaski, Shenandoah, and Warrren) (Trollinger and Reay 2001). Terwilliger and Tate (1995) estimated the state's breeding population at 15to 20 pairs. Based on broad-scale surveys, the U.S. Shorebird Conservation Plan estimated the population of upland sandpipers in North America to be approximately 470,000 birds in 2001 (Brown et al. 2001).

Under the Code of Virginia, and the Virginia Administrative Code, it is, unlawful to, *"take, transport, process, sell or offer for sale …any threatened, or endangered species of fish or wildlife".* The definition of "*take*" is an *"intentional …act …which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering."* The definition of *'take'* as defined by the code does not include the implementation of non-lethal harassment methods described above.

From 2007 through 2012, WS used non-lethal methods to disperse two upland sandpipers in the Commonwealth. The USFWS did not issue depredation permits to WS or other entities during this period.

WS has previously received requests for assistance associated with upland sandpipers posing threats at airports. WS would employ harassment methods to disperse upland sandpipers from airfields or surrounding areas. No lethal take of upland sandpipers would occur and non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over such a wide geographical scope that long-term adverse effects would occur to upland sandpiper populations.

Sanderling Population Impact Analysis

As arctic breeders, sanderlings can be observed during the non-breeding season along the Atlantic, Gulf and Pacific coasts (Macwhirter et al. 2002). During the non-breeding season these birds can be observed on coastal beaches, tidal mudflats and inland along ponds, streams and reservoirs (Macwhirter et al. 2002). Sanderlings are highly social birds migrating and wintering in flocks (Macwhirter et al. 2002). As many as 16,365 sanderlings have been observed in a single flock during fall migration in Virginia (Rottenborn and Brinkley 2007).

Because they are arctic breeders no BBS data on sanderlings is available (Sauer et al. 2014). However, sanderlings nesting in northern portions of Canada and along the arctic coast migrate through and overwinter in the Commonwealth (Macwhirter et al. 2002). The number of sanderlings observed overwintering in the Commonwealth during the CBC has shown a cyclical and stable trend since 1966. In the last decade, the lowest number of sanderlings observed was 717 (2006–2007) and the highest was 2,523 (2003–2004) (National Audubon Society 2010). On average, 1,458 sanderlings have been observed overwintering in Virginia during the CBC since 2000–2001 (National Audubon Society 2010).

The number of sanderlings taken or dispersed by WS and the total number of sanderlings taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.19.

Table 4.19 – Number of sanderlings addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	0	0	0
2008	12	1	1	1
2009	235	5	0	0
2010	3,431	30	2	2
2011	4,800	70	0	7
2012	134	50	7	32
TOTAL	**8,612**	**156**	**10**	**42**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with sanderlings occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 100 sanderlings annually.

The number of sanderlings present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of sanderlings in North America is approximately 300,000 birds (Brown et al. 2001). Based on this estimate, the removal of up to 100 sanderlings by WS would represent 0.03% of the North American population. From 2007 through 2012, an average of 4.5 sanderlings were lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.03% of the estimated North American population. Given the limited take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of sanderlings can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of sanderlings would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Bonaparte's Gull Population Impact Analysis

During the breeding season, Bonaparte's gulls can be found in Alaska, and the central and northern part of Canada, west of Hudson Bay (Burger and Gochfeld 2002). During the non-breeding season, Bonaparte's gulls can be found along the Atlantic, Pacific and Gulf coasts as well as along the great lakes and in-land particularly Southern California, Texas, and the Mississippi Valley and the Atlantic coast (Burger and Gochfeld 2002). Habitat during the non-breeding season includes lakes, rivers, marshes, sewage lagoons, costal bays and harbors, sandbars and mudflats (Burger and Gochfeld 2002). Like most gulls, Bonaparte's gulls are highly social. Bonaparte's gulls form flocks in the tens of thousands to migrate, roost and forage during the nonbreeding season (Burger and Gochfeld 2002). In Virginia, these birds have been observed in flocks numbering up to 10,000 individuals in the spring and 14,000 individuals in the fall (Rottenborn and Brinkley 2007).

Most Bonaparte's gulls in the eastern U.S. migrate and winter in BCR 14 and the Pelagic Bird Conservation Region (PBCR) 78 (MANEM 2006) as well as BCR 27, BCR 31 and BCR 37 (Hunter et al. 2006). Bonaparte's gulls in BCR 14 and 30 have been given a conservation status of lowest concern (MANEM 2006) while gulls in BCR 27 are at the planning and responsibility action level (Hunter et al. 2006). The number of Bonaparte's gulls overwintering in Virginia has shown a cyclical trend since 1966 (National Audubon Society 2010). Over the last 20 years, anywhere from 456 to 7,581 Bonaparte's gulls have been observed in the Commonwealth during the CBC (National Audubon Society 2010). There are no population estimates for Bonaparte's gulls in the Commonwealth. However, the MANEM Waterbird Conservation Plan estimates the North American population of Bonaparte's gulls to be approximately 255,000 to 525,000 gulls (MANEM 2006).

The number of Bonaparte's gulls taken or dispersed by WS and the total number of gulls taken by all entities from 2007 to 2012to alleviate damage and threats associated with these birds are shown in Table 4.20.

Table 4.20 – Number of Bonaparte's gulls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	75	0	0
2008	71	125	4	10
2009	164	127	17	17
2010	0	77	1	1
2011	719	127	58	58
2012	28	127	0	2
TOTAL	**982**	**658**	**80**	**88**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

To address requests for assistance to manage damage and threats associated with Bonaparte's gulls in the future, up to 250 Bonaparte's gulls could be taken annually by WS. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2012 is in anticipation of requests to address damage and threats of damage occurring at airports where they pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carry it off the property to feed, depositing garbage and droppings on buildings, equipment, vehicles, in neighboring areas.

The number of Bonaparte's gulls present in Virginia fluctuates throughout the year. The best available data estimates that the population of Bonaparte's gulls in North America is approximately 255,000 to 525,000 gulls (MANEM 2006). Based on this estimate, the annual removal of up to 250 Bonaparte's gulls by WS would represent anywhere from 0.09% to 0.04% of this population. From 2007 to 2012, an average of 1.3 gulls per year was taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent anywhere from 0.09% to 0.04% of the estimated population. Given the limited take proposed by WS when compared to the population, the magnitude of WS' take could be considered low. The take of Bonaparte's gulls can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of Bonaparte's gulls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Laughing, Ring-billed, Herring and Great Blacked Backed Gull Population Impact Analysis

Biological assessments for identifying the potential impact of harvest and/or removal programs on bird populations have a long history of application in the U.S. Population modeling and extensive monitoring programs form the basis of an adaptive decision-making process used each year for setting migratory game bird harvest regulations, while ensuring that levels of take are sustainable. Increasing human-wildlife conflicts caused by migratory bird species (both game and nongame), and their potential impacts on sensitive species and their habitats, has resulted in greater use of analytical tools to evaluate the effects of authorized take to achieve population objectives (Runge et al. 2009). One such tool is referred to as the Potential Biological Removal (PBR) model (Wade 1998, Runge et al. 2004).

PBR models were developed by the USFWS for BCR 14 and BCR 30 to evaluate harvest levels for gulls in the northeastern U.S. to ensure take occurs at levels which achieve desired population objectives for those species. Although only the Delmarva Peninsula and the Chesapeake Bay watershed lie within BCR 30, the majority of the gulls present in the Commonwealth are those gulls likely to migrate from or have breeding colonies in BCR 14 and 30. The four gull species addressed are known to breed along coastal

areas and inland sites that are contained within BCR 14 and BCR 30. Since population estimates and trends for gulls are limited, the PBR models were developed for BCR 14 and BCR 30 to analyze potential population impacts from lethal take. Given the close geographical proximity of states in the region and given the mobility of gulls, assessing allowable take for each state would be difficult.

Allowable harvest models for bird species have had a long history of use in the U.S., primarily with waterfowl species to determine allowable harvest during annual hunting seasons. Although no hunting season exists for gulls, the take of gulls under depredation permits issued by the USFWS can occur. The USFWS recently prepared PBR models using population parameters for each gull species to estimate the allowable take level for gulls in BCR 14 and BCR 30. Population parameter estimates were taken from available literature for each gull species (see Table 4.21), or in cases where estimates were not available, surrogate estimates from closely-related species were used (Seamans et al. 2007). Because there was uncertainty associated with demographic parameter estimates, allowable take levels were calculated using a simulation approach to estimate a range of R_{max} values with parameter estimates randomly drawn from normal distributions based on reported standard errors (see Table 4.21; Seamans et al. 2007).

To use the PBR method to determine levels of allowable take, or cumulative impacts over a large geographic area, the information required includes a minimum estimate of the population size using science-based monitoring programs (e.g., BBS, CBC, coordinated colony surveys) and the intrinsic rate of population growth. The formula for PBR is:

$$PBR = \tfrac{1}{2} R_{max} N_{min} F_R$$

Where R_{max} is the maximum population growth rate at low densities and in the absence of removal, N_{min} is the minimum population size, and F_R is a recovery factor ranging from 0.1 to 2.0 (Runge et al. 2004). The recovery factor is a qualitative assessment that is typically set at low levels for endangered ($F_R = 0.1$) or threatened species ($F_R = 0.5$; Taylor et al. 2000), or if the status of the population is poorly known (Runge et al. 2004). However, using a recovery factor above 1.0 has been discussed for species in which the management objective is to hold the population at a smaller fraction of its carrying capacity (Runge et al. 2009).

Table 4.21 - Demographic parameter estimates (θ) used for estimating R_{max} and Potential Biological Removal of gulls in BCR 14 and BCR 30 (Seamans et al. 2007).

		Great black-backed gull[1]		Herring gull[2]		Laughing gull[3]		Ring-billed gull[4]	
Parameter	**Age class**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**	**(θ)**	**SE (θ)**
p	Adult	0.87	0.03	0.87	0.03	0.87	0.03	0.87	0.03
*l*α	Adult	0.42		0.42		0.56		0.56	
	Hatch Year	0.729	0.035	0.729	0.035	0.729	0.035	0.729	0.035
	Second Year	0.886	0.024	0.886	0.024	0.886	0.024	0.886	0.024
b		0.784	0.018	0.752	0.022	0.752	0.022	0.752	0.022
α		5		5		3		3	
ω		19		20		19		19	
N_{min}		250,000		390,000		270,000		54,000	
R_{max}		0.09	0.027	0.086	0.027	0.113	0.036	0.113	0.036

[1]Good 1998
[2]Pierotti and Good 1994
[3]Burger 1996, Dinsmore and Schreiber 1974
[4]Ryder 1993, Seamans et al. 2007

To estimate R_{max} for gulls, the Slade formula (Slade et al. 1998) was used:

$$1 = p\lambda^{-1} + 1_{\alpha}\, b\lambda^{-\alpha} - l_{\alpha}bp^{(\omega-\alpha+1)}\, \lambda^{-(\omega+1)}$$

where p is adult annual survival rate, $l\alpha$ is the survival rate from birth to age at first reproduction, b is the number of female offspring per female of reproductive age per year, α is the age at first reproduction, ω is the age at last reproduction, and λ is the intrinsic rate of population change. After solving the above equation for λ, R_{max} was estimated as $\ln(\lambda)$.

Population estimates (N_{min}) for each species were based on the number of gulls at known breeding colonies in BCR 14 and BCR 30 during the mid-1990s (MANEM 2006), and adjusted using a conservative estimate of 0.75 non-breeding gull for every breeding adult to estimate the total population (Seamans et al. 2007). Allowable take levels (± 95% CI) for each of the four gull species addressed in this assessment under three recovery factors (0.5, 1.0, 1.5) in BCR 14 and BCR 30 are presented in Table 4.22.

Table 4.22 - Potential Biological Removal (± 95% CI) of gulls in BCR 14 and BCR 30 under three recovery factors (Seamans et al. 2007).

Species	$F_R = 0.5$	$F_R = 1.0$	$F_R = 1.5$
Laughing Gull	7,685 (3,927–12,685)	15,274 (7,188–23,042)	26,044 (10,798–34,818)
Ring-billed Gull	1,532 (713–2,318)	3,065 (1,455–4,634)	4,588 (2,161–6,951)
Herring Gull	8,360 (3,892– 12,656)	16,725 (7,788–25,397)	25,048 (11,716–37,875)
Great Black-backed Gull	5,614 (2,764 – 8,358)	11,234 (5,561–16,670)	16,853 (8,364–25,086)

The PBR models were developed by the USFWS for BCR 14 and BCR 30 to evaluate harvest levels for gulls in the northeastern U.S. to ensure take occurs at levels which achieve desired population objectives for those species. The four gull species addressed in this assessment are known to breed along coastal areas and inland sites that are contained within BCR 14 and BCR 30. Some concerns arise regarding the use of regional gull population estimates for assessing allowable take in BCR 14 and BCR 30 as opposed to the more specific state population estimates. However, there are no comprehensive population estimates available for gull species in the Commonwealth.

Gulls are migratory bird species and the breeding population of gulls estimated at the state-level is only representative of the number of gulls present in a state during a short period of time (i.e., during the breeding season). The breeding surveys do not account for migratory gulls present during the winter, nor do they account for the population of non-breeding gulls (i.e., sub-adults and non-breeding adults) present during the breeding season. Unlike breeding surveys, the PBR models developed by the USFWS are based on both breeding and non-breeding gulls. As previously mentioned, USFWS's PBR models estimate allowable take by calculating a total population for each gull species using 0.75 non-breeding gulls for every breeding adult. Since the take of gulls to alleviate damage can occur throughout the year and not just during the breeding season, a comprehensive model like the PBR that includes non-breeding populations of gulls allows for a more systemic analysis of allowable take on gull populations.

Laughing Gull Population Impact Analysis

In the U.S., laughing gulls can be found from Maine south along the Atlantic and Gulf coasts (including the coastal areas of BCR 14, 27 and 30) during the breeding season and from North Carolina south along the Atlantic and Gulf coast during the rest of the year (Burger 1996). In the Commonwealth, laughing gulls can be observed nesting on the Delmarva Peninsula, on islands in the Chesapeake Bay and in the

greater Hampton, Newport News, Norfolk area (Hampton Roads Bridge-Tunnel) (Watts and Paxton 2009, 2014). During the breeding season, laughing gulls use coastal habitats such as salt marshes, sandy islands with patches of long grass for nesting. These areas as well as lakes, marshes, impoundments, meadows and plowed fields are used for foraging (MANEM 2006).

The number of laughing gulls present in Virginia fluctuates throughout the year. Because those gulls nesting in BCR 14, BCR 27, and BCR 30 are likely the same gulls that either migrate through or are present in Virginia throughout the year, the analyses for potential impacts will incorporate information from surveys conducted in those areas. In the 1970's the breeding population of laughing gulls in the U.S. was 129,768 birds distributed among 63 nesting sites (MANEM 2006). By the 1990's the breeding population of laughing gulls had increased to 205,348 birds distributed among 275 nesting sites (MANEM 2006). Laughing gull populations in BCR 27 have seen similar dramatic population increases (Hunter et al. 2006). BBS data for laughing gulls in the Eastern BBS Region shows a statistically significant increasing trend estimated at 3.2% annually from 1966–2012 and 4.7% annually from 2002–2012 (Sauer et al. 2014). Similar trends have been observed in the New England/Mid-Atlantic Coast BBS region, and the Southeastern Coastal Plain where the population has increased at an estimated 5.1% and 5.2% annually from 1966–2012 (Sauer et al. 2014). Laughing gulls have also increased in Virginia with an estimated increase of 4.8% annually since 1966 and 7.2% since 2002 (Sauer et al. 2014). CBC data for laughing gulls in the Commonwealth has shown an increasing trend since 1966 (National Audubon Society 2010). In BCR 30 the breeding population of laughing gulls is estimated at 202,646 and in BCR 14 the breeding population is estimated at 2,704 (MANEM 2006). In BCR 27 the breeding population is estimated at 92,232 gulls (Hunter et al. 2006). Both BCR 30 and 14 laughing gull populations have been given a conservation rank of lowest concern (MANEM 2006) while Hunter et al. (2006) states that laughing gull populations in BCR 27 should be reduced. Watts and Paxton (2014) estimated the Commonwealth's breeding population at 48,320 birds in 2013.

The number of laughing gulls taken or dispersed by WS in Virginia and the total number of gulls taken by all entities in the northeastern U.S. (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4.23.

Table 4.23 – Number of laughing gulls addressed from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			
		Adults		Nests	
		WS' Take[1]	Total Take by All Entities[2]	WS' Take[1]	Total Take by All Entities[2]
2007	5,226	252	5,880	6,142	9,126
2008	9,431	517	5,121	3,782	9,679
2009	142,909	904	5,146	1,262	6,334
2010	165,619	1,260	5,188	1,886	2,982
2011	202,185	1,476	6,029	1,213	6,526
2012	80,619	826	2,123	2,259	2,679
TOTAL	**605,989**	**5,235**	**29,487**	**16,544**	**37,326**

[1]Dispersal or take in Virginia, data reported by federal fiscal year
[2]Take in northeastern U.S. (USFWS Region 5), data reported by calendar year; includes WS' take

To address requests for assistance to manage damage and threats associated with laughing gulls in the future as described in Chapter 1, up to 3,500 herring gulls and 10,500 nests could be taken annually by WS to alleviate damage and threats as described in this EA. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2012 is in anticipation of requests to address

damage and threats of damage occurring at airports where they pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carry it off the property to feed, depositing garbage and droppings on buildings, equipment, and vehicles in neighboring areas. Additionally, gulls prey on the eggs and nestlings of native birds on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth.

The best available data estimates the population of laughing gulls in BCR 14 and 30 at 270,000 birds (Seamans et al. 2007). However, because population trends indicate an increasing laughing gull population, the population is likely greater than 270,000 which is considered a minimum population (N_{min}). Based on this estimate, the annual removal of up to 3,500 laughing gulls by WS would represent 1.2% of this population.

From 2007 through 2012, the annual take of laughing gulls by all entities in the northeastern U.S. (USFWS Region 5) has averaged 4,915 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities could be up to 8,415 gulls or 3.1% of the estimated population. The PBR model for laughing gulls in BCR 14 and BCR 30 estimates that 15,274 laughing gulls can be taken annually with no adverse effect on the current population (Table 1). Current take from all known entities has not exceeded this level of take. In addition, portions of southern coastal Virginia lie within BCR 27 where an additional 92,232 gulls breed and where a population objective of 50,000 breeding pairs has been set (Hunter et al. 2006). Based on the best available information, WS' potential impacts to populations of laughing gulls are expected to be insignificant to their overall viability and reproductive success. This determination is based on increasing population trends and the limited take proposed when compared to the estimated population. The take of laughing gulls can only occur when permitted by the USFWS through the issuance of depredation permits. The USFWS ensures cumulative take is considered as part of population management objectives for these birds.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the laughing gull population. Laughing gulls are a long lived species that have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult laughing gulls. The cumulative destruction of up to 10,500 laughing gull nests annually by WS would occur in localized areas and would not reach a level where adverse effects on laughing gull populations would occur. As with the lethal take of gulls, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Ring-billed gull Population Impact Analysis

During the breeding season ring-billed gulls can be found in the northern portions of BCR 14 (New Brunswick, Prince Edward Island, Southeastern Quebec) west along the Saint Lawrence Seaway into the Great Lakes region (BCR 13) and North Dakota, Montana, Wyoming, Idaho, Oregon and Washington (MANEM 2006, Ryder 1993). In the non-breeding season ring-billed gulls can be observed along the Atlantic coast and inland in agricultural fields, on golf courses, at landfills and shopping malls (Ryder 1993). In the Chesapeake Bay region sub-adult birds can be observed during the breeding season (Ellison 2010) while both sub-adults and adults can be observed during the non-breeding season (National Audubon Society 2010). Ring-billed gulls are highly social birds nesting in colonies of 20,000 to 80,000 pairs and loafing at landfill sites in winter in groups of up to 50,000 individuals (Ryder 1993). In January 2003, the Nansemond CBC in the Commonwealth observed a total of 44,834 ring-billed gulls (Rottenborn and Brinkley 2007). Ring-billed gulls are opportunistic feeders consuming fish, insects, earthworms, rodents, grain and garbage (Ryder 1993).

Unlike the other gull species analyzed by Seamans et al. (2007), the ring-billed gulls which can be observed in the Commonwealth are not likely nesting in BCR 14 and 30, but are likely nesting in BCR 13. The areas surrounding Lake Erie and Ontario as well as the areas along the southern border of Lake Huron, the northwest portion of Pennsylvania , northeast Ohio and portions of New York all lie within BCR 13 where 63% of the North American population of ring-billed gulls is known to nest (Wiers et al. 2010). In the fall these birds are known to migrate from these areas east through Pennsylvania and New York state and along the Atlantic coast (Ryder 1993). In the spring, these birds migrate north along the Atlantic coast to the Chesapeake Bay and then west to the Lakes (Ryder 1993). By comparison 2% of the North American population of ring-billed gulls nest in BCR 14, while no ring-billed gulls are known to nest in BCR 30 (MANEM 2006).

BBS data for the Eastern BBS region shows an increasing trend estimated at 4.3% annually from 1966–2012, and 8.1% from 2002–2012, both statistically significant increases (Sauer et al. 2014). No BBS data for ring-billed gulls is available for Virginia (Sauer et al. 2014). Both the population of ring-billed gulls in BCR 14 and 30 have been given a conservation rank of lowest concern (MANEM 2006) and the BCR 13 population has been given a conservation rank of low concern (Wiers et al. 2010). The population of ring-billed gulls in BCR 14 and 30 has increased at a rate of 8% to 11% per year since 1976 (MANEM 2006). Ring-billed gull populations in BCR 13 have also increased (Wiers et al. 2010). For example, the number of ring-billed gulls nesting on Lake Erie (in BCR 13) increased by 161% from 1976–2009 (Morris et al. 2011). CBC data from 1966 through 2010 shows a cyclical trend in the number of ring-billed gulls overwintering in the Commonwealth (National Audubon Society 2010). An estimated 1,065,800 ring-billed gulls breed in BCR 13 (Wiers et al. 2010) while 40,800 ring-billed gulls are believed to breed in BCR 14 (MANEM 2006). There are currently no known breeding populations of ring-billed gulls in BCR 30 (MANEM 2006) or BCR 27 (Hunter et al. 2006).

The number of ring-billed gulls taken or dispersed by WS in Virginia and the total number of gulls taken by all entities in the northeastern United States (USFWS Region 5) to alleviate damage and threats are shown in Table 4.24.

Table 4.24 – Number of ring-billed gulls addressed from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			
		Adults		Nests	
		WS' Take[1]	Total Take by All Entities[2]	WS' Take[1]	Total Take by All Entities[2]
2007	14,232	255	403	0	14,280
2008	4,052	163	2,089	0	10,091
2009	151,352	579	2,786	0	8,752
2010	105,186	575	3,325	0	15,230
2011	91,882	612	4,641	0	414
2012	60,420	203	2,620	0	506
TOTAL	**427,124**	**2,387**	**15,864**	**0**	**49,273**

[1]Dispersal or take in Virginia, data reported by federal fiscal year
[2]Take in northeastern U.S. (USFWS Region 5), data reported by calendar year, includes WS' take

To address requests for assistance to manage damage and threats associated with ring-billed gulls in the future, up to 2,500 ring-billed gulls could be taken annually by WS. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2012 is in anticipation of requests to

address damage and threats of damage occurring at airports where they pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carry it off the property to feed, depositing garbage and droppings on buildings, equipment, and vehicles in neighboring areas.

The best available data estimates the ring-billed gull population in BCR 14 and 30 at 54,000 breeding and non-breeding birds (Seamans et al. 2007) and the population in BCR 13 at 1,065,800 breeding birds (Wires et al. 2010). WS annual removal of up to 2,500 ring-billed gulls would represent 0.22% of the combined population estimates for BCR 13, 14 and 30 (1,119,800 birds). From 2007 through 2012, the annual take of ring-billed gulls by all entities in the northeastern United States (USFWS Region 5) has averaged 2,644 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities would be 5,144 gulls or 0.46% of the estimated population. The PBR model for ring-billed gulls in BCR 14 and BCR 30 estimates that nearly 3,065 ring-billed gulls can be taken annually with no adverse effect on the current population (Table 4.22). Although the average annual cumulative take by all entities (5,144) could exceeded this level of take by 2,079 gulls if up to 2,500 ring-billed gulls are taken annually, the PBR model only includes BCR 14 and 30, where only 2% of the North American ring-billed gull population reside. The PBR estimates are based on a closed population of breeding birds in BCR 14 and 30. It does not include or consider gulls nesting in BCR 13 where 63% of the North American ring-billed gull population resides and where a substantial number of ring-billed gulls in the Commonwealth are likely to come from. As stated above, the ring-billed gulls in BCR 13 are known to migrate to the Atlantic coast and the Chesapeake Bay where they overwinter (Ryder 1993). Based on the best available information, WS' potential impacts to populations of ring-billed gulls are expected to be insignificant to their overall viability and reproductive success. This determination is based on increasing population trends and the limited take proposed when compared to the estimated population. The take of ring-billed gulls can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of ring-billed gulls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Herring Gull Population Impact Analysis

Herring gulls are the most common gulls in the northeastern U.S. (Pierotti and Good 1994). In the U.S., herring gulls can be found along the Atlantic coast from Cape Hatteras north across northern New England and along the Great Lakes during the breeding season (Pierotti and Good 1994). During the non-breeding season, herring gulls can be found along the Atlantic, Gulf and Pacific coasts (Pierotti and Good 1994, MANEM 2006) as well as northward from the Gulf of Mexico along the Mississippi, Ohio and Columbia Rivers and west along the Pecos, Red, Cimarron, Arkansas, Platte and Missouri Rivers (Pierotti and Good 1994). During the breeding season herring gulls use areas such as bays, estuaries, lakes, rivers, rocky or sandy coasts, islands, cliffs, building roofs or break walls for nesting (MANEM 2006). First observed nesting in the region in the late 1940's and early 1950's (Brinker et al. 2007), today herring gulls can be observed nesting on the Delmarva Peninsula, on islands in the Chesapeake Bay and in the greater Hampton, Newport News, Norfolk area as well as along the western shore of the Bay (Watts and Paxton 2009). These areas, as well as additional areas located up to 100 km away are used for feeding (MANEM 2006). During the non-breeding season herring gulls can be observed in coastal areas as well as in agricultural fields, at landfills, around picnic areas, or at fish-processing plants (Pierotti and Good 1994). Herring gulls will also use parking lots, fields, helipads and airport runways as roosting and loafing sites (Pierotti and Good 1994). Herring gulls are social birds which nest in colonies and roost, loaf and forage in groups (Pierotti and Good 1994).

In the 1970s, the breeding population of herring gulls in the U.S. was 184,278 birds distributed among 414 nesting sites (MANEM 2006). By the 1990s, the breeding population of herring gulls in the U.S. had

declined 19% to 148,416 birds while the number of nesting sites increased to 468 (MANEM 2006). In contrast, herring gull populations in BCR 27 have increased (Hunter et al. 2006). BBS data for herring gulls in the Eastern BBS region shows a declining trend estimated at -3.0% annually from 1966–2012 and -1.5% annually from 2002–2012 (Sauer et al. 2014). Similarly, in the New England/Mid-Atlantic coast BBS region herring gull populations have declined at an estimated -4.5% annually since 1966, a statistically significant trend (Sauer et al. 2014). No BBS data is available for Virginia (Sauer et al. 2014). CBC data for herring gulls observed overwintering in the Commonwealth shows a cyclical trend (National Audubon Society 2010). The herring gull population in BCR 30 has been given a conservation rank of low concern and in BCR 14 the population has been given a rank of moderate concern (MANEM 2006). In BCR 30, the breeding population of herring gulls is estimated at 90,734 and in BCR 14 the breeding population is estimated at 196,182 (MANEM 2006). Watts and Paxton (2014) estimated the Commonwealth's breeding population at 6,652 birds in 2013.

The number of herring gulls taken or dispersed by WS in Virginia and the total number of gulls taken by all entities in the northeastern U.S. (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4.25.

Table 4.25 – Number of herring gulls addressed from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			
		Adults		Nests	
		WS' Take[1]	Total Take by All Entities[2]	WS' Take[1]	Total Take by All Entities[2]
2007	1,358	325	3,080	111	3,390
2008	2,645	71	1,957	114	1,541
2009	77,990	362	3,197	110	2,307
2010	40,750	193	3,994	145	1,111
2011	79,552	519	6,122	26	1,336
2012	47,313	254	6,772	108	2,452
TOTAL	**249,608**	**1,724**	**25,122**	**614**	**11,137**

[1]Dispersal or take in Virginia, data reported by federal fiscal year
[2]Take in northeastern U.S. (USFWS Region 5), data reported by calendar year; includes WS' take

To address requests for assistance to manage damage and threats associated with herring gulls up to 1,500 herring gulls and 450 nests could be taken annually by WS. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2012 is in anticipation of requests to address damage and threats of damage occurring at airports where they pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carrying it off the property to feed, depositing garbage and droppings on buildings, equipment, and vehicles in neighboring areas. Additionally, gulls prey on the eggs and nestlings of native birds on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth.

The best available data estimates that the population of herring gulls in BCR 14 and 30 at 390,000 birds which is considered a minimum population (N_{min}) (Seamans et al. 2007). Based on this estimate, the annual removal of up to 1,500 herring gulls by WS would represent 0.38% of this population.

From 2007 through 2012, the annual take of herring gulls by all entities in the northeastern U.S. (USFWS Region 5) has averaged 4,187 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities would be 5,687 gulls or 1.5% of the estimated population. The PBR model

for herring gulls in BCR 14 and BCR 30 estimates that nearly 16,725 herring gulls can be taken annually with no adverse effect on the current population (Table 4.22). Current take from all known entities has not exceeded this level of take. In addition, portions of southern coastal Virginia lie within BCR 27 where an additional 1,820 gulls breed and where a population objective of 750 breeding pairs has been set (Hunter et al. 2006). Based on the best available information, WS' potential impacts to populations of herring gulls are expected to be insignificant to their overall viability and reproductive success. This determination is based on the limited take proposed when compared to the estimated population. The take of herring gulls can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of herring gulls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the herring gull population. Herring gulls are a long lived species that have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult herring gulls. The cumulative destruction of up to 450 herring gull nests annually by WS would occur in localized areas and would not reach a level where adverse effects on herring gull populations would occur. As with the lethal take of gulls, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Great Black-backed Population Impact Analysis

During the breeding season great black-backed gulls can be observed along the Atlantic coast north of Virginia and along the Saint Lawrence River and the Great Lakes (Good 1998, MANEM 2006). In the non-breeding season, great black-backed gulls can be found along the Atlantic coast from Florida north into the Gulf of Saint Lawrence and inland across New England, New York and Pennsylvania to the Great Lakes (Good 1998, MANEM 2006). During the breeding season, great black-backed gulls use seacoasts and inland bodies of water for nesting (MANEM 2006). In the Commonwealth, these birds can be observed nesting on the Delmarva Peninsula, on islands in the Chesapeake Bay and in the greater Hampton, Newport News, Norfolk area as well as along the western shore of the Bay (Watts and Paxton 2009, 2014). These areas as well as areas up to 100 km away are used for feeding (MANEM 2006). Great black-backed gulls often nest in loose colonies with nests located as far apart as adequate habitat allows (Good 1998). During the non-breeding season great black-backed gulls can be observed in coastal areas as well as in parking lots fields, helipads, airport runways and landfills (Good 1998).

In the U.S., the great black-backed gull breeding population increased 109% from the 1970s to 1990s (MANEM 2006). Great black-backed gull populations in BCR 27 have seen similar increases (Hunter et al. 2006). As reported by the BBS, populations of great black-backed gulls in the Eastern BBS region have decreased annually at a rate of -2.6% from 1966 through 2012, but increased by 0.4% in the last decade (Sauer et al. 2014). In contrast, in the New England/ Mid-Atlantic Coast region, the number of great black-backed gulls observed has shown an increasing trend estimated at 2.8% annually from 1966 through 2012 and 13.0% from 2002 through 2012 (Sauer et al. 2014). No BBS data is currently available for great black-backed gulls in Virginia (Sauer et al. 2014). However, between 1993 and 2008, the breeding population of great black-backed gulls in the Commonwealth has more than tripled (Watts and Paxton 2009). CBC data for great black-backed gulls observed in Virginia since 1966 shows an increasing trend with a cyclical pattern since the mid- 1970s (National Audubon Society 2010). In BCR 30, the breeding population of great black-backed gulls has been estimated at 37,372 gulls and in BCR 14 the population is estimated at 115,546 gulls (MANEM 2006). Great black-backed gulls are considered a species of lowest concern in BCR 30 and a species of low concern in BCR 14 while Hunter et al. (2006)

states that great black-backed gull populations in BCR 27 should be reduced. Watts and Paxton (2014) estimated Virginia's breeding population at 2,344 birds in 2013.

The number of great black-backed gulls taken or dispersed by WS in Virginia and the total number of gulls taken by all entities in the northeastern U.S. (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4.26.

Table 4.26 – Number of great black-backed gulls addressed from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			
		Adults		Nests	
		WS' Take[1]	Total Take by All Entities[2]	WS' Take[1]	Total Take by All Entities[2]
2007	58	36	428	27	743
2008	90	45	710	6	495
2009	265	65	560	2	561
2010	94	31	360	4	506
2011	525	21	593	15	565
2012	3,155	21	795	23	777
TOTAL	**4,187**	**219**	**3,446**	77	**3,647**

[1]Dispersal or take in Virginia, data reported by federal fiscal year
[2]Take in northeastern U.S. (USFWS Region 5), data reported by calendar year; includes WS' take

To address requests for assistance to manage damage and threats associated with great black-backed gulls in the future, up to 500 great black-backed gulls and 100 nests could be taken annually by WS. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2012 is in anticipation of requests to address damage and threats of damage occurring at airports where they pose a strike hazard to aircraft and at landfills where they feed and loaf causing damage to equipment and buildings from excessive accumulations of droppings. Gulls also pick up refuse at landfills and carry it off the property to feed, depositing garbage and droppings on buildings, equipment, and vehicles in neighboring areas. Additionally, gulls prey on the eggs and nestling s of native birds on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth.

The best available data estimates that the population of great black-backed gulls in BCR 14 and 30 at 250,000 birds (Seamans et al. 2007). However, since population trends continue to indicate an increasing gull population, the population of great black-backed gulls in the region is likely greater than 250,000 which is considered a minimum population (N_{min}). Based on this estimate, the annual removal of up to 500 great black-backed gulls by WS would represent 0.2% of this population.

From 2007 through 2012, the annual take of great black-backed gulls by all entities in the northeastern U.S. (USFWS Region 5) has averaged 574 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities would be 1,074 gulls or 0.4% of the estimated population. The PBR model for great black-backed gulls in BCR 14 and BCR 30 estimates that 11,234 great black-backed gulls can be taken annually with no adverse effect on the current population (Table 4.22). Current take from all known entities has not exceeded this level of take. In addition, portions of southern coastal Virginia lie within BCR 27 where an additional 362 gulls breed and where a population objective of 75 breeding pairs has been set (Hunter et al. 2006). Based on the best available information, WS' potential impacts to populations of great black-backed gulls are expected to be insignificant to their overall viability and reproductive success. This determination is based on increasing population trends and the limited take proposed when compared to the estimated population. The take of great black-backed gulls

can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of great black-backed gulls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the great black-backed gull population. Great black-backed gulls are a long lived species that have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult great black-backed gulls. The cumulative destruction of up to 100 great black-backed gull nests annually by WS would occur in localized areas and would not reach a level where adverse effects on great black-backed gull populations would occur. As with the lethal take of gulls, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Rock Pigeon Population Impact Analysis

Rock pigeons, also known as rock doves, are a non-native species that were first introduced into the U.S. by European settlers as a domestic bird to be used for sport, carrying messages, and as a source of food (Johnston 1992). Many of those birds escaped and eventually formed the feral pigeon populations that are now found throughout the U.S., southern Canada, and Mexico (Johnston 1992). Rock pigeons can be found nesting throughout the Commonwealth (Trollinger and Reay 2001). Pigeons are closely associated with humans where human structures and activities provide them with food and sites for roosting, loafing, and nesting (Johnston 1992). Thus, they are commonly found around city buildings, bridges, parks, farm yards, grain elevators, feed mills, and other manmade structures (Johnston 1992).

The number of rock pigeons observed in the Commonwealth along routes surveyed during the BBS has shown a decreasing trend estimated at -2.4% annually since 1966 and -2.5% from 2002 to 2012 (Sauer et al. 2014). A similar trend has been observed for the number of rock pigeons observed in the Eastern BBS region, where the population has decreased at an estimated -1.3 % annually since 1966 (Sauer et al. 2014). The number of rock pigeons observed in the Commonwealth during the CBC has shown a generally stable trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of rock pigeons to be 90,000 birds.

The number of rock pigeons taken or dispersed by WS from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.27. Since pigeons are non-native they are afforded no protection under the MBTA, and no depredation permit from the USFWS nor reporting of take is required. Therefore the take of pigeons by other entities to alleviate damage in the Commonwealth is unknown.

Table 4.27 – Number of rock pigeons addressed by WS' in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	
		Adults	Nests
2007	417	3,765	0
2008	2,004	4,981	0
2009	317	1,660	2
2010	215	2,061	0
2011	1,276	2,857	6
2012	1,283	1,503	0
TOTAL	**5,512**	**16,827**	**8**

[1]Data reported by federal fiscal year

Based on previous requests for assistance received by WS and in anticipation of future requests for assistance to manage damage associated with rock pigeons, up to 10,000 rock pigeons and 500 pigeon nests could be taken annually by WS.

WS' proposed take of up to 10,000 rock pigeons annually would represent 11.1% of the statewide population. Rock pigeons are a non-native species and therefore not protected under the MBTA. Rock pigeons are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of rock pigeons, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health.

Mourning Dove Population Impact Analysis

Mourning doves are one of the most abundant and widespread birds in North America (Otis et al. 2008). They can be found year round throughout most of the continental U.S. including Virginia (Otis et al. 2008). Mourning doves are habitat generalists which have benefitted from human changes to the environment (Otis et al. 2008). They prefer open habitats and can be found in rural, suburban and urban environments (Otis et al. 2008). Mourning doves are social birds, and during the breeding season have been observed in flocks of up to 50 birds (Otis et al. 2008).

The number of mourning doves observed along routes surveyed in the Eastern BBS Region during the BBS has shown a statistically significant increasing trend estimated at 0.5% annually since 1966 and 0.3% from 2002 to 2012 (Sauer et al. 2014). The numbers of mourning doves observed in the Commonwealth during the BBS has shown a trend estimated at -0.1% annually since 1966, and -0.04% from 2002 to 2012 (Sauer et al. 2014). The number of doves observed from 2001 through 2010 during mourning dove surveys has shown an increasing trend estimated at 0.4% annually in Virginia (Seamans et al. 2011). The number of mourning doves observed in the Commonwealth during the CBC has shown a stable trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of mourning doves to be one million birds.

The number of mourning doves taken or dispersed to alleviate damage and threats as well as the number harvested by hunters from 2007 to 2012 is shown in Table 4.28. The population of mourning doves in Commonwealth is sufficient to allow for regulated hunting seasons. Mourning doves can be harvested during annual split seasons in the fall and winter, with a daily limit of 15 birds (Virginia Department of Game and Inland Fisheries 2013*b*). The average annual harvest from 2007 to 2012 was 316,333 doves

(Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013).

Table 4.28 – Number of mourning doves addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			Hunter Harvest[4]
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	
2007	7,658	1,695	1,169	1,230	418,100
2008	21,688	2,145	1,811	1,923	333,600
2009	4,830	2,305	1,789	1,867	305,500
2010	7,277	3,325	1,306	1,489	299,000
2011	7,980	3,355	1,761	1,813	245,900
2012	12,053	3,755	1,329	2,105	295,900
TOTAL	**61,486**	**15,980**	**9,165**	**10,427**	**1,898,000**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
[4]Data obtained from Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013.

Requests for assistance associated with mourning doves occur primarily at airports in the Commonwealth. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance as the dove population increases, WS could take up to 4,000 mourning doves and 20 nests annually.

Based on the population estimate of one million birds, the take of up to 4,000 mourning doves would represent 0.4% of the population. From 2007–2012, an average of 316,333 doves per year were harvested in the Commonwealth. WS' take of up to 4,000 doves annually would represent 1.26% of the average number of doves taken annually by hunters and would not cause any cumulative adverse effects.

Given the substantial population of mourning doves observed in the Commonwealth and the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on mourning dove populations. As stated previously, most requests received by WS concerning mourning doves were associated with airports. Airports are restricted areas where hunting is not permitted. Therefore, WS' take of mourning doves is likely to occur in locations where take will not limit the ability to harvest doves. WS' take would be a limited component of the overall take occurring. WS' take could be considered of low magnitude when compared to the number of mourning doves in the Commonwealth. The take of mourning doves can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of mourning doves would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives. The take of up to 20 mourning dove nests to alleviate damage and threats of damage is also not expected to adversely affect the population of mourning doves and is addressed in additional detail below.

Monk Parakeet Population Impact Analysis

Monk parakeets, a non-native species, were first brought to the U.S. from South America as pets (Spreyer and Bucher 1998). Many of those birds escaped or were released, forming the feral monk parakeet populations that can be found in the U.S. today (Spreyer and Bucher1998). These birds have either been released or come from established populations in nearby states (Spreyer and Bucher 1998). Monk parakeets are closely associated with humans and can be found in urban-suburban areas, particularly city parks (Spreyer and Bucher 1998). In Virginia, these birds have been observed in the Tidewater area since

the early 1970's and in 2005 the Virginia Avian Records Committee added Monk parakeets to the list of non-native birds maintaining self-sustaining wild populations in the state (Rottenborn and Brinkley 2007). Monk parakeets are highly social birds, feeding, loafing and nesting colonially in groups of up to 55 birds (Spreyer and Bucher 1998). Colonies of birds maintain a single nest or an aggregation of nests on light poles, utility poles, transmission towers or substations, fire escapes or in trees year round with both young and adult birds participating in nest maintenance activities (Spreyer and Bucher 1998). Nests can reach enormous sizes (over 2,500 lbs., Spreyer and Bucher 1998) and cause short-circuiting of electrical systems that result in power outages, damage to power grids, and associated cost to electric customers for loss of service (Avery et al. 2002).

The BBS does not have monk parakeets included in their list of surveyed birds (Sauer et al. 2014). A population of 40–50 birds was recorded nesting and residing year round in Newport News in the early 1990s (Schwab and Gwynn 1992, Rottenborn and Brinkley 2007). Monk parakeets have been observed six times in the Commonwealth during the CBC; one was observed in 1986 and 1991, two were observed in 1972, 1980, and 1994, and four were observed in 1993 (National Audubon Society 2010). There are currently no estimates on the population of monk parakeets in the Commonwealth.

From 2007 to 2012, WS did not take or disperse any monk parakeets to alleviate damage and threats associated with these birds. Since monk parakeets are afforded no protection under the MBTA, no depredation permit from the USFWS is required and reporting the take to the USFWS is not required. Therefore the take of monk parakeets by other entities to alleviate damage is unknown.

In anticipation of future requests for assistance to manage damage associated with monk parakeets, up to 50 monk parakeets and 20 nests could be taken annually by WS. Monk parakeets are considered a non-native species under the MBTA. Therefore, monk parakeets are afforded no protection under the Act. In addition, under Title 15, Agency 30, Chapter 40 of the Virginia Administrative code, a permit is required to import, possess, or sell monk parakeets and the permit must be renewed every five years. Exceptions are made for monk parakeets which "have been captive bred and are closed-banded with a seamless band." Monk parakeets are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of monk parakeets, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health.

Barn Owl Population Impact Analysis

With the exception of the Appalachian Plateau, the barn owl can be found across the state and throughout the year in suitable habitat (Trollinger and Reay 2001, Marti et al. 2005). As their name implies, barn owls are often found nesting in human structures including barns, church steeples, as well as the crevices and cavities of buildings adjacent to open habitat (Marti et al. 2005). Historically, these birds nested in the cavities of trees, on cliffs or rock outcrops (Marti et al. 2005).

In the Eastern BBS region, the number of barn owls has shown an increasing trend estimated at 3.8% since 1966 (Sauer et al. 2014). However, no additional regional or state BBS data is available (Sauer et al. 2014). The number of barn owls observed in the Commonwealth during the CBC has shown an increasing trend over the last decade (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the U.S. population of barn owls to be 160,000 birds.

The number of barn owls taken or dispersed by WS and the total number of owls taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.29.

Table 4.29 – Number of barn owls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	0	0	0
2008	2	10	3	3
2009	0	15	0	0
2010	0	20	0	0
2011	0	10	0	0
2012	0	20	0	0
TOTAL	**2**	**75**	**3**	**3**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with barn owls occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 20 and relocate up to an additional 20 barn owls annually under the proposed action. Additionally, WS could take up to 20 barn owl nests annually under the proposed action.

Based on the best available information, the removal of up to 20 barn owls by WS under the proposed project would represent 0.01% of the U.S. population. From 2007 through 2012, no owls were lethally taken per year by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 barn owls. Owls live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of barn owls can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of barn owls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 barn owl nests to alleviate damage and threats of damage is also not expected to adversely affect the population and is addressed in additional detail below.

Short-Eared Owl Population Impact Analysis

Unlike most owls, the short-eared owl nests and roosts on the ground, sometimes colonially, and hunts both diurnally and nocturnally (Wiggins et al. 2006). Short-eared owls can be found during the breeding season across Canada south to northern California, Nevada, Utah, Colorado, Kansas, Missouri, Illinois, along the great lakes, northern New York, New Hampshire and Vermont (Wiggins et al. 2006). However, isolated populations can be found nesting in Massachusetts, New Jersey, Pennsylvania, and Virginia (Wiggins et al. 2006). Two breeding records of short-eared owls exist in the Commonwealth; one from Westmoreland and one from Loudoun County (Johnston 1997), with an additional possible observation occurring in Mathews County during the Virginia Breeding Bird Atlas (1985–1986) (Trollinger and Reay 2001). During the non-breeding season, short-eared owls can be found from Southern Canada south to Mexico in suitable habitat in communal roosts of up to 200 individuals (Wiggins et al. 2006). Short-eared owls prefer open habitat, typically grasslands, heathlands, and tundra but will also use open areas in woodlots, saltwater marshes, gravel pits, rock quarries, airports and re-claimed strip mines (Wiggins et al.

2006). This species is currently in decline as suitable open habitat is lost to development or is converted into more intensive agricultural practices (Haffner and Gross 2009).

Across the U.S. the number of short-eared owls observed during the BBS since 1966 has declined at an estimated -0.9% annually, while the number of owls observed since 2002 has increased by 1.4% annually (Sauer et al. 2014). In contrast, the number of short-eared owls observed in the Eastern BBS region has declined at an estimated -6.0% annually since 1966 and -1.4% annually since 2002 (Sauer et al. 2014). A major cause of these declines is the loss of grassland habitat although birds have been observed nesting at reclaimed strip mines in recent years (Ellison 2010, Wilson et al. 2013). No BBS data on short-eared owls in the Commonwealth is available (Sauer et al. 2014). The number of short-eared owls observed in the Commonwealth during the CBC has shown a cyclical and stable pattern since 1966 (National Audubon Society 2010).

The number of short-eared owls taken or dispersed by WS and the total number of owls taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.30.

Table 4.30 – Number of short-eared owls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	1	10	0	0
2008	7	10	2	2
2009	0	15	0	0
2010	0	20	0	0
2011	2	13	2	5
2012	9	26	5	13
TOTAL	**19**	**94**	**9**	**20**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with short-eared owls occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 10 and relocate up to an additional five short-eared owls annually under the proposed action. Additionally, WS could take up to five short-eared owl nests annually under the proposed action.

The number of short-eared owls present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of short-eared owls in North America at 600,000 birds (Partners in Flight Science Committee 2013). Those short-eared owls nesting across the northern U.S. and Canada are likely the same owls that either migrate through or are present in Virginia during the non-breeding season. Based on this estimate, the annual removal of up to 10 short-eared owls by WS would represent 0.002% of this population. From 2007 to 2012, 11 short-eared owls were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.004% of the estimated population. Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-trap and relocate up to 10 short-eared owls. Owls live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of short-eared owls can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of short-eared owls would only occur at levels authorized by the

USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to five short-eared owl nests to alleviate damage and threats of damage is also not expected to adversely affect the population and is addressed in additional detail below.

Great Horned Owl Population Impact Analysis

The great horned owl is a large owl, easily distinguished by its size, ear tufts, white chest and yellow eyes (Houston et al. 1998). These owls don't have an annual migration and can be found throughout North America, including Virginia, year round (Houston et al. 1998, Trollinger and Reay 2001). Great horned owls can be found in a wide variety of habitats including forest, open habitat and deserts (Houston et al. 1998). Nests are constructed in trees, in tree cavities, on cliffs, buildings, artificial platforms, and on the ground (Houston et al. 1998).

In Virginia, the number of great horned owls observed during the BBS has shown a declining trend estimated at -0.7% annually since 1966, and an increasing trend estimated at 0.9%, from 2002–2012 (Sauer et al. 2014). In the Eastern BBS region, the population has declined at an estimated -2.8% annually since 1966, a statistically significant trend (Sauer et al. 2014). The number of great horned owls observed in the Commonwealth during the CBC has shown a generally stable trend, with an average of 166 birds observed annually since 2001 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of great horned owls to be 15,000 birds.

The number of great horned owls taken or dispersed by WS and the total number of great horned owls taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.31. From 2007 through 2012, WS lethally removed one owl.

Table 4.31 – Number of great horned owls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	18	0	0
2008	0	15	0	0
2009	0	21	0	0
2010	0	21	0	0
2011	0	13	1*	1
2012	0	23	0	0
TOTAL	**0**	**111**	**1**	**1**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 1

Requests for assistance associated with great horned owls occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 20 and relocate up to an additional 20 great horned owls annually under the proposed action. Additionally, WS could take up to 10 great horned owl nests annually under the proposed action.

The best available data estimates that the population of great horned owls in Virginia at 15,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 20 great horned owls by WS would represent 0.1% of the population. From 2007 to 2012, no other great horned owls were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the limited

magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 great horned owls. Owls live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of great horned owls can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of great horned owls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 10 great horned owl nests to alleviate damage and threats of damage is also not expected to adversely affect the population and is addressed in additional detail below.

Snowy Owl Population Impact Analysis

Arctic breeders, snowy owls can be observed during the non-breeding season across southern Canada and the northern portion of the United States (Parmelee 1992) and occasionally in locations farther south including Virginia (Rottenborn and Brinkley 2007). In 2013, Virginia airports observed a large influx of snowy owls that caused numerous safety hazards to aircraft. Snowy owls are a large-bodied bird that can cause substantial damage. Preferred habitat includes open areas with rises or structures to perch on (Parmelee 1992). Snowy owls are attracted to the open habitat of airfields and may occur at any airfield in the Commonwealth. Unlike most owls, snowy owls are largely diurnal relying on sight and to a certain extent sound to locate small mammals, rabbits and birds (Parmelee 1992).

Because they are arctic breeders no BBS data on snowy owls is available (Sauer et al. 2014). However, snowy owls nesting in northern portions of Canada and along the arctic coast overwinter in the Commonwealth (Parmelee 1992). The number of snowy owls observed overwintering in the Commonwealth during the CBC has shown a stable trend (National Audubon Society 2010). The Partners in Flight Science Committee (2013) estimated that the population of snowy owls in North America is approximately 100,000 birds.

From 2007 through 2012, WS did not take or disperse any snowy owls in the Commonwealth. The USFWS issued depredation permits for snowy owls during this period (Table 4.32). However, no snowy owls were taken.

However, in 2013 snowy owls were observed on the runways, taxiways, and safety areas of airfields in the Commonwealth. These birds were harassed using a variety of methods described in Appendix C. However, snowy owls are not always responsive to dispersal techniques. Snowy owls on an airfield are a direct, immediate, persistent threat to safe aircraft operations. When snowy owls persist in these areas WS could trap and relocate them. However, trapping may not always be a feasible option. In order for trapping to occur on or adjacent to active runways and taxiways, WS personnel would be subjected to human health and safety risks. If active runways and taxiways were temporarily shut down to allow access by personnel while trapping, this would alter flight patterns, delay schedules, and cause major aberrations to air traffic.

Table 4.32 – Number of snowy owls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	0	0	0
2008	0	0	0	0
2009	0	5	0	0
2010	0	10	0	0
2011	0	10	0	0
2012	0	10	0	0
TOTAL	**0**	**35**	**0**	**0**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

While translocation of raptors can be effective, trapping and relocation is not always possible when birds persist on the airfield or when birds return to the airport after being relocated. WS could lethally remove snowy owls in such instances.

Based on the best available estimate for the population of snowy owls, the annual removal of up to 20 snowy owls by WS would represent 0.02% of the population. If the take by other entities remains stable the average annual cumulative take by all entities under the proposed action alternative would represent 0.02% of the estimated population and would remain the same. Compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 snowy owls under the proposed action alternative. Owls live-captured and relocated could also be banded for identification purposes (see Appendix C). The take or translocation of snowy owls can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of snowy owls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Barred Owl Population Impact Analysis

In Virginia, the barred owl can be found across the state and throughout the year in suitable habitat (Trollinger and Reay 2001). Barred owls prefer mature forested habitat where they use existing cavities or nests built by raptors, crows or ravens in large deciduous trees for nesting (Mazur and James 2000). Barred owls typically hunt from elevated perches at night but they have been observed hunting during the day (Mazur and James 2000).

In Virginia, the number of barred owls observed during the BBS has shown an increasing trend estimated at 2.1% annually since 1966, and 2.1%, from 2002–2012 (Sauer et al. 2014). A similar trend has been observed for the number of barred owls observed in the Eastern BBS region where the population has increased at an estimated 1.1% annually since 1966 (Sauer et al. 2014). The number of barred owls observed in the Commonwealth during the CBC has shown an increasing trend since1966 (National Audubon Society 2010). The Partners in Flight Science Committee (2013) estimated that the population of barred owls in Virginia is approximately 50,000 birds.

The number of barred owls taken or dispersed by WS and the total number of owls taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.33.

Table 4.33 – Number of barred owls addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	5	0	0
2008	0	5	0	0
2009	1	5	0	0
2010	68	5	0	0
2011	2	5	0	0
2012	0	5	0	0
TOTAL	**71**	**30**	**0**	**0**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with barred owls occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 20 and relocate up to an additional 20 barred owls annually under the proposed action. Additionally, WS could take up to 10 barred owl nests annually under the proposed action.

The best available data estimates that the population of barred owls in Virginia at 50,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 20 barred owls by WS would represent 0.04% of the population. From 2007 to 2012, no barred owls were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain the same. Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. Additionally, as detailed in Appendix C, WS could live-capture and relocate up to 20 barred owls. Owls live-captured and relocated could also be banded with leg bands for identification purposes (see Appendix C). The take or translocation of barred owls can only occur when permitted by the USFWS. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of barred owls would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 10 barred owl nests to alleviate damage and threats of damage is also not expected to adversely affect the population and is addressed in additional detail below.

American Crow Population Impact Analysis

American crows are found across the U.S. but are generally more common in the east (Verbeek and Caffery 2002). In Virginia, American crows can be found throughout the year and across the Commonwealth (Trollinger and Reay 2001, Rottenborn and Brinkley 2007). American crows are found in a wide variety of habitats including urban, suburban, and rural environments but prefer areas with scattered trees for roosting (Verbeek and Caffery 2002). Historically, American crows benefitted from the clearing of hardwood and coniferous forests and the expansion of agricultural lands (Verbeek and Caffery 2002). These birds are highly social, forming social units and roosting communally (Verbeek and Caffery 2002). Communal roosts can vary in size from a few hundred to more than two million birds and often the same sites are used year after year (Verbeek and Caffery 2002). During the day, birds disperse up to 50 miles from the roost site to different feeding areas (Verbeek and Caffery 2002). When roosts occur in suburban or urban areas they can cause damage and pose threats to resources including a buildup of droppings, damage to roost trees, health concerns and noise problems (Johnson 1994). Crows can also cause damage to crops and consume the eggs of waterfowl and endangered or threatened shorebirds (Johnson 1994).

In Virginia, the number of American crows observed during the BBS has shown an increasing trend estimated at 0.2% annually since 1966 and 0.01% from 2002 to 2012 (Sauer et al. 2014). A similar trend has been observed for the number of American crows observed in the Eastern BBS region where the population has increased at an estimated 0.5% annually since 1966, which is a statistically significant trend (Sauer et al. 2014). The number of American crows observed in the Commonwealth during the CBC has shown an increasing trend since1966 (National Audubon Society 2010). Partners in Flight Science Committee (2013) estimated the statewide breeding population of American crows to be 640,000 birds.

The number of American crows taken or dispersed by WS to alleviate damage and threats as well as the number harvested by hunters from 2007 to 2012 is shown in Table 4.34. The population of crows in the Commonwealth is sufficient to allow for regulated hunting seasons. Crows can be harvested on private lands from August through March on Mondays, Wednesdays, Fridays, and Saturdays with no limit on the number of birds taken and on these same days from September through March on National Forest and VDGIF lands (Virginia Department of Game and Inland Fisheries 2013*b*). The VDGIF estimates the annual take of "crows" (which includes both American and fish crows) during the regulated harvest season. The average annual harvest from 2007 to 2012 was 145,551 crows. As discussed previously, under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take American crows when found committing or about to commit damage to resources or when concentrated in such numbers and in a manner as to constitute a health hazard or other nuisance. Prior to January 3, 2011 there were no reporting requirements for take under 50 CFR 21.43 (Sobeck 2010). Therefore, the number of American crows taken under 50 CFR 21.43 of the MBTA is unknown.

Table 4.34 – Number of American crows addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2,3,4]
2007	383	73	200,642
2008	2,729	89	146,144
2009	3,037	174*	127,309
2010	3,566	159**	132,036
2011	5,012	325	no survey conducted
2012	3,258	135	121,625
TOTAL	**17,985**	**955**	**727,756**

[1]Data reported by federal fiscal year
[2]Combined American crow and fish crow harvest, take of each individual species is unknown
[3]Data obtained from Jagnow et al. 2008*a*, Jagnow et al. 2008*b*, Jagnow et al. 2009, Virginia Department of Game and Inland Fisheries 2010 and Virginia Department of Game and Inland Fisheries 2012
[4]Data reported by Virginia hunting license season (July 1 – June 30)
*Includes non-target take of 1
**Includes non-target take of 2

To address requests for assistance to manage damage and threats associated with American crows in the future as described in Chapter 1, up to 1,500 crows and 50 nests could be taken annually by WS to alleviate damage and threats under the proposed action.

Based on the best available data, WS' proposed take of up to 1,500 American crows annually would represent 0.2% of the estimated American crow population. The Partners in Flight Science Committee (2013) estimates the fish crow population in the Commonwealth at 9,000 birds. If the population ratio of American crows to fish crows in the Commonwealth is an indication of the average number of American crows taken annually during the regulated harvest season, an average of 143,529 American crows are harvested annually in the Commonwealth. WS' take of up to 1,500 crows annually would represent 1.04% of this average.

Given the increasing population of American crows observed in the Commonwealth and the limited magnitude of take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on crow populations. As stated previously, most requests received by WS concerning crows in Commonwealth are associated with airports or urban crow roosts, areas where hunting is not permitted. Therefore, WS' take of crows is likely to occur in locations where take will not limit the ability to harvest crows during the regulated harvest season. WS' take would be a limited component of the overall take occurring. WS' take could be considered of low magnitude when compared to the number of crows in the state. The take of crows can only occur during regulated harvest seasons, under depredation permits issued by USFWS or when taken under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds. The take of up to 50 American crow nests to alleviate damage and threats of damage is also not expected to adversely affect the population of crows.

Fish Crow Population Impact Analysis

Fish crows, often confused with their larger relative the American crow, are found along the east coast, gulf coast and in the greater Mississippi River drainage of the U.S. (McGowan 2001). In the Commonwealth, the fish crow is generally restricted to coastal regions and the drainage basins of the Chowan, James, Potomac, Rappahannock, and York rivers (Trollinger and Reay 2001, Rottenborn and Brinkley 2007). Fish crows are primarily a coastal species usually found near water (McGowan 2001) but can also be found nesting more than a mile from large bodies of water in woodlots and in urban and suburban areas (McGowan 2001). Fish crows are extremely social, especially during the non-breeding season, forming flocks of up to 45,000 birds in a single roost (McGowan 2001). Fish crows often roost together with American crows (McGowan 2001). Where the range of fish crows and American crows overlap in Virginia it can be difficult to distinguish between the two. Therefore, distinguishing the number of individual fish crows and American crows in a roost can be difficult. Like American crow roosts, fish crow roosts or fish crow / American crow mixed flock roosts can cause damage and threats to resources including a buildup of droppings, damage to roost trees, health concerns and noise problems (Johnson 1994). Crows can also cause damage to crops and consume the eggs of waterfowl and endangered or threatened shorebirds (Johnson 1994).

In Virginia, the number of fish crows observed during the BBS has shown an increasing trend estimated at 0.9% annually since 1966 and a 3.7% annually from 2002–2012 (Sauer et al. 2014). A similar trend has been observed for the number of fish crows observed in the Eastern BBS region where the population has increased at an estimated 0.2% annually since 1966 (Sauer et al. 2014). The number of fish crows observed in the Commonwealth during the CBC has shown a general increasing trend since 1966 (National Audubon Society 2010). Partners in Flight Science Committee (2013) estimated the statewide breeding population of fish crows to be 9,000 birds.

The number of fish crows taken or dispersed by WS to alleviate damage and threats as well as the number harvested by hunters from 2007 to 2012 is shown in Table 4.35. The population of crows in the Commonwealth is sufficient to allow for regulated hunting seasons as outlined for American crows above.

Table 4.35 – Number of fish crows addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2,3,4]
2007	39	3*	200,642
2008	119	21	146,144
2009	94	19	127,309
2010	149	8	132,036
2011	52	9	no survey conducted
2012	86	9	121,625
TOTAL	539	**69**	**727,756**

[1]Data reported by federal fiscal year
[2]Combined American crow and fish crow harvest, take of each individual species is unknown
[3]Data obtained from Jagnow et al. 2008*a*, Jagnow et al. 2008*b*, Jagnow et al. 2009, Virginia Department of Game and Inland Fisheries 2010 and Virginia Department of Game and Inland Fisheries 2012
*Includes non-target take of 1

To address requests for assistance to manage damage and threats associated with fish crows in the future, as described in Chapter 1, up to 300 crows and 50 nests could be taken annually by WS to alleviate damage and threats under the proposed action alternative.

Based on the best available data, WS' proposed take of up to 300 fish crows annually would represent 3.3% of the estimated fish crow population. The Partners in Flight Science Committee (2013) estimates the American crow population in the Commonwealth at 640,000 birds. If the population ratio of fish crows to American crows, in the Commonwealth is an indication of the average number of fish crows taken annually during the regulated harvest season, an average of 2,021 fish crows are harvested annually in the Commonwealth. WS' take of up to 300 crows annually would represent 14.8% of the average number of crows taken annually by hunters in the Commonwealth.

Given the increasing population of fish crows observed in the Commonwealth and the limited magnitude of take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on crow populations. As stated previously, most requests received by WS concerning crows in the Commonwealth are associated with either airports or urban crow roosts, areas where hunting is not permitted. Therefore, WS' take of crows is likely to occur in locations where take will not limit the ability to harvest crows during the regulated harvest season. WS' take would be a limited component of the overall take occurring. WS' take could be considered of low magnitude when compared to the number of crows in the state. The take of crows can only occur during regulated harvest seasons, under depredation permits issued by USFWS or when taken under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds. The take of up to 50 fish crow nests to alleviate damage and threats of damage is also not expected to adversely affect the population of crows.

Common Raven Population Impact Analysis

Common ravens can be observed year-round throughout the Commonwealth, although they are more commonly observed west of the Blue Ridge (Boarman and Heinrich 1999, Trollinger and Reay 2001). Ravens occupy a broad range of habitats including boreal, conifer and deciduous forest, tundra, grasslands, agricultural, deserts and urban areas (Trollinger and Reay 2001). Common ravens forage in groups and sleep in communal roosts (Boarman and Heinrich 1999). In Western North America birds have been observed in groups numbering over 2,000 (Boarman and Heinrich 1999).

The number of common ravens observed in the Commonwealth during the BBS has shown an increasing trend estimated at 0.8% annually since 1966 and 2.5% annually from 2002 to 2012 (Sauer et al. 2014). The number of common ravens observed in the Eastern BBS region has also increased at an estimated

2.1% annually since 1966 and an estimated 4.1% since 2002, a statistically significant increase (Sauer et al. 2014). The number of common ravens observed in the Commonwealth during the CBC has shown an increasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of common ravens at 1,300 birds.

From 2007 through 2012, WS lethally took 45 and used non-lethal methods to disperse 218 common ravens in the Commonwealth (Table 4.36). In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of common ravens during this period. From 2007 to 2012 a total of 51 common ravens were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4.36 – Number of common ravens addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	11	5	3	3
2008	10	5	5*	8
2009	26	15	6	6
2010	0	30	13	13
2011	2	30	4**	4
2012	169	30	14	17
TOTAL	**218**	**115**	**45**	**51**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 1
**Includes non-target take of 1

Requests for assistance associated with common ravens occur primarily at airports. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 50 ravens and 20 nests annually under the proposed action.

Based on the state population estimate, the take of up to 50 common ravens under the proposed project would represent 3.8% of the population. If the average annual take by other entities is reflective of take that will occur in the future, the combined WS' take and take by other entities would represent 3.9% of the estimated breeding population in the Commonwealth. Given the increasing population trends observed for common ravens in the Commonwealth and the region, this magnitude of take could be considered low. The take of common ravens can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. Permitting of take ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 raven nests to alleviate damage or threats of damage is not expected to adversely affect the population of ravens and is further addressed in additional detail below.

Horned Lark Population Impact Analysis

Horned lark habitat consists of open country including short grass prairie, deserts and alpine habitat or other areas with low vegetation (Beason 1995), making airports attractive habitat. A social species, horned larks form flocks during the non-breeding season of up to several hundred birds which may join with other flocks of tree sparrows (*Spizella arborea*), dark-eyed juncos (*Junco hyemalis*), lapland longspurs (*Calcarius lapponicus*), and snow buntings (*Plectrophenax nivalis*) (Beason 1995).

The number of horned larks observed in the Commonwealth along routes surveyed during the BBS has shown a decreasing trend estimated at -0.3% annually since 1966 and an increasing trend estimated at 3.2% annually from 2002 to 2012 (Sauer et al. 2014). The number of horned larks observed in the Eastern BBS region has declined at an estimated -2.8% annually since 1966 (Sauer et al. 2014). The number of horned larks observed in the Commonwealth during the CBC has shown an increasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of horned larks to be 8,000 birds.

The number of horned larks taken or dispersed by WS and the total number of horned larks taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.37.

Table 4.37 – Number of horned larks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	0	0	0
2008	3	0	0	0
2009	8	55	11	11
2010	148	70	28	28
2011	250	190	24	25
2012	294	190	29	105
TOTAL	**703**	**505**	**92**	**169**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with horned larks occur primarily at airports in the Commonwealth where they pose a hazard to aircraft. To address requests for assistance at airports, up to 250 horned larks and 20 nests could be taken annually by WS.

Based on the state population estimate, the annual removal of up to 250 horned larks by WS would represent 3.1% of this population. The average annual take by other entities in the Commonwealth has been 12.8 birds since 2007. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 3.3% of the estimated population. The take of horned larks can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of horned larks would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 horned lark nests to alleviate damage or threats of damage is not expected to adversely affect the population of horned larks and is further addressed in additional detail below.

Tree Swallow Population Impact Analysis

Tree swallows are migratory birds found throughout much of the U.S. (Winkler et al. 2011). Tree swallows are present across most of the state during the breeding season, overwintering in small numbers in the southeast portion of the state (Trollinger and Reay 2001). Tree swallows are generally thought to be associated with bodies of water including wet fields, marshes, shorelines and wooded swamps (Winkler et al. 2011).

The numbers of tree swallows observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 11.0% annually since 1966 and 12.0% annually from 2002 to 2012, statistically significant trends (Sauer et al. 2014). The number of tree swallows observed in the Eastern BBS region has decreased an estimated -1.7% annually since 1966, a statistically significant trend (Sauer et al. 2014). The number of tree swallows observed in the Commonwealth during the CBC has shown a stable trend since1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of tree swallows to be 70,000 birds.

The number of tree swallows taken or dispersed by WS and the total number of tree swallows taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.38.

Table 4.38 – Number of tree swallows addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	100	10*	10
2008	0	100	3	3
2009	0	105	6**	17
2010	84	110	15***	15
2011	400	210	12**	12
2012	1,764	210	4***	5
TOTAL	**2,248**	**835**	**50**	**62**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 6
**Includes non-target take of 3
***Includes non-target take of 1

The majority of requests for assistance associated with tree swallows in Virginia originate at airports. Based on the number of previous requests and the increasing need to address damage and threats associated with tree swallows in the Commonwealth, up to 150 tree swallows and 20 nests could be taken annually .

Based on the best available data, the annual removal of up to 150 tree swallows by WS would represent 0.21% of this population. From 2007 to 2012, 12 tree swallows or an average of two tree swallows per year were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.21% of the estimated population. The take of tree swallows can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of swallows would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 tree swallow nests to alleviate damage or threats of damage is not expected to adversely affect the population of tree swallows and is further addressed in additional detail below.

Barn Swallow Population Impact Analysis

Barn swallows are migratory birds that can be observed throughout all of North America (Brown and Brown 1999). Barn swallows can be found across the state with the exception of very urban areas and large contiguous forest during the breeding season where nesting habitat is unavailable (Brown and Brown 1999). Historically, barn swallows nested in caves or on ledges of cliffs. Now barn swallows nest

almost exclusively on any sort of building, bridge, culvert or other manmade structure that provides a wall with an overhang (Brown and Brown 1999). Like other species of swallows, barn swallows are highly social nesting in colonies of up to 22 nests in the northeast (Brown and Brown 1999).

According to BBS trend data, barn swallow populations have declined at an annual rate of -0.5% in Virginia since 1966, and increased at an annual rate of 0.5% annually from 2002 to 2012 (Sauer et al. 2014). Barn swallow populations for the Eastern BBS Region show a statistically significant annual population decline of -1.5% since 1966 (Sauer et al. 2014). Across all BBS routes in the U.S., barn swallows have exhibited an annual population decline of -0.3% since 1966 (Sauer et al. 2014). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of barn swallows to be 500,000 birds.

The number of barn swallows taken or dispersed by WS and the total number of barn swallows taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.39.

Table 4.39 – Number of barn swallows addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits					
		Adults			Nests		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	144	195	4	24	110	0	18
2008	951	217	98	145	90	0	1
2009	1,056	375	88	139	90	0	0
2010	1,524	560	187	203	110	1	16
2011	289	735	84	84	110	0	0
2012	596	745	24	24	160	0	6
TOTAL	**4,560**	**2,827**	**485**	**619**	**670**	**1**	**41**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with barn swallows occur when a colony of birds nest on or in buildings or pose a risk of an aircraft strike. Droppings they deposit can damage goods, equipment and cause a health hazard (Gorenzel and Salmon 1994). When their mud nests degrade and fall to the ground they can cause similar problems (Gorenzel and Salmon 1994). Based on the number of previous requests and the increasing need to address damage and threats associated with barn swallows in the Commonwealth, up to 500 barn swallows and 100 nests could be taken annually.

Based on the state population estimate, the annual removal of up to 500 barn swallows by WS would represent 0.1% of the population. From 2007 to 2012, 134 barn swallows or an average of 22.3 swallows per year were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain at 0.1% of the estimated population. The take of barn swallows can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of swallows would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the barn swallow population. Although there may be reduced fecundity for the individuals affected by nest

destruction, this activity has no long term effect on breeding adult barn swallows. The destruction of up to 100 barn swallow nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on swallow populations would occur. As with the lethal take of adults, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

American Robin Population Impact Analysis

The American robin, one of the most easily recognized birds in North America, can be found throughout the U.S. (Sallabanks and James 1999). Robins can be found across the state and throughout the year although their numbers fluctuate due to migration (Sallabanks and James 1999). Preferred habitat includes forest and woodlands in close proximity to open areas with short grass for feeding, making suburban and other human modified landscapes ideal habitat (Sallabanks and James 1999). Robins regularly nest and raise two broods of chicks per season (Sallabanks and James 1999). Nests are located in trees, on the tops of tree stumps, in road banks, on cliffs, on buildings or other man-made structures (Sallabanks and James 1999). Robins are highly social during the non-breeding season, forming flocks as large as 250,000 birds for migration, feeding and roosting (Sallabanks and James 1999). American robins will also roost communally with European starlings and common grackles (Sallabanks and James 1999).

In Virginia, the number of American robins observed during the BBS has shown a decreasing trend estimated at -0.09% annually since 1966, and an increasing trend estimated at 0.1%, from 2002–2012, although these trends are not statistically significant (Sauer et al. 2014). In contrast, the number of American robins observed in the Eastern BBS region has shown an increasing trend estimated at 0.3% annually since 1966, a statistically significant increase (Sauer et al. 2014). The number of American robins observed in the Commonwealth during the CBC has shown a cyclical and increasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of American robins to be two million birds.

The number of American robins taken or dispersed by WS and the total number of robins taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.40.

Table 4.40 – Number of American robins addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	200	30	0	0
2008	54	30	0	0
2009	177	50	13	13
2010	135	55	8	24
2011	385	115	28	29
2012	328	206	18	32
TOTAL	**1,279**	**486**	**67**	**98**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take

Requests for assistance associated with American robins occur primarily at airports where they pose a hazard to aircraft. To address requests for assistance at airports, up to 50 American robins and 20 nests could be taken annually by WS.

Based on the state population estimate, the annual removal of up to 50 American robins by WS would represent 0.002% of this population. From 2007 to 2012, 98 American robins or 5.16 robins per year, on average, were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain at 0.002% of the estimated population. The take of American robins can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of American robins would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 American robin nests to alleviate damage or threats of damage is not expected to adversely affect the population of American robins is further addressed in additional detail below.

Northern Mockingbird Population Impact Analysis

Northern mockingbirds can be found across the United States throughout the year (Farnsworth et al. 2011). Mockingbirds prefer open habitat including cultivated land, parks, suburban and urban areas (Farnsworth et al. 2011). Mockingbirds are social and highly territorial, defending areas year-round in pairs (Farnsworth et al. 2011).

According to BBS trend data, mockingbird populations have declined at an annual rate of -0.6% in Virginia since 1966, and -1.3% annually from 2002 to 2012 (Sauer et al. 2014). Similarly, mockingbird populations for the Eastern BBS Region show a statistically significant annual population decline of -0.5% since 1966 (Sauer et al. 2014). Across all BBS routes in the U.S., mockingbirds have exhibited an annual population decline of -0.6% since 1966 (Sauer et al. 2014). Despite observed declines during the BBS, the number of birds observed during the CBC has shown a stable to increasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of mockingbirds to be 460,000 birds.

The number of Northern mockingbirds taken or dispersed by WS and the total number of mockingbirds taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.41.

Table 4.41 – Number of Northern mockingbirds addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits					
		Adults			Nests		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]	Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	0	69	15	25	10	0	0
2008	6	75	14	14	10	0	0
2009	22	75	14	16	10	0	0
2010	1	100	24*	24	10	1	1
2011	6	100	31**	31	10	0	0
2012	4	105	6	7	10	1	1
TOTAL	**39**	524	**104**	**117**	**60**	**2**	**2**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 10
**Includes non-target take of 4

The majority of requests for assistance associated with Northern mockingbirds in Virginia originate at airports. Based on the number of previous requests and the increasing need to address damage and threats associated with Northern mockingbirds in the Commonwealth, up to 50 mockingbirds and 20 nests could be taken annually.

The number of mockingbirds present in the Commonwealth fluctuates throughout the year. Based on the best available data the annual removal of up to 50 Northern mockingbirds by WS would represent 0.01% of the state population. From 2007 to 2012, 13 Northern mockingbirds or 2.1 mockingbirds per year, on average, were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would remain at 0.01% of the estimated population. The take of Northern mockingbirds can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of Northern mockingbirds would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 Northern mockingbird nests to alleviate damage or threats of damage is not expected to adversely affect the population of Northern mockingbirds and is further addressed in additional detail below.

European Starling Population Impact Analysis

As their name suggests, European starlings are native to parts of Europe and Asia (Cabe 1993). Their colonization of North America began in 1890 and 1891 when about 100 birds were introduced into New York's Central Park (Cabe 1993). First observed in Newport News in 1912, today these birds can be found across the Commonwealth and throughout the year (Trollinger and Reay 2001, Rottenborn and Brinkley 2007). European starlings are highly adaptable and are found in a wide range of habitats; however, they are most often associated with disturbed areas created by humans (Cabe 1993). European starlings prefer to forage in open country on mowed or grazed fields (Cabe 1993). European starlings are highly social birds feeding, roosting and migrating in flocks at all times of the year (Cabe 1993). European starlings are aggressive cavity nesters which evict native cavity nesting species (Cabe 1993). In the absence of natural cavities, European starlings will nest in manmade structures such as streetlights, mail boxes, attics etc. (Cabe 1993). Although few conclusive studies have been conducted, evidence suggests European starlings have a detrimental effect on native species (Cabe 1993).

The number of European starlings observed in the Commonwealth along routes surveyed during the BBS has shown a decreasing trend estimated at -1.4% annually since 1966, which is statistically significant (Sauer et al. 2014). A similar trend has been observed for the number of European starlings observed in the Eastern BBS region where the population has declined at an estimated -1.3% annually since 1966, which is also a statistically significant trend (Sauer et al. 2014). The number of European starlings observed in the Commonwealth during the CBC has shown a declining trend since 1969 (National Audubon Society 2010). Partners in Flight Science Committee (2013) estimated the statewide breeding population of European starlings to be one million birds.

The number of European starlings taken or dispersed by WS from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.42. Since starlings are non-native they are afforded no protection under the MBTA, and no depredation permit from the USFWS is required to take them. Reporting the take of starlings to the USFWS is also not required. Therefore the take of starlings by other entities to alleviate damage is unknown.

Table 4.42 – Number of European starlings addressed by WS' in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	
		Adults	Nests
2007	43,864	911	3
2008	58,800	2,870	10
2009	81,303	2,693	5
2010	121,226	5,720	2
2011	150,154	8,905*	12
2012	194,448	3,213	10
TOTAL	**649,795**	**24,312**	**42**

[1]Data reported by federal fiscal year
*Includes a non-target take of 1

Requests for assistance to reduce damage and threats associated with European starlings come from people in urban areas, industrial locations, airports and agricultural businesses. Starlings gather in roosts numbering from several hundred to more than one million birds (Johnson and Glahn 1994). Fecal droppings at these roost sites can damage vehicles, buildings, sidewalks and other structures, create unsanitary conditions and transfer diseases (Johnson and Glahn 1994). Starlings can also cause other damage by consuming cultivated fruit and vegetable crops and livestock feed (Johnson and Glahn 1994). Starlings also pose a strike risk to aircraft. In 1960, a commercial aircraft in Boston collided with a flock of starlings, resulting in 62 fatalities (Johnson and Glahn 1994).

Based on previous requests for assistance received by WS and in anticipation of future requests for assistance to manage damage associated with European starlings, up to 50,000 starlings and 500 nests could be lethally taken annually by WS in the Commonwealth. With a statewide population estimated at one million starlings, WS' proposed take of up to 50,000 annually would represent 5% of the statewide population. European starlings are considered a non-native species under the MBTA. Therefore, starlings are afforded no protection under the Act. European starlings are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of European starlings, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health.

Eastern Meadowlark Population Impact Analysis

The Eastern meadowlark is a migratory bird that can be found throughout the eastern states, central and southeastern Arizona, central New Mexico and Southwest Texas (Jaster et al. 2012). In Virginia, Eastern meadowlarks can be found year round throughout the state wherever there is adequate habitat (Trollinger and Reay 2001, Jaster et al. 2012). Eastern meadowlarks require open habitat such as pastures, cultivated fields, barrens, orchards, golf courses, airports, reclaimed strip-mines or other types of open area for nesting and feeding (Jaster et al. 2012). During the non-breeding season Eastern meadowlarks are highly social forming flocks of up to 200 birds (Jaster et al. 2012).

CBC data indicates meadowlarks wintering in Virginia have shown an overall declining trend since 1966 (National Audubon Society 2010). Similarly, according to BBS data, meadowlarks are showing a declining trend estimated at -3.2% annually since 1966 in Virginia, which is a statistically significant, decline (Sauer et al. 2014). Meadowlarks are also showing a declining trend across the Eastern BBS Region, estimated at -3.7% annually since 1966, a statistically significant trend (Sauer et al. 2014).

Partners in Flight Science Committee (2013) estimated the statewide breeding population of Eastern meadowlarks to be 400,000 birds.

The number of Eastern meadowlarks taken or dispersed by WS and taken by other entities in the Commonwealth from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.43.

Table 4.43 – Number of Eastern meadowlarks addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits		
		Authorized Take[2]	WS' Take[1]	Total Take by All Entities[3]
2007	215	321	10	16
2008	812	341	48	54
2009	1,155	365	45	48
2010	1,829	400	51*	66
2011	779	400	30	38
2012	884	450	45	50
TOTAL	**5,674**	**2,277**	**229**	**272**

[1]Data reported by federal fiscal year
[2]Permitted by USFWS; includes WS' authorized take
[3]Data reported by calendar year; includes WS' take
*Includes non-target take of 1

The open areas found at airports make them ideal habitat for Eastern meadowlarks. Most requests for assistance to reduce damage and threats associated with Eastern meadowlarks in Virginia originate from airports. To address requests for assistance at airports, up to 500 Eastern meadowlarks and 20 nests could be taken annually by WS to alleviate damage and threats.

Based on the state population estimate, the annual removal of up to 500 Eastern meadowlarks by WS would represent 0.12% of this population. From 2007 to 2012, 43 Eastern meadowlarks or 7.16 meadowlarks per year, on average, were taken by other entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities would represent 0.12% of the estimated population. The take of Eastern meadowlarks can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of Eastern meadowlarks would only occur at levels authorized by the USFWS which ensures cumulative take is considered as part of population management objectives for these birds. The take of up to 20 Eastern meadowlark nests to alleviate damage or threats of damage is not expected to adversely affect the population of meadowlarks and is further addressed in additional detail below.

Red-winged Blackbird Population Impact Analysis

The red-winged blackbird is one of the most abundant bird species in North America (Yasukawa and Searcy 1995). Red-winged blackbirds are a migratory bird species that can be observed throughout most of the U.S. year round (Yasukawa and Searcy 1995). Red-winged blackbirds are primarily associated with fresh water wetlands and upland habitat including wet roadside ditches, fields, and suburban and urban parks (Yasukawa and Searcy 1995). Red-winged black birds are social throughout the year, nesting colonially and forming flocks numbering in the millions during the non-breeding season (Yasukawa and Searcy 1995).

The number of red-winged blackbirds observed in the Commonwealth along routes surveyed during the BBS has shown a decreasing trend estimated at -2.7% annually since 1966, which is statistically

significant (Sauer et al. 2014). A similar trend has been observed for the number of red-winged blackbirds observed in the Eastern BBS region where the population has decreased at an estimated -1.6% annually since 1966, which is also a statistically significant trend (Sauer et al. 2014). The number of red-winged blackbirds observed in the Commonwealth during the CBC has shown a generally stable trend since 1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population red-winged blackbirds to be 400,000 birds.

The number of red-winged blackbirds taken or dispersed by WS to alleviate damage and threats is shown in Table 4.44. Under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take red-winged blackbirds when found committing or about to commit damage to resources or when concentrated in such numbers and in a manner as to constitute a health hazard or other nuisance. Prior to January 3, 2011 there were no reporting requirements for take under 50 CFR 21.43 (Sobeck 2010). Therefore, the number of red-winged blackbirds taken under 50 CFR 21.43 of the MBTA is unknown.

Table 4.44 – Number of red-winged black birds addressed by WS in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	5,163	28
2008	3,918	637
2009	6,343	393
2010	15,769	496
2011	2,023	380
2012	3,266	205
TOTAL	**36,482**	**2,139**

[1]Data reported by federal fiscal year

Requests for WS' assistance with red-winged blackbirds often arise at airports where the flocking behavior of these birds poses risks to aircraft and human safety. Additionally, requests for assistance are received when crops or livestock feed are damaged or consumed by red-winged blackbirds (Dolbeer 1994). Based on the previous number of requests to manage damages and threats associated with red-winged blackbirds, and in an anticipation of an increased need to address future damages and threats in the Commonwealth, up to2,500 red-winged blackbirds and 20 nests could be taken by WS annually in Virginia.

Based on the state population estimate, WS' proposed take of up to 2,500 red-winged blackbirds annually would represent 0.62% of the estimated statewide red-winged blackbird population. Given the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on red-winged blackbird populations when compared to the number of red-winged blackbirds in the state. The take of these birds can only occur when permitted by the USFWS or when taken under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds. The take of up to 20 red-winged blackbird nests to alleviate damage and threats of damage is also not expected to adversely affect the population of blackbirds and is further addressed in additional detail below. The take of red-winged blackbirds by other entities in the Commonwealth is unknown.

Common Grackle Population Impact Analysis

Common grackles are migratory and found throughout the year east of the Rocky Mountains and in a smaller portion of that range during the winter (Peer and Bollinger 1997). In Virginia, common grackles can be found across the state and throughout the year (Rottenborn and Brinkley 2007). The common grackles use a wide range of open or partially open habitat including open woodland, forest edges and

suburban areas (Peer and Bollinger 1997). The population and distribution of common grackles has benefitted from changes in land use practices particularly the expansion of suburban areas (Peer and Bollinger 1997). Common grackles are social birds nesting in colonies of up to 200 pairs and forming flocks with other black birds which may exceed one million birds (Peer and Bollinger 1997).

The number of common grackles observed in the Commonwealth along routes surveyed during the BBS has shown an annual declining trend estimated at -3.0% annually since 1966, which is statistically significant (Sauer et al. 2014). A similar trend has been observed for the number of common grackles observed in the Eastern BBS region where the population has declined at an estimated -2.0% annually since 1966, a statistically significant trend (Sauer et al. 2014). The number of common grackles observed in the Commonwealth during the CBC has shown a stable and cyclical trend (National Audubon Society 2010). Using data from the BBS, The Partners in Flight Science Committee (2013) estimated the statewide breeding population of common grackles to be 1.7 million birds.

The number of common grackles taken or dispersed by WS to alleviate damage and threats as well is shown in Table 4.45. Under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take common grackles when found committing or about to commit damage to resources or when concentrated in such numbers and in a manner as to constitute a health hazard or other nuisance. Prior to January 3, 2011 there were no reporting requirements for take under 50 CFR 21.43 (Sobeck 2010). Therefore, the number of common grackles taken under 50 CFR 21.43 of the MBTA is unknown.

Table 4.45 – Number of common grackles addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	233	12
2008	2,064	41
2009	5,484	82
2010	15,579	197
2011	1,491	138
2012	6,766	59
TOTAL	**31,617**	**529**

[1]Data reported by federal fiscal year

Requests for WS' assistance with common grackles often arise at airports where the flocking behavior of these birds poses risks to aircraft and human safety. Additionally, requests for assistance are received when fish at aquaculture facilities or crops or livestock feed are damaged or consumed by common grackles (Dolbeer 1994, Glahn et al. 1999*a*). Based on the previous number of requests to manage damages and threats associated with common grackles, and in an anticipation of an increased need to address future damages and threats in the Commonwealth, up to 1,000 common grackles and 120 nests could be taken by WS annually in Virginia.

Based on the state population estimate, WS' proposed take of up to 1,000 common grackles annually would represent 0.05% of the estimated statewide population. The take of common grackles by other entities is unknown. Given the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on common grackle populations when compared to the number of common grackles in the state. The take of these birds can only occur when permitted by the USFWS or when taken under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds.

Additionally, cumulative take of up to 120 common grackle nests by WS is also not expected to adversely affect the population of grackles. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult common grackles. The

cumulative destruction of up to 120 common grackle nests annually by WS would occur in localized areas and would not reach a level where adverse effects on common grackle populations would occur. The take of common grackles by other entities in the Commonwealth is unknown.

Boat-tailed Grackle Population Impact Analysis

Boat-tailed grackles can be found year round along the Atlantic coast south of New York, across Florida and west along the Gulf Coast to central Texas (Post et al. 1996). In the Chesapeake Bay, boat-tailed grackles are year round residents (Rottenborn and Brinkley 2007). Preferred habitat includes salt and freshwater marsh for breeding but can also be found feeding in cities, cultivated fields, stockyards and beaches (Post et al. 1996).

The number of boat-tailed grackles observed in the Eastern U.S. along routes surveyed during the BBS has shown an annual declining trend estimated at -0.6% annually since 1966, and -0.1% since 2002 (Sauer et al. 2014). A similar trend has been observed for the number of boat-tailed grackles observed in the New England / Mid-Atlantic coast BBS region where the population has shown an annual declining trend estimated at -0.2% annually since 1966, and an increasing trend estimated at 2.4% annually since 2002 (Sauer et al. 2014). The number of boat-tailed grackles observed in the Commonwealth during the CBC has shown a declining trend (National Audubon Society 2010). In the last decade, an average of 1,048 boat-tailed grackles were observed annually in the Commonwealth during the CBC (National Audubon Society 2010). Using data from the BBS, The Partners in Flight Science Committee (2013) estimated the statewide breeding population of boat-tailed grackles to be 9,000 birds.

The number of boat-tailed grackles taken or dispersed by WS to alleviate damage and threats as well is shown in Table 4.46. Under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take grackles when found committing or about to commit damage to resources or when concentrated in such numbers and in a manner as to constitute a health hazard or other nuisance. Prior to January 3, 2011 there were no reporting requirements for take under 50 CFR 21.43 (Sobeck 2010). Therefore, the number of boat-tailed grackles taken under 50 CFR 21.43 of the MBTA is unknown.

Table 4.46 – Number of boat-tailed grackles addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	15	0
2008	213	17
2009	401	18
2010	615	9
2011	0	0
2012	697	7
TOTAL	**1,941**	**51**

[1]Data reported by federal fiscal year

Requests for WS assistance with grackles often arise at airports where the flocking behavior of these birds poses risks to aircraft and human safety. Based on the previous number of requests to manage damages and threats associated with boat-tailed grackles, and in an anticipation of an increased need to address future damages and threats in the Commonwealth, up to 50 grackles and 20 nests could be taken by WS annually in Virginia.

Based on the state population estimate and a stable population trend, WS' proposed take of up to 50 boat-tailed grackles annually would represent 0.5% of the estimated statewide population. The take of boat-tailed grackles by other entities in the Commonwealth is unknown.

Given the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on boat-tailed grackle populations. The take of these birds can only occur when permitted by the USFWS or when taken Under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds. The take of up to 20 boat-tailed grackle nests to alleviate damage and threats of damage is also not expected to adversely affect the population of grackles and is further addressed in additional detail below.

Brown-headed Cowbird Population Impact Analysis

Brown-headed cowbirds are migratory birds found throughout the U.S. (Lowther 1993). During the non-breeding season their range is restricted to the pacific coast and to the east and south of a line extending from west Texas through western Nebraska and Missouri along the southern part of the Great Lakes and through New England (Lowther 1993). In the Commonwealth, brown-headed cowbirds can be found across the state (Trollinger and Reay 2001, Rottenborn and Brinkley 2007). Cowbirds are still commonly found in open grassland habitats but also inhabit urban and residential areas (Lowther 1993). Somewhat unique in their breeding habits, cowbirds are known as brood parasites, meaning they lay their eggs in the nests of other bird species (Lowther 1993). Female cowbirds can lay up to 40 eggs per season with eggs reportedly being laid in the nests of over 220 species of birds (Lowther 1993). No parental care is provided by cowbirds with the raising of cowbird young occurring by the host species (Lowther 1993). Brown-headed cowbirds are highly social and are a common component of mix-species blackbird flocks which may exceed one million birds (Lowther 1993, Peer and Bollinger 1997).

The number of brown-headed cowbirds observed in the Commonwealth along routes surveyed during the BBS has shown a decreasing trend estimated at -1.2% annually since 1966, a statistically significant decrease (Sauer et al. 2014). A similar trend has been observed for the number of brown-headed cowbirds observed in the Eastern BBS region where the population has decreased at an estimated -1.6% annually since 1966, which is also a statistically significant trend (Sauer et al. 2014). The number of brown-headed cowbirds observed in the Commonwealth during the CBC has shown a stable trend (National Audubon Society 2010). Using data from the BBS, The Partners in Flight Science Committee (2013) estimated the statewide breeding population of brown-headed cowbirds to be 390,000 birds.

The number of brown-headed cowbirds taken or dispersed by WS to alleviate damage and threats is shown in Table 4.47. Under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take brown-headed cowbirds when found committing or about to commit damage to resources or when concentrated in such numbers and in a manner as to constitute a health hazard or other nuisance. Prior to January 3, 2011 there were no reporting requirements for take under 50 CFR 21.43 (Sobeck 2010). Therefore, the number of brown-headed cowbirds taken under 50 CFR 21.43 of the MBTA is unknown.

Table 4.47 – Number of brown-headed cowbirds addressed in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	14,685	195
2008	1,378	266
2009	2,321	183
2010	14,846	2,824
2011	8,647	906
2012	10,074	620
TOTAL	**51,951**	**4,994**

[1]Data reported by federal fiscal year

Requests for WS assistance with brown-headed cowbirds often arise at airports where the flocking behavior of these birds poses risks to aircraft and human safety. Additionally, requests for assistance are

received when crops are damaged or consumed by brown-headed cowbirds (Dolbeer 1994). Based on the previous number of requests to manage damages and threats associated with brown-headed cowbirds, and in an anticipation of an increased need to address future damages and threats in the Commonwealth, up to 5,000 brown-headed cowbirds could be taken by WS annually in Virginia.

Based on the state population estimate and a stable population trend, WS' proposed take of up to 5,000 brown-headed cowbirds annually would represent 1.2% of the estimated statewide population. The take of brown-headed cowbirds by other entities in the Commonwealth is unknown.

Given the limited take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on brown-headed cowbirds populations when compared to the number of brown-headed cowbirds in the state. The take of these birds can only occur when permitted by the USFWS or when taken under 50 CFR 21.43 of the MBTA. All take is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds. However, take of these birds is reported to the USFWS to ensure cumulative take is considered as part of population management objectives for these birds.

House Sparrow Population Impact Analysis

House sparrows or English sparrows are native to parts of Europe and Asia. European sparrows were first introduced to North America in 1851 and 1852 (Lowther and Cink 2006). Today, house sparrows can be found across the U.S. and throughout the year. House sparrows can be found throughout the state year round in suitable habitat (Trollinger and Reay 2001). House sparrows thrive in urban, suburban and agricultural areas. As their name suggests, house sparrows can commonly be found nesting in nooks and crannies on or around houses and other buildings (Lowther and Cink 2006). They aggressively compete with native birds for nesting habitat, destroying their eggs and young and driving them away (Fitzwater 1994). House sparrows are social birds nesting in small colonies and forming flocks for feeding and roosting (Lowther and Cink 2006).

The number of house sparrows observed along routes surveyed during the BBS has decreased at an annual rate of -7.3% and -3.7% since 1966 in Virginia and in the Eastern BBS region respectively (Sauer et al. 2014). The number of house sparrows observed in the Commonwealth during the CBC has shown a general decline since 1966 (National Audubon Society 2010). The Partners in Flight Science Committee estimate the population of house sparrows in the Commonwealth at 300,000 birds.

The number of house sparrows taken or dispersed by WS from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4.48. Since house sparrows are non-native they are afforded no protection under the MBTA, and no depredation permit from the USFWS is required to take them. Reporting the take of house sparrows to the USFWS is also not required. Therefore the take of house sparrows by other entities to alleviate damage is unknown.

Table 4.48 – Number of house sparrows addressed by WS' in Virginia from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	
		Adults	Nests
2007	2	80	7
2008	3	123	12
2009	95	37	0
2010	66	107	20
2011	59	81	0
2012	45	117*	0
TOTAL	**270**	**545**	**39**

[1]Data reported by federal fiscal year
*Includes non-target take of 1

Requests for assistance to reduce damage and threats associated with house sparrows come from people in urban areas, industrial locations, airports and agricultural businesses where their nests and waste cause a nuisance. Unlike most birds, house sparrows use their nests outside the nesting season for shelter (Lowther and Clink 2006). These nests are sometimes built where they plug gutters, destroy insulation or come into contact with heat sources; causing potential fire hazards or other nuisance (Fitzwater 1994). Fecal droppings at these sites can damage vehicles, buildings, sidewalks and other structures, create unsanitary conditions and transfer diseases (Fitzwater 1994). House sparrows can also cause other damage by consuming cultivated fruit and vegetable crops and livestock feed (Fitzwater 1994).

Based on previous requests for assistance received by WS and in anticipation of future requests for assistance to manage damage associated with house sparrows, up to 1,000 sparrows and 500 nests could be lethally taken annually by WS. With a statewide population estimated at 300,000 house sparrows, WS' proposed take of up to 1,000 annually would represent 0.3% of the statewide population. House sparrows are considered a non-native species under the MBTA. Therefore, house sparrows are afforded no protection under the Act. House sparrows are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of house sparrows, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs Federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health.

Nest Destruction Population Impact Analysis (not discussed in detail above)

The nests and associated eggs of those species indicated above could be destroyed annually by WS as part of an integrated approach to managing damage. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, relocating and nesting elsewhere when confronted with repeated nest failure. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on breeding adult birds. Nest and egg removal is not used by WS as a population management method. This method is used by WS to inhibit nesting in an area experiencing damage due to nesting activity and is employed only at the localized level. As with the lethal take of birds, the take of nests must be authorized by the USFWS. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS.

Other Target Species

Other bird species may be taken in limited numbers when a request is received to address damage or threats. Those species include; brown pelican (*Pelecanus erythrorhynchos*), snowy egret (*Egretta thula*), green heron (*Butorides virescens*), black-crowned night-heron (*Nycticorax nycticorax*), yellow-crowned

night-heron (*Nyctanassa violacea*), glossy ibis (*Plegadis falcinellus*), black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Charadrius semipalmatus*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), willet (*Catoptrophorus semipalmatus*), dunlin (*Calidris alpina*), least sandpiper (*Calidris minutilla*), lesser black-backed gull (*Larus fuscus*), Caspian tern (*Sterna caspia*), common tern (*Sterna hirundo*), Eurasian collared-dove (*Streptopelia decaocto*), chimney swift (*Chaetura pelagica*), yellow-bellied sapsucker (*Sphyrapicus varius*), red-bellied woodpecker (*Melanerpes carolinus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), pileated woodpecker (*Dryocopus pileatus*), Northern flicker (*Colaptes auratus*), Eastern kingbird (*Tyrannus tyrannus*), blue jay (*Cyanocitta cristata*), bank swallow (*Riparia riparia*), Eastern blue bird (*Sialia sialis*), Northern cardinal (*Cardinalis cardinalis*), grasshopper sparrow (*Ammodramus savannarum*), savannah sparrow (*Passerculus sandwichensis*), dark-eyed junco (*Junco hyemalis*), bobolink (*Dolichonyx oryzivorus*), Lapland longspurs (*Calcarius lapponicus*), Wilson's snipe (*Gallinago delicata*), and house finch (*Carpodacus mexicanus*). WS' could take of up to 20 individuals and 20 nests and their associated eggs of any of these bird species on an annual basis. Take of up to 20 individual birds of these species is not expected to have any adverse impact on those species' populations in Virginia. These species' populations are not of low density in the Commonwealth and take would be limited to those individuals deemed causing damage or posing a threat. Impacts due to nest removal and destruction should have little adverse impact on the population of these bird species. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long term effect on adult breeding birds. The destruction of nests by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects to bird populations would occur. All take can only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at their discretion. The take of these species would only occur at levels authorized by the USFWS which ensures cumulative which ensures cumulative take is considered as part of population management objectives for these birds.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only.

Despite no direct involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. Appendix C contains a thorough discussion of the methods available for use in managing damage and threats associated with birds. With the exception of Mesurol (EPA No. 56228-33) and DRC-1339, all methods listed in the Appendix could 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 persons with pesticide applicator licenses. Although DRC-1339 is only available for use by WS, a product containing the same active ingredient, Starlicide, is commercially available as a restricted-use pesticide for managing damage associated with starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds at livestock and poultry operations. Management actions taken by non-federal entities would be considered the *environmental status quo*.

The number of birds lethally taken under this alternative would likely be similar to the other alternatives. Lethal take of birds could continue to occur either without a permit (if those species are non-native), during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS or the VDGIF. WS' involvement would not be additive to take that could occur since the individual requesting WS' assistance could conduct bird 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 persons experiencing damage or threats could take action using those methods legally available to resolve or prevent bird damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action. Therefore, bird populations in the Commonwealth would not be directly impacted by WS from a program implementing technical assistance only.

With the oversight of the USFWS and the VDGIF, it is unlikely that bird populations would be adversely impacted by the implementation of this alternative. Management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the VDGIF. If direct operational assistance is not provided by WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and threats could lead to illegal take which could lead to real but unknown effects on other wildlife populations. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – WS Would Not Address Bird Damage

Under this alternative, WS would not be involved with any aspect of bird damage management. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. Similar to Alternative 2, with the exception of Mesurol (EPA No. 56228-33) and DRC-1339, all methods listed in the Appendix could 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 persons with pesticide applicators licenses. Although DRC-1339 is only available for use by WS, a product containing the same active ingredient, Starlicide, is commercially available as a restricted-use pesticide for managing damage associated with starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds at livestock and poultry operations.

Lethal take of birds could continue to occur either without a permit (if those species are non-native), during hunting seasons, under depredation orders or through the issuance of depredation permits by the USFWS or the VDGIF. The USFWS issues permits for those species of birds protected under the MBTA while the VDGIF issues permits for those species of birds including wild turkey protected under Commonwealth law. Management actions taken by non-federal entities would be considered the *environmental status quo*.

Under this alternative, property owners or 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 (technical assistance) for how to address bird damage as part of the permitting process. Under this alternative, WS would not perform this function. However, the USFWS needs professional recommendations on individual damage situations before issuing a depredation permit for lethal take and 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 provide this information. If the information were provided to USFWS, they could review the application and make a determination as described in Alternative 1.

The number of birds lethally taken under this alternative would likely be similar to the other alternatives. WS' involvement would not be additive to take that could occur since the persons requesting WS' assistance could conduct bird 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 persons experiencing damage or threats could take action using those methods legally available to resolve or prevent bird damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

Management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the VDGIF. If direct operational assistance and technical assistance is not provided by WS or other entities, 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 persons or organizations providing technical assistance have less technical knowledge and experience managing wildlife 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 (White et al. 1989, USFWS 2001, FDA 2003).

Issue 2 - Effects of Damage Management Activities on Non-target Wildlife Species, Including Threatened and Endangered Species

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

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

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

Standard Operating Procedures (SOPs) for bird damage management in Virginia discussed in Chapter 3 ensure risks to non-target wildlife species, including threatened and endangered species, would be reduced or prevented under the proposed action alternative. Pertinent SOPs include not only the WS' Decision Model (WS Directive 2.201), an evaluation process for the appropriateness of methods (WS Directive 2.101) and the use of integrated management (WS Directive 2.105) but also several other SOPs including the following. WS personnel are trained and experienced in wildlife identification and in the selection of and implementation of methods which are as species-specific as possible thus reducing the risks to non-target wildlife including threatened and endangered species. Management actions are directed towards specific birds or groups of birds responsible for causing damage or posing threats. WS consults with the USFWS or the NMFS and the VDGIF to determine the potential risks to federally and state listed threatened and endangered species in accordance with the ESA and Commonwealth laws. Non-lethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Non-target animals captured in traps are released unless it is determined that the animal would not survive and or that the animal cannot be safely released. To limit the possibility that birds which died from DRC-

1339 are scavenged by non-targets, WS would retrieve all dead birds to the extent possible and dispose of them in accordance with WS Directive 2.515.

Non-Lethal Methods

Non-lethal methods have the potential to cause adverse effects to non-targets primarily though physical exclusion, frightening devices or deterrents (see Appendix C). Any exclusionary device erected to prevent access to a resource by a target species could also potentially exclude non-target species; therefore adversely impacting that species. The use of frightening devices or deterrents may also disperse non-target species from the immediate area where they are employed. However, the potential impacts to non-targets, like the impacts to target species, are expected to be temporary. WS would not employ or recommend these methods be employed over large geographic areas or at such an intensity that essential resources would be unavailable and that long term adverse impacts to non-target populations would occur.

Under the Bald and Golden Eagle Act, activities that could result in the "take" of bald eagles cannot occur unless the USFWS allows those activities to occur through the issuance of a permit. Take could occur through purposeful take (e.g., harassing an eagle from an airport using pyrotechnics to alleviate aircraft strike hazards) or non-purposeful take (e.g., unintentionally capturing an eagle in a trap). Both purposeful take and non-purposeful take require a permit from the USFWS (see 50 CFR 22.26, 50 CFR 22.27). In those cases where purposeful take could occur or where there is a high likelihood of non-purposeful take occurring, WS would apply for a permit for those activities.

However, routine activities conducted by WS' personnel under the proposed action alternative could occur in areas where Bald Eagles were present, which could disrupt the current behavior of an eagle or eagles that were nearby during those activities. WS has reviewed those methods available under the proposed action alternative and the use patterns of those methods. The routine measures that WS conducts would not meet the definition of disturb requiring a permit for the non-purposeful take of bald eagles. The USFWS states, "Eagles are unlikely to be disturbed by routine use of roads, homes, or other facilities where such use was present before an eagle pair nesting in a given area. For instance, if eagles build a nest near your existing home, cabin, or place of business you do not need a permit" (USFWS 2012). Therefore, activities that are species-specific and are not of a duration and intensity that would result in disturbance as defined by the Act would not result in non-purposeful take. Activities, such as walking to a site, discharging a firearm, or riding an ATV along a trail, generally represent short-term disturbances to sites where those activities take place. WS would conduct activities that were located near eagle nests using the National Bald Eagle Management Guidelines (USFWS 2007). The categories that would encompass most of these activities are Category D (Off-road vehicle use), Category F (Non-motorized recreation and human entry), and Category H (Blasting and other loud, intermittent noises). These categories generally call for a buffer of 330 to 660 feet for category D and F, and a ½-mile buffer for category H. WS would take active measures to avoid disturbance of bald eagle nests by following the National Bald Eagle Management Guidelines. However, other routine activities conducted by WS do not meet the definition of "disturb" as defined under 50 CFR 22.3. Those methods and activities would not cause injuries to eagles and would not substantially interfere with the normal breeding, feeding, or sheltering behavior of bald eagles.Other non-lethal methods available for use under any of the alternatives are live-capture traps (see Appendix C). WS would use and recommend the use of target-specific attractants in these devices and place them or recommend they be placed in areas where target species are active to reduce the risk of capturing non-targets. WS would monitor or recommend traps be monitored frequently so non-target species can be released unharmed.

Eagles may occur in or near areas where vulture damage management activities are conducted. The walk-in, live traps used to capture vultures are baited with animal carcasses and therefore may attract scavenging bald eagles. Eagles that walk into these traps would be released unharmed by opening the trap to allow the birds to fly out. Based on previous activities conducted by WS and the selective nature of walk-in traps employed to live-capture vultures, the USFWS determined that no Eagle Act permit would be required relating to the use of walk-in traps and the potential to live-capture and release bald eagles (S. Hoskin, USFWS, pers. comm. 2012).

Egg and nest destruction is another non-lethal method that could be used under any of the alternatives (see Appendix C). WS would identify the species of bird responsible for laying the egg(s) or building the nest prior to destruction which would eliminate risks to non-targets. With the exception of Mesurol (EPA No. 56228-33), all non-lethal chemical methods could be available under all the alternatives. Non-lethal chemical methods used or recommended by WS under this alternative would be registered as required by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (see Appendix C). WS personnel that use restricted-use chemical methods would be certified as pesticide applicators by the Commonwealth of Virginia and would be required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations. Mesurol is only registered for use by WS personnel who have been trained and certified in its use (see Appendix C). Mesurol is a repellent used to deter crows and ravens predating the eggs of threatened or endangered species (see Appendix C). Application involves injecting Mesurol into eggs of domestic birds similar in appearance to the eggs of the threatened or endangered species needing protection. These eggs are then placed in artificial nests or upon elevated platforms. After eating treated eggs, birds develop post-ingestional malaise and an aversion to consuming similar looking eggs (Dimmick and Nicolaus 1990). WS would not place treated eggs in locations where there is a danger that threatened or endangered species will consume them. If there is a danger, WS would take special precautions such as constant observation or the use of hazing techniques. Additional label requirements limiting the number of treated eggs per acre and detailing the removal and disposal process for unconsumed or unused treated eggs would further limit the risk to non-target species. Non-lethal methods are generally regarded has having minimal impacts on populations since individuals are unharmed. Therefore, non-lethal methods would not have any adverse impacts on non-target populations of wildlife including threatened and endangered species under this alternative.

Lethal Methods

In cases where shooting were selected as an appropriate method, identification of an individual target would occur prior to application, eliminating risks to non-targets. Additionally, suppressed firearms would be used when appropriate to minimize noise impacts to non-targets. WS' recommendation that hunting or shooting be used would not increase risks to non-targets. Shooting would essentially be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS' recommendation of the method. Non-target species captured during the implementation of non-lethal capture methods can be released prior to euthanasia which occurs subsequent to live-capture. Therefore, no adverse effects to non-targets would occur from the use of euthanasia methods by WS under this alternative. Similarly, WS' recommendation of euthanasia methods would not increase risks to non-targets because these methods are selective for target species and the unintentional euthanasia of non-targets would not likely increase based on WS' recommendation of the method.

Avitrol - Although Avitrol is registered as a chemical frightening agent, some birds that ingest the product will die. However, WS takes care to prebait and select sites that are predominately used by target species. If non-targets are observed in the vicinity of bait stations, then WS will cease

operations and remove unused bait. Additionally, WS removed all unused bait at the conclusion of projects. Since Avitrol is available to all registered pesticide users, WS' use does not change the status quo. In fact, WS use of Avitrol may reduce threats to non-target wildlife as only professional federal employees following strict standard operating procedures would be using the product.

DRC-1339 - A common concern regarding the use of DRC-1339 is the potential risks to non-targets. All label requirements of DRC-1339 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 are observed feeding on the pre-bait, the plots are abandoned and no baiting would occur at those locations. Treated bait is mixed with untreated bait per label requirements when applied to bait sites to minimize the likelihood of non-targets finding and consuming bait that has been treated. The bait type selected can also limit the likelihood that non-target species would consume treated bait since some bait types are not preferred by non-target species.

By acclimating target bird species to a feeding schedule, baiting can occur at specific times to ensure bait placed is quickly consumed by target bird species, especially when large flocks of target species are present. The acclimation period allows treated bait to be present only when birds are conditioned to be present at the site and provides a higher likelihood that treated bait would be consumed by the target species, which makes it unavailable to non-targets. In addition, many bird species when present in large numbers tend to exclude non-targets from a feeding area due to their aggressive behavior and by the large number of conspecifics present at the location. Therefore, risks to non-target species from consuming treated bait only occurs when treated bait is present at a bait location. Any treated bait remaining at the location after target birds had finished feeding would be removed to avoid attracting non-targets. WS would retrieve all dead birds to the extent possible following treatment with DRC-1339.

DRC-1339 Primary Hazard Profile - DRC-1339 was selected for reducing bird damage because of its high toxicity to blackbirds (DeCino et al. 1966, West et al. 1967, Schafer, Jr. 1972) and low toxicity to most mammals, sparrows, and finches (Schafer, Jr. and Cunningham 1966, Apostolou 1969, Schafer, Jr. 1972, Schafer, Jr. et al. 1977, Matteson 1978, Cunningham et al. 1979, Cummings et al. 1992, Sterner et al. 1992). The likelihood of a non-target bird obtaining a lethal dose is dependent on: (1) frequency of encountering the bait, (2) length of feeding incident, (3) the bait dilution rate, (4) the bird's propensity to select against the treated bait, and (5) the susceptibility of the non-target species to the toxicant. Birds that ingest DRC-1339 probably die because of irreversible necrosis of the kidney and subsequent inability to excrete uric acid (***i.e.***, uremic poisoning) (DeCino et al. 1966, Felsenstein et al. 1974, Knittle et al. 1990). Birds ingesting a lethal dose of DRC-1339 usually die in one to three days.

The median acute lethal dose (LD_{50})[8] values for starlings, blackbirds, and magpies (Corvidae) range from one to five mg/kg (Eisemann et al. 2003). For American crows, the median acute lethal dose has been estimated at 1.33 mg/kg (DeCino et al. 1966). The acute oral toxicity (LD_{50}) of DRC-1339 has been estimated for over 55 species of birds (Eisemann et al. 2003). DRC-1339 is toxic to mourning doves, pigeons, quail (*Coturnix coturnix*), chickens and ducks (*Anas* spp.) at ≥5.6 mg/kg (DeCino et al. 1966). In cage trials, Cummings et al. (1992) found that 2% DRC-1339-treated rice did not kill savannah sparrows (*Passerculus sandwichensis*). Gallinaceous birds and waterfowl may be more resistant to DRC-1339 than blackbirds, and their large size may reduce the chances of ingesting a lethal dose (DeCino et al. 1966). Avian reproduction does not appear to be affected from

[8] An LD_{50} is the dosage in milligrams of material per kilogram of body weight required to cause death in 50% of a test population of a species.

ingestion of DRC-1339 treated baits until levels are ingested where toxicity is expressed (USDA 2001).

There have been concerns expressed about the study designs used to derive acute lethal doses of DRC-1339 for some bird species (Gamble et al. 2003). The appropriateness of study designs used to determine acute toxicity to pesticides has many views (Lipnick et al. 1995). The use of small sample sizes was the preferred method of screening for toxicity beginning as early as 1948 to minimize the number of animals involved (Dixon and Mood 1948). In 1982, the EPA established standardized methods for testing for acute toxicity that favored larger sample sizes (EPA 1982). More recently, regulatory agencies have again begun to debate the appropriate level of sample sizes in determining acute toxicity based on a growing public concern for the number of animals used for scientific purposes.

Based on those concerns, the Ecological Committee on FIFRA Risk Assessment (ECOFRAM) was established by the EPA to provide guidance on ecological risk assessment methods (EPA 1999). The committee report recommended to the EPA that only one definitive LD_{50} be used in toxicity screening either on the mallard or northern bobwhite and recommended further testing be conducted using the up-and-down method (EPA 1999). Many of the screening methods used for DRC-1339 prior to the establishment of EPA guidelines in 1982 used the up-and-down method of screening (Eisemann et al. 2003).

A review of the literature shows that LD_{50} research using smaller sample sizes conducted prior to EPA established guidelines are good indicators of LD_{50} derived from more rigorous designs (Bruce 1985, Bruce 1987, Lipnick et al. 1995). Therefore, acute and chronic toxicity data gathered prior to EPA guidance remain valid and to ignore the data would be inappropriate and wasteful of animal life (Eisemann et al. 2003).

DRC-1339 Secondary Hazards - Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds that died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1979). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers.

DRC-1339 is rapidly metabolized and excreted and does not bioaccumulate, which probably accounts for its low secondary hazard profile (Schafer, Jr. 1991). For example, cats, owls, and magpies would be at risk only after exclusively eating DRC-1339-poisoned starlings for 30 continuous days (Cunningham et al. 1979). No probable risk is expected to American kestrels based on the low hazard quotient value for marsh hawks used as a surrogate species (Schafer 1970). The risk to mammalian predators from feeding on birds killed with DRC-1339 appears to be low (Johnston et al. 1999).

The risks associated with non-target animal exposure to DRC-1339 baits have been evaluated in rice fields in Louisiana (Glahn et al. 1990, Cummings et al. 1992, Glahn and Wilson 1992), poultry and cattle feedlots in several western states (Besser 1964, Ford 1967, Royall et al. 1967), ripening sunflower fields in North Dakota (Linz et al. 2000), and around blackbird staging areas in east-central South Dakota (Knutsen 1998, Kostecke et al. 2001, Smith 1999). Smith (1999) used field personnel and dogs to search for dead non-target animals and found no non-target carcasses that exhibited histological signs consistent with DRC-1339 poisoning. The other studies also failed to detect any non-target birds that had succumbed to DRC-1339. However, DRC-1339 is a slow-acting avicide and thus, some birds could move to areas not searched by the study participants before dying.

DRC-1339 Environmental Degradation - DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation and has a half-life of less than two days. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. The chemical tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (*i.e.*, degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (EPA 1995).

Additional concerns have been raised regarding the risks to non-target wildlife associated with crows caching bait treated with DRC-1339. Crows are known to cache surplus food usually by making a small hole in the soil using the bill, by pushing the food item under the substrate, or covering items with debris (Verbeek and Caffrey 2002). Distances traveled from where the food items were gathered to where the item is cached varies, but some studies suggests crows can travel up to 100 meters (Kilham 1989) and up to 2 kilometers (Cristol 2001, Cristol 2005). Caching activities appear to occur throughout the year, but may increase when food supplies are low. Therefore, the potential for treated baits to be carried from a bait site to surrounding areas exists as part of the food cache behavior exhibited by crows.

Several mitigating factors must be overcome for non-target risks to occur from bait cached by a crow. Those factors being: (1) the non-target wildlife species would have to locate the cached bait, (2) the bait-type used to target crows would have to be palatable or selected for by the non-target wildlife, (3) the non-target wildlife species consuming the treated bait would have to consume a lethal dose from a single bait, and (4) if a lethal dose is not achieved by eating a single treated cached bait, the non-target wildlife would have to ingest several treated baits (either from cached bait or from the bait site) to obtain a lethal dose which could vary by the species.

Threatened and Endangered Species

Special efforts are made to avoid jeopardizing threatened and endangered species. Threatened and endangered species listed by the USFWS or the National Marine Fisheries Service (NMFS), under the ESA for the Commonwealth can be found in Appendix D. These lists were obtained and reviewed during the development of this EA.

Federally Listed Species - WS has made a "no effect" determination for all T&E species except the piping plover (*Charadrius melodus*) and the roseate tern (*Sterna dougallii dougallii*). The roseate tern historically nested on the Commonwealth's barrier islands; however, no breeding has been recorded since 1927 (Rottenborn and Brinkley 2007). Roseate terns are rarely observed along the coast during migration periods, and only about 50 records of such observations have been made since 1952 (Rottenborn and Brinkley 2007). During the breeding season, piping plovers can be observed nesting on barrier islands off of the Delmarva Peninsula (Rottenborn and Brinkley 2007). The highest breeding populations recorded are located on Metompkin Island and Assateague Island (VDGIF 2014). WS is regularly requested to implement avian and mammalian predator management to protect these and other shorebird species. Although this requires WS personnel to work in close proximity to T&E species, any minor disturbances are offset by the protection of eggs and hatchlings from predators. Therefore, WS has made a "may affect, but not likely to adversely affect" determination for roseate terns and piping plovers. WS conducted an informal Section 7 consultation with the USFWS in 2014 in which the USFWS concurred with WS' determination (Mike Drummond, USFWS, personal communication, July 23, 2014).

State Listed Species - The current list of species designated as endangered, threatened, or special concern by the state, as determined by the VDGIF, was obtained and reviewed during the

development of the EA (see Appendix E). Based on the review of species listed, WS has determined that the proposed activities would have no effect on those species currently listed by the state.

Summary

Based on WS' determination and USFWS concurrence, the employment of methods by WS would not likely adversely affect any non-target species, including threatened and endangered species. These occurrences would be rare and should not affect the overall population of any species. WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to non-targets. Additionally, WS consults with the USFWS and the VDGIF to determine the potential risks to federally and state listed threatened and endangered species in accordance with the ESA and Commonwealth laws and annually reports to these entities to ensure that any non-target take by WS is considered as part of management objectives. Potential impacts to non-target species, including threatened and endangered species from the recommendation of methods by WS is expected to be variable. If methods are employed as recommended by WS and according to label requirements (in the case of chemical methods) potential risks to non-targets would be low. However, if methods are not employed as recommended or methods that are not recommended are employed, potential impacts to non-targets are likely to be higher.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

Despite no direct involvement by WS in resolving damage and threats associated with birds in the state, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. Lethal take could continue to occur either without a permit (if those species are non-native), during hunting seasons, under depredation orders or through the issuance of depredation permits by the USFWS or the VDGIF. Non-lethal methods have the potential to inadvertently disperse non-target wildlife while lethal methods have the potential to inadvertently capture or kill non-target wildlife. Management actions taken by non-federal entities would be considered the *environmental status quo*.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent bird damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action. Therefore, non-target populations would not be directly impacted by WS from a program implementing technical assistance only.

If direct operational assistance is not provided by WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and threats could lead to illegal take which could lead to real but unknown effects on other wildlife populations. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Potential impacts to non-target species, including threatened and endangered species from the recommendation of methods by WS under this alternative would be variable. If methods were employed as recommended by WS and according to label requirements, in the case of chemical methods, potential

risks to non-targets would likely be low and similar to the proposed action. WS' involvement would not be additive to take that could occur since the individual requesting WS' assistance could conduct bird damage management activities without WS' involvement. However, if methods were not employed as recommended or methods that are not recommended are employed, potential impacts to non-targets are likely to be higher.

Alternative 3 – WS Would Not Address Bird Damage

WS would not be involved with any aspect of bird damage management. Therefore, WS would have no direct impact to non-targets or threatened and endangered species under this alternative. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. Lethal take of birds could continue as stated under Alternative 2.

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

Potential impacts to non-target species, including threatened and endangered species would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, 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. Illegal, unsafe, and environmentally unfriendly actions could lead to real but unknown effects on non-target species. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003). However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing wildlife damage, the risks would be similar to Alternative 2.

Issue 3 – Effects of Damage Management Activities on Human Health and Safety

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage caused by birds. Both chemical and non-chemical methods have the potential to have adverse effects on human health and safety. Risks can occur both to persons employing methods and persons coming into contact with methods. Risks can be inherent to the method itself or related to the misuse of the method. Potential effects of damage management activities on human health and safety under each of the three alternatives are analyzed below.

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

Standard Operating Procedures (SOPs) for bird damage management in Virginia discussed in Chapter 3 ensure risks to human health and safety would be reduced or prevented. Pertinent SOPs include not only

the WS' Decision Model (WS Directive 2.201), an evaluation process for the appropriateness of methods (WS Directive 2.101) and the use of integrated management (WS Directive 2.105) but also several other SOPs including the following. WS identifies hazards in advance of work assignments and provides employees with personal protective equipment (PPE). WS employees must adhere to safety requirements and use appropriate PPE. WS employees are required to work cooperatively to minimize hazards and immediately report unsafe working conditions (WS Directive 2.601). Damage management activities would be conducted away from areas of high human activity (e.g., in areas closed to the public) or during periods when human activity is low (e.g., early mornings, at night) to the extent possible. Although hazards to human health and safety from both non-lethal and lethal methods exist, those methods would generally be regarded as safe when used by individuals trained and experienced in their use and with regard and consideration of possible risks to human health and safety.

Although some risk of bodily harm exists from the use of non-lethal non-chemical methods, when used appropriately and with consideration of possible risks these methods can be used with a high degree of safety. If used incorrectly, physical exclusion devices (e.g., electric fencing), frightening devices / deterrents (e.g., propane exploders, pyrotechnics, lasers, paintballs) can pose safety hazards. Other non-lethal methods available for use under any of the alternatives are live-capture traps (see Appendix C). Risks of most live-capture traps to human health and safety (decoy traps, nest box traps, clover/funnel/pigeon traps, mist nets, bow nets, hand nets, panel nets/drive traps, raptor traps) are small to non-existent. Risks of other live-capture traps including cannon/rocket nets, net guns and padded-jaw pole to human health and safety are greater. However, proper application of cannon/rocket nets, net guns and padded-jaw pole requires trained and experienced personnel to be present at all times. Live capture traps can only be triggered through direct activation of the device. Therefore, if left undisturbed, these traps would pose no risk. Under the proposed action, all WS personnel who use these devices would be trained and experienced in their use and required to wear appropriate PPE (WS Directive 2.601). WS would not implement these methods in locations or in such a manner in which they would pose hazards to WS staff or the public. When recommending these methods, WS would caution those persons against their misuse.

With the exception of Mesurol (EPA No. 56228-33), all non-lethal chemical methods could be available under all the alternatives. Non-lethal chemical methods used or recommended by WS would be registered as required by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (see Appendix C). When recommending these methods, WS would caution those persons against their misuse. WS personnel that use restricted-use chemical methods would be certified as pesticide applicators by the Commonwealth of Virginia and would be required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations and WS Directive 2.401. Mesurol is only registered for use by WS personnel who have been trained and certified in its use and whom are required to wear appropriate PPE they are provided with (WS Directive 2.601) (see Appendix C). Following label requirements of Mesurol eliminates the risk to human health and safety. These label requirements include posting the area of application with warning signs, a removal and disposal process for unconsumed or unused treated eggs.

WS personnel are trained and experienced in the use of firearms. WS employees who use shooting as a method must comply with WS Directive 2.615 and all standards described in the WS Firearms Safety Training Manual. Directive 2.615 requires that personnel undergo regular training, adhere to a set of safety standards, submit to drug testing, and are subject to the Lautenberg Amendment. WS' recommendation that hunting or shooting be used would not increase risks to human health and safety above those already inherent with hunting birds. When used appropriately and with consideration of human safety, risks associated with firearms are minimal. When recommending that hunting or shooting be used, WS would caution against the improper use of firearms. Since the use of firearms would be

available under any of the alternatives and their use could occur whether WS was consulted or not, the risks to human health and safety would be similar among all the alternatives.

As mentioned previously, the avicide DRC-1339 is only available for use by WS. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide and would be available under any of the alternatives. A common concern regarding the use of chemicals is the risk to human health and safety. WS personnel that use DRC-1339 would be certified as pesticide applicators by the Commonwealth of Virginia and be required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations. WS would follow all label requirements. Following label requirements of DRC-1339 or Starlicide eliminates these risks. When recommending the use of Starlicide, WS would caution against its misuse. Given the strict application requirements this avicide, WS does not anticipate any negative impacts on human health and safety. Additionally, WS does not anticipate any increased risks to human health and safety from providing technical assistance regarding Starlicide because it is commercially available as a restricted-use pesticide and would be available under any of the alternatives.

To limit the possibility that the public is exposed to birds which died from DRC-1339, WS would retrieve all dead birds to the extent possible and dispose of them in accordance with WS Directive 2.515. Locations where treated bait may be placed are determined based on product label requirements (*e.g.*, distance from water, specific location restrictions), the target bird species use of the site (determined through prebaiting and an acclimation period), non-target use of the area (areas with non-target activity are not used or abandoned), and based on human safety (*e.g.*, in areas restricted or inaccessible by the public or where warning signs have been placed). Once appropriate locations were determined, treated baits would be placed in feeding stations or would be broadcast using mechanical methods (ground-based equipment or hand spreaders) and by manual broadcast (distributed by hand) per label requirements. Once baited using the diluted mixture (treated bait and untreated bait) when required by the label, locations would be monitored for non-target activity and to ensure the safety of the public. After each baiting session, all uneaten bait would be retrieved. The prebaiting period allows treated bait to be placed at a location only when target birds were conditioned to be present at the site and provides a higher likelihood that treated bait would be consumed by the target species, which makes it unavailable for potential exposure to humans. To be exposed to the bait, someone would have to approach a bait site and handle treated bait. If the bait had been consumed by target species or was removed by WS, then treated bait would no longer be available and human exposure to the bait could not occur. Therefore, direct exposure to treated bait during the baiting process would only occur if someone approached a bait site that contained bait and if treated bait was present, would have to handle treated bait.

Factors that minimize any risk of public health problems from the use of DRC-1339 are: 1) its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops (DRC-1339 is not applied to feed materials that livestock can feed upon), 2) DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation (the half-life is about 25 hours; in general, DRC-1339 on treated bait material is almost completely broken down within a week if not consumed or retrieved), 3) the chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people, 4) application rates are extremely low (EPA 1995), 5) a human would need to ingest the internal organs of birds found dead from DRC-1339 to be exposed, and 6) the EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995).

Of additional concern is the potential exposure of people to crows harvested during the regulated hunting season that have ingested DRC-1339 treated bait. Baiting using DRC-1339 to reduce crow damage could occur during the period of time when crows can be harvested. Although baiting could occur in rural areas

during those periods, most requests for assistance to manage crow damage during the period of time when crows can be harvested occur in urban areas associated with urban crow roosts. Crows using urban communal roost locations often travel long distances to forage before returning to the roost location during the evening.

For a crow that ingested DRC-1339-treated bait to pose a potential safety risk to someone harvesting crows during the hunting season, a hunter would have to harvest a crow that ingested DRC-1339 treated bait and subsequently consume certain portions of the crow. The mode of action of DRC-1339 requires ingestion by crows so handling a crow harvested or found dead would not pose any primary risks to human safety. Although not specifically known for crows, in other sensitive species, DRC-1339 is metabolized and/or excreted quickly once ingested. In starlings, nearly 90% of the DRC-1339 administered dosages well above the LD_{50} for starlings was metabolized or excreted within 30 minutes of dosage (Cunningham et al. 1979). In one study, more than 98% of a DRC-1339 dose delivered to starlings could be detected in the feces within 2.5 hours (Peoples and Apostolou 1967) with similar results found for other bird species (Eisemann et al. 2003). Once death occurs, DRC-1339 concentrations appear to be highest in the gastrointestinal tract of birds, but some residue could be found in other tissue of carcasses examined (Giri et al. 1976, Cunningham et al. 1979, Johnston et al. 1999) with residues diminishing more slowly in the kidneys (Eisemann et al. 2003). However, most residue tests to detect DRC-1339 in tissues of birds have been completed using DRC-1339 dosages that far exceeded the known acute lethal oral dose for those species tested and far exceeds the level of DRC-1339 that would be ingested from treated bait. Johnston et al. (1999) found DRC-1339 residues in breast tissue of boat-tailed grackles (*Quiscalus major*) using acute doses ranging from 40 to 863 mg/kg. The acute lethal oral dose of DRC-1339 for boat-tailed grackles has been estimated to be $\leq$ 1 mg/kg, which is similar to the LD_{50} for crows (Eisemann et al. 2003). In those boat-tailed grackles consuming a trace of DRC-1339 up to 22 mg/kg, no DRC-1339 residues were found in the gastrointestinal track nor found in breast tissue (Johnston et al. 1999).

In summary, nearly all of the DRC-1339 ingested by sensitive species is metabolized or excreted quickly, normally within a few hours. Residues of DRC-1339 have been found in the tissues of birds consuming DRC-1339 at very high dosage rates that exceed current acute lethal dosages achieved under the label requirements of DRC-1339. Residues of DRC-1339 ingested by birds appear to be primarily located in the gastrointestinal tract of birds.

No adverse effects to human safety have occurred from WS' use of methods to alleviate bird damage from FY 2007 through FY 2012. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on potential use patterns, the chemical and physical characteristics of the above mentioned toxicants and repellents, and factors related to the environmental fate, no cumulative impacts are expected from the chemical components used or recommended by the WS program.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Direct operational assistance provided by WS as described above would not be available. This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses.

Despite no direct involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-

lethal and lethal methods. With the exception of Mesurol (EPA No. 56228-33) and DRC-1339, all methods listed in the Appendix could be available under this alternative, although some methods would only be available to those persons with pesticide applicator licenses. Although DRC-1339 is only available for use by WS, a product containing the same active ingredient, Starlicide, would be available. Private efforts to reduce or prevent damage would be expected to increase, and would likely result in less experienced persons implementing chemical or other damage management methods which may have a greater risk to human and pet health and safety than under Alternative 1. Ignorance and/or frustration caused by the inability to reduce losses could lead to illegal use of toxicants by others which could lead to unknown impacts to humans.

Potential impacts to human health and safety from the recommendation of methods by WS under this alternative would be variable. If methods were employed as recommended by WS and according to label requirements, in the case of chemical methods, potential risks to human health would likely be low and similar to the proposed action. However, if methods were employed without guidance from WS or applied inappropriately, the risks to human health and safety could increase.

Alternative 3 – WS Would Not Address Bird Damage

Under this alternative, WS would not be involved with any aspect of bird damage management. Therefore, WS would have no direct impact to human health and safety under this alternative. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods.

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

Potential impacts to human health and safety would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, 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. Illegal, unsafe, and environmentally unfriendly actions could lead to real but unknown effects on health and safety. However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing wildlife damage, the risks would be similar to Alternative 2.

Issue 4 – Humaneness and Animal Welfare Concerns

As described in Chapter 2, humaneness and animal welfare concerns associated with methods available to reduce bird damage has been identified as an issue. The humaneness and animal welfare concerns of the methods as they relate to the alternatives are discussed below.

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

As previously discussed, 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.

Bird damage management methods viewed by some persons as inhumane would be employed or recommended by WS under this alternative. These methods would include shooting, trapping, toxicants, and repellents. Despite SOPs designed to maximize humaneness, the perceived stress and trauma associated with being held in a trap until the WS employee arrives at the capture site to dispatch or release the animal is unacceptable to some persons. Other bird damage management methods used to take target animals, including shooting, result in a relatively humane death because the animals die instantly or within seconds to a few minutes. These methods, however, are also considered inhumane by some individuals. Some individuals believe any use of lethal methods to alleviate damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS would be to use methods as humanely as possible to alleviate requests for assistance to reduce damage and threats. WS would continue to evaluate methods and activities to minimize the pain and suffering. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (WS Directive 2.430, WS Directive 2.505) and recommended by the AVMA for use on free-ranging wildlife under field conditions (AVMA 2007).

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a cage trap is generally considered by most members of the public as "*humane*". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately. Therefore, the goal would be to address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some bird damage management methods are used in situations where non-lethal damage management methods are not practical or effective.

Overall, the management of resources, physical exclusion, or frightening devices are regarded as humane when used appropriately. Although some issues of humaneness and animal welfare concerns could occur from the use of live-capture methods, 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 would 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. When live-capture devices are deemed appropriate, WS personnel would be present on-site during capture events or methods would be checked frequently to ensure birds captured were

addressed timely to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

Nicarbazin is currently the only reproductive inhibitor that is registered with the EPA for application with birds. Nicarbazin (sold under the trade name OvoControl™) can be used to reduce pigeon egg production and viability (for detailed discussion see Appendix C). The use of nicarbazin would generally be considered as a humane method. Nicarbazin reduces the hatchability of eggs. Consuming bait daily did not appear to adversely affect chicks that hatched from female birds fed nicarbazin (Avery et al. 2006, Avery et al. 2008). Nicarbazin has been characterized as a veterinary drug since 1955 by the FDA treat outbreaks of coccidiosis in broiler chickens to with no apparent ill effects to chickens. Based on current information, the use of nicarbazin would generally be considered humane based on current research.

Mesurol (EPA No. 56228-33) was recently registered by WS (for WS use only) as a bird repellent to deter predation by crows and ravens on eggs of threatened and endangered species. After ingestion, birds develop post-ingestional malaise but recover (Dimmick and Nicolaus 1990). When used appropriately and by trained personnel, Mesurol would not result in the inhumane treatment of wildlife.

Also under the proposed action, lethal methods could also be employed to alleviate or prevent bird damage and threats, when requested. Lethal methods would include the recommendation that birds be harvested during the regulated hunting season, shooting, DRC-1339 (or Starlicide), Avitrol, and euthanasia after birds were live-captured. WS' use of euthanasia methods under the proposed action would adhere to WS' directives (see WS Directive 2.430, WS Directive 2.505). The euthanasia methods available for use under the proposed action for live-captured birds would be shooting, cervical dislocation and carbon dioxide. The AVMA guidelines on euthanasia list cervical dislocation and carbon dioxide as acceptable methods of euthanasia for free-ranging birds, which can lead to a humane death (AVMA 2007). The use of cervical dislocation or carbon dioxide for euthanasia would occur after the animal has been live-captured and away from public view. Although the AVMA guidelines also list gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (AVMA 2007). WS' personnel that employ firearms to address bird damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death.

With the exception of DRC-1339, all lethal methods listed in the Appendix would be available under all alternatives. However, a product containing the same active ingredient, Starlicide, is commercially available as a restricted-use pesticide for managing damage associated with starlings, red-winged blackbirds, common grackles, and brown-headed cowbirds at livestock and poultry operations. Although the mode of action of DRC-1339 and Starlicide is not well understood, when ingested it appears to cause death primarily by nephrotoxicity in susceptible species and by central nervous system depression in non-susceptible species (DeCino et al. 1966, Westberg 1969, Schafer, Jr. 1984). DRC-1339 causes irreversible necrosis of the kidney and the affected bird is subsequently unable to excrete uric acid with death occurring from uremic poisoning and congestion of major organs (DeCino et al. 1966, Knittle et al. 1990). The external appearances and behavior of starlings that ingested DRC-1339 slightly above the LD_{50} for starlings appeared normal for 20 to 30 hours, but water consumption doubled after 4 to 8 hours and decreased thereafter. Food consumption remained fairly constant until about 4 hours before death, at which time starlings refused food and water and became listless and inactive. The birds perched with feathers fluffed as in cold weather and appeared to doze, but were responsive to external stimuli. As death nears, breathing increased slightly in rate and became more difficult; the birds no longer responded to external stimuli and became comatose. Death followed shortly thereafter without convulsions or spasms (DeCino et al. 1966). Birds ingesting a lethal dose of DRC-1339 become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. This method appears to result in a less stressful death than which probably occurs by most natural causes, which are primarily disease,

starvation, and predation. In non-sensitive birds and mammals, central nervous system depression and the attendant cardiac or pulmonary arrest is the cause of death (Felsenstein et al. 1974).

Avitrol is a chemical method that works as a dispersing agent. When a treated particle is consumed, affected birds begin to emit distress calls and fly erratically, thereby frightening the remaining flock away (see discussion in Appendix C). Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. In most cases where Avitrol is used, only a small percentage of the birds are affected and killed by the chemical, with the rest being dispersed. In experiments to determine suffering, stress, or pain in affected animals, Rowsell et al. (1979) tested Avitrol on pigeons and observed subjects for clinical, pathological, or neural changes indicative of pain or distress but none were observed. Conclusions of the study were that the chemical met the criteria for a humane pesticide. Avitrol is a restricted use pesticide that can only be used by certified applicators but would be available for use under any of the alternatives.

The majority of the methods listed in Appendix C would be available for use under any of the alternatives. Therefore, 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.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

Despite no direct involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. The issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed under the proposed action. 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 the proposed action.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target bird species and to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by an individual would be based on the skill and knowledge of the requester in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of birds or improperly identifying the damage caused by birds 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 in the proposed action alternative.

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 or distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requesters implementing methods are 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 birds would likely be higher.

Alternative 3 – WS Would Not Address Bird Damage

Under this alternative, WS would not be involved with any aspect of bird damage management. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. 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 the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public to use to alleviate damage and threats caused by birds. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing bird damage apply those methods considered humane methods 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 those persons experiencing bird damage were not provided with information and demonstration on the proper use of those methods and employed humane methods in ways that were inhumane, the issue of method humaneness could be greater under this alternative. 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.

Issue 5 – Effects of Bird Damage Management Activities on the Aesthetic Values of Birds

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

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

The implementation or recommendation of methods by WS under this alternative would result in the dispersal, exclusion, or removal of individuals or small groups of birds to alleviate damage and threats. In some instances where birds were dispersed or removed, the ability of interested persons to observe and enjoy those birds 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, because once the attractant was removed or made unavailable, the birds would likely disperse to other areas. WS has no authority to regulate take or harassment of birds. That authority rests with the USFWS and the VDGIF. Therefore, WS involvement in bird damage management activities would not increase the number of birds taken or dispersed. Those birds removed or dispersed by WS under this alternative, would likely be those same birds that could and likely would be removed or dispersed by those individuals experiencing damage in the absence of assistance from WS. Since those birds removed or dispersed by WS under this alternative could be removed by other entities, WS' involvement in removing those birds would not likely be additive to the number of birds that could be taken in the absence of WS' involvement. The lethal take of birds can occur either without a permit if those species are non-native, during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS or the VDGIF.

Direct operational assistance would only be conducted by WS after a request for assistance was received and after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance. WS' take of birds over the last five years has been of low magnitude when compared to population estimates, population trends and other available information (see Issue 1, Alternative 1 for additional information on impacts to target bird populations). Given the limited take proposed by WS under this alternative, when compared to the known sources of mortality of birds and their population information, damage management activities conducted by WS pursuant to the proposed action would not adversely affect the aesthetic value of birds.

Some aesthetic value could be gained by the removal of birds when artificially high populations of birds (either native or non-native) have displaced other wildlife and plants allowing for the return of a more natural environment. The ability to view and enjoy birds would remain if a reasonable effort were made to locate birds outside the area in which damage management activities occurred. The impact on the aesthetic value of birds and the ability of the public to view and enjoy birds under the proposed action would be similar to the other alternatives and would likely be low.

When damage caused by birds has occurred, any removal of birds by the property or resource owner would likely occur whether WS was involved with taking the birds or not. Therefore, the activities of WS are not 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.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

The provision of technical assistance by WS under this alternative is unlikely to increase the number of birds addressed because those individuals experiencing damage could and likely would employ both lethal and non-lethal methods in the absence of WS' assistance. Since birds could continue to be taken or dispersed under this alternative, despite WS' lack of direct involvement, the ability to view and enjoy

birds would likely be similar to the other alternatives. The lack of WS' direct involvement would not lead to a reduction in the number of birds dispersed or taken since WS has no authority to regulate take or the harassment of birds. The USFWS and the VDGIF have management authority over birds and would continue to adjust all take levels based on population objectives for those bird species in the Commonwealth. Therefore, the number of birds lethally taken annually during hunting seasons, under depredation orders, or through the issuance of depredation permits would be regulated and adjusted by the USFWS and the VDGIF. Because those individuals experiencing damage could and likely would continue to employ both lethal and non-lethal methods, despite WS' lack of direct involvement under this alternative, the impacts to the aesthetic value of birds would be similar to the other alternatives. Impacts would only be lower than the proposed action alternative if those individuals experiencing damage were not as diligent in employing methods as WS would be if conducting direct operational assistance. If those people experiencing damage abandoned the use of those methods then birds would likely remain in the area and available for viewing and enjoying for those people interested in doing so.

Alternative 3 – WS Would Not Address Bird Damage

Under this alternative, WS would not be involved with any aspect of bird damage management. Therefore, WS would have no direct impact on the aesthetic values of birds under this alternative. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the VDGIF, the VDACS, and/or private entities. Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods.

Since birds could continue to be taken or dispersed under this alternative, despite WS' lack of involvement, the ability to view and enjoy birds would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of birds dispersed or taken since WS has no authority to regulate take or the harassment of birds. The USFWS and the VDGIF have management authority over birds and would continue to adjust all take levels based on population objectives for those bird species in the Commonwealth. Therefore, the number of birds lethally taken annually during hunting seasons, under depredation orders, or through the issuance of depredation permits would be regulated and adjusted by the USFWS and the VDGIF. Under this alternative, those individuals experiencing damage could and likely would continue to employ both lethal and non-lethal methods, despite WS' lack of involvement. Therefore, the impacts to the aesthetic value of birds would be similar to the other alternatives. Impacts would only be lower than the proposed action alternative if those individuals experiencing damage were not as diligent in employing methods as WS would be if conducting direct operational assistance. If those people experiencing damage abandoned the use of those methods then birds would likely remain in the area and available for viewing and enjoying for those people interested in doing so.

Issue 6 – Effects of Bird Damage Management Activities on the Regulated Harvest

Another issue commonly identified as a concern is that damage management activities could affect the ability of hunters to harvest species targeted by management activities. Potential impacts could arise from both lethal and non-lethal damage management methods. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. If the target species is also a harvestable bird species, the presence of these species could be reduced in the area where damage management activities are occurring. Lethal methods remove individuals of the species (target species) causing the damage, thereby reducing the local population and the presence of those species in the area. Therefore, if the target species is also a harvestable bird species, lethal methods could reduce the local population and the presence of harvestable bird species in the area where damage management activities are occurring.

Often, bird damage management activities are conducted in areas where hunting is restricted (e.g., airports) or has been ineffective (e.g., urban areas). Because both non-lethal and lethal methods disperse birds from areas where damage is occurring, birds may move from areas where hunting is restricted to areas more accessible to hunters (i.e., individual birds not directly removed by lethal methods may disperse from an area due to secondary effects of the method, such as noise created by firearms).

Species addressed in this EA which are harvestable during regulated hunting seasons in the Commonwealth include: wild turkey, Wilson's snipe, mourning dove, American crow and fish crow.

Alternative 1 – WS Would Continue to Address Bird Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)

Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

The proposed level of take for species which are harvestable during the regulated season would be of low magnitude when compared to the overall population and the cumulative take from all known sources (see Issue 1, Alternative 1 for additional species specific information). When WS' proposed take of harvestable bird species was included as part of the cumulative take of those species from all known sources and compared to the estimated populations of those species, the potential impacts on those species' population were below the level of removal that would cause a decrease in the population. WS' bird damage management activities would primarily be conducted in areas where hunting access was restricted (*e.g.*, airports) or has been ineffective (*e.g.*, urban areas). Additionally, the use of non-lethal or lethal methods often disperses birds from areas where damage is occurring to areas outside the damage area, which could serve to move birds from areas which are less accessible to places which are more accessible to hunters.

The MBTA grants the USFWS the authority to establish hunting seasons for the take of migratory birds and crows. USFWS uses its authority to issue frameworks for the take of migratory game birds to state wildlife agencies such as the VDGIF. These frameworks include the allowable length of hunting seasons, methods of take, and allowed take which are implemented by the state wildlife agency. The VDGIF is responsible for establishing and enforcing hunting seasons for bird species such as wild turkey that are not listed under the Migratory Bird Treaty Act (MBTA) (Title 34, Section 322 c(1)). It is also responsible for establishing and enforcing hunting seasons in the Commonwealth for migratory game birds listed under the MBTA under frameworks developed by the USFWS.

With oversight by the USFWS and the VDGIF, the lethal removal of birds by WS or the recommendation of hunting by WS would not limit the ability to harvest birds during the regulated harvest season. All take by WS would be reported to the USFWS and the VDGIF annually to ensure take by WS was incorporated into cumulative population management objectives established for harvestable bird populations. Based on the limited take proposed by WS and the oversight by the USFWS and the VDGIF, WS' take of birds under this alternative would have no effect on the ability of those people interested to harvest birds during the regulated harvest season.

Alternative 2 – WS Would Address Bird Damage Using Technical Assistance Only

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with birds with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

The provision of technical assistance by WS under this alternative is unlikely to increase the number of birds addressed because those individuals experiencing damage could and likely would employ both lethal and non-lethal methods in the absence of WS' assistance. Since harvestable birds could continue to be taken or dispersed under this alternative, despite WS' lack of direct involvement, the ability to harvest these birds would be similar among the alternatives. If those individuals experiencing damage caused by harvestable bird species received a recommendation from WS to use dispersal methods to reduce damage and chose to implement those methods, it is likely that those birds would be dispersed. In this scenario, it is possible that birds would be dispersed from areas more accessible to hunters to areas which are less accessible to hunters. However, it is also possible birds would be dispersed from areas less accessible to hunters to areas which are more accessible to hunters. The recommendation of dispersal methods by WS would not impact the ability of persons interested in doing so to harvest birds. Additionally, lethal methods including the take of birds during the regulated hunting season could be recommended by WS for harvestable bird species under a technical assistance only alternative. However, the use of those methods could only occur after the property owner or manager obtained the necessary permits or licenses from the USFWS and or the VDGIF or if birds were taken under a depredation order. Therefore, WS' recommendation of lethal methods, including hunting, under this alternative would not limit the ability of those people interested to harvest birds during the regulated season since the USFWS and VDGIF determine the number of birds that may be taken.

Alternative 3 – WS Would Not Address Bird Damage

Under this alternative, WS would not be involved with any aspect of bird damage management. Therefore, WS would have no direct impact on the ability to harvest birds under this alternative. Despite no involvement by WS in resolving damage and threats associated with birds, those persons experiencing damage caused by birds could continue to alleviate damage by employing both non-lethal and lethal methods. The number of birds lethally taken annually during hunting seasons, under depredation orders, or through the issuance of depredation permits would be regulated and adjusted by the USFWS or the VDGIF.

4.2 CUMULATIVE EFFECTS OF THE PROPOSED ACTION / NO ACTION ALTERNATIVE

WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.), USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Cumulative impacts, as defined by the CEQ (40 CFR 1508.7), are impacts to the environment that results from the incremental impacts 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 the proposed action/no action alternative (Alternative 1) WS would respond to requests for assistance by: 1) taking no action, if warranted, 2) providing technical assistance to property owners or managers on actions they could take to reduce damage or threats of damage, or 3) provide technical assistance and direct operational assistance to a property owner or manager experiencing damage or threats of damage. Under this alternative, WS would be the primary agency conducting direct operational assistance. However, other federal, Commonwealth and private entities could also be conducting bird damage management activities.

WS does not normally conduct direct damage management activities concurrently with other public (federal or Commonwealth) entities in the same area but these activities may occur at adjacent sites within the same period. However, WS may conduct direct damage management activities concurrently in the same area that private entities such as commercial pest control companies are conducting similar

activities. The potential cumulative effects analyzed below could occur because of A) the aggregate effects of WS' activities along with the activities of other entities and individuals either over a short or extended period of time or B) because of the aggregate effects of WS' activities over a short or extended period. Through ongoing coordination and collaboration between WS, the USFWS, and the VDGIF, the activities of each agency and the take of birds during hunting seasons, under depredation orders or depredation permits would be available. Damage management activities would be monitored to ensure they are within the scope of analysis of this EA.

Cumulative Impacts on Wildlife Populations

Evaluation of WS' activities relative to wildlife populations indicated that program activities will likely have no cumulative adverse effects on populations in Virginia. WS' actions would be occurring simultaneously, over time, with other natural processes and human-generated changes that are currently taking place. Those activities include, but are not limited to:

- Natural mortality of wildlife
- Human-induced mortality through private damage management activities
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in population densities

All those factors play a role in the dynamics of wildlife populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. WS' 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 evaluates damage occurring, including other affected elements and the dynamics of the damaging species; determines appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

No cumulative adverse impacts on wildlife populations are expected from WS' actions based on the following considerations:

Historical outcomes of WS' programs on wildlife
No cumulative adverse effects have been identified for wildlife as a result of program activities implemented over time based on analyses contained in the EA, from annual monitoring reports, or from analyses contained in the proposed supplement. WS continues to implement an integrated damage management program that adapts to the damage situation and the species involved with causing the damage. WS only targets wildlife causing damage and only after a request for assistance is received. All program activities are coordinated with appropriate federal, state, and local entities to ensure WS' activities do not adversely impact the populations of any native wildlife species.

In the past several years, the number of species and the total number of bird species addressed by WS has increased annually which provides some indication that WS' activities are not cumulatively impacting populations. WS continues to implement an integrated program that employs primarily non-lethal dispersal and harassment methods. WS will continue to provide technical assistance to those persons requesting assistance to identify and alleviate damage.

SOPs built into WS' program
SOPs are designed to reduce the potential negative effects of WS' actions on wildlife, 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 program activities are defined through SOPs, and implementation is insured through monitoring, in accordance with WS' Decision Model (Slate et al. 1992).

Migratory Bird Treaty Act, as amended
The Migratory Bird Treaty Act, as amended, places the protection of all bird species designated under the Act under the management authority of the USFWS. All take for damage management purposes is authorized by permit or order pursuant to the Act issued by the USFWS. Oversight of the allowed take of bird species by the USFWS ensures cumulative impacts are considered and addressed when determining the allowable take of bird species to ensure the viability of a population. The allowed take, including cumulative take, is analyzed and determine by the USFWS prior to the issuance of permits under the Act. Therefore, WS' allowed take, as authorized by the USFWS by permit, should not reach a level where cumulative take would adversely impact bird populations.

Summary of Cumulative Impacts

No significant cumulative environmental impacts are expected from any of the proposed actions analyzed in this supplement. Under the Current/Proposed Action, the lethal removal of birds by WS has not and would not have a significant impact on overall bird populations in Virginia or nationwide, but some local reductions may occur. No risk to public safety is expected when WS' services are provided and accepted by continuing the bird damage management program with the included supplemental actions since only trained and experienced wildlife biologists/specialists would conduct and recommend bird damage management activities. Although some persons will likely be opposed to WS' participation in bird damage management activities on public and private lands, the analysis in this EA indicates that WS integrated bird damage management program would not result in significant cumulative adverse impacts on the quality of the human environment.

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APPENDIX A: LITERATURE CITED

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APPENDIX B: ADDITIONAL BIRD SPECIES THAT COULD BE ADDRESSED BY WILDLIFE SERVICES

In addition to the species identified in Chapter 1, WS also receives requests for assistance to manage damage and threats of damage associated with several other bird species. Damages and threats of damages associated with those species would occur primarily at airports where those species pose a threat of aircraft strikes. Those species that WS could address in low numbers and/or infrequently when those species cause damage or pose a threat of damage include; brown pelican (*Pelecanus erythrorhynchos*), snowy egret (*Egretta thula*), green heron (*Butorides virescens*), black-crowned night-heron (*Nycticorax nycticorax*), yellow-crowned night-heron (*Nyctanassa violacea*), glossy ibis (*Plegadis falcinellus*), black-bellied plover (*Pluvialis squatarola*), semipalmated plover (*Charadrius semipalmatus*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), willet (*Catoptrophorus semipalmatus*), dunlin (*Calidris alpina*), least sandpiper (*Calidris minutilla*), lesser black-backed gull (*Larus fuscus*), Caspian tern (*Sterna caspia*), common tern (*Sterna hirundo*), Eurasian collared-dove (*Streptopelia decaocto*), chimney swift (*Chaetura pelagica*), yellow-bellied sapsucker (*Sphyrapicus varius*), red-bellied woodpecker (*Melanerpes carolinus*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), pileated woodpecker (*Dryocopus pileatus*), Northern flicker (*Colaptes auratus*), Eastern kingbird (*Tyrannus tyrannus*), blue jay (*Cyanocitta cristata*), bank swallow (*Riparia riparia*), Eastern blue bird (*Sialia sialis*), Northern cardinal (*Cardinalis cardinalis*), grasshopper sparrow (*Ammodramus savannarum*), savannah sparrow (*Passerculus sandwichensis*), dark-eyed junco (*Junco hyemalis*), bobolink (*Dolichonyx oryzivorus*), Lapland longspurs (*Calcarius lapponicus*), Wilson's snipe (*Gallinago delicata*), and house finch (*Carpodacus mexicanus.*

Table B1 – Additional bird species addressed in the EA and resources affected by these bird species[1].

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
brown pelican	X		X	X	Yellow-bellied sapsucker			X	X
snowy egret	X		X	X	Red-bellied woodpecker			X	X
green heron	X		X	X	Downy woodpecker			X	X
black-crowned night-heron	X		X	X	Hairy woodpecker			X	X
yellow-crowned night heron	X		X	X	Pileated woodpecker			X	X
glossy ibis	X		X	X	Northern flicker			X	X
black-bellied plover			X	X	Eastern kingbird	X		X	X
semipalmated plover			X	X	Blue jay			X	X
greater yellowlegs			X	X	Bank swallow			X	X
lesser yellowlegs			X	X	Eastern blue bird			X	X
willet			X	X	Northern cardinal			X	X
dunlin			X	X	Grasshopper sparrow			X	X
least sandpiper			X	X	Savannah sparrow			X	X
Lesser black-backed gull			X	X	Dark-eyed junco			X	X
Caspian tern			X	X	Bobolink			X	X
Common tern			X	X	Lapland longspurs			X	X
Eurasian collared-dove		X	X	X	Wilson's snipe			X	X
Chimney swift			X	X	House finch			X	X

[1]A=Agriculture, N =Natural Resources, P=Property, H=Human Safety

APPENDIX C: METHODS AVAILABLE FOR PREVENTING, REDUCING AND ELIMINATING DAMAGE AND THREATS ASSOCIATED WITH BIRDS IN THE COMMONWEALTH OF VIRGINIA

A variety of methods are potentially available to the WS program in Virginia. Various federal, Commonwealth, and local statutes and regulations and WS Directives govern WS' use of these methods. The following methods and materials may be recommended or used in technical assistance and direct damage management efforts of the WS program in Virginia. Not all methods would be considered effective, efficient, practical, or legal in every situation and may not be recommended or utilized.

NON-LETHAL METHODS (NON-CHEMICAL)

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners or managers to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without substantially increasing a resource owner's costs or diminishing their ability to manage resources pursuant to goals. Resource management recommendations are made through WS technical assistance efforts.

Animal Husbandry: This category includes modifications in the level of care and attention given to livestock, shifts in the timing of breeding and births, selection of less vulnerable livestock species, and introduction of human custodians or guard animals to protect livestock. The level of attention given to livestock varies. Generally, when the frequency and intensity of livestock handling increases, so does the degree of protection. The use of human custodians, may reduce damage levels, but can be very costly.

The risk of predation to poultry and small livestock, primarily newborns, can be reduced when operations monitor their livestock during the hours when predatory birds are most active. The risk of predation is usually greatest with immature livestock, and this risk can be reduced by holding pregnant females and newborns in pens or sheds. The risk of predation to livestock diminishes with age and the increase in size. Shifts in breeding schedules can reduce the risk of predation by altering the timing of births to coincide with the greatest availability of natural food items for predators or to avoid seasonal concentrations of migrating predators.

Altering animal husbandry to reduce wildlife damage has many limitations. Gathering may not be possible when grazing conditions require livestock to scatter. Hiring extra people, building secure holding pens, and adjusting the timing of births is usually expensive. The timing of births may be related to weather or seasonal marketing of livestock. The expense associated with a change in husbandry practice may exceed the savings. WS encourages resource owners to use these strategies where they may be beneficial, but does not conduct direct operational assistance.

Crop Selection and Scheduling: In areas where damage to crops from birds occurs, different crops can be planted that are less attractive to the birds causing damage. Alternatively, crops can be planted at an earlier or later date to coincide with periods when there is a greater availability of natural food items. This practice depends on the species causing damage, the availability of alternate food sources, and the market for alternative crops. Research has been conducted on damage resistant crop varieties with little success.

Lure Crops: If depredation cannot be avoided by careful crop selection or a modified planting schedule, lure crops can sometimes be used to mitigate the potential loss (Cummings et al. 1987). Lure crops are crops planted or left for consumption by wildlife as an alternate food source. To improve the efficacy of this technique, frightening devices should be used in nearby non-lure crop fields and wildlife should not be disturbed in the lure crop fields. This approach provides relief for critical crops by sacrificing less

important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area. Lure crops have been used successfully to reduce damage by cranes and geese in the Middle Rio Grande Valley of New Mexico for many years (USDA WS 2009). Implementation of this method is limited by the authority of those involved to manage the property.

Habitat Management: Localized habitat management is often an integral part of wildlife damage management. The type, quality, and quantity of habitat are directly related to the species of wildlife in an area. Therefore, it is possible to manage habitat in a way that discourages its use by specific species. For example, vegetation can be planted that is unpalatable to certain wildlife species or trees and shrubs can be pruned or cleared to make an area unattractive for roosting birds. Ponds or other water sources can be eliminated or modified to reduce their attractiveness to birds. Habitat management is typically aimed at eliminating nesting, roosting, loafing, or feeding sites used by particular species. Limitations of habitat management as a method of reducing wildlife damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats. In most cases, the resource or property owner or manager is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Most habitat management recommended by WS is aimed at reducing wildlife aircraft strike hazards at airports or eliminating winter bird roosts.

Change in the architectural design of a building or a public space can often help to avoid potential wildlife damage. For example, selecting species of trees and shrubs that are not attractive to wildlife can reduce the likelihood of potential wildlife damage in parks, public spaces, or residential areas. Similarly, incorporating spaces or open areas into landscape designs that reduce the cover available to wildlife can reduce potential problems. However, modifying public spaces to remove the potential for wildlife conflict is often impractical because of costs or the presence of other nearby habitat features that attract wildlife. Some forms of habitat management may also be incompatible with the aesthetic or recreational features of the site. Birds use trees, poles or signs for roosting, perching and nesting. The removal or modification of these could reduce the attractiveness of the area or may not be possible. The number of birds roosting at large winter roosts can be greatly reduced by removing all the trees or selectively thinning the trees. Roosts often re-form year after year at the same site, and substantial habitat alteration is the only way to permanently stop such activity.

Modification of Human Behavior: Altering human behavior may resolve conflicts between humans and birds. For example, WS encourages eliminating the feeding of birds that occurs in parks, recreational sites, or residential areas to reduce damage by species, such as rock pigeons and gulls. This includes the inadvertent feeding allowed by improper disposal of garbage or leaving pet food outdoors where birds can feed on it, especially near restaurants. Many bird species adapt well to human environments, but their proximity to humans may result in damage to structures or threats to public health and safety. Eliminating bird feeding and handling can reduce potential problems, but many people who are not directly affected by problems caused by birds enjoy watching wild animals and engage in activities that encourage their presence. It is difficult to consistently enforce no-feeding regulations and to effectively educate all people concerning the potential liabilities of feeding birds. Additionally, artificial feeding of birds by humans attracts and sustains more birds in an area than could normally be supported by natural food supplies. This unnatural food source exacerbates damage. The Commonwealth of Virginia allows localities to enact and enforce ordinances that prohibit the feeding of wildlife. Some localities have enacted such ordinances and taken steps to educate the public about the negative aspects of feeding wildlife and the existence of the ordinance. However, the public does not always comply and ordinances must be enforced to be effective.

PHYSICAL EXCLUSION

Physical exclusion methods restrict the access of birds to resources. These methods can provide effective prevention of bird damage in many situations. Bird proof barriers can be effective but are often cost-prohibitive, particularly because of the aerial mobility of birds which requires overhead barriers as well as peripheral fencing or netting. Exclusion adequate to stop bird movements can also restrict movements of livestock, people, and other wildlife (Fuller-Perrine and Tobin 1993). Exclusionary devices are often more costly than the value of the resource being protected, especially for large areas, and, therefore, are uneconomical and not used often. In addition, some exclusionary devices are labor intensive which can further reduce their cost-effectiveness. Exclusionary devices can inadvertently capture, injure or kill non-target wildlife species, including threatened and endangered species. Because of this, certain methods would not be appropriate when threatened and endangered species which could be affected by these methods are present. In these situations, exclusion methods would not be recommended.

Fencing: Fences are widely used to prevent damage from wildlife. However, the construction or placement of physical barriers has limited application for birds. Lawn furniture, vehicles, boats, snow fencing, plastic hazard fencing, woven wire fencing, multiple strand fencing and electric fencing have all been used to limit the movement of birds. Barriers can be either temporary or permanent structures. Fences constructed of woven wire or multiple strands of electrified wire can be effective in keeping wading birds from aquaculture facilities. However, with any type of fencing the distance between wires must be small enough and the height of the fence high enough to keep the birds from entering the area. Birds that are capable of or willing to fly into areas enclosed with barrier fencing render this method useless, unless areas are small enough to prevent birds from landing. At aquaculture facilities, fences should be high enough to prevent birds feeding from above. Application of fencing is limited as it can create problems associated with restricting access to people, domestic animals and other wildlife. Additionally, even an electrified fence is not always bird-proof and the expense of the fencing can often exceed the benefit. Application of electric fencing is also limited due to the possibility or likelihood of interaction with people and other animals. Additional limits of this application include the ability to erect, and in the case of electric fencing, electrify and maintain power to the fence.

Surface Coverings: Overhead barriers such as netting and wire grids are mostly used to prevent birds from accessing areas such as gardens, fish ponds, rooftops, and livestock and poultry pens. Selection of a barrier system depends on the bird species involved, expected duration of the damage, size of the area to be excluded, compatibility of the barrier with other operations (e.g., feeding, cleaning, harvesting, etc.), resilience to weather, and aesthetics. Birds may be excluded from ponds or other areas using overhead wire grids (Fairaizl 1992, Lowney 1993). Birds apparently fear colliding with the wires and thus avoid flying into areas where the method has been employed. Overhead wire grids have been demonstrated to be most applicable for use on ponds of two acres or less. Installation costs are about $1,000 per acre for materials and they can be financially burdensome to maintain. Another option for bodies of water is to cover the surface with plastic balls approximately five inches in diameter. Floating plastic balls marketed under the trade name Euro-Matic Bird Balls™ have successfully been used at airports and settling ponds to keep birds from landing on ponds. However, these systems are very expensive, costing about $131,000 per surface acre of water. Netting can also be used to exclude birds from a specific area by placing it over and around the specific resource to be protected. Netting is typically used to protect areas such as poultry pens, fish ponds and raceways, and high value crops. Exclusion with wire grids, ball blankets or netting may be impractical for large areas (e.g., commercial agriculture) but can be practical in small areas (e.g., personal gardens, ponds less than 2 acres) or for high-value crops (e.g., grapes). Although surface coverings can provide short-term relief from damage, they may not completely deter birds from feeding, loafing, staging, or roosting at the site. Additionally, some people may consider wire grids, ball blankets or netting aesthetically unappealing.

Predator Exclosures on Nests: Studies have shown that predator exclosures can help minimize predation to piping plover nests (Smith et al. 2011). However, this minimization is largely limited to eggs, as chicks leave the nest bowl soon after hatching. Several authors have noted that avian predators will associate exclosures with a potential meal causing increased predation on adults (Nol and Brooks 1982, Johnson and Oring, 2002, Neuman et al. 2004 and Isaksson et al. 2007). Therefore the use of exclosures should be carefully evaluated prior to use (Smith et al. 2011).

Other Exclusionary Methods: Entrance barricades of various kinds are used to exclude bird species such as starlings, pigeons, and House sparrows from dwellings, storage areas, gardens, or other areas. Heavy plastic strips hung vertically in open doorways have been successful in excluding birds from buildings used for livestock (Johnson and Glahn 1994). Similarly, metal flashing or hardware cloth may be used to prevent entry of wildlife into buildings or roosting areas. Additionally, short, sharp and pointy wire, placed along roosting surfaces, (marketed under the trade name Nixalite™ and Catclaw™) can be used to exclude pigeons and other birds from ledges and other roosting surfaces (Williams and Corrigan 1994). The sharp points inflict temporary discomfort on the birds as they try to land which deters them from roosting. Drawbacks of this method are that some birds will build nests on top of the wire and that it can be expensive to implement when large areas are involved. Additionally, shelters have been placed in tern colonies to give flightless chicks a place to hide from avian predators (Burness and Morris 1992, Jenks-Jay 1982). There are many more examples of these types of exclusionary devices to keep birds from entering, loafing or resting in areas where they are unwanted.

FRIGHTENING DEVICES OR DETERRENTS

Frightening devices are used to repel birds from areas where they are causing damage or posing threats of damage. The success of frightening methods depends on an animal's fear of, and subsequent aversion to, offensive stimuli (Shivik and Martin 2001). A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used scare tactics and ignore them (Rossbach 1975, Pfeifer and Goos 1982, Conover 1982, Shirota et al. 1983, Mott 1985, Dolbeer et al. 1986, Tobin et al. 1988). In addition, in many cases birds frightened from one location become a problem at another.

Devices used to frighten or deter birds are probably the oldest methods of combating wildlife damage. These devices may be either auditory or visual and generally only provide short-term relief from damage. However, a number of sophisticated techniques have been developed to scare or harass birds from an area. Methods include but are not limited to; reflective tape, flags, scarecrows, effigies, eye spot balloons, alarm or distress calls, propane exploders, pyrotechnics, vehicles, lights, lasers, or paintballs. These methods are used to frighten birds from the area where damage is occurring. As with other methods, these techniques tend to be more effective when used collectively in a varied regime rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting (see Shooting). These techniques are generally only practical for small areas. Finally, it must be noted that sound-scare devices can also scare people, domestic or wild animals when they are used in their vicinity.

Reflective Tape and Flags: Visual deterrents such as reflective tape (Mylar® tape), flags, and wind socks are sometimes effective in reducing bird damage. Both reflective tape, which has a mirror like surface that can produce flashes of light when exposed to the sun, and flags which are made of lightweight materials that can move in the wind, can produce visual effects that can startle birds. Some studies have shown reflective tape can successfully repel some birds from crops (Bruggers et al. 1986, Dolbeer et al. 1986). While other studies have shown that reflective tape is ineffective (Bruggers et al. 1986, Dolbeer et al. 1986, Tobin et al. 1988, Conover and Dolbeer 1989). Both reflective tape and

flagging is impractical in many locations and is considered aesthetically unappealing to some people. These devices can be effective but effectiveness is reduced after a short time as birds become accustomed to and learn to ignore them.

Scarecrows or Effigies: The use of scarecrows or effigies has had mixed results. Scarecrows or effigies which mimic alligators, humans, floating swans, and dead birds as well as air-filled balls with 'eye spots' have been employed, with limited success for short time periods in small areas. In general, scarecrows or effigies are most effective when they are moved frequently, used as part of an integrated approach, and are well maintained. However, the effectiveness of scarecrows and effigies is reduced after a short time as birds become accustomed to and learn to ignore them and as bird populations increase (Smith et al. 1999). Avery et al. (2002) and Seamans (2004) found that the use of vulture effigies were an effective non-lethal method to disperse roosting vultures.

Alarm or Distress Calls: 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, and herons from aquaculture facilities and American crows from roosts (Conover 2002). However, the effectiveness of alarm or distress calls is reduced after birds become accustomed to 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. 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 realize maximum effectiveness. In some situations, the level of volume required for this method to be effective may be disturbing to residents or be prohibited by local noise ordinances.

Propane Exploders: Propane exploders or cannons operate on propane gas and are designed to produce loud explosions at controllable intervals. They are strategically located to frighten birds from the area where damage or threats are occurring. Although a propane cannon can be an effective dispersal tool for migrant birds in agricultural settings, resident birds are more tolerant of noise and habituate to propane cannons relatively quickly. Because animals are known to habituate to sounds, exploders must be moved frequently and used in conjunction with other scare devices. Propane exploders are generally inappropriate for urban and suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance.

Pyrotechnics: Pyrotechnics, scare cartridges or bombs and shell-crackers have been used to repel many species of birds (Booth 1994). They can be used to frighten birds, and are most often used to prevent crop depredation by birds, to disperse birds from airfields, or to discourage birds from undesirable roost locations. Pyrotechnics should be fired so they explode in front of, or underneath, flocks of birds attempting to enter crop fields or roosts, or the air operating area at an airport. The purpose is to produce an explosion between the birds and their objective. Birds already in a crop field can be frightened from the field; however, it is extremely difficult to disperse birds that have already settled in a roost.

Although one of the more effective methods of dispersing birds, more often than not, pyrotechnics simply move birds to other areas. There are also safety and legal implications regarding their use. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, and trigger dogs to bark incessantly. Additionally, the discharge of pyrotechnics is inappropriate or prohibited in some areas by firearm discharge and noise ordinances. As with other methods, pyrotechnics tend to be more effective when used collectively in a varied regime rather than individually.

Physical Human and Vehicle Harassment or Hazing: Physical human harassment or hazing involves people pursuing birds on foot, clapping their hands, or shouting. Vehicle harassment involves people pursuing birds with remote control vehicles, or with non-motorized or motorized boats or motor vehicles. These techniques have been successfully used to keep a variety of bird species from areas where they cause damage or threats. However, like other methods of harassment birds hazed from one area where they are causing damage may move to another area where they cause damage (Brough 1969, Conover 1984, Summers 1985). Additionally, birds tend to habituate to hazing techniques (Zucchi and Bergman 1975, Summers 1985, Aubin 1990) but this can be mitigated by using an integrated management approach.

Dog Harassment or Hazing: Harassment or hazing occurs when birds are chased away from a site. When this occurs repeatedly, birds will stop returning to the site, especially in instances where resources available at the site can be found elsewhere. Dogs can be effective at harassing birds (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 1998).

Lights: Lights such as strobe, barricade, and revolving units, have been used with mixed results to frighten waterfowl. Brilliant lights, similar to those used on aircraft, are most effective in frightening night-feeding birds. These extremely bright-flashing lights have a blinding effect, causing confusion that reduces the bird's ability to see. Flashing amber barricade lights, like those used at construction sites, and revolving or moving lights may also frighten birds when these units are placed at aquaculture facilities. However, most birds rapidly become accustomed to such lights and their long-term effectiveness is questionable. In general, the type of light, the number of units, and their location are determined by the size of the area to be protected and by the power source available.

Lasers: The term "laser" is an acronym for light amplification by simulated emission of radiation. The use of lasers to alter bird behavior was first introduced nearly 35 years ago (Lustick 1973). Study results have shown that several bird species, including double-crested cormorants, gulls, and American crows avoid laser beams (Glahn et al. 2000, Blackwell et al. 2002*a*). Lasers have been found to be moderately effective for dispersing double-crested cormorants (Blackwell et al. 2002*b*). Best results are achieved under low-light conditions (i.e., after sunset, before sunrise) and by targeting structures or trees in proximity to roosting birds, thereby reflecting the beam. In the daytime, lasers can be used on overcast days or in dark or shaded areas to move individual and small numbers of birds, although the effective range of the laser is greatly diminished. As with other bird-damage management tools, lasers are most effective when used as part of an integrated management program.

Paintballs: Recreational paintball equipment may be used to supplement other harassment methods. Paintballs do not actually contain paint, but are marking capsules which consist of a gelatin shell filled with a non-toxic glycol and water-based coloring. 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). 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. Though 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.

Egg and Nest Destruction: Egg and nest destruction is used mainly to control or limit the growth of a nesting population in a specific area through limiting reproduction or encouraging birds to nest in other locations. Nest Destruction includes the manual 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 where they may cause damage or pose threats.

Egg destruction, addling, or oiling, can also be effective (Christens et al. 1995, Cummings et al. 1997). Throughout the nesting season, eggs may be treated or destroyed to eliminate reproduction at the site where damage or threats are occurring. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, puncturing them, addling (vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac) or spraying the entire egg with a liquid that prevents the egg from obtaining oxygen (see egg oiling below). Eggs are punctured, addled or oiled so that birds do not re-nest at least for an extended period. This is because the bird will continue to sit on or incubate non-viable eggs beyond the date they were expected to hatch. This method is only applicable during a relatively short time interval and requires skill to properly identify the eggs and nests of target species.

While egg removal or destruction can reduce production of young, merely destroying an egg does not reduce a population as quickly as removing adults (Cooper and Keefe 1997). To equal the effect of removing an adult bird from a population, all eggs produced by that bird during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal efforts must be nearly complete in order to prevent recruitment from a small number of surviving nests that would offset control efforts (Smith et al. 1999). Cooper and Keefe (1997), Rockwell et al. (1997), and Schmutz et al. (1997) reported that egg destruction is only fractionally effective in attaining population reduction objectives, and that nest and egg destruction is not an efficient or cost-effective damage management or population reduction approach.

CAPTURE WITH LIVE CAPTURE TRAPS

Birds can be live captured through the use of several methods listed and described in detail below. Upon capture, birds can be relocated or euthanized. Relocation may be appropriate in some situations (i.e., if the problem species' population is at very low levels, a suitable relocation site is known, and the additional dollars required for relocation can be obtained). However, in most situations birds captured in live traps are subsequently euthanized (see lethal methods). Although relocation is not necessarily precluded in all cases, it would in many cases be logistically impractical and biologically unwise. Relocation to other areas following live capture would not generally be effective or cost effective because problem bird species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and relocation would most likely result in bird damage problems at the new location. Additionally, those species that often cause damage are abundant and relocation is not necessary for the maintenance of viable populations. Relocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats.

However, there may be situations in which the relocation of individual birds maybe deemed appropriate. The relocation of birds can only occur when permitted by the USFWS. Therefore, all relocation including relocation conducted by WS is authorized and conducted at the discretion of the USFWS. Birds would be transported promptly in an appropriately sized sanitary container with adequate ventilation. Birds would then be released at a site away from where damage and threats are occurring with suitable habitat and with permission of the landowner or manager.

Prior to their release, birds may be banded with leg bands for identification purposes. Bird banding can only occur when a person with a demonstrated proficiency in banding has applied and been granted a permit by the United States Geological Survey (USGS). Bird banding permits require the use of specific bands issued by USGS for specific species and that permittees band birds "in accordance with the principles, spirit, and intent of the most recent revision of The Ornithological Council's Guidelines in the Use of Wild Birds in Research". These Guidelines (Fair et al. 2010) provide guidance on the capture, handling, band attachment and release of birds. When appropriately sized leg bands are used banded birds should not adversely be affected (Fair et al. 2010).

Hand Capture: Hand capture involves using hands to take hold of a bird.

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

Cage traps usually work best when baited with foods attractive to the target animal. They are used to capture birds ranging in size from sparrows to vultures. Cage traps do have a few drawbacks. Some individual target animals avoid cage traps. Some non-target animals become "trap happy" and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. For example, an animal may die quickly if the cage trap is placed in direct summertime sunlight. Another potential problem with the use of cage traps is that some animals fight to escape and injure themselves in the process or a predator enters the trap and injures or kills an animal. WS SOPs require that active traps be checked regularly to replenish bait, food and water and to remove captured birds. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely.

> ***Decoy, funnel, vulture, pigeon, and sparrow traps:*** These types of traps, used to capture a variety of species of birds have various names but work using the same principals. They are screen enclosures with the access modified to suit the target species. Carrion, corn, seed or other food items (depending on the target species) is placed within the trap or just outside the entrance. After the first few birds are captured they act as decoy birds. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. A few live birds may be maintained in the baited trap to attract birds of the same species. As discussed above non-target animals are released, traps are checked regularly and sufficient food and water is provided to sustain the birds captured.
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> ***Nest Box Traps:*** Nest box traps can be used to capture birds in a variety of damage situations (DeHaven and Guarino 1969, Knittle and Guarino 1976). Traps are made of nylon netting, hardware cloth, and wood, and come in many different sizes and designs, to appeal as a nesting site for the target bird species. Traps can also be baited with grains or other feed. As discussed above, non-target animals are released, traps are checked regularly and sufficient food and water is provided to sustain the birds captured.

Cannon / Rocket Nets: Cannon or rocket netting involves setting bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the birds to escape. Rocket netting is normally used for larger birds such as turkey or waterfowl but can be used to capture a wide variety of bird species.

Net Gun: Net guns are normally used to capture turkeys. This technique fires a net from a shoulder mounted gun which captures the target bird.

Mist Nets: Mist nets, made of a very fine mesh, are hung vertically in a drape like fashion. Birds cannot see the netting and become entangled when they fly into it. The size of the mesh determines the species of birds that can be caught (Day et al. 1980). These nets are generally used for capturing small birds such as house sparrows and finches entrapped in warehouses and other structures. Mist nets are monitored closely, to ensure that any captured birds (target or non-target), can be promptly removed.

Bow nets: Bow nets are small circular net traps used for capturing birds and small mammals. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source and triggered by an observer using a pull cord.

Hand nets: Hand nets are used to catch birds in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles. A variant on the hand net is a round throw-net with weights at the edges of the net, similar to that used for fishing.

Raptor traps: Raptor traps come in a variety of styles such as the bal-chatri, Swedish goshawk trap, and purse traps. These traps are most often used at airports to capture raptors to remove them from the airfield. They are also used to remove raptors predating threatened or endangered species. These traps are monitored frequently so non-target species can be released unharmed.

Padded-jaw pole traps: These traps are modified No. 0 or 1 coil spring leghold traps used to capture specific target birds such as raptors and crows. These are placed on top of poles or typical roosting spots frequented by targeted birds. These traps are monitored frequently so non-target species can be released unharmed.

NON-LETHAL METHODS (CHEMICAL)

Non-lethal chemical methods could include reproductive inhibitors and repellents. With the exception of Mesurol (EPA No. 56228-33), all of these substances could be available under all the alternatives. Nicarbazin (sold under the trade name OvoControl^{TM}) is a reproductive inhibitor. In Virginia, Nicarbazin is registered for use by those persons registered with the VDACS as pesticide applicators. Nicarbazin would be available for use under any of the alternatives. There are several chemical repellents being considered for use in this assessment: Avitrol, Mesurol, and products listed under a variety of trade names containing the chemicals polybutene, anthraquinone and methyl anthranilate. Repellents available which contain the chemicals polybutene, anthraquinone, and methyl anthranilate including Bird Shield®, 4 the birds®, and Flight Control® are available for use by persons registered with the VDACS as pesticide applicators and therefore would be available for use under any of the alternatives. Avitrol is another avian repellent available for use for persons registered with the VDACS as a pesticide applicator. Finally, the repellent Mesurol is registered only for use by WS and therefore could only be available under the proposed action alternative. Mesurol is not currently registered for use in Virginia.

The use of chemical methods is strictly regulated by the EPA, FDA and VDACS. All pesticides have to be registered with the Environmental Protection Agency (EPA) and must have labels approved by the agency which details the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment and directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. These chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. Each of the chemical methods listed above have specific requirements for their handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code.

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the Virginia Department of Agriculture and Consumer Services). WS' personnel that use restricted-use chemical methods are certified as pesticide applicators by the Commonwealth of Virginia and are required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner or manager.

Avitrol or 4-Aminopyridine: Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits. Avitrol, however, is not completely non-lethal in that a small portion of the birds are killed (Johnson and Glahn 1994). When a treated particle is consumed, affected birds begin to emit distress calls and fly erratically, thereby frightening the remaining flock away. Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, blackbirds, starlings, and house sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding.

Avitrol is a restricted use pesticide that can only be used by certified applicators. It is available in several bait formulations, where only a small portion of the individual grains carry the chemical. Avitrol is water soluble, but laboratory studies have demonstrated that Avitrol is strongly absorbed onto soil and that it has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from 3 to 22 months. However, Avitrol may form covalent bonds with organic materials, which may serve to reduce its availability for uptake by organisms. Additionally, it is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991). Although Avitrol can be acutely toxic, blackbirds are more sensitive to the chemical than other birds or mammals and there is little evidence of chronic toxicity for many species. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning and during field use only magpies and crows appear to have been affected (Schafer 1991). A laboratory study by Schafer et al. (1974) showed that magpies exposed to 2–3.2 times the published LD_{50} in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for 7–45 days were not adversely affected. However, some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Schafer 1981, Holler and Shafer 1982).

As stated above, the use of Avitrol is strictly regulated by the EPA and the VDACS. Avitrol can only be applied by persons who have been specially trained and certified by the VDACS for the use of restricted use pesticides. These persons (certified applicators) are required to take continuing education credits and/or exams to maintain their certification. Additionally, Avitrol has specific requirements for handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code. Therefore, the use of Avitrol by WS is not likely to have an adverse effect on humans, animals or the environment, because it would be used according to label restrictions.

Chemical Repellents: Chemical repellents are non-lethal chemicals used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally liquids, gases or granules, and require application to areas or surfaces needing protection. Taste repellents are compounds (i.e.,

liquids, dusts, granules) that are normally applied to trees, shrubs and other materials that are likely to be ingested or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by irritating the feet or making the area undesirable for travel. Effective and practical chemical repellents should be nonhazardous to wildlife; nontoxic to humans, animals and the environment; resistant to weathering; easily applied; reasonably priced; and capable of providing good repellent qualities. The reaction of different animals to a single chemical formulation varies and this variation in repellency may be different from one habitat to the next. Development of chemical repellents is expensive and cost prohibitive in many situations. Chemical repellents are strictly regulated, and suitable repellents are not available for many wildlife species or wildlife damage situations. Most repellents are ineffective or short-lived in reducing or eliminating damage caused by wildlife, therefore, are not used very often by WS.

Methyl Anthranilate (MA): Marketed under the trade names RejeX-iT® and Bird Shield®, Methyl anthranilate (MA) is the artificial grape flavoring used in foods and soft drinks for human consumption and as a bird repellent. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[9]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L2), 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 and is used as a food additive and perfume ingredient (Dolbeer et al. 1992). It has been listed as "*Generally Recognized as Safe*" by the FDA (Dolbeer et al. 1992).
Methyl anthranilate has been shown to be a promising repellent for many bird species (Dolbeer et al. 1993). It is registered for applications to turf or to surface water areas used by birds associated with damage or threats. MA is water soluble, therefore moderate to heavy rain or daily watering and/or mowing render MA ineffective.

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb., with re-treatment required every 3-4 weeks. The cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water, which indicates the repellent effect is short-lived.

Another potentially more cost-effective method of MA application is the use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated (e.g., roost trees) and is irritating to the birds. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon the area. Applied at a rate of about 0.25 lb./acre of water surface, the cost is considerably less than when using the turf or water treatment methods. RejeX-iT® TP 40 is the MA containing product used for fog application. Stevens and Clark (1998) found starlings were irritated by MA fog and did not habituate to it. RejeX-iT® TP 40 fogger has variable effectiveness on birds and is thought to work best on passerines and waterfowl. Inactive ingredients in RejeX-iT® TP 40 include limonene, a human irritant. Therefore, fogging is not recommended for use in areas of high human activity.

Polybutene: Polybutene (sold under the trade names 4 the birds® and Tanglefoot®) is contained in a number of tactile repellent products which reportedly deter birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that birds avoid. However, experimental data in support of this claim is sparse (Mason and Clark 1992). The repellency of

[9] 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.

tactile products is generally short-lived because of dust. The repellents can also cause aesthetic problems and expensive clean-up costs.

Anthraquinone: Anthraquinone (sold under the trades name Flight Control® and Avipel®) is a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism. Anthraquinone has been effective in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also been effective as a foraging repellent when used to limit brown-headed cowbirds feeding on seed (Dolbeer et al. 1998). Anthraquinone has low toxicity to birds and mammals.

Mesurol®: Mesurol (EPA No. 56228-33) was recently registered by WS (for WS use only) as a bird repellent to deter predation by crows and ravens on eggs of threatened and endangered species. Mesurol has not yet been registered for use in Virginia. If it were to be registered for use in Virginia, it would only be available under the proposed action alternative. Dimmick and Nicolaus (1990) showed breeding pairs of crows could be conditioned to avoid eggs treated with chemicals that made them ill. However, Avery and Decker (1994) observed increased consumption of eggs treated with higher doses of Mesurol by fish crows. Sullivan and Dinsmore (1990) reported bird nests greater than 700 yards from crow nests were relatively safe from crow predation, thus nests more than 700 yards from active crow nests may not need treatment.

WS would treat eggs similar in appearance to eggs from the threatened and endangered species needing protection. The active ingredient is injected into the eggs which are placed in artificial nests or upon elevated platforms. After ingestion, birds develop post-ingestional malaise and an aversion to consuming similar looking eggs (Mason 1989, Dimmick and Nicolaus 1990). Repeated exposures may be necessary to develop and maintain aversion to threatened and endangered species eggs as the learning curve for crows can take from 23 days to three months (Dimmick and Nicolaus 1990, Avery and Decker 1994).

Treated areas would be posted with warning signs at access points to exclude people from threatened and endangered species nesting areas. Treated eggs are not placed in locations where there is a danger that threatened or endangered species will consume them. If there is a danger, special precautions such as constant observation or using of hazing techniques would be used. Additional label requirements limiting the number of treated eggs per acre and detailing the removal and disposal process for unconsumed or unused treated eggs limits the risk to non-target species. Mesurol is toxic to birds, mammals, fish, and honey bees.

Reproductive Inhibitors: Reproductive control for wildlife can be accomplished either through sterilization (permanent) or contraception (reversible) means. However, the use and effectiveness of reproductive control as a wildlife population management tool is limited by characteristics of the species (e.g., life expectancy, age at onset of reproduction, population size, etc.), environmental factors (e.g., isolation of target population, access to target individuals, etc.), socioeconomic, and other factors. In addition, in order to be effective, a sufficiently large number of birds, which are, in many cases migratory, or at the very least have the ability to fly and move long distances must be the same individual birds that remain at the site where damage is occurring with no immigration of other birds from adjacent areas. Currently, the only reproductive inhibitor that is registered with the EPA for application with birds is nicarbazin.

Nicarbazin: Nicarbazin is currently the only reproductive inhibitor that is registered with the EPA for application with birds. Nicarbazin (sold under the trade name OvoControl™) can be used to reduce pigeon egg production and viability. At the time this EA was developed nicarbazin was only registered to manage rock pigeon populations in the Commonwealth. Nicarbazin is a complex of

two compounds, 4,4'-dinitrocarbanilide (DNC) and 4,6-dimethyl-2-pyrimidinol (HDP) which interferes with the formation of the vitelline membrane that separates the egg yolk and egg white which prevents the development of an embryo inside the egg (EPA 2005). The active component of nicarbazin is the DNC compound with the HDP compound aiding in absorption of DNC into the bloodstream (EPA 2005). Nicarbazin was first developed to treat coccidiosis outbreaks in broiler chickens and has been approved as a veterinary drug by the FDA since 1955 for use in chicken feed to prevent the protozoal disease coccidiosis (EPA 2005). Current studies on nicarbazin as a reproductive inhibitor have shown variability in hatch rates of target species fed treated baits (VerCauteren et al. 2000, Bynum et al. 2005, Yoder et al. 2006). Although localized bird populations could be reduced from the use of nicarbazin, the extent of the reduction would be variable given the uncertainty in effectiveness of nicarbazin to reduce egg hatch. In addition, birds must consume bait treated with nicarbazin daily in the correct dosage throughout the breeding season to achieve the highest level of effectiveness.

OvoControl® P (EPA Reg. No. 80224-1) is a restricted use pesticide registered for use to reduce the egg hatch of pigeons. The formulation for pigeons contains 0.5% of the active ingredient nicarbazin by volume as a ready-to-use bait for pigeons only in urban areas. Urban areas have been defined by the EPA as municipalities and surrounding areas with a population of 50,000 or more people (EPA 2005). Baiting can only occur by applicators certified by the Commonwealth and only on rooftops or other flat paved or concrete surfaces with restricted access. OvoControl® P is currently registered for use in the Commonwealth.

Egg Oiling: Egg oiling is a method of egg destruction. It involves spraying a small quantity of food grade vegetable oil or mineral oil on eggs in the nest. The oil prevents exchange of gases and causes asphyxiation of developing embryos. This method is 96-100% effective in reducing hatchability (Pochop 1998, Pochop et al. 1998). Like egg addling or puncturing (see Egg and Nest Destruction) this method has an advantage over nest or egg destruction because the incubating birds generally continue to sit on the nest log after the expected hatch date and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under Federal Insecticide, Fungicide and Rodenticide Act (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.

Particulate Feed Additives: The use of food additives have been investigated for their bird-repellent characteristics. In pen trials, European starlings rejected grain to which charcoal particles were adhered. If further research finds this method to be effective and economical in field applications, it might become available as a bird repellent on livestock feed. Charcoal feed additives have been explored for use in reducing methane production in livestock and should have no adverse effects on livestock, meat or milk production, or human consumers of meat or dairy products.

LETHAL METHODS (MECHANICAL)

Hunting: Where appropriate, WS recommends that resource owners consider legal hunting as an option for reducing damage. Hunting not only removes individual birds causing damage but also reinforces harassment programs as part of an integrated approach. Although legal hunting is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of birds. Even in urban/suburban areas (*e.g.*, golf courses and green spaces) there may be locations where controlled hunting would be effective in reducing bird damage. Valid hunting licenses and other additional permits are required for the implementation of this method.

Shooting: Shooting is the practice of selectively removing target birds using firearms. Shooting, when deemed appropriate using the WS Decision Model, can be highly effective in removing those individual birds responsible for causing damage and posing threats. It is selective for target species. It is also effective in supplementing harassment as part of an integrated approach. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques. Shooting may be used by persons implementing wildlife damage management methods under depredation orders or depredation permits, during annual hunting seasons or for unprotected non-native birds at any time. Birds are killed as quickly and humanely as possible in accordance with WS Directive 2.505.

Snap Traps: Snap traps are modified rat snap traps used to remove individual cavity nesting birds. The trap treadle is baited with peanut butter or other food attractant and attached near the area damaged by the offending bird. These traps pose no imminent danger to humans or the environment. They also pose no imminent threat to other animals because they are located in areas which are inaccessible to most non-avian animals. Additionally, these traps are very selective because they are usually set in areas defended by the target bird.

Cervical Dislocation: This method is sometimes used to euthanize birds which 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 approves this technique as a humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and other small birds (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

LETHAL METHODS (CHEMICAL)

The use of chemical methods is strictly regulated by the EPA and VDACS. All pesticides have to be registered with the Environmental Protection Agency (EPA) and must have labels approved by the agency which details the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment and directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. These chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. Each of the chemical methods listed below have specific requirements for their handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code.

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the VDACS). WS' personnel that use restricted-use chemical methods are certified as pesticide applicators by the Commonwealth of Virginia and are required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner or manager.

3-chloro-p-toluidine hydrochloride (DRC-1339 and Starlicide): 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$) is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. It was developed as an avicide because of its differential toxicity to mammals. In Virginia, DRC-1339 is registered for use by WS only while Starlicide is registered for use by persons registered with the VDACS

as pesticide applicators. Both contain the active ingredient $C_7H_9Cl_2N$ but in different formulations for different species and damage situations.

Although $C_7H_9Cl_2N$ is highly toxic to sensitive species it is only slightly toxic to non-sensitive birds (EPA 1995, Schafer 1981, 1991). For example, European starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall Jr. et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, and pigeons, are highly sensitive to $C_7H_9Cl_2N$ (Johnson et al. 1999). Many other bird species, such as raptors, are less sensitive (EPA 1995, DeCino et al. 1966, Schafer 1984). Secondary poisoning has not been observed with $C_7H_9Cl_2N$, except in crows eating gut contents of pigeons (Krebs 1974). During research studies, carcasses of birds which died from $C_7H_9Cl_2N$ were fed to raptors, including northern harriers up to 141 days with no symptoms of secondary poisoning observed (DeCino et al. 1966). This can be attributed to the chemical's relatively low toxicity to these birds of prey and the tendency of $C_7H_9Cl_2N$ to be almost completely metabolized by the target birds, leaving little residue to be ingested by scavengers (Cunningham et al. 1979). A common concern regarding the use of chemicals is the risk to humans, animals and the environment. Following label requirements of $C_7H_9Cl_2N$ eliminates the risk to non-target species. These label requirements include a period of pre-baiting and observation to ensure the absence of non-targets and the rapid uptake of treated bait by the target bird species. Additionally, $C_7H_9Cl_2N$ is typically very unstable in the environment and degrades quickly when exposed to sunlight, heat and ultraviolet radiation (EPA 1995). $C_7H_9Cl_2N$ is also highly soluble in water, does not hydrolyze, and photodegrades quickly in water with a half-life estimated at 6.3 hours in summer, 9.2 hours in spring sunlight, and 41 hours during winter (EPA 1995). $C_7H_9Cl_2N$ binds tightly with soil and is considered to have low mobility (EPA 1995). The half-life of $C_7H_9Cl_2N$ in biologically active soil was estimated at 25 hours with the identified metabolites having a low toxicity (EPA 1995). Although $C_7H_9Cl_2N$ is moderately toxic to fish and highly toxic to aquatic invertebrates (EPA 1995), following labeling requirements eliminates the risks to non-target amphibian species. These label requirements include application more than 50 feet from a body of water, as well as, pre-baiting and observation to ensure the absence of non-targets and the rapid uptake of treated bait by the target bird species. Given the strict application requirements for $C_7H_9Cl_2N$, WS does not anticipate any negative impacts on humans, non-target animals or the environment.

Avitrol or 4-Aminopyridine: Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits. Avitrol, however, is not completely non-lethal in that a small portion of the birds are killed (Johnson and Glahn 1994). When a treated particle is consumed, affected birds begin to emit distress calls and fly erratically, thereby frightening the remaining flock away. Pre-baiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, blackbirds, starlings, and house sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding.

Avitrol is a restricted use pesticide that can only be used by certified applicators. It is available in several bait formulations, where only a small portion of the individual grains carry the chemical. Avitrol is water soluble, but laboratory studies have demonstrated that Avitrol is strongly absorbed onto soil and that it has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from 3 to 22 months. However, Avitrol may form covalent bonds with organic materials, which may serve to reduce its availability for uptake by organisms. Additionally, it is non-accumulative in tissues and rapidly metabolized by many species (Schafer 1991). Although Avitrol can be acutely toxic, blackbirds are more sensitive to the chemical than other birds or mammals and there is little evidence of chronic toxicity for many species. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning and during field use only magpies and crows appear to have been affected (Schafer 1991). A laboratory study by Schafer et al. (1974) showed that magpies exposed to 2–3.2 times the published LD_{50} in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for 7–45 days were not adversely affected.

However, some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Schafer 1981, Holler and Shafer 1982).

As stated above, the use of Avitrol is strictly regulated by the EPA and the VDACS. Avitrol products can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. Additionally, Avitrol has specific requirements for handling, transport, storage, use and disposal under Code of Virginia and the Virginia Administrative Code. Therefore, the use of Avitrol by WS is not likely to have an adverse effect on humans, animals or the environment, because it would be used according to label restrictions.

Carbon Dioxide (CO_2): Although not a registered pesticide, CO_2 is a chemical method. Carbon dioxide is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic five gallon bucket or chamber which is then sealed. CO_2 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 American Veterinary Medical Association (Beaver et al. 2001). CO_2 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 also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society. Euthanasia conducted by WS would be done in accordance with WS Directive 2.505.

APPENDIX D: SPECIES LISTED BY THE U.S. FISH AND WILDLIFE SERVICE[1]

[1]List obtained from <http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=VA&s8fid=112761032792&s8fid=112762573902> on 14 January 2014

Notes:

- This report shows the listed species associated in some way with this state.
- This list does not include experimental populations and similarity of appearance listings.
- This list includes non-nesting sea turtles and whales in State/Territory coastal waters.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.

Summary of Animals listings:

Animal species listed in this state that occur in this state (51 species):

Status	Species
E	Bat, gray Entire (*Myotis grisescens*)
E	Bat, Indiana Entire (*Myotis sodalis*)
E	Bat, Virginia big-eared Entire (*Corynorhinus (=Plecotus) townsendii virginianus*)
E	Bean, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Villosa trabalis*)
E	Bean, purple (*Villosa perpurpurea*)
E	Bean, rayed (*Villosa fabalis*)
E	Blossom, green (pearlymussel) Entire (*Epioblasma torulosa gubernaculum*)
T	Chub, slender Entire (*Erimystax cahni*)
T	Chub, spotfin Entire (*Erimonax monachus*)
E	Combshell, Cumberlandian Entire Range; Except where listed as Experimental Populations (*Epioblasma brevidens*)
E	Darter, duskytail Entire (*Etheostoma percnurum*)
E	Fanshell (*Cyprogenia stegaria*)
E	Isopod, Lee County cave Entire (*Lirceus usdagalun*)
T	Isopod, Madison Cave Entire (*Antrolana lira*)
E	Kidneyshell, Fluted (*Ptycholbranchus subtentum*)
E	Logperch, Roanoke Entire (*Percina rex*)
T	Madtom, yellowfin except where EXPN (*Noturus flavipinnis*)
E	Monkeyface, Appalachian (pearlymussel) (*Quadrula sparsa*)
E	Monkeyface, Cumberland (pearlymussel) Entire Range; Except where listed as Experimental Populations (*Quadrula intermedia*)
E	Mucket, pink (pearlymussel) Entire (*Lampsilis abrupta*)
E	Mussel, oyster Entire Range; Except where listed as Experimental Populations (*Epioblasma capsaeformis*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Pearlymussel, birdwing Entire Range; Except where listed as Experimental Populations (*Lemiox rimosus*)
E	Pearlymussel, cracking Entire Range; Except where listed as Experimental Populations (*Hemistena lata*)

E	Pearlymussel, dromedary Entire Range; Except where listed as Experimental Populations (*Dromus dromas*)
E	Pearlymussel, littlewing Entire (*Pegias fabula*)
E	Pearlymussel, slabside (*Lexingtonia dolabelloides*)
E	Pigtoe, finerayed Entire Range; Except where listed as Experimental Populations (*Fusconaia cuneolus*)
E	Pigtoe, rough (*Pleurobema plenum*)
E	Pigtoe, shiny Entire Range; Except where listed as Experimental Populations (*Fusconaia cor*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Rabbitsfoot, rough (*Quadrula cylindrica strigillata*)
E	Riffleshell, tan Entire (Epioblasma florentina walkeri (=E. *walkeri*))
E	Salamander, Shenandoah Entire (*Plethodon shenandoah*)
T	Sea turtle, green except where endangered (*Chelonia mydas*)
E	Sea turtle, hawksbill Entire (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley Entire (*Lepidochelys kempii*)
E	Sea turtle, leatherback Entire (*Dermochelys coriacea*)
E	Snail, Virginia fringed mountain Entire (*Polygyriscus virginianus*)
E	Spectaclecase (mussel) (*Cumberlandia monodonta*)
E	Spinymussel, James Entire (*Pleurobema collina*)
E	Squirrel, Delmarva Peninsula fox Entire, except Sussex Co., DE (*Sciurus niger cinereus*)
E	Sturgeon, shortnose Entire (*Acipenser brevirostrum*)
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach Entire (*Cicindela dorsalis dorsalis*)
E	Wedgemussel, dwarf Entire (*Alasmidonta heterodon*)
E	Whale, finback Entire (*Balaenoptera physalus*)
E	Whale, humpback Entire (*Megaptera novaeangliae*)
E	Whale, North Atlantic Right Entire (*Eubalaena glacialis*)
E	Woodpecker, red-cockaded Entire (*Picoides borealis*)

Animal species listed in this state that do not occur in this state (3 species):

Status	**Species**
E	Beetle, American burying Entire (*Nicrophorus americanus*)
E	Puma (=cougar), eastern Entire (*Puma (=Felis) concolor couguar*)
E	Wolf, gray U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, KS, KY, LA, MA, MD, ME, MO, MS, NC, NE, NH, NJ, NV, NY, OK, PA, RI, SC, TN, VA, VT and WV; those portions of AZ, NM, and TX not included in an experimental population; and portions of IA, IN, IL, ND, OH, OR, SD, UT, and WA. Mexico. (*Canis lupus*)

Animal listed species occurring in this state that are not listed in this state (5 species):

Status	**Species**
E	Butterfly, Mitchell's satyr Entire (*Neonympha mitchellii mitchellii*)
T	Dace, blackside Entire (*Phoxinus cumberlandensis*)
T	Sea turtle, loggerhead Northwest Atlantic DPS (*Caretta caretta*)
E	Spider, spruce-fir moss (*Microhexura montivaga*)
E	Squirrel, Carolina northern flying Entire (*Glaucomys sabrinus coloratus*)

Summary of Plant listings:

Plant species listed in this state that occur in this state (15 species):

Status	Species
T	Amaranth, seabeach (*Amaranthus pumilus*)
T	Birch, Virginia round-leaf (*Betula uber*)
E	Bittercress, small-anthered (*Cardamine micranthera*)
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
E	Chaffseed, American (*Schwalbea americana*)
E	Coneflower, smooth (*Echinacea laevigata*)
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
E	Mallow, Peter's Mountain (*Iliamna corei*)
T	Orchid, Eastern prairie fringed (*Platanthera leucophaea*)
T	Pink, swamp (*Helonias bullata*)
T	Pogonia, small whorled (*Isotria medeoloides*)
E	rock cress, Shale barren (*Arabis serotina*)
T	Sneezeweed, Virginia (*Helenium virginicum*)
T	Spiraea, Virginia (*Spiraea virginiana*)
E	Sumac, Michaux' (*Rhus michauxii*)

Plant listed species occurring in this state that are not listed in this state (2 species):

Status	Species
E	Bluet, Roan Mountain (*Hedyotis purpurea var. montana*)
E	Harperella *(Ptilimnium nodosum*)
E	Lichen, rock gnome (*Gymnoderma lineare*)

APPENDIX E: SPECIES LISTED BY THE COMMONWEALTH OF VIRGINIA[1]

[1]List obtained from < http://www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf > and <https://vanhde.org/species-search> on 14 January 2014

Common Name	***Scientific Name***	**Status**
Amphibians		
Mabee's Salamander	*Ambystoma mabeei*	LT
Tiger Salamander	*Ambystoma tigrinum*	LE
Barking Treefrog	*Hyla gratiosa*	LT
Shenandoah Salamander	*Plethodon shenandoah*	LE
Arachnida (spiders and pseudoscorpions)		
Spruce-fir moss spider	*Microhexura montivaga*	LE
Birds		
Henslow's Sparrow	*Ammodramus henslowii*	LT
Upland Sandpiper	*Bartramia longicauda*	LT
Piping Plover	*Charadrius melodus*	LT
Wilson's Plover	*Charadrius wilsonia*	LE
Peregrine Falcon	*Falco peregrinus*	LT
Gull-billed Tern	*Gelochelidon nilotica*	LT
Loggerhead Shrike	*Lanius ludovicianus*	LT
Black Rail	*Laterallus jamaicensis*	LE
Bachman's Sparrow	*Peucaea aestivalis*	LT
Red-cockaded Woodpecker	*Picoides borealis*	LE
Appalachian Bewick's Wren	*Thryomanes bewickii altus*	LE
Bachman's warbler (=wood)	*Vermivora bachmanii*	LE
Kirtland's warbler (=wood)	*Dendroica kirtlandii*	LE
Bivalvia (mussels)		
Dwarf Wedgemussel	*Alasmidonta heterodon*	LE
Brook Floater	*Alasmidonta varicosa*	LE
Slippershell Mussel	*Alasmidonta viridis*	LE
Spectaclecase	*Cumberlandia monodonta*	LE
Fanshell	*Cyprogenia stegaria*	LE
Dromedary Pearlymussel	*Dromus dromas*	LE
Elephant Ear	*Elliptio crassidens*	LE
Cumberland Combshell	*Epioblasma brevidens*	LE
Oyster Mussel	*Epioblasma capsaeformis*	LE
Tan Riffleshell	*Epioblasma florentina aureola*	LE
Green-blossom Pearlymussel	*Epioblasma torulosa gubernaculum*	LE
Snuffbox	*Epioblasma triquetra*	LE
Shiny Pigtoe	*Fusconaia cor*	LE
Fine-rayed Pigtoe	*Fusconaia cuneolus*	LE
Atlantic Pigtoe	*Fusconaia masoni*	LT
Cracking Pearlymussel	*Hemistena lata*	LE
Pink Mucket	*Lampsilis abrupta*	LE
Tennessee Heelsplitter	*Lasmigona holstonia*	LE
Green Floater	*Lasmigona subviridis*	LT

Birdwing Pearlymussel	*Lemiox rimosus*	LE
Fragile Papershell	*Leptodea fragilis*	LT
Black Sandshell	*Ligumia recta*	LT
Little-winged Pearlymussel	*Pegias fabula*	LE
Sheepnose	*Plethobasus cyphyus*	LE
James Spinymussel	*Pleurobema collina*	LE
Ohio Pigtoe	*Pleurobema cordatum*	LE
Rough Pigtoe	*Pleurobema plenum*	LE
Pyramid Pigtoe	*Pleurobema rubrum*	LE
Slabside Pearlymussel	*Pleuronaia dolabelloides*	LT
Rough Rabbits Foot	*Quadrula cylindrica strigillata*	LE
Cumberland Monkeyface	*Quadrula intermedia*	LE
Pimple Back	*Quadrula pustulosa*	LT
Appalachian Monkeyface	*Quadrula sparsa*	LE
Purple Liliput	*Toxolasma lividum*	LE
Deertoe	*Truncilla truncata*	LE
Purple Bean	*Villosa perpurpurea*	LE
Cumberland Bean	*Villosa trabalis*	LE
Pistolgrip	*Tritogonia verrucosa*	LT
Rayed Bean	*Villosa fabalis*	LE
Coleoptera (beetles)		
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	LT
Holsinger's Cave Beetle	*Pseudanophthalmus holsingeri*	LE
Crustacea (Amphipods, Isopods, and decapods)		
Madison Cave Isopod	*Antrolana Iira*	LT
Big Sandy Crayfish	*Cambarus veteranus*	LE
Lee County Cave Isopod	*Lirceus usdagalun*	LE
Madison Cave Amphipod	*Stygobromus stegerorum*	LT
Diplopoda (millipedes)		
Ellett Valley Pseudotremia Millipede	*Pseudotremia cavernarum*	LT
Laurel Creek Xystodesmid Millipede	*Sigmoria whiteheadi*	LT
Fish		
Atlantic Sturgeon	*Acipenser oxyrinchus*	LE
Western Sand Darter	*Ammocrypta clara*	LT
Blackside Dace	*Chrosomus cumberlandensis*	LT
Tennessee Dace	*Chrosomus tennesseensis*	LE
Steelcolor Shiner	*Cyprinella whipplei*	LT
Blackbanded Sunfish	*Enneacanthus chaetodon*	LE
Turquoise Shiner (Spotfin chub)	*Erimonax monachus*	LT
Slender Chub	*Erimystax cahni*	LT
Sharphead Darter	*Etheostoma acuticeps*	LE
Greenfin Darter	*Etheostoma chlorobranchium*	LT
Carolina Darter	*Etheostoma collis*	LT
Golden Darter	*Etheostoma denoncourti*	LT

Duskytail Darter	*Etheostoma percnurum*	LE
Whitemouth Shiner	*Notropis alborus*	LT
Emerald Shiner	*Notropis atherinoides*	LT
Yellowfin Madtom	*Noturus flavipinnis*	LT
Orangefin Madtom	*Noturus gilberti*	LT
Roanoke Logperch	*Percina rex*	LE
Sickle darter	*Percina williamsi*	LT
Paddlefish	*Polyodon spathula*	LT
Shortnose sturgeon	*Acipenser brevirostrum*	LE
Variegate darter	*Etheostoma variatum*	LE
Gastropoda (snails)		
Appalachian Springsnail	*Fontigens bottimeri*	LE
Virginia Springsnail	*Fontigens morrisoni*	LE
Shaggy Coil	*Helicodiscus diadema*	LE
Rubble Coil	*Helicodiscus lirellus*	LE
Thankless ghostsnail	*Holsingeria unthanksensis*	LE
Spiny Riversnail	*Io fluvialis*	LT
Spirit Supercoil	*Paravitrea hera*	LE
Brown Supercoil	*Paravitrea septadens*	LT
Virginia Fringed Mountain Snail (=Virginia coil)	*Polygyriscus virginianus*	LE
Spider elimia	*Elimia arachnoidea*	LE
Heteroptera (true bugs)		
Virginia Piedmont Water Boatman	*Sigara depressa*	LE
Homoptera (cicadas and leaf hoppers)		
Buffalo Mountain mealybug	*Puto kosztarabi*	LE
Lepidoptera (butterflies and moths)		
Mitchell's satyr	*Neonympha mitchellii*	LE
Appalachian grizzled skipper	*Pyrgus centaureae wyandot*	LT
Mammals		
Eastern Big-eared Bat	*Corynorhinus rafinesquii macrotis*	LE
Virginia Big-eared Bat	*Corynorhinus townsendii virginianus*	LE
Carolina Northern Flying Squirrel	*Glaucomys sabrinus coloratus*	LE
Virginia Northern Flying Squirrel	*Glaucomys sabrinus fuscus*	LE
Snowshoe Hare	*Lepus americanus*	LE
Southern Rock Vole	*Microtus chrotorrhinus carolinensis*	LE
Gray Bat	*Myotis grisescens*	LE
Indiana Bat	*Myotis sodalis*	LE
Delmarva Fox Squirrel	*Sciurus niger cinereus*	LE
Dismal Swamp Southeastern Shrew	*Sorex longirostris fisheri*	LT
Southern Water Shrew	*Sorex palustris punctulatus*	LE
Eastern puma	*Puma (Felis) concolor cougar*	LE
Gray wolf	*Canis lupus*	LE

Blue whale	*Balaenoptera musculus*	LE
Finback whale	*Balaenoptera physalus*	LE
Humpback whale	*Meagaptera novaeangliae*	LE
North Atlantic Right whale	*Eubalaena glacialis*	LE
Sei whale	*Balaenoptera borealis*	LE
Sperm whale	*Physeter catodon (=macrocephalus)*	LE
West Indian manatee	*Trichechus manatus*	LE
Reptiles		
Loggerhead (Sea Turtle)	*Caretta caretta*	LT
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	LE
Chicken Turtle	*Deirochelys reticularia*	LE
Wood Turtle	*Glyptemys insculpta*	LT
Bog Turtle	*Glyptemys muhlenbergii*	LE
Eastern Glass Lizard	*Ophisaurus ventralis*	LT
Green sea turtle	*Chelonia mydas*	LT
Hawksbill sea turtle	*Eretmochelys imbricata*	LE
Kemp's ridley sea turtle	*Lepidochelys kempii*	LE
Leatherback sea turtle	*Dermochelys coriacea*	LE
Vascular Plants		
Sensitive Joint-vetch	*Aeschynomene virginica*	LT
Sea-beach amaranth	*Amaranthus pumilus*	LT
Virginia Roundleaf birch	*Betula lenta var. uber*	LE
Shale barren rock cress	*Boechera serotina*	LT
Small-anthered Bittercress	*Cardamine micranthera*	LE
Juniper sedge	*Carex juniperorum*	LE
Bentley's coralroot	*Corallorhiza bentleyi*	LE
Smooth Coneflower	*Echinacea laevigata*	LT
Harper's fimbry	*Fimbristylis perpusilla*	LE
Harperella	*Harperella nodosa*	LE
Virginia Sneezeweed	*Helenium virginicum*	LE
Swamp-pink	*Helonias bullata*	LE
Long-stalked Holly	*Ilex collina*	LE
Peters Mountain mallow	*Iliamna corei*	LE
Small Whorled Pogonia	*Isotria medeoloides*	LE
New Jersey Rush	*Juncus caesariensis*	LT
Nestronia	*Nestronia umbellula*	LE
Narrow-leaved Spatterdock	*Nuphar sagittifolia*	LT
Prairie fringed orchid	*Platanthera leucophaea*	LT
Michaux's Sumac	*Rhus michauxii*	LT
Northeastern Bulrush	*Scirpus ancistrochaetus*	LE
Reclining Bulrush	*Scirpus flaccidifolius*	LT
Virginia Spiraea	*Spiraea virginiana*	LE
Running Glade Clover	*Trifolium calcaricum*	LE

[2] In the Commonwealth of Virginia, plants and insects fall under one authority while amphibians, wild birds, mussels, fish, gastropods, mammals and reptiles fall under the jurisdiction of another authority. Each authority, as outlined below, has different definitions for listing status.

Plant and Insect Status Codes and Definitions:
Code of Virginia, Title 3.2, Chapter 10, sections 1000–1011. This section of the Code gives the Virginia Department of Agriculture and Consumer Services legislative authority over the listing, protection and taking of threatened and endangered plant and insect species in the Commonwealth.

LE (Endangered): Any species or variety of plant life or insect life determined by the Board to be in danger of extinction throughout all or a significant part of its range other than a species determined by the Commissioner not to be in the best intrest of the welfare of man.

LT (Threatened): Any species determined by the Board to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its native range.

Fish and Wildlife Status Codes and Definitions:
Code of Virginia, Title 29.1, Chapter 5, sections 563–568. This section of the Code gives the Virginia Department of Game and Inland Fisheries legislative authority over the listing, protection and taking of threatenend and endangered fish and wildlife species in the Commonwealth.

LE (Endangered): Any species which is in danger of extinction throughout all or a significant portion of its range.

LT (Threatened): Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.