ENVIRONMENTAL ASSESSMENT

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

Prepared by:
United States Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

In cooperation with:

United States Department of Interior
United States Fish and Wildlife Service
Migratory Bird Program
Region 5

and

Pennsylvania Game Commission

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ACRONYMS

AC	Alpha chloralose
AFRCGMP	Atlantic Flyway Resident Canada Goose Management Plan
AP	Atlantic Population
APHIS	Animal and Plant Health Inspection Service
APMV	paramyxoviruses
AQDO	Aquaculture Depredation Order
AVMA	American Veterinary Medical Association
BBA	Breeding Bird Atlas
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	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	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
NAP	North Atlantic Population
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NJDFW	New Jersey Division of Fish and Wildlife
NWRC	National Wildlife Research Center
PBCR	Pelagic Bird Conservation Region
PBR	Potential Biological Removal
PDA	Pennsylvania Department of Agriculture
PGC	Pennsylvania Game Commission
PPE	Personal Protective Equipment
PRDO	Public Resource Depredation Order
USGS	United States Geological Survey
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
SJBP	Southern James Bay Population
SOPs	Standard Operating Procedures
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program and the United States Fish and Wildlife Service (USFWS)[2] continue to receive requests for assistance or anticipates 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 cormorants (*Phalacrocorax auritus*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), black-crowned night-herons (*Nycticorax nycticorax*), black vultures (*Coragyps atratus*), turkey vultures (*Cathartes aura*), Canada geese (*Branta canadensis*), free-ranging domestic and feral waterfowl[3], mute swans (*Cygnus olor*), snow geese (*Chen caerulescens*), mallards (*Anas platyrhynchos*), American black ducks (*Anas rubripes*), ospreys (*Pandion haliaetus*), sharp-shinned hawks (*Accipiter striatus*), Cooper's hawks (*Accipiter cooperii*), northern harriers (*Circus cyaneus*), red-shouldered hawks (*Buteo lineatus*), broad-winged hawks (*Buteo platypterus*), red-tailed hawks (*Buteo jamaicensis*), bald eagles (*Haliaeetus leucocephalus*), American kestrels (*Falco sparverius*), merlin (*Falco columbarius*), wild turkeys (*Meleagris gallopavo*), killdeer (*Charadrius vociferus*), upland sandpipers (*Bartramia longicauda*), Bonaparte's gulls (*Chroicocephalus philadelphia*), laughing gulls (*Leucophaeus atricilla*), ring-billed gulls (*Larus delawarensis*), herring gulls (*Larus argentatus*), great black-backed gulls (*Larus marinus*), rock pigeons (*Columba livia*), mourning doves (*Zenaida macroura*), monk parakeets (*Myiopsitta monachus*), short-eared owls (*Asio flammeus*), great horned owls (*Bubo virginianus*), snowy owls (*Bubo scandiacus*), barred owls (*Strix varia*), downy woodpeckers (*Picoides pubescens*), hairy woodpeckers (*Picoides villosus*), northern flickers (*Colaptes auratus*), American crows (*Corvus brachyrhynchos*), fish crows (*Corvus ossifragus*), horned larks (*Eremophila alpestris*), tree swallows (*Tachycineta bicolor*), bank swallows (*Riparia riparia*), cliff swallows (*Petrochelidon pyrrhonota*), barn swallows (*Hirundo rustica*), American robins (*Turdus migratorius*), European starlings (*Sturnus vulgaris*), eastern meadowlarks (*Sturnella magna*), red-winged blackbirds (*Agelaius phoeniceus*), common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), house sparrows (*Passer domesticus*), and house finches (*Haemorhous mexicanus*) in Pennsylvania.

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 but requests for assistance associated with those species would occur infrequently and/or requests would involve a small number of individual birds of a species. Damages and threats of damages associated with those species would occur primarily at airports where individuals of those species pose a threat of aircraft strikes. Appendix B contains a list of species that WS could address in low numbers and/or infrequently when those species cause damage or pose a threat of damage.

All federal actions are subject to the National Environmental Policy Act (NEPA) (Public Law 9-190, 42 USC 4321 et seq.), including the actions of WS[4] and the USFWS. The NEPA sets forth the requirement

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

[2]The 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.

[3]Free-ranging or feral domestic waterfowl refers to captive-reared, domestic, of some domestic genetic stock, or domesticated breeds of ducks, geese, and swans. Examples of domestic waterfowl include, but are not limited to; African geese, call ducks, Cayuga ducks, Chinese geese, crested ducks, Embden geese, Indian runner ducks, khaki Campbell ducks, Muscovy ducks, Peking ducks, pilgrim geese, Rouen ducks, Swedish ducks, and Toulouse geese. Feral ducks may include a combination of mallards, Muscovy duck, and mallard-Muscovy hybrids.

[4]The WS program follows the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process.

that all federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse effects. Federal activities affecting the physical and biological environment are regulated in part by the Council of Environmental Quality (CEQ) through regulations in 40 CFR 1500-1508. The NEPA and the CEQ guidelines generally outline five broad types of activities to be accomplished as part of projects conducted by a federal agency. Those five types of activities are public involvement, analysis, documentation, implementation, and monitoring.

Normally, individual wildlife damage management projects conducted by the WS program could be categorically excluded from further analysis under the NEPA, in accordance with APHIS implementing regulations (see 7 CFR 372.5, 60 FR 6000-6003). Pursuant to the NEPA and the CEQ regulations, WS and the USFWS are preparing this Environmental Assessment (EA)[5] to document the analyses associated with proposed federal actions and to inform decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse effects. This EA will also serve as a decision-aiding mechanism to ensure that WS and the USFWS infuse the policies and goals of the NEPA and the CEQ into the actions of each agency. Preparing the EA will assist in determining if the proposed cumulative management of bird damage could have a significant impact on the environment based on previous activities conducted and based on the anticipation of conducting additional efforts to manage damage. The goal of WS and the USFWS would be to conduct a coordinated program to alleviate bird damage in accordance with plans, goals, and objectives developed to reduce damage. Because the goals and directives[6] would be to provide assistance when the appropriate property owner or manager requests such assistance, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Pennsylvania as part of a coordinated program.

More specifically, WS and the USFWS are preparing this EA to: 1) facilitate planning between agencies, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities; 5) evaluate and determine if there could be any potentially significant or cumulative effects associated with managing bird damage, and 6) to comply with the NEPA. Developing the EA will assist WS and the USFWS with determining if the proposed action or the other alternatives could potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an Environmental Impact Statement (EIS). The EA addresses impacts for managing damage and threats to human safety associated with birds in the Commonwealth to analyze individual and cumulative impacts and to provide a thorough analysis of individual projects conducted by WS. In addition, this EA will facilitate planning between WS, the USFWS, the Pennsylvania Game Commission (PGC), and Pennsylvania Fish and Boat Commission (PAFBC) to initiate funding mechanisms under grant programs administered by the Wildlife and Sport Fish Program for the conservation of native species, including threatened or endangered (T&E) species. Other federal funding mechanisms through the USFWS, including Endangered Species Act (ESA) recovery implementation funds or refuge project funds may also be evaluated and utilized.

This EA analyzes the potential effects of bird damage management when requested, as coordinated between WS, the USFWS, and the PGC. The analyses contained in this EA are based on information

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

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

derived from WS' Management Information System, data from the USFWS, published documents (see Appendix A), interagency consultations, public involvement, and other environmental documents.

The EA evaluates the need for action to manage damage associated with birds in the Commonwealth, the potential issues associated with bird damage management, and the environmental consequences of conducting alternative approaches to meeting the need for action while addressing the identified issues. The issues and alternatives associated with bird damage management were initially developed by WS and the USFWS, in consultation with the PGC and the Pennsylvania Department of Agriculture (PDA). The USFWS has overall regulatory authority to manage populations of migratory and federally endangered/threatened bird species, while the PGC has the authority to manage wildlife populations in the Commonwealth of Pennsylvania. To assist with identifying additional issues and alternatives to managing damage, this EA will be made available to the public for review and comment prior to the issuance of a Decision[7].

WS has previously developed EAs that analyzed the need for action to manage damage associated with pigeons, European starlings, brown-headed cowbirds, common grackles, and house sparrows (USDA 2003*a*), waterfowl (2003*b*), and other bird species (USDA 2005). 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.

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 new EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action, primarily a need to address damage and threats of damage associated with several additional species of birds. 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.

1.2 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.

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

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 animals have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people often seek assistance with resolving damage or reducing threats to human safety.

The threshold triggering a request for assistance is often unique to the individual person requesting assistance and 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.

The need for action to manage damage and threats associated with birds in Pennsylvania arises from requests for assistance[8] received by WS to reduce and prevent damage from occurring to four major categories. Those four major 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 in the Commonwealth based on previous requests for assistance and assessments of the threat of bird strike hazards at airports in the Commonwealth. 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 Pennsylvania from the federal fiscal year[9] (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.

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

[8]WS only conducts bird damage management after receiving a request for assistance. Before initiating bird damage activities, a Memorandum of Understanding, work initiation document, or other comparable document must be signed between WS and the cooperating entity which lists all the methods the property owner or manager will allow to be used on property they own and/or manage.
[9]The federal fiscal year begins on October 1 and ends on September 30 the following year.

EA. The technical assistance projects conducted by WS are representative of the damage and threats that could be caused by birds in Pennsylvania. From FY 2007 through FY 2012, WS conducted 3,043 technical assistance projects that addressed damage and threats of damage associated with many of the bird species addressed in this assessment. Many of the projects involved multiple resources and multiple species.

Table 1-1. Technical assistance projects conducted by WS in Pennsylvania, FY 2007–FY 2012.

Species	Projects	Species	Projects
Double-Crested Cormorant	5	**Ring-billed Gull**	71
Great Blue Heron	27	**Herring Gull**	42
Black-crowned Night-Heron	3	**Great Black-backed Gull**	9
Black Vulture	133	**Rock Pigeon**	87
Turkey Vulture	194	**Mourning Dove**	28
Canada Geese	1,188	**Short-eared Owl**	2
Domestic/Feral Waterfowl	37	**Great Horned Owl**	7
Mute Swan	6	**Downy Woodpecker**	77
Snow Geese	19	**Hairy Woodpecker**	26
Wood Duck	2	**Northern Flicker**	8
Mallard	78	**American Crow**	162
American Black Duck	5	**Fish Crow**	5
Osprey	1	**Horned Lark**	5
Sharp-shinned Hawk	2	**Tree Swallow**	7
Cooper's Hawk	12	**Bank Swallow**	10
Northern Harrier	4	**Cliff Swallow**	1
Broad-winged Hawk	3	**Barn Swallow**	23
Red-tailed Hawk	144	**American Robin**	11
Bald Eagle	6	**European Starling**	415
American Kestrel	19	**Eastern Meadowlark**	4
Merlin	2	**Red-winged Blackbird**	45
Wild Turkey	20	**Common Grackle**	14
Killdeer	17	**Brown-headed Cowbird**	4
Upland Sandpiper	2	**House Sparrow**	36
Bonaparte's Gull	5	**House Finch**	3
Laughing Gull	7	**TOTAL**	**3,043**

Table 1-2 lists those bird species and the resource types that those bird species can cause damage to in Pennsylvania. 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 in the Commonwealth. Many of the bird species addressed in this EA can cause damage to or pose threats to a variety of resources. In Pennsylvania, most requests for assistance received by WS are related to threats associated with those bird species being struck by aircraft at or near airports in the Commonwealth. 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), 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 can increase 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].

	Resource					Resource			
Species	**A**	**N**	**P**	**H**	**Species**	**A**	**N**	**P**	**H**
Double-crested Cormorant	X	X	X	X	**Herring Gull**	X	X	X	X
Great Blue Heron	X	X	X	X	**Great Black-backed Gull**	X	X	X	X
Great Egret	X	X	X	X	**Rock Pigeon***	X		X	X
Black-crowned Night-Heron	X	X	X	X	**Mourning Dove**			X	X
Black Vulture	X		X	X	**Monk Parakeet***		X	X	X
Turkey Vulture	X		X	X	**Short-eared Owl**	X	X	X	X
Canada Goose	X	X	X	X	**Great Horned Owl**	X	X	X	X
Feral Waterfowl	X	X	X	X	**Snowy Owl**			X	X
Mute Swan*	X	X	X	X	**Barred Owl**	X	X	X	X
Snow Goose	X	X	X	X	**Downy Woodpecker**	X	X	X	X
Mallard	X	X	X	X	**Hairy Woodpecker**			X	X
American Black Duck			X	X	**Northern Flicker**			X	X
Osprey	X	X	X	X	**American Crow**	X	X	X	X
Sharp-shinned Hawk	X	X	X	X	**Fish Crow**	X	X	X	X
Cooper's Hawk	X	X	X	X	**Horned Lark**			X	X
Northern Harrier	X	X	X	X	**Tree Swallow**	X		X	X
Red-shouldered Hawk	X	X	X	X	**Bank Swallow**	X		X	X
Broad-winged Hawk	X	X	X	X	**Cliff Swallow**	X		X	X
Red-tailed Hawk	X	X	X	X	**Barn Swallow**	X		X	X
Bald Eagle			X	X	**American Robin**			X	X
American Kestrel	X	X	X	X	**European Starling***	X	X	X	X
Merlin	X	X	X	X	**Eastern Meadowlark**			X	X
Wild Turkey**	X		X	X	**Red-winged Blackbird**	X		X	X
Killdeer			X	X	**Common Grackle**	X	X	X	X
Upland Sandpiper			X	X	**Brown-headed Cowbird**	X	X	X	X
Bonaparte's Gull	X	X	X	X	**House Sparrow***	X	X	X	X
Laughing Gull	X	X	X	X	**House Finch**			X	X
Ring-billed Gull	X	X	X	X					

[1]A=Agriculture, N=Natural Resources, P=Property, H=Human Safety
* Species not protected by Federal or Commonwealth law.
** Species not protected by Federal law but protected by Commonwealth law.

As stated previously, the need for action arises from requests received from Commonwealth, federal, and private entities to provide assistance with resolving damage or threats of damage to four main categories of resources in Pennsylvania that include agricultural resources, natural resources, property, and human safety. Additional information regarding bird damage is discussed in the following subsections of the EA.

Need to Resolve Bird Damage to Agricultural Resources

According to the National Agricultural Statistics Service (NASS), approximately 7.8 million acres were devoted to agricultural production in Pennsylvania in 2007 (NASS 2009). In the same year, agricultural products sold in the Commonwealth had a market value estimated at $5.8 billion (NASS 2009). In total, 67.8% of those sales were in livestock and 32.2% were in crops (NASS 2009). The top grossing livestock industries in 2007 included cattle ($2.4 billion), poultry and egg ($1.0 billion), hog and pig ($317 million), horse and equine ($47 million), and aquaculture ($44 million) (NASS 2009). The top grossing crop industries in 2007 included greenhouse, nursery and floriculture products ($908 million), oilseed and grain crops ($343 million), fruit and tree nuts ($145 million), hay ($136 million), and vegetables and melons ($103 million) (NASS 2009).

A variety of bird species can cause damage to agricultural resources in the Commonwealth. Damages 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 principal aquaculture products propagated at facilities in Pennsylvania are catfish, trout, baitfish, crustaceans, mollusks, and ornamental fish (NASS 2009).

Of those birds shown in Table 1-2 associated with damage to agriculture, of primary concern to aquaculture facilities in Pennsylvania are double-crested cormorants, gulls, osprey, herons, egrets, and to a lesser extent waterfowl, red-tailed hawks, gulls, kingfishers, 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 2009*a*, USFWS 2014*a*). 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 often 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, Mott et al. 1998, 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 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*a*). Loss of trout in ponds with herons present ranged from 9.1% to 39.4% in a Pennsylvania study 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 addition to cormorants and herons, other bird species have been identified as causing damage or posing threats to aquaculture facilities. In 1984, a survey of fish producing facilities identified 43 species of birds as foraging on fish at those facilities, including mallards, egrets, kingfishers, osprey, red-tailed hawks, Northern harriers, owls, gulls, terns, American crows, mergansers, common grackles, and brown-headed cowbirds (Parkhurst et al. 1987).

Mallards have been identified by aquaculture facilities as posing a threat of economic loss from foraging behavior (Parkhurst et al. 1987, Parkhurst et al. 1992). During a survey conducted in 1984 of fisheries primarily in the eastern United States, managers at 49 of 175 facilities reported mallards as feeding on fish at those facilities, which represented an increase in the number of facilities reporting mallards as feeding on fish when compared to prior surveys (Parkhurst et al. 1987). Parkhurst et al. (1992) found mallards foraging on trout fingerlings at facilities in Pennsylvania. Mallards selected trout ranging in size from 8.9 centimeters to 12.2 centimeters in length. Once trout fingerlings reached a mean length of approximately 14 centimeters in raceways, mallards present at facilities switched to other food sources (Parkhurst et al. 1992). Of those predatory birds observed by Parkhurst et al. (1992), mallards consumed the most fish at the facilities with a mean of 148,599 fish captured and had the highest mean economic loss per year per site based on mallards being present at those facilities for a longer period of time per year compared to other species.

During a survey of fisheries 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 fisheries in 1985 and 1986, American crows were observed at eight of the facilities in central Pennsylvania (Parkhurst et al. 1992). The mean size of trout captured by crows in one study was 22.5 centimeters with a range of 15.2 to 31.7 centimeters (Parkhurst et al. 1992). A study conducted in Pennsylvania during 1985 and 1986 found crows consumed a mean of 11,651 trout per year per site from ten trout hatcheries (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 impacts 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 in central Pennsylvania, 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 actual transmission of diseases through transport by birds is difficult to document, birds have been documented as having the capability of spreading diseases through fecal droppings and possibly through other mechanical means such as on feathers, feet, and regurgitation.

Birds have been identified as a possible source of transmission of three fish viruses in Europe: Spring Viraemia of Carp, Viral Hemorrhagic Septicaemia, and Infectious Pancreatic Necrosis (European Inland Fisheries Advisory Commission 1989). Viral Hemorrhagic Septicaemia and Infectious Pancreatic Necrosis are known to occur in North America (Price and Nickum 1995). Spring Viraemia of Carp has also been documented to occur in North America (USDA 2003*c*). Peters and Neukirch (1986) found the Infectious Pancreatic Necrosis virus in the fecal droppings of herons when the herons were fed Infectious Pancreatic Necrosis infected trout. Olesen and Vestergard-Jorgensen (1982) found herons could transmit the Viral Hemorrhagic Septicaemia (Egtved virus) from beak to fish when the beaks of herons were contaminated with the virus. However, Eskildsen and Vestergard-Jorgensen (1973) found the Egtved virus did not pass through the digestive tracks into the fecal droppings of black-headed gulls (*Chroicocephalus ridibundus*) when artificially inserted into the esophagus of the gulls.

Birds are also capable of passing bacterial pathogens through fecal droppings and on their feet (Price and Nickum 1995). The bacterial pathogen for the fish disease Enteric Septicemia of Catfish has been found within the intestines and rectal areas of great blue herons and double-crested cormorants from aquaculture facilities in Mississippi (Taylor 1992). However, since Enteric Septicemia of Catfish is considered endemic in the region, Taylor (1992) did not consider birds as a primary vector of the disease. Birds also pose as primary hosts to several cestodes, nematods, trematodes, and other parasites that can infect fish. Birds can also act as intermediate hosts of parasites that can infect fish after completing a portion of their life cycle in crustaceans or mollusks (Price and Nickum 1995).

Although documented that birds, primarily herons and cormorants, can pose as vectors of diseases known to infect fish, the rate of transmission is currently unknown and is likely very low. Fish-eating birds are known to target fish that are diseased and less likely to escape predation at aquaculture facilities (Price and Nickum 1995, Glahn et al. 2002). Since birds have the mobility to move from one impoundment or facility to another, the threat of disease transmission is a concern given the potential economic loss that could occur from extensive mortality of fish or other cultivated aquatic wildlife if a disease outbreak occurs.

Damage and Threats to Livestock Operations

Damage to livestock operations can occur from several bird species in Pennsylvania. 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 concentrations 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 Pennsylvania are vultures, Rock 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 in 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. Direct damage to livestock occurs primarily from vultures, but can also include raptors. Vultures are known to prey upon newly born calves and harass adult cattle, especially during the birthing process. The National Agricultural Statistics Service (NASS) reported that in 2010, 11,900 cows and calves valued at $4.6 million were lost to vultures in the United States (NASS 2011). In Pennsylvania, an estimated nine calves valued at $2,700 dollars were lost to vultures during 2010. While both turkey vultures and black vultures have been documented harassing expectant cattle, livestock predation is generally restricted to black vultures. Vulture predation on livestock is distinctive. Lovell (1947, 1952) and Lowney (1999) reported that black vultures targeted the eyes and rectal area. During a difficult birth, vultures can harass the mother and peck at the half-expunged calf. This predation behavior often results in serious injury to livestock, which can cause livestock to die from those injuries or require the livestock be euthanized due to the extent of the injuries.

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, 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 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* (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. 2011*a*). 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).

Contamination of livestock facilities by various bird species through fecal accumulation has been identified as a concern. Numerous diseases can spread through feces, with Salmonellois and *E. coli* being two diseases of concern. Salmonellosis is an infection with bacteria called *Salmonella* and numerous bird species have been documented as reservoirs for this bacterium (Friend et al. 1999, Tizard 2004). *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). Multiple species have been documented as carrying dangerous strains of *E. coli*, including gulls, geese, pigeons, and starlings

(Pedersen and Clark 2007). European starlings have 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). Transmission of Salmonella from gulls to livestock is also a concern (Williams et al. 1977, Johnston et al. 1979, Coulson et al. 1983). Although difficult to document, wild birds at livestock facilities are strongly associated with the contamination of food and water sources. The potential for introduction of *E. coli* or Salmonella to a livestock operation or the transmission of these pathogens between sites by wild birds is a strong possibility (Pedersen and Clark 2007).

Starlings and gulls, as well as other species, have been documented as transferring species-specific diseases, like transmissible gastroenteritis and Johne's disease (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 through 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.

Waterfowl, including ducks, geese, and swans are also a concern to livestock producers. Fraser and Fraser (2010) provided a review of disease concerns to livestock from Canada geese, and highlighted 50 bacteria, viral, fungal diseases and parasites that could infect livestock, including swine, cattle, and poultry. Waterfowl droppings in and around livestock ponds can affect water quality and can be a source of a number of different types of bacteria. The transmission of diseases through drinking water is one of the primary concerns for a safe water supply for livestock. Bacteria levels for livestock depend on the age of the animal since adults are more tolerant of bacteria than young animals (Mancl 1989). The bacteria guidelines for livestock water supplies are <1000 fecal coliform/100 ml for adult animals and < 1 fecal coliform/100 ml for young animals (Mancl 1989). Salmonella causes shedding of the intestinal lining and severe diarrhea in cattle. If undetected and untreated, salmonella can kill cattle and calves. Additionally, the contamination of feed by waterfowl through fecal droppings in pastures, crops, or harvested grasses can also be a method of disease transmission to livestock (Fraser and Fraser 2010).

Wild and domestic waterfowl, as well as a variety of other 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 waterfowl (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 waterfowl an important issue (Davidson and Nettles 1997, Clark and Hall 2006, Gauthier-Clerc et al. 2007). Although low pathogenic strains of avian influenza are often found in wild birds (Stallknecht 2003, Pedersen et al. 2010), high pathogenic strains have also been found to exist in wild waterfowl species (Brown et al. 2006, Keawcharoen et al. 2008). The ability of wild birds to carry those highly pathogenic strains increases the potential for transmission to domestic poultry facilities, which are highly susceptible to these high pathogenic strains of avian influenza (Nettles et al. 1985, Gauthier-Clerc et al. 2007, Pedersen et al. 2010). The potential impacts from an outbreak of high pathogenic avian influenza in domestic poultry could be devastating, and possibly cripple the multi-billion dollar industry through losses in trade, consumer confidence, and eradication efforts (Pedersen et al. 2010).

Newcastle disease is a contagious viral disease affecting birds that is caused by virulent avian paramyxovirus serotype 1 (APMV-1). More than 230 species of birds have been determined to be susceptible to natural or experimental infections with avian paramyxoviruses (APMV), but in most cases were asymptomatic. In wild birds, the effects appear to vary depending on the species of bird and the virulence of the particular APMV strain. Newcastle disease can cause mortalities of double-crested cormorants but often show little effect on other species (Glaser et al. 1999), although poultry have been found to be highly susceptible (Docherty and Friend 1999, Alexander and Senne 2008). Other species that may carry APMV includes pigeons, which because of their use of agricultural settings and possible interactions with livestock may pose a risk of transmission (Kommers et al. 2001).

Bovine coccidiosis is caused by parasites from the *Eimeria* genus. While Canada geese have been implicated in causing Bovine coccidiosis in calves, the coccidia that infect cattle is a different species than the coccidian, which infects Canada geese (Doster 1998). European starlings do not appear to play a role in the transmission of the disease (Carlson et al. 2011*b*).

Although birds are known to be carriers of diseases (vectors) that are transmissible to livestock, the rate that transmission occurs is unknown but is likely to be low. Since many sources of disease transmission exist, identifying a specific source can be difficult. Birds are known to be vectors of disease, which increases the threat of transmission when large numbers of birds are defecating and contacting surfaces and areas used by livestock. The rate of transmission is likely very low; however, the threat of transmission exists since birds are known vectors of many diseases transmittable to livestock.

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 32.2% of the market value of agricultural products sold in the Commonwealth or an estimated $1.8 billion (NASS 2009). The top grossing crop industries in 2007 included greenhouse, nursery and floriculture products ($908 million), oilseed and grain crops ($343 million), fruit and tree nuts ($145 million), hay ($136 million), and vegetables and melons ($103 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 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.

The most common waterfowl damage to agricultural crops is crop consumption, but also consists of the trampling of emerging crops and unacceptable accumulations of feces on pastures. Waterfowl can feed on and trample a variety of crops, including alfalfa, barley, corn, soybeans, wheat, rye, and oats (Cleary 1994). For example, a single intense grazing event by Canada geese in fall, winter, or spring can reduce the yield of winter wheat by 16 to 30% (Fledger et al. 1987) and reduce growth of rye plants by more than 40% (Conover 1988). Some research has reported that grazing by geese during the winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). However, agricultural practices have changed since these studies were conducted, resulting in intensive wheat growing practices unable to sustain even light grazing pressure without losing yield. Associated costs with agricultural damage involving waterfowl include costs to replant grazed crops, implement wildlife damage management, purchase replacement hay, and decreased yields.

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, waterfowl, 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 (primarily from waterfowl).

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 that 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 is a common infection in birds. However, when it infects people is called Psittacosis. Its official name is *Chlamydophila psittaci* and is transmitted to humans via a variety of birds (Bonner et al. 2004). Canada geese can transmit this disease to humans and the agent is viable in goose eggs (Bonner et al. 2004). Severe cases of chlamydiosis have occurred among people handling waterfowl, pigeons, and other birds (Wobeser and Brand 1982, Locke 1987). Infected birds shed the bacteria through feces and nasal discharge. 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 working with Canada geese or involved in the removal or cleaning of bird feces, the risk of infection is quite low (Bradshaw and Trainer 1966, Palmer and Trainer 1969).

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 Canada geese and 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). Findings have demonstrated that geese are carriers of *C. jejuni* (Pacha et al. 1988, Fallacara et al. 2004, Rutledge et al. 2013). 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 geese, 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). Kuhn et al. (2002) found that cryptosporidium was present in 49% and giardia in 29% of wild duck species. Graczyk et al. (1998) found cysts of both parasites in Canada geese from Maryland. With increases in waterfowl populations and their use of drinking water reservoirs, there is an increased potential for contamination from these parasites, and therefore increased human health risks due to the ability of the cysts to survive many water treatment programs (Brown et al. 1999).

In 2000, West Nile virus, a mosquito-borne zoonotic arbovirus belonging to the genus Flavivirus in the family Flaviviridae first appeared in Pennsylvania. 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 along with 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 (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 waterfowl 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 Commonwealth 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 during 1960 when 62 people were killed in the crash of an airliner that collided with a flock of European Starlings (Dolbeer and Wright 2008). More recently, 24 lives were lost when a military aircraft struck a flock of Canada geese at Elmendorf, Alaska in 1995. Globally, wildlife strikes have killed more than 250 people and strikes have 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 $577.5 million in monetary losses and 517,391 hours of aircraft downtime (Dolbeer et al. 2013). These figures are an underestimate of total damage 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, Cleary et al. 2000, Wright and Dolbeer 2005). Between 2004 and 2008, Dolbeer (2009) estimated the FAA received reports on only 39% of the actual aircraft strikes; therefore, 61% of aircraft strikes went unreported. 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. Dolbeer et al. (2013) estimated that the actual annual costs to the United States civil aviation industry from wildlife strikes (includes mammal strikes) to be over 583,175 hours of aircraft downtime and $957 million in losses.

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 2010, 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). Waterfowl were responsible for 30% of the damage occurring followed by gulls at 22% of the reported damage (Dolbeer et al. 2013).

Gulls were involved in more reported strikes in the United States from 1990 to 2012 than any other bird species (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 2012, laughing, ring-billed, herring and greater black-backed gulls were all struck by aircraft in the Commonwealth (FAA 2013). One of the more serious instances occurred in December of 1997 when both engines of a plane were damaged during takeoff at Lehigh Valley International Airport when gulls were ingested by the engines resulting in a total cost of repair of $500,000 (Wright 2012).

Pigeons and doves comprised 15% of the total reported strikes in the United States from 1990 through 2012 (Dolbeer et al. 2013). In Pennsylvania, in August 1998, a plane hit a mixed flock of mourning doves and killdeer during landing at Altoona-Blair County airport (Wright 2012). One or more birds were ingested by the engine and 22 birds were found dead on the runway. Passengers were displaced and the engine had to be overhauled. This is one of the more serious instances to occur in the Commonwealth in recent history involving mourning doves but numerous less serious strikes have occurred in the Commonwealth (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.

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 2012 including bald eagle, Cooper's hawk, merlin, northern harrier, osprey, 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. Vultures are considered one of the most hazardous birds for an aircraft to strike based on the frequency of strikes, effect on flight, and amount of damage caused by vultures throughout the country (DeVault et al. 2011, Dolbeer et al. 2013).

Waterfowl are involved in the greatest number of damaging strikes (30%) in which the bird species was identified when compared to all other bird groups (Dolbeer et al. 2013). Nationally, the resident Canada goose population probably represents the single most serious bird threat to aircraft safety (Alge 1999, Seubert and Dolbeer 2004, Dolbeer and Seubert 2006). Resident Canada geese are of particular concern to aviation because of their large size (typically 8 to 15 pounds, which exceeds the 4 pound bird certification standard for engines and airframes); flocking behavior (which increases the likelihood of multiple bird strikes); attraction to airports for grazing; and year-around presence in urban environments near airports (Seubert and Dolbeer 2004). From 1990 through 2012, there were 1,400 reported strikes involving Canada geese in the United States, including Pennsylvania, resulting in nearly $116.3 million in damage and associated costs to civil aircraft (Dolbeer et al. 2013). The threat that Canada geese pose to aircraft safety was dramatically demonstrated in January 2009 when US Airways Flight 1549 made an emergency landing in the Hudson River after ingesting multiple Canada geese into both engines shortly after takeoff from New York's LaGuardia Airport (Wright 2012, Dolbeer et al. 2013).

Bird species included in this analysis which were reported involved in airstrikes from 1990 to 2013 in Pennsylvania include American coot, American crow, American kestrel, American robin, American wigeon, American woodcock, bald eagle, bank swallow, barn swallow, barred owl, belted kingfisher, brown-headed cowbird, Canada goose, chimney swift, cliff swallow, common grackle, common loon, Cooper's hawk, double-crested cormorant, eastern kingbird, eastern meadowlark, European starlings, great black-backed gull, great blue heron, great egret, great horned owl, green-winged teal, herring gull, horned lark, house finch, house sparrow, killdeer, laughing gull, least sandpiper, lesser yellowlegs, mallard, merlin, mourning dove, northern flicker, northern harrier, northern rough-winged swallow, osprey, red-shouldered hawk, red-tailed hawk, red-winged blackbird, ring-billed gull, rock pigeon, semipalmated sandpiper, short-eared owl, snow goose, tree swallow, turkey vulture, upland sandpiper, wild turkey, Wilson's snipe, and wood duck (FAA 2013). However, as previously mentioned, many bird species involved in strikes are not or cannot be identified and an estimated 80% of bird strikes go unreported (Linnell et al. 1999, Cleary et al. 2000, Wright and Dolbeer 2005). Therefore, additional species were likely involved in airstrikes in Pennsylvania during this period.

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. In April 2012, a man drowned in Des Plains, Illinois when he was attacked by a mute swan that knocked him out of his kayak (Golab 2012).

In addition to raptors, waterfowl can also aggressively defend their nests and nestlings during the nesting season. Waterfowl aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Smith et al. 1999). Feral waterfowl often nest in high densities in areas used by humans for recreational purposes such as industrial areas, parks, beaches, and sports fields (VerCauteren and Marks 2004). If people or their pets unknowingly approach waterfowl or their nests at those locations, injuries could occur if waterfowl react aggressively to the presence of those people or pets (Conover 2002). 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.

Human safety concerns due to monk parakeet nesting on electrical utility poles and transmission structures also exist. These include the possible loss of power to critical care facilities, risk of injury to maintenance crews, and increased incentives to and risks of trespassing. In some service areas, distribution poles with lines connecting to residences have signs indicating that the resident is on some type of life support system requiring continuous power. Nests on these poles or nearby distribution feeders pose a significant risk to these residents. Crews taking down nests are also at increased risk of injury and need to be protected from nest materials that contain mites and other insects that can cause itching and discomfort. Because of the trade in monk parakeets in the pet industry, it is common for people to trap monk parakeets and to sell them to pet shops and other individuals. Wild caught monk parakeets can be sold to pet owners and a number of electrocutions have occurred to individuals who have trespassed and climbed into substations to trap monk parakeets (Newman et al. 2004).

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 Pennsylvania. 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, roosting behavior, and nesting activities. One example of direct damage to property occurs when vultures tear roofing shingles or pull out latex caulking around windows. Woodpeckers also cause direct damage to property when they excavate holes in the wood siding of a building. 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, raptors, and waterfowl, are the bird groups most frequently struck by aircraft in the United States (Dolbeer et al. 2013). Since 1990, nearly $213 million in damages to civil aircraft have been reported from strikes involving waterfowl (Dolbeer et al. 2013). Snowy owls have been involved with 84 reported aircraft strikes in the United States resulting in 147 hours of aircraft downtime and over $444,000 in damages (Dolbeer et al. 2013). In total, aircraft strikes involving birds have resulted in over $577 million in reported damages to civil aircraft 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, swallows, vultures, and waterfowl, occurs primarily from accumulations of droppings and feather debris. Many of the bird species addressed in this assessment are gregarious (*i.e*., form large flocks). Although damage and threats can occur throughout the year, damage is highest during those periods when birds are concentrated into large flocks. 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*. see 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). The accumulation of fecal matter from birds can also negatively affect landscaping and walkways, often at golf courses and water front property (Conover and Chasko 1985). Businesses may be concerned about the negative aesthetic appearance of their property caused by excessive droppings and resulting 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 windowpanes, asphalt and cedar roof shingles, vinyl seat covers from boats, patio furniture, and other equipment. Similarly, nesting colonies of gulls frequently cause damage to structures when they 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. Waterfowl can cause damage to landscaping, when they consume or trample flowers, gardens, and lawns (Conover 1991). Gulls pick up refuse at landfills and carry it off the property to feed, resulting in garbage being deposited 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, United States 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 most 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 disease. 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 and become aesthetically displeasing. Competition can occur 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 or endangered species.

Crows, gulls, and great horned owls will consume a variety of prey including the eggs and chicks of other birds (Pierotti and Good 1994, Good 1998, Houston et al. 1998, Verbeek and Caffrey 2002). These species in particular are among the most frequently reported avian predator of colonial nesting waterbirds in the United States (Frederick and Collopy 1989). Impacts on the productivity and survivorship of rare or threatened colonial waterbirds can be substantial when nesting colonies become targets of avian predators. Fish eating birds such as double-crested cormorants, egrets, herons, and osprey also have the potential to impact fish and amphibian populations, and especially those of threatened or endangered species.

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. At Wade Island on the Susquehanna River in Pennsylvania, cormorants have the potential to negatively impact other colonial nesting waterbird species including great egrets and black-crowned night-herons, both Commonwealth listed endangered species, through competition (Master 2001, Gross and Haffner 2011). Similarly, gulls will also displace other colonial nesting birds (USFWS 1996). 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 adversely affect American kestrels (Wilmers 1987, 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).

Degradation of habitat primarily occurs from the continuous accumulation of fecal droppings under nesting colonies of birds or under areas where birds consistently roost. Overtime, 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 or endangered species (Korfanty et al. 1999). Wires and Cuthbert (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. Finally, degradation of habitat can occur when large concentrations of waterfowl remove shoreline vegetation resulting in erosion (USFWS 2005). Waterfowl can also contribute substantial amounts of phosphorus and nitrogen into lakes through feces, which causes excessive aquatic macrophyte growth and algae blooms (Scherer et al. 1995) and accelerates eutrophication through nutrient loading (Harris et al. 1981).

It has been well documented that birds can carry a wide range of bacterial, viral, fungal, and protozoan diseases that can affect other bird species, as well as mammals. There are numerous published documents and books that outline the variety of diseases that birds can carry and how they can affect natural resources (*e.g.*, see Friend and Franson 1999, Forrester and Spalding 2003, Thomas et al. 2007). Impacts from diseases found in wild birds may include transmission to a single individual or a local population, transmission to a new habitat and transmission to other species of wildlife including birds, mammals, reptiles, amphibians, and fish species. Birds may also act as a vector, reservoir, or intermediate host as it relates to diseases and parasites. Diseases like avian botulism, avian cholera, and new castle disease can account for the death of hundreds to thousands of bird species across the natural landscape (Friend et al. 2001). It is believed that West Nile virus is responsible for the decline of many bird species (LaDeau et al. 2007, LaDeau et al. 2008) and has been documented in causing the further decline of species with critically low population levels (Naugle et al. 2004, Kilpatrick et al. 2007). Other disease outbreaks are more localized and many only affect a few individuals. In Pennsylvania, avian botulism has been documented in Lake Erie where it was responsible for mass die-offs of common loon (Campbell et al. 2001), as well as other species that may have fed on the carcasses or on fly larva associated with the carcasses (Duncan and Jensen 1976). Other avian diseases have caused mortalities of wildlife in the Commonwealth, but they have rarely occurred on such a large scale. Although diseases spread through birds occur, it is often difficult to determine the impacts they will have on other wildlife species due to the range of variables involved in a disease outbreak (Friend et al. 2001).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

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 Pennsylvania, wherever such management is requested by a cooperator. This EA discusses the issues associated with conducting damage management activities in the Commonwealth 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 the 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, except under specified conditions (16 USC 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.

Native American Lands and Tribes

The WS program in Pennsylvania 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 work initiation document 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 when agreed upon between the Tribe and WS.

Federal, Commonwealth, County, City, and Private Lands

WS could continue to provide assistance under two of the alternatives analyzed in detail. Assistance could be conducted on federal, Commonwealth, county, municipal, and private land in Pennsylvania 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 EIS is not warranted, this EA would remain valid until WS and the USFWS 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

Actions could be taken to reduce threats to human health and safety, reduce damage to agricultural resources, alleviate property damage, and protect native wildlife, including threatened or endangered species, in the Commonwealth. As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. In addition, WS' activities that could involve the lethal removal of birds under the alternatives would only occur when permitted by the USFWS, when required, and only at levels permitted.

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 Pennsylvania where WS and the appropriate entities have entered into an agreement through the signing of a MOU, work initiation document, or other comparable document. This EA also addresses the potential impacts of conducting damage management approaches in areas where additional MOUs, work initiation documents, 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, 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 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 Pennsylvania. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in the Commonwealth (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) 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 Pennsylvania. 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 PGC. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the 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.

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

1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

Final Environmental Impact Statement: Double-crested Cormorant Management in the United States

To reduce depredation on aquaculture stock at private fish farms and Commonwealth and federal fish hatcheries, the USFWS established an Aquaculture Depredation Order (AQDO) that 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 their impacts to other resources were not adequately being addressed by the AQDO. Therefore, 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). USFWS published a Final Rule and Record of Decision (ROD) on October 8, 2003 (68 FR 47603) and WS, a formal cooperating agency in the preparation of the FEIS, published its ROD on December 5, 2003 (68 FR 68020). WS has adopted the FEIS to support WS' program decisions for its involvement in the management of cormorant damage. Pertinent and current information available in the FEIS has been incorporated by reference into this EA.

Final Environmental Assessment: Extended Management of Double-crested Cormorants under 50 CFR 21.47 and 21.48

The cormorant management FEIS developed by the USFWS, in cooperation with WS, established a Public Resource Depredation Order (PRDO; 50 CFR 21.48) and made changes to the 1998 Aquaculture Depredation Order (AQDO; 50 CFR 21.47). To allow for an adaptive evaluation of activities conducted under the PRDO and the AQDO established by the FEIS, those Orders are subject to review and renewal every five years (USFWS 2003). An EA developed in 2009 (USFWS 2009*a*) and again in 2014 (USFWS 2014*a*) determined that a five-year extension of the expiration date of the PRDO and the AQDO would not threaten cormorant populations and activities conducted under those Orders would not have a significant impact on the human environment (74 FR 15394-15398; USFWS 2009*a*, USFWS 2014*a*).

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 permitting 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 authorized disturbance of eagles, which constitutes "*take*" as defined under the Bald and Golden Eagle Protection Act, authorizes the removal of eagle nests where necessary to reduce threats to human safety, and evaluated the issuance of permits authorizing the lethal take of eagles in limited circumstances (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). A Final Rule was published on September 11, 2009 (74 FR 46836-46879). Pertinent and current information available in the EA has been incorporated by reference into this EA.

Final Environmental Impact Statement: Light Goose Management

The USFWS has issued a FEIS that analyzes the potential environmental impacts of management alternatives for addressing problems associated with overabundant light goose populations (USFWS 2007). The light geese referred to in the FEIS include the lesser snow geese (*Chen caerulescens caerulescens*), greater snow geese (*C. c. atlantica*), and Ross's geese (*C. rossii*) that nest in Arctic and sub-Arctic regions of Canada and migrate and winter throughout the United States. A Record of Decision (ROD) and Final Rule were published by the USFWS and the Final Rule went into effect on December 5, 2008. Pertinent and current information available in the FEIS has been incorporated by reference into this EA.

Atlantic Flyway Mute Swan Management Plan 2002–2013

In response to increasing populations of mute swans along the Atlantic Flyway, the Atlantic Flyway Council developed a management plan to reduce swan populations in the Flyway in order to minimize the negative ecological damages occurring to wetland habitats from the overgrazing of submerged aquatic vegetation by mute swans. Another goal of the Plan is to reduce swan populations in the Flyway to reduce competition between swans and native wildlife and to prevent the further expansion of mute swans (Atlantic Flyway Council 2003).

Final Environmental Impact Statement: Resident Canada Goose Management

To address the increasing population of resident Canada geese and the personal and public property damage and public health concerns associated with this increase, the USFWS developed a FEIS that evaluated alternative strategies to reduce, manage, and control the population and related damages (USFWS 2005). The selected alternative in the FEIS establishes regulations that; 1) establishes specific control and depredation orders (airports, nests and eggs, agricultural and public health) designed to address resident Canada goose depredation, damage and conflict, 2) provides expanded hunting methods and opportunities to increase the number of resident Canada geese harvested during existing September seasons, 3) authorizes the implementation of a resident Canada geese population control program. More specifically, the selected alternative in the FEIS modified 50 CFR 20.11, 20.21, and 21.3 to include the definition of resident Canada geese, increase restrictions on shotgun capacity and allow for the use of electronic calls during the early September season designed to target resident Canada geese. It also added 50 CFR 21.49, 21.50, 21.51 and 21.52 to subpart D which establishes the control order for resident Canada geese at airports, a depredation order for nests and eggs, a depredation order for resident Canada geese at agricultural facilities and a public health control order for resident Canada geese. Finally the

FEIS added 50 CFR 21.61 to subpart E to establish the resident Canada geese population control program. A Record of Decision (ROD) and Final Rule were published by the USFWS on August 10, 2006 (71 FR 45964- 45993). On June 27, 2007, WS issued a ROD and adopted the USFWS FEIS (72 FR 35217). Pertinent and current information available in the FEIS has been incorporated by reference into this EA.

Atlantic Flyway Resident Canada Goose Management Plan (AFRCGMP)

In response to increasing populations of resident Canada geese along the Atlantic Flyway, the Atlantic Flyway Council composed the Atlantic Flyway Resident Canada Goose Management Plan to describe the status of resident geese and set population goals and management strategies for the flyway. To relieve damage and manage conflicts, the AFRCGMP recommended a variety of options including the adoption of a federal depredation order or conservation order to allow states to manage resident goose populations while maximizing the opportunities for the use and appreciation of resident Canada geese. The AFRCGMP also called for management, which is compatible with management criteria already established for migratory Canada geese. Finally, the AFRCGMP called for annual monitoring of resident Canada geese populations, harvest and conflict levels so that the effectiveness of the plan could be assessed (Atlantic Flyway Council 1999). This plan was updated in 2011 with revised population goals (Atlantic Flyway Council 2011).

Waterbird Conservation Plan: 2006–2010 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 Region Waterbird Working Group 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 Region Waterbird Working Group 2006). Information in the Plan on waterbirds and their habitats provide a regional perspective for local conservation action.

WS' Environmental Assessments

WS has previously developed EAs that analyzed the need for action to manage damage associated with pigeons, European starlings, brown-headed cowbirds, common grackles, and house sparrows (USDA 2003*a*), waterfowl (2003*b*), and other bird species (USDA 2005). 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.

Changes in the need for action and the affected environment have prompted WS to initiate this new analysis to address damage management activities in the 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. 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. However, information in the need for action in the previous EAs relative to birds continues to be appropriate to the need for action associated with this EA (USDA 2003*a*, USDA 2003*b*, USDA 2005).

1.5 AUTHORITY OF FEDERAL AND COMMONWEALTH AGENCIES

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

WS' Legislative Authority

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

United States Fish and Wildlife Service Authority

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitat. The USFWS has specific responsibilities for the protection of migratory birds, threatened or endangered species, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources, such as 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 MBTA. 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[10]:

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

Therefore, the USFWS can and does authorize depredation permits or orders for the take of migratory birds when certain criteria are met pursuant to the Act. Additionally, the USFWS can and does issue frameworks for the take of migratory game birds to state wildlife agencies. These frameworks include the allowable length of hunting seasons, methods of take, and allowed take, which are implemented by the state wildlife agency.

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

United States Environmental Protection Agency (EPA)

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

United States Food and Drug Administration (FDA)

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

Pennsylvania Game Commission

The authority to manage natural resources in the Commonwealth is found in Article 1, Section 27 of the Constitution of the Commonwealth of Pennsylvania. More specifically, the PGC is charged "*...to protect, propagate, manage, and preserve the game or wildlife of this Commonwealth and to enforce, by proper actions and proceedings, the law of this Commonwealth relating thereto*" under Title 34 (Game and Wildlife Code), Chapter 3, Section 322(a), of the Constitution of the Commonwealth of Pennsylvania. The PGC is responsible for establishing and enforcing hunting seasons for bird species such as wild turkey and ring-necked pheasant 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. Additionally, the PGC is responsible for adding or changing the classification of wild birds (Title 34, Section 322 c(8)) and has jurisdiction over state listed threatened or endangered species (Title 34, Chapter 21, Section 2121(b)).

Pennsylvania Department of Agriculture (PDA)

Under the Pennsylvania Pesticide Control Act of 1973 (3 P.S. 111.21-111.61), the Pennsylvania Department of Agriculture has the authority to classify restricted pesticides, certify and register pesticide applicators, and license pesticide dealers, businesses and consultants, conduct investigations and enforce the act. This authority rests in The Bureau of Plant Industry of the Pennsylvania Department of Agriculture.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise would affect WS' activities. WS would comply with those laws and statutes and would consult with other agencies as appropriate. 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

The National Environmental Policy Act (NEPA) requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of the NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS and the USFWS follow the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.). In addition, WS follows the USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities 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 that could be capable of avoiding or minimizing adverse 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 of 1918 (16 USC 703-711; 40 Stat. 755), as amended

The MBTA makes it unlawful, "*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, except under specified conditions (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, the USFWS published a list of bird species not protected under the MBTA (70 FR 12710-12716). Free-ranging domestic and feral waterfowl, mute swans, wild turkeys, ring-necked pheasants, rock pigeons, Eurasian collared doves, monk parakeets, European starlings, and house sparrows addressed in this EA are not protected under the MBTA (70 FR 12710-12716). A depredation permit from the USFWS is not required to take Free-ranging domestic and feral waterfowl, mute swans, wild turkeys, ring-necked pheasants, rock pigeons, Eurasian collared doves, monk parakeets, European starlings, and house sparrows.

The law prohibits "*take*" of those migratory bird species listed in the Act except as permitted. As mentioned in Section 1.5, the MBTA provides the USFWS with statutory authority for enforcing the MBTA. Under this authority, the USFWS may issue depredation/control orders or depredation 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 would comply with the regulations of the MBTA, as amended.

Depredation Order for Double-crested Cormorants at Aquaculture Facilities (50 CFR 21.47)

The AQDO was established to reduce cormorant depredation of aquaculture stock at private fish farms and state and federal fish hatcheries. Under the AQDO, cormorants can be lethally taken at commercial freshwater aquaculture facilities and state and federal fish hatcheries in 13 States. The Order authorizes landowners, operators, and tenants, or their employees/agents, that are actually engaged in the production of aquaculture commodities to take cormorants causing or about to cause damage at those facilities without the need for a depredation permit. Those activities can only occur during daylight hours and only within the boundaries of the aquaculture facility. The AQDO also authorized WS to take cormorants from October through April at roost sites near aquaculture facilities at any time. When conducting those activities, WS would not be required to have a depredation permit from the USFWS. WS would only conduct activities after receiving the appropriate landowner permissions. Pennsylvania is not one of the states included in the AQDO.

Depredation Order for Double-crested Cormorants to Protect Public Resources (50 CFR 21.48)

The purpose of the PRDO is to reduce the actual occurrence, and/or minimize the risk, of adverse impacts of cormorants to public resources. Public resources, as defined by the PRDO, are natural resources managed and conserved by public agencies. Public resources include fish (free-swimming fish and stocked fish at federal, state, and tribal hatcheries that are intended for release in public waters), wildlife, plants, and their habitats. The PRDO authorizes WS, state fish and wildlife agencies, and federally recognized Tribes in 24 states to conduct damage management activities involving cormorants without the need for a depredation permit from the USFWS. It authorizes the take of cormorants on "*all lands and freshwaters*" including public and private lands. However, landowner/manager permission must be obtained before cormorant damage management activities may be conducted at any site. Pennsylvania is not one of the states included in the PRDO.

Depredation Orders for Canada Geese (see 50 CFR 21.49, 50 CFR 21.50, 50 CFR 21.51, 50 CFR 21.52, and 50 CFR 21.61)

As discussed previously in Section 1.4, to address the increasing population of resident Canada geese and the personal and public property damage and public health concerns associated with this increase, the USFWS developed a FEIS that evaluated alternative strategies to reduce, manage, and control the population and related damages (USFWS 2005). The selected alternative in the FEIS established specific depredation orders to manage damage associated with resident Canada geese when certain criteria are occurring. Specifically, it added 50 CFR 21.49, 21.50, 21.51 and 21.52 to subpart D. Under 50 CFR 21.49, resident Canada geese can be lethally taken at airports and military airfields by airport authorities or their agents when those geese are causing damage or posing a threat of damage to aircraft. Under 21.50, the nests and eggs of resident Canada geese causing or posing a threat to people, property, agricultural crops, and other interests can be destroyed without the need for a depredation permit once the participant has registered with the USFWS. Under 50 CFR 21.51, resident Canada geese can be lethally taken in designated states, including Pennsylvania, when geese are causing damage to agricultural resources. Finally, under 50 CFR 21.52, resident Canada Geese can be addressed using lethal and non-lethal methods by state agencies, Tribes, and the District of Columbia when those geese pose a direct threat to human health. Finally the FEIS added 50 CFR 21.61 to subpart E to establish the resident Canada geese population control program. Under these depredation orders for Canada geese, no depredation permit is required from the USFWS once the criteria of those orders have been met.

Depredation Order for Muscovy Ducks (50 CFR 21.54)

Muscovy ducks are native to South America, Central America, and Mexico with a small naturally occurring population in southern Texas. Muscovy ducks have also been domesticated and have been sold and kept for food and as pets in the United States. In many States, Muscovy ducks have been released or escaped captivity and have formed feral populations, especially in urban areas, that are non-migratory. The USFWS has issued a Final Rule on the status of the Muscovy ducks in the United States (75 FR

9316-9322). Since naturally occurring populations of Muscovy ducks are known to inhabit parts of south Texas, the USFWS has included the Muscovy duck on the list of bird species afforded protection under the MBTA under 50 CFR 10.13 (75 FR 9316-9322). To address damage and threats of damage associated with Muscovy ducks, the USFWS has also established a control order for Muscovy ducks under 50 CFR 21.54 (75 FR 9316-9322). Under 50 CFR 21.54, Muscovy ducks, and their nests and eggs, may be removed or destroyed without a depredation permit from the USFWS at any time in the United States, except in Hidalgo, Starr, and Zapata Counties in Texas (75 FR 9316-9322).

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 remove 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 could be lethally removed under this depredation order include American crows, fish crows, red-winged blackbirds, common grackles, and brown-headed cowbirds.

Conservation Order for Light Geese (50 CFR 21.60)

Under 50 CFR 21.60, additional hunting methods, such as electronic calls and unplugged shotguns, can be used to harvest lesser snow geese, greater snow geese, and Ross's geese, also referred to as "*light geese*". These regulations are allowed during a light-goose-only hunting season when all other waterfowl and crane hunting seasons, excluding falconry, are closed. The rule also authorizes States to implement a conservation order to allow the harvest of light geese outside of traditional hunting seasons. In addition, the conservation order allows shooting hours to continue until one-half hour after sunset and removes the daily bag limit for light geese.

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 steep declining trends in bald eagles, the Bald Eagle Protection Act (16 USC 668) 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. 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 can "*molest"* or *"disturb"* eagles. For the purposes of the Act, under 40 CFR 22.3, the term "*disturb"* as it relates to take 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."*

Endangered Species Act (16 USC 1531-1544)

The 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 to ensure that the agencies actions 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 could be available for use under the alternatives cause major ground disturbance, any physical 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. Therefore, those activities would be conducted to benefit 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.

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

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on 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 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 has considered the impacts that the alternatives might have on children in Chapter 4.

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 with the USFWS that shall promote the conservation of migratory bird populations*". The APHIS and the 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 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 (7 USC 136 et seq.)

The 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 Commonwealth's Coastal Zone Management Program.

New Animal Drugs for Investigational Use (21 CFR 511)

The FDA has the authority to grant permission to use investigational new animal drugs (21 CFR 511). The sedative drug alpha-chloralose is registered with the FDA to capture waterfowl, coots, and pigeons. The use of alpha-chloralose by WS was authorized by the FDA, which allows use of the drug as a non-lethal form of capture. The use of alpha-chloralose as a method for resolving damage and threats caused by birds is discussed in Appendix C of this EA.

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.

Game and Wildlife Code (Constitution of the Commonwealth of Pennsylvania, Title 34)

Title 34 of the Constitution of the Commonwealth of Pennsylvania has been designated as the Game and Wildlife Code. It defines the responsibilities and duties of the PGC including several provisions that address birds and wildlife damage management.

Title 34, Chapter 21, Section 2121(a) states "*...nothing in this title shall be construed to prohibit any person from killing any game or wildlife...which the person may witness actually engaged in the material* *destruction of cultivated crops, fruit trees, vegetables, livestock, poultry or beehives*...". The section goes on to state that, "*Before any game or wildlife, which may be designated by regulation of the commission, or any bird or animal classified as threatened or endangered may be killed, every reasonable effort shall be made to live trap and transfer such game or wildlife. The trapping and transfer shall be done in cooperation with a representative of the commission*" (Title 34, Chapter 21, Section 2121(b)).

Additionally, Title 34 also addresses bird species. Chapter 21, Section 2164(a) states, "*...it is unlawful for any person at any time to attempt or conspire to kill or take or attempt, assist, aid or abet in the taking of any protected birds or possess protected birds, or any part thereof*". Additionally, under Chapter 21, Section 2165(a), "*...it is unlawful for any person to take or have in possession or under control either the active nests or any egg of any game bird or protected bird or to interfere with or destroy the active nest or egg*."

Recreation (The Pennsylvania Code, Title 58)

Not to be confused with the Constitution of the Commonwealth of Pennsylvania, the Pennsylvania Code is an official publication of the Commonwealth of Pennsylvania containing regulations and other documents. It consists of 55 titles.

Several provisions in Title 58 (Recreation) of the Pennsylvania Code relate and govern damage management activities within the Commonwealth. Chapter 147 of Title 58 relates to the issuance of special permits related to wildlife and defines those activities that require a permit. Specifically, Section 147.721 states, "*...a permit is required for any resident or nonresident person to take, harass, transport, release or dispatch designated wildlife for another person or to solicit or offer his services to another to take, harass, transport or dispatch designated wildlife that is creating a nuisance, causing damage to property or is a risk to human health or safety. This permit authorizes the agent to control designated wildlife for another at any time of the year"*. With regards to WS' activities, Section 147.729(a) states that *"a nuisance wildlife control operator permit will not be required for municipal, State or Federal employees conducting animal control activities if ... (1) the municipal, State or Federal employee has agreed, in writing, to conduct animal control in accordance with this subchapter..."*.

Pennsylvania Pesticide Laws (Pesticide Control Act of 1973, The Pennsylvania Code Chapter 128)

Under the Pennsylvania Pesticide Control Act of 1973 (3 P.S. 111.21-111.61), as amended, the Pennsylvania Department of Agriculture has the authority to classify restricted pesticides, certify and register pesticide applicators, license pesticide dealers, businesses, and consultants, as well as conduct investigations and enforce the act. This authority rests in The Bureau of Plant Industry of the Pennsylvania Department of Agriculture (PDA). Additionally, the Act outlines the rules and regulations related to the use of pesticides and the penalties (criminal and civil) which can be imposed by the PDA for improper use. Chapter 128 of the Pennsylvania Code contains the implementing regulations of the Act including but not limited to; specific categories of pesticide licenses, specific insurance requirements, specific records to be kept, specific requirements for recertification, specific requirements for reporting accidents, and specific requirements related to the use of pesticides in protected areas or near threatened or endangered species.

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. Management of migratory birds is the responsibility of the USFWS. As the authority for the overall management of bird populations and as a cooperating agency, the USFWS has provided input throughout the EA preparation process to ensure an interdisciplinary approach in accordance with the NEPA and agency mandates, policies, and regulations.

The PGC is responsible for managing wildlife in the Commonwealth of Pennsylvania, including birds. The PGC establishes and enforces regulated hunting seasons in the Commonwealth, including the establishment of seasons that allow the harvest of some of the bird species addressed in this EA. As mentioned previously, the PGC can establish hunting seasons for migratory birds as defined by the MBTA. However, the PGC must conform to frameworks determined by the USFWS. WS' activities to reduce and/or prevent bird damage in the Commonwealth would be coordinated with the USFWS and the PGC, which ensures WS' actions were incorporated into population objectives established by those agencies for bird populations. The take of many of the bird species addressed in this EA could only occur when authorized by a depredation permit issued by the USFWS and/or the PGC. Therefore, the take of those bird species to alleviate damage or reduce threats of damage would occur at the discretion of the USFWS and/or the PGC. 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: 1) should WS conduct disease surveillance and monitoring in the bird population when requested by the PGC, the USFWS, and other agencies, 2) should WS, in cooperation with the USFWS, continue to conduct bird damage management activities to alleviate damage or threats to agriculture, property, natural resources, and threats to human safety in the Commonwealth of Pennsylvania, 3) should the USFWS Region 5 Migratory Bird Program continue to issue depredation permits to WS and other entities to conduct bird damage management activities, 4) should WS implement an integrated wildlife damage management strategy, including technical assistance and direct operational assistance, to meet the need for bird damage management in Pennsylvania, 5) if not, should WS attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, and 6) would the proposed action or the other alternatives result in effects to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that 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

Damage or threats of damage caused by those bird species addressed in this EA can occur statewide in Pennsylvania wherever those species of birds occur. However, WS and the USFWS would only provide assistance when the appropriate landowner or manager requested such assistance and only on properties where WS and the appropriate landowner or manager has signed a MOU, work initiation document, or another similar document. Most species of birds addressed in this EA are capable of utilizing a variety of habitats and occur statewide where suitable habitat exists for foraging, loafing, roosting, and breeding. In addition, many of the bird species occur throughout the year in the Commonwealth. Since most bird species addressed in this EA occur statewide, requests for assistance to manage damage or threats of damage could occur in areas of the Commonwealth occupied by those bird species. Additional information on the affected environment is provided in Chapter 4.

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 Pennsylvania 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 Pennsylvania that are currently being conducted under a MOU, work initiation document, or a similar document with WS where activities have been and currently are being conducted. This EA also addresses the potential impacts of bird damage management in the Commonwealth where additional agreements may be signed in the future. The USFWS would only issue a depredation permit 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, but are not necessarily limited to 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 also 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 effects that occur or would occur from a non-federal entity conducting the action in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency (*e.g.*, the PGC), invasive species, or unprotected wildlife species.

Most bird species are protected under state and/or federal law and to address damage associated with those species, a permit must be obtained from the appropriate federal and/or state agency. However, in some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), some species can be managed without the need for a permit when they are causing damage (*e.g.*, take under depredation/control orders, 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 PGC. Under the blackbird depredation order (see 50 CFR 21.43), 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. Resident Canada geese can be addressed under several depredation orders. Muscovy ducks can also be addressed under a control order. 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 and ring-necked pheasants, are not protected from take under the MBTA and are instead protected under Commonwealth law and their removal requires a permit from the PGC.

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. Free-ranging domestic and feral waterfowl, mute swans, rock pigeons, monk parakeets, European starlings, and house sparrows are not protected under the MBTA or by Commonwealth law; therefore, no permit would be required from the USFWS or the PGC to resolve damage or to 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 species, the action is not subject to compliance with the NEPA due to the lack of federal involvement[11] 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 and the PGC. 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 using methods that have no prior experience with managing damage or threats associated with birds. The lack of experience in bird behavior and damage management methods could lead to the continuation of damage, which could threaten human

[11]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.

safety or 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 concerning effectiveness, humaneness, minimizes non-target take, and reduces threats to human safety from those methods. WS' mission is to provide leadership in resolving and preventing damage to resources and to reduce threats to human safety caused by wildlife, including birds in Pennsylvania. 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.

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 identified in the cormorant management FEIS developed by the USFWS, in cooperation with WS (USFWS 2003), as well as those issues identified in the resident Canada geese FEIS developed by the USFWS (USFWS 2005), were considered during the development of this EA. Issues related to managing damage associated with birds in Pennsylvania were developed by WS in consultation with the USFWS and the PGC. 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 is the potential impacts of management actions on the populations of target species. Methods available to resolve damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods available can disperse or otherwise make an area unattractive to the target species causing damage, which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods were employed. Lethal methods would also be available to remove a bird or those birds responsible for causing damage or posing a threat of damage. Therefore, if lethal methods were used, the removal of a bird or birds would result in local population reductions in the area where damage or threats were occurring. The number of individuals from a target species that could be removed from a population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individual birds involved with the associated damage or threat, and the efficacy of methods employed.

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. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations would be based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. 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 and only after the take of those bird species had been permitted by the USFWS pursuant to the MBTA and the PGC, when required.

In addition, some of the bird species addressed in this EA can be harvested in the Commonwealth during annual hunting seasons. Therefore, any activities conducted by WS and permitted by the USFWS under the alternatives addressed would be occurring along with other natural processes and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

Methods available under each of the alternatives to alleviate damage and reduce threats to human safety would be employed targeting an individual of a bird species or a group of individuals after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. The effects on the populations of target bird populations in the Commonwealth from implementation of the alternatives addressed in detail, including the proposed action, are analyzed in Chapter 4. Information on bird populations and trends are often derived from several sources including the Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), the Partners in Flight Landbird Population database, the Pennsylvania Breeding Bird Atlas (BBA), published literature, and harvest data. Further information on those sources of information is provided below.

Breeding Bird Survey

Under established guidelines, observers count birds at established survey points along roadways for a set duration along a pre-determined route. Routes are 24.5 miles long and are surveyed once per year with the observer stopping every 0.5 miles along the route to conduct the survey. The numbers of birds observed and heard within 0.25 miles of each of the survey points are recorded during a 3-minute sampling period at each point. Surveys were started in 1966 and are conducted in June, which is generally considered as the period of time when those birds present at a location are likely breeding in the immediate area.

Bird populations can be monitored by using trend data 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).

Atlantic Flyway Breeding Waterfowl Plot Survey / Atlantic Flyway Midwinter Waterfowl Survey

The Atlantic Flyway Breeding Waterfowl Plot Survey has been conducted annually since 1989 in Pennsylvania and other Atlantic Flyway states from Virginia to New Hampshire. Established 1-km^2 plots are surveyed for ducks and geese once each year from the ground or air between mid-April and early May. This data is then used to estimate breeding population trends and are not necessarily accurate estimates of abundance. The survey methodology has been described in detail by Heusmann and Sauer (1997, 2000). Reports that summarize this data are published annually (*e.g*., see Klimstra and Padding 2013).

Similarly, the Midwinter Waterfowl Survey estimates the number of ducks and geese overwintering in Atlantic Flyway States. States in the Atlantic Flyway, including Pennsylvania, conduct this survey, primarily from aircraft, each January on major coastal and inland waterfowl wintering areas. These surveys provide information on population status, distribution, and habitats used by waterfowl species.

The current (2002 - present) Pennsylvania survey consists of 11 survey segments covered by the PGC plus 1 segment in the middle Delaware River Valley covered by the New Jersey Division of Fish and Wildlife (NJDFW). For the purposes of state-level summary reports, one-half of each species total from this NJDFW survey is used as an estimate for the Pennsylvania portion of this segment. However, for the purposes of flyway-level summary reports, all the birds recorded in the Delaware Valley are recorded under New Jersey. The survey methodology has been described in detail by Eggeman and Johnson (1989). Reports that summarize this data are published annually (*e.g.*, see Klimstra and Padding 2013).

Waterfowl Breeding Population and Habitat Survey

Additional breeding survey data for areas not covered by the Atlantic Flyway Breeding Waterfowl Plot Survey are obtained during the Waterfowl Breeding Population and Habitat Survey. The number of waterfowl observed are recorded by aerial crews flying along established transect lines. In areas where access is possible, ground crews survey a sub-set of aerial transects to determine factors needed to adjust the aerial figures for birds that could not be observed from the air. This survey is conducted cooperatively by USFWS and Canadian Wildlife Service. The primary purpose of the survey is to obtain information on spring population of waterfowl. The survey methodology has been described in detail by Smith (1995). Reports that summarize this data are published annually (*e.g.*, see USFWS 2014*b*).

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 BBS and the CBC (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. Two 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 Region Waterbird Working Group 2006) and the Upper Mississippi Valley / Great Lakes Waterbird Conservation Plan which includes BCR 13 (Wires et al. 2010). See ***Bird Conservation Regions*** section below for a detailed description of BCRs. 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.

Second Atlas of Breeding Birds in Pennsylvania (Pennsylvania Breeding Bird Atlas)

The second atlas of Breeding Birds in Pennsylvania was conducted from January 1, 2004 through December 31, 2009. During this period, volunteer observers recorded the species, location, date, and category of breeding behavior observed for all species under a standard methodology. Under additional standardized methodology, audio playback surveys were used to make observations of marsh birds, and two types of audio playback surveys were used to make observations of nocturnal birds. The survey also used professional staff to observe birds at 37,552 points throughout the Commonwealth from May 25 to July 4, a period that corresponds with when most bird species are breeding. Finally, additional data collected during this period were also reviewed and incorporated into the data set. Data incorporated into the data set included rare or unusual birds published in the journal *Pennsylvania Birds*, threatened or endangered birds compiled by the PGC, PGC surveys on American woodcock, bald eagle, mute swan, osprey, colonial waterbirds, and other species, and from the BBS in Pennsylvania (see above). This data was then used to estimate species distribution, abundance, and change since the first atlas (1983–1989) and to derive population estimates (Wilson et al. 2012).

Pennsylvania Game Commission Surveys

The PGC conducts a variety of surveys within the Commonwealth to monitor species of concern including bald eagle, mute swan, osprey, colonial waterbirds, and waterfowl. The bald eagle survey uses staff, partner, and volunteer observers to identify and monitor nests using a standardized methodology during the breeding season to monitor the population and nesting success (Gross 2010). To monitor the number of eagles overwintering in the Commonwealth, the PGC uses data collected according to a nationally standardized mid-winter eagle survey methodology by staff, partner, and volunteer observers (Gross 2010). This data is analyzed and compiled in an annual report entitled, Bald Eagle Breeding and Wintering Surveys (Gross 2010, Gross and Brauning 2010). Similarly, the PGC uses staff, partner, and volunteer observers to survey the population and nesting success of osprey (Barber and Gross 2012) and colonial waterbirds (Gross and Haffner 2011). Great egret, black-crowned night-heron, double-crested cormorant, and great blue heron are included in the more recent colonial waterbird surveys (Gross and Haffner 2011) while past surveys also included gull species (Brauning 2001, 2002). Using the methodology outlined in the Atlantic Flyway Mute Swan Management Plan (Atlantic Flyway Council 2003), PGC employees conduct surveys to monitor the population of mute swans every three years (Gregg 2011). Finally, the waterfowl population project monitors the status of breeding and wintering populations of waterfowl in the Commonwealth using data from a variety of sources including the surveys described in ***Annual Hunter Harvest Estimates***, ***Atlantic Flyway Breeding Waterfowl Plot***

Survey, and the ***Atlantic Flyway Midwinter Waterfowl Survey*** sections of this EA (see Jacobs and Gregg 2011).

Hawk Mountain Sanctuary

Hawk Mountain Sanctuary is a mountaintop watch site located on the Kittatinny Ridge, in the central Appalachian mountains of eastern Pennsylvania. Due to a variety of factors, the Sanctuary is an excellent location to observe migrating raptors. The Sanctuary's long-term count site, the North Lookout, consists of a rocky outcrop, which has a 240° view to the east. The numbers of individual species of migrating raptors observed are recorded daily from August 15 through December 15 and April 1 through May 15 (Hawk Mountain Sanctuary 2013).

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 data 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. Some species of birds that are more conspicuous (visual and auditory) are more likely to be detected during bird surveys when 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 several migratory bird species 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 PGC. Species that fall into this category and are addressed in this EA include Canada geese, Atlantic brant, snow geese, mallard, American black duck, wood duck, northern pintail, gadwall, American wigeon, Northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, greater scaup, lesser scaup, ring-necked duck, long-tailed duck, white-winged scoter, black scoter, common goldeneye, bufflehead, hooded merganser, common merganser, ruddy duck, American coot, Wilson's snipe, American woodcock, mourning dove, American crow, and fish crow. Two species of non-migratory game birds, the wild turkey and ring-necked pheasant, are not protected under the MBTA, but are protected by the Commonwealth of Pennsylvania and can be harvested during regular hunting seasons established and enforced by the PGC. Finally, mute swans and free-ranging domestic and feral waterfowl are non-native and not protected under Commonwealth or federal law.

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, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013). The PGC also conducts detailed surveys to estimate and prepare reports on the number of birds harvested (*e.g.*, see Casalena 2011, Johnson et al. 2012).

Bird Conservation Regions

BCRs are areas in North America that are characterized by distinct ecological habitats that have similar bird communities and resource management issues. The Commonwealth of Pennsylvania lies within the Lower Great Lakes / St. Lawrence Plain (BCR 13), Appalachian Mountains (BCR 28), Piedmont (BCR 29) and the New England / Mid-Atlantic Coast (BCR 30) regions (USFWS 2000*a*; see Figure 2-1).

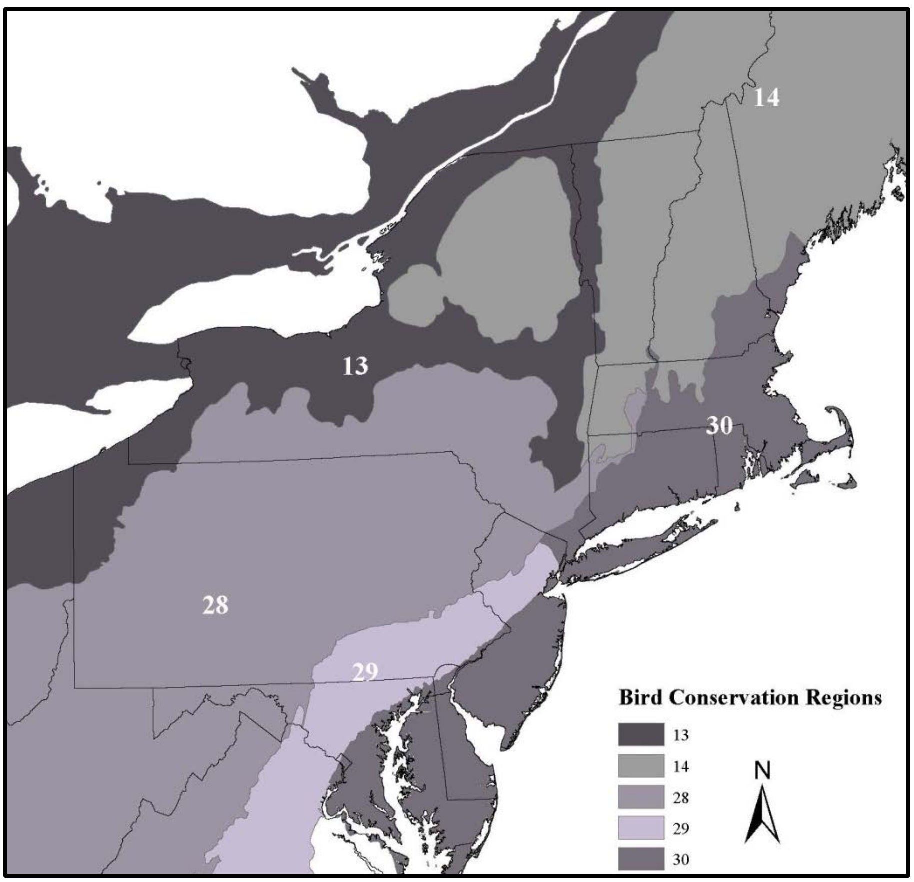

Figure 2-1. Map of Bird Conservation Regions Relevant to the EA

The Lower Great Lakes / St. Lawrence Plain region (BCR 13) is characterized by lakeshore habitat and the associated wetlands. Although originally covered with a mixture of oak-hickory, northern hardwood and mixed-coniferous forests, very little of the forest remains and the region is now dominated by grasslands which are being lost to agricultural abandonment and urbanization. In Pennsylvania, this region covers the northwest portion of the Commonwealth (USFWS 2000*a*).

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. Vegetation is dominated by oak-hickory and other deciduous forest types at lower elevations and at higher elevations, pine, hemlock, spruce, and fir dominate the landscape. The majority of the region is forested, but some agricultural practices occur in the flatter portions of the landscape (USFWS 2000*a*). In Pennsylvania, the Appalachian Mountains region covers all but the northwest and southeast portions of the Commonwealth.

The southeast 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 and the flat coastal plain of the Atlantic Ocean consisting of a patchwork of various hardwood, grassland, and urban settings (USFWS 2000*a*).

BCR 30, or the New England/Mid-Atlantic Coast region, overlaps a small portion of the southeastern part of the Commonwealth. This region, as the name implies, is characterized by coastal wetland and beach habitats. Much of the region was converted to agricultural production as human settlements expanded in the region, but today is dominated by forest and residential use (USFWS 2000*a*).

The Atlantic Northern Forest region (BCR 14) is the other Bird Conservation Region that dominates the northeast. Although the Atlantic Northern Forest region does not include any of the land area of Pennsylvania, 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 Pennsylvania 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 Pennsylvania. Several of the analyses in Chapter 4 of this EA will address birds with breeding populations that occur primarily in BCR 14.

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on non-target species, including state and federally threatened or endangered species. The use of non-lethal and lethal methods to alleviate damage or threats caused by target species also has the potential to inadvertently disperse, capture, or kill non-target wildlife.

To reduce the risk to non-target wildlife, including state and federally threatened or endangered species, persons employing damage management activities should select methods or implement methods in a specific way that targets the specific species causing the damage. For example, persons should implement methods in locations that are extensively, and if possible exclusively, used by the target species. WS would also use SOPs designed to reduce the effects on non-target species' populations. SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix C.

Specific concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods that would be available to manage damage or threats of damage associated with birds include the avicide DRC-1339, Avitrol, alpha chloralose, mesurol, nicarbazin, and taste repellents. Chemical methods that could be available for use to manage damage and threats associated with birds in Pennsylvania are further discussed in Appendix C.

The 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 ESA 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. Special efforts are made to avoid jeopardizing threatened or endangered species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS also consults with the PGC regarding potential risks to state-listed species from the proposed action and would consult with PGC prior to the take of any state-listed threatened or endangered species.

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 target bird species. 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 that may encounter 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, immobilizing drugs, reproductive inhibitors, and repellents. With the exception of immobilizing drugs and DRC-1339, all of those chemical methods would be available to entities other than WS under all of the alternatives analyzed in detail.

Avicides are those chemical methods used to remove birds lethally. DRC-1339 is the only avicide currently being considered for use to manage damage in this EA. The active ingredient of DRC-1339 is 3-chloro-p-toluidine hydrochloride. DRC-1339 is currently registered with the EPA for use by WS to manage damage associated with pigeons, starlings, red-winged blackbirds, brown-headed cowbirds, common grackles, crows, and gulls. However, at the time this EA was developed, DRC-1339 could only be used to target pigeons, starlings, red-winged blackbirds, brown-headed cowbirds, common grackles, and crows in the Commonwealth. A commercially available product with the same active ingredient as DRC-1339 is registered for use in the Commonwealth under the trade name Starlicide™ Complete. Starlicide™ Complete is registered for use by persons registered with the PDA as pesticide applicators to manage damage caused by starlings, common grackles, brown-headed cowbirds, and red-winged blackbirds at livestock and poultry operations.

The immobilizing drug alpha chloralose is available for use by WS only as an investigational new animal drug (see 21 CFR 511). The use of alpha chloralose by WS was authorized by the FDA, which allows use of the drug as a non-lethal form of capture for waterfowl, geese, and pigeons. Alpha chloralose would only be available for use by WS under the proposed action alternative.

Nicarbazin is the active ingredient of 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. In Pennsylvania, nicarbazin is registered for use by persons registered with the PDA as pesticide applicators. However, at the time this EA was developed, only products to manage local pigeon populations were available. Nicarbazin would be available for use under any of the alternatives analyzed in detail.

Several avian repellents are commercially available to disperse birds from an area or discourage birds from feeding on desired resources. Those repellents being considered for use in this EA include Avitrol®, Mesurol®, and products listed under a variety of trade names containing the chemicals polybutene, anthraquinone, and methyl anthranilate. Taste repellents available that contain the chemicals anthraquinone and methyl anthranilate include ReJeX-iT®, Bird Shield®, 4 the Birds®, and Flight Control®, which are available for use by persons registered with the PDA as pesticide applicators and therefore would be available for use under any of the alternatives. Taste repellents are available to alleviate feeding by birds, such as waterfowl, geese, and blackbirds. Polybutene is the active ingredient in many tactile repellents registered for birds, such as pigeons, starlings, and house sparrows. Avitrol is another avian repellent available for use by persons registered with the PDA as a pesticide applicator. Avitrol is a flock dispersal method available for use to manage damage associated with some bird species. For those bird species addressed in this EA, Avitrol is registered with the EPA and the PDA to manage damage associated with house sparrows, red-winged blackbirds, common grackles, brown-headed cowbirds, European starlings, rock pigeons, and American crows. An additional repellent being considered for use in this EA is mesurol, which is intended for use to discourage crows from predating on the eggs of threatened or endangered species. Mesurol® is registered for use by WS' personnel only; therefore, would only be available under the proposed action alternative. However, at the time this EA was developed, Mesurol was not registered with PDA for use by WS in the Commonwealth.

The use of chemical methods is strictly regulated by the EPA, the FDA, and the PDA. These chemicals can only be applied by persons who have been specially trained and certified by the PDA 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 a specific requirements for their handling, transport, storage, use and disposal under Chapter 128 of the Pennsylvania 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 may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, changes in crop rotations, or conducting structural repairs. Limited habitat modification would be practices that alter specific characteristics of a localized area, such as pruning trees to discourage birds from roosting or planting vegetation that was less palatable to birds. Animal behavior modification methods would include those methods designed to disperse birds from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, bird-proof barriers, anti-perching devices, structural repairs, electronic distress calls, effigies, mylar tape, lasers, eyespot balloons, fencing, or nest destruction. Other mechanical methods could include live-traps, mist nests, cannon nets, shooting, or recommending a local population of harvestable birds be reduced through hunting.

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 or those people assisting. 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 Pennsylvania 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 in 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 – Effectiveness of Bird Damage Management Activities

The effectiveness of any wildlife damage management program can be defined in terms of; 1) the accurate identification of the species causing the damage; 2) the knowledge of available methods; 3) the selection of the most appropriate method or methods; 4) the correct implementation of those methods; 5) the reduction of or mitigation of damage and or the elimination of threats and the potential for threats; 6) damage prevented or eliminated. To realize this effectiveness, management actions must be conducted expeditiously in a humane manner that minimizes harm to humans, non-target wildlife, and the environment. The most effective approach to any damage management problem is to use an adapted integrated approach that may call for the use of several methods simultaneously or sequentially (Courchamp et al. 2003). This approach is commonly known as integrated management. The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[12]. The goal of wildlife damage management is to reduce damage or threats caused by wildlife, not necessarily to reduce or eliminate wildlife populations. However, localized short-term population reduction is a possible outcome until new individuals immigrate to the area or new individuals are born to animals remaining at the site (Courchamp et al. 2003). The ability of wildlife populations to sustain a certain level of removal and eventually return to pre-management levels does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on wildlife populations.

Issue 5 – Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of 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) 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

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

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, "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild animals. The AVMA has previously stated that "[f]*or wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

Pain and suffering, as it relates to methods available for use to manage birds has both a professional and lay point of arbitration. Wildlife managers and the public 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. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

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.

Additional concerns have been expressed over the potential separation of goose families through management actions. Generally, adult geese form pair bonds that are maintained until one of the pair dies. However, geese will form new pairs bonds even when their previous mate is still alive (MacInnes et al. 1974). Goose family units generally migrate together during the fall migration period and spend much of the fall and winter together (Raveling 1968, Raveling 1969). The separation of family units could occur during damage management activities targeting geese. This could occur through translocation of geese, dispersal, or through removal and euthanasia.

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 6 – 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 to reduce threats disperse or otherwise make an area where damage was occurring unattractive to the target species causing the damage, or alternatively, lethally removes individuals of the species causing the damage. Those activities reduce the presence of target species in the area where damage was 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 7 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

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 was occurring unattractive to the 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 those species could be reduced in the area where damage management activities were occurring. Similarly, lethal methods remove individuals of the 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 were occurring.

Often, bird damage management activities would be conducted in areas where hunting was restricted (*e.g*., airports, urban areas) or has been ineffective. Because both non-lethal and lethal methods disperse birds from areas where damage was occurring, birds may move from areas where hunting was 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 that are harvestable during regulated hunting seasons in the Commonwealth include Canada geese, Atlantic brant, free-ranging domestic and feral waterfowl, mute swan, snow geese, mallard, American black duck, wood duck, northern pintail, gadwall, American wigeon, Northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, greater scaup, lesser scaup, ring-necked duck, long-tailed duck, white-winged scoter, black scoter, common goldeneye, bufflehead, hooded merganser, common merganser, ruddy duck, wild turkey, ring-necked pheasant, American coot, Wilson's snipe, American woodcock, 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 PGC during the scoping process of this EA. Those issues were considered by WS, the USFWS, and the PGC 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 Pennsylvania 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 describe accurately such locations or times in an EA or EIS. Although WS, the USFWS, and the PGC 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 PGC 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 United States 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 the Commonwealth. In terms of cumulative impacts, a single EA that analyzes impacts for the entire Commonwealth will provide a more comprehensive and less redundant analysis that 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.

A Site Specific Analysis Should be made for Every Location Where Bird Damage Management Activities Could Occur

The underlying intent for preparing an EA is to determine if a proposed action might have a significant impact on the human environment. The EA development process of WS and the USFWS is issue driven, meaning issues that were raised during the interdisciplinary process and through public involvement that were substantive were used to drive the analysis and determine the significance of the environmental impacts of the proposed action and the alternatives. Therefore, the scale of the analysis must be appropriate to the issues. Many of the issues identified relate to the potential effects on populations of wildlife. Wildlife populations are managed on state or regional, and not localized scales. This is especially true for birds because of their ability to fly and move large distances. Therefore, it is only appropriate to analyze impacts at this scale. Additionally, as discussed previously, one EA analyzing impacts for the entire Commonwealth would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were made through this EA that the alternatives developed to meet the need for action could result in a significant impact on the quality of the human environment, then an EIS would be prepared.

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 PGC do not attempt to eradicate any species of native wildlife. As stated previously, the purpose of damage management is to reduce or alleviate the damage or threats of damage by targeting individual or groups of birds 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 Pennsylvania. Any take of native bird species can only occur at the discretion of the USFWS or the PGC, 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, damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity in the Commonwealth.

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 employing lethal methods to resolve damage and that wildlife damage 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 is often unique to the individual persons and can be based on many factors (*e.g.*, economic, social, aesthetics). How damage is defined is also often unique to the individual person, 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 person. 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. Damage management is often constrained by the financial means of those people experiencing damage. The cost effectiveness of methods and the effectiveness of methods are therefore linked.

Impacts of Avian Influenza (AI) on Bird Populations

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). Most strains of avian influenza circulate among those birds without clinical signs and are not an important mortality factor in wild waterfowl (Davidson and Nettles 1997, Clark and Hall 2006). There are two types of avian influenza viruses, low pathogenic and high pathogenic (USGS 2013). The low and high refer to the potential of the viruses to kill domestic poultry (USGS 2013). In wild birds, low pathogenic avian influenza strains rarely cause signs of illness and are not an important mortality factor for wild birds (Davidson and Nettles 1997, Clark and Hall 2006). In contrast, high pathogenic avian influenza has sickened and killed large numbers of wild birds in China (USGS 2013). However, there have been reports of apparently healthy wild birds being infected with high pathogenic avian influenza (USGS 2013). High pathogenic strains have only been found to exist in wild waterfowl species in China (Brown et al. 2006, Keawcharoen et al. 2008, USGS 2013). WS has been one of several agencies and organizations conducting surveillance for avian influenza in migratory birds. This nationwide surveillance effort has tested tens of thousands of birds but there has been no evidence of high pathogenic in the United States or low pathogenic avian influenza negatively affecting bird populations in North America (USGS 2013).

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 to harvest waterfowl. However, lead shot may be used by persons implementing damage management methods during annual hunting seasons for some bird species (*e.g.*, wild turkey, ring-necked pheasant, mourning dove, American crow, and fish crow) or for unprotected non-native birds (*e.g.*, European starlings, pigeons, house sparrows) 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, which 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 reduce further 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. WS' assistance would not be additive to the environmental status quo since those birds removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. 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 those people 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 those 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 damage management activities to move with the roost as long it remains within the municipality.

Bird Damage Should Be Managed by Private Nuisance Wildlife Control Agents

Wildlife control agents and private entities could be contacted to reduce bird damage when deemed appropriate by the resource owner under any of the alternatives. In addition, WS could refer persons requesting assistance to agents and/or private entities 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 the Commonwealth of Pennsylvania are primarily funded by work initiation documents with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Pennsylvania. 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 work initiation documents.

Effects on Human Health from the Consumption of Waterfowl Donated by Wildlife Services

An issue identified as a concern is that waterfowl donated to charitable organizations after it has been lethally taken by WS may contain lead bullet fragments or other contaminants from the environment. In the Commonwealth, the PGC requires that Canada geese lethally removed by WS during specific damage management activities be donated to charity for human consumption. As part of this program, WS conducted contaminate testing from 2002 to 2009 to help ensure that the meat was suitable for donation. The primary focus of these tests was on metals, with cholinesterase, organochlorine, and organic chemicals tested during various years. All samples were tested by the Pennsylvania Animal Diagnostic Laboratory System, New Bolton Center. Protocols for testing stated that for each location in which geese were removed, a subset (roughly 10%) of the total geese taken and processed for donation be tested. These results were then compared to the standards published for healthy geese. Although there are no guidelines in the United States for acceptable levels of contaminates in Canada goose meat, there are levels for consumables published by the Federal Drug Administration, the Environmental Protection Agency, and the World Health Organization that were used. Tests for cholinesterase, organochlorine, and organic chemicals found no anomalies. Results from tested geese were similar to those published for healthy geese. Tests for metals detected no significant concentrations. Of particular concern with regard to waterfowl and human consumption is lead. Tests for lead in muscle tissue were never found to be above acceptable levels. The results from 8 years of contaminate testing by the WS program in the Commonwealth show that Canada geese taken as part of damage management activities are healthy and there should be no contamination concerns if muscle tissue is consumed.

Additionally, the donation protocols followed by WS lower the potential that an individual may have long-term exposure to donated meat, minimizing concerns. For processing, goose breast meat is removed, cleaned, and packaged by a licensed processor in packages containing approximately 5 pounds of meat. The meat is then taken to the charitable organization for distribution with instruction that meat should be donated in a way that individuals would receive no more than two packages of meat (approximately 10 pounds or less). If meat were to have higher than normal contaminate levels, this method would decrease any risk of exposure. The goal would be that consumption of this amount of meat, even by a single person in a single serving would not have adverse effects were it to have higher levels of contaminates. Additionally, this methodology ensures there could be no long-term exposure because individuals are receiving a limited amount of meat. Currently goose meat donations are being distributed though the Central Pennsylvania Food Bank, based in Harrisburg. This organization, servicing 21 counties, distributes food on an individual family basis and is able to ensure that donation protocols are followed to limit potential exposure levels. This method is designed to create no greater threat to recipients than recreational harvest and meat consumption by sportsmen. Canada goose meat is the only type of bird meat donated for human consumption by WS in the Commonwealth.

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. SOPs for bird damage management in Pennsylvania 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 in the Commonwealth:

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 Pennsylvania. 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, work initiation document, 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 an 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. As mentioned previously, persons receiving technical assistance can choose to use the services of WS (*i.e.*, direct operational assistance) when available. If this were the case, 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.

As mentioned previously, 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[13]. 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 Appendix C would be available under this alternative although not all methods would be available for direct implementation by all persons. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators 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 Pennsylvania 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. WS would provide technical assistance to the appropriate decision-maker(s). 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. The local decision-maker(s) may then 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 (*i.e.*, direct operational assistance) when available. 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. Direct operational assistance would be provided by WS if requested, funding is provided, and the requested management was according to WS' recommendations. The decision-maker for local, Commonwealth, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS would provide technical assistance to this person and

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

recommendations to reduce damage. Direct control would be provided by WS if requested, funding is provided, and the requested actions were within the recommendations made by WS.

Technical Assistance

As stated previously, 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.

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. In addition, 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.

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. The NWRC uses scientific expertise to develop methods to resolve conflicts between humans and wildlife while maintaining the quality of the human environment. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques to alleviate wildlife damage. Research biologists with the NWRC have authored hundreds of scientific publications and reports, and they are respected worldwide for their expertise in wildlife damage management.

As previously stated, the lethal take of birds can occur without a permit (if those species are not protected by the MBTA), during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS and the PGC. Currently, as part of the application process, the USFWS requires that permittees contact WS to obtain a recommendation to address the 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 the USFWS issue a depredation permit for lethal actions. However, the USFWS requires that non-lethal actions were used and shown ineffective or impractical prior to issuing a permit for lethal actions. The 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

As stated previously, direct operational assistance is the implementation of management activities by WS personnel. Direct operation 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, work initiation document, 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. As mentioned previously, when providing direct operational assistance, WS uses an integrated management approach, as well as the WS Decision Model, to address damage using a combination of methods, while continually monitoring, evaluating, and making modifications as necessary to the methods or strategy to reduce damage to an acceptable level. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would only be available when WS is providing direct operational assistance.

To address the anticipated needs of all property owners or managers with bird damage in Pennsylvania that may request WS' assistance with lethal methods to alleviate their damages, WS would annually submit an application for a depredation permit 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. Some species of birds, including wild turkey and ring-neck pheasants, are not protected from take under the MBTA and are instead protected under Commonwealth law, and their removal requires a permit from the PGC.

A similar process would be followed for receiving a permit from the PGC for those species of birds managed by the Commonwealth. 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 of activities were identified through the monitoring of activities, this EA would be reviewed and supplemented, if appropriate, to insure 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 in Alternative 1, including recommendations for depredation permits. Under Alternative 2, those persons receiving technical assistance could 1) take no action, 2) choose to implement WS' recommendations on their own, 3) use the services of a private entity, or 4) use volunteer services of private individuals or organizations. 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, called 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 in the Commonwealth. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the PGC, the PDA, 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 in the Commonwealth. Similar to Alternative 2, with the exception of Mesurol®, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, called 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.

Under this alternative, property owners or managers may have difficulty obtaining permits to use lethal damage management methods. The USFWS requires professional recommendations on individual damage situations before issuing depredation permits for lethal take, as described above in Alternative 1. The USFWS does not have the mandate or the resources to conduct 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 PGC 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 in the Commonwealth. 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 and alpha chloralose are only available for use by WS and therefore would be unavailable under Alternatives 2 and 3. In addition, 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 PGC, the PDA, 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. As previously stated, 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 and the PGC. Under any of the alternatives analyzed in detail or not, the regulatory authorities for the management of birds would continue to be the USFWS and the PGC.

Under this alternative, property owners or managers may have difficulty obtaining permits to use lethal damage management methods. The USFWS requires professional recommendations on individual damage situations before issuing depredation permits for lethal take, as described under Alternative 1. The USFWS does not have the mandate or the resources to conduct 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

Under this alternative, 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 and/or the PGC. Therefore, the translocation of birds by WS would only occur as directed by those agencies. Translocation sites would be identified and have to be approved by the USFWS, the PGC, and/or the property owner where the translocated birds would be placed prior to live-capture. When authorized by the USFWS and/or the PGC, WS could translocate birds under any of the alternatives analyzed in detail. Since WS does not have the authority to translocate birds in the Commonwealth unless permitted by the USFWS and/or the PGC, 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. In addition, 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 Reduce Damage by Managing Bird Populations Through the Use of Reproductive Inhibitors

Under this alternative, the only method available for resolving damage or threats associated with birds would be the recommendation of and the use of reproductive inhibitors to reduce or prevent reproduction in species of birds responsible for causing damage or threats. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are restricted, infeasible, or not publicly acceptable (Muller et. al. 1997, The Wildlife Society 2008). 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), environmental factors (*e.g.*, isolation of target population, access to target individuals), socioeconomic, and other factors. Reproductive control for wildlife could be accomplished through sterilization (permanent) or contraception (reversible) means.

Population modeling indicates that reproductive control is only more efficient than lethal control for some rodent and bird species with high reproductive and low survival rates (Dolbeer 1998). 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 is registered for use to manage local populations of Canada geese and pigeons. However, at the time this EA was developed nicarbazin was only registered to manage rock pigeon populations in the Commonwealth. Appendix C contains a thorough discussion of Nicarbazin for use in managing damage and threats associated with birds under the alternatives. Chemical reproductive inhibitors (contraceptives) are not available for use to manage most bird species. Given the lack of availability of chemical reproductive inhibitors for the management of most bird species, and the costs associated with live-capturing and performing sterilization procedures on birds, this alternative was not evaluated in detail. If a reproductive inhibitor that has proven effective in reducing large populations of several species becomes available, the EA would be reviewed and supplemented to the degree necessary to evaluate the use of the new reproductive inhibitor.

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 SOPs improve the safety, selectivity, and efficacy of those methods available to alleviate or prevent damage. WS' directives and SOPs would be incorporated into activities conducted by WS when addressing bird damage and threats in the Commonwealth.

Some key SOPs pertinent to the proposed action and 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 damage management strategies.

- 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, 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 FIFRA and its implementing guidelines, using any pesticide in a manner that is inconsistent with the label of the pesticide is a violation of federal law. 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 and the PGC to determine the potential risks of activities to federally and Commonwealth listed threatened or endangered species in accordance with the ESA and Commonwealth laws.

- 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.

- 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.

- When activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public would be further reduced.

- WS would only use non-toxic shot as listed in 50 CFR 20.21(j) to take migratory birds.

- The take of birds would only occur when authorized by the USFWS or the PGC, 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 PGC to ensure cumulative take is considered as part of population management objectives.

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

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

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

- Preference would be given to non-lethal methods, when practical and effective under WS Directive 2.101.

- If practical and effective non-lethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

Issue 2 - Effects of Damage Management Activities on Non-target Wildlife Populations, Including Threatened or 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.

- 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.

- Carcasses of birds retrieved after damage management activities have been conducted 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.

- WS has consulted with the USFWS and the PGC to determine the potential risks of activities to federally and Commonwealth listed threatened or endangered species in accordance with the ESA and Commonwealth laws.

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

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

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

- Personnel involved in shooting operations would be fully trained in the proper and safe application of this method.

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

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

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

Issue 4 – Effectiveness of Bird Damage Management Activities

- 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 specific to each site.

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

Issue 5 – 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 6 – Effects of Bird Damage Management Activities on the Aesthetic Values of Birds

- 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.

- Preference would be given to non-lethal methods, when practical and effective under WS Directive 2.101. If practical and effective non-lethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

- Direct operational assistance would only be conducted by WS after a memorandum of understanding, work initiation document, 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' activities to manage damage and threats caused by birds would be coordinated with the USFWS and the PGC.

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

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

Issue 7 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

- 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.

- Direct operational assistance would only be conducted by WS after a memorandum of understanding, work initiation document, 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.

- Preference would be given to non-lethal methods, when practical and effective under WS Directive 2.101. If practical and effective non-lethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. This chapter analyzes the environmental consequences of each alternative as those alternatives relate to the issues identified.

The following resource values in the Commonwealth 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 or 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.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each of the three alternatives in comparison to determine the extent of actual or potential impacts on the issues. 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 PGC, and the PDA.

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 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. 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. As discussed previously, the most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach, commonly known as integrated management, which may call for the use of several methods simultaneously or sequentially. 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. Integrated damage management may incorporate both non-lethal and lethal methods depending upon the circumstances of the specific damage problem.

As discussed previously in Chapter 3, both lethal and non-lethal methods would be available under all three alternatives. For a complete list of available methods, please see Appendix C. Non-lethal methods are generally regarded as having minimal effects on overall populations of target bird species since those birds are unharmed. The use of non-lethal methods would not have adverse effects on target bird populations in the Commonwealth under any of the alternatives. The analysis for the magnitude of impact of lethal methods 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. As previously stated, 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 and the PGC. Lethal methods can therefore occur under any of the alternatives. The use of lethal methods could result in local population reductions in the area where damage or threats were occurring since birds would be removed from the population. Often of concern with the use of lethal methods is that birds that are lethally taken would only be replaced by other birds either during the application of those methods (from other birds that move into the area) or by birds the following year (increase in reproduction that could result from less competition for limited resources). As stated previously, lethal methods that would be available for use are not intended to be population management tools over broad areas (except for hunting). The use of lethal methods, including the use of DRC-1339, would be intended to reduce the number of birds present at a location where damage was occurring by targeting those birds causing damage or posing threats. Therefore, the intent of lethal methods would be to manage those birds causing damage and not to manage entire bird populations. Information on bird populations and trends are derived from several sources including the BBS, the CBC, the Partners in Flight Landbird Population database, the Pennsylvania Breeding Bird Atlas (BBA), published literature, and harvest data.

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 Pennsylvania. 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. 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 methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, 5) use volunteer services of private individuals or organizations, or 6) use the services of WS (direct operational assistance) when available.

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. 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. This information is then provided to the requestor in the form of technical assistance. As mentioned previously, those persons receiving technical assistance can then if they choose, use the services of WS (direct operational assistance) when available. If this is the case, WS continues to monitor and evaluate the situation as assistance is provided, modifying the strategy and methods used to reduce the damage to an acceptable level.

As mentioned previously, 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. Integrated damage management may incorporate both non-lethal and lethal methods depending upon the circumstances of the specific damage problem. 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 Appendix C would be available under this alternative although not all methods would be available for direct implementation by all persons. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators 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.

Under this alternative, non-lethal methods would be given priority when addressing requests for assistance (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed to alleviate every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if an individual requesting assistance had already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat. Non-lethal methods would be used to exclude, harass, and/or disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse birds from the area resulting in a reduction in the presence of those birds at the site where those methods were employed. 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 a species' population. Non-lethal methods are generally regarded as having minimal effects on overall populations of target bird species since those birds are unharmed.

Under the proposed action alternative, WS could destroy nests and the associated eggs of target bird species as part of an integrated approach to managing damage. Nest and egg destruction methods are considered non-lethal when conducted before the development of an embryo. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success, 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 would not be used by WS as a population management method. This method would be used by WS to inhibit nesting in an area experiencing damage due to nesting activity and would be employed only at the localized level. As with the lethal take of birds, the take of nests must be authorized by the USFWS and the PGC. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the PGC.

Under the proposed action alternative, requests for assistance could be addressed using live-capture methods and the subsequent translocation of target bird species. Any of the target birds could be live-captured using live-traps, cannon nets, rocket nets, mist nests, or other methods and translocated; however, translocation would most often be used for raptor species, waterfowl species, and bird species that were harvestable (*e.g.*, wild turkeys). Translocation of birds could only occur under the authority of the USFWS and/or the PGC, when required. Therefore, the translocation of birds by WS would only occur as directed by those agencies. Translocation sites would be identified and have to be approved by the USFWS, the PGC, and/or the property owner where the translocated birds would be placed prior to live-capture. When authorized by the USFWS and/or the PGC, WS could translocate birds under this alternative and recommend translocation under Alternative 2. When birds were released into appropriate habitat and when translocation occurred during the migration periods, WS does not anticipate translocation to affect target bird populations adversely or to affect individual birds adversely.

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

As previously stated, 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 and the PGC. The USFWS issues permits for those species of birds protected under the MBTA while the PGC issues permits for those species of birds, including wild turkey and ring-necked pheasant, protected under Commonwealth law. Management actions taken by non-federal entities would be considered the *environmental status quo*.

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 problem. WS evaluates the situation and then issues 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. This is formally known as a Migratory Bird Damage Report. 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 non-lethal actions must have been used and shown ineffective or impractical 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: 1) deny an application for a depredation permit, 2) issue a permit for the number of birds requested, or 3) issue a permit for less than the number of birds requested. Upon a receipt of a depredation permit, the property owner or manager, or an appropriate designated sub-permittee, may then commence the authorized activities. WS could be listed as a sub-permittee at the discretion of the permittee. 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. This process would continue to occur as described under this alternative.

In order to address the anticipated needs of all property owners or managers with bird damage in Pennsylvania that may request WS' assistance to alleviate their damages, WS would annually submit an application for a depredation permit to the USFWS estimating the maximum number of birds of each species to be lethally taken as part of an integrated approach. WS would not submit a Migratory Bird Damage Report as part of the application process. The USFWS would conduct an independent review of the application and make a determination to: 1) deny an application for a depredation permit, 2) issue a permit for the number of birds requested, or 3) issue a permit for less than the number of birds requested. 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 make a determination as described above pursuant to the MBTA depredation permit regulations (see 50 CFR 21.41). WS could request an amendment to a permit to increase the number of birds that could be taken to address unpredicted and emerging damage or threats of damage. A similar process would be followed for receiving a permit from the PGC for those species of birds managed by the Commonwealth and protected under Commonwealth law.

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). Double-crested cormorants can be found during the breeding season nesting along the Delaware and Susquehanna Rivers and at a reservoir in Bucks County (Gross and Haffner 2011, Wilson et al. 2012). Although double-crested cormorants are migrants, some birds overwinter locally in Pennsylvania, especially along the coastal areas of the Commonwealth (Hatch and Weseloh 1999). Habitat consists of coastal areas, rivers, ponds, lakes, estuaries, and artificial impoundments (Hatch and Weseloh 1999). Nests in colonies can exceed 1,000, on the ground on rocky or sandy islands, or in trees close to water, will also nest on bridges, docks, or other manmade structures (Hatch and Weseloh 1999). Nesting behavior may negatively affect other nesting colonial waterbirds (*e.g*., Commonwealth listed great egrets and black-crowned night-herons) in the Commonwealth (Gross and Haffner 2011). The diet of a cormorant consists almost entirely of fish but they 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 increasing trends in the eastern BBS region (estimated at 3.9% annually since 1966) and across the United States (estimated at 4.6% annually since 1966) (Sauer et al. 2014). The BBS has also shown an increasing trend in the Commonwealth estimated at 10.9% annually since 1966 (Sauer et al. 2014). Nesting surveys in Pennsylvania have observed an increase in the number of double-crested cormorant nests in the Commonwealth from 11 in 2001 to 121 in 2010 (Gross and Haffner 2011). The number of double-crested cormorants overwintering in the Commonwealth has also shown an increasing trend since 1966 (National Audubon Society 2010). Currently, there are no estimates of the breeding population of double-crested cormorants in the Commonwealth. The total population of double-crested cormorants in the United States and Canada is estimated at between 2 and 2.4 million birds (USFWS 2003).

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, 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 their impacts to other resources were not adequately being addressed by the AQDO. As a result, the USFWS, in cooperation with WS, prepared a 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 of 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 and again in 2014, 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*, USFWS 2014*a*). All other take of double-crested cormorants to alleviate damage requires a depredation permit issued by the USFWS. Pennsylvania 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 entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-1. From 2007 through 2012, WS lethally removed 696 double-crested cormorants and used non-lethal methods to disperse an additional 2,815 double-crested cormorants in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of double-crested cormorants during this period. From 2007 to 2012, a total of 721 double-crested cormorants, or 120 cormorants per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-1. Number of double-crested cormorants addressed in Pennsylvania 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	701	170	20	20
2008	8	170	3	8
2009	80	185	18	28
2010	186	185	35	35
2011	1,384	810	149	155
2012	456	712	471	475
TOTAL	**2,815**	**2,232**	**696**	**721**

[1]Data reported by federal fiscal year

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

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

Although only limited double-crested cormorant damage management activities have been conducted by WS in Pennsylvania, 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 damage and impacts to other colonial waterbirds, particularly herons and egrets, when cormorants degrade shared nesting habitat or compete for nest sites. To address request for assistance to manage damage associated with double-crested cormorants in the future, up to 1,000 cormorants and 200 nests could be taken annually by WS under the proposed action alternative 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% (159,636) of the continental double-crested cormorant population 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*, USFWS 2014*a*). This analysis and determination included not only cormorants taken under the PRDO and the AQDO but also depredation permits (USFWS 2003, USFWS 2009*a*, USFWS 2014*a*). Additionally, nest destruction is anticipated to have minimal effects on regional or continental cormorant populations (USFWS 2003, USFWS 2009*a*, USFWS 2014*a*).

The total take of double-crested cormorants by all entities in the United States on an annual basis from 2005 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 (see Table 4-2). 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 200 double-crested cormorant nests is anticipated to have minimal effects on regional or continental cormorant populations (USFWS 2003).

Table 4-2. Double-crested cormorant take in the states included in the PRDO and AQDO

Year	Take by Depredation Order or Permit			TOTAL
	PRDO	AQDO	Depredation Permits	
2005	11,221	21,513	4,745	**37,479**
2006	21,043	32,057	3,435	**56,535**
2007	20,256	17,393	3,980	**41,629**
2008	18,889	17,561	5,102	**41,552**
2009	25,612	16,338	4,659	**46,609**
2010	18,637	14,632	6,883	**40,152**
2011	28,704	12,980	6,542	**48,226**
2012	26,313	14,216	5,583	**46,112**

GREAT BLUE HERON POPULATION IMPACT ANALYSIS

Great blue herons are a common, large wading bird that can be found throughout most of the United States year-around (Vennesland and Butler Wilson et al. 2012). In Pennsylvania, great blue herons can be found nesting across the Commonwealth (Wilson et al. 2012). Great blue herons are most often observed in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM Region Waterbird Working Group 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 Region Waterbird Working Group 2006). The largest nesting colony in the Commonwealth had 225 nests in 2009, down from a high of 441 in 1999 (Detwiler and Barber 2013). The diet of great blue herons consists mainly of fish but they also consume invertebrates, amphibians, reptiles, birds, and mammals (MANEM Region Waterbird Working Group 2006).

Most nesting great blue heron colonies in the northeastern United States occur along the coastal areas located in BCR 30 and BCR 14. In the 1970s, the breeding population of great blue herons in BCR 30 and 14 was 6,824 birds distributed among 37 nesting colonies (MANEM Region Waterbird Working Group 2006). By the 1990s, the breeding population of great blue herons in BCR 30 and BCR 14 had increased by 367% to 31,838 birds nesting in 232 colonies (MANEM Region Waterbird Working Group 2006). The breeding populations of great blue herons in BCR 30 and BCR 14 have been given a conservation ranking of lowest concern (MANEM Region Waterbird Working Group 2006). Great blue herons are showing an increase across all survey routes of the BBS. Since 1966, the number of great blue herons observed across the United States has increased at an annual rate of 1.3% (Sauer et al. 2014). In Pennsylvania, herons observed on BBS routes are showing an increase estimated at 3.1% annually since 1966 (Sauer et al. 2014). There were 55 nests observed distributed among 33 nesting colonies in the Commonwealth in 2010 (Gross and Haffner 2011). Fourteen of the 33 colonies were not known prior to 2010 and an additional three known colonies were not surveyed that year (Gross and Haffner 2011). Great blue herons observed overwintering in Pennsylvania have also shown a general increasing trend since 1966 (National Audubon Society 2010). However, there are no breeding or wintering population estimates available for great blue herons in Pennsylvania.

The number of great blue herons taken or dispersed by WS and the total number of herons taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-3. From 2007 through 2012, WS lethally removed 54 great blue herons and used non-lethal methods to disperse an additional 697 great blue herons in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of great blue herons during this period. From 2007 to 2012, the USFWS has authorized the lethal removal of up to 2,464 great blue herons in the

Commonwealth to alleviate damage or threats of damage. In total, 1,794 great blue herons, or 299 great blue herons per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-3. Number of great blue herons addressed in Pennsylvania 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	88	102	0	68
2008	45	237	2	207
2009	40	321	3	262
2010	100	399	10	322
2011	198	579	20	312
2012	226	826	19	623
TOTAL	**697**	**2,464**	**54**	**1,794**

[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 WS' assistance with great blue herons in the Commonwealth arise at airports when these birds pose risks to aircraft and human safety or when these birds compete with endangered or threatened colonial waterbirds for nesting sites. Additional requests for assistance are received when fish at aquaculture facilities are damaged or consumed by great blue herons (Glahn et al. 1999*a*). At four Pennsylvania aquaculture facilities, great blue herons damaged or consumed trout valued between $422 and $28,784 from April-June 1996. To address requests for assistance to manage damage associated with great blue herons in the future, up to 500 herons and 20 heron nests could be taken annually by WS under the proposed action alternative 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 requests to address threats to natural resources, such as nest site competition between herons and other colonial nesting waterbirds.

The number of great blue herons present in Pennsylvania fluctuates throughout the year. No breeding or wintering population estimates are available for great blue herons in Pennsylvania. However, since those herons nesting in BCR 14 and BCR 30 are likely the same herons that migrate through and are present in Pennsylvania throughout the year, 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. Those estimates do not reflect non-breeding herons that may be present in those areas during the breeding season. The take of up to 500 herons to alleviate damage or threats of damage under the proposed action alternative would represent 1.2% of the estimated breeding population in BCR 14 and BCR 30.

If the USFWS continued to authorize the lethal removal of up to 826 herons annually, the take by all entities within the Commonwealth would represent 1.9% of the breeding population estimated in BCR 14 and BCR 30, including Pennsylvania. The average annual take of herons by other entities in the Commonwealth has been 290 herons since 2007. If the average annual take of herons by other entities were reflective of take that would occur in the future, the combined WS' take and take by other entities would represent 1.8% of the estimated breeding population in BCR 14 and BCR 30. 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 could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. 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 heron nests to alleviate damage or threats of damage is not expected to affect adversely the population of herons.

GREAT EGRET POPULATION IMPACT ANALYSIS

Great egrets are large wading birds similar to herons with all white plumage. They can be distinguished from other herons and egrets by their black legs and feet, long neck, and long yellow bill (McCrimmon et al. 2011). 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 Region Waterbird Working Group 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 Pennsylvania, great egrets nest in deciduous trees including river birch, silver maple, and sycamore along the lower Susquehanna River (Wilson et al. 2012*a*). Outside of the nesting season, great egrets can be found wintering in low numbers in these same areas (MANEM Region Waterbird Working Group 2006). Like other wading birds, the diet of great egrets consists of fish, invertebrates, amphibians, and reptiles (McCrimmon et al. 2011). In Pennsylvania, research has found that egrets nesting on Wade Island forage mainly on small fish, tadpoles, and crayfish during the nesting season (Gross and Haffner 2011). This species is listed as endangered by the PGC but is not listed on the federal level.

Most nesting great egret colonies in the northeastern United States occur along the coastal areas located in BCR 14 and BCR 30. In the 1970s, the breeding population of great egrets in BCR 14 and 30 consisted of 4,384 birds distributed among 52 nesting colonies (MANEM Region Waterbird Working Group 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 Region Waterbird Working Group 2006). The breeding populations of great egrets in BCR 30 and BCR 14 have been given a conservation ranking of lowest concern (MANEM Region Waterbird Working Group 2006). However, great egrets are listed by the Commonwealth as endangered (Gross and Haffner 2011). Great egrets are showing an increase across all BBS survey routes in the United States. Since 1966, the number of great egrets observed survey-wide has increased at an annual rate of 2.2% (Sauer et al. 2014). Similarly, the number of egrets observed on BBS routes in Pennsylvania have increased at an annual rate of 5.5% since 1966 and 6.6% since 2002 (Sauer et al. 2014). There are two known nesting colonies of great egrets in the Commonwealth (Gross and Haffner 2011). At the larger colony, on Wade Island in Dauphin County, an average of 166 nests were observed per year from 2001 through 2010 (Gross and Haffner 2011). The smaller colony, located in York County, saw a record number of nests (8) in both 2009 and 2010 (Gross and Haffner 2011). Great egrets observed overwintering in Pennsylvania have shown a stable trend since 1966 (National Audubon Society 2010). There are no breeding or wintering population estimates available for great egrets in Pennsylvania.

The number of great egrets taken or dispersed by WS and the total number of egrets taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-4. From 2007 through 2012, WS did not lethally remove great egrets but used non-lethal methods to disperse 160 great egrets in the Commonwealth. During this period, the USFWS did not issue any depredation permits to other entities for the take of great egrets. From 2007 to 2012, no great egrets were lethally taken in the Commonwealth.

To address request for assistance to manage damage associated with great egrets in the future, up to 5 egrets and 10 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats when non-lethal techniques are unsuccessful and with the permission of the PGC.

Table 4-4. Number of great egrets addressed in Pennsylvania 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	35	0	0	0
2008	10	0	0	0
2009	11	0	0	0
2010	4	10	0	0
2011	73	10	0	0
2012	27	10	0	0
TOTAL	**160**	**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

The number of great egrets present in Pennsylvania fluctuates throughout the year. No breeding or wintering population estimates are available for great egrets in Pennsylvania. However, since those egrets nesting in BCR 14 and BCR 30 are likely the same egrets that migrate through and are present in Pennsylvania throughout the year, 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. Those estimates do not reflect non-breeding egrets that may be present in those areas during the breeding season.

The take of up to 5 egrets by WS to alleviate damage or threats of damage under the proposed action alternative would represent 0.05% of the estimated breeding population in BCR 14 and BCR 30. No authorized take of egrets by other entities in the Commonwealth has occurred since 2007. If the USFWS authorized the lethal removal of up to 10 additional egrets annually, the combined WS' take and take by other entities would represent 0.1% of the estimated breeding population in BCR 14 and BCR 30. Given the limited magnitude of take proposed by WS when compared to the estimated breeding population in BCR 14 and BCR 30, the magnitude of WS' take could be considered low. The take of great egrets could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA ensures take by WS and by other entities would occur within allowable take levels to achieve the desired population objectives for egrets in the Commonwealth. Great egrets are listed as an endangered species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take occurring. The take of up to 10 great egret nests to alleviate damage or threats of damage would not be expected to affect adversely the population of egrets for the reasons discussed previously.

BLACK-CROWNED NIGHT-HERON POPULATION IMPACT ANALYSIS

Black-crowned night-herons are a medium sized stocky heron (Hothem et al. 2010). They can be distinguished from the other night-heron found in the Commonwealth, the yellow-crowned night-heron, by their distinctive black cap and back that contrasts with their white and grey wings, tail, and undersides (Hothem et al. 2010). Black-crowned night-herons can be found throughout the United States wherever suitable habitat is available (Hothem et al. 2010). They are commonly observed in freshwater and brackish marshes, lakes, rivers, and lagoons (MANEM Region Waterbird Working Group 2006). In Pennsylvania, this species can be found nesting along the Susquehanna River in Berks, Dauphin, Lancaster, and York counties (Wilson et al. 2012). Outside of the nesting season, black-crowned night-herons can be found wintering in low numbers in these same areas (Hothem et al. 2010). These birds are generally colonial nesters, nesting in trees with great egrets, double-crested cormorants, or other colonial water birds near lakes or rivers (Wilson et al. 2012).

Most nesting black-crowned night-heron colonies in the northeastern United States occur along the coastal areas located in BCR 30 and BCR 14. In the 1970s, the breeding population of herons in BCR 30 and BCR 14 was estimated to be 18,926 birds; however, by the 1990s, the breeding population had decreased by 44% to 10,606 birds (MANEM Region Waterbird Working Group 2006). The breeding populations of black-crowned night-herons in BCR 30 and BCR 14 have been given a conservation ranking of moderate concern (MANEM Region Waterbird Working Group 2006) although the species is listed by the Commonwealth as endangered (Gross and Haffner 2011). Since 1966, the number of herons observed in the eastern United States during the breeding season has decreased -1.4% annually, but a 2.0% annual increase has been observed since 2002 (Sauer et al. 2014). In Pennsylvania, herons observed on BBS routes are showing an increasing trend estimated at 1.1% since 1966 (Sauer et al. 2014). Additionally, the number of nesting birds and the number of nesting colonies observed in the Commonwealth have decreased since the 1980s (Gross and Haffner 2011). In contrast, the number of herons observed overwintering in Pennsylvania has shown a stable trend since 1985 (National Audubon Society 2010). However, the number of black-crowned night-herons present in Pennsylvania fluctuates throughout the year. There are no breeding or wintering population estimates available for herons in Pennsylvania.

The number of black-crowned night-herons taken or dispersed by WS and the total number of herons taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-5. From FY 2007 through FY 2012, WS dispersed one night-heron to reduce threats of damage. The USFWS issued depredation permits to other entities for the take of herons in the Commonwealth from 2007 through 2012; however, no herons were reported as being lethally removed.

Table 4-5. Number of black-crowned night-herons addressed in Pennsylvania 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	0	0	0
2009	0	0	0	0
2010	0	10	0	0
2011	0	10	0	0
2012	1	20	0	0
TOTAL	**1**	**45**	**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

To address request for assistance to manage damage associated with black-crowned night-herons in the future, up to 5 herons and 10 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats when non-lethal techniques were unsuccessful and with the permission of the PGC. Requests for assistance are likely to be associated with aircraft strike risks at airports or military facility in the Commonwealth.

Since those herons nesting in BCR 14 and BCR 30 would likely be the same herons that migrate through and would be present in Pennsylvania throughout the year, the analyses for potential impacts will incorporate information from surveys conducted in those areas. Based on colonial waterbird surveys, an estimated 12,856 black-crowned night-herons are known to nest in both the United States and Canadian areas of BCR 14 and BCR 30. This estimate does not reflect non-breeding herons that may be present in those areas. The take of up to 5 black-crowned night-herons by WS to alleviate damage or threats of damage under the proposed action alternative would represent 0.04% of the estimated breeding population in BCR 14 and BCR 30. No black-crowned night-herons were reported as being lethally removed by other entities in the Commonwealth since 2007. If the USFWS continued to authorize the lethal removal of up to 20 night-herons annually in the Commonwealth, including take that could occur by WS, the combined take by all entities would represent 0.2% of the estimated breeding population in BCR 14 and BCR 30.

Given the limited magnitude of take proposed by WS when compared to the estimated breeding population in BCR 14 and BCR 30, the magnitude of WS' take could be considered low. The take of black-crowned night-herons could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA ensures take by WS and by other entities would occur within allowable take levels to achieve the desired population objectives in the Commonwealth. Black-crowned night-herons are listed as an endangered species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take occurring. The take of up to 10 black-crowned night-heron nests to alleviate damage or threats would not be expected to affect adversely the population based on the discussion previously.

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, West Virginia, and rarely Connecticut and New York (Buckley 1999). In winter, black vultures migrate south from the most northern part of their range (Buckley 1999). In Pennsylvania, black vultures can be observed most often in the southeastern quarter of the Commonwealth (Wilson et al. 2012). Black vultures can be found in virtually all habitats but are most abundant where forest is interrupted by open land (Buckley 1999). In Pennsylvania, black vultures nest on rock outcroppings and in buildings (Wilson et al. 2012). Black vultures are highly social, roosting communally with other black vultures and turkey vultures in trees, electric towers, and other structures (Buckley 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 can also be 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 9.3% since 1966. From the first (1983–1989) to the second (2004–2009) Pennsylvania BBA, black vultures expanded their range northward an average of 16 miles (Wilson et al. 2012). Three migration watch sites in the Commonwealth have also reported increases in the number of black vultures (Wilson et al. 2012). Additionally, during the last decade, the number of black vultures observed in the eastern BBS region increased at an annual rate of 3.7% (Sauer et al. 2014). Black vultures overwintering in the Commonwealth have shown a cyclical but general increasing trend since 1966 (National Audubon Society 2010). The population of black vultures in the Commonwealth is currently unknown. Rich et al. (2004) estimated the statewide population at 400 black vultures based on BBS data available from the Commonwealth.

The data quality rating assigned by Rich et al. (2004) for the statewide black vulture population estimates is poor in Pennsylvania due to high variance on BBS counts, low sample size, or due to other species-specific limitations of BBS survey methods. Population estimates calculated by Rich et al. (2004) were derived from BBS data for individual species. BBS data is derived from surveyors identifying bird species based on visual and auditory cues at stationary points. 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 to 33% of the day in summer and 9 to 27% of the day in winter flying. Avery et al. (2011) found that vultures were most active in the winter (January to March) and least active during the summer (July to September). Avery et al. (2011) found that across all months of the year, black vultures spent 8.4% of daylight hours in flight. Most vultures counted during surveys would be counted while flying since counting at roosts could be difficult due to visual obstructions and due to the methodology of the surveys. For example, for the BBS, observers are limited to counting only those bird species within a quarter mile of a survey point. In addition, observations conducted for the BBS are initiated in the morning since mornings tend to be periods of high bird activity. Bunn et al. (1995) reported vulture activity increased from morning to afternoon as temperatures increased. Avery et al. (2011) found that more than 60% of the flight activity of vultures occurred from four to nine hours after sunrise. Therefore, surveys for vultures should occur later in the day to increase the likelihood of vultures being observed by surveyors. Since activities of vultures tend 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. The limitations associated with surveying for vultures under current BBS guidelines is the likely cause of the poor data quality ratings assigned by Rich et al. (2004) for the population estimate of black vultures in the Commonwealth.

Recent modeling efforts have shown that population estimates for vultures derived from the BBS are likely not reflective of an actual statewide population. For example, Rich et al. (2004) estimated the black vulture population in Virginia at 5,000 vultures using BBS data. In comparison, Runge et al. (2009) estimated the population at 91,190 black vultures in Virginia during 2006, or 1,724% higher than the estimate provided by Rich et al. (2004). Runge et al. (2009) estimated the population growth rate for vultures to be between 7 and 14% in Virginia, which could withstand an annual take of 3,533 black vultures and continue to allow that population to increase.

Given the limitations of current survey protocols, and current research on modeling vulture populations, populations of vultures in Pennsylvania are likely higher than the population estimate reported by Rich et al. (2004). If the population of black vultures in Pennsylvania were approximately 1,724% higher than the population estimated at 400 vultures provided by Rich et al. (2004), the population would be nearly 6,900 vultures throughout the Commonwealth.

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 4-6. From FY 2007 through FY 2012, WS lethally removed 140 black vultures and used non-lethal methods to disperse an additional 3,099 black vultures in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of black vultures during this period. From 2007 to 2012, a total of 169 black vultures, or 28 black vultures per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

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 350 black vultures and 20 nests could be taken annually by WS to alleviate damage and threats.

Table 4-6. Number of black vultures addressed in Pennsylvania 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	50	27	3	5
2008	120	95	5	11
2009	696	72	29	31
2010	1,103	273	44	58
2011	558	288	27	27
2012	572	396	32	37
TOTAL	**3,099**	**1,151**	**140**	**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

The take of up to 350 black vultures annually by WS under the proposed action alternative would represent 5.1% of a statewide population that was estimated at 6,900 vultures. From 2007 through 2012, the average annual take of black vultures by all entitles was 28 vultures. If the take by other entities remains stable, the average annual cumulative take of black vultures would represent 5.5% of the estimated population. The take of vultures could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities would occur 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 would not be expected to affect adversely the population of vultures based on previous discussions.

TURKEY VULTURE POPULATION IMPACT ANALYSIS

Turkey vultures can be found throughout Mexico, across most of the United States, and along the southern tier of Canada (Kirk and Mossman 1998). In Pennsylvania, turkey vultures can be found throughout the year across the Commonwealth (Wilson et al. 2012). 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 nest on rock ledges, in tree cavities, on the ground in thickets, or abandoned buildings (Wilson et al. 2012). 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 they will eat virtually anything including insects, fish, reptiles, amphibians, young 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 4.3% annually since 1966 and 4.2% annually from 2002 through 2012 (Sauer et al. 2014). Turkey vultures observed at Pennsylvania migration watch sites have also shown strong increases (Wilson et al. 2012). 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 4.9% from 2002 through 2012 (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 population of turkey vultures in the Commonwealth is currently unknown. The Partners in Flight Science Committee (2013) estimated the statewide population of turkey vultures at 51,000 birds based on

BBS data. Data collected during the second Pennsylvania BBA was used to estimate the turkey vulture population at 7,500 breeding pairs (15,000 breeding birds) in the Commonwealth; however, this is considered a conservative estimate due to the lack of auditory cues that can be used to identify them (Wilson et al. 2012). Population estimates calculated by the Partners in Flight Science Committee (2013) were derived from BBS data for individual species, which have limitations similar to those discussed for black vultures. Vultures produce very few auditory cues that would allow for identification (Buckley 1999) and thus, surveying for vultures is reliant upon visual identification. The limitations associated with vulture population estimates based on current BBS guidelines that were discussed for black vultures would be similar to population estimates derived from the BBS for turkey vultures.

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 are shown in Table 4-7. From FY 2007 through FY 2012, WS lethally removed 120 turkey vultures and used non-lethal methods to disperse an additional 3,833 turkey vultures in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of turkey vultures during this period. From 2007 to 2012, a total of 146 turkey vultures, or 24 turkey vultures per year on average, were taken by all entities to alleviate damage and threats associated with turkey vultures occurring within the Commonwealth.

Table 4-7. Number of turkey vultures addressed in Pennsylvania 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	256	44	5	6
2008	400	96	8	14
2009	1080	284	40	42
2010	730	329	10	10
2011	772	404	27	37
2012	595	452	30	37
TOTAL	**3,833**	**1,609**	**120**	**146**

[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 600 turkey vultures and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

Based on population estimates by the Partners in Flight Science Committee (2013) and Wilson et al. (2012), the take of up to 600 turkey vultures annually by WS under the proposed action alternative would represent 1.2% to 4.0% of the estimated turkey vulture population. However, due to the limitations in survey protocols, the population is likely much higher than 15,000 vultures and therefore the proposed level take would likely be a much lower percentage of the population. From 2007 through 2012, all entities lethally removed an average of 24 vultures per year. If the take by other entities remains stable, the average annual cumulative take of vultures by all entities would represent anywhere from 1.2% to 4.2% of statewide population. The take of vultures could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA would ensure 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 affect adversely the population of vultures, which was addressed in additional detail previously.

CANADA GOOSE POPULATION IMPACT ANALYSIS

Canada geese are the most widely distributed goose in North America (Mowbray et al. 2002). Unlikely to be confused with any other species of goose, Canada geese have a brownish gray body and wings, and black neck with a conspicuous white band that runs from under the chin over the cheek and behind the eye (Mowbray et al. 2002). Historically, the breeding range of Canada geese occurred in Canada and other northern latitudes and they migrated south to spend the winter in more temperate climates (USFWS 2005). However, due to translocation by people, Canada geese can now be found breeding and residing year-round in every state (Mowbray et al. 2002, USFWS 2005). Many of these populations of translocated geese do not migrate and are therefore year-round residents (USFWS 2005). Pennsylvania is one of the many states where Canada geese were not historically known to breed (Wilson et al. 2012). However, by the 1980s, they could be found breeding in every county in the Commonwealth (Wilson et al. 2012). There are two distinct populations of Canada geese in the Commonwealth: resident and migratory (USFWS 2005, Jacobs and Gregg 2011). Canada geese can be found in a broad range of habitats including prairie, arctic plains, mountain meadows, agricultural areas, reservoirs, sewage lagoons, parks, golf courses, lawn-rich suburban areas, or other similar areas not far from permanent sources of water (Mowbray et al. 2002, Wilson et al. 2012). Diet consists of grasses, sedges, berries, and seeds, including agricultural grain (Mowbray et al. 2002). Canada geese are highly social birds gathering and feeding in flocks of over a 1,000 birds (Mowbray et al. 2002).

Resident Canada Geese

Canada geese are considered "*resident*" when one of several criteria is met. Those criteria include geese that nest and/or reside on a year round basis within the contiguous United States. Those geese that nest within the lower 48 States during the months of March, April, May, or June and those geese that reside within the lower 48 States and the District of Columbia in the months of April, May, June, July, and August (see 50 CFR 20.11, USFWS 2005). Therefore, during much of the year, the majority of Canada geese present in the Commonwealth would be resident geese, not migratory. However, distinguishing a resident Canada goose from a migratory Canada goose by appearance can be difficult.

Resident Canada geese are not simply geese that stopped migrating but geese with very different population growth rates, management needs, and opportunities (Atlantic Flyway Council 2011). Most resident Canada geese in the Atlantic Flyway are reluctant to leave the areas in which they breed, moving less than 22 miles on average, when winter weather makes it necessary to find open water and food. These moves to wintering areas typically occur in late November or December, with birds returning to nest in March (Atlantic Flyway Council 2011). Resident Canada geese have a relatively high nesting success compared to migratory Canada geese (USFWS 2005). Resident Canada geese primarily nest from March through May each year. Resident Canada geese nest in traditional sites (*e.g.*, along shorelines, on islands and peninsulas, small ponds, lakes, and reservoirs), as well as on rooftops, adjacent to roadways, swimming pools, and in parking lots, playgrounds, planters, and abandoned property (*e.g.*, tires, automobiles). In Pennsylvania, resident Canada geese molt and are flightless from mid-June through mid-July each year. Molting is the process whereby geese annually replace their primary and secondary flight (wing) feathers. Portions of a flock of geese can be flightless from about one week before until two weeks after the primary molt period because individual birds molt at slightly different times.

In Pennsylvania, the number of resident Canada geese observed along routes surveyed during the BBS have shown an increasing trend, estimated at 12.8% annually since 1966 and 3.8% annually from 2002 through 2012 (Sauer et al. 2014). Similarly, the number of Canada geese observed nesting in the Commonwealth increased by 108% between the first (1983–1989) and second (2004–2009) Pennsylvania BBA with a major expansion of the breeding range in the Commonwealth (Wilson et al. 2012). The second Pennsylvania BBA estimated the number of resident Canada Geese at 215,000 (±10,000) birds (Wilson et al. 2012). The population estimate for breeding Canada geese in the Commonwealth during Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2013 was 278,862 (±50,529) geese while the population estimate for breeding Canada geese in the Atlantic Flyway was 951,936 (±79,106) (Klimstra and Padding 2013).

Potential impacts associated with increasing populations of resident Canada geese are well documented (*e.g*., see Atlantic Flyway Council 1999, USFWS 2005, Atlantic Flyway Council 2011). Those potential impacts include damage to property, concerns about human health and safety, and impacts to agriculture and natural resources. Damage to property occurs when geese congregate on lawns or mowed areas including athletic fields, golf courses, lawns, and parks, as well as beaches and marinas, depositing their droppings and feathers (Atlantic Flyway Council 1999, USFWS 2005, Atlantic Flyway Council 2011). Concerns to human health and safety from Canada geese can arise in several ways. At airports, geese can create a threat to aircraft and to human life (Atlantic Flyway Council 1999, USFWS 2005, Atlantic Flyway Council 2011). In addition, during the nesting season, geese aggressively defend the area around their nests and goslings from other animals and people (Atlantic Flyway Council 1999, USFWS 2005, Atlantic Flyway Council 2011). Agricultural and natural resource impacts include losses to corn, soybeans, and winter wheat, as well as overgrazing of pastures and a degradation of water quality (Atlantic Flyway Council 1999, USFWS 2005, Atlantic Flyway Council 2011).

To manage resident Canada goose populations in the Atlantic Flyway, the Atlantic Flyway Council (comprised of representatives from State and Canadian Province wildlife management agencies along the Atlantic flyway, including the PGC) composed the AFRCGMP to describe the status of resident geese and set population goals and management strategies for the Flyway (Atlantic Flyway Council 1999). The AFRCGMP estimated that the resident Canada goose population in the flyway was 30 to 35% above the population deemed acceptable by state and province wildlife management agencies to manage conflicts caused by resident geese. The Plan also set an objective of 650,000 resident Canada Geese in the Flyway by 2005 (Atlantic Flyway Council 1999). In Pennsylvania, the population objective was set at 100,000 resident Canada Geese (Atlantic Flyway Council 1999).

To relieve damage and manage conflicts, the AFRCGMP recommended a variety of options including the adoption of a federal depredation order or conservation order to allow states to manage resident goose populations while maximizing the opportunities for the use and appreciation of resident Canada geese. The AFRCGMP also called for management that is compatible with management criteria already established for migratory Canada geese. Finally, the AFRCGMP called for annual monitoring of resident Canada geese populations, harvest, and conflict levels so that the effectiveness of the Plan could be assessed (Atlantic Flyway Council 1999). This Plan was updated in 2011 with a revised population goal of 700,000 resident Canada Geese in the Flyway by 2020, and a statewide goal of 150,000 geese in Pennsylvania (Atlantic Flyway Council 2011).

To address the increasing population of resident Canada geese and the personal and public property damage and public health concerns associated with this increase, the USFWS developed a FEIS that evaluated alternative strategies to reduce, manage, and control the population and related damages (USFWS 2005). The selected alternative in the FEIS established regulations that created specific control and depredation orders (airports, nests and eggs, agricultural, and public health) designed to address resident Canada goose depredation, damage, and conflicts. The selected alternative also provided expanded hunting methods and opportunities to increase the number of resident Canada geese harvested during existing September seasons and authorized the implementation of a resident Canada geese population control program. More specifically, the selected alternative in the FEIS modified existing regulations by including the definition of a resident Canada goose (see 50 CFR 20.11, 50 CFR 21.3). The FEIS also made modifications by allowing the use of shotguns holding more than three shells during resident Canada goose seasons, and by allowing the use of electronic calls during harvest seasons targeting resident Canada geese (see 50 CFR 20.21). The FEIS also added to the regulations a control order for resident Canada geese at airports (see 50 CFR 21.49), a depredation order for nests and eggs (see 50 CFR 21.50), a depredation order for resident Canada geese at agricultural facilities (see 50 CFR 21.51), and a public health control order for resident Canada geese (see 50 CFR 21.52). Finally, the FEIS added 50 CFR 21.61 to establish the resident Canada geese population control program.

The PGC has implemented various components of the control and depredation orders authorized by the FEIS for the control of resident Canada geese (Atlantic Flyway Council 2011). These include depredation orders for nests and eggs, at agricultural facilities with required Commonwealth permit, and at airports (Atlantic Flyway Council 2011). In addition, the PGC has also expanded hunting hours during September seasons authorized by 50 CFR 21.61 (Atlantic Flyway Council 2011).

The number of Canada geese taken or dispersed by WS and the total number of Canada geese taken by all entities to alleviate damage and threats from 2007 to 2012 are shown in Table 4-8. From FY 2007 through FY 2012, WS lethally removed 11,974 Canada geese and used non-lethal methods to disperse an additional 630,978 Canada geese in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of Canada geese during this period. From 2007 to 2012, 15,041 geese, or 2,507 geese per year on average, were taken by all entities under depredation permits to alleviate damage and threats associated with these birds occurring within the Commonwealth.

In addition to take under depredation permits, resident Canada geese could be taken under the agriculture depredation order or the control order for airports and military airfields established by the FEIS (USFWS 2005) and implemented by the PGC. Take under the agriculture depredation order is allowed from May 1 through August 31. A permit from the PGC is required to take geese pursuant to the agriculture depredation order and permittees are required to report take. From 2007 to 2010, a total of 52 resident Canada geese, or 13 geese per year on average, were taken under the agriculture depredation order. Take under the control order at airports and military airfields is allowed from April 1 through September 15 and take does not require a permit; however, take must be reported. Take under this control order is currently unknown.

Table 4-8. Number of Canada geese addressed in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	Take under Depredation Permits			Take under Agriculture Depredation Order[4]	
		Authorized Take[2]	WS' Take[1]	Take by All Entities[3]	Permits	Take by All Entities
2007	191,647	3,927	1,738	2,153	8	12
2008	237,202	5,032	1,267	1,761	3	14
2009	59,598	5,253	2,258	2,822	n/a	10
2010	43,731	5,955	2,141	2,591	n/a	16
2011	42,562	5,960	2,739	3,388	n/a	n/a
2012	56,238	6,116	1,831	2,326	n/a	n/a
TOTAL	**630,978**	**32,243**	**11,974**	**15,041**	**11**	**52**

[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 Atlantic Flyway Council 2011

The number of resident Canada goose eggs and nests destroyed by WS and other entities to alleviate damage and threats associated with geese occurring within the Commonwealth are shown in Table 4-9. From FY 2007 through FY 2012, WS destroyed 3,632 nests. In addition to the take by WS, the USFWS issued depredation permits to other entities for the destruction of resident Canada geese nests during this period. From 2007 to 2011, 3,311 nests were taken under depredation permits by all entities within the Commonwealth. Resident Canada goose nests can also be destroyed under the agriculture depredation order or the depredation order for nests and eggs established by the FEIS (USFWS 2005) and implemented by the PGC. From 2007 to 2010, no resident Canada goose nests were taken under the agricultural depredation order. Under the nest and egg depredation order, the destruction of resident Canada geese nests and eggs is allowed from March 1 through June 30. Registration and reporting of take to the USFWS is required. From 2007 to 2011, 4,579 nests were reported destroyed under the nest and egg depredation order.

Table 4-9. Number of resident Canada geese nest and eggs destroyed in Pennsylvania, 2007 - 2012

	Take Under Depredation Permits			Take Under Nest and Egg Depredation Order[4]	
Year	**Authorized Take[1]**	**WS' Take[2] nest/egg**	**Total Nests Destroyed by All Entities[3]**	**Registrants (total reported)**	**Total Nest Destroyed by All Entities[3]**
2007	5,600	555/3,496	614	145	1058
2008	5,075	626/4,352	630	158	978
2009	5,137	787/4,123	852	146	721
2010	5,085	629/3,328	639	145 (126)	1169
2011	5,045	568/3,231	576	162 (129)[5]	653[5]
2012	5,000	467/2,609	n/a	n/a	n/a
TOTAL	**30,942**	**3,632/21,139**	**3,311**	**756**	**4,579**

[1]Permitted by USFWS; includes WS' authorized take
[2]Data reported by federal fiscal year
[3]Data reported by calendar year; includes WS' take
[4]Data obtained from USFWS personal communication, 2011
[5]Preliminary results

Under additional frameworks for the harvest of waterfowl developed by the USFWS, the PGC allows Canada geese to be harvested during regulated seasons in the Commonwealth. Dates of harvest and bag limits are dependent on location in the Commonwealth (PGC 2015), and have changed over time to meet management objectives for both resident and migratory Canada goose populations (Dunn and Jacobs 2000, Atlantic Flyway Council 2011). From 2007 to 2012, hunters harvested an estimated 1,001,900 geese, or an average of 166,983 geese per year, in the Commonwealth (see Table 4-10). On an annual basis, an average of 33.5% of Canada geese harvested in the Commonwealth were harvested during the September season specifically designed to target resident Canada geese.

To address requests for assistance to manage damage and threats associated with Canada geese in the future, up to 6,000 geese and 10,000 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats. 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, parks, golf courses, beaches, and other areas where geese congregate.

Most requests for assistance received by WS to address damage caused by Canada geese in the Commonwealth occur during the months when geese present are considered resident. As stated previously, Canada geese are considered resident when they nest and/or reside on a year round basis within the contiguous United States. In addition, resident geese include those geese that nest within the lower 48 States in the months of March, April, May, or June or resides within the lower 48 States and the District of Columbia in the months of April, May, June, July, and August (see 50 CFR 20.11, 50 CFR 21.3; USFWS 2005). Distinguishing resident and migratory geese is not possible through visual identification. However, due to the time of year in which geese were addressed and the type of damage occurring, those geese addressed by WS from FY 2007 through FY 2012 were likely resident geese (*i.e.*, present in the Commonwealth all year). Therefore, WS' take will be analyzed here as if all birds taken were resident geese. A population impact analysis for migratory Canada geese is given below.

Table 4-10. Number of Canada geese harvested by hunters during various seasons in Pennsylvania from 2007 to 2012.

Year	Hunter Harvest[1]		
	September	**Regular**	**Total Hunter Harvest**
2007	93,700	182,300	276,000
2008	70,400	161,200	231,600
2009	54,600	107,300	161,900
2010	42,100	111,100	153,300
2011	15,000	60,100	75,100
2012	60,100	76,600	104,000
TOTAL	**335,900**	**698,600**	**1,001,900**

[1]Data obtained from Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013

The best available data estimates the breeding population of resident Canada geese in the Commonwealth at anywhere from 215,000 (Wilson et al. 2012) to 278,862 (Klimstra and Padding 2013) geese, which represents an estimated 43 to 86% above the population objective of 150,000 geese in the Commonwealth (Atlantic Flyway Council 2011). Based on this estimate, the removal of up to 6,000 geese by WS under the proposed action alternative would represent anywhere from 2.2 to 2.8% of the estimated population of resident geese in the Commonwealth. This estimate is likely less because the breeding population estimate does not include young of the year; however, some take does occur on young of the year geese.

Cumulative impacts of the proposed action on resident Canada geese are based on WS' anticipated take, take by other entities under depredation permits, take by other entities under depredation/control orders, and hunter harvest. From 2007 through 2012, the annual take of Canada geese by all entities in the Commonwealth under depredation permits has averaged 2,507 geese. From 2007 through 2012, the annual take of Canada geese by other entities in the Commonwealth under the agriculture depredation order has averaged 13 geese. During this same period, on average, 55,983 geese were taken annually by hunters in the Commonwealth during the September season specifically intended to target resident Canada geese[14]. As discussed previously, geese can also be harvested in the Commonwealth during the normal hunting season for waterfowl. The exact number of resident geese harvested annually during the regular waterfowl season is unknown because both resident and non-resident geese are present in the Commonwealth during those periods. During the 2004 through 2008 regular waterfowl hunting seasons, Klimstra and Padding (2012) estimated that 62% of the Canada goose harvest consisted of resident Canada geese in the United States portion of the Atlantic Flyway. To provide a range of possible cumulative impacts on resident Canada geese, this analysis will evaluate cumulative impacts of the proposed action as though 62% of the geese harvested during the regular hunting season were resident

[14]Klimstra and Padding (2012) estimated that 98% of the geese harvested in the Atlantic Flyway during the special September hunting season were resident Canada geese.

geese. From 2007 through 2012, 116,433 geese were harvested annually by hunters on average during the regular waterfowl hunting seasons in the Commonwealth. If 62% of those geese harvested on average from 2007 through 2012 during the regular waterfowl hunting seasons were resident Canada geese, the average annual harvest of resident geese during the regular waterfowl hunting seasons would have been 72,189 geese.

The combined average take of resident Canada geese by all entities under depredation permits (2,507), depredation orders (13), during the September hunting season (55,983), and harvest under the regular waterfowl season (72,189) from 2007 through 2012 would be 130,692 geese. This combined take would represent 46.9 to 60.8% of the estimated statewide resident Canada goose population. All Canada geese taken in the Commonwealth under depredation permits or orders were considered resident geese since the permits and orders authorize removal during the periods of the year when those birds present are likely to be resident. Despite this level of take, the resident Canada goose population in the Commonwealth has not decreased, with one survey even indicating it increased 3.8% annually from 2002 through 2012 (Sauer et al. 2014). Resident Canada goose population estimates from the Atlantic Flyway Breeding Waterfowl Plot Survey indicate a relatively stable trend between 2007 and 2013 (see Figure 4-1; Klimstra and Padding 2013).

As stated previously, the current population of Canada geese in the Commonwealth is estimated at anywhere from 215,000 (Wilson et al. 2012) to 278,862 (Klimstra and Padding 2013) geese, which exceeds the statewide population objective of 150,000 geese by 43 to 86%. The take of up to 6,000 geese annually by WS under the proposed action alternative to alleviate damage or threats would represent anywhere from 2.2 to 2.8% of the current population or 4.0% of the population goal. If WS' annual take reached 6,000 geese, the combined average take of resident Canada geese by all entities under depredation permits (2,507), depredation orders (13), during the September hunting season (55,983), and harvest under the regular waterfowl season (72,189) from 2007 through 2012 would be 136,692 geese. This combined take would represent 49.0 to 63.6% of the estimated statewide resident Canada goose population.

Given the increasing population trends observed for Canada geese by the BBS and the relatively stable trend observed during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted from 2007 through 2013, the current take levels have not substantively reduced resident Canada goose populations in the Commonwealth. In addition, the goal of management agencies, including the USFWS and the PGC, is to reduce the resident goose population in the Commonwealth and throughout the Atlantic Flyway (Atlantic Flyway Council 1999, Atlantic Flyway Council 2011). Despite the expansion of hunting opportunities that targets resident Canada geese, the harvest of resident geese from 2004 through 2008 did not reach levels to reduce the number of resident geese and to meet the breeding population goal of 700,000 resident geese in the Flyway (Klimstra and Padding 2012). WS' limited proposed take would also not substantially limit the ability to harvest Canada geese in the Commonwealth. WS' proposed take would be a limited portion of the overall removal occurring. WS' proposed take is of low magnitude when compared to the number of Canada geese observed in the Commonwealth annually.

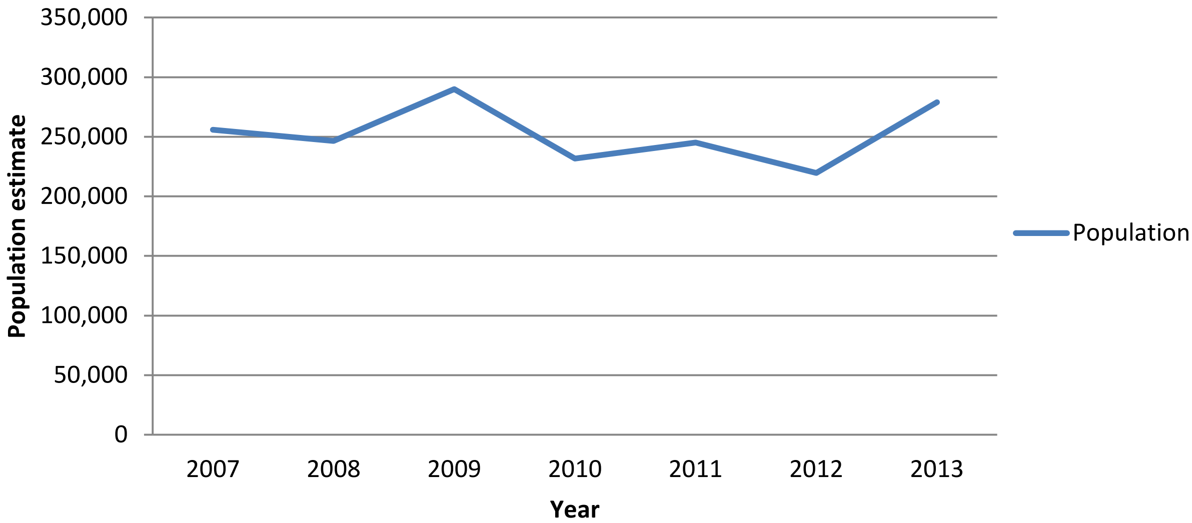

Figure 4-1. Resident Canada goose population estimates in Pennsylvania (Klimstra and Padding 2013).

Under the proposed action alternative, up to 10,000 nests and the associated eggs of resident Canada geese could be destroyed annually by WS as part of an integrated approach to managing damage. Nest and egg destruction methods are considered non-lethal when conducted before the development of an embryo. Canada geese 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 geese when completed in a localized area.

Nest and egg removal would not be used by WS as a population management method. Treatment of 95% of all Canada goose eggs each year would result in only a 25% reduction in the population over 10 years (Allan et al. 1995). This method would be used by WS to inhibit nesting in an area experiencing damage due to nesting activity and would be employed only at a localized level. The destruction of up to 10,000 resident Canada geese nests annually by WS would occur in localized areas where nesting occurred and would not reach a level where adverse effects on geese populations would occur. The resident Canada goose FEIS developed by the USFWS concluded that the nest and egg depredation order would have minimal impacts on resident Canada goose populations with only localized reductions in the number of geese (USFWS 2005). As with the lethal take of Canada geese, 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.

<u>Migratory Canada Geese</u>

Migratory Canada geese nest across the arctic, subarctic, and boreal regions of Canada and Alaska then migrate south to winter in the United States and Mexico (Mowbray et al. 2002). In the Atlantic Flyway, migratory Canada geese exist primarily in three distinct populations. Those populations include the North Atlantic Population (NAP), Atlantic Population (AP), and the Southern James Bay Population (SJBP) (USFWS 2014*b*). The wintering migratory population of Canada geese in Pennsylvania is comprised of geese from the AP and the SJBP. The AP of Canada geese nest throughout much of Quebec and the eastern shore of Hudson Bay. The AP winters from New England to South Carolina, with the largest concentrations on the Delmarva Peninsula. The AP was estimated at 785,600 geese in 2014 (USFWS

2014*b*). The SJBP of Canada geese nest on Akimiski Island and in the Hudson Bay lowlands to the west and south of James Bay. The SJBP winters from Southern Ontario and Michigan south to Mississippi, Alabama, Georgia, and South Carolina. The total population of SJBP geese was estimated at 81,300 geese in 2014 (USFWS 2014*b*).

As discussed previously, the AP and SJBP of Canada geese can be found wintering or migrating through the Commonwealth. The number of Canada geese observed in the Commonwealth during the CBC when migratory birds are present has shown a general increasing trend since 1966 (National Audubon Society 2010). During the CBC conducted in the winter of 2013–2014, observers counted 181,671 geese in the Commonwealth (National Audubon Society 2010). On average, 196,370 Canada geese have been observed overwintering in the Commonwealth during the CBC conducted between 2004–2005 and 2013–2014 (National Audubon Society 2010). The number of migratory Canada geese present in the Commonwealth during the winter or during the spring and fall migration is unknown (because both resident and non-resident geese are present in the Commonwealth during those periods).

The number of Canada geese taken by WS and the total number of Canada geese taken by all entities to alleviate damage and threats from 2007 to 2012 are shown in Table 4-8. From 2007 through 2012, WS lethally removed 11,974 Canada geese in the Commonwealth. During this period, 430 Canada geese, or 3.6% of the geese taken, were taken from September through March when geese present in the Commonwealth could be migratory (see Figure 4-2). In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of Canada geese during this period. From 2007 to 2012, a total of 15,041 geese, or 2,507 geese per year on average, were taken under depredation permits by all entities to alleviate damage and threats associated with geese occurring within the Commonwealth. Although most geese taken under depredation permits are likely resident, there is a possibility that some of the geese taken were migratory geese. Under depredation permits, there is no requirement to report the months in which birds were taken.

As previously stated, under frameworks for the harvest of waterfowl developed by the USFWS, the PGC allows Canada geese to be harvested during regulated seasons in the Commonwealth. Dates of harvest and bag limits are dependent on location in the Commonwealth (PGC 2015), and have changed over time to meet management objectives for both resident and migratory Canada goose populations (Dunn and Jacobs 2000, Atlantic Flyway Council 2011). From 2007 to 2012, hunters harvested an estimated 698,600 geese, or an average of 116,433 geese per year, in the Commonwealth during the regular season when those geese present could be migratory (see Table 4-10). Klimstra and Padding (2012) estimated that 38% of the geese harvested in the Atlantic Flyway during the regular waterfowl hunting seasons were migratory geese.

Cumulative impacts of the proposed action on migratory Canada geese would be based upon anticipated WS' take, take by other entities under depredation permits, and hunter harvest. From FY 2007 through FY 2012, WS lethally removed 430 Canada geese in the Commonwealth from September through March when geese present could be migratory. The lethal removal of 430 geese by WS represented 3.6% of the total number of geese taken by WS from 2007 through 2012. Therefore, under the proposed action alternative, this analysis will estimate that up to 4.0% of the potential total take of geese by WS, or 240 geese, could be taken annually when migratory geese could be present in the Commonwealth. From 2007 to 2012, hunters harvested an average of 116,433 geese during the regular hunting season. If 38% of those geese harvested during the regular season were migratory geese between 2007 and 2012, hunters harvested 44,245 migratory geese per year on average in the Commonwealth. WS' take of 240 geese that could be migratory would represent 0.5% of the average number of geese taken during the regular hunting season that could be considered migratory.

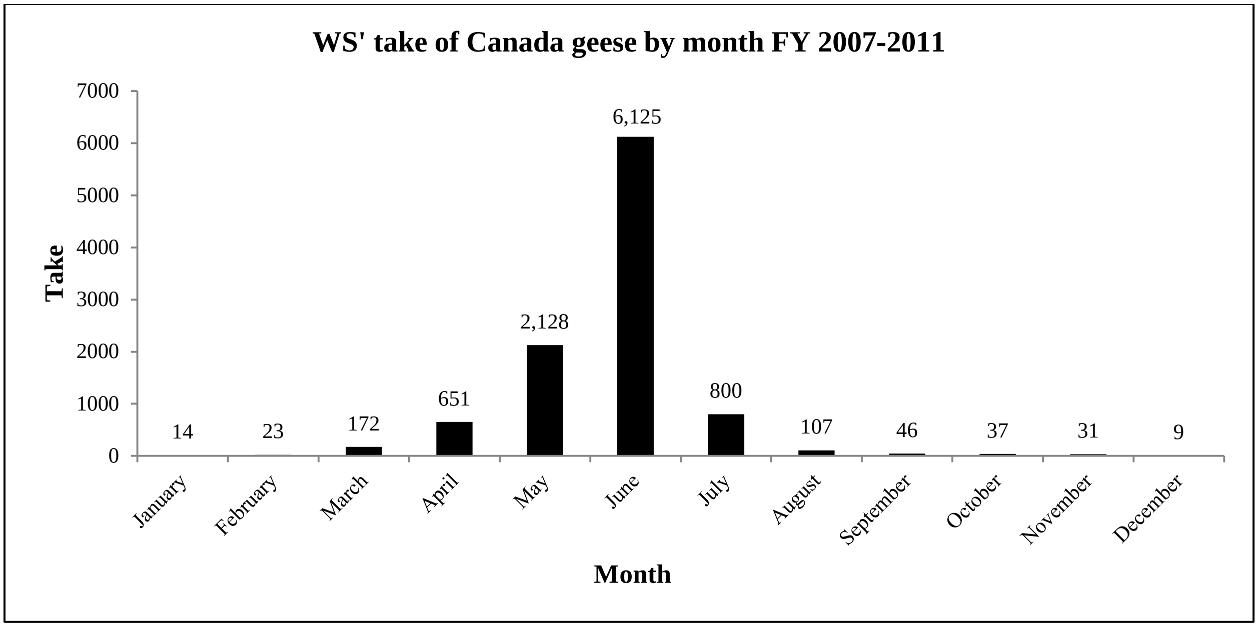

Figure 4-2. WS' take of Canada geese by month for FY 2007 – 2011

If WS takes 240 migratory Canada geese under the proposed action alternative, it would represent 0.1% of the average number of geese observed overwintering in the Commonwealth (196,370) during the CBC since the 2004–2005 survey was completed. CBC data is best interpreted as an indication of long-term trends in the number of birds observed wintering in the Commonwealth and is not intended to represent estimates of wintering bird populations. This information is presented in this analysis to indicate the low magnitude of take proposed by WS when compared to the number of geese observed in the Commonwealth during the CBC. The number of migratory geese potentially taken by WS on an annual basis in Pennsylvania is believed to be relatively low. The majority of WS' lethal activities would occur when migratory geese were not present in Pennsylvania (*i.e.*, from April through August). Most, if not all, of WS' Canada goose damage management activities are targeted towards the resident Canada geese population. WS' proposed take is of low magnitude when compared with the number of geese that are harvested annually in the Commonwealth. WS' limited proposed take would not substantially limit the ability of people to harvest Canada geese in the Commonwealth based on the limited portion of the overall take occurring by WS. WS' proposed take is of low magnitude when compared to the number of Canada geese observed in the Commonwealth annually. The take of migratory Canada geese could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives for geese.

FREE-RANGING DOMESTIC AND FERAL WATERFOWL POPULATION IMPACT ANALYSIS

Domestic waterfowl refers to captive-reared, domestic, of some domestic genetic stock, or domesticated breeds of ducks, geese, and swans. Examples of domestic waterfowl in the Commonwealth include, but are not limited to; African geese, call ducks, Cayuga ducks, Chinese geese, crested ducks, Embden geese, Indian runner ducks, khaki Campbell ducks, Muscovy ducks, Peking ducks, pilgrim geese, Rouen ducks, Swedish ducks, and Toulouse geese. All domestic ducks, except for Muscovy ducks, were derived from the mallard (Drilling et al. 2002). Crossbreeding has resulted in the development of numerous domestic varieties of the mallard duck that no longer exhibit the external characteristics or coloration of their wild mallard ancestors. Domestic waterfowl have been purchased and released by property owners for their aesthetic value or as a food source, but may not always remain at the release sites; thereby, becoming feral. Feral waterfowl are defined as a domestic species of waterfowl that cannot be linked to a specific ownership. Examples of areas where domestic waterfowl have been released are business parks, universities, wildlife management areas, parks, military bases, residential communities, and housing developments. Many times, those birds are released without regard or understanding of the consequences or problems they can cause to the environment or the local community. Domestic and feral waterfowl may crossbreed with migratory waterfowl species creating hybrids. Some domestic and feral ducks are incapable of sustained flight, while others are incapable of flight due to hybridization.

Currently, there are no population estimates for domestic and feral waterfowl in the Commonwealth. Domestic and feral waterfowl are almost always found near water, such as ponds, lakes, retaining pools, and waterways and generally reside in the same area year round with little to no migration occurring.

Domestic and feral waterfowl are not protected by federal and Commonwealth laws, including the MBTA, with the exception of certain populations of Muscovy ducks. The Muscovy ducks found in the Commonwealth are from non-migratory populations that originated from domestic stock. The USFWS has recently changed the regulations governing Muscovy Ducks. Because Muscovy ducks now occur naturally in southern Texas, this species has been added to the list of migratory birds afforded protection under the MBTA. However, it has been introduced and is not native in other parts of the United States, including Pennsylvania. The USFWS now prohibits sale, transfer, or propagation of Muscovy ducks for hunting and any other purpose other than food production, and allows their removal in locations in which the species does not occur naturally in United States, including Pennsylvania. The USFWS has revised 50 CFR 21.14 (permit exceptions for captive-bred migratory waterfowl other than mallard ducks) and 50 CFR 21.25 (waterfowl sale and disposal permits), and has added 50 CFR 21.54, an order to allow control of Muscovy ducks, their nests, and eggs.

The number of domestic or feral ducks taken or dispersed by WS and the total number of domestic mallards harvested by hunters from 2007 to 2012 are shown in Table 4-11. From FY 2007 through FY 2012, WS lethally removed 30 domestic or feral ducks and used non-lethal methods to disperse an additional 60 domestic or feral ducks in the Commonwealth. In addition to the take by WS, hunters harvested 3,931 domestic mallards during this period. WS also destroyed a total of 38 eggs and 2 nests from FY 2007 to FY 2012 to alleviate damage and threats.

Table 4-11. Number of feral ducks addressed by WS in Pennsylvania from FY 2007 to FY 2012

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2,3]
2007	0	19	918
2008	60	5	1,129
2009	0	1	191
2010	0	0	998
2011	0	3	416
2012	0	2	279
TOTAL	**60**	**30**	**3,931**

[1]Data reported by federal fiscal year

[2]Data obtained from Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013

[3]Number of 'domestic mallards' harvested

The number of domestic or feral geese taken or dispersed by WS from FY 2007 to FY 2012 is shown in Table 4-12. From FY 2007 through FY 2012, WS lethally removed 35 feral geese and used non-lethal methods to disperse seven domestic or feral geese in the Commonwealth. In addition, WS destroyed three eggs from FY 2007 to FY 2012 to alleviate damage and threats.

Table 4-12. Number of feral geese addressed in Pennsylvania from FY 2007 to FY 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	0	6
2008	6	14
2009	0	1
2010	1	7
2011	0	2
2012	0	5
TOTAL	7	35

[1]Data reported by federal fiscal year

Based on previous requests for assistance and in anticipation of an increase in the number of requests received by WS annually, up to 500 feral ducks and 500 feral geese and up to 200 feral duck and 200 feral goose nests could occur annually under the proposed action alternative. The number of feral waterfowl inhabiting the Commonwealth is currently unknown. Domestic and feral waterfowl are afforded no protection under the MBTA and are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Given their negative effects on native wildlife, any reduction of the domestic and feral waterfowl population in the Commonwealth, even to the extent of complete eradication from the natural environment, could be considered as providing some benefit to native waterfowl species and ecosystems. Since feral waterfowl often compete with native wildlife species for resources, any take of feral waterfowl could be viewed as benefitting the natural environment.

SNOW GOOSE POPULATION IMPACT ANALYSIS

Snow geese are a medium-sized white or grey-brown goose often first identified by their baying hound-like call (Mowbray et al. 2000). Snow geese breed across the extreme northern portions of Canada and along the arctic coast on low wet meadows (Mowbray et al. 2000). During migration and in winter, snow geese utilize coastal areas, marshes, rivers, lakes, farm fields, grasslands, and sandbars (Mowbray et al. 2000). Like most geese, snow geese consume grasses, aquatic plants, forbs, seeds, roots, and berries (Mowbray et al. 2000). Snow geese are highly social, nesting colonially and forming flocks of tens of thousands of individuals during the non-breeding season (Mowbray et al. 2000).

In 2014, there were an estimated 796,000 greater snow geese in North America (USFWS 2014*b*). No breeding populations of snow geese occur in Pennsylvania. However, snow geese nesting in northern portions of Canada and along the arctic coast migrate through Pennsylvania and overwinter in the Commonwealth (Mowbray et al. 2000). Major concentrations of overwintering geese occur in Lancaster and Lebanon Counties with fewer numbers occurring in Berks, Lehigh, and Montour Counties (D'Angelo 2011). The fall migration period occurs from September through November and the spring migration occurs from late February through the first part of June (Mowbray et al. 2000). Snow geese have been known to form flocks in the tens of thousands during these periods (Mowbray et al. 2000). The number of snow geese observed overwintering in the Commonwealth has increased dramatically in the last 20 years. Prior to the 1990–1991 CBC, the highest number of observed overwintering snow geese in Pennsylvania was 241 (National Audubon Society 2010). Since the 1990–1991 season, the lowest number of geese observed was 475 (2000–2001) and the highest was 239,493 (2013–2014) (National Audubon Society 2010). On average, 80,430 snow geese were observed overwintering in Pennsylvania from 2004–2005 to 2013–2014 (National Audubon Society 2010).

Snow geese, like many waterfowl species, can be harvested in Pennsylvania during a regular hunting season that traditionally occurs during the fall migration period of waterfowl. However, snow geese can also be harvested during their spring migration period in Pennsylvania under a Conservation Order established by the USFWS (see 50 CFR 21.60) and authorized under the Arctic Tundra Habitat Emergency Conservation Act (Public Law 106-108, Nov. 24, 1999, 113 Stat. 1491). The Conservation Order is intended to allow for the maximum number of snow geese to be taken annually in attempts to reduce the overall population of snow geese. During the regular harvest season and during the Conservation Order season up to 25 geese can be harvested daily with no possession limit and during the Conservation Order season, expanded hunting hours and special methods are allowed (electric/motorized decoys and electric calls) (PGC 2015). The overall population of snow geese has increased dramatically since the mid-1970s and has reached historic highs across their breeding and wintering range (Mowbray et al. 2000). The current population level of snow geese has led to serious damage of its arctic breeding habitat, and in some areas its wintering habitat (Mowbray et al. 2000). Current populations could be considered environmentally unsustainable (Mowbray et al. 2000). Despite the introduction of special seasons, biologists remain concerned about their high population (USFWS 2014*b*).

The number of snow geese taken or dispersed by WS and the total number taken by all entities to alleviate damage and threats, as well as the number harvested by hunters, from 2007 to 2012 are shown in Table 4-13. From FY 2007 through FY 2012, WS employed non-lethal methods to disperse 127,851 snow geese in the Commonwealth to alleviate damage or threats of damage. During this period, the USFWS issued depredation permits to other entities for the take of snow geese. From 2007 through 2012, 34 snow geese were taken by all entities under depredation permits. In addition to the take pursuant to depredation permits, hunters harvested 62,682 snow geese during this period. From 2007 to 2012, 62,716 snow geese, or 10,453 snow geese per year on average, were taken by all entities per year within the Commonwealth.

Table 4-13. Number of snow geese addressed in Pennsylvania from 2007 to 2012.

		Take under Depredation Permits			
Year	**Dispersed by WS[1]**	**Authorized Take[2]**	**WS' Take[1]**	**Total Take by All Entities[3]**	**Hunter Harvest[4,5]**
2007	0	50	0	0	11,772
2008	0	210	0	0	10,009
2009	37,054	235	0	9	6,719
2010	5,795	220	0	0	2,045
2011	190	320	0	0	20,902
2012	84,812	435	0	25	11,235
TOTAL	**127,851**	**1,470**	**0**	**34**	**62,682**

[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

[5]Data does not include Conservation Order harvests.

Requests for assistance to manage damage and threats associated with snow geese primarily originate from airports. Large flocks of snow geese on or near airport property pose risks to aircraft and passenger safety due to aircraft strikes. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 1,000 snow geese annually under the proposed action alternative.

The number of snow geese present in Pennsylvania fluctuates throughout the year and from year to year. Snow geese breed across northern portions of Canada and along the arctic coast, migrating south to overwinter in locations along the Atlantic Flyway, including Pennsylvania. As stated previously, the greater snow goose population is estimated at 796,000 geese (USFWS 2014*b*). The take of up to 1,000 geese annually under the proposed action alternative to alleviate damage or threats would represent 0.1%

of the population. On average, 80,429 snow geese have been observed overwintering in Pennsylvania since 2004–2005 (National Audubon Society 2010). The take of up to 1,000 snow geese annually under the proposed action alternative to alleviate damage or threats would represent 1.2% of the average number of geese observed overwintering in the Commonwealth during the CBC since 2004–2005. WS' take of up to 1,000 geese annually under the proposed action alternative would represent 9.6% of the average number of geese (10,447) taken annually by hunters in the Commonwealth. If the USFWS continued to issue depredation permits for the removal of up to 435 snow geese annually and if WS' take reached 1,000 snow geese, the cumulative take would represent 0.2% of the estimated snow goose population and 1.8% of the average number of snow geese observed overwintering in the Commonwealth since 2004-2005. In addition, the cumulative take of 1,435 snow geese would represent 13.7% of the average number of geese harvested annually by hunters in the Commonwealth.

Given the increasing population trends observed for snow geese and the desire of management agencies to reduce the overall population to alleviate the damage occurring to fragile arctic habitat, the limited take proposed by WS to alleviate damage and threats would not adversely impact snow goose populations. WS' limited proposed take would also not substantially limit the ability to harvest snow geese in the Commonwealth based on the limited take that could occur by WS when compared to the annual number of geese harvested in the Commonwealth. WS' proposed take could be considered of low magnitude when compared to the number of snow geese observed in the Commonwealth annually. WS' take of snow geese could only occur when authorized through the issuance of depredation permits by the USFWS. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives for these birds.

MUTE SWAN POPULATION IMPACT ANALYSIS

A large white swan with an orange bill, mute swans are native to parts of Europe and Asia and are thought to have been introduced into the United States prior to 1900 (Ciaranca et al. 1997). Feral populations became established over time as swans escaped captivity or as swans were intentionally released. Today, mute swan populations have expanded to include much of the northeastern United States, the Upper Great Lakes region, and the Pacific Northwest. Mute swans often have negative effects on localized habitats because they consume large quantities of submerged aquatic vegetation essential to native fish and wildlife species (Ciaranca et al. 1997). Fenwick (1983) found that female mute swans in Chesapeake Bay could consume an average of 43% of their body weight daily while male mute swans could consume an average of 35% of their body weight daily. Thus, large concentrations of mute swans can have negative effects on submerged aquatic vegetation beds essential to many fish, wildlife, and invertebrate species. Mute swans also aggressively defend large nesting territories, often excluding native wildlife from those areas (Ciaranca et al. 1997).

Long term trend data from the BBS shows the number of mute swans observed along routes surveyed in the Commonwealth has increased at an annual rate of 13.4% since 1966 (Sauer et al. 2014). The number of blocks in which mute swans were observed quadrupled between the first (1983–1989) and second (2004–2009) Pennsylvania BBA (Wilson et al. 2012). Similarly, the number of mute swans observed overwintering in the Commonwealth has increased from an average of less than 9 swans per year from 1966–1967 to 1986–1987 (20 years) to an average of nearly 168 swans per year from 1994–1995 to 20013–2014 (20 years) (National Audubon Society 2010). In 2013–2014, 224 mute swans were observed overwintering in the Commonwealth (National Audubon Society 2010). The PGC surveys the statewide mute swan population during summer in 3-year intervals. In 2011, 167 mute swans were recorded statewide (Gregg 2011). This should be considered a minimum estimate of the Pennsylvania mute swan population. In addition to swans possibly present in Wildlife Conservation Officer districts not surveyed, some mute swans known to exist in surveyed districts were not actually observed during the 2011 survey period and therefore were not included in the statewide total. The number of mute swans observed in 2011 was 41% lower than the number observed in 2008. In addition to the overall decline in the numbers of mute swans observed, mute swans were also observed in the smallest number of districts since 1999 (Gregg 2011).

In 2003, the Atlantic Flyway Council adopted a Mute Swan Management Plan with the goals of reducing mute swan populations in the Flyway to levels that would minimize negative effects on wetland habitats and native waterfowl, and prevent expansion of their range into unoccupied areas. To achieve those goals, the Plan called for a reduction of the mute swan population in the Atlantic Flyway to less than 3,000 swans by 2013 (Atlantic Flyway Council 2003). The target population in the Commonwealth is zero free-ranging swans (Atlantic Flyway Council 2003). The number of breeding mute swans along the Atlantic Flyway is currently estimated at 24,468 birds (Klimstra and Padding 2013).

The number of mute swans taken or dispersed by WS from FY 2007 to FY 2012 to alleviate damage and threats are shown in Table 4-14. From FY 2007 through FY 2012, WS lethally removed 43 mute swans and used non-lethal methods to disperse an additional 138 mute swans in the Commonwealth. WS also destroyed a total of 14 eggs and 1 nest from FY 2007 to FY 2012 to alleviate damage and threats.

Mute swans are afforded no protection under the MBTA, as amended by the Migratory Bird Treaty Reform Act of 2004. Mute swans are considered by many wildlife biologists and ornithologists to be an undesirable component of wild and native ecosystems due to their detrimental effects. Given the invasive status of mute swans, any reduction in mute swan populations, or even the complete removal of populations, could be considered as providing some benefit to the local environment since native habitats, and the fish, wildlife, and invertebrates that rely on them, could be negatively affected by the presence of mute swans. Executive Order 13112 directs federal agencies to use their programs and authorities to prevent the spread or control populations of invasive species that cause economic or environmental harm, or harm to human health. Since mute swans are non-native and therefore afforded no protection under the MBTA, no depredation permit from the USFWS is required and reporting the take of mute swans to the USFWS is not required. Therefore, the take of mute swans by other entities in the Commonwealth is unknown.

Table 4-14. Number of mute swans addressed by WS in Pennsylvania from FY 2007 to FY 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	0	0
2008	0	1
2009	0	4
2010	98	28
2011	15	3
2012	25	7
TOTAL	**138**	**43**

[1]Data reported by federal fiscal year

Based on the desire to limit the expansion of mute swans and to reduce the population further in the Commonwealth, WS could take up to 300 mute swans and up to 50 mute swan nests annually. As previously stated, any reduction of the mute swan population in the Commonwealth, even to the extent of the complete eradication of mute swans from the natural environment, could be considered as providing some benefit to native species by reducing competition. Mute swans are a non-native species in Pennsylvania; therefore, any take by WS could be viewed as benefiting the human environment since mute swans often compete with other bird species for food and nesting sites.

MALLARD POPULATION IMPACT ANALYSIS

Found across most of North America, the mallard is the most abundant and one of the most recognizable waterfowl species (Drilling et al. 2002). In Pennsylvania, mallards can be found year-round throughout the Commonwealth (Wilson et al. 2012). Mallards are often associated with wetlands, steams, ponds, and lakes; however, mallards are flexible and adaptable and can be found in a variety of habitats (Drilling et al. 2002). An omnivorous and opportunistic duck, mallards will consume a wide variety of invertebrates, vegetation, seeds, and human provided food (Drilling et al. 2002). With the exception of mating season, mallards are highly social, congregating in flocks that can number in the thousands during the winter and spring and fall migration (Drilling et al. 2002).

The number of mallards observed in the Commonwealth during the BBS has increased an estimated 1.1% annually since 1966 and 0.7% annually from 2002 through 2012 (Sauer et al. 2014). In contrast, the number of mallards observed during the BBS in the Eastern BBS survey area has decreased -1.2% annually since 1966 with a -0.3% decrease from 2002 through 2012 (Sauer et al. 2014). The population estimate for breeding mallards in the Commonwealth during the Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2013 was 138,804 (±18,527) mallards (Klimstra and Padding 2013). This represents a decreasing trend when compared to the recent 10-year average of 188,516 (PGC 2014). The population estimate for breeding mallards in the Atlantic Flyway was 604,157 (±42,755) (Klimstra and Padding 2013). On average, 30,100 mallards were observed in the Commonwealth during the CBC over the last 30 years (since 1984–1985) (National Audubon Society 2010).

The number of mallards taken or dispersed by WS and the total number of mallards taken by all entities to alleviate damage and threats, as well as the number harvested by hunters from 2007 to 2012, are shown in Table 4-15. From FY 2007 through FY 2012, WS lethally removed 574 mallards and used non-lethal methods to disperse an additional 12,884 mallards in the Commonwealth. WS also destroyed 179 eggs and 12 nests from FY 2007 to FY 2012 to alleviate damage and threats. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of mallards during this period. From 2007 to 2012, a total of 671 mallards, or 111 mallards per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth. Like other waterfowl species, mallards can be harvested during a regulated season in the Commonwealth. Hunters harvested an estimated 372,338 mallards or an average of 62,056 mallards per year, in the Commonwealth from 2007 to 2012 (see Table 4-15).

Table 4-15. Number of mallards addressed in Pennsylvania 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	4,287	278	124	124	92,323
2008	2,417	642	125	129	94,187
2009	1,054	532	92	116	56,316
2010	1,331	520	63	80	50,672
2011	2,270	752	101	108	40,893
2012	1,525	827	69	114	37,947
TOTAL	**12,884**	**3,551**	**574**	**671**	**372,338**

[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 WS assistance with mallards in the Commonwealth often arise at airports when those birds pose a risk to aircraft and human safety. Additionally, requests for assistance could be received when fish at aquaculture facilities are damaged or consumed by mallards (Glahn et al. 1999*a*). At three Pennsylvania aquaculture facilities, mallards consumed trout valued between $5,601 and $54,936 from April through June during 1996. Based on the number of requests received for assistance previously and in anticipation of an increase in the number of requests for assistance associated with mallards on or near airport property that would be received annually, an annual take of up to 1,000 mallards and 200 nests could occur under the proposed action alternative.

The number of mallards present in Pennsylvania fluctuates throughout the year. As stated previously, the population of mallards in Pennsylvania during the breeding season was estimated at 138,804 (Klimstra and Padding 2013). The take of up to 1,000 mallards annually under the proposed action alternative would represent 0.7% of the estimated breeding population. WS' take of up to 1,000 mallards annually under the proposed action alternative would represent 1.6% of the average number of mallards (62,056) harvested annually by hunters in the Commonwealth. If the USFWS continued to allow the lethal take of up to 827 mallards in the Commonwealth and if WS' take reached 1,000 mallards, the cumulative take would be 1,827 mallards annually. The take of 1,827 mallards cumulatively would represent 1.3% of the current estimated breeding population in the Commonwealth and 2.9% of the average number of mallards harvested annually in the Commonwealth.

Given the limited take proposed, the proposed take would not adversely affect mallard populations. WS' limited proposed take would also not substantially limit the ability to harvest mallards in the Commonwealth. WS' proposed take would be a limited component of the overall take of mallards occurring. WS' proposed take is of low magnitude when compared to the number of mallards observed in the Commonwealth annually. WS take of mallards could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives.

Additionally, impacts due to nest removal and destruction should have little adverse effect on the mallard population. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity would not have a long-term effect on breeding adult mallards. The destruction of up to 200 mallard nests annually by WS would occur in localized areas where nesting occurred and would not reach a level where adverse effects on mallard populations would occur. As with the lethal take of mallards, the take of nests must be authorized by the USFWS and the PGC. Therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the PGC.

AMERICAN BLACK DUCK POPULATION IMPACT ANALYSIS

A large dabbling duck, the black duck can be found throughout North America's eastern states and provinces (Longcore et al. 2000). In Pennsylvania, black ducks can be found year-round (Wilson et al. 2012). Black duck habitat includes brushy and woody wetlands, and marshes or slow flowing streams surrounded by woods (Longcore et al. 2000). Diet includes a wide variety of invertebrates, fish, vegetation, seeds, and grains (Longcore et al. 2000). With the exception of breeding season, black ducks are highly social, congregating with other ducks during the nonbreeding season (Longcore et al. 2000).

The number of black ducks observed in the Commonwealth and across the eastern BBS region during the breeding season has decreased an estimated -7.2% and an estimated -0.7% annually, respectively, since 1966 (Sauer et al. 2014). The population estimate for black ducks in the Commonwealth during Atlantic Flyway Breeding Waterfowl Plot Survey conducted in 2013 was 4,278 (±1,981) black ducks, while the population estimate for breeding black ducks in the Atlantic Flyway was 49,735 (±8,041) (Klimstra and Padding 2013). The number of black ducks observed overwintering in the Commonwealth during the CBC has also shown a declining trend since 1966, with an average of 4,380 birds observed since 1994–1995 (National Audubon Society 2010).

The number of black ducks taken or dispersed by WS and the total number of black ducks taken by all entities to alleviate damage and threats, as well as the number harvested by hunters, from 2007 to 2012 are shown in Table 4-16. From FY 2007 through FY 2012, WS lethally removed nine black ducks and used non-lethal methods to disperse an additional 1,487 black ducks in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of black ducks during this period. From 2007 to 2012, 11 black ducks, or 2 black ducks per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth. Like other waterfowl species, black ducks can be harvested during a regulated season in the Commonwealth. In addition to the take by WS, hunters harvested an estimated 42,597 black ducks, or an average of 7,100 black ducks per year, in the Commonwealth during this period (see Table 4-16).

Table 4-16. Number of black ducks addressed in Pennsylvania 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	334	1	1	1	12,065
2008	199	5	2	2	7,903
2009	55	6	0	0	5,059
2010	96	11	0	2	7,370
2011	334	31	2	2	4,713
2012	469	55	4	4	5,487
TOTAL	**1,487**	**109**	**9**	**11**	**42,597**

[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

Based on the number of requests received for assistance previously and in anticipation of an increase in the number of requests for assistance that would be received annually, an annual take of up to 100 black ducks and 10 nests could occur under the proposed action alternative. WS anticipates the number of airports requesting assistance with managing threats associated with black ducks on or near airport property to increase.

The number of black ducks present in the Commonwealth fluctuates throughout the year and from year to year. As stated previously, the population of black ducks in Pennsylvania during the breeding season in 2013 was estimated at 4,278 (±1,981) ducks, while the population in the Atlantic Flyway was 49,735 (±8,041) (Klimstra and Padding 2013). The take of up to 100 black ducks under the proposed action alternative would represent 2.3% of the breeding population in the Commonwealth during 2013 and 0.2% of the breeding population in the Atlantic Flyway. It would also represent 2.3% of the black duck population observed overwintering in the Commonwealth and 1.4% of the average number of black ducks taken annually by hunters in the Commonwealth. If the USFWS continued to issue permits that authorized the lethal removal of up to 55 black ducks annually and if 55 black ducks were lethally removed annually, the cumulative take under depredation permits would be 155 black ducks, if WS' take occurred at the maximum level of 100 ducks. The cumulative take of 155 black ducks would represent 3.6% of the estimated breeding population in the Commonwealth and 0.3% of the Atlantic Flyway population during 2013. The lethal removal of up to 155 black ducks would also represent 3.5% of the average black duck population observed overwintering in the Commonwealth and 2.2% of the average number of black ducks taken annually by hunters in the Commonwealth.

WS' proposed take would be a limited component of the overall take of black ducks occurring in the Commonwealth and would not adversely affect black duck populations. WS' proposed take could be considered of low magnitude when compared to the number of black ducks observed in the Commonwealth annually. WS' limited proposed take would also not substantially limit the ability to harvest black ducks in the Commonwealth. WS take of black ducks 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. The take of up to 10 black duck nests to alleviate damage and threats of damage is not expected to affect adversely the population of black ducks for those reasons discussed previously.

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). Ospreys are most common in the Commonwealth during the breeding season (Poole et al. 2002). Osprey can be observed across the Commonwealth during the spring and summer and can be found nesting along the Allegheny, Delaware, Monongahela, Ohio, and Susquehanna River drainages, as well as at reservoirs (Gross 2012). During the second Pennsylvania Breeding Bird Atlas conducted from 2002 through 2008, osprey were confirmed nesting in 90 of the breeding bird atlas survey blocks in the Commonwealth, many of which contained multiple nests (Wilson et al. 2012). The number of osprey observed in the Commonwealth and across the eastern BBS region during the breeding season has increased dramatically at an estimated 10.1% and 3.4% annually, respectively, since 1966 (Sauer et al. 2014). The Partners in Flight Science Committee (2013) estimated the statewide population of osprey at 600 ospreys based on BBS data. Ospreys are currently listed as threatened by the Commonwealth, although an increasing population and geographical distribution may soon justify down listing (Barber and Gross 2012, Gross 2012, Detwiler and Barber 2013). Osprey are migratory and in general do not overwinter in the Commonwealth; however, an average of two birds have been observed during the CBC since 1994–1995 (National Audubon Society 2010).

Previous requests for assistance received by WS to alleviate damage or the threat of damage associated with ospreys involved threats to aircraft from strikes along with threats of damage associated with their nesting behavior. 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, and man-made nesting platforms (Poole et al. 2002, United States Geological Survey 2005). 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, boats). Disruptions in the electrical power supply could occur when nests were located on utility structures and could inhibit access to utility structures for maintenance by creating obstacles to workers. For example, the average size of an osprey nest in Corvallis, Oregon was 41-inches in diameter and weighed 264 pounds (United States Geological Survey 2005). In 2001, 74% of occupied osprey nests along the Willamette River in Oregon occurred on power pole sites (United States Geological Survey 2005). In 2010, 91% of osprey nests observed in Pennsylvania were located on man-made structures (Gross 2012).

WS has responded to requests for assistance involving osprey previously by providing technical assistance and by providing direct operational assistance non-lethal harassment methods to disperse osprey. 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 4-17. From FY 2007 through FY 2012, WS used non-lethal methods to disperse 35 ospreys in the Commonwealth. During this period, the USFWS issued depredation permits for the lethal removal of up to 10 ospreys annually from 2010 through 2012. However, from 2007 to 2012, no ospreys were reported as lethally taken in the Commonwealth.

Table 4-17. Number of osprey addressed in Pennsylvania 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	1	0	0	0
2009	6	0	0	0
2010	5	10	0	0
2011	13	10	0	0
2012	10	10	0	0
TOTAL	**35**	**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

Under the proposed action alternative, WS could be requested to use lethal methods to remove osprey when non-lethal methods were ineffective or were determined to be inappropriate using WS Decision model. An example could include osprey that pose an immediate strike threat at an airport where attempts to disperse the osprey were ineffective. WS would continue to employ primarily non-lethal methods to address requests for assistance with managing damage or threats of damage associated with osprey in the Commonwealth. Based on previous requests for assistance to manage damage associated with osprey and in anticipation of additional efforts, WS could lethally take up to 10 ospreys and destroy up to 10 active osprey nests annually in the Commonwealth to alleviate damage and threats when non-lethal techniques were unsuccessful and with the permission of the PGC. WS anticipates that requests for assistance will increase as the osprey population continues to increase.

The number of osprey present in Pennsylvania fluctuates throughout the year; however, request for assistance would most likely occur during the breeding season when ospreys are most common and nesting occurs. The take of up to 10 ospreys under the proposed action alternative would represent 1.7% of the breeding population estimated by the Partners in Flight Science Committee (2013). If the USFWS continued to authorize the lethal removal of up to 10 ospreys annually and if other entities removed 10 ospreys, the cumulative take when combined with the take of 10 ospreys that could occur by WS would represent 3.3% of the breeding population in the Commonwealth.

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 effect on osprey populations. The take of osprey could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of take by the USFWS pursuant to the MBTA would ensure take by WS and other entities occurred within allowable take levels to achieve desired population objectives for these birds. Ospreys are listed as a threatened species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take. The take of up to 10 osprey nests to alleviate damage and threats of damage is also not expected to affect adversely the population of osprey based on the previous discussions related to egg and nest removal.

SHARP-SHINNED HAWK POPULATION IMPACT ANALYSIS

Sharp-shinned hawks are found throughout the United States (Bildstein and Meyer 2000). In Pennsylvania, sharp-shinned hawks can be found throughout the year (Wilson et al. 2012). 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 diet of the sharp-shinned hawk consists primarily of birds, but also includes a wide variety of small mammals and occasionally insects (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.

In Pennsylvania, the number of sharp-shinned hawks observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 2.0% 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 doubling since the mid-1990s (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of sharp-shinned hawks to be 11,000 hawks.

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 4-18. From FY 2007 through FY 2012, WS lethally removed six sharp-shinned hawks and used non-lethal methods to disperse an additional five sharp-shinned hawks in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of sharp-shinned hawks during this period. From 2007 to 2012, a total of six sharp-shinned hawks, or less than 1 hawk per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-18. Number of sharp-shinned hawks addressed in Pennsylvania 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	9	0	0
2008	1	9	0	0
2009	0	11	1	1
2010	2	18	1	1
2011	0	14	1	1
2012	2	18	3	3
TOTAL	**5**	**79**	**6**	**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 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 those requests for assistance in the future, up to 50 sharp-shinned hawks and 20 nests could be taken annually by WS under the proposed action alternative.

From 2007 through 2012, no sharp-shinned hawks were lethally taken by other entities in the Commonwealth. The best available information estimated the statewide breeding population of sharp-shinned hawks at 11,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual take of sharp-shinned hawks would represent 0.5% of the estimated statewide breeding population. 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 hawk populations. If the USFWS continued to authorize the annual take of 18 hawks and if 18 hawks were lethally removed annually, the cumulative take could be 68 hawks if WS' take reached 50 birds. The cumulative take of 68 sharp-shinned hawks would represent 0.6% of a breeding population estimated at 11,000 hawks.

The take of sharp-shinned hawks could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of take by the USFWS pursuant to the MBTA would ensure take by WS and other entities occurred within allowable take levels to achieve desired population objectives for these birds. The take of up to 20 sharp-shinned hawk nests to alleviate damage and threats of damage would not be expected to affect the population adversely based on previous discussions.

COOPER'S HAWK POPULATION IMPACT ANALYSIS

Cooper's hawks can be found throughout the United States (Curtis et al. 2006). In Pennsylvania, Cooper's hawks can be found year round across the Commonwealth (Wilson et al. 2012). 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 diet of the Cooper's hawk consists primarily of medium sized birds, but also includes a wide variety of small mammals and occasionally insects (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 Pennsylvania, the number of Cooper's hawks observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 4.8% 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 survey blocks where Cooper's hawks were observed nesting increased by 44% between the first (1983–1989) and second (2004–2009) Pennsylvania BBA (Wilson et al. 2012). The number of Cooper's hawks observed in the Commonwealth during the CBC has also shown an increasing trend since 1966, with observations doubling since the mid-1990s (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of Cooper's hawks to be 16,000 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 4-19. From FY 2007 through FY 2012, WS lethally removed 18 Cooper's hawks and used non-lethal methods to disperse an additional 17 Cooper's hawks in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of Cooper's hawks during this period. From 2007 to 2012, a total of 42 Cooper's hawks, or seven hawks per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Requests for assistance to manage damage and threats associated with Cooper's hawks primarily originate at airports. WS anticipates the number of airports requesting assistance with managing damage and threats associated with Cooper's hawks to increase. To address those requests for assistance, up to 80 Cooper's hawks and 20 nests could be taken annually by WS under the proposed action alternative.

Table 4-19. Number of Cooper's hawks addressed in Pennsylvania 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	12	0	2
2008	2	16	0	6
2009	5	17	4	6
2010	3	32	1	7
2011	1	35	6*	10
2012	6	40	7	11
TOTAL	**17**	**152**	**18**	**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

*Includes non-target take of 1

The take of up to 80 Cooper's hawks annually by WS under the proposed action alternative would represent 0.5% of a statewide population estimated at 16,000 Cooper's hawks. From 2007 through 2012, seven Cooper's hawks per year on average were lethally taken by all entities in the Commonwealth. If the take by all entities were representative of take that could occur, the average annual cumulative take by all entities would represent 0.5% of the estimated statewide population under the proposed action alternative. If the USFWS continued to authorize the take of up to 40 Cooper's hawks annually in the Commonwealth and if the take reached 40 hawks, the cumulative take would represent 0.8% of a population estimated at 16,000 hawks. Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of hawks could only occur when authorized through the issuance of depredation permits by the USFWS and the PGC. The permitting of the take by the USFWS pursuant to the MBTA would ensure take by WS and by other entities occurred within allowable take levels to achieve the desired population objectives for Cooper's hawks in the Commonwealth. The take of up to 20 Cooper's hawk nests to alleviate damage or threats of damage would not be expected to affect the population of hawks adversely based on previous discussions.

NORTHERN HARRIER POPULATION IMPACT ANALYSIS

Northern harriers are a widespread but locally distributed raptor species in the United States (Smith et al. 2011). In Pennsylvania, northern harriers can be observed across the Commonwealth and throughout the year (Wilson et al. 2012). 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 et al. 2011). Like other harrier species, the northern harrier nests on the ground, usually in tall, dense clumps of vegetation (Smith et al. 2011). While foraging, northern harriers often fly low to the ground in search of small mammals and birds. The open grassland habitat associated with airports provides ideal foraging conditions for northern harriers.

In Pennsylvania, the number of northern harriers observed in the Commonwealth along routes surveyed during the BBS have shown an increasing trend estimated at 1.2% annually since 1966 and 2.8% from 2002 to 2013 (Sauer et al. 2014). In contrast, the number of northern harriers observed in the eastern BBS region has declined at an estimated -2.1% annually since 1966 and -0.7% from 2002 through 2012 (Sauer et al. 2014). The number of northern harriers observed in the Commonwealth during the CBC has shown a cyclical trend since 1966 with an average of 175 birds observed during the census in the last decade (National Audubon Society 2010). Northern harriers were added to the Pennsylvania's list of threatened birds in June of 2012 (PGC 2012). Loss of habitat is seen as the primary reason for the population decline with the Commonwealth (Gross 2014). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of northern harriers to be 600 birds.

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 4-20. From FY 2007 through FY 2012, WS lethally removed eight and used non-lethal methods to disperse 164 northern harriers in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of northern harriers during this period. The highest authorized annual take permitted by the USFWS was 20 harriers. From 2007 to 2012, a total of nine northern harriers, or two harriers per year on average, were taken by all entities to alleviate damage and threat.

Table 4-20. Number of northern harriers addressed in Pennsylvania 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	21	0	0	0
2008	10	0	0	0
2009	45	0	0	1
2010	31	15	3	4
2011	14	20	2	1
2012	43	20	3	3
TOTAL	**164**	**55**	**8**	**9**

[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 airport authorities where harriers pose 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 those requests for assistance, up to 10 northern harriers and 10 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats when non-lethal techniques were unsuccessful and with the permission of the PGC.

The take of up to 10 northern harriers annually by WS under the proposed action alternative would represent 1.7% of the estimated population of northern harriers in the Commonwealth. From 2007 through 2012, an average of two northern harriers per year was lethally taken by all entities in the Commonwealth. If the take by other entities were representative of future take, the average annual cumulative take by all entities would represent 2.0% of the estimated statewide population under the proposed action alternative. If the USFWS authorized other entities to remove up to 20 harriers and if the USFWS authorized WS to take up to 10 harriers, the cumulative take would represent 5.0% of a population estimated at 600 harriers. However, most requests associated with harriers and many other raptors occur during the migration periods as birds move through the Commonwealth. In those cases, cumulative take would represent a smaller percentage of the statewide breeding population.

Given the limited take proposed by WS, the magnitude of WS' take could be considered low. The take of northern harriers could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and would occur at the discretion of those two agencies. The take of northern harriers would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for northern harriers. Northern Harriers are listed as a threatened species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take. The take of up to 5 northern harrier nests to alleviate damage or threats of damage would not be expected to adversely affect the population of harriers based on previous discussions.

RED-SHOULDERED HAWK POPULATION IMPACT ANALYSIS

Red-shouldered hawks are found throughout the Central and Eastern portions of the United States (Dykstra and Hayes 2008). In Pennsylvania, red-shouldered hawks can be found throughout the year with the largest number of nesting birds residing in the northwest part of the Commonwealth (Wilson et al. 2012). 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 diet of the red-shouldered hawk consists primarily of small mammals, but also includes birds, amphibians, reptiles, and occasionally insects (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 Pennsylvania, red-shouldered hawks observed in the Commonwealth along routes surveyed during the BBS have shown an increasing trend estimated at 1.6% annually since 1966 (Sauer et al. 2014). A similar trend has been observed for the number of red-shouldered hawks observed the Eastern BBS region, where the population has increased at an estimated 2.8% annually since 1966 (Sauer et al. 2014). The number of survey blocks where red-shouldered hawks were observed nesting increased 55% between the first (1983–1989) and second (2004–2009) Pennsylvania BBA (Wilson et al. 2012). The number of red-shouldered hawks observed in the Commonwealth during the CBC has also shown an increasing trend since 1966, with observations doubling in the past few years (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of red-shouldered hawk to be 4,000 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 4-21. From FY 2007 through FY 2012, WS used non-lethal methods to disperse nine red-shouldered hawks in the Commonwealth. The USFWS authorized the lethal take of up to 10 red-shouldered hawks annually in the Commonwealth; however, no lethal take of red-shouldered hawks was reported to the USFWS between 2007 and 2012.

Most requests for assistance associated with red-shouldered 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-shouldered hawks to increase. To address those requests for assistance, up to 30 red-shouldered hawks and 20 nests could be taken annually by WS under the proposed action alternative.

The take of up to 30 red-shouldered hawks annually by WS under the proposed action alternative would represent 0.8% of the estimated population of hawks in the Commonwealth. From 2007 through 2012, no red-shouldered hawks were lethally taken by other entities in the Commonwealth. If the USFWS authorized other entities to remove up to 10 red-shouldered hawks and if the USFWS authorized WS to take up to 30 hawks, the cumulative take would represent 1.0% of a population estimated at 4,000 hawks. Similar to harriers and most other raptors, requests associated with red-shouldered hawks primarily occur during the migration periods as birds move through the Commonwealth. In those cases, cumulative take would represent a smaller percentage of the statewide breeding population.

Table 4-21. Number of red-shouldered hawks addressed in Pennsylvania 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	1	0	0	0
2009	8	0	0	0
2010	0	10	0	0
2011	0	10	0	0
2012	0	10	0	0
TOTAL	**9**	**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

Given the limited magnitude of take proposed by WS, the magnitude of WS' take could be considered low. The take of red-shouldered hawks would only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and would occur at the discretion of those agencies. The take of red-shouldered hawks would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 red-shouldered hawk nests to alleviate damage or threats of damage would not be expected to adversely affect the population of hawks based on previous discussions.

BROAD-WINGED HAWK POPULATION IMPACT ANALYSIS

Broad-winged hawks are found throughout the central and eastern portions of the United States (Goodrich et al. 1996). In Pennsylvania, broad-winged hawks can be observed during the breeding season across the majority of the Commonwealth with highest concentrations of nesting birds occurring in counties with contiguous forest habitat (Wilson et al. 2012). 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 they have been documented in groups ranging from a few birds to thousands (Goodrich et al. 1996). Their diet consists primarily of small mammals, but also includes birds, amphibians, reptiles, and occasionally insects (Goodrich et at. 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 Pennsylvania, the number of broad-winged hawks observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 0.1% annually since 1966 and a trend of 0.1% from 2002 through 2012 (Sauer et al. 2014). An increasing trend has been observed for the number of 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, with a 2.1% annual increase from 2002 through 2012 (Sauer et al. 2014). The number of broad-winged hawks observed in the Commonwealth during the CBC has declined since 1966, with few observations in the past 20 years (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of broad-winged hawk to be 40,000 birds. Wilson et al. (2012) estimated the statewide population at 36,000 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 4-22. From FY 2007 through FY 2012, WS used non-lethal methods to disperse 201 broad-winged hawks in the Commonwealth. The USFWS issued depredation permits for the take of broad-winged hawks during this period. The highest authorized annual take levels permitted by the USFWS occurred in 2011 and 2012 when the USFWS authorized the take of up to 12 broad-winged hawks in the Commonwealth. However, no take was reported to the USFWS from 2007 through 2012.

Table 4-22. Number of broad-winged hawk addressed in Pennsylvania 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	1	5	0	0
2009	0	5	0	0
2010	200	10	0	0
2011	0	12	0	0
2012	0	12	0	0
TOTAL	**201**	**49**	**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

Similar to the other raptor species, 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 those requests for assistance, up to 50 broad-winged hawks and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 50 broad-winged hawks annually by WS under the proposed action alternative would represent 0.1% of the estimated population of broad-winged hawks in the Commonwealth. From 2007 through 2012, no broad-winged hawks were lethally taken by other entities in the Commonwealth. If the USFWS continued to authorize other entities to take 12 broad-winged hawks and authorized WS to take up to 50 hawks, the cumulative take would represent 0.2% of the estimated statewide breeding population. However, as with other raptors, most requests for assistance occur during the migration periods; therefore, take would likely represent a lower percentage of the estimated breeding population in the Commonwealth.

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of broad-winged hawks could only occur when permitted by the USFWS through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and would occur at the discretion of the USFWS and the PGC. The take of broad-winged hawks would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for broad-winged hawks. The take of up to 20 broad-winged hawk nests to alleviate damage or threats of damage would not be expected to adversely affect the population of hawks based on previous discussions.

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). In Pennsylvania, red-tailed hawks can be found across the Commonwealth and throughout the year (Wilson et al. 2012). Red-tailed hawks are generally found in open areas that are interspersed with patches of trees or other perching structures (Preston and Beane 2009). The diet of the red-tailed hawk consists of a wide variety of medium-sized mammals, birds, reptiles, amphibians, arthropods, and fresh carrion (Preston and Beane 2009). The open habitat and availability of perches makes airports attractive locations for red-tailed hawks. Most requests for assistance to alleviate threats occur at airports in the Commonwealth. However, red-tailed hawks can also cause economic losses to agricultural producers when they feed on livestock.

In Pennsylvania, the number of red-tailed hawks observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 4.3% annually since 1966 (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 (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, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of red-tailed hawks to be 18,000 hawks. Using data from the second Pennsylvania BBA (2004–2009), Wilson et al. (2012) estimated the statewide breeding population of red-tailed hawks at 23,000 birds.

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 4-23. From FY 2007 through FY 2012, WS lethally removed 255 red-tailed hawks and used non-lethal methods to disperse an additional 2,632 red-tailed hawks in the Commonwealth. WS also destroyed a total of two eggs and one nest from FY 2007 to FY 2012 to alleviate damage and threats. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of red-tailed hawks and nests during this period. From 2007 to 2012, 328 red-tailed hawks and one nest were taken by all entities to alleviate damage and threats associated with red-tailed hawks occurring within the Commonwealth.

Table 4-23. Number of red-tailed hawks addressed in Pennsylvania 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	64	23	2	7
2008	122	39	14	15
2009	946	74	38	40
2010	645	97	39	58
2011	313	203	62	103
2012	542	236	100	105
TOTAL	**2,632**	**672**	**255**	**328**

[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, up to 250 red-tailed hawks and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 250 red-tailed hawks annually by WS under the proposed action alternative would represent anywhere from 1.1% to 1.4% of the estimated population of red-tailed hawks in the Commonwealth. On average, 55 red-tailed hawks were lethally removed annually from 2007 through 2012 in the Commonwealth by all entities. The highest annual take level occurred in 2012 when all entities issued permits removed 105 red-tailed hawks to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 1.5% to 2.0% of the estimated breeding population in the Commonwealth.

The take of red-tailed hawks could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and would occur at the discretion of the USFWS and the PGC. The take of red-tailed hawks would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for red-tailed hawks. The take of up to 20 red-tailed hawk nests to alleviate damage or threats of damage would not be expected to adversely affect the population of hawks and was further addressed in additional detail previously.

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 United States (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). In Pennsylvania, in 2011, 217 pairs were recorded nesting in 50 of the Commonwealth's 67 counties (Gross and Brauning 2012). In winter, large congregations of eagles can be found along the Delaware River between Matamoras and Hancock, NY, along the Lackawaxen River in Pike and Wayne Counties, on the Susquehanna River south of Harrisburg, and at the Pymatuning Reservoir in Crawford County (Gross and Brauning 2012, 2010; Gross 2010). Bald eagles are primarily associated with aquatic habitats and open water in particular (Buehler 2000). They hunt from perches or while soaring preferring to take prey on the wing (Buehler 2000). Bald eagles are opportunistic feeders with a varied diet that includes fish, mammals, birds, and carrion (Buehler 2000). Although no longer listed at the federal or state level in Pennsylvania, the bald eagle is still protected under the Bald and Golden Eagle Act.

The number of bald eagles observed in the Commonwealth along routes surveyed during the BBS have shown an increasing trend estimated at 11.2% annually since 1966, and 12.0% from 2002 through 2012 (Sauer et al. 2014). The number of bald eagles in the eastern BBS region has also increased, by an estimated 8.7% since 1966 and 13.1% from 2002 through 2012 (Sauer et al. 2014). Similarly, the number of bald eagles observed in the Commonwealth during the CBC has shown a general increasing trend since 1966 (National Audubon Society 2010). The smallest number of bald eagles observed since 1966 during the CBC in the Commonwealth was one bird in (1965–1966) (1968–1969) (1971–1972) (1974–1975). The greatest number of birds observed during the CBC in the Commonwealth was 335 in (2008–2009). Using data from the BBS, Rich et al. (2004) estimated the statewide breeding population to be 60 birds. However, given the data collected by the PGC (Gross and Brauning 2012), a population of 434 breeding individuals (2 birds per nest observed in 2011) is probably more accurate.

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 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.

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 USC 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 FY 2007 through FY 2012, WS used non-lethal methods to disperse 22 bald eagles in the Commonwealth (see Table 4-24). The USFWS did not issue depredation permits for lethal take to WS or other entities during this period.

Table 4-24. Number of bald eagles addressed in Pennsylvania 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	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	7	0	0	0
2011	4	0	0	0
2012	10	0	0	0
TOTAL	**22**	**0**	**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

WS has previously received requests for assistance associated with bald eagles posing threats at or near airports in the Commonwealth. The large body size and soaring behavior of eagles can pose threats of aircraft strikes when eagles occur in close proximity to airports. 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.

Under the proposed action alternative, WS would continue to employ harassment methods to disperse bald eagles from airports or surrounding areas when authorized and permitted by the USFWS pursuant to the Act. Therefore, if no permit were issued by the USFWS to harass bald eagles that are posing a threat of aircraft strikes, no harassment would be conducted by WS. 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 Pennsylvania, kestrels can be found nesting in all parts of the Commonwealth with the exception of the heavily forested areas in the Commonwealth's northern counties (Wilson et al. 2012). Kestrels prefer open habitat with adequate perch sites from which to hunt; however, they will also hunt by hovering (Smallwood and Bird 2002). Diet consists of insects, small birds, and rodents (Smallwood and Bird 2002). Nests are located in tree cavities, rock crevices, or in the nooks of buildings (Smallwood and Bird 2002). Kestrels can be found nesting in areas with dense human development and heavy human activity, including Philadelphia (Wilson et al. 2012).

According to trend data available from the BBS, American kestrels are showing a declining trend in Pennsylvania estimated at -0.6% annually since the BBS was initiated in 1966 (Sauer et al. 2014). Kestrels observed on BBS routes in the eastern United States has also shown a declining trend estimated at -2.1% annually since 1966 (Sauer et al. 2014). Similarly, the number of atlas blocks where they were observed nesting declined 13% between the first (1983–1989) and second (2004–2009) Pennsylvania BBA (Wilson et al. 2012). Trend data available from the CBC also indicates a decline in American kestrel populations wintering in Pennsylvania (National Audubon Society 2010). The population of American kestrels in Pennsylvania has been estimated at 24,000 (Partners in Flight Science Committee 2013) and 13,600 birds (Wilson et al. 2012).

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 4-25. From FY 2007 through FY 2012, WS lethally removed 111 American kestrels and used non-lethal methods to disperse an additional 836 American kestrels in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of American kestrels during this period. From 2007 to 2012, 131 American kestrels were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Most requests for assistance associated with American kestrels are received from airport authorities 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, up to 250 American kestrels and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 250 American kestrels annually by WS under the proposed action alternative would represent anywhere from 1.0% to 1.8% of the estimated population of American kestrels in the Commonwealth. On average, 22 kestrels were lethally removed annually from 2007 through 2012 in the Commonwealth by all entities. The highest annual take level occurred in 2011 when all entities issued permits removed 47 kestrels to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 1.2% to 2.2% of the estimated breeding population in the Commonwealth.

Table 4-25. Number of American kestrels addressed in Pennsylvania 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	28	34	2	4
2008	76	43	7	8
2009	262	70	32	37
2010	181	78	18	17
2011	113	163	34	47
2012	176	163	18	18
TOTAL	**836**	**551**	**111**	**131**

[1]Data reported by federal fiscal year

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

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

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of American kestrels could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and PGC and occurs at the discretion of the USFWS and the PGC. The take of American kestrels would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for kestrels. The take of up to 20 American kestrel nests to alleviate damage or threats of damage would not be expected to adversely affect the population of kestrels based on previous discussions.

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, and Wyoming (Warkentin et al. 2005). Prior to the second Pennsylvania BBA (2004–2009), merlin had never before been observed nesting in the Commonwealth (Wilson et al. 2012). During the survey period, merlin were confirmed nesting in Bradford, McKean, Pike, Sullivan, and Warren counties (Wilson et al. 2012). In the winter, merlin can be found from southern Canada south to Central America (Warkentin et al. 2005). In Pennsylvania, merlin can most often be observed during spring and fall migration (Hawk Mountain Sanctuary 2013*a*) and during the winter months (National Audubon Society 2010). Opportunistic hunters, their diet consists of other birds, flying insects, bats, carrion, and small rodents. Merlin are both solitary and cooperative hunters, hunting in pairs or alongside other raptors (*e.g.*, juvenile sharp-shinned hawks) (Warkentin et al. 2005). Merlin 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 Pennsylvania, the number of merlin observed during the CBC has shown an increasing trend since 1997–1998 (National Audubon Society 2010). From 1997–1998 to 2013–2014, a total of 17 years, an average of 24 birds were observed per year during the CBC (National Audubon Society 2010). This is in sharp contrast to the preceding 17 years (to 1996–1997), when an average of 3.3 birds was observed per year during the CBC (National Audubon Society 2010). From 2002 through 2011, an average of 164 merlin were observed on an annual basis migrating over Hawk Mountain Sanctuary (Hawk Mountain Sanctuary 2013*b*). There are currently no population estimates available for the number of merlin present in the Commonwealth. However, the breeding population of merlin in the United States and Canada has been estimated at approximately 1.3 million 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 4-26. From FY 2007 through FY 2012, WS used non-lethal methods to disperse three merlin in the Commonwealth. The USFWS did not issue depredation permits to other entities for the take of merlin during this period.

Table 4-26. Number of merlin addressed in Pennsylvania 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	2	0	0	0
2010	1	10	0	0
2011	0	10	0	0
2012	0	10	0	0
TOTAL	**3**	**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

Most requests for assistance associated with merlin are received from airport authorities 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 those requests for assistance, up to 20 merlin could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The take of up to 20 merlin annually by WS under the proposed action alternative would represent 0.002% of the estimated population of merlin in the United States and Canada. From 2007 through 2012, no merlin were reported as lethally taken in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 10 merlin and authorized WS to take up to 20 merlin, the cumulative take would represent 0.002% of the estimated breeding population.

Given the increasing number of merlin 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 merlin populations. The take of merlin could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of merlin would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for these raptors.

WILD TURKEY POPULATION IMPACT ANALYSIS

A non-migratory bird, wild turkeys can be found from southern Canada south across the United States (Eaton 1992). Once nearly extirpated from areas of the Commonwealth from over-hunting and habitat loss, the wild turkey now can be found statewide in suitable habitat (Casalena 2006). In the Eastern United States, 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 in underbrush (Eaton 1992). Wild turkeys are highly social. Poults remain with females after hatching and may unite with other females and their poults (Eaton 1992). In the late fall or early winter, yearling males leave females to form male flocks of up to nine individuals (Eaton 1992). Then, in the winter, both sexes and yearlings group up to form bands that may number 200 or more at food and roosting sites (Eaton 1992). In spring, the bands break up into groups of females, which are attended by male suitors (Eaton 1992).

The number of wild turkeys observed during the BBS has shown an increasing trend in the Commonwealth estimated at 7.2% from 1966 through 2012 (Sauer et al. 2014). Similarly, the number of turkeys observed in the Commonwealth during the CBC have shown an overall increasing trend since 1966 (National Audubon Society 2010). The PGC estimates that the wild turkey population in Pennsylvania has been recently been trending downward and has been below average for the last four years (PGC 2014). Spring populations of wild turkeys in Pennsylvania averaged 216,000 birds from 2002-2011 (PGC, unpublished data).

The number of wild 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 4-27. From FY 2007 to FY 2012, WS lethally removed 270 wild turkeys and used non-lethal methods to disperse an additional 671 wild turkeys in the Commonwealth. The wild turkey population in the Commonwealth is sufficient to allow for regulated hunting seasons. Turkeys with visible beards, which in most cases are males, can be harvested during annual spring hunting seasons and both male and female turkeys can be harvested during the annual fall hunting season. Although wild turkeys can be taken in either season, more are taken during the spring. Since 2007, the highest number of wild turkeys harvested in a single season occurred in the spring of 2009 when 44,639 turkeys were harvested (Casalena 2013). However, the highest annual harvest from 2007 to 2012 occurred in 2008 when 66,725 turkeys where harvested (Casalena 2013). The average annual harvest from 2007 to 2012 was 57,513 turkeys.

Table 4-27. Number of wild turkeys addressed in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2]		
			Spring	**Fall**	**Total Hunter Harvest**
2007	0	16	37,912	25,369	63,281
2008	12	22	42,437	24,288	66,725
2009	70	36	44,639	20,934	65,573
2010	86	42	33,876	16,078	49,954
2011	300	83*	35,465	14,385	49,850
2012	203	71	35,621	14,074	49,695
TOTAL	**671**	**270**	**229,950**	**115,128**	**345,078**

[1]Data reported by federal fiscal year

[2]Data obtained from Casalena 2013

*Includes non-target take of 1

Requests for assistance received by the WS program in Pennsylvania 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 200 wild turkeys and 20 nests annually under the proposed action alternative.

As stated previously, the estimated spring population of wild turkeys in Pennsylvania averaged 216,000 birds from 2002-2011 (PGC, unpublished data). The take of up to 200 wild turkeys under the proposed action alternative would represent 0.1% of the average population and 0.4% of the average number (57,513) taken annually by hunters in the Commonwealth.

Given the abundant population of wild 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 wild turkey populations. As stated previously, most requests received by WS concerning wild turkeys in the Commonwealth were associated with airports. Airports are restricted areas where hunting is not permitted. Therefore, WS' take of wild turkeys is likely to occur in locations where take will not limit the ability to harvest turkeys. WS' take would be a limited portion of the overall take occurring and is of low magnitude when compared to the number of wild turkeys in the Commonwealth. The take of turkeys can only occur when permitted by the PGC. Therefore, all take, including take by WS, is authorized by the PGC and occurs at the discretion of the PGC. The take of wild turkeys would only occur at levels authorized by the PGC, which ensures cumulative take is considered as part of population management objectives. The take of up to 20 wild turkey nests to alleviate damage and threats of damage is also not expected to adversely affect the population of turkeys.

KILLDEER POPULATION IMPACT ANALYSIS

Killdeer occur over much of North America from the Gulf of Alaska southward throughout the United States and to the Atlantic and Pacific coasts (Jackson and Jackson 2000). In Pennsylvania, killdeer can be found throughout the Commonwealth during the breeding season and in the southeastern part of the Commonwealth in the winter (Jackson and Jackson 2000, Wilson et al. 2012). 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). Diet consists of invertebrates including insects, snails, and earthworms, as well as seeds and occasionally small vertebrates (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 Pennsylvania, the number of killdeer observed during the BBS has shown a trend estimated at -0.5% annually since 1966, and -1.9%, from 2002 through 2012 (Sauer et al. 2014). A similar trend has been observed for the number of killdeer observed in the eastern BBS region, where the population has declined at an estimated -1.6% annually since 1966, with a -0.6% annual decline occurring from 2002 through 2012 (Sauer et al. 2014). The number of killdeer observed in the Commonwealth during the CBC has also shown a slightly declining trend since the mid-1970s, with an average of 314 birds observed overwintering in the Commonwealth annually since 1994–1995 (National Audubon Society 2012). 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 United States Shorebird Conservation Plan estimated the population of killdeer in the United States to be approximately 2,000,000 birds in 2001 (Brown et al. 2001). Data collected during the second Pennsylvania BBA was used to estimate the Commonwealth's killdeer population at 240,000 breeding birds (Wilson et al. 2012).

The number of killdeer taken or dispersed by WS and the total number of killdeer taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-28. From FY 2007 through FY 2012, WS lethally removed 427 killdeer and used non-lethal methods to disperse an additional 4,188 killdeer in the Commonwealth. WS also destroyed a total of 11 eggs and two nests during this period to alleviate damage and threats associated with these birds. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of killdeer during this period. From 2007 to 2012, 739 killdeer, or 123 killdeer per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4-28. Number of killdeer addressed in Pennsylvania 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	133	125	5	6
2008	759	167	8	11
2009	1,010	452	170	214
2010	691	657	86	142
2011	727	752	73	98
2012	868	777	85	268
TOTAL	**4,188**	**2,930**	**427**	**739**

[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 in the Commonwealth. Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could take up to 800 killdeer and 100 nests annually under the proposed action alternative.

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) and is 240,000 birds in the Commonwealth (Wilson et al. 2012). Based on this estimate, the annual removal of up to 800 killdeer by WS under the proposed action alternative would represent 0.04% of the North American population and 0.3% of the Commonwealth population. On average, 123 killdeer were lethally removed annually from 2007 through 2012 in the Commonwealth by all entities. If WS removed 800 killdeer annually and other entities lethally removed 123 annually, the cumulative take would represent 0.4% of the estimated 240,000 breeding killdeer in the Commonwealth. The highest annual take level occurred in 2012 when all entities issued permits removed 268 killdeer to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.5% of the estimated breeding population in the Commonwealth.

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of killdeer could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of killdeer would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for killdeer.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the killdeer population. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Killdeer 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 killdeer. The destruction of up to 100 killdeer nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on killdeer populations would occur. As with the lethal take of killdeer, 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.

UPLAND SANDPIPER POPULATION IMPACT ANALYSIS

Upland sandpipers can be found during the breeding season across southern Canada and the northern United States east of the Rocky Mountains where suitable habitat occurs (Houston et al. 2011, Wilson et al. 2012). In Pennsylvania, upland sandpipers can be found nesting in the Commonwealth's west and central regions (Haffner and Gross 2012). These birds arrive in April and depart by August after chicks have fledged (Wilson et al. 2012*b*, Haffner and Gross 2012). 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, golf courses, airports, fallow fields, and reclaimed surface mine sites (Wilson et al. 2012). Diet consists of primarily of invertebrates, mostly insects (Houston et al. 2011). The species is currently in decline and has disappeared from most areas of the Commonwealth due to a loss of habitat, changing farming practices, and the use of pesticides (Haffner and Gross 2012). This species is listed as endangered by the PGC although it is not listed on the federal level (Haffner and Gross 2012).

Since 1966, populations of upland sandpipers in the United States have exhibited an annual increase of 0.8% while populations in the Eastern BBS Region have exhibited annual decreases of -3.6% (Sauer et al. 2014). Breeding populations in Pennsylvania have exhibited a decline of -17.3% annually since 1966 (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 second Pennsylvania BBA observation period (2004–2009), upland sandpipers were observed in just a few counties (Adams, Butler, Clarion, Clearfield, Centre, Crawford, Erie, Franklin, Huntington, Lawrence, Mercer, Somerset, Venango, and Westmoreland), a decrease from the first atlas period (1984–1989) (Wilson et al. 2012). Based on broad-scale surveys, the United States Shorebird Conservation Plan estimated the population of upland sandpipers in North America to be approximately 470,000 birds in 2001 (Brown et al. 2001).

From FY 2007 through FY 2012, WS used non-lethal methods to disperse three upland sandpipers to alleviate damage and threats associated with these birds in the Commonwealth. The USFWS did not issue any depredation permits to other entities for the take of upland sandpipers during this period. Requests for assistance associated with upland sandpipers occur primarily at airports in the Commonwealth where they pose a hazard to aircraft. To address requests for assistance at airports, up to 10 upland sandpipers and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats when non-lethal techniques are unsuccessful and with the permission of the PGC.

The number of upland sandpipers present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of upland sandpipers in North America is approximately 470,000 birds (Brown et al. 2001). Based on this estimate, the annual removal of up to 10 upland sandpipers by WS under the proposed action alternative would represent 0.002% of this population.

The take of upland sandpipers could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of upland sandpipers would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for upland sandpipers. Upland sandpipers are listed as an endangered species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take. The take of up to 20 upland sandpiper nests to alleviate damage or threats of damage would not be expected to adversely affect the population of upland sandpipers and was further addressed in additional detail previously.

BONAPARTE'S GULL POPULATION IMPACT ANALYSIS

Bonaparte's gulls are a small gull characterized by their size, pink legs, and black beak (Burger and Gochfeld 2002). 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 (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). An opportunistic feeder, their diet consists of invertebrates and fish (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).

Most Bonaparte's gulls in the northeastern United States migrate and winter in BCR 14 and the Pelagic Bird Conservation Region (PBCR) 78 (MANEM Region Waterbird Working Group 2006). Bonaparte's gulls have been given a conservation status of lowest concern (MANEM Region Waterbird Working Group 2006). The number of Bonaparte's gulls overwintering in Pennsylvania have shown a cyclical trend since 1966 (National Audubon Society 2010). Over the last 20 years, anywhere from 16 to 7,262 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 Region Waterbird Working Group 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 2012 to alleviate damage and threats associated with these birds are shown in Table 4-29. From FY 2007 through FY 2012, WS lethally removed nine Bonaparte's gulls and used non-lethal methods to disperse an additional 39 Bonaparte's gulls in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of Bonaparte's gulls during this period. From 2007 to 2012, 16 Bonaparte's gulls, or 3 gulls per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4-29. Number of Bonaparte's gulls addressed in Pennsylvania 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	65	0	0
2011	35	95	6	13
2012	4	90	3	3
TOTAL	**39**	**255**	**9**	**16**

[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 100 Bonaparte's gulls could be take annually by WS under the proposed action alternative to alleviate damage and threats. 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 Bonaparte's gulls 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 of the property to feed, depositing garbage and droppings on buildings, equipment, and vehicles in neighboring areas.

The number of Bonaparte's gulls present in Pennsylvania 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 Region Waterbird Working Group 2006). Based on this estimate, the annual removal of up to 100 Bonaparte's gulls by WS under the proposed action alternative would represent anywhere from 0.02% to 0.04% of this population. From 2007 to 2012, an average of three gulls per year was taken by all entities in the Commonwealth. The highest annual take level occurred in 2011 when all entities issued permits removed 13 gulls to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.02% to 0.04% of the estimated population in North America.

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 could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of Bonaparte's gulls would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives.

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 United States. 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).

The USFWS has constructed PBR models for laughing gulls, ring-billed gulls, herring gulls, and great black-backed gulls that nest in BCR 14 and BCR 30 (Seamans et al. 2007). Although only a small portion of Pennsylvania lies within BCR 30, the gulls present in the Commonwealth are those gulls likely to migrate from, or have breeding colonies in, BCR 14 and BCR 30, which cover most of the coastal and inland areas of the upper northeastern United States. Since population estimates and trends for gulls in the Commonwealth are limited, the PBR models developed by the USFWS for BCR 14 and BCR 30 will be used to analyze potential population impacts to gull species under the proposed action alternative.

Allowable harvest models for bird species have had a long history of use in the United States, 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 in the Commonwealth. 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 4-30), 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 4-30; 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:

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

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 4-30. 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*α 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(λ).

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 Region Waterbird Working Group 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 4-31.

Table 4-31. 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 United States to ensure take occurs at levels that 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. 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 northeastern United States and given the mobility of gulls, assessing allowable take for each state in the northeast would be difficult. 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 Commonwealth population estimates. However, there are no 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 (*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

Laughing gulls are a small gull characterized by their black hood, red beak, and loud "laughing" call (Burger 1996). In the United States, laughing gulls can be found from Maine south along the Atlantic and Gulf coasts (including the coastal areas of BCR 14 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 on the lower Delaware and Susquehanna Rivers, on nearby lakes (Berks, Delaware, Lancaster, Montgomery, and Philadelphia counties), and on Lake Erie, as well as in Clinton, Monroe and Union counties (Wood 1979). 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 Region Waterbird Working Group 2006). Laughing gulls' diet consists of invertebrates including earthworms, insects, snails, crabs, crab eggs and larva, fish, squid, berries, and garbage (Burger 1996).

In the 1970s, the breeding population of laughing gulls in BCR 14 and 30 was 129,768 birds distributed among 63 nesting sites (MANEM Region Waterbird Working Group 2006). By the 1990s, the breeding population of laughing gulls had increased to 205,348 birds distributed among 275 nesting sites (MANEM Region Waterbird Working Group 2006). BBS data for laughing gulls in the Eastern BBS Region shows an increasing trend estimated at 3.2% annually from 1966 through 2012 and 4.8% annually from 2002 through 2012 (Sauer et al. 2014). A similar trend has been observed in the New England/Mid-Atlantic Coast BBS region, where the population has increased at an estimated 5.1% annually from 1966 through 2002 and 4.0% annually from 2002 through 2012 (Sauer et al. 2014). No BBS data is currently available for Pennsylvania (Sauer et al. 2014); however, birds are regularly observed in high numbers during the breeding season (see Table 4-32). Wilson et al. (2012) reported that laughing gulls have been observed copulating at landfills in Bucks County; however, the closest known nesting colony is in New Jersey. CBC data for laughing gulls in the Commonwealth has shown a cyclical trend since 1966, with few birds observed (National Audubon Society 2010). However, laughing gulls are regularly observed in significant numbers at sites in Bucks County in November (see Table 4-32). In BCR 30, the breeding population of laughing gulls has been estimated at 202,646 gulls and in BCR 14 the breeding population has been estimated at 2,704 gulls (MANEM Region Waterbird Working Group 2006). Both BCR 30 and BCR 14 laughing gull populations have been given a conservation rank of lowest concern (MANEM Region Waterbird Working Group 2006). Seamans et al. (2007) estimates the minimum population of breeding and non-breeding laughing gulls in BCR 14 and 30 at 270,000 birds (see Table 4-30).

Table 4-32. Total number of laughing gulls observed by WS staff at landfill sites in Bucks County, Pennsylvania from 2010 to 2012*

Month	Year		
	2010	**2011**	**2012**
January	0	0	0
February	0	0	0
March	0	0	0
April	10,465	16,885	15,475
May	7,845	10,565	5,540
June	4,280	3,545	2,835
July	7,878	11,633	5,275
August	12,770	24,460	4,675
September	12,415	39,060	12,900
October	11,625	39,225	27,320
November	1,170	6,000	0
December	0	0	0
TOTAL	**68,448**	**151,373**	**74,020**

*Surveys conducted at 18 points for 3 minutes 6 times each month (2 times in the morning, 2 times at midday and 2 times in the evening).

The number of laughing gulls taken or dispersed by WS in Pennsylvania and the total number of gulls taken by all entities in the northeastern United States (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4-33. From FY 2007 through FY 2012, WS lethally removed 370 laughing gulls and 0 nests and used non-lethal methods to disperse an additional 53,510 laughing gulls in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of laughing gulls during this period. From 2007 to 2012, 29,487 laughing gulls, or 4,915 gulls per year on average, were taken by all entities to alleviate damage and threats associated with these birds in the northeastern United States (USFWS Region 5).

Table 4-33. 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 (nest/egg)[1,3]	Total Take by All Entities[2]
2007	921	3	5,880	0	9,126
2008	42,929	6	5,121	0	9,679
2009	114	13	5,146	0	6,334
2010	3,905	24	5,188	0	2,982
2011	3,405	286	6,029	0	6,526
2012	2,236	38	2,123	0	2,679
TOTAL	**53,510**	**370**	**29,487**	**0**	**37,326**

[1]Dispersal or take in Pennsylvania, data reported by federal fiscal year

[2]Take in northeastern United States (USFWS Region 5), data reported by calendar year; includes WS' take

[3]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

To address requests for assistance to manage damage and threats associated with laughing gulls in the future, up to 1,500 laughing gulls and 100 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats. 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 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 1,500 laughing gulls by WS under the proposed action alternative would represent 0.6% of this population. From 2007 through 2010, the annual take of laughing gulls by all entities in the northeastern United States (USFWS Region 5) has averaged 4,915 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would be 6,415 gulls, or 2.4% 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 (see Table 4-31). Current take from all known entities has not exceeded this level of take.

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. Therefore, all take, including take by WS, is authorized by the USFWS and occurs at the discretion of the USFWS. The take of laughing 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 laughing gull population. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. 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 destruction of up to 100 laughing gull nests annually by WS would occur in localized areas where nesting takes place 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

Ring-billed gulls are medium sized gulls characterized by a black band or ring that runs vertically around the bird's bill (Ryder 1993). 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 Region Waterbird Working Group 2006, Ryder 1993). In the Commonwealth, ring-billed gulls can be observed nesting in Erie County (Brauning 2001, Brauning 2002) with possible nesting birds observed at Pymatuning Lake, Allegheny Reservoir, the upper North Branch of the Susquehanna River, along the Lower Susquehanna River, and along the lower Delaware River during the Second Pennsylvania Breeding Bird Atlas (Wilson et al. 2012). Wilson et al. (2012) noted that, "*a colony could be established anywhere in northern or western Pennsylvania with a substantial lake or waterway*". In the non-breeding season, ring-billed gulls can be observed along the coast and inland in agricultural fields, on golf courses, at landfills, and at shopping malls (Ryder 1993) throughout the Commonwealth. 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). 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 can be observed in the Commonwealth but are not likely nesting in BCR 14 and 30, but are likely nesting in BCR 13. The major nesting colonies of the other species (laughing, herring and great black backed gulls) analyzed by Seamans et al. (2007) lie within BCR 14 and 30, not BCR 13. The northwest portion of Pennsylvania lies within BCR 13, where 63% of the North American population of ring-billed gulls is known to nest (Wiers et al. 2010). By comparison, 0% and 2% of the North American population of ring-billed gulls nest in BCR 30 and 14, respectively (MANEM Region Waterbird Working Group 2006).

BBS data for the eastern BBS region shows an increasing trend for ring-billed gulls estimated at 4.4% annually from 1966 through 2012 and 8.2% from 2002 through 2012 (Sauer et al. 2014). In Pennsylvania, BBS trend data indicates ring-billed gulls have increased at an estimated annual rate of 1.9% since 1966 (Sauer et al. 2014). Population of ring-billed gulls in both BCR 14 and 30 have been given a conservation rank of lowest concern (MANEM Region Waterbird Working Group 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 Region Waterbird Working Group 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). In Pennsylvania, a nesting colony of 8,000–8,500 pairs of ring-billed gulls have been observed in Erie County, which falls within BCR 13 (Brauning 2002); however, no additional information on the population of nesting ring-billed gulls in the Commonwealth is available. CBC data from 1996 through 2010 shows an increasing 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 Region Waterbird Working Group 2006). There are currently no known breeding populations of ring-billed gulls in BCR 30 (MANEM Region Waterbird Working Group 2006). Seamans et al. (2007) estimates the minimum population of breeding and non-breeding laughing gulls in BCR 14 and 30 at 54,000 birds (see Table 4-30).

The number of ring-billed gulls taken or dispersed by WS in Pennsylvania and the total number of gulls taken by all entities in the northeastern United States (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4-34. From FY 2007 through FY 2012, WS lethally removed 326 ring-billed gulls and 99 nests, and used non-lethal methods to disperse an additional 93,191 gulls in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of ring-billed gulls during this period. From 2007 to 2012, a total of 15,864 ring-billed gulls, or 2,644 gulls per year on average, were taken by all entities to alleviate damage and threats associated with these birds in the northeastern United States (USFWS Region 5).

Table 4-34. 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 (nest/egg)[1,3]	Total Take by All Entities[2]
2007	35,456	53	403	33/0	14,280
2008	13,031	12	2,089	22/11	10,091
2009	14,515	42	2,786	44/13	8,752
2010	2,782	16	3,325	0	15,230
2011	12,643	62	4,641	0	414
2012	14,764	141	2,620	0	506
TOTAL	**93,191**	**326**	**15,864**	**99/24**	**49,273**

[1]Dispersal or take in Pennsylvania, data reported by federal fiscal year

[2]Take in northeastern United States (USFWS Region 5), data reported by calendar year, includes WS' take

[3]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

To address requests for assistance to manage damage and threats associated with ring-billed gulls in the future, up to 1,300 ring-billed gulls and 4,000 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats. 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. Ring-billed gulls also cause conflicts when they nest on roof tops or when they alter nesting habitat for other species, uprooting and trampling plants and altering soil chemistry with their fecal material (USFWS 2000*b*, Wires et al. 2010). 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 1,300 ring-billed gulls under the proposed action alternative would represent 0.12% 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 under the proposed action alternative would be 3,944 gulls, or 0.4% of the estimated combined population of BCR 13, BCR 14, and BCR 30. 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 (see Table 4-31). Although the average annual cumulative take by all entities (3,944) could exceed this level of take by 879 gulls if up to 1,300 ring-billed gulls are taken annually under the proposed action alternative, as mentioned previously, the PBR model only includes BCR 14 and 30, where 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 since where the northwest portion of Pennsylvania lies within it, a substantial number of ring-billed gulls in the Commonwealth are likely to come from. 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.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the ring-billed gull population. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Additionally, ring-billed 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 ring-billed gulls. The destruction of up to 4,000 ring-billed gull nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on ring-billed 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.

HERRING GULL POPULATION IMPACT ANALYSIS

Herring gulls are the most common gulls in the northeastern United States (Pierotti and Good 1994). In the United States, 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 Region Waterbird Working Group 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 Region Waterbird Working Group 2006). In Pennsylvania, herring gulls can be observed nesting in Erie County and along the Allegheny and Ohio Rivers in Allegheny, Armstrong, Beaver, and Westmorland Counties in Pittsburgh (Brauning 2001, 2002, Wilson et al. 2012). During the second Pennsylvania BBA (2004–2009), herring gulls were observed but not confirmed nesting in Berks, Bucks, Crawford, Dauphin, Delaware, Lancaster, Lycoming, Mercer, Mifflin, Philadelphia, Perry, Pike, Schuylkill, Warren, Washington, Wayne, and Westmoreland Counties (Wilson et al. 2012). These areas, as well as additional areas located up to 100 km away, are used for feeding (MANEM Region Waterbird Working Group 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 that nest in colonies and roost, loaf, and forage in groups (Pierotti and Good 1994). Herring gulls, like most gulls, are opportunistic feeders consuming fish, insects, marine invertebrates, other adult birds, the eggs and young of other birds, as well as carrion and human refuse (Pierotti and Good 1994).

In the 1970s, the breeding population of herring gulls in BCR 14 and BCR 30 was 184,278 birds distributed among 414 nesting sites (MANEM Region Waterbird Working Group 2006). By the 1990s, the breeding population of herring gulls in BCR 14 and 30 had declined 19% to 148,416 birds while the number of nesting sites increased to 468 (MANEM Region Waterbird Working Group 2006). BBS data for herring gulls in the Eastern BBS region shows a declining trend estimated at -3.0% annually from 1966 through 2012 and a -1.5% annually decline from 2002 through 2012 (Sauer et al. 2014). Similarly, in the New England/Mid-Atlantic coast BBS region, herring gull populations have declined at an estimated -4.6% annually since 1966 (Sauer et al. 2014). In contrast, the number of herring gulls observed along routes surveyed in the Commonwealth during the BBS has shown an increasing trend estimated at 1.3% annually since 1966 (Sauer et al. 2014). Similarly, the number of Pennsylvania BBA blocks where herring gulls were observed nesting increased by 2,900% between the first (1984–1989) and second (2004–2009) Pennsylvania BBA (Wilson et al. 2012). CBC data for herring gulls observed overwintering in the Commonwealth shows a highly cyclical trend with an overall general increasing 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 Region Waterbird Working Group 2006). In BCR 30, the breeding population of herring gulls has been estimated at 90,734 gulls and in BCR 14, the breeding population has been estimated at 196,182 gulls (MANEM Region Waterbird Working Group 2006). Seamans et al. (2007) estimated the minimum population of breeding and non-breeding herring gulls in BCR 14 and 30 to be 390,000 birds (see Table 4-30).

The number of herring gulls taken or dispersed by WS in Pennsylvania and the total number of gulls taken by all entities in the northeastern United States (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4-35. From FY 2007 through FY 2012, WS lethally removed 525 herring gulls and 464 nests, and used non-lethal methods to disperse an additional 100,532 gulls in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of herring gulls during this period. From 2007 to 2012, a total of 25,122 herring gulls, or 4,187 gulls per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring in the northeastern United States (USFWS Region 5).

To address requests for assistance to manage damage and threats associated with herring gulls in the future, up to 1,500 herring gulls and 300 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats. 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 population of herring gulls in BCR 14 and 30 at 390,000 birds (Seamans et al. 2007). However, since population trends continue to indicate an increasing herring gull population, the population of herring gulls in the region is likely greater than 390,000, which is considered a minimum population (N_{min}). Based on this estimate, the annual removal of up to 1,500 herring gulls by WS under the proposed action alternative would represent 0.4% of this population. From 2007 through 2012, the annual take of herring gulls by all entities in the northeastern United States

(USFWS Region 5) has averaged 4,187 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative 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 4-31). Current take from all known entities has not exceeded this level of take.

Table 4-35. 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 (nest/egg)[1,3]	Total Take by All Entities[2]
2007	210	0	3,080	290/477	3,390
2008	54,495	90	1,957	80/50	1,541
2009	29,785	196	3,197	43/60	2,307
2010	3,464	50	3,994	45/71	1,111
2011	3,932	70	6,122	5/9	1,336
2012	8,646	119	6,772	1/2	2,452
TOTAL	**100,532**	**525**	**25,122**	**464/669**	**12,137**

[1]Dispersal or take in Pennsylvania, data reported by federal fiscal year

[2]Take in northeastern United States (USFWS Region 5), data reported by calendar year; includes WS' take

[3]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

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 increasing population trends and 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. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Additionally, 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 destruction of up to 300 herring gull nests annually by WS would occur in localized areas where nesting takes place 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

Great black-backed gulls, the largest gulls in North America, are easily distinguished by their white head and chest that contrasts against their black back and wings (Good 1998). 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 Region Waterbird Working Group 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 Region Waterbird Working Group 2006). In Pennsylvania, great black-backed gulls were first recorded successfully nesting in Delaware County in 2006. Possible nesting birds were observed in Bucks and Philadelphia counties during the second Pennsylvania BBA (Wilson et al. 2012). During the breeding season, great black-backed gulls use seacoasts and inland bodies of water for nesting (MANEM Region Waterbird Working Group 2006). These areas, as well as areas up to 100 km away, are used for feeding (MANEM Region Waterbird Working Group 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). During this period, great black backed gulls can be observed in Cranford, Erie, Warren, Burks, Bucks, Cumberland, Delaware, Lancaster, Montgomery, and Philadelphia counties in the Commonwealth (Wood 1979). Great black-backed gulls are generalist predators, consuming fish, insects, mammals, other adult birds, their young and eggs, as well as carrion and human refuse (Good 1998). Away from the breeding colony, great black-backed gulls loaf, roost and, feed in groups (Good 1998).

In BCR 14 and BCR 30, the great black-backed gull breeding population increased 109% from the 1970s to 1990s (MANEM Region Waterbird Working Group 2006). As reported by the BBS, populations of great black-backed gulls in the Eastern BBS region decreased at an estimated annual rate of -2.7% from 1966 through 2012, but increased at an estimated annual rate of 0.4% from 2002 to 2012 (Sauer et al. 2014). In the New England/ Mid-Atlantic Coast region, the number of great black-backed gulls observed has shown an increasing trend estimated at 2.9% annually from 1966 through 2012 and 13.0% annually from 2002 to 2012 (Sauer et al. 2014). No BBS data is currently available for great black-backed gulls in Pennsylvania (Sauer et al. 2014); however, they are regularly observed during the breeding season (see Table 4-36).

Table 4-36. Total number of great black-backed gulls observed by WS staff at landfill sites in Bucks County Pennsylvania from 2010 to 2012*

Month	Year		
	2010	**2011**	**2012**
January	4,370	1,852	7,510
February	4,395	1,940	6,600
March	4,849	3,960	2,450
April	2,250	3,053	330
May	320	335	25
June	150	75	10
July	390	725	70
August	965	1,020	995
September	1,790	1,545	1,045
October	2,685	2,650	2,780
November	4,950	3,760	5,200
December	6,045	6,560	4,515
TOTAL	**33,159**	**27,475**	**31,530**

*Surveys were conducted at 18 points for 3 minutes 6 times each month (2 times in the morning, 2 times at midday and 2 times in the evening).

The total number of atlas blocks where great black-backed gulls were observed nesting increased 800% between the first and second Pennsylvania BBA (Wilson et al. 2012). CBC data for great black-backed gulls observed in Pennsylvania since 1966 shows a stable to slightly increasing trend with a cyclical pattern (National Audubon Society 2010). The highest recorded CBC count of great black-backed gulls in the Commonwealth occurred in Bucks County in 2004 when 15,867 birds were observed (Wilson et al. 2012). 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 Region Waterbird Working Group 2006). Great black-backed gulls are considered a species of lowest concern in BCR 30 and a species of low concern in BCR 14. Seamans et al. (2007) estimates the minimum breeding and non-breeding great black-backed gull population in BCR 14 and 30 to be 250,000 birds (see Table 4-31).

The number of great black-backed gulls taken or dispersed by WS in Pennsylvania and the total number of gulls taken by all entities in the northeastern United States (USFWS Region 5) to alleviate damage and threats associated with these birds are shown in Table 4-37. From FY 2007 through FY 2012, WS lethally removed 108 great black-backed gulls and 0 nests, and used non-lethal methods to disperse an additional 9,907 gulls in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of great black-backed gulls during this period. From 2007 to 2012, 3,446 great black-backed gulls, or 574 gulls per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring in the northeastern United States (USFWS Region 5).

Table 4-37. 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 (nest/egg)[1,3]	Total Take by All Entities[2]
2007	0	0	428	0	743
2008	820	0	710	0	495
2009	5,569	49	560	0	561
2010	1,093	6	360	0	506
2011	523	17	593	0	565
2012	1,902	36	795	0	777
TOTAL	**9,907**	**108**	**3,446**	**0**	**3,647**

[1]Dispersal or take in Pennsylvania, data reported by federal fiscal year
[2]Take in northeastern United States (USFWS Region 5), data reported by calendar year; includes WS' take
[3]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

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 under the proposed action alternative to alleviate damage and threats. The increased level of take analyzed when compared to the take occurring by WS from FY 2007 to FY 2013 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 population of great black-backed gulls in BCR 14 and BCR 30 at 250,000 birds (Seamans et al. 2007). However, since population trends continue to indicate an increasing herring gull population, the population of great black-backed gulls in the region is likely greater than 250,000 gulls, 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 under the proposed action alternative 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 United States (USFWS Region 5) has averaged 574 gulls. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative 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 could be taken annually with no adverse effect on the current population (see Table 4.31). Current take from all known entities has not exceeded this level of take.

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. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Additionally, 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 destruction of up to 100 great black-backed gull nests annually by WS would occur in localized areas where nesting takes place 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 first introduced into the United States 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 now found throughout the United States, southern Canada, and Mexico (Johnston 1992). In Pennsylvania, rock pigeons can be found nesting year-round throughout the Commonwealth (Wilson et al. 2012). 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, farmyards, grain elevators, feed mills, and other manmade structures (Johnston 1992). Although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, insects, and any other available food (Johnston 1992).

In Pennsylvania, the number of rock pigeons observed in the Commonwealth along routes surveyed during the BBS have shown a decreasing trend estimated at -3.0% annually since 1966 and -1.3% 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 and -0.2% annually from 2002 through 2012 (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, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of rock pigeons to be 500,000 pigeons. Data collected during the second Pennsylvania BBA estimated the Commonwealth rock pigeon population at 414,000 (Wilson et al. 2012).

The number of rock pigeons taken or dispersed by WS from FY 2007 to FY 2012 to alleviate damage and threats associated with these birds are shown in Table 4-38. From FY 2007 through FY 2012, WS lethally removed 4,217 rock pigeons and 20 nests, and used non-lethal methods to disperse an additional

2,239 pigeons in the Commonwealth. Pigeons are afforded no protection under the MBTA and no depredation permit from the USFWS or the PGC is required to take them. Reporting the take of pigeons to the USFWS is also not required. Therefore, the take of pigeons by other entities to alleviate damage in the Commonwealth is unknown.

Table 4-38. Number of rock pigeons addressed by WS' in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	
		Adults	Nests/Eggs[2]
2007	507	211	0
2008	302	192	0
2009	539	173	4/4
2010	239	186	5/0
2011	242	2,277	7/4
2012	410	1,178	4/6
TOTAL	**2,239**	**4,217**	**20/14**

[1]Data reported by federal fiscal year

[2]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

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 5,000 rock pigeons and 500 nests could be taken annually by WS in the Commonwealth under the proposed action alternative.

With a statewide population estimated between 414,000 (Wilson et al. 2012) and 500,000 (Partners in Flight Science Committee 2013) rock pigeons, WS' proposed take of up to 5,000 rock pigeons annually would represent anywhere from 1.0% to 1.2% of the statewide population, which could be considered as a low magnitude of take. Rock pigeons are considered a non-native species under the Commonwealth. Therefore, rock pigeons are afforded no protection under the Act. 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 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 United States, including Pennsylvania (Otis et al. 2008). Mourning doves are habitat generalists and 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). The diet of mourning doves consists of seeds from cultivated (*e.g.*, sunflower, wheat, millet) or wild plants (*e.g.*, grasses, ragweed, pine) (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).

In Pennsylvania, the numbers of mourning doves observed in the Commonwealth along routes surveyed during the BBS have shown an increasing trend estimated at 1.3% annually since 1966 and a decreasing trend estimated at -0.2% annually from 2002 to 2012 (Sauer et al. 2014). The number of doves observed from 2004 through 2013 during mourning dove surveys has shown an increasing trend estimated at 0.7% annually in Pennsylvania (Seamans and Sanders 2014). The number of mourning doves observed in the

Commonwealth during the CBC has shown a general increasing trend since 1966 (National Audubon Society 2010). Similarly, the breeding mourning doves were observed in 92% of atlas blocks in the first Pennsylvania BBA, and over 98% in the second Atlas (Wilson et al. 2012). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of mourning doves to be 1.2 million birds. The second Pennsylvania BBA estimated the statewide breeding population at 3,100,000 birds (Wilson et al. 2012).

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 4-39. From FY 2007 to FY 2012, WS lethally removed 1,453 mourning doves and used non-lethal methods to disperse an additional 16,381 mourning doves in the Commonwealth. WS also destroyed three nests during this period to alleviate damage and threats associated with these birds. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of mourning doves during this period. From 2007 to 2012, 2,113 mourning doves, or 352 mourning doves per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth. The population of mourning doves in the Commonwealth is sufficient to allow for regulated hunting seasons. Mourning doves can be harvested during an annual split season in the fall and winter, with a daily limit of 15 birds (PGC 2015). Since 2007, the highest number of doves harvested occurred in 2007 when 509,100 doves were harvested (Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012). The average annual harvest from 2007 to 2012 was 271,083 doves (Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013).

Table 4-39. Number of mourning doves addressed in Pennsylvania 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	570	348	20	37	509,100
2008	1,470	438	27	91	340,900
2009	2,506	610	362	526	188,000
2010	4,631	943	211*	316	226,500
2011	2,475	1,048	435	580	158,800
2012	4,729	1,298	398	563	203,200
TOTAL	**16,381**	**4,685**	**1,453**	**2,113**	**1,626,500**

[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

*Includes non-target take of 2

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 1,200 mourning doves and 50 nests annually under the proposed action alternative.

The best available data estimates the population of mourning doves to be between 1.2 million (Partners in Flight Science Committee 2013) and 3.1 million (Wilson et al. 2012) birds. Based on this estimate, the take of up to 1,200 mourning doves under the proposed action alternative would represent anywhere from 0.04% to 0.1% of the estimated population. The USFWS and the PGC authorized all entities to remove up to 1,298 doves during 2012, which represents the highest annual removal permitted by the USFWS and the PGC from 2007 through 2012. If 1,298 doves were removed under permits issued by the USFWS and the PGC and WS lethally removed 1,200 doves, the cumulative take to alleviate damage would represent 0.1% to 0.2% of the estimated breeding population in the Commonwealth, if take only occurred during the breeding season. Doves are primarily targeted to alleviate strike risks at airports where the flocking behavior of doves during migration periods can increase aircraft strike risks at airports. Therefore, take would likely represent a much smaller portion of the breeding population. From 2007 through 2012, 1,626,500 doves, or 271,083 doves per year on average, were harvested in the Commonwealth (Raftovich et al. 2009, Raftovich et al. 2010, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013). WS' take of up to 1,200 doves annually under the proposed action alternative would represent 0.4% of the average number of doves taken annually by hunters in the Commonwealth.

Given the increasing 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 in the Commonwealth 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 is 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.

Additionally, impacts due to nest removal and destruction should have little adverse impact on the mourning dove population. Nest destruction methods are considered non-lethal when conducted before the development of an embryo. Although there may be reduced fecundity for the individuals affected by nest destruction, this activity has no long-term effect on breeding adult mourning doves. The destruction of up to 50 mourning dove nests annually by WS would occur in localized areas where nesting takes place and would not reach a level where adverse effects on mourning dove 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.

MONK PARAKEET POPULATION IMPACT ANALYSIS

Monk parakeets, a non-native species, were first brought to the United States from South America as pets (Spreyer and Enrique 1998). Many of those birds escaped or were released, forming the feral monk parakeet populations that can be found in the United States today (Spreyer and Enrique 1998). In Pennsylvania, Freeland (1973) described Monk Parakeets breeding in Pittsburgh in the early 1970s. Since then, other observations have been reported from around the Commonwealth (*e.g.*, Lehigh County 2012). These birds have either been released or come from established populations in the nearby states of Connecticut, Delaware, New Jersey, New York, and Rhode Island (Spreyer and Enrique 1998). Monk parakeets are closely associated with humans and can be found in urban-suburban areas, particularly city parks (Spreyer and Enrique 1998). Diet consist of leaf buds, weed seeds, acorns, berries, fruit, and human provided birdseed (Spreyer and Enrique 1998). Monk parakeets are highly social birds, feeding, loafing, and nesting colonially in groups of up to 55 birds (Spreyer and Enrique 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 Enrique 1998). Nests can reach enormous sizes (over 2,500 lbs., Spreyer and Enrique 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). Monk parakeets have only been observed twice in the Commonwealth during the CBC; 3 were observed in 1974–1975 and 4 were observed in 1972–1973 (National Audubon Society 2010). There are currently no estimates on the population of monk parakeets in the Commonwealth.

From FY 2007 to FY 2012, WS lethally removed five monk parakeets and destroyed one nest in the Commonwealth 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 the reporting of take to the USFWS is not required. Therefore, the take of monk parakeets by other entities to alleviate damage in the Commonwealth is unknown.

In anticipation of future requests for assistance to manage damage associated with monk parakeets, up to 100 monk parakeets and 20 nests could be taken annually by WS in the Commonwealth under the proposed action alternative. Monk parakeets are considered a non-native species under the MBTA. Therefore, monk parakeets are afforded no protection under the Act. In addition, under §137.1 of the Pennsylvania Game Code, the importation, possession, sale, and release of monk parakeets is illegal. 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.

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). In Pennsylvania, short-eared owls have been observed nesting in Allegheny, Cambria, Centre, Clarion, Clinton, and Lawrence Counties (Haffner and Gross 2009). 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, Haffner and Gross 2009). Diet consists primarily of mice and other small mammals (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). It has been listed as endangered by the PGC, although it is not listed on the federal level (Haffner and Gross 2009).

Since 1966, breeding populations of short-eared owls in the United States have exhibited a decreasing annual trend of -1.0%; however, from 2002 through 2012, the number of short-eared owls observed in areas of the United States surveyed during the BBS has shown an increasing trend estimated at 1.5% annually (Sauer et al. 2014). In the Eastern BBS Region, the number of short-eared owls observed during the BBS has shown an annual decrease of -6.1% since 1966, with a -1.5% annual decrease occurring from 2002 through 2012 (Sauer et al. 2014). The number of owls observed in the Commonwealth during the CBC has shown a cyclical trend since 1966 (National Audubon Society 2010). In the last two decades, the number of owls observed in Pennsylvania during the CBC has ranged from six to 45 (National Audubon Society 2010). Currently, no other data is available on the population of short-eared owls in the Commonwealth (National Audubon Society 2010, Sauer et al. 2014). Based on BBS data, Partners in

Flight Science Committee (2013) estimated the population of short-eared owls in North America to be approximately 600,000 owls.

From FY 2007 through FY 2012, WS used non-lethal methods to disperse 20 short-eared owls to alleviate damage and threats associated with these birds in the Commonwealth. The USFWS did not issue any depredation permits to other entities for the take of short-eared owls during this period. Requests for assistance associated with short-eared owls occur at airports in the Commonwealth where they pose a hazard to aircraft. To address requests for assistance at airports, up to 5 short-eared owls and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats when non-lethal techniques are unsuccessful and with the permission of the PGC.

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 is approximately 600,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 5 short-eared owls by WS under the proposed action alternative would represent 0.001% of this population. From 2007 to 2012, no short-eared owls were taken by other entities in the Commonwealth.

The take of short-eared owls could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of short-eared owls would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. Short-eared owls are listed as an endangered species in the Commonwealth; therefore, permission from the PGC would be requested by WS prior to any take.

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 do not have an annual migration and can be found throughout North America, including Pennsylvania, year round (Houston et al. 1998). Great horned owls can be found in a wide variety of habitats including forest, open habitat, and deserts (Houston et al. 1998). In a Pennsylvania study, great horned owls used cropland and pasture more than deciduous and unfragmented forest, indicating a preference for fragmented habitat (Morrell and Yahner 1994). Nests are constructed in trees and tree cavities, on cliffs, buildings, artificial platforms, and on the ground (Houston et al. 1998). A generalist and opportunistic feeder, the diet of the great horned owl includes small rodents, rabbits, waterfowl, amphibians, reptiles, and insects (Houston et al. 1998). In a study of Pennsylvania great horned owls, more than 30% of diet consisted of opossums (*Didelphis marsupilis*), testament to this owl's generalistic and opportunistic nature (Wink et al. 1987).

In Pennsylvania, the number of great horned owls observed during the BBS has shown a declining trend estimated at -0.9% annually since 1966 and -1.0% annually from 2002 through 2012 (Sauer et al. 2014). A similar trend has been observed for the number of great horned owls observed in the eastern BBS region where the population has declined at an estimated -2.9% annually since 1966 with a -1.0% annual decline occurring from 2002 through 2012 (Sauer et al. 2014). Similarly, the number of observation blocks where these owls were observed declined by 28% between the first and second Pennsylvania BBA (Wilson et al. 2012). The number of great horned owls observed in the Commonwealth during the CBC has shown a generally stable trend since the late 1970s, with an average of 459 birds observed annually since 2004–2005 (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 entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-40. From FY 2007 through FY 2012, WS lethally removed one great horned owl and used non-lethal methods to disperse three great horned owls in the Commonwealth. In addition to the take by WS, the USFWS and the PGC issued depredation permits to other entities for the take of great horned owls during this period. The USFWS and the PGC have authorized the annual take of up to 15 great horned owls in the Commonwealth since 2010. However, only one great horned owl was lethally removed by WS from 2007 through 2012.

Table 4-40. Number of great horned owls addressed in Pennsylvania 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	6	1	1
2009	0	2	0	0
2010	0	15	0	0
2011	0	15	0	0
2012	3	15	0	0
TOTAL	**3**	**53**	**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

Requests for assistance associated with great horned owls 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, WS could take up to 10 great horned owls and 20 nests annually under the proposed action alternative.

The best available data estimates that the population of great horned owls in Pennsylvania is approximately 15,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 10 great horned owls by WS under the proposed action alternative would represent 0.1% of the estimated breeding population. From 2007 through 2012, no great horned owls were lethally taken by other entities in the Commonwealth. If the USFWS and the PGC continued to authorize the lethal take of up to 15 great horned owls and if WS was permitted to remove up to 10 owls, the cumulative take would represent 0.2% of the estimated breeding population in the Commonwealth.

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of great horned owls could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of great horned owls would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 great horned owl nests to alleviate damage or threats of damage would not be expected to adversely affect the population of owls and was further addressed in additional detail previously.

SNOWY OWL POPULATION IMPACT ANALYSIS

Snowy owls breed in open terrain of the artic barrens from the Aleutian Islands along the northern edge of Alaska, throughout the Canadian Arctic Islands and from northern Yukon, northeastern Manitoba, northern Quebec, and northern Labrador (Parmalee 1992). Snowy owls can be found in similar open habitats during their winter migrations. During the winter migrations, snowy owls can be found across Canada, Alaska, and the northern edge of the United States; however, during years with severe winters or limited available food, snowy owls can be found as far south as Texas and Florida (Parmalee 1992).

The open habitats of airports provide ideal wintering areas for snowy owls. The number of snowy owls observed during the CBC across all areas surveyed in the United States has shown a variable trend over the past 20 years (National Audubon Society 2010). The number of snowy owls observed during the CBC in areas of the Commonwealth surveyed has also shown a variable trend, with owls observed infrequently and in low numbers (National Audubon Society 2010). There are no breeding or year-round populations of snowy owls within Pennsylvania (Parmalee 1992). Population and trend data for snowy owls is limited and long-term data is lacking (Parmalee 1992). The Partners in Flight Science Committee (2013) estimated the breeding population in North America at 100,000 snowy owls.

Requests for assistance associated with snowy owls occur at airports where owls can pose a strike risk with aircraft. However, requests occur infrequently in the Commonwealth. Between FY 2007 and FY 2012, WS dispersed four snowy owls at airports; however, the only request for direct operational assistance associated with snowy owls occurred during FY 2012. Based on previous requests for assistance and in anticipation of receiving requests for additional efforts associated with snowy owls, WS could lethally remove up to five snowy owls annually under the proposed action alternative. WS would continue to address snowy owls at airports primarily using non-lethal dispersal methods and translocation. However, snowy owls could be lethally removed when those birds pose a direct threat to aviation safety that threatens property and human safety or when those owls consistently use areas of the airport where live-trapping or persistent harassment would not be practical, such as near high-use runways. In those situations, those runways or taxiways would have to be closed during trapping activities or harassment activities due to the safety of employees working in close proximity to active aircraft and for the safety of aircraft and passengers. The lethal removal of snowy owls, when necessary, would represent 0.01% of the estimated breeding population in North America.

The take of snowy owls could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of snowy owls would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives.

BARRED OWL POPULATION IMPACT ANALYSIS

The barred owl is a resident of the deep forests of the eastern United States and the Midwest through the boreal forests of the central Canada and into the forests of the Pacific Northwest(Mazur and James 2000). In Pennsylvania, the barred owl can be found across the Commonwealth and throughout the year in suitable habitat (Mazur and James 2000, Wilson et al. 2012). 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 are opportunistic, consuming other birds, small mammals, amphibians, reptiles, and invertebrates (Mazur and James 2000). Barred owls typically hunt from elevated perches at night but have been observed hunting during the day (Mazur and James 2000).

In Pennsylvania, the number of barred owls observed during the BBS has shown an increasing trend estimated at 1.5% annually since 1966 and 1.3% annually from 2002 through 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 rate of 1.1% annually since 1966 and 1.7% annually from 2002 through 2012 (Sauer et al. 2014). Also, the number of observation blocks where these owls were observed increased by 17% between the first and second Pennsylvania BBA (Wilson et al. 2012). The number of barred owls observed in the Commonwealth during the CBC has shown an increasing trend since1966 (National Audubon Society 2010). Using data from the BBS, Partners in Flight Science Committee (2013) estimated the statewide breeding population of barred owls to be 17,000 birds.

From FY 2007 through FY 2012, WS did not receive requests for direct operational assistance associated with barred owls in the Commonwealth. The USFWS issued depredation permits for the take of barred owls during this period. However, from 2007 to 2012, no barred owls were reported as lethally removed to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Requests for assistance associated with barred owls would 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, WS could take up to 10 barred owls and 20 nests annually under the proposed action alternative.

The best available data estimates that the population of barred owls in Pennsylvania is approximately 17,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 10 barred owls by WS under the proposed action alternative would represent 0.1% of the estimated breeding population. From 2007 through 2012, no barred owls were reported as lethally taken in the Commonwealth.

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of barred owls could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of barred owls would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives for these birds. The take of up to 20 barred owl nests to alleviate damage or threats of damage would not be expected to adversely affect the population of barred owls, which was discussed further above.

DOWNY WOODPECKER POPULATION IMPACT ANALYSIS

The smallest of the North American woodpeckers, downy woodpeckers are characterized not only by their size but also their relatively short stubby bill (Jackson and Ouellet 2002). Downy woodpeckers can be found across North America, including Pennsylvania, throughout the year in suitable habitat (Jackson and Ouellet 2002, Wilson et al. 2012). These woodpeckers prefer open, deciduous woodlands including urban and suburban parks and residential areas (Jackson and Ouellet 2002). Downy woodpeckers are cavity nesters, excavating cavities in rotting wood of living or dead trees (Jackson and Ouellet 2002). Diet consists of insects, fruits, seed and, sap (Jackson and Ouellet 2002). Downy woodpeckers use their bill to excavate insects from bark or other substrate (Jackson and Ouellet 2002). Like other species of woodpeckers, downy woodpeckers use drumming as a means of communication. Drumming occurs year-round but seems to be more intense in both the winter and spring (Jackson and Ouellet 2002).

In Pennsylvania, the number of downy woodpeckers observed during the BBS has shown a declining trend estimated at -0.1% annually since 1966 and decreasing trend estimated at -0.8%, from 2002 through 2012 (Sauer et al. 2014). The population of downy woodpeckers observed in the eastern BBS region has increased at an estimated 0.2% annually since 1966 (Sauer et al. 2014). The number of downy woodpeckers observed in the Commonwealth during the CBC has shown a stable trend since1966 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of downy woodpeckers to be 380,000 birds. The second Pennsylvania BBA estimated the Commonwealth population at 450,000 birds (Wilson et al. 2012).

The number of downy woodpeckers taken or dispersed by WS and the total number of downy woodpeckers taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-41. From FY 2007 through FY 2012, WS lethally removed 13 downy woodpeckers in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of downy woodpeckers during this period. From 2007 to 2012, 26 downy woodpeckers, or four birds per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4-41. Number of downy woodpeckers addressed in Pennsylvania 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	33	6	10
2008	0	26	0	1
2009	0	25	2	3
2010	0	34	2	2
2011	0	26	1	7
2012	0	26	2	3
TOTAL	**0**	**170**	**13**	**26**

[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 hairy woodpeckers occur when these birds chisel holes in the wooden siding, eves, or trim of buildings or drum on these surfaces or on metal gutters, chimney caps, vents, or roofing materials (Evans et al. 1984, Marsh 1994). Evans et al. (1984) reported that 48% of woodpecker damage to homes surveyed in Tennessee involved holes that had completely penetrated the building material (usually wood). Although drumming causes less damage, the noise created by drumming often reverberates through the building and because most activity occurs early in the day (Evans et al. 1984), can be very annoying when occupants are still asleep (Marsh 1994).
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 downy woodpeckers and 20 nests annually under the proposed action alternative.

The best available data estimates that the population of downy woodpeckers in Pennsylvania is 380,000 (Partners in Flight Science Committee 2013) to 450,000 birds (Wilson et al. 2012). Based on this estimate, the annual removal of up to 50 downy woodpeckers by WS under the proposed action alternative would represent 0.01% of this population. From 2007 through 2012, four downy woodpeckers on average were lethally taken per year by all 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 population under the proposed action alternative. The highest annual take level occurred in 2007 when all entities issued permits removed 10 woodpeckers to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.01% to 0.02% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 34 woodpeckers and authorized WS to take up to 50 woodpeckers, the cumulative take would represent 0.02% of the estimated statewide breeding 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. The take of downy woodpeckers could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of downy woodpeckers would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 downy woodpecker nests to alleviate damage or threats of damage would not be expected to adversely affect the population of downy woodpeckers, which was addressed previously.

HAIRY WOODPECKER POPULATION IMPACT ANALYSIS

A small to medium sized woodpecker, the hairy woodpecker can be found across much of North America, including Pennsylvania, throughout the year (Jackson et al. 2002, Wilson et al. 2012). Hairy woodpeckers occupy both deciduous and coniferous forest habitat but can also be found in urban and suburban parks and residential areas (Jackson et al. 2002). Like most woodpeckers, hairy woodpeckers are cavity nesters, excavating holes in either dead or live trees (Jackson et al. 2002). Diet consists of seeds, fruits, and insects (Jackson et al. 2002). Insects are either located visually or by rapid bill drumming which presumably allows the bird to locate the tunnels of wood-boring insects (Jackson et al. 2002). The woodpecker then chisels away bark and wood to extract the insect (Jackson et al. 2002). Sizeable holes (greater than 2 inches deep) can be made during this process (Jackson et al. 2002). Like other species of woodpeckers, hairy woodpeckers use drumming not only as a means to obtain food or excavate a nest cavity but also as a means of communication. Hairy woodpeckers drum throughout the year for a variety of reason including maintaining territories and soliciting mates (Jackson et al. 2002).

In Pennsylvania, the number of hairy woodpeckers observed during the BBS has shown an increasing trend estimated at 0.9% annually since 1966 and 1.0% annually from 2002 through 2012 (Sauer et al. 2014). The number of hairy woodpeckers observed in the eastern BBS region has increased at an estimated 1.1% annually since 1966, with a 1.7% annual increase occurring from 2002 through 2012 (Sauer et al. 2014). The number of hairy woodpeckers observed in the Commonwealth during the CBC has shown a stable trend since1966 (National Audubon Society 2010). Using data from the BBS, the Partners if Flight Science Committee (2013) estimated the statewide breeding population of hairy woodpeckers to be 82,000 birds. The second Pennsylvania BBA estimated the Commonwealth hairy woodpecker population at 97,000 birds (Wilson et al. 2012).

The number of hairy woodpeckers taken or dispersed by WS and the total number of hairy woodpeckers taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-42. From FY 2007 through FY 2012, WS lethally removed seven hairy woodpeckers in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of hairy woodpeckers during this period. From 2007 to 2012, eight hairy woodpeckers, or one bird per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Requests for assistance associated with hairy woodpeckers occur when these birds chisel holes in the wooden siding, eves, or trim of buildings or drum on these surfaces or on metal gutters, chimney caps, vents, or roofing materials (Evans et al. 1984, Marsh 1994). Evans et al. (1984) reported that 48% of woodpecker damage to homes surveyed in Tennessee involved holes that had completely penetrated the building material (usually wood). Although drumming causes less damage, the noise created by drumming often reverberates through the building and because most activity occurs early in the day (Evans et al. 1984), can be very annoying when occupants are still asleep (Marsh 1994). 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 hairy woodpeckers and 20 nests annually under the proposed action alternative.

Table 4-42. Number of hairy woodpeckers addressed in Pennsylvania 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	33	2	2
2008	0	22	0	0
2009	0	27	5	5
2010	0	22	0	0
2011	0	20	0	0
2012	0	22	0	1
TOTAL	**0**	**146**	**7**	**8**

[1]Data reported by federal fiscal year

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

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

The best available data estimates that the population of hairy woodpeckers in Pennsylvania is approximately 82,000 (Partners in Flight Science Committee 2013) to 97,000 (Wilson et al. 2012) birds. Based on this estimate, the annual removal of up to 50 hairy woodpeckers by WS under the proposed action alternative would represent 0.1% of the estimated breeding population. On average, approximately one hairy woodpecker has been lethally removed annually by all entities issued depredation permits issued by the USFWS and the PGC. If the average annual take by all entities remains stable, the average annual cumulative take by all entities would represent 0.1% of the estimated population under the proposed action alternative. The highest annual take level occurred in 2009 when all entities issued permits removed five woodpeckers to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.1% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 33 woodpeckers and authorized WS to take up to 50 woodpeckers, the cumulative take would represent 0.1% of the estimated statewide breeding 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. The take of hairy woodpeckers could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of hairy woodpeckers would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 hairy woodpecker nests to alleviate damage or threats of damage would not be expected to adversely affect the population of hairy woodpeckers, which was addressed previously.

NORTHERN FLICKER POPULATION IMPACT ANALYSIS

The third largest woodpecker in North America, the northern flicker is recognized by its brownish and black barred back, spotted belly, and black breast band (Wiebe and Moore 2008). The northern flicker can be found across much of North America, including Pennsylvania, year round in suitable habitat (Wiebe and Moore 2008, Wilson et al. 2012). Northern flickers prefer forest edge, open woodlands, riparian wetlands, and urban and suburban areas (Wiebe and Moore 2008). Like other woodpeckers, northern flickers are generally cavity nesters, excavating holes in dead or diseased trees; however, they also use existing cavities and sometimes buildings (Wiebe and Moore 2008). Cavity entrances range in size from 2.5 to 3.3 inches in diameter (Wiebe and Moore 2008). Unlike other woodpeckers, northern flickers feed on the ground using their bill to probe or drum the soil (Wiebe and Moore 2008). Diet consists of insects, mostly ants, as well as fruits and seeds (Wiebe and Moore 2008). Like other species of woodpeckers, northern flickers use rapid bill drumming not only as a way to excavate their cavity nests but also as a way to communicate (Wiebe and Moore 2008). Northern flickers drum throughout the year for territorial defense on a variety of objects such as trees, buildings, vehicles, and telephone poles (Wiebe and Moore 2008). Northern flickers are considered non-social, but can be found foraging in loose groups of up to 20 individuals (Wiebe and Moore 2008).

In Pennsylvania, the number of northern flickers observed during the BBS has shown a decreasing trend estimated at -1.8% annually since 1966 (Sauer et al. 2014). Similarly, the number of northern flickers observed in the eastern BBS region has decreased at an estimated -1.6% annually since 1966 (Sauer et al. 2014). The number of northern flickers observed in the Commonwealth during the CBC has shown a stable trend since1966 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of northern flickers to be 110,000 birds.

From FY 2007 through FY 2012, WS used non-lethal methods to disperse three northern flickers in the Commonwealth. Other than permits issued to WS, the USFWS did not issue depredation permits to other entities for the take of northern flickers from 2007 through 2012. Requests for assistance associated with northern flickers are similar to those requests received for other woodpeckers. 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 northern flickers and 20 nests annually under the proposed action alternative.

The best available data estimates that the population of northern flickers in Pennsylvania is approximately 110,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 50 northern flickers by WS under the proposed action alternative would represent 0.1% of the estimated breeding 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. The take of northern flickers could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of northern flickers would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 northern flicker nests to alleviate damage or threats of damage would not be expected to adversely affect the population of northern flickers, which was addressed previously.

AMERICAN CROW POPULATION IMPACT ANALYSIS

American crows are found across the United States but are generally more common in the east (Verbeek and Caffery 2002). In Pennsylvania, American crows can be found throughout the year and across the Commonwealth (Wilson et al. 2012). 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). American crows are omnivores and consume a variety of invertebrates, amphibians, reptiles, small birds and mammals, eggs, grain crops, fruit, carrion, and human refuse (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 2 million birds and often the same sites are used year after year

(Verbeek and Caffery 2002). During the day, American crows 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 Pennsylvania, the number of American crows observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 0.5% annually since 1966 and an increasing trend estimated at 0.1% 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 population has increased at an estimated 0.6% annually since 1966, with a 0.4% annual increase occurring from 2002 through 2012 (Sauer et al. 2014). The number of American crows observed in the Commonwealth during the CBC has shown a general decreasing trend since 1966 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of American crows to be 540,000 birds. The second Pennsylvania BBA estimated the Commonwealth American crow population at 745,000 birds (Wilson et al. 2012).

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 4-43. From FY 2007 to FY 2012, WS lethally removed 262 American crows and used non-lethal methods to disperse an additional 374,063 American crows in the Commonwealth. The population of American crows in the Commonwealth is sufficient to allow for regulated hunting seasons. Crows can be harvested from July through April on Fridays, Saturdays, and Sundays with no limit on the number of birds taken (D’Angelo 2011). The PGC 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 200,593 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 (Sobek 2010). Therefore, the number of American crows taken in the Commonwealth under 50 CFR 21.43 of the MBTA is unknown.

Table 4-43. Number of American crows addressed in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	WS’ Take[1]	Hunter Harvest[2,3,4]
2007	28,255	32	182,320
2008	2,963	23*	183,203
2009	93,691	53	268,711
2010	225,631	37	96,831
2011	11,969	49	182,659
2012	11,554	68	289,833
TOTAL	**374,063**	**262**	**1,203,557**

[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 Johnson et al. 2012, Johnson and Boyd 2013

[4]Data reported by calendar year

*Includes non-target take of 2

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, primarily to alleviate damage and threats associated with urban crow roosts, WS could take up to 5,000 American crows and 20 nests annually under the proposed action alternative.

The best available data estimates the population of American crows to be anywhere from 540,000 (Partners in Flight Science Committee 2013) to 745,000 (Wilson et al. 2012). Based on this estimate and a stable population trend, WS' proposed take of up to 5,000 American crows annually would represent anywhere from 0.7% to 0.9% of the estimated statewide American crow population. 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 192,528 to 199,478 American crows are harvested annually in the Commonwealth. The Partners in Flight Science Committee (2013) estimates the fish crow population at 3,000. Wilson et al. (2012) estimates the fish crow population at 30,000. WS' take of up to 5,000 American crows annually under the proposed action alternative would represent 2.5% to 2.6% of the average numbers of American crows taken annually by hunters in the Commonwealth.

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 urban crow roosts, areas where hunting is not permitted. Therefore, WS' take of crows is likely to occur in locations where take would 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 is of low magnitude when compared to the number of crows in the Commonwealth. The take of crows can only occur when permitted by the PGC and 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 American crow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of American crow, which was addressed previously.

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 United States (McGowan 2001). In the Commonwealth, the fish crow is generally restricted to the eastern half of the Commonwealth and the drainage basins of the Susquehanna, Delaware, and Potomac watersheds (Wilson et al. 2012). However, during the second Pennsylvania BBA, fish crows were also observed nesting in some of the Commonwealth's western counties (Wilson et al. 2012). 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, Wilson et al. 2012). Like American crows, fish crows are omnivores and consume a variety of invertebrates, grain crops, fruit, and human refuse (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 Pennsylvania, it can be difficult to distinguish between the two. The only reliable way to distinguish between the 2 species at a distance is through vocalizations (McGowan 2001). Given this, 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 Pennsylvania, the number of fish crows observed in the Commonwealth along routes surveyed during the BBS has shown an increasing trend estimated at 0.9% annually since 1966 and a increasing trend estimated at 0.1% annually from 2002 through 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, with a 0.8% annual increase occurring between 2002 and 2012 (Sauer et al. 2014). The number of fish crows observed in the Commonwealth during the CBC has also shown a general increasing trend since 1966 (National Audubon Society 2010). The second Pennsylvania BBA estimated the Commonwealth fish crow population at 30,000 birds (Wilson et al. 2012). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of fish crows to be 3,000 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 4-44. From 2007 to 2012, WS lethally removed 278 fish crows and used non-lethal methods to disperse an additional 18,167 fish crows in the Commonwealth. The population of crows in the Commonwealth is sufficient to allow for regulated hunting seasons. Crows can be harvested from July through April on Fridays, Saturdays, and Sundays with no limit on the number of birds taken (D'Angelo 2011). The PGC 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 200,593 crows. As discussed previously, under 50 CFR 21.43 of the MBTA, a permit is not required to lethally take fish 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 (Sobek 2010). Therefore, the number of fish crows taken in the Commonwealth under 50 CFR 21.43 of the MBTA is unknown.

Table 4-44. Number of fish crows addressed in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]	Hunter Harvest[2,3,4]
2007	15,000	257	182,320
2008	0	0	183,203
2009	0	1	268,711
2010	125	0	96,831
2011	1,704	16	182,659
2012	1,338	4	289,833
TOTAL	**18,167**	**278**	**1,203,557**

[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 Johnson et al. 2012, Johnson and Boyd 2013

[4]Data reported by calendar year

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, primarily to alleviate damage and threats associated with urban crow roosts, WS could take up to 300 fish crows and 20 nests annually under the proposed action alternative.

The best available data estimates the population of fish crows to be anywhere from 3,000 (Partners in Flight Science Committee 2013) to 30,000 birds (Wilson et al. 2012). Based on this estimate and a stable population trend, WS' proposed take of up to 300 fish crows annually would represent anywhere from 1.0% to 10.0% of the estimated statewide fish crow population. 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 in the during the regulated harvest season, an average 1,115 to 8,063 fish crows are harvested annually in the Commonwealth. The Partners in Flight Science Committee (2013) estimates the American crow population at 540,000. Wilson et al. (2012) estimates the American crow population at 745,000. WS' take of up to 300 fish crows annually under the proposed action alternative would represent anywhere from 3.72% to 26.9% of the average numbers of fish 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 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 taken in the Commonwealth. The take of fish crows can only occur when permitted by the PGC and 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 fish crow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of fish crow, which was addressed previously.

HORNED LARK POPULATION IMPACT ANALYSIS

Easily identified by its black tufted head feathers, or "*horns*", horned larks can be found across most of the United States, in suitable habitat (Beason 1995). In Pennsylvania, a quarter of the population can be found in just three counties; Franklin, Lancaster, and York (Wilson et al. 2012). Preferred 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. Horned larks nest and feed on the ground (Beason 1995). Diet consists of seeds, insects, and sprouting crops (*e.g*., lettuce, wheat, oats) (Beason 1995). 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).

In Pennsylvania, the number of horned larks observed in the Commonwealth along routes surveyed during the BBS have shown an decreasing trend estimated at -2.0% annually since 1966 and an increasing trend estimated at 1.9% 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 -2.9% annually since 1966 (Sauer et al. 2014). The number of horned larks observed in the Commonwealth during the CBC has shown a cyclical trend since 1966 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of horned larks to be 20,000 birds. The second Pennsylvania BBA estimated the Commonwealth population at 81,000 birds (Wilson et al. 2012).

The number of horned larks taken or dispersed by WS and the total number of horned larks taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-45. From FY 2007 through FY 2012, WS lethally removed five horned larks and used non-lethal methods to disperse an additional 756 horned larks in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of horned larks during this period. From 2007 to 2012, five horned larks, or less than 1 bird per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

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 100 horned larks and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The best available data estimates that the population of horned larks in Pennsylvania is approximately 20,000 (Partners in Flight Science Committee 2013) to 81,000 birds (Wilson et al. 2012). Based on this estimate, the annual removal of up to 100 horned larks by WS under the proposed action alternative would represent anywhere from 0.1% to 0.5% of this population. The highest annual take level occurred in 2012 when all entities issued permits removed three larks to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.1% to 0.5% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 60 larks and authorized WS to take up to 100 larks, the cumulative take would represent 0.2% to 0.8% of the estimated statewide breeding population.

Table 4-45. Number of horned larks addressed in Pennsylvania 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	20	0	0
2008	17	20	0	0
2009	113	20	2	2
2010	267	30	0	0
2011	319	35	0	0
2012	40	60	3	3
TOTAL	**756**	**185**	**5**	**5**

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

The take of horned larks could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of horned larks would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 horned lark nests to alleviate damage or threats of damage would not be expected to adversely affect the population of horned lark, which was addressed previously.

TREE SWALLOW POPULATION IMPACT ANALYSIS

Tree swallows are migratory birds found throughout much of the United States (Winkler et al. 2011). In Pennsylvania, tree swallows are present across the Commonwealth during the breeding season (Wilson et al. 2012). Tree swallows are generally thought to be associated with bodies of water including wet fields, marshes, shorelines, and wooded swamps (Winkler et al. 2011, Wilson et al. 2012); however, observations in Pennsylvania found no correlation between the bird's distribution and rivers and streams (Wilson et al. 2012). The diet of tree swallows consists of mostly flying insects (Winkler et al. 2011). Tree swallows are cavity nesters commonly nesting in groups when cavities are available (Winkler et al. 2011).

Tree swallows were found in 80% of survey blocks during the second Pennsylvania BBA, a 26% increase from the first atlas (Wilson et al. 2012). In Pennsylvania, the numbers of tree swallows observed in the Commonwealth along routes surveyed during the BBS have shown an increasing trend estimated at 4.6% annually since 1966, with a 1.1% annual increase occurring from 2002 through 2012 (Sauer et al. 2014). The number of tree swallows observed in the eastern BBS region has decreased an estimated -1.7% annually since 1966, with a -0.4% annual decline occurring from 2002 through 2012 (Sauer et al. 2014). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of tree swallows to be 300,000 birds. The second Pennsylvania BBA estimated the tree swallow population at 120,000 birds (Wilson et al. 2012).

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 4-46. From FY 2007 through FY 2012, WS lethally removed 16 tree swallows and used non-lethal methods to disperse an additional 24,352 tree swallows in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of tree swallows during this period. From 2007 to 2012, 21 tree swallows, or four swallows per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-46. Number of tree swallows addressed in Pennsylvania 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	445	50	0	0
2008	1,482	150	5	5
2009	11,485	150	0	0
2010	50	200	5	5
2011	770	225	0	5
2012	10,120	225	6	6
TOTAL	**24,352**	**1,000**	**16**	**21**

[1]Data reported by federal fiscal year

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

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

The majority of requests for assistance associated with tree swallows in Pennsylvania 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 500 tree swallows and 100 nests could be taken annually under the proposed action alternative to alleviate damage and threats.

The number of tree swallows present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of tree swallows in Pennsylvania is approximately anywhere from 120,000 (Wilson et al. 2012) to 300,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 500 tree swallows by WS under the proposed action alternative would represent anywhere from 0.2% to 0.4% of the estimated breeding population. From 2007 to 2012, 21 tree swallows, or an average of four tree swallow per year, were taken by all entities in the Commonwealth. If the take by all entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would represent 0.2% to 0.4% of the estimated population. The highest annual take level occurred in 2012 when all entities issued permits removed six tree swallows to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.2% to 0.4% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 225 swallow and authorized WS to take up to 500 swallow, the cumulative take would represent 0.2% to 0.6% of the estimated statewide breeding 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. The take of tree swallow could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of tree swallow would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 100 tree swallow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of tree swallow, which was addressed previously.

BANK SWALLOW POPULATION IMPACT ANALYSIS

Bank swallows are migratory birds found throughout much of the northern two-thirds of the United States (Garrison 1999). The Pennsylvania Breeding Bird Atlas notes that although bank swallows can be observed in almost every county in the Commonwealth, they are spottily distributed (Wilson et al. 2012). This is likely because their distribution is limited to areas which provide proper nesting habitat (vertical banks) into which the bird digs its own burrow for nesting (Garrison 1999). The bank swallow's diet consists of flying and jumping insects (Garrison 1999). Bank swallows are a highly social species, nesting in colonies of up to 1,000 pairs (Garrison 1999).

According to BBS trend data, bank swallow populations have decreased at an annual rate of -1.5% in Pennsylvania since 1966, with a -0.6% annual decline occurring between 2002 and 2012 (Sauer et al. 2014). In contrast, bank swallows were found in 36% fewer survey blocks during the second Pennsylvania BBA than the first (Wilson et al. 2012). Similarly, bank swallow populations in the Eastern BBS Region have shown an annual decrease of -7.6% since 1966 (Sauer et al. 2014). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of bank swallows to be 13,000 birds.

The number of bank swallows taken or dispersed by WS and the total number of bank swallows taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-47. From FY 2007 through FY 2012, WS lethally removed 286 bank swallows and used non-lethal methods to disperse an additional 56,132 bank swallows in the Commonwealth. WS also removed one bank swallow nest during this period. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of bank swallows during this period. From 2007 to 2012, 290 bank swallows, or 48 swallows per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-47. Number of bank swallows addressed in Pennsylvania 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	1,500	175	8	8
2008	700	225	3	3
2009	0	225	0	0
2010	0	225	0	0
2011	20,403	450	177	181
2012	33,529	450	98	98
TOTAL	**56,132**	**1,750**	**286**	**290**

[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 bank swallows occur primarily at airports in the Commonwealth where they pose a hazard to aircraft. Based on the number of previous requests to manage bank swallow damage and the increasing need to address damage and threats associated with bank swallows in the Commonwealth, up to 250 bank swallows and 100 nests could be taken by WS annually in the Commonwealth under the proposed action alternative.

The number of bank swallows present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of bank swallows in Pennsylvania is approximately 13,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 250 bank swallows by WS under the proposed action alternative would represent 1.9% of the estimated breeding population. From 2007 to 2012, 290 bank swallows, or an average of 48 swallows per year, were taken by all entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would represent 2.3% of the estimated population. The highest annual take level occurred in 2011 when all entities issued permits removed 181 bank swallows to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 3.3% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 450 bank swallows and authorized WS to take up to 250 bank swallows, the cumulative take would represent 5.4% of the estimated statewide breeding 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. The take of bank swallows could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of bank swallows would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 100 bank swallow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of bank swallow, which was addressed previously.

CLIFF SWALLOW POPULATION IMPACT ANALYSIS

Cliff swallows are migratory birds that can be observed throughout much of the United States (Brown and Brown 1995). In Pennsylvania, the population distribution of cliff swallows is widely scattered and it is not uncommon for established nesting sites to be abandoned for unexplained reasons (Wilson et al. 2012). Historically, cliff swallows were not present in Pennsylvania; however, over the last 100 years they have expanded their range across the plains and into the northeast (Brown and Brown 1995). Cliff swallows historically nested in caves or on ledge of cliffs but now nest on any sort of building, bridge, culvert, or other manmade structure that provides a wall with an overhang (Wilson et al. 2012, Brown and Brown 1995). An increase in the nesting habitat coincided with the expansion of the range of cliff swallows (Brown and Brown 1995, Wilson et al. 2012). Cliff swallows are the most social of any of the swallow species, nesting in colonies of up to 3,700 nests in the United States (Brown and Brown 1995). Like other species of swallows, cliff swallows consume flying insects (Wilson et al. 2012, Brown and Brown 1995).

According to BBS trend data, cliff swallow populations have decreased at an annual rate of -0.8% in Pennsylvania since 1966, with a -0.4% annual decrease occurring between 2002 and 2012 (Sauer et al. 2014). Similarly, cliff swallow populations for the Eastern BBS Region have shown an annual population decrease of -2.5% since 1966, but a 4.9% annual increase between 2002 and 2012 (Sauer et al. 2014). Wilson et al. (2012) noted that Pennsylvania BBA atlas data indicates that the population is stable. The breeding cliff swallow population in Pennsylvania has been estimated to be 20,000 birds (Partners in Flight Science Committee 2013).

The number of cliff swallows taken or dispersed by WS and the total number of cliff swallows taken by all entities from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-48. From FY 2007 through FY 2012, used non-lethal methods to disperse 20 cliff swallows in the Commonwealth. WS also destroyed three cliff swallow nests during this period. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of cliff swallows during this period. However, no lethal take was reported from 2007 through 2012 to alleviate damage and threat associated with these birds occurring within the Commonwealth.

Table 4-48. Number of cliff swallows addressed in Pennsylvania 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	50	0	0
2008	0	50	0	0
2009	0	50	0	0
2010	0	120	0	0
2011	20	120	0	0
2012	0	170	0	0
TOTAL	**20**	**560**	**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 cliff swallows in the Commonwealth 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 cliff swallows in the Commonwealth, up to 400 cliff swallows and 100 nests could be taken annually under the proposed action alternative.

The number of cliff swallows present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of cliff swallows in Pennsylvania is approximately 20,000 birds (Partners in Flight Science Committee 2013) to 43,000 (Wilson et al. 2012). Based on this estimate, the annual removal of up to 400 cliff swallows by WS under the proposed action alternative would represent 0.9% to 2.0% of the estimated breeding population. If the USFWS and the PGC continued to authorize other entities to take 170 cliff swallows and authorized WS to take up to 400 cliff swallows, the cumulative take would represent 1.3% to 2.9% of the estimated statewide breeding 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. The take of cliff swallows could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of cliff swallow would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 100 cliff swallow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of cliff swallow, which was addressed previously.

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 Commonwealth with the exception of very urban areas and large contiguous forest during the breeding season where nesting habitat is available (Brown and Brown 1999, Wilson et al. 2012). 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). Barn swallows consume flying insects (Brown and Brown 1999, Wilson et al. 2012).

According to BBS trend data, barn swallow populations have declined at an annual rate of -0.9% in Pennsylvania since 1966, with a -0.4% annual decline between 2002 and 2012 (Sauer et al. 2014). Similarly, barn swallow populations for the Eastern BBS Region show an annual decline of -1.6% since 1966, with a -0.2% annual decline occurring from 2002 through 2012 (Sauer et al. 2014). Across all BBS routes in the United States, barn swallows have exhibited an annual population decline of -0.3% since 1966, but a 0.4% annual increase from 2002 through 2012 (Sauer et al. 2014). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of barn swallows to be 760,000 birds. Using data from the second Pennsylvania BBA, Wilson et al. (2012) estimated the Commonwealth's barn swallow population at 590,000 birds.

The number of barn swallows taken or dispersed by WS and the total number of barn swallows taken by all entitles from 2007 to 2012 to alleviate damage and threats associated with these birds are shown in Table 4-49. From FY 2007 through FY 2012, WS lethally removed 296 barn swallows and used non-lethal methods to disperse an additional 4,578 barn swallows in the Commonwealth. WS also destroyed 641 barn swallow nests during this period. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of barn swallows during this period. From 2007 to 2012, 296 barn swallows and 651 nests were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4-49. Number of barn swallows addressed in Pennsylvania from 2007 to 2012.

		Take under Depredation Permits					
		Adults			Nests		
Year	Dispersed by WS[1]	Authorized Take[2]	WS' Take[1]	Take by All Entities[3]	Authorized Take[2]	WS' Take (nest/egg)[1,4]	Take by All Entities[3]
2007	150	105	10	10	360	54/106	58
2008	528	100	3	3	100	19/12	19
2009	639	100	35	35	360	16/29	22
2010	1,998	200	53	53	360	351/123	351
2011	487	330	57	57	360	107/105	107
2012	776	350	138	138	360	94/59	94
TOTAL	**4,578**	**1,185**	**296**	**296**	**1,900**	**641/164**	**651**

[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]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

Requests for assistance associated with barn swallows in the Commonwealth 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 1,000 barn swallows and 200 nests could be taken annually under the proposed action alternative.

The number of barn swallows present in the Commonwealth fluctuates throughout the year. The best available data estimates that the population of barn swallows in Pennsylvania is anywhere from 590,000 (Wilson et al. 2012) to 760,000 birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 1,000 barn swallows by WS under the proposed action alternative would represent 0.1% to 0.2% of the population. From 2007 to 2012, no barn swallows were taken by other entities in the Commonwealth. WS was the only entity authorized to take barn swallows from 2007 through 2012.

Given the limited magnitude of take proposed by WS when compared to the estimated population, the magnitude of WS' take could be considered low. The take of barn swallows could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of barn swallows would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 200 barn swallow nests to alleviate damage or threats of damage would not be expected to adversely affect the population of barn swallow, which was addressed previously.

AMERICAN ROBIN POPULATION IMPACT ANALYSIS

The American robin, one of the most easily recognized birds in North America, can be found throughout the United States (Sallabanks and James 1999). In Pennsylvania, robins can be found across the Commonwealth 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). Diet consists of insects, worms, and fruit (Sallabanks and James 1999). Robins regularly nest and raise 2 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 on 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 Pennsylvania, the number of American robins observed during the BBS has shown an increasing trend estimated at 0.1% annually since 1966 and 0.6% annually from 2002 through 2012 (Sauer et al. 2014). A similar trend has been observed for the number of American robins observed in the eastern BBS region where the population has increased at an estimated 0.4% annually since 1966 and 0.4% from 2002 through 2012 (Sauer et al. 2014). The number of American robins observed in the Commonwealth during the CBC has shown a cyclical trend since1966 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of American robins to be 5.9million birds. Wilson et al. (2012) estimated the population in the Commonwealth at 2,900,000 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 4-50. From FY 2007 through FY 2012, WS lethally removed 121 American robins and used non-lethal methods to disperse an additional 4,464 American robins in the Commonwealth. WS also destroyed 80 American robin nests during this period. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of American robins during this period. From 2007 to 2012, 147

American robins, or 25 birds per year on average, were taken by all entities to alleviate damage and threats associated with these birds occurring within the Commonwealth.

Table 4-50. Number of American robins addressed in Pennsylvania 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	202	20	0	0
2008	62	20	0	0
2009	494	110	20	33
2010	623	205	36	36
2011	1,063	300	30	30
2012	2,020	300	35	48
TOTAL	**4,464**	**955**	**121**	**147**

[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 in the Commonwealth where they pose a hazard to aircraft. To address requests for assistance at airports, up to 500 American robins and 50 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The best available data estimates that the population of American robins in Pennsylvania has been estimated at between 2,900,000 (Wilson et al. 2012) and 5.9 million birds (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 500 American robins by WS under the proposed action alternative would represent anywhere from 0.01% to 0.02% of the estimated breeding population. From 2007 to 2012, 147American robins, or 25 robins per year on average, were taken by all entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would represent anywhere from 0.01% to 0.02% of the estimated population. The highest annual take level occurred in 2012 when all entities issued permits removed 48 robins to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.01% to 0.02% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 300 robins and authorized WS to take up to 500 robins, the cumulative take would represent 0.01% to 0.03% of the estimated statewide breeding population.

The take of American robins could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of American robins would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 50 American robin nests to alleviate damage or threats of damage would not be expected to adversely affect the population of American robins, which was addressed previously.

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). The European starling was first reported in the Commonwealth in 1904 and can now be found across the Commonwealth and throughout the year with highest densities in the Philadelphia metropolitan area and the Piedmont (Wilson et al. 2012). 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 mown or grazed fields (Cabe 1993). The diet of starlings consists of insects, fruits and berries, seeds, and spilled cultivated grain (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 that can evict native cavity nesting species (Cabe 1993, Wilson et al. 2012). In the absence of natural cavities, European starlings will nest in manmade structures, such as streetlights, mailboxes, and attics. (Cabe 1993). Although few conclusive studies have been conducted, evidence suggests European starlings have a detrimental effect on native species (Cabe 1993).

In Pennsylvania, the number of European starlings observed in the Commonwealth along routes surveyed during the BBS have shown a decreasing trend estimated at -1.4% annually since 1966 (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 (Sauer et al. 2014). The number of European starlings observed in the Commonwealth during the CBC has shown a generally stable trend since 1981-1982 (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population to be 2 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 4-51. From FY 2007 through FY 2012, WS lethally removed 379,655 European starlings and used non-lethal methods to disperse an additional 1,016,912 starlings in the Commonwealth. WS also destroyed 138 European starling nests during this period. Since starlings are non-native, they are afforded no protection under the MBTA and no depredation permit from the USFWS or the PGC is required to lethally remove those starlings causing damage. Reporting the take of starlings to the USFWS or the PGC is also not required. Therefore, the take of starlings by other entities to alleviate damage in the Commonwealth is unknown.

Table 4-51. Number of European starlings addressed by WS' in Pennsylvania from 2007 to 2012.

		WS' Take[1]	
Year	**Dispersed by WS[1]**	**Adults**	**Nests/Eggs[2]**
2007	55,878	4,302	1/0
2008	64,043	42,841	1/0
2009	118,140	82,704	13/14
2010	120,657	105,597	31/48
2011	186,430	117,062	59/16
2012	471,764	27,149	33/20
TOTAL	**1,016,912**	**379,655**	**138/98**

[1]Data reported by federal fiscal year

[2]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

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 1 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 200,000 starlings and 200 nests could be lethally taken annually by WS in the Commonwealth under the proposed action alternative. With a statewide population estimated at 2 million starlings, WS' proposed take of up to 200,000 annually would represent 10.0% 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 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 Pennsylvania, eastern meadowlarks can be found year round throughout the Commonwealth wherever there is adequate habitat (Jaster et al. 2012, Wilson 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). The diet of eastern meadowlarks consists largely of insects, supplemented by seeds and fruit (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 Pennsylvania are showing an overall declining trend since 1966 (National Audubon Society 2010). Similarly, according to BBS data, meadowlarks are showing a declining trend estimated at -4.4% annually since 1966 in Pennsylvania, with a -2.8% annual decline occurring from 2002 through 2012 (Sauer et al. 2014). The number of blocks in which eastern meadowlarks were observed declined by -15% between the first and second Pennsylvania BBA (Wilson et al. 2012). Meadowlarks are also showing a declining trend across the Eastern BBS Region estimated at -3.7% since 1966 (Sauer et al. 2014). The breeding population of eastern meadowlarks in the Commonwealth was estimated at 160,000 birds (Partners in Flight Science Committee 2013). Wilson et al. (2012) estimates the eastern meadowlark population in the Commonwealth as 178,000 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 4-52. From FY 2007 through FY 2012, WS lethally removed 16 eastern meadowlarks and used non-lethal methods to disperse an additional 344 meadowlarks in the Commonwealth. In addition to the take by WS, the USFWS issued depredation permits to other entities for the take of meadowlarks during this period. From 2007 to 2012, a total of 18 meadowlarks, or 3 meadowlarks per year on average, were taken by all entities to alleviate damage and threat associated with these birds occurring within the Commonwealth.

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 Pennsylvania originate from airports. To address requests for assistance at airports, up to 200 eastern meadowlarks and 20 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats.

The best available data estimates that the population of Eastern meadowlarks in Pennsylvania is anywhere from approximately 160,000 (Partners in Flight Science Committee 2013) to 178,000 birds (Wilson et al.

2012). Based on this estimate, the annual removal of up to 200 Eastern meadowlarks by WS under the proposed action alternative would represent 0.1% of the estimated breeding population. From 2007 to 2012, 18 eastern meadowlarks, or 3 meadowlarks per year on average, were taken by all entities in the Commonwealth. If the take by other entities remains stable, the average annual cumulative take by all entities under the proposed action alternative would represent 0.1% of the estimated population. The highest annual take level occurred in 2011 when all entities issued permits removed eight meadowlarks to alleviate damage. If the highest annual take by all entities were representative of the take that could occur in addition to take by WS, the cumulative take would represent 0.1% of the estimated breeding population in the Commonwealth. If the USFWS and the PGC continued to authorize other entities to take 175 meadowlarks and authorized WS to take up to 200 meadowlarks, the cumulative take would represent 0.2% of the estimated statewide breeding population.

Table 4-52. Number of eastern meadowlarks addressed in Pennsylvania 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	50	0	0
2008	3	62	0	0
2009	83	65	1	2
2010	11	125	3	3
2011	39	125	7	8
2012	208	175	5	5
TOTAL	**344**	**602**	**16**	**18**

[1]Data reported by federal fiscal year

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

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

The take of eastern meadowlarks could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of eastern meadowlarks would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 20 eastern meadowlarks nests to alleviate damage or threats of damage would not be expected to adversely affect the population of eastern meadowlarks, which was addressed previously.

RED-WINGED BLACKBIRD POPULATION IMPACT ANALYSIS

The red-winged blackbird is one of the most abundant bird species in North America, easily recognized by its distinctive red and yellow shoulder patches and loud gurgling "Konk-a-ree" call (Yasukawa and Searcy 1995). Red-winged blackbirds are a migratory bird species that can be observed throughout most of the United States year round (Yasukawa and Searcy 1995). In Pennsylvania, red-winged blackbird can be found in every county in the Commonwealth during the breeding season (Wilson et al. 2012). 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). Diet consists of spilled cultivated seeds, weed seeds, tree seeds, and insects (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).

In Pennsylvania, the number of red-winged blackbirds observed in the Commonwealth along routes surveyed during the BBS have shown a decreasing trend estimated at -1.2% annually since 1966, but a 0.1% annual increase from 2002 through 2012 (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 and -2.0% annually from 2002 through 2012 (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). During this period, the lowest number of red-winged blackbirds observed was 1,080 birds (1989–1990) and the greatest number of red-winged blackbirds observed was 549,675 birds (1999–2000) (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population red-winged blackbirds to be 1.2 million birds. Wilson et al. (2012) estimated the Commonwealth population at 2,320,000 birds.

The number of red-winged blackbirds taken or dispersed by WS to alleviate damage and threats as well is shown in Table 4-53. From FY 2007 to FY 2012, WS lethally removed 1,399 red-winged blackbirds and used non-lethal methods to disperse an additional 35,862 red-winged blackbirds in the Commonwealth. As discussed previously, 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 (Sobek 2010). Therefore, the number of red-winged blackbirds taken in the Commonwealth under 50 CFR 21.43 of the MBTA is unknown.

Table 4-53. Number of red-winged black birds addressed by WS' in Pennsylvania from 2007 to 2012.

Year	Dispersed by WS[1]	WS' Take[1]
2007	8,587	168
2008	9,408	169
2009	4,979	453
2010	2,840	111
2011	4,784	289
2012	5,264	209
TOTAL	**35,862**	**1,399**

[1]Data reported by federal fiscal year

Requests for WS' assistance with red-winged blackbirds in the Commonwealth 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 to 5,000 red-winged blackbirds and 20 nests could be taken by WS annually in Pennsylvania under the proposed action alternative.

The best available data estimates the population of red-winged blackbirds in the Commonwealth to be 1.2 million (Partners in Flight Science Committee 2013) to 2,320,000 birds (Wilson et al. 2012). Based on this estimate and a stable population trend, WS' proposed take of up to 5,000 red-winged blackbirds annually would represent 0.2% to 0.4% of the estimated statewide red-winged blackbird population. The take of red-winged blackbirds by other entities in the Commonwealth is unknown.

Given the limited magnitude of take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on red-winged blackbird populations. WS' take could be considered of low magnitude when compared to the number of red-winged blackbirds in the Commonwealth. 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.

COMMON GRACKLE POPULATION IMPACT ANALYSIS

Characterized by its yellow eyes and iridescent bronze or purple plumage, common grackles are a conspicuous bird (Peer and Bollinger 1997). 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 Pennsylvania, common grackles can be found across the Commonwealth and throughout the year (Peer and Bollinger 1997, Wilson et al. 2012). 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). Their diet includes insects and other invertebrates, eggs, young birds, spilled cultivated grain, seeds, and fruits (Peer and Bollinger 1997). Common grackles are social birds, nesting in colonies of up to 200 pairs and forming flocks with other blackbirds, which may exceed 1 million birds (Peer and Bollinger 1997).

In Pennsylvania, the number of common grackles observed in the Commonwealth along routes surveyed during the BBS have shown an annual declining trend estimated at -2.2% annually since 1966 and -2.1% annually from 2002 through 2012 (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 and -2.5% annually from 2002 through 2012 (Sauer et al. 2014). The population's distribution in the Commonwealth remained stable between the first and second Pennsylvania BBA (Wilson et al. 2012). The number of common grackles observed in the Commonwealth during the CBC has shown a stable trend since the early 1980s (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 2 million birds. Wilson et al. (2012) estimated the common grackle population in the Commonwealth at 1,520,000 birds.

The number of common grackles taken or dispersed by WS to alleviate damage and threats as well is shown in Table 4-54. From FY 2007 to FY 2012, WS lethally removed 147 common grackles and used non-lethal methods to disperse an additional 32,051 common grackles in the Commonwealth. As discussed previously, 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 (Sobek 2010). Therefore, the number of common grackles taken in the Commonwealth under 50 CFR 21.43 of the MBTA is unknown.

Table 4-54. Number of common grackles addressed by WS in Pennsylvania, FY 2007 - FY 2012

Year	Dispersed by WS[1]	WS' Take[1]
2007	134	5
2008	43	1
2009	1,238	35
2010	2,183	8
2011	168	23
2012	28,285	75
TOTAL	**32,051**	**147**

[1]Data reported by federal fiscal year

Requests for WS assistance with common grackles in the Commonwealth 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, crops, or livestock feed are damaged or consumed by common grackles (Dolbeer 1994, Glahn et al. 1999*a*). At five Pennsylvania aquaculture facilities, common grackles consumed trout valued between $2,047 and $23,286 from April-June 1996. 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 5,000 common grackles and 20 nests could be taken by WS annually in Pennsylvania under the proposed action alternative.

The best available data estimates the population of common grackles in the Commonwealth to be 1,520,000 birds (Wilson et al. 2012) to 2 million birds (Partners in Flight Science Committee 2013). Based on this estimate and a stable population trend, WS' proposed take of up to 5,000 common grackles annually would represent 0.3% of the estimated statewide population. The take of common grackles by other entities in the Commonwealth is unknown.

Given the limited magnitude of take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on common grackle populations. WS' take could be considered of low magnitude when compared to the number of common grackles in the Commonwealth. 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 common 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 United States (Lowther 1993). During the non-breeding season, their range is restricted to the pacific coast and to 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). Likely restricted to the range of bison (*Bison bison*) prior to the presence of European settlers, cowbirds were probably a common occurrence on the short-grass plains where they fed on insects distributed by foraging bison (Lowther 1993). As people began clearing forests for agriculture, cowbirds expanded their breeding range (Lowther 1993). In the Commonwealth, brown-headed cowbirds can be found statewide (Wilson et al. 2012). 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). The diet of brown-headed cowbirds includes insects and seeds (Lowther 1993). Brown-headed cowbirds are highly social and are a common component of mix-species blackbird flocks that may exceed 1 million birds (Lowther 1993, Peer and Bollinger 1997).

In Pennsylvania, the number of brown-headed cowbirds observed in the Commonwealth along routes surveyed during the BBS have shown a decreasing trend estimated at -2.1% annually since 1966 and -1.1% annually from 2002 through 2012 (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 -1.7% annually since 1966, with a -0.4% annual decline occurring between 2002 and 2012 (Sauer et al. 2014). The number of brown-headed cowbirds observed in the

Commonwealth during the CBC has shown a stable trend since the early 1980s (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 630,000 birds. Wilson et al. (2012) estimated the population at 520,000 birds.

The number of brown-headed cowbirds taken or dispersed by WS to alleviate damage and threats as well is shown in Table 4-55. From FY 2007 to FY 2012, WS lethally removed 2,341 brown-headed cowbirds and used non-lethal methods to disperse an additional 187,476 brown-headed cowbirds in the Commonwealth. As discussed previously, 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 (Sobek 2010). Therefore, the number of brown-headed cowbirds taken in the Commonwealth under 50 CFR 21.43 of the MBTA is unknown.

Table 4-55. Number of brown-headed cowbirds addressed by WS in Pennsylvania, FY 2007 - FY 2012

Year	Dispersed by WS[1]	WS' Take[1]
2007	15,490	302
2008	27,945	375
2009	12,445	285
2010	14,963	79
2011	59,212	624
2012	57,421	676
TOTAL	**187,476**	**2,341**

[1]Data reported by federal fiscal year

Requests for WS assistance with brown-headed cowbirds in the Commonwealth 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 Pennsylvania under the proposed action alternative.

The best available data estimates the population of brown-headed cowbirds in the Commonwealth to be 520,000 birds (Wilson et al. 2012) to 630,000 (Partners in Flight Science Committee 2013). Based on this estimate and a stable population trend, WS' proposed take of up to 5,000 brown-headed cowbirds annually would represent anywhere from 0.8% to 1.0% of the estimated statewide breeding population. The take of brown-headed cowbirds by other entities in the Commonwealth is unknown.

Given the limited magnitude of take proposed by WS to alleviate damage and threats, WS' proposed take should not have an adverse impact on brown-headed cowbirds populations. WS' take could be considered of low magnitude when compared to the number of brown-headed cowbirds in the Commonwealth. 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.

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 United States and throughout the year. In Pennsylvania, house sparrows can be found throughout the Commonwealth year round in suitable habitat (Wilson et al. 2012). 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). House sparrows aggressively compete with native birds for nesting habitat, destroying their eggs and young, and driving them away (Fitzwater1994). House sparrows are social birds, nesting in small colonies and forming flocks for feeding and roosting (Lowther and Cink 2006). House sparrow diet consists mostly of grain, seeds, insects, and human refuse (Lowther and Cink 2006).

The number of house sparrows observed along routes surveyed during the BBS has decreased at an annual rate of -2.1% and -3.7% since 1966 in Pennsylvania 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). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of house sparrows to be 1.6 million birds. Wilson et al. (2012) estimated the Commonwealth's population of house sparrows at 1,530,000 birds.

The number of house sparrows taken or dispersed by WS from FY 2007 to FY 2012 to alleviate damage and threats associated with these birds are shown in Table 4-56. From FY 2007 through FY 2012, WS lethally removed 577 house sparrows and used non-lethal methods to disperse an additional 207 house sparrows in the Commonwealth. WS also destroyed 195 nests during this period. 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 in the Commonwealth is unknown.

Table 4-56. Number of house sparrows addressed by WS' in Pennsylvania from 2007 to 2012.

		WS' Take[1]	
Year	**Dispersed by WS[1]**	**Adults**	**Nests/Eggs[2]**
2007	0	2	22/0
2008	0	7	18/0
2009	205	25	38/18
2010	0	54	30/6
2011	1	327	20/4
2012	1	162	67/24
TOTAL	**207**	**577**	**195/52**

[1]Data reported by federal fiscal year

[2]Eggs may be addled or oiled and placed back into the nest, therefore, eggs maybe taken when nests are not

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 200 nests could be lethally taken annually by WS in the Commonwealth under the proposed action alternative.
With a statewide population estimated at anywhere from 1,530,000 (Wilson et al. 2012) to 1.6 million (Partners in Flight Science Committee 2013) house sparrows, WS' proposed take of up to 1,000 annually would represent 0.1% of the statewide breeding 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 and control populations of invasive species that cause economic or environmental harm, or harm to human health.

HOUSE FINCH POPULATION IMPACT ANALYSIS

Historically, house finches only occurred along the west coast of North America (Badyaev et al. 2012). Then in the 1930s, birds were shipped east for sale in the pet trade (Badyaev et al. 2012). Birds were released or escaped and quickly colonized Long Island, New Jersey, and then southeastern Pennsylvania (Wilson et al. 2012). Today, house finches can be found year round throughout the Commonwealth with the exception of heavily forested areas (Badyaev et al. 2012). House finches have a fondness for nesting (as their name suggests) near, in, or on human structures (Badyaev et al. 2012). Prolific breeders, house finches lay two or more clutches per year, often nesting in loose colonies and maintaining flocks of up to 12 birds in the non-breeding season (Badyaev et al. 2012). Diet consists of seeds, fruit, leaves, buds, and other vegetative material (Badyaev et al. 2012).

In Pennsylvania, the number of house finches observed in the Commonwealth along routes surveyed during the BBS has increased at an annual rate of 11.2% since 1966; however, from 2002 through 2012, the number of house finches observed in areas of the Commonwealth surveyed during the BBS has declined -5.3% annually between 2002 and 2012 (Sauer et al. 2014). Similarly, the numbers of house finches observed along routes in the eastern BBS region have increased by 9.1% annually since 1966; however, from 2002 through 2012, the number observed in the eastern BBS region has declined -3.4% annually (Sauer et al. 2014). The number of house finches observed during the CBC has declined since the early 1990s (National Audubon Society 2010). Using data from the BBS, the Partners in Flight Science Committee (2013) estimated the statewide breeding population of house finches to be 1.1 million birds. Wilson et al. (2012) estimated the population of house finches in the Commonwealth at 840,000 birds.

The number of house finches taken or dispersed by WS and taken by other entities in the Commonwealth from FY 2007 to FY 2012 to alleviate damage and threats associated with these birds are shown in Table 4-57. From FY 2007 through FY 2012, WS lethally removed five house finches in the Commonwealth. WS also took three house finch nests during this period. To address requests for assistance, up to 50 house finches and 100 nests could be taken annually by WS under the proposed action alternative to alleviate damage and threats. The USFWS did not issue depredation permits to other entities for the take of house finches during this period.

Table 4-57. Number of house finches addressed in Pennsylvania 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	30	5	5
2012	0	30	0	0
TOTAL	**0**	**180**	**5**	**5**

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

The best available data estimates the population of house finches in the Commonwealth to be anywhere from 840,000 birds (Wilson et al. 2012) to 1.1 million (Partners in Flight Science Committee 2013). Based on this estimate, the annual removal of up to 50 house finches by WS under the proposed action alternative would represent 0.01% of the estimated breeding population. If the USFWS and the PGC continued to authorize other entities to take 30 house finches and authorized WS to take up to 50 house finches, the cumulative take would represent 0.01% of the estimated statewide breeding population.

The take of house finches could only occur when permitted by the USFWS and the PGC through the issuance of depredation permits. Therefore, all take, including take by WS, would be authorized by the USFWS and the PGC and occurs at the discretion of the USFWS and the PGC. The take of house finches would only occur at levels authorized by the USFWS and the PGC, which ensures cumulative take would be considered as part of population management objectives. The take of up to 100 house finches nests to alleviate damage or threats of damage would not be expected to adversely affect the population of house finches, which was addressed previously.

ADDITIONAL TARGET BIRD SPECIES

WS has addressed limited numbers of additional target species previously or WS anticipates addressing a limited number of additional species under the proposed action alternative. WS would primarily address those species to alleviate aircraft strike risks at airports in the Commonwealth. Requests for assistance associated with those species would often occur infrequently or would involve only a few individuals. WS anticipates addressing those requests for assistance using primarily non-lethal dispersal methods. Under the proposed action alternative, WS could receive requests for assistance to use lethal methods to remove those species when non-lethal methods were ineffective or were determined to be inappropriate using the WS Decision model. An example could include birds that pose an immediate strike threat at an airport where attempts to disperse the birds were ineffective. The target bird species that WS could address in limited numbers, after receiving a request for assistance associated with those species, would include those birds identified in Appendix B[15].

Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance, WS would not lethally remove more than 20 individuals annually of any of those species identified in Appendix B. In addition, to alleviate damage or discourage nesting in areas where damages were occurring, WS could destroy up to 20 nests annually of those species that nest in the Commonwealth. WS does not expect the annual take of those species to occur at any level that would

[15]Appendix B contains a list of the common and scientific names of those bird species that WS could address infrequently and/or in low numbers.

adversely affect populations of those species. Take would be limited to those individual birds deemed causing damage or posing a threat. The MBTA protects most of those bird species from take unless the USFWS permits the take pursuant to the Act. If the USFWS and the PGC did not issue a permit, no take would occur by WS. In addition, take could only occur at those levels stipulated in the permits.

Therefore, the take of those bird species would occur in accordance with applicable state and federal laws and regulations authorizing take of migratory birds and their nests and eggs, including the USFWS and the PGC permitting processes. The USFWS, as the agency with management responsibility for migratory birds, and the PGC, as the agency with management responsibility for birds in the Commonwealth, could impose restrictions on depredation take as needed to assure cumulative take does not adversely affect the continued viability of populations. This would assure that cumulative effects on those bird populations would not have a significant adverse impact on the quality of the human environment. In addition, WS would report annually to the USFWS and the PGC any take of the bird species listed in Appendix B in accordance with a federal and state permit.

As part of an integrated approach to managing damage, WS could destroy up to 20 nests and the associated eggs annually of those species that nest in the Commonwealth. People often consider nest and egg destruction methods as a non-lethal approach when conducted before the development of an embryo. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success and they will relocate to nest 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. WS would not use nest and egg removal as a population management method. WS would use nest and egg destruction to inhibit nesting in an area experiencing damage due to the nesting activity and WS would only employ nest and egg destruction at a localized level. As with the lethal removal of birds, the destruction of nests could only occur when authorized by the USFWS and the PGC, when required. Therefore, the number of nests that WS would remove annually would occur at the discretion of the USFWS and the PGC.

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

Under a technical assistance only alternative, WS would recommend an integrated methods approach similar to the proposed action alternative (Alternative 1); however, WS would not provide direct operational assistance under this alternative. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. In some instances, wildlife-related information provided to the requestor by WS could result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended.

When damage management options were discussed, WS could recommend and demonstrate for use both non-lethal and lethal methods legally available for use to alleviate bird damage. Those persons receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action.

Despite no direct involvement by WS in resolving damage and threats associated with birds in the Commonwealth, those persons experiencing damage caused by birds could continue to alleviate damage by employing those methods legally 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods would only be available to those persons with pesticide applicators licenses[16]. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, Starlicide™ Complete 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, which contains the same active ingredient as DRC-1339. Management actions taken by non-federal entities would be considered the *environmental status quo*.

Under this alternative, those persons experiencing threats or damage associated with birds could lethally remove birds. In order for the property owner or manager to use lethal methods, they must apply for their own depredation permit to take birds from the USFWS and the PGC, when required. Lethal removal of birds could continue to occur without a permit, during hunting seasons, under depredation/control orders, or through the issuance of depredation permits by the USFWS and the PGC. The USFWS issues permits for those species of birds protected under the MBTA, while the PGC issues permits for those species of birds, as well as wild turkey and ring-necked pheasant, which are protected under Commonwealth law. Technical assistance could also be provided by WS as part of the application process for issuing a depredation permit by the USFWS under this alternative, when deemed appropriate. WS could evaluate the damage and complete a Migratory Bird Damage Report for the requester, which would include information on the extent of the damages, the number of birds present, and a recommendation for the number of birds that should be taken to best alleviate the damages. Following USFWS review of a complete application for a depredation permit from a property owner or manager and the Migratory Bird Damage Report, a depredation permit could be issued by the USFWS to authorize the lethal take of a specified number of each bird species.

Therefore, under this alternative, the number of birds lethally taken would likely be similar to the other alternatives. Take could be similar since take could occur through the issuance of a depredation permit, take could occur under depredation/control orders, take of some bird species could occur without the need for a permit, and take would continue to occur during the harvest season for certain species.

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

With the oversight of the USFWS and the PGC, it is unlikely that bird populations would be adversely affected by implementation of this alternative. Under this alternative, WS would not be directly involved with damage management actions and direct operational assistance could be provided by other entities, such as the PGC, the USFWS, private entities, and/or municipal authorities. If direct operational assistance was not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – 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.

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

WS would not be involved with any aspect of bird damage management in the Commonwealth. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the PGC, the PDA, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, those people 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®, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those people with pesticide applicators licenses. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide™ Complete, 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 without the need for a permit, during hunting seasons, under depredation/control orders, or through the issuance of depredation permits by the USFWS and the PGC. The USFWS issues permits for those species of birds protected under the MBTA, while the PGC issues permits for those species of birds, as well as wild turkeys and ring-necked pheasants, which are 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 (*i.e.*, technical assistance) on how to address bird damage as part of the permitting process. When completing a Migratory Bird Damage Report for a requester, WS would evaluate the situation and then issue a recommendation describing the damage, species involved, number of individual birds involved, previous actions taken to address the problem, and recommendations on how to address the problem. Under this alternative, WS would not assist the requester in preparing the Migratory Bird Damage Report for submission to the USFWS. The USFWS does not have the mandate or the resources to conduct damage management activities. Therefore, Commonwealth agencies with responsibilities for migratory birds would likely have to collect the information needed to complete the Migratory Bird Damage Report. If the information were provided to USFWS by the PGC, they could review the application and make a determination as described in Alternative 1.

The number of birds lethally removed under this alternative would likely be similar to the other alternatives. Take would be similar since lethal removal could continue to occur without the need for a permit, during hunting seasons, under depredation/control orders, or through the issuance of depredation permits by the USFWS and the PGC. WS' involvement would not be additive to the lethal removal that could occur since the people 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 people 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.

As previously stated, WS would not be involved with any aspect of addressing damage or threats of damage caused by birds under this alternative. Management actions could be undertaken by a property owner or manager, provided by private entities, provided by volunteer services of private individuals or organizations, or provided by other entities, such as the USFWS and the PGC. If direct operational assistance and technical assistance were 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 people 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 (*e.g*., see White et al. 1989, USFWS 2001, FDA 2003).

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on non-target species, including threatened or endangered species. Potential adverse effects to non-target wildlife could occur from the employment of methods to address bird damage or threats of damage. Non-lethal methods have the potential to disperse non-target wildlife inadvertently, while lethal methods have the potential to inadvertently capture or kill non-target wildlife. To reduce the risk to non-target wildlife, including threatened or endangered species, persons employing damage management activities should select methods or implement methods in a specific way that targets the specific species causing the damage. For example, persons should implement methods in locations that are extensively, and if possible exclusively, used by the target species. Additionally, if captured, non-target species should be released.

The 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. Section 7 of 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.

Potential effects of damage management activities on populations of non-target wildlife species, including threatened or endangered species under the three alternatives are analyzed below. Species listed by the USFWS in the Commonwealth can be found in Appendix D while species listed by the Commonwealth can be found in Appendix E.

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 Pennsylvania. WS' personnel use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). As part of that thought process, WS' employees would consider the methods available and their potential to disperse, capture, or kill non-targets based on the use pattern of the method.

Personnel from WS would be experienced and trained in wildlife identification to identify damage or recognize damage threats. In addition, WS' employees would be knowledgeable in the use patterns of methods to select the most appropriate methods to address target animals and exclude non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that were as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse effects on non-targets are discussed in Section 3.3 and Section 3.4 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse effects to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, dispersal, and could include inadvertently live capturing non-target animals. Any exclusionary device erected to prevent access of target species also potentially excludes species that are not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded were large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by birds would also likely disperse non-targets in the immediate area the methods were employed. Therefore, non-targets could be dispersed from an area while employing non-lethal harassment and dispersal techniques. However, like target species, the potential impacts on non-target species would likely be temporary with target and non-target species often returning after the cessation of dispersal methods. Non-lethal dispersal and harassment methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal harassment and dispersal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species would be unharmed. The use of non-lethal harassment and dispersal methods would not have adverse impacts on non-target populations in the Commonwealth under any of the alternatives.

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

Nets could include the use of net guns, net launchers, cannon/rocket nets, drop nets, bow nets, dipping nets, and mist nets. Nets would virtually be selective for target individuals since application would occur by attending personnel, with handling of wildlife occurring after deployment of the net or nets would be checked frequently to address any live-captured wildlife. Therefore, any non-targets captured using nets could be immediately released on site. Any potential non-targets captured using non-lethal methods would be handled in such a manner as to ensure the survivability of the animal if released. Even though live-capture does occur from those methods, the potential for death of a target or non-target animal while being restrained or released does exist, primarily from being struck by the net gun/launcher weights, or cannon/rocket assemblies during deployment. The likelihood of non-targets being struck is extremely low and is based on being present when the net is activated and in a position to be struck. Nets would be positioned to envelop wildlife upon deployment and to minimize striking hazards. Baiting of the areas to attract target species often occurs when using nets. Therefore, sites could be abandoned if non-target use of the area was high.

Nest destruction would not adversely affect non-target species since identification of the nest would occur prior to efforts to destroy the nest. Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage could be employed to elicit fright responses in target bird species. When employing those methods to disperse or harass target species, any non-targets near those methods when employed would also likely be dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species would also exclude access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas by both target and non-target species where non-lethal methods were employed. Therefore, any use of non-lethal methods would have similar results on both non-target and target species. Although non-lethal methods do not result in lethal removal of non-targets, the use of non-lethal methods could restrict or prevent access of non-targets to beneficial resources. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods would often be temporary.

Only those repellents registered with the EPA pursuant to the FIFRA and registered with the PDA for use in the Commonwealth would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative effects on non-target species when used according to label requirements. Many taste repellents for birds are derived from natural ingredients that pose a very low risk to non-targets when exposed to or when ingested.

Two chemicals commonly registered with the EPA as bird taste repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes. Methyl anthranilate has been used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants, like aloe. Anthraquinone has also been used to make dye. Both chemicals claim to be unpalatable to many bird species. Several products are registered for use to reduce bird damage containing either methyl anthranilate or anthraquinone. Formulations containing those chemicals are liquids that are applied directly to susceptible resources. Methyl anthranilate applied to alleviate goose damage was effective for about four days depending on environmental conditions, which was a similar duration experienced when applying anthraquinone as geese continued to feed on treated areas (Cummings et al. 1995, Dolbeer et al. 1998). Dolbeer et al. (1998) found that geese tended to loaf on anthraquinone treated turf, albeit at lower abundance, but the quantity of feces on treated and untreated turf was the same, thus the risk of damage was unabated. Mesurol is applied directly inside eggs that are of a similar appearance to those being predated on by crows. Therefore, risks to non-target would be restricted to those wildlife species that would select for the egg baits. 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. Adherence to the label requirements of mesurol would ensure threats to non-targets would be minimal. Avitrol is a flock dispersing methods available to manage damage caused by house sparrows, blackbirds, crows, starlings, and pigeons. When used in accordance with the label requirements, the use of Avitrol would also not adversely affect non-targets based on restrictions on baiting locations (Shafer, Jr. et al. 1974).

The immobilizing drug alpha chloralose could be available to target waterfowl, geese, and pigeons. Immobilizing drugs could be applied through hand baiting that would target specific individuals or groups of target species. Therefore, immobilizing drugs would only be applied after identification of the target occurred prior to application. Pre-baiting and acclimation of the target species would occur prior to the application of alpha chloralose, which would allow for the identification of non-targets that may visit the site prior to application of the bait. All unconsumed bait would be retrieved after the application session had been completed. Since sedation occurs after consumption of the bait, personnel would be present on site at all times to retrieve target species. This constant presence by WS' personnel would allow for continual monitoring of the bait to ensure non-targets were not present. Based on the use pattern of alpha chloralose by WS, no adverse effects to non-targets would be expected from the use of alpha chloralose.

Since products containing the active ingredient nicarbazin could be commercially available and purchased by people with a certified applicators license, the use of the product could occur under any of the alternatives discussed in the EA; therefore, the effects of the use would be similar across all the alternatives if the product were used according to label instructions. Under the proposed action, WS could use or recommend products containing nicarbazin as part of an integrated approach to managing damages associated with geese, domestic waterfowl, and pigeons, if products were registered for use in Pennsylvania. A product containing the active ingredient nicarbazin is currently registered in the Commonwealth to manage local pigeon populations. Products containing nicarbazin are not currently registered in the Commonwealth for use to manage local goose and domestic waterfowl populations. WS' use of nicarbazin under the proposed action would not be additive since the use of the product could occur from other sources, such as private pest management companies or those people experiencing damage could become a certified applicator and apply the bait themselves when the appropriate depredation permits were received[17].

Exposure of non-target wildlife to nicarbazin could occur from direct ingestion of the bait by non-target wildlife or from secondary hazards associated with wildlife consuming birds that have eaten treated bait. Several label restrictions of products containing nicarbazin are intended to reduce risks to non-target wildlife from direct consumption of treated bait (EPA 2005). The labels require an acclimation period that habituates target birds to feeding in one location at a certain time. During baiting periods, the applicator must be present on site until all bait has been consumed. Non-target risks can be further minimized by requirements on where treated baits can be placed. All unconsumed bait must also be retrieved daily, which further reduces threats of non-targets consuming treated bait.

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

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

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

daily and receiving the appropriate levels of DNC and HDP daily to negatively impact reproduction, secondary hazards to wildlife from the use of nicarbazin were extremely low (EPA 2005).

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

Impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. Impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be low.

WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage damage caused by birds under this alternative would include shooting, lethal traps, and DRC-1339. In addition, birds could also be euthanized once live-captured by other methods. Available methods and the application of those methods to alleviate bird damage are further discussed in Appendix C. In addition, birds could still be lethally removed during the regulated harvest season, through depredation/control orders, and through the issuance of depredation permits under this alternative.

The use of firearms would essentially be selective for target species since birds would be identified prior to application; therefore, no adverse effects to non-targets would be anticipated from use of this method. The euthanasia of birds by WS' personnel would be conducted in accordance with WS Directive 2.505. Chemical methods used for euthanasia would be limited to carbon dioxide administered in an enclosed chamber after birds were live-captured. Since live-capture of birds using other methods would occur prior to the administering of carbon dioxide, no adverse effects to non-targets would occur under this alternative. WS' recommendation that birds be harvested during the regulated season by private entities to alleviate damage 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. Additionally, when appropriate, WS would use suppressed firearms to minimize noise and the associated dispersal effect that could occur from the discharge of a firearm.

As mentioned previously, the avicide DRC-1339 is only available for use by WS and would therefore only be available under the proposed action alternative. However, a product containing the same active ingredient, 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$), as DRC-1339, called Starlicide™, is commercially available as a restricted-use pesticide and would be available under any of the alternatives. A common concern with the use of DRC-1339 is the potential non-target risks. All label requirements of DRC-1339 would be followed to minimize non-target hazards. As required by the label, all potential bait sites would be pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets were observed feeding on the pre-bait, the plots would be abandoned and no baiting would occur at those locations. Treated bait would be mixed with untreated bait per label requirements when applied to bait sites to minimize the likelihood of non-targets finding and consuming bait that had been treated. The bait type selected can also limit the likelihood that non-target species would consume treated bait since some bait types would not be preferred by non-target species.

Once sites were baited, sites would be monitored daily to observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be abandoned. By acclimating target bird species to a feeding schedule, baiting could occur at specific times to ensure bait placed would be quickly consumed by target bird species, especially when large flocks of target species were present. The acclimation period would allow treated bait to be present only when birds were conditioned to be present at the site. An acclimation period would also increase the likelihood that treated bait would be consumed by the target species, which would make it unavailable to non-targets. In addition, when present in large numbers, many bird species 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 would only occur when treated bait was present at a bait location. WS would retrieve all dead birds, to the extent possible, following treatment with DRC-1339 to minimize secondary hazards associated with scavengers feeding on bird carcasses.

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 bout, (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})[18] 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 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 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

[18] 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.

(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). According to the EPA (1995), laboratory studies with raptors indicated no adverse effects when certain raptor species were fed starlings poisoned with 1% DRC-1339 treated baits. Two American Kestrels survived eating 11 and 60 poisoned starlings over 24 and 141 days, respectively. Two Cooper's Hawks ate 191 and 222 starlings with no observable adverse effects. Three Northern Harriers ate 100, 191, and 222 starlings over 75 to 104 days and survived with no apparent detrimental effects. The LD_{50} values established for other avian predators and scavengers such as crows, ravens, and owls indicate these species are acutely more sensitive to DRC-1339 than hawks and kestrels (EPA 1995). 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, Linz et al. 1999, Smith 1999). Smith (1999) used field personnel and dogs to search for dead non-target animals around sites baited with DRC-1339. Smith (1999) did not find carcasses of non-targets that exhibited histological signs consistent with DRC-1339 poisoning. 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; therefore, DRC-1339 degrades rapidly when exposed to sunlight, heat, or ultra violet radiation and has a short half-life (EPA 1995). 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.

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 suggest crows can travel from 100 meters (Kilham 1989) 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 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.

DRC-1339 is typically very unstable in the environment and degrades quickly when exposed to sunlight, heat, and ultraviolet radiation. The half-life of DRC-1339 in biologically active soil was estimated at 25 hours with the identified metabolites having a low toxicity (EPA 1995). DRC-1339 is also highly soluble in water, does not hydrolyze, and photo degrades 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). DRC-1339 binds tightly with soil; thus, is considered to have low mobility (EPA 1995). Given the best environmental fate information available and the unlikelihood of a non-target locating enough treated bait(s) sufficient to produce lethal effects, the risks to non-targets from crows caching treated bait would be low. Treated bait would be mixed with untreated bait before baiting an area. Mixing treated bait with untreated bait would minimize non-target hazards and reduce the likelihood of the target species developing bait aversion. Since treated bait is diluted, often times up to 1 treated bait for every 25 untreated baits, the likelihood of a crow selecting treated bait and then caching the bait is further reduced.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by birds, the use of such methods can result in the incidental take of unintended species. Those occurrences would be rare and should not affect the overall populations of any species under the proposed action. WS' take of non-target species during activities to reduce damage or threats to human safety associated with birds in Pennsylvania would be expected to be extremely low to non-existent. Non-targets have not been lethally removed by WS during prior activities targeting birds in the Commonwealth. WS would monitor the take of non-target species to ensure program activities or methodologies used in bird damage management do not adversely affect non-targets. Methods available to alleviate and prevent bird damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the USFWS and/or the PGC any non-target take to ensure take by WS is considered as part of management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered minimal to non-existent.

The proposed bird damage management could benefit many other wildlife species that were adversely affected by predation or competition for resources. For example, crows are generally very aggressive nesting area colonizers and they will force other species from those nesting areas. American crows and fish crows often feed on the eggs, nestlings, and fledglings of other bird species. Fish crows are known to feed heavily on colonial waterbird eggs (McGowan 2001). This alternative has the greatest possibility of successfully reducing bird damage and conflicts to wildlife species since all available methods could possibly be implemented or recommended by WS.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. SOPs to avoid T&E effects are described in Chapter 3 of this EA.

***Federally Listed Species* -** The current list of species designated as threatened or endangered in Pennsylvania as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix D contains the list of species currently listed in the Commonwealth along with common and scientific names.

Based on a review of those T&E species listed in the Commonwealth during the development of the EA, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect those species listed in the Commonwealth by the USFWS and the National Marine Fisheries Services nor their critical habitats. As part of the development of the EA, WS consulted with the USFWS under Section 7 of the ESA. The USFWS concurred with WS' determination that activities conducted pursuant to the proposed action would not likely adversely affect those species currently listed in the Commonwealth or their critical habitats (L. Zimmerman, Project Leader/Supervisor, USFWS, pers. comm. 2014).

Commonwealth Listed Species – The current list of Commonwealth listed species designated as endangered or threatened by the PGC was reviewed during the development of the EA (see Appendix E). Based on the review of species listed in the Commonwealth, WS has determined that the proposed activities would not likely adversely affect those species currently listed by the Commonwealth. The PGC has concurred with WS' determination for Commonwealth listed species and WS will follow those recommendations provided during the consultation regarding listed species (D. Brauning, Wildlife Diversity Chief, PGC, pers. comm. 2014).

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 in Alternative 1. This includes the recommendation and demonstration of both non-lethal and lethal methods, as well as the issuance of Migratory Bird Damage Reports. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide. 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 and the PGC. 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, bird populations in the Commonwealth would not be directly impacted by WS from a program implementing technical assistance only.

As previously stated, WS would not implement management actions under this alternative. Management actions could be undertaken by a property owner or manager, provided by private entities, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the PGC. 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 or 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

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 in the Commonwealth. Therefore, WS would have no direct impact to non-targets or threatened or 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 PGC, the PDA, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, 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®, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, called Starlicide™, is commercially available as a restricted-use pesticide.

Lethal take of birds could continue to occur either without a permit, during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS and the PGC. The

USFWS issues permits for those species of birds protected under the MBTA while the PGC issues permits for those species of birds, including wild turkey and ring-necked pheasant, protected under Commonwealth law. 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.

As previously stated, WS would not be involved with any aspect of addressing damage or threats of damage caused by birds under 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 PGC. Potential impacts to non-target species, including threatened or 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 encountering 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)

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 Pennsylvania. 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. WS response to requests for assistance is dependent upon those persons initiating the request. Those persons receiving technical assistance can 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, 5) use volunteer services of private individuals or organizations, or 6) use the services of WS (direct operational assistance) when available.

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). This includes considering risks to human safety. Methods deemed practical for the situation are then developed into a management strategy. As mentioned previously, 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. Potential harmful effects are also minimized because 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 human health and safety.

SOPs that would be integrated into the relevant alternatives were discussed in Chapter 3. Those SOPs would ensure risks to human health and safety were reduced or prevented under the proposed action alternative. Pertinent SOPs would include the WS' Decision Model, which is an evaluation process for the appropriateness of methods (see WS Directive 2.101) and the use of integrated management (see WS Directive 2.105) mentioned in the previous paragraph. In addition, WS would identify hazards in advance of work assignments and would provide employees with Personal Protective Equipment (PPE), when necessary. 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 (see 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). If that were not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early mornings, at night).

All of the methods listed in Appendix C would be available under this alternative although not all methods would be available for direct implementation by all persons. Mesurol®, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators licenses. 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 would exist from the use of non-lethal non-chemical methods, when used appropriately and with consideration of possible risks, those 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) could all 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 (*e.g.*, 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 poles, to human health and safety are greater. However, proper application of cannon/rocket nets, net guns, and padded-jaw poles 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 they are provided with (see 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 person's against their misuse.

With the exception of alpha-chloralose and Mesurol®, all non-lethal chemical methods would be available under all the alternatives. Under the proposed action, non-lethal chemical methods used or recommended by WS would be registered as required by the FIFRA (see Appendix C). When recommending these methods, WS would caution those person's against their misuse. WS' personnel that use restricted-use chemical methods would be certified as pesticide applicators by the Commonwealth of Pennsylvania and would be required to adhere to all certification requirements set forth in FIFRA, the Pennsylvania pesticide control laws and regulations, and WS Directive 2.401. As previously mentioned, alpha-chloralose, an immobilizing drug, may be used only by WS personnel who have been trained and certified in its use and whom are required to wear appropriate PPE they are provided with (see WS Directive 2.601 and Appendix C). Application would involve single bread or corn baits being fed directly to target birds. Immobilized birds and uneaten baits are then retrieved. Pursuant to FDA restrictions, waterfowl captured with alpha chloralose for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days, at which time the birds may be killed and processed for human consumption. Alternatively, if a bird is going to be relocated, it can be released once the effects of the drug wears off (about 10 hours) or if drug application occurs during or 30 days prior to a regulated hunting season for that species the birds must be held alive for at least 30 days prior to their release. Risks to human safety would be minimal since alpha chloralose would be monitored at the application site and treated bait would be fed directly to target species. In addition, uneaten bait would be retrieved by WS' personnel. Alpha chloralose could be used to live-capture waterfowl that are harvestable during hunting season. Waterfowl that could be harvested for human consumption must be held captive until the drug has exited their system or euthanized. Similarly, 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). 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 and then placing the eggs in artificial nests or upon elevated platforms. 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 and a removal and disposal process for unconsumed or unused treated eggs.

All of the lethal methods listed in Appendix C would be available for use or recommendation under this alternative including shooting or the recommendation of shooting or hunting. 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. Questions have arisen about the deposition of lead into the environment from ammunition used in firearms. Lead is a metal that can be poisonous to humans. Risk of lead exposure to humans occurs primarily when they ingest lead. To minimize risk to humans, WS would use non-toxic shot as required by the USFWS. 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 and would therefore only be available under the proposed action alternative. However, a product containing the same active ingredient, 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$), 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. Following label requirements of DRC-1339 would reduce these risks. When recommending the use of Starlicide™, WS would caution against its misuse. Under the proposed action, WS' personnel that use DRC-1339 would be certified as pesticide applicators by the Commonwealth of Pennsylvania and be required to adhere to all certification requirements set forth in FIFRA and Pennsylvania pesticide control laws and regulations. WS would follow all label requirements. WS would remove and disposed of all unconsumed bait material in accordance with federal, Commonwealth, and local laws. To limit the possibility that the public is exposed to birds which have 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. Given the strict application requirements for DRC-1339 and Starlicide, 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.

As mentioned previously, direct operational assistance would only be conducted by WS after a memorandum of understanding, work initiation document, 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. Therefore, persons requesting assistance would be aware of the methods being used on property they own or manage, which would assist in identifying any risks to human health and safety associated with those methods.

WS would only use legal, effective, and environmentally safe methods, tools, and approaches. Chemical methods employed by WS would be regulated by the EPA through FIFRA, the FDA, the PDA, by MOUs with land managing agencies, and by WS' Directives. WS would properly dispose of any excess solid or hazardous waste. It is not anticipated that this alternatives would result in any adverse or disproportionate environmental impacts to minority and low-income people or populations. In contrast, two of the alternatives analyzed in detail may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

The proposed bird damage management program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

Many of the non-chemical methods available would only be activated when triggered by attending personnel (*e.g*., cannon nets, firearms, pyrotechnics, lasers), are passive live-capture methods (*e.g*., walk-in style live-traps, mist nets), or are passive harassment methods (*e.g*., effigies, exclusion techniques, anti-perching devices, electronic distress calls).

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. Technical assistance would be provided as described above in Alternative 1. This includes the recommendation and demonstration of both non-lethal and lethal methods, as well as the issuance of Migratory Bird Damage Reports. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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.

As previously stated, WS would not implement management actions under 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 PGC. 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 the inappropriate use of methods, which could lead to real but unknown effects on human health and safety. 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 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 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 in the Commonwealth. 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 PGC, the PDA, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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.

As previously stated, WS would not be involved with any aspect of addressing damage or threats of damage caused by birds under 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 PGC. Potential impacts to human health and safety would be variable under this alternative. If direct operational assistance and technical assistance was 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 which could have real but unknown effects on human health and safety. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (*e.g.*, see White et al. 1989, USFWS 2001, FDA 2003). 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 – Effectiveness of Bird Damage Management Activities

A common issue when addressing wildlife damage is the effectiveness of the activities being employed to alleviate damage. The effectiveness of any wildlife damage management program can be defined in terms of; 1) the accurate identification of the species causing the damage; 2) the knowledge of available methods; 3) the selection of the most appropriate method or methods; 4) the correct implementation of those methods; 5) the reduction of or mitigation of damage and or the elimination of threats and the potential for threats; 6) damage prevented or eliminated. To realize this effectiveness, management actions must be conducted expeditiously in a humane manner that minimizes harm to humans, non-target wildlife, and the environment. The most effective approach to any damage management problem is to use an adapted integrated approach that may call for the use of several methods simultaneously or sequentially (Courchamp et al. 2003). This approach is commonly known as integrated management. The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. The goal of wildlife damage management is to reduce damage or threats caused by wildlife, not necessarily to reduce or eliminate wildlife populations. However, localized short-term population reduction is a possible outcome until new individuals immigrate or are born to animals remaining at the site (Courchamp et al. 2003). The ability of wildlife populations to sustain a certain level of removal and eventually return to pre-management levels does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on wildlife populations.

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 Pennsylvania. 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. 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 methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, 5) use volunteer services of private individuals or organizations, or 6) use the services of WS (direct operational assistance) when available.

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 in an adaptive integrated approach. As part of this approach, the effectiveness of bird management activities is continually evaluated. If assessment shows methods are ineffective, those methods are discontinued and additional methods are evaluated for use and application.

Under the proposed action, an adaptive integrated approach would be used by WS for providing both technical assistance and direct operational assistance.

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 in Alternative 1. This includes the recommendation and demonstration of both non-lethal and lethal methods, as well as the issuance of Migratory Bird Damage Reports. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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. The effectiveness of methods under this alternative would be similar to the other alternatives since many of the same methods would be available.

As previously stated, WS would not implement management actions under 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 PGC. If methods are employed as intended with regard to the bird species causing damage, those methods are likely to be effective in resolving damage. The demonstration of methods and the provision of information on bird behavior by WS in the form of technical assistance under this alternative are likely to increase the effectiveness of the methods employed by those requesting assistance. However, if methods were employed without guidance from WS or applied inappropriately, the effectiveness of methods could be reduced.

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 in the Commonwealth. Therefore, WS would have no direct impact on the effectiveness of bird damage management activities under this alternative. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the PGC, the PDA, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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.

As previously stated, WS would not be involved with any aspect of addressing damage or threats of damage caused by birds under this alternative. Management actions could be undertaken by a property owner or manager, provided by private entities, provided by volunteer services of private individuals or organizations, or provided by other entities such as the USFWS and the PGC. If methods are employed as intended with regard to the bird species causing damage, those methods are likely to be effective in resolving damage. However, if methods were employed without guidance from WS or applied inappropriately, the effectiveness of methods could be reduced.

Issue 5 – 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. As previously stated, with the exception of Mesurol, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under all alternatives. 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)

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 Pennsylvania. 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. WS response to requests for assistance is dependent upon those persons initiating the request. Those persons receiving technical assistance can 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, 5) use volunteer services of private individuals or organizations, or 6) use the services of WS (direct operational assistance) when available.

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 Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators licenses. However, a product containing the same active ingredient as DRC-1339, 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.

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.

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. Under the proposed action alternative, WS would continue to evaluate methods and activities to minimize the pain and suffering.

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.

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, immobilizing chemicals, 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. Under the proposed action, when live-capture devices are deemed appropriate, WS' personnel would be present on-site during capture events or methods would be checked at least once every 24 hours 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.

Alpha chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl, and other birds. Alpha chloralose is only available for use by WS and therefore would only be available for use under this alternative. Although overdosing waterfowl with alpha chloralose can cause death, WS would employ alpha chloralose as a non-lethal method only. When using alpha chloralose, WS' personnel would be present on site to retrieve birds that become sedated.

Some concern occurs that waterfowl may drown if sedation occurs while they are loafing on water. WS would ensure that a boat and/or a canoe were available for quick retrieval of birds that become sedated while in the water (for additional details see Appendix C).

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 Canada goose and 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*b*, Avery et al. 2008). Nicarbazin has been characterized as a veterinary drug since 1955 by the FDA and used to 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 was recently registered by WS (for WS use only) as a bird repellent to deter predation by crows and ravens on eggs of threatened or 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, 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$), 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 2013). The use of cervical dislocation or carbon dioxide for euthanasia would occur after the bird 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 2013). 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 Appendix C would be available under all alternatives. However, a product containing the same active ingredient (3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$)), 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 $C_7H_9Cl_2N$ 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). $C_7H_9Cl_2N$ 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 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.

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use and recommendation of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. With the exception of Mesurol, alpha chloralose, and DRC-1339, all the methods listed in Appendix C would be available for use under all the alternatives. However, Starlicide, a product containing the same active ingredient as DRC-1339, would be available for use under all the alternatives. Therefore, the issue of humaneness associated with methods would be similar across any of the alternatives since those methods could be employed under any of the alternatives. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that ensure WS use methods as humanely as possible under the proposed action alternative are listed in Chapter 3.

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 in Alternative 1. This includes the recommendation and demonstration of both non-lethal and lethal methods, as well as the issuance of Migratory Bird Damage Reports. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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 WS recommending methods and 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. If monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering, and if not addressed timely, could experience distress. The amount of time an animal is restrained under 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 determine 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 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 in the Commonwealth. All requests for assistance received by WS to resolve damage caused by birds would be referred to the USFWS, the PGC, the PDA, and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, 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, alpha chloralose, and DRC-1339, all methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons because several chemical methods are only available to those persons with pesticide applicators licenses. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and therefore would be unavailable for use under this alternative. However, a product containing the same active ingredient as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide.

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 6 – 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. 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)

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 Pennsylvania. 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. 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 methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, 5) use volunteer services of private individuals or organizations, or 6) use the services of WS (direct operational assistance) when available.

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 in the Commonwealth. That authority rests with the USFWS and the PGC. 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 and the PGC.

Direct operational assistance would only be conducted by WS after a request for assistance was received and after a memorandum of understanding, work initiation document, 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.

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 in Alternative 1. This includes the recommendation and demonstration of both non-lethal and lethal methods, as well as the issuance of Migratory Bird Damage Reports. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 in the Commonwealth. The USFWS and the PGC, with management authority over birds, 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 PGC. 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 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 in the Commonwealth. 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 PGC, the PDA, and/or private entities. Despite no involvement by WS in resolving damage and threats associated with birds in the Commonwealth, 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 in the Commonwealth. The USFWS and the PGC, with management authority over birds, 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 PGC. 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 7 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

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. 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 that are harvestable during regulated hunting seasons in the Commonwealth include: Canada geese, Atlantic brant, free-ranging domestic and feral waterfowl, mute swan, snow geese, mallard, American black duck, wood duck, northern pintail, gadwall, American wigeon, Northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, greater scaup, lesser scaup, ring-necked duck, long-tailed duck, white-winged scoter, black scoter, common goldeneye, bufflehead, hooded merganser, common merganser, ruddy duck, wild turkey, ring-necked pheasant, American coot, Wilson's snipe, American woodcock, 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 alternative, the proposed level of take for species that 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' populations 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 that 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. The USFWS uses its authority to issue frameworks for the take of migratory game birds to state wildlife agencies, such as the PGC. These frameworks include the allowable length of hunting seasons, methods of take, and allowed take, which are implemented by the state wildlife agency. The PGC is responsible for establishing and enforcing hunting seasons for bird species, such as wild turkey and ring-necked pheasant, 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 PGC, the lethal removal of birds by WS or the recommendation of hunting by WS under the proposed action alternative would not substantially limit the ability to harvest birds during the regulated harvest season. All take by WS would be reported to the USFWS and the PGC annually to ensure take by WS was incorporated into population management objectives established for harvestable bird populations. Based on the limited take proposed by WS and the oversight by the USFWS and the PGC, 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. Technical assistance would be provided as described above in Alternative 1. This includes the recommendation of harassment techniques that disperse birds and the recommendation of harvesting birds during the regulated hunting season. Under this alternative, those persons receiving technical assistance could 1) take no action, 2) choose to implement methods recommended by WS on their own, 3) choose to implement methods not recommended by WS' on their own, 4) use the services of a private nuisance wildlife control agent, or 5) use volunteer services of private individuals or organizations. 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 that are less accessible to hunters. However, it is also possible birds would be dispersed from areas less accessible to hunters to areas that are more accessible to hunters. The recommendation of dispersal methods by WS would not affect 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 PGC. 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 PGC determine the number of birds that may be taken.

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 in the Commonwealth. 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 in the Commonwealth, 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 and the PGC.

4.2 CUMULATIVE EFFECTS OF THE PROPOSED ACTION BY ISSUE

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 in the Commonwealth. However, other federal, Commonwealth, and private entities could also be conducting bird damage management activities in the Commonwealth. As stated previously, lethal take of birds can occur either: without a permit, during hunting seasons, under depredation orders, or through the issuance of depredation permits by the USFWS and the PGC. Therefore, take can occur not only by WS but also by other public and private entities, as well as individuals.

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 or B) the aggregate effects of WS' activities over a short or extended period. Through ongoing coordination and collaboration between WS, the USFWS, and the PGC, the activities of each agency and the take of birds during hunting seasons, under depredation orders, or under depredation permits would be available. Damage management activities would be monitored to ensure they are within the scope of analysis of this EA.

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. WS' actions would happen over short or extended periods simultaneously with other natural processes and other human impacts. These processes and impacts include but are not limited to:

- The natural mortality of birds
- bird-vehicle collisions, bird-aircraft collisions, bird-tower (*e.g*. radio, windmill) collisions, and bird collisions with other made structures (*e.g*., windows)
- illegal take
- take of birds during regulated hunting seasons
- take under depredation orders or permits
- natural and human-induced alterations of habitat
- human introductions of birds into non-native areas
- natural annual and perennial cycles in bird populations

All these factors play a role in the dynamics of bird populations. In many circumstances, requests for WS' assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken or recommended by WS under the proposed action alternative to minimize or eliminate damage would be constrained in scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the species and the environment. WS' personnel use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model and described by Slate et al. (1992). The Model allows WS to take into consideration environmental processes and impacts, such as those listed above, in order to avoid cumulative adverse impacts on target species.

WS' has no authority to regulate take or the harassment of birds in the Commonwealth. That authority rests with the USFWS and the PGC. Under the proposed action, these agencies would continue to adjust take levels based on population objectives for target 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 continue to be regulated and adjusted by the USFWS and the PGC. The USFWS and the PGC considers all known take when determining population objectives for birds and could adjust the number of birds that could be taken during the regulated hunting season and the number of birds taken for damage management purposes to achieve population objectives. Take by WS would be authorized by the USFWS or the PGC and would occur at their discretion. Consultation and reporting of take by WS under the proposed action would ensure the USFWS and the PGC considers any activities conducted by WS. Any target bird population declines or increases induced through the regulation of take would be the collective objective for bird populations established by the USFWS and the PGC. Therefore, the cumulative take of birds annually or over time by WS would occur at the discretion of the USFWS and the PGC as part of their management objectives for birds in the Commonwealth. No cumulative effects on target bird populations would be expected from WS' damage management activities based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

As outlined in Chapter 3, under the proposed action / no action alternative, damage management activities would continue to be conducted by WS. Currently, WS monitors its activities to ensure any potential impacts are identified and addressed. In addition, WS would work closely with Commonwealth and federal resource agencies to ensure damage management activities were not adversely affecting bird populations and that WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage birds in Pennsylvania have not reached a magnitude that would cause adverse impacts to bird populations in the Commonwealth.

Standard Operating Procedures

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

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on non-target species, including threatened or endangered species. Potential adverse effects to non-target wildlife occur from the employment of activities to address bird damage or threats of damage. 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.

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 Pennsylvania.
As mentioned previously, WS uses an adaptive integrated approach for providing both technical assistance and direct operational assistance. The philosophy behind this approach 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. Potential harmful effects are also minimized because 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-target species, including threatened or endangered species. Additionally, SOPs for bird damage management in Pennsylvania, discussed in Chapter 3, ensure risks to non-target wildlife species, including threatened or endangered species, would be reduced or prevented under the proposed action alternative. Pertinent SOPs include not only the WS' Decision Model, an evaluation process for the appropriateness of methods, and the use of integrated management, 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 or 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 and the PGC to determine the potential risks to federally and Commonwealth listed threatened or endangered species in accordance with the ESA and Commonwealth laws. Non-lethal methods are given priority when addressing requests for assistance. 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.

All of the methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators licenses. 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.

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 affecting that species. However, exclusion devices are usually limited to small, high-value areas and not used to the extent that non-targets would be excluded from large areas that would cumulatively affect non-target populations. 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. Under the proposed action, 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 cumulative impacts to non-target populations would occur. Other non-lethal methods available for use under any of the alternatives are live capture traps (see Appendix C). Under the proposed action, 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 and no long term impacts would occur. Egg and nest destruction is another non-lethal method that could be used under any of the alternatives (see Appendix C). WS personnel are trained and experienced in wildlife identification. Under the proposed action alternative, 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 alpha-chloralose and Mesurol, all non-lethal chemical methods would 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 FIFRA (see Appendix C). Under the proposed action, WS' personnel that use restricted-use chemical methods would be certified as pesticide applicators by the Commonwealth of Pennsylvania and would be required to adhere to all certification requirements set forth in FIFRA and Pennsylvania pesticide control laws and regulations. As previously mentioned, alpha-chloralose, an immobilizing drug, may be used only by WS personnel who have been trained and certified in its use (see Appendix C). Since alpha chloralose is monitored at the application site, fed directly to target species, and uneaten baits are retrieved, there are no potential cumulative impacts to non-targets. For a discussion of specific application requirements of alpha chloralose as they relate to excluding non-targets, please refer to Chapter 4, section 4.1, issue 2, alternative 1. Similarly, 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). Following label requirements of Mesurol would eliminate any short or long-term cumulative risks 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 cumulative impacts on non-target populations of wildlife, including threatened or endangered, species under this alternative.

As previously stated, lethal methods have the potential to inadvertently capture or kill non-target wildlife. All of the lethal methods listed in Appendix C would be available under this alternative. In cases where shooting were selected as an appropriate method, identification of an individual target would occur prior to application, eliminating cumulative impacts to non-targets. Birds causing damage or posing threats could be lethally removed with firearms under any of the alternatives. Questions have arisen about the deposition of lead into the environment from ammunition used in firearms. Lead is a metal that can be poisonous to non-targets. Risk of lead exposure to non-targets occurs primarily when they ingest lead shot or bullet fragments. To address this problem, WS would use non-toxic shot as required by the USFWS. WS would also retrieve birds after damage management activities and dispose of them in accordance with WS Directive 2.515 to alleviate the risk to non-targets that may scavenge and consume those lethally removed birds and the lead shot or bullet fragments that they contain. Given these precautions, the low amounts of lead that could be deposited from damage management activities and ingested by non-target wildlife would have no cumulative effects under the proposed action alternative. WS' recommendation that hunting or shooting be used would not increase cumulative impacts 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. Under the proposed action alternative, birds could be euthanized after being trapped using the non-lethal live capture traps described in the previous paragraph and in Appendix C. All euthanasia methods available under the proposed action alternative would also be available under the other alternatives. As detailed in Appendix C, euthanasia could occur via shooting (as discussed above), carbon dioxide, or cervical dislocation. WS personnel are trained and experienced in wildlife identification. Under the proposed action alternative, WS would identify the species of bird responsible for causing damage prior to the initiation of an evaluation process for the appropriateness of methods (WS Directive 2.101). Non-target species are therefore known prior to the initiation of non-lethal capture methods and can be released prior to euthanasia, which occurs subsequent to live capture. Therefore, no cumulative 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.

As mentioned previously, the avicide DRC-1339 is only available for use by WS and would therefore only be available under the proposed action alternative. However, a product containing the same active ingredient, 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$), as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide and would be available under any of the alternatives. Although DRC-1339 and Starlicide are highly toxic to sensitive species, it is only slightly toxic to non-sensitive birds (EPA 1995, Schafer 1981, Schafer 1991). Following label requirements of DRC-1339 and Starlicide eliminates any short or long term cumulative risks to non-target species. For a discussion of specific label requirements and toxicity of DRC-1339 and Starlicide as they relate to non-targets, please refer to Chapter 4, Section 4.1, Issue 2, Alternative 1.

Special efforts are made to avoid jeopardizing threatened or endangered species. Species listed by the USFWS in the Commonwealth can be found in Appendix D, while species listed by the Commonwealth can be found in Appendix E. These lists were obtained and reviewed during the development of this EA. Based on a review of these lists, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect those species nor their critical habitats. As part of the development of this EA, WS consulted with the USFWS and the PGC to determine potential risks to federally and Commonwealth listed threatened or endangered species in accordance with the ESA and Commonwealth laws. The USFWS concurred with WS' determination that activities conducted pursuant to the proposed action would not likely adversely affect those species currently listed or their critical habitats (L. Zimmerman, Project Leader/Supervisor, USFWS, pers. comm. 2014). The PGC has reviewed the EA and concurred with WS' determination (D. Brauning, Wildlife Diversity Chief, PGC, pers. comm. 2014).

The employment of methods by WS under the proposed action alternative would not cumulatively affect non-target species, including threatened or endangered 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 PGC to determine the potential risks to federally and Commonwealth listed threatened or 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 cumulative impacts to non-target species, including threatened or endangered species, from the recommendation of methods by WS under the proposed action alternative is expected to 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 be low. 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.

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 could occur to persons employing methods and persons encountering methods. Risks can be inherent to the method itself or related to the misuse of the method.

WS' personnel would use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). This would include considering risks to human safety. WS would use an adaptive integrated methods approach under the proposed action alternative. The philosophy behind this approach would be to implement methods in the most effective manner while minimizing the potentially harmful effects to people, target and non-target species, and the environment. Potential harmful effects would also be minimized because WS would continually monitor, evaluate, and make modifications as necessary to methods or strategies when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to human health and safety.

Additionally, those SOPs discussed in Chapter 3 would be incorporated by WS into activities conducted under the proposed action alternative to ensure risks to human health and safety would be reduced or prevented. WS would identify hazards in advance of work assignments and would provide employees with PPE appropriate to the activities. WS' employees would adhere to safety requirements and use the appropriate PPE. WS' employees would be required to work cooperatively to minimize hazards and immediately report unsafe working conditions (see 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). If that were not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early mornings, at night).

All of the methods listed in Appendix C would be available under this alternative, although not all methods would be available for direct implementation by all persons. Mesurol, alpha chloralose, and DRC-1339 are only available for use by WS and several other chemical methods are only available to those persons with pesticide applicators licenses. 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. 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 they are provided with (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 person's against their misuse.

With the exception of alpha-chloralose and Mesurol®, all non-lethal chemical methods would be available under all the alternatives. Under the proposed action alternative, non-lethal chemical methods used or recommended by WS would be registered as required by the FIFRA (see Appendix C). When recommending those methods, WS would caution those person's against their misuse. WS' personnel that use restricted-use chemical methods would be certified as pesticide applicators by the Commonwealth of Pennsylvania and would be required to adhere to all certification requirements set forth in the FIFRA, the Pennsylvania pesticide control laws and regulations, and WS Directive 2.401. As previously mentioned, alpha-chloralose may be used only by WS' personnel who have been trained and certified in its use. When using or handling alpha chloralose, personal would be required to wear appropriate PPE (see WS Directive 2.601 and Appendix C).

Since alpha chloralose would be monitored at the application site, fed directly to target species, any uneaten baits would be retrieved, and waterfowl that could be harvested for human consumption must be held captive until the drug has exited their system, there would be no potential cumulative impacts to human health and safety. Similarly, 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 would be provided with (WS Directive 2.601) (see Appendix C). Mesurol is a repellent used to deter crows and ravens predating the eggs of threatened or endangered species (see Appendix C). Following label requirements of mesurol would eliminate the risk to human health and safety.

All of the lethal methods listed in Appendix C would be available for use or recommendation under this alternative, including shooting or the recommendation of shooting and hunting. When used appropriately and with consideration of human safety, risks associated with firearms are minimal. Questions have arisen about the deposition of lead into the environment from ammunition used in firearms. Lead is a metal that can be poisonous to humans. Risk of lead exposure to humans occurs primarily when people ingest lead. To minimize risk to humans, WS would use non-toxic shot as required by the USFWS; thereby, eliminating any cumulative impacts of lead on human health and safety.

As mentioned previously, the avicide DRC-1339 is only available for use by WS and would therefore only be available under the proposed action alternative. However, a product containing the same active ingredient, 3-chloro-p-toluidine hydrochloride ($C_7H_9Cl_2N$), as DRC-1339, Starlicide, is commercially available as a restricted-use pesticide and would be available under any of the alternatives. Following label requirements of $C_7H_9Cl_2N$ eliminates any short or long-term cumulative risks to human health and safety.

As mentioned previously, direct operational assistance would only be conducted by WS after a MOU, Work Initiation Document, 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 people requesting assistance. Therefore, people requesting assistance would be aware of the methods being used on property they own or manage, which would assist in identifying any risks to human health and safety associated with those methods.

Issue 4 – Effectiveness of Bird Damage Management Activities

A common issue when addressing wildlife damage is the effectiveness of the activities being employed to alleviate damage. 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 would be made as to whether the problem was within the authority of WS. If WS has authority to address the request, information about the damage would be 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 would evaluate 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 would then be developed into a management strategy in an adaptive integrated approach. As part of this approach, the effectiveness of bird management activities would be continually evaluated. If assessment showed methods were ineffective, those methods would be discontinued and additional methods would be evaluated for use and application.

Methods employed to manage bird damage, whether non-lethal or lethal, are often temporary with the duration dependent on many factors discussed in previous sections of the EA. WS' objective would be to respond to request for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model to adapt methods in an integrated approach to manage bird damage.

Issue 5 – 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. 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.

Research and development by WS has improved the selectivity and humaneness of methods and WS continues to seek new methods and ways to improve current technology to improve the selectivity and humaneness of methods used to manage damage caused by wildlife.

Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of and recommendation of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. As previously stated, all methods listed in Appendix C would be available under the proposed action alternative. SOPs that ensure WS use methods as humanely as possible under the proposed action alternative are listed in Chapter 3.

Issue 6 – 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. 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.

WS has no authority to regulate take or harassment of birds in the Commonwealth. That authority rests with the USFWS and the PGC. 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.

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. 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 have cumulative adverse impacts on the aesthetic value of birds.

Issue 7 – Effects of Bird Damage Management Activities on the Regulated Harvest of Birds

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. The MBTA grants the USFWS the authority to establish hunting seasons for the take of migratory birds and crows. The USFWS uses its authority to issue frameworks for the take of migratory game birds to state wildlife agencies, such as the PGC. These frameworks include the allowable length of hunting seasons, methods of take, and allowed take, which are implemented by the state wildlife agency. The PGC is responsible for establishing and enforcing hunting seasons for bird species, such as wild turkey and ring-necked pheasant, that are not listed under the MBTA (Title 34, Section 322 c(1)). The PGC is also responsible for establishing and enforcing hunting seasons in the Commonwealth for migratory game birds under frameworks developed by the USFWS.

With oversight by the USFWS and the PGC, the lethal removal of birds by WS or the recommendation of hunting by WS under the proposed action alternative 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 PGC annually to ensure take by WS was incorporated into population management objectives established for harvestable bird populations. Based on the limited take proposed by WS and the oversight by the USFWS and the PGC, WS' take of birds under this alternative would have no cumulative effect on the ability of those people interested to harvest birds during the regulated harvest season.

CHAPTER 5 - LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS AND REVIEWERS

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Ryan Wimberly	USDA, APHIS, WS – Environmental Management Coordinator

5.2 LIST OF PERSONS CONSULTED

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John Dunn, Acting Director, Bureau of Wildlife Management, Pennsylvania Game Commission
Ian Gregg, Game Bird Section Supervisor, Pennsylvania Game Commission
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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 bird species identified in Chapter 1, WS could also receive requests for assistance to manage damage and threats of damage associated with several other bird species but those requests would occur infrequently or the requests would involve only a few individual birds. Damages and threats of damages associated with those species would occur primarily at airports where those species pose a threat of aircraft strikes. WS anticipates addressing those requests for assistance using primarily non-lethal dispersal methods. Under the proposed action alternative, WS could receive requests for assistance to use lethal methods to remove those species when non-lethal methods were ineffective or were determined to be inappropriate using the WS Decision model. An example could include birds that pose an immediate strike threat at an airport where attempts to disperse the birds were ineffective.

Those species that WS could address in low numbers and/or infrequently when those species cause damage or pose a threat of damage include the cattle egret (*Bubulcus ibis*), green heron (*Butorides virescens*), Atlantic brant (*Branta bernicla*), tundra swan (*Cygnus columbianus*), wood duck (*Aix sponsa*), Muscovy duck (*Cairina moschata*), northern pintail (*Anas acuta*), gadwall (*Anas strepera*), American wigeon (*Anas ameriana*), Northern shoveler (*Anas clypeata*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), ring-necked duck (*Aythya collaris*), long-tailed duck (*Clangula hyemalis*), white-winged scoter (*Melanitta fusca*), black scoter (*Melanitta nigra*), common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), hooded merganser (*Lophodytes cucullatus*), common merganser (*Mergus merganser*), ruddy duck (*Oxyura jamaicensis*), ring-necked pheasant (*Phasianus colchicus*), American coot (*Fulica americana*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), semipalmated sandpiper (*Calidris pusilla*), Western sandpiper (*Calidris mauri*), Wilson's snipe (*Gallinago delicata*), American woodcock (*Scolopax minor*), Eurasian collared-dove (*Streptopelia decaocto*), chimney swift (*Chaetura pelagica*), belted kingfisher (*Ceryle alcyon*), pileated woodpecker (*Dryocopus pileatus*), eastern kingbird (*Tyrannus tyrannus*), blue jay (*Cyanocitta cristata*), common raven (*Corvus corax*), purple martin (*Progne subis*), Northern rough-winged swallow (*Stelgidopteryx serripennis*), tufted titmouse (*Baeolophus bicolor*), gray catbird (*Dumetella carolinensis*), Northern mockingbird (*Mimus polyglottos*), Northern cardinal (*Cardinalis cardinalis*), snow bunting (*Plectrophenax nivalis*), and bobolink (*Dolichonyx oryzivorus*).

Many of those bird species can cause damage to or pose threats to a variety of resources. The bird species associated with requests for assistance that WS could receive and the resource types those bird species can damage in Pennsylvania occur in Table B-1.

Table B-1. Additional bird species that WS could address in Pennsylvania and the resource types damaged by those species [1].

	Resource					Resource			
Species	**A**	**N**	**P**	**H**	**Species**	**A**	**N**	**P**	**H**
Cattle Egret	X	X	X	X	**Ruddy Duck**			X	X
Green Heron	X	X	X	X	**Ring-Necked Pheasant***	X		X	X
Atlantic Brant			X	X	**American Coot**			X	X
Tundra Swan			X	X	**Greater Yellowlegs**			X	X
Wood Duck			X	X	**Lesser Yellowlegs**			X	X
Muscovy Duck			X	X	**Semipalmated Sandpiper**			X	X
Northern Pintail			X	X	**Western Sandpiper**			X	X
Gadwall			X	X	**Wilson's Snipe**			X	X
American Wigeon			X	X	**American Woodcock**			X	X

Species	Resource A	N	P	H	Species	Resource A	N	P	H
Northern Shoveler			X	X	**Eurasian Collared-Dove**		X	X	X
Blue-winged Teal			X	X	**Chimney Swift**			X	X
Green-winged Teal			X	X	**Belted Kingfisher**	X		X	X
Canvasback			X	X	**Pileated Woodpecker**			X	X
Redhead			X	X	**Eastern Kingbird**			X	X
Greater Scaup			X	X	**Blue Jay**			X	X
Lesser Scaup			X	X	**Common Raven**	X	X	X	X
Ring-necked Duck			X	X	**Purple Martin**			X	X
Long-tailed Duck			X	X	**Northern Rough-winged Swallow**			X	X
White-winged Scoter			X	X	**Tufted Titmouse**			X	X
Black Scoter			X	X	**Gray Catbird**			X	X
Common Goldeneye			X	X	**Northern Mockingbird**			X	X
Bufflehead			X	X	**Northern Cardinal**			X	X
Hooded Merganser			X	X	**Snow Bunting**			X	X
Common Merganser			X	X	**Bobolink**			X	X

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

Table B-2 shows the number of technical assistance projects that WS conducted involving those species addressed in B-1 from FY 2007 through FY 2012. Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance, WS would not lethally remove more than 20 individuals annually of any of those species identified in Table B-1. In addition, to alleviate damage or discourage nesting in areas where damages were occurring, WS could destroy up to 20 nests annually of those species in Table B-1 that nest in the Commonwealth.

Table B-2. Technical assistance projects conducted by WS in Pennsylvania, FY 2007–FY 2012.

Species	Total	Species	Total
Green Heron	1	**Pileated Woodpecker**	14
Green-winged Teal	4	**Eastern Kingbird**	5
Hooded Merganser	2	**Blue Jay**	4
Common Merganser	1	**Common Raven**	4
American Coot	4	**Northern Mockingbird**	6
Chimney Swift	1	**Northern Cardinal**	7
Belted Kingfisher	3	**TOTAL**	**56**

Nest and egg destruction methods are often considered non-lethal when conducted before the development of an embryo. Many bird species have the ability to identify areas with regular human disturbance and low reproductive success and they will relocate to nest 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 would not be used by WS as a population management method. This method would be used by WS to inhibit nesting in an area experiencing damage due to nesting activity and would only be employed at a localized level. As with the lethal removal of birds, the destruction of nests can only occur when authorized by the USFWS and the PGC; therefore, the number of nests taken by WS annually would occur at the discretion of the USFWS and the PGC.

Annual migratory bird hunting seasons allow hunters the opportunity to harvest Altantic brant, tundra swans, wood ducks, northern pintails, gadwall, American wigeon, northern shoveler, blue-winged teal, green-winged teal, canvasback, redhead, greater scaup, lesser scaup, ring-necked duck, long-tailed duck, white-winged scoter, black scoter, common goldeneye, bufflehead, hooded mergansers, common mergansers, ruddy ducks, ring-necked pheasants, American coots, Wilson's snipe, and American woodcocks. As migratory species, most of those species can be found statewide during the winter as they migrate south. The PGC is responsible for establishing limits and monitoring the take of all game species in Pennsylvania, including waterfowl. Each of those species is also federally protected under the MBTA and take outside of the regular hunting season is prohibited without the issuance of a depredation permit.

Most requests for assistance associated with waterfowl species occur near airports where waterfowl and other waterbirds may aggregate in large numbers in wet areas or on large bodies of water in close proximity to active runways, posing a strike risk and threat to human safety. Assistance may also be requested by fish hatcheries in the State that are receiving damage from fish-eating birds, such as mergansers, or from urban parks with large resident waterfowl populations that may be accumulating feces in public areas or behaving aggressively toward visitors. In addition, waterfowl may sometimes be used as bioindicators to assess environmental quality and, thus, individuals of these species are frequently sampled for environmental toxins, viruses, and/or bacterial organisms. When compared to the annual take levels of these species, WS' take of up to 20 individuals a year would have little impact on the population or hunter harvest.

WS does not expect the annual take of any of those species in Table B-1 to occur at any level that would adversely affect populations of those species. Take would be limited to those individuals deemed causing damage or posing a threat. The MBTA protects most of those bird species from take unless the USFWS permits the take pursuant to the Act. If the USFWS and/or the PGC did not issue a permit, no take would occur by WS. In addition, take could only occur at those levels stipulated in the permits. Therefore, the take of those bird species would occur in accordance with applicable state and federal laws and regulations authorizing take of migratory birds and their nests and eggs, including the USFWS and the PGC permitting processes. The USFWS, as the agency with management responsibility for migratory birds, and the PGC, as the agency responsible for bird species in the Commonwealth, could impose restrictions on depredation take as needed to assure cumulative take does not adversely affect the continued viability of populations. This would assure that cumulative effects on those bird populations would not have a significant adverse effect on the quality of the human environment. In addition, WS would report annually to the USFWS and the PGC any take of the bird species listed in Table B-1 in accordance with a federal and state permit.

APPENDIX C: METHODS AVAILABLE FOR PREVENTING, REDUCING AND ELIMINATING DAMAGE AND THREATS ASSOCIATED WITH BIRDS IN THE COMMONWEALTH OF PENNSYLVANIA

The most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach, which 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[19]. 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.

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 the request for assistance occurs within the authority of WS, information about the damage would be gathered and analyzed (*e.g.*, what species is responsible for the damage, the type of damage occurring, the 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). Specific examples of factors used to determine suitability may include but are not limited to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of overriding environmental, legal, human health and safety, animal welfare, or other concerns. Methods deemed practical for the situation are then developed into a management strategy. This information is then provided to the requestor in the form of technical assistance. As mentioned previously, those persons receiving technical assistance can then 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. If they choose to use the services of WS, WS would continue to monitor and evaluate the situation as assistance was provided, modifying the strategy and methods used to reduce the damage to an acceptable level.

A variety of methods are potentially available to the WS program in Pennsylvania. Various federal, Commonwealth, and local statutes and regulations, as well as 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 Pennsylvania.

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

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

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. This is especially true during calving and lambing when young livestock are vulnerable to species such as black vultures. The use of human custodians, such as sheep herders, 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. For example, black vultures kill calves within a short time after they are born. Keeping cows gathered during calving can reduce the opportunity for this if custodians are present to scare away the birds. Shifts in breeding schedules can also 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 such as vultures.

Altering animal husbandry to reduce wildlife damage has many limitations. Gathering may not be possible where livestock are in many fenced pastures and where grazing conditions require livestock to scatter. Hiring extra herders, 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 are a greater availability of natural food items. This practice depends on the species causing damage (e.g., resident vs. migrant), 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 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 owner or manager of the resource or property 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 and poles for roosting, perching, and nesting. The removal or modification of these will often reduce the attractiveness of the area, but may also reduce the aesthetics. 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.

Conover (1991) found that even hungry Canada geese refused to eat some plants. Planting less palatable plants to discourage geese from a specific area could work more effectively if good alternative plants are nearby. However, the manipulation of turf grass varieties in urban or suburban areas that are heavily used by the public (*e.g.*, parks, athletic fields, and golf courses) is often not feasible. Varieties of turf grass that grow well and can withstand regular mowing and heavy use by humans include Kentucky blue grass, red fescue, perennial bent grass, perennial rye grass, and white clover. All of these grasses are appealing to most waterfowl. Turf grass varieties that are not appealing to waterfowl, such as tall fescue, orchard grass, and timothy, do not withstand regular mowing or heavy human use. Additional habitat alteration strategies for waterfowl include placing hedges, shrubs, or boulders near shorelines. Restricting a bird’s ability to move between water and land deters them from an area, especially during the period of year when they molt and are flightless (Gosser et al. 1997). Molting is the process whereby geese annually replace their primary and secondary flight (wing) feathers. However, people are often reluctant to make appropriate landscape modifications to discourage waterfowl activity (Breault and McKelvey 1991, Conover and Kania 1991). Unfortunately, because both humans and waterfowl appear to find lawn areas near water attractive (Addison and Amernic 1983), conflicts between humans and waterfowl are likely to continue wherever this interface occurs

Modification of Human Behavior: Altering human behavior can resolve conflicts between humans and birds. For example, WS encourages eliminating the feeding of birds that occur in parks, recreational sites, or residential areas to reduce damage by species such as rock pigeons, Canada geese, 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 fast food 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; however, 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 Pennsylvania allows localities to enact and enforce ordinances that prohibit the feeding of birds such as waterfowl. Some localities have enacted such ordinances and taken steps to educate the public about the negative aspects of feeding waterfowl and the existence of the ordinance. However, the public does not always comply and ordinances must be enforced to be effective.

Alter Aircraft Flight Patterns: In cases where the presence of birds at airports results in threats to human health and safety, and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering airport operations to decrease the potential for bird strike hazards is not feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities generally make this practice prohibitive.

Removal of Free-Ranging Domestic and Feral Waterfowl: Flocks of free-ranging domestic and feral waterfowl are known to act as decoys and attract migrating waterfowl (Crisley et al. 1968, Woronecki 1992). The removal of free-ranging domestic and feral waterfowl removes birds that act as decoys in attracting additional waterfowl, which can exacerbate conflicts. Free-ranging domestic and feral waterfowl also have the potential to carry and transfer diseases to wild waterfowl populations. However, property owners or managers may be reluctant to remove some or all decoy birds due to their economic, recreational, and aesthetic benefits.

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 or endangered species. As a result, certain methods would not be appropriate when threatened or 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. 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 and molting Canada geese and their flightless young away from turf. Barrier fences are an effective method to use with breeding waterfowl due to their preference for walking or swimming, rather than flying, during this time. 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 renders 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 by the possibility or likelihood of interaction with people and other animals. Additional limits of this application include the ability to erect, 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, 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), 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 maintenance can be financially burdensome. 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.

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, placement of short, sharp, and pointy wire (marketed under the trade name Nixalite™ and Catclaw™) along roosting surfaces 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. 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 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. 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, people, vehicles, lights, lasers, and 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 and 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 windsocks 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 that are made of lightweight materials that can move in the wind, can produce visual effects that may startle birds. Some studies have shown reflective tape can successfully repel some birds from crops (Bruggers et al. 1986, Dolbeer et al. 1986, Heinrich and Craven 1990). 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 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. Conover and Chasko (1985) found that an integrated approach, which used scarecrows or effigies in combination with other methods (distress calls and non-lethal chemical repellents), was ineffective at scaring or repelling nuisance waterfowl. In contrast, Heinrich and Craven (1990) reported that using scarecrows reduced the use of agricultural fields by migrant Canada geese in rural 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 and learn to ignore them and as bird populations increase (Smith et al. 1999).

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, herons from aquaculture facilities, and American crows from roosts (Conover 2002). However, the effectiveness of alarm or distress calls is reduced as birds become accustomed 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 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 waterfowl in agricultural settings, resident waterfowl in urban areas 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). Shell-crackers are 12-gauge shotgun shells containing firecrackers that are projected up to 75 yards in the air before exploding. They can be used to frighten birds and are most often used to prevent crop depredation by birds or to discourage birds from undesirable roost locations. The shells should be fired so they explode in front of or underneath flocks of birds attempting to enter crop fields, 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. Noise, whistle, racket, and rocket bombs are fired from 15-millimeter flare pistols. They are used similarly to shell-crackers but are projected for shorter distances. Noise bombs (also called bird bombs) are firecrackers that travel about 25 yards before exploding. Whistle bombs are similar to noise bombs, but whistle in flight rather than exploding. They produce a noticeable response because of the trail of smoke and fire, as well as the whistling sound. Racket bombs make a screaming noise in flight and do not explode. Rocket bombs are similar to noise bombs, but may travel up to 150 yards before exploding. A variety of other pyrotechnic devices, including firecrackers, rockets, and Roman candles, are used for dispersing wildlife. Firecrackers can be inserted in slow-burning fuse ropes to control the timing of each explosion. The interval between explosions is determined by the rate at which the rope burns and the spacing between firecrackers.

Aguilera et al. (1991) found 15mm screamer shells effective at reducing the use of an area by Canada geese. Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is partially dependent on availability of alternative loafing and feeding areas. 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, 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 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 waterfowl and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift and Felegy 2009).

Mute Swans: Mute swans, non-native, invasive species, have been used in an attempt to dissuade Canada geese from using or nesting in a given area. However, mute swans are ineffective at preventing Canada geese from using or nesting on ponds (Conover and Kania 1994), have undesirable effects on native aquatic vegetation that is essential to native fish and wildlife species (Ciaranca et al. 1997), and can be aggressive toward humans (Conover and Kania 1994, Chasko 1986). Additionally, Executive Order 13112 directs 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 use of mute swans as a Canada goose damage management technique is ineffective and not recommended.

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, Canada geese, mallards, gulls, vultures, 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 Canada geese (Sherman and Barras 2004), double-crested cormorants (Blackwell et al. 2002*b*), and vultures (Avery et al. 2006*a*). Best results are achieved under low-light conditions (*e.g.*, 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 consist of a gelatin shell filled with a non-toxic glycol and water-based coloring that rapidly dissipates and is not harmful to the environment. A paintball marker (or gun) uses compressed CO_2 to propel paintballs an average of 280 feet per second, although 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 Canada geese, 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 geese. 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 renest at least for an extended period; for example, Canada geese 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.

The Atlantic Flyway Resident Canada Goose Management Plan (Atlantic Flyway Council 1999) states that to effectively reduce resident goose populations, an increase in adult mortality rates, combined with reproductive control, is necessary. Reproductive control alone cannot reduce the population in an acceptable period; treatment of 95% of all eggs each year would result in only a 25% population reduction over 10 years (Allan et al. 1995). In contrast, reducing annual survival of adult Canada geese by just 10% would reduce a predicted growth rate of more than 15% per year to a stable level, assuming moderate recruitment (Atlantic Flyway Council 1999).

CAPTURE WITH LIVE CAPTURE TRAPS

Birds can be live captured using several methods (panel nests, rocket cannon nets, drive traps, net guns, dip nets, decoy traps, foothold traps, nest box traps, and mist nets). 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 costs 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 (*e.g*., Canada geese) are abundant and relocation is not necessary for the maintenance of viable populations. Relocation 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 in adapting to new locations or habitats. When the relocation of birds is deemed appropriate, WS would consult with the USFWS or the PGC, as appropriate, and birds would be transferred in appropriate containers to suitable habitat away from the site where damage and threats are occurring, with permission of the landowner or manager. To discourage the return of free ranging and domestic waterfowl to capture sites, the primary wing feathers of these birds are typically clipped. Waterfowl with clipped wings are able to fly after their next molting.

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. Other potential problems with the use of cage traps are 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 Traps: Decoy traps are used to capture several species of birds, including crows, starlings, sparrows, magpies, gulls, and vultures. They are large screen enclosures with the access modified to suit the target species. A few live birds are maintained in the baited trap to attract birds of the same species and, as such, act as decoys. As discussed above, non-target animals are released, traps are checked regularly, and sufficient food and water is provided to sustain the birds captured.

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 made of nylon netting, hardware cloth, and wood 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.

Clover, funnel, and pigeon traps: Clover, funnel, and pigeon traps are traps made of nylon netting or hardware cloth. Traps are baited with grains or other feed to attract the target birds. 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 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 waterfowl, but can be used to capture a wide variety of bird species.

Net Gun: Net guns are normally used to capture waterfowl. 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 those used for fishing.

Panel Nets or Drive Traps: Panel nets, as described by Costanzo et al. (1995), are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround waterfowl into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways). Target species are herded into the pen by people on foot or in boats, depending on the target species and the existing conditions.

Raptor traps: Raptor traps come in a variety of styles such as the bal-chatri, Swedish goshawk, and purse traps. These traps are most often used at airports to capture raptors and 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 foothold traps used to capture specific target birds, such as raptors and crows. Traps 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 immobilizing drugs, reproductive inhibitors, and repellents. With the exception of alpha-chloralose and Mesurol, all of these substances would be available under all the alternatives. The immobilizing drug alpha chloralose is currently registered for use by WS only, as an investigational new animal drug (21 CFR 511). The use of alpha chloralose by WS was authorized by the FDA, which allows use of the drug as a non-lethal form of capture. This class of chemicals would only be available under the proposed action alternative. Nicarbazin (sold under the trade name OvoControl™) is a reproductive inhibitor. In Pennsylvania, Nicarbazin is registered for use by those persons registered with the PDA 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 ReJeX-iT®, Bird Shield®, 4 the birds®, and Flight Control®, are available for use by persons registered with the PDA as pesticide applicators, and therefore would be available for use under any of the alternatives. Avitrol is another avian repellent available for use by persons registered with the PDA as a pesticide applicator. Finally, the repellent Mesurol is registered only for use by WS, and therefore would only be available under the proposed action alternative.

The use of chemical methods is strictly regulated by the EPA, the FDA, and the PDA. All pesticides have to be registered with the EPA and must have labels approved by the agency detailing 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 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 are certified by the PDA 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 Chapter 128 of the Pennsylvania Code.

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the PDA). WS personnel that use restricted-use chemical methods are certified as pesticide applicators by the Commonwealth of Pennsylvania and are required to adhere to all certification requirements set forth in FIFRA and Pennsylvania pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner or manager.

Alpha chloralose: Alpha chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl, and other birds. The drug is currently approved for use by WS only as an FDA Investigational New Animal Drug, rather than a pesticide. It is labor intensive and in some cases may not be cost effective (Wright 1973, Feare et al. 1981). Single bread or corn baits are fed directly to target birds and those treated are monitored until the drug takes effect. WS personnel then retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be 2 to 30 times lower than the dosage which would cause death in half (50%) of the birds (LD_{50}). The solubility and mobility of AC is believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Since AC is monitored at the application site, fed directly to target species, and uneaten baits are retrieved, the potential impact to humans, domestic animals, and non-target animals is low. Pursuant to FDA restrictions, waterfowl captured with AC for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days at which time the birds may be killed and processed for human consumption. Alternatively, if a bird is going to be relocated, it can be released once the effects of the drug wears off (about 10 hours), or if drug application occurs during or 30 days prior to a regulated hunting season for that species the birds must be held alive for at least 30 days prior to their release. As stated above, AC may be used only by WS personnel who have been trained and certified in its use.

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. Avitrol treated bait is placed in an area where the targeted birds are feeding. This chemical is registered for use on pigeons, crows, blackbirds, starlings, and house sparrows in various situations.

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 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 PDA. Avitrol can only be applied by persons who have been specially trained and certified by the PDA for its 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 Chapter 128 of the Pennsylvania 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 that 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, and therefore would not be 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 can be used as a bird repellent. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee1)[20], nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L2)[21], 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. Cummings et al. (1995) reported that MA repelled Canada geese from grazing turf for

[20]An LD50 is the dosage in milligrams of material per kilogram of body weight, or in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.
[21]An LC50 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.

four days. However, Belant et al. (1996) found it ineffective as a grazing repellent when applied at 22.6 and 67.8 kg/ha, which is the label rate and triple the label rate, respectively. MA is water soluble; therefore, moderate to heavy rain or daily watering and/or mowing render MA ineffective. Additionally, Belant et al. (1996) found Canada geese habituated or developed tolerance for MA when applied to turf.

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 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 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. Antraquinone 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 Canada goose grazing on turf and brown-headed cowbirds feeding on seed (Dolbeer et al. 1998). Anthraquinone has low toxicity to birds and mammals.

Mesurol®: Mesurol was recently registered by WS (for WS use only) as a bird repellent to deter predation by crows and ravens on eggs of threatened or endangered species. 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 or 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 eggs of threatened or endangered species, 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 or 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 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). 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), environmental factors (*e.g.*, isolation of target population, access to target individuals), 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.

Sterilization: Sterlization is a permanent method of reproductive control. However, surgical sterilization is generally impractical because it requires that each animal be captured and sterilized by licensed veterinarians, an extremely labor intensive and expensive venture. Keefe (1996) estimated sterilization of Canada geese to cost over $100 per bird. Reduction of local populations could conceivably be achieved through natural mortality combined with reproduction control. However, sterilized animals could continue to cause damage, sterilized birds could leave the area, and other birds could immigrate from adjacent areas. Although male Canada geese have been successfully sterilized, sterilization is only effective if females bond with sterilized males. Additionally, the ability to identify breeding pairs in order to capture a male bird for sterilization becomes increasingly difficult as the number of birds increase (Converse and Kennelly 1994).

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 Canada goose and 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. When geese were provided nicarbazin at dosage levels found formulated in OvoControl® G, not all eggs laid were infertile (VerCauteren et al. 2000, Bynum et al. 2005, Yoder et al. 2006). In addition, birds must consume bait treated with nicarbazin daily and in the correct dosage throughout the breeding season to achieve the highest level of effectiveness.

OvoControl® G (EPA Reg. No. 80224-5) is a restricted use pesticide registered for use to reduce the egg hatch of geese. The formulation for geese contains 0.5% of the active ingredient nicarbazin by volume as a ready-to-use bait for geese in urban areas and at airports only. 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 in urban areas such as office parks, recreational parks, malls, hospitals, airports, golf courses, schools, hospitals, restaurants, and commercial sites. OvoControl® G is not currently registered for use on geese in the Commonwealth.

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 long 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 the 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 may 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. Zielske et al. (1993) believed legal hunting would not reduce resident Canada geese populations where there is limited interest in legally hunting resident geese. However, hunting has had a major impact on the distribution of Canada geese in the Minneapolis-St. Paul metro area of Minnesota (Cooper and Keefe 1997). Cooper and Keefe (1997) reported that goose densities were three times lower during the summer in areas of the metro area where hunting was allowed compared to areas that were not hunted. Similarly, Conover and Kania (1991) reported that Canada geese were more likely to cause damage in areas that waterfowl hunting was prohibited. Even in urban/suburban areas (*e.g.*, golf courses and green spaces) there may be locations and times of the day where controlled hunting would be effective in reducing bird damage while creating minimal conflicts with other user groups. Valid hunting licenses and other additional permits are required for the implementation of this method.

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, USFWS requires that non-toxic shot be used to harvest waterfowl. The effects from the use of lead ammunition in firearms are further discussed in Chapter 2.

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 and may be used in conjunction with spotlights, decoys, and calling. 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.

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. WS 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, which prohibits those convicted of a misdemeanor crime of domestic violence from possessing a firearm.

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, USFWS requires that non-toxic shot be used to take birds under depredation permits issued pursuant to the MBTA and to harvest waterfowl. However, lead shot may be used by persons implementing wildlife damage management methods under depredation orders, during annual hunting seasons (except for waterfowl hunting, for which non-toxic shot is required), or for unprotected non-native birds at any time. If lead shot were 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 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. The effects from the use of lead ammunition in firearms are further discussed in Chapter 2.

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 attractants 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 that 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 captured in live traps. The neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA has stated 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, AVMA 2013). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001, AVMA 2013).

LETHAL METHODS (CHEMICAL)

The use of chemical methods is strictly regulated by the EPA and the PDA. All pesticides have to be registered with the 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 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 specially trained and certified by the PDA 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 havespecific requirements for their handling, transport, storage, use, and disposal under Chapter 128 of the Pennsylvania Code.

All chemicals used by WS are registered as required by the FIFRA (administered by the EPA and the PDA). WS personnel that use restricted-use chemical methods are certified as pesticide applicators by the Commonwealth of Pennsylvania and are required to adhere to all certification requirements set forth in FIFRA and Pennsylvania 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 Pennsylvania, DRC-1339 is registered for use by WS only, while Starlicide is registered for use by persons registered with the PDA 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 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 andhas 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 PDA. Avitrol can only be applied by persons who have been specially trained and certified by the PDA for its 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 Chapter 128 of the Pennsylvania 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 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 UNITED STATES FISH AND WILDLIFE SERVICE[1]

[1]List obtained from <http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=PA&s8fid=112761032792&s8fid=112762573902> on 29 March 2013

Notes:

- This report shows the listed species associated in some way with this Commonwealth.
- This list does not include experimental populations and similarity of appearance listings.

Animal species listed in this Commonwealth that occur in this Commonwealth:

Status	Species
E	Bat, Indiana Entire (*Myotis sodalis*)
E	Bean, rayed (*Villosa fabalis*)
E	Clubshell (*Pleurobema clava*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Plover, piping (*Charadrius melodus*)
E	Riffleshell, northern (*Epioblasma torulosa rangiana*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
T	Turtle, bog (=Muhlenberg) northern (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)

Animal species listed in this Commonwealth that do not occur in this Commonwealth:

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E	Fanshell (*Cyprogenia stegaria*)
E	Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E	Pigtoe, rough (*Pleurobema plenum*)
E	Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Ring pink (mussel) (*Obovaria retusa*)
E	Squirrel, Delmarva Peninsula fox (*Sciurus niger cinereus*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
E	Wolf, gray (*Canis lupus*)

Plant species listed in this Commonwealth that occur in this Commonwealth:

Status	Species
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
T	Pogonia, small whorled (*Isotria medeoloides*)

Plant species listed in this Commonwealth that do not occur in this Commonwealth:

Status	Species
E	Coneflower, smooth (*Echinacea laevigata*)
T	Joint-vetch, sensitive (*Aeschynomene virginica*)
T	Orchid, eastern prairie fringed (*Platanthera leucophaea*)
T	Spiraea, Virginia (*Spiraea virginiana*)

APPENDIX E: SPECIES LISTED BY THE COMMONWEALTH OF PENNSYLVANIA[1]

[1]List obtained from <http://www.naturalheritage.state.pa.us/HomePage.aspx> on 29 March 2013

Scientific Name	Common Name	Status[2]
Abies balsamea	Balsam Fir	N
Acalypha deamii	Three-seeded Mercury	N
Ageratina aromatica	Small White-snakeroot	N
Alopecurus aequalis	Short-awn Foxtail	N
Amelanchier canadensis	Serviceberry	N
Andropogon gyrans	Elliott's Beardgrass	N
Antennaria virginica	Shale Barren Pussytoes	N
Arabis patens	Spreading Rockcress	N
Arctosa littoralis	A Sand Spider	N
Aristida longespica		N
Aristida longespica var. *longespica*	Slender Three-awn	N
Arnoglossum reniforme	Great Indian-plantain	N
Asimina triloba	Pawpaw	N
Asplenium pinnatifidum	Lobed Spleenwort	N
Astragalus canadensis	Canadian Milkvetch	N
Baptisia australis	Blue False-indigo	N
Bartonia paniculata	Screw-stem	N
Bidens discoidea	Small Beggar-ticks	N
Bidens laevis	Beggar-ticks	N
Botrychium simplex	Least Grape-fern	N
Bromus kalmii	Brome Grass	N
Calamagrostis porteri	Porter's Reedgrass	N
Cardamine maxima	Large Toothwort	N
Carex brevior	A Sedge	N
Carex ormostachya	Spike Sedge	N
Carex planispicata		N
Carex richardsonii	Richardson's Sedge	N
Carex shortiana	Sedge	N
Carex siccata	A Sedge	N
Carex sprengelii	Sedge	N
Carya laciniosa	Shellbark Hickory	N
Chionanthus virginicus	Fringe-tree	N
Conoclinium coelestinum	Mistflower	N
Corydalis aurea	Golden Corydalis	N
Crataegus dilatata	A Hawthorn	N
Crataegus pennsylvanica	Red-fruited Hawthorn	N
Cuscuta campestris	Dodder	N
Cuscuta compacta	Dodder	N
Cuscuta pentagona	Field Dodder	N
Cyperus lancastriensis	Many-flowered Umbrella Sedge	N
Cystopteris tennesseensis	Bladder Fern	N
Deschampsia cespitosa	Tufted Hairgrass	N
Desmodium laevigatum	Smooth Tick-trefoil	N
Desmodium obtusum	Stiff Tick-trefoil	N
Desmodium viridiflorum	Velvety Tick-trefoil	N

Diarrhena americana	American Beakgrain	N
Dichanthelium laxiflorum	Lax-flower Witchgrass	N
Dichanthelium oligosanthes	Heller's Witchgrass	N
Dryopteris celsa	Log Fern	N
Dryopteris clintoniana	Clinton's Wood Fern	N
Dryopteris filix-mas	Male Fern	N
Elymus trachycaulus	Slender Wheatgrass	N
Equisetum x *ferrissii*	Scouring-rush	N
Erythronium albidum	White Trout-lily	N
Eupatorium godfreyanum	Godfrey's Thoroughwort	N
Eurybia radula	Rough-leaved Aster	N
Fraxinus profunda	Pumpkin Ash	N
Fraxinus quadrangulata	Blue Ash	N
Galium latifolium	Purple Bedstraw	N
Galium trifidum	Marsh Bedstraw	N
Gentiana linearis	Narrow-leaved Gentian	N
Goodyera repens	Lesser Rattlesnake-plantain	N
Gymnocarpium x *heterosporum*	A Fern Hybrid (Sterile Triploid)	N
Helianthemum propinquum	Low Rockrose	N
Helianthus hirsutus	Sunflower	N
Helianthus microcephalus	Small Wood Sunflower	N
Helianthus occidentalis	Sunflower	N
Hieracium umbellatum	Umbellate Hawkweed	N
Hierochloe hirta ssp. *arctica*	Common Northern Sweet Grass	N
Houstonia serpyllifolia	Creeping Bluets	N
Hypericum stragulum	St Andrew's-cross	N
Ilex laevigata	Smooth Winterberry Holly	N
Ipomoea lacunosa	White Morning-glory	N
Iris virginica	Virginia Blue Flag	N
Isoetes valida	Quillwort	N
Isoetes x *brittonii*	Quillwort	N
Juglans cinerea	Butternut	N
Juncus debilis	Weak Rush	N
Juniperus communis	Common Juniper	N
Lactuca hirsuta	Downy Lettuce	N
Lasius minutus	An Ant	N
Lathyrus venosus	Veiny Pea	N
Lechea minor	Thyme-leaved Pinweed	N
Lemna perpusilla	Minute Duckweed	N
Liatris scariosa	Round-head Gayfeather	N
Linaria canadensis	Old-field Toadflax	N
Lithospermum canescens	Hoary Puccoon	N
Lycopodiella margueritae	A Clubmoss	N
Lycopodiella x *copelandii*		N
Lysimachia hybrida	Lance-leaf Loosestrife	N
Oenothera oakesiana	Evening-primrose	N
Omalotheca sylvatica	Woodland Cudweed	N
Oxysoma cubana	A Sac-spider	N
Panicum polyanthes	Panic-grass	N

Pedicularis lanceolata	Swamp Lousewort	N
Penstemon canescens	Beard-tongue	N
Penstemon laevigatus	Beard-tongue	N
Phaseolus polystachios	Wild Kidney Bean	N
Pinus echinata	Short-leaf Pine	N
Pinus resinosa	Red Pine	N
Piptochaetium avenaceum	Blackseed Needlegrass	N
Platanthera blephariglottis	White Fringed-orchid	N
Polygala nuttallii	Nuttall's Milkwort	N
Polymnia canadensis	Leaf-cup	N
Potamogeton bicupulatus	Pondweed	N
Prenanthes serpentaria	Lion's-foot	N
Prunus alleghaniensis	Alleghany Plum	N
Prunus angustifolia	Chickasaw Plum	N
Pycnanthemum clinopodioides	Mountain-mint	N
Pyrola chlorantha		N
Quercus macrocarpa	Bur Oak	N
Quercus michauxii	Swamp Chestnut Oak	N
Ranunculus ambigens		N
Ranunculus flabellaris	Yellow Water-crowfoot	N
Ranunculus pusillus	Spearwort	N
Rosa blanda	Meadow Rose	N
Rosa setigera	Prairie Rose	N
Rudbeckia fulgida	Eastern Coneflower	N
Ruellia pedunculata	Stalked Wild-petunia	N
Sagittaria cuneata	Wapatum Arrowhead	N
Salix caroliniana	Carolina Willow	N
Salix myricoides	Broad-leaved Willow	N
Salix pedicellaris	Bog Willow	N
Schoenoplectus subterminalis	Water Bulrush	N
Singa eugeni	An Orb-weaver Spider	N
Smallanthus uvedalius	Leaf-cup	N
Solidago speciosa var. *speciosa*	Showy Goldenrod	N
Solidago uliginosa	Bog Goldenrod	N
Sparganium angustifolium	Bur-reed	N
Spiranthes lucida	Shining Ladies'-tresses	N
Stellaria borealis	Mountain Starwort	N
Stenanthium gramineum	Featherbells	N
Strophostyles umbellata	Wild Bean	N
Symphyotrichum drummondii	Hairy Heart-leaved Aster	N
Symphyotrichum praealtum	Veiny-lined Aster	N
Thalictrum dasycarpum	Purple Meadow-rue	N
Toxicodendron rydbergii	Giant Poison-ivy	N
Triadenum walteri	Walter's St. John's-wort	N
Trillium cernuum		N
Trisetum spicatum	Narrow False Oats	N
Utricularia cornuta	Horned Bladderwort	N
Utricularia geminiscapa	Bladderwort	N
Utricularia inflata	Floating Bladderwort	N

Utricularia subulata		N
Veratrum virginicum	Virginia Bunchflower	N
Viola selkirkii	Great-spurred Violet	N
Woodwardia areolata	Netted Chainfern	N
Xyris torta	Twisted Yellow-eyed Grass	N
Zanthoxylum americanum	Northern Prickly-ash	N
Zigadenus glaucus	White Camas	N
Amia calva	Bowfin	PC
Crotalus horridus	Timber Rattlesnake	PC
Culaea inconstans	Brook Stickleback	PC
Emydoidea blandingii	Blanding's Turtle	PC
Ichthyomyzon bdellium	Ohio Lamprey	PC
Lampetra aepyptera	Least Brook Lamprey	PC
Nocomis biguttatus	Hornyhead Chub	PC
Plestiodon laticeps	Broadhead Skink	PC
Umbra limi	Central Mudminnow	PC
Umbra pygmaea	Eastern Mudminnow	PC
Umbra pygmaea	Eastern Mudminnow	PC
Acipenser brevirostrum	Shortnose Sturgeon	PE
Acipenser fulvescens	Lake Sturgeon	PE
Acipenser oxyrinchus	Atlantic Sturgeon	PE
Aconitum reclinatum	White Monkshood	PE
Acorus americanus	Sweet Flag	PE
Acris crepitans	Northern Cricket Frog	PE
Agalinis auriculata	Eared False-foxglove	PE
Agalinis paupercula	Small-flowered False-foxglove	PE
Alasmidonta heterodon	Dwarf Wedgemussel	PE
Alisma triviale	Northern Water-plantain	PE
Alnus viridis	Mountain Alder	PE
Alosa mediocris	Hickory Shad	PE
Ambystoma laterale	Blue-spotted Salamander	PE
Ameiurus melas	Black Bullhead	PE
Amelanchier bartramiana	Oblong-fruited Serviceberry	PE
Ammannia coccinea	Scarlet Ammannia	PE
Anemone cylindrica	Long-fruited Anemone	PE
Arabis missouriensis	Missouri Rock-cress	PE
Ardea alba	Great Egret	PE
Arethusa bulbosa	Swamp-pink	PE
Arnica acaulis	Leopard's-bane	PE
Artemisia campestris ssp. caudata	Beach Wormwood	PE
Asio flammeus	Short-eared Owl	PE
Asplenium resiliens	Black-stemmed Spleenwort	PE
Astragalus neglectus	Cooper's Milk-vetch	PE
Bartramia longicauda	Upland Sandpiper	PE
Boltonia asteroides	Aster-like Boltonia	PE
Botaurus lentiginosus	American Bittern	PE
Cardamine pratensis var. palustris	Cuckooflower	PE
Carex atherodes	Awned Sedge	PE
Carex aurea	Golden-fruited Sedge	PE

Carex bebbii	Bebb's Sedge	PE
Carex bicknellii	Bicknell's Sedge	PE
Carex bullata	Bull Sedge	PE
Carex careyana	Carey's Sedge	PE
Carex collinsii	Collin's Sedge	PE
Carex crinita var. *brevicrinis*	Short Hair Sedge	PE
Carex eburnea	Ebony Sedge	PE
Carex foenea	A Sedge	PE
Carex formosa	Handsome Sedge	PE
Carex garberi	Elk Sedge	PE
Carex geyeri	Geyer's Sedge	PE
Carex mitchelliana	Mitchell's Sedge	PE
Carex pauciflora	Few-flowered Sedge	PE
Carex polymorpha	Variable Sedge	PE
Carex pseudocyperus	Cyperus-like Sedge	PE
Carex retrorsa	Backward Sedge	PE
Carex typhina	Cattail Sedge	PE
Carex viridula	Green Sedge	PE
Catostomus catostomus	Longnose Sucker	PE
Cerastium velutinum var. *villosissimum*	Goat Hill Chickweed	PE
Chaenobryttus gulosus	Warmouth	PE
Chasmanthium laxum	Slender Sea-oats	PE
Chenopodium foggii	Fogg's Goosefoot	PE
Chlidonias niger	Black Tern	PE
Chrysogonum virginianum	Green-and-gold	PE
Cirsium horridulum	Horrible Thistle	PE
Cistothorus platensis	Sedge Wren	PE
Cladium mariscoides	Twig Rush	PE
Clematis viorna	Vase-vine Leather-flower	PE
Clethra acuminata	Mountain Pepper-bush	PE
Clitoria mariana	Butterfly-pea	PE
Clonophis kirtlandii	Kirtland's Snake	PE
Conioselinum chinense	Hemlock-parsley	PE
Coregonus artedi	Cisco	PE
Cryptogramma stelleri	Slender Rock-brake	PE
Cryptotis parva	Least Shrew	PE
Cymophyllus fraserianus	Fraser's Sedge	PE
Cynanchum laeve	Smooth Swallow-wort	PE
Cyperus diandrus	Umbrella Flatsedge	PE
Cyperus houghtonii	Houghton's Flatsedge	PE
Cyperus refractus	Reflexed Flatsedge	PE
Cyperus retrorsus	Retrorse Flatsedge	PE
Cypripedium calceolus var. *parviflorum*	Small Yellow Lady's-slipper	PE
Delphinium exaltatum	Tall Larkspur	PE
Diarrhena obovata	American Beakgrain	PE
Dicentra eximia	Wild Bleeding-hearts	PE
Dichanthelium scoparium	Velvety Panic-grass	PE
Dodecatheon meadia	Common Shooting-star	PE
Dryopteris campyloptera	Mountain Wood Fern	PE

Echinochloa walteri	Walter's Barnyard-grass	PE
Eleocharis caribaea	Capitate Spike-rush	PE
Eleocharis compressa	Flat-stemmed Spike-rush	PE
Eleocharis elliptica	Slender Spike-rush	PE
Eleocharis obtusa var. *peasei*	Wrights Spike Rush	PE
Eleocharis parvula	Little-spike Spike-rush	PE
Eleocharis pauciflora var. *fernaldii*	Few-flowered Spike-rush	PE
Eleocharis quadrangulata	Four-angled Spike-rush	PE
Eleocharis rostellata	Beaked Spike-rush	PE
Eleocharis tenuis var. *verrucosa*	Slender Spike-rush	PE
Elephantopus carolinianus	Elephant's Foot	PE
Empidonax flaviventris	Yellow-bellied Flycatcher	PE
Enneacanthus obesus	Banded Sunfish	PE
Epilobium strictum	Downy Willow-herb	PE
Epioblasma torulosa rangiana	Northern Riffleshell	PE
Epioblasma triquetra	Snuffbox	PE
Equisetum variegatum	Variegated Horsetail	PE
Erimystax x *punctatus*	Gravel Chub	PE
Eriophorum gracile	Slender Cotton-grass	PE
Eriophorum tenellum	Rough Cotton-grass	PE
Etheostoma exile	Iowa Darter	PE
Etheostoma pellucida	Eastern Sand Darter	PE
Euphorbia ipecacuanhae	Wild Ipecac	PE
Euphorbia purpurea	Glade Spurge	PE
Eurybia spectabilis	Low Showy Aster	PE
Falco peregrinus	Peregrine Falcon	PE
Festuca paradoxa	Cluster Fescue	PE
Galium labradoricum	Labrador Marsh Bedstraw	PE
Gasterosteus aculeatus	Threespine Stickleback	PE
Gaylussacia dumosa	Dwarf Huckleberry	PE
Geranium bicknellii	Cranesbill	PE
Glaucomys sabrinus	Northern Flying Squirrel	PE
Glyceria borealis	Small-floating Manna-grass	PE
Glyceria obtusa	Blunt Manna-grass	PE
Glyptemys muhlenbergii	Bog Turtle	PE
Gymnopogon ambiguus	Broad-leaved Beardgrass	PE
Helianthemum bicknellii	Bicknell's Hoary Rockrose	PE
Heteranthera multiflora	Multiflowered Mud-plantain	PE
Hieracium traillii	Maryland Hawkweed	PE
Hierochloe odorata	Vanilla Sweet-grass	PE
Huperzia porophila	Rock Clubmoss	PE
Hydrophyllum macrophyllum	Large-leaved Waterleaf	PE
Ichthyomyzon fossor	Northern Brook Lamprey	PE
Ictiobus cyprinellus	Bigmouth Buffalo	PE
Iodanthus pinnatifidus	Purple Rocket	PE
Iris cristata	Crested Dwarf Iris	PE
Iris prismatica	Slender Blue Iris	PE
Iris verna	Dwarf Iris	PE
Isotria medeoloides	Small-whorled Pogonia	PE

Ixobrychus exilis	Least Bittern	PE
Juncus brachycarpus	Short-fruited Rush	PE
Juncus dichotomus	Forked Rush	PE
Juncus militaris	Bayonet Rush	PE
Juncus scirpoides	Scirpus-like Rush	PE
Kinosternon subrubrum subrubrum	Eastern Mud Turtle	PE
Lanius ludovicianus migrans	Migrant Loggerhead Shrike	PE
Lepisosteus oculatus	Spotted Gar	PE
Lepomis megalotis	Longear Sunfish	PE
Lespedeza angustifolia	Narrowleaf Bushclover	PE
Ligusticum canadense	Nondo Lovage	PE
Linum intercursum	Sandplain Wild Flax	PE
Linum sulcatum	Grooved Yellow Flax	PE
Lipocarpha micrantha	Common Hemicarpa	PE
Listera australis	Southern Twayblade	PE
Listera cordata	Heart-leaved Twayblade	PE
Listera smallii	Kidney-leaved Twayblade	PE
Lithobates sphenocephalus utricularius	Southern Leopard Frog	PE
Lithospermum caroliniense	Hispid Gromwell	PE
Lithospermum latifolium	American Gromwell	PE
Lobelia kalmii	Brook Lobelia	PE
Lobelia puberula	Downy Lobelia	PE
Lonicera oblongifolia	Swamp Fly Honeysuckle	PE
Lonicera villosa	Mountain Fly Honeysuckle	PE
Lota lota	Burbot	PE
Ludwigia decurrens	Upright Primrose-willow	PE
Ludwigia polycarpa	False Loosestrife Seedbox	PE
Lycopodiella alopecuroides	Foxtail Clubmoss	PE
Lycopus rubellus	Bugleweed	PE
Lyonia mariana	Stagger-bush	PE
Lythrurus umbratilis	Redfin Shiner	PE
Margaritifera margaritifera	Eastern Pearlshell	PE
Marshallia grandiflora	Large-flowered Marshallia	PE
Matelea obliqua	Oblique Milkvine	PE
Megalodonta beckii	Beck's Water-marigold	PE
Mitella nuda	Naked Bishop's-cap	PE
Monarda punctata	Spotted Bee-balm	PE
Montia chamissoi	Chamisso's Miner's-lettuce	PE
Muhlenbergia uniflora	Fall Dropseed Muhly	PE
Myotis sodalis	Indiana or Social Myotis	PE
Myriophyllum farwellii	Farwell's Water-milfoil	PE
Myriophyllum heterophyllum	Broad-leaved Water-milfoil	PE
Myriophyllum sibiricum	Northern Water-milfoil	PE
Myriophyllum verticillatum	Whorled Water-milfoil	PE
Notropis bifrenatus	Bridle Shiner	PE
Notropis blennius	River Shiner	PE
Notropis buchanani	Ghost Shiner	PE
Notropis chalybaeus	Ironcolor Shiner	PE
Notropis heterodon	Blackchin Shiner	PE

Noturus eleutherus	Mountain Madtom	PE
Noturus gyrinus	Tadpole Madtom	PE
Noturus stigmosus	Northern Madtom	PE
Nyctanassa violacea	Yellow-crowned Night-heron	PE
Nycticorax nycticorax	Black-crowned Night-heron	PE
Obovaria subrotunda	Round Hickorynut	PE
Oclemena nemoralis	Bog Aster	PE
Onosmodium molle var. *hispidissimum*	False Gromwell	PE
Opheodrys aestivus	Rough Green Snake	PE
Ophioglossum engelmannii	Limestone Adder's-tongue	PE
Packera antennariifolia	Cat's-paw Ragwort	PE
Panicum amarum var. *amarulum*	Southern Sea-beach Panic-grass	PE
Panicum xanthophysum	Slender Panic-grass	PE
Parnassia glauca	Carolina Grass-of-parnassus	PE
Passiflora lutea	Passion-flower	PE
Paxistima canbyi	Canby's Mountain-lover	PE
Phlox ovata	Mountain Phlox	PE
Phlox subulata ssp. *brittonii*	Moss Pink	PE
Phoxinus eos	Northern Redbelly Dace	PE
Phyllanthus caroliniensis	Carolina Leaf-flower	PE
Piptatherum pungens	Slender Mountain-ricegrass	PE
Platanthera dilatata	Leafy White Orchid	PE
Pleurobema clava	Clubshell	PE
Poa autumnalis	Autumn Bluegrass	PE
Polemonium vanbruntiae	Jacob's-ladder	PE
Polygala cruciata	Cross-leaved Milkwort	PE
Polygala curtissii	Curtis's Milkwort	PE
Polygala incarnata	Pink Milkwort	PE
Polygonum careyi	Carey's Smartweed	PE
Polystichum braunii	Braun's Holly Fern	PE
Populus balsamifera	Balsam Poplar	PE
Potamogeton friesii	Fries' Pondweed	PE
Potamogeton gramineus	Grassy Pondweed	PE
Potamogeton hillii	Hill's Pondweed	PE
Potamogeton obtusifolius	Blunt-leaved Pondweed	PE
Potamogeton pulcher	Spotted Pondweed	PE
Potamogeton strictifolius	Narrow-leaved Pondweed	PE
Potamogeton tennesseensis	Tennessee Pondweed	PE
Potamogeton vaseyi	Vasey's Pondweed	PE
Potentilla fruticosa	Shrubby Cinquefoil	PE
Potentilla paradoxa	Bushy Cinquefoil	PE
Potentilla tridentata	Three-toothed Cinquefoil	PE
Prenanthes crepidinea	Crepis Rattlesnake-root	PE
Prunus maritima	Beach Plum	PE
Pseudacris kalmi	New Jersey Chorus Frog	PE
Pseudotriton montanus montanus	Eastern Mud Salamander	PE
Ptilimnium capillaceum	Mock Bishop-weed	PE
Pycnanthemum torrei	Torrey's Mountain-mint	PE
Quadrula cylindrica	Rabbitsfoot	PE

Quadrula verrucosa	Pistolgrip Mussel	PE
Quercus falcata	Southern Red Oak	PE
Quercus phellos	Willow Oak	PE
Quercus shumardii	Shumard's Oak	PE
Rallus elegans	King Rail	PE
Ranunculus fascicularis	Tufted Buttercup	PE
Rhamnus lanceolata	Lance-leaved Buckthorn	PE
Rhexia mariana	Maryland Meadow-beauty	PE
Rhododendron atlanticum	Dwarf Azalea	PE
Rhynchospora capillacea	Capillary Beaked-rush	PE
Ribes missouriense	Missouri Gooseberry	PE
Ruellia humilis	Fringed-leaved Petunia	PE
Sagittaria calycina var. *spongiosa*	Long-lobed Arrow-head	PE
Scaphiopus holbrookii	Eastern Spadefoot	PE
Scheuchzeria palustris	Pod-grass	PE
Schoenoplectus acutus	Hard-stemmed Bulrush	PE
Schoenoplectus smithii	Smith's Bulrush	PE
Schoenoplectus torreyi	Torrey's Bulrush	PE
Scirpus ancistrochaetus	Northeastern Bulrush	PE
Scleria minor	Minor Nutrush	PE
Scleria muehlenbergii	Reticulated Nutrush	PE
Scleria verticillata	Whorled Nutrush	PE
Sedum rosea	Roseroot Stonecrop	PE
Sericocarpus linifolius	Narrow-leaved White-topped Aster	PE
Setophaga striata	Blackpoll Warbler	PE
Shepherdia canadensis	Canada Buffalo-berry	PE
Sida hermaphrodita	Sida	PE
Simpsonaias ambigua	Salamander Mussel	PE
Sistrurus catenatus catenatus	Eastern Massasauga	PE
Sisyrinchium atlanticum	Eastern Blue-eyed Grass	PE
Solidago arguta var. *harrisii*	Harris' Golden-rod	PE
Solidago curtisii	Curtis' Golden-rod	PE
Solidago erecta	Slender Golden-rod	PE
Solidago simplex ssp. *randii* var. *racemosa*	Sticky Golden-rod	PE
Sorbus decora	Showy Mountain-ash	PE
Sparganium androcladum	Branching Bur-reed	PE
Spiranthes casei	Case's Ladies'-tresses	PE
Spiranthes ovalis	October Ladies'-tresses	PE
Spiranthes romanzoffiana	Hooded Ladies'-tresses	PE
Spiranthes vernalis	Spring Ladies'-tresses	PE
Spiza americana	Dickcissel	PE
Sporobolus clandestinus	Rough Dropseed	PE
Sporobolus heterolepis	Prairie Dropseed	PE
Stachys cordata	Nuttall's Hedge-nettle	PE
Sterna hirundo	Common Tern	PE
Swertia caroliniensis	American Columbo	PE
Symphyotrichum boreale	Rush Aster	PE
Taenidia montana	Mountain Pimpernel	PE
Thalictrum coriaceum	Thick-leaved Meadow-rue	PE

Trichostema setaceum	Blue-curls	PE
Trifolium virginicum	Kate's Mountain Clover	PE
Triphora trianthophora	Nodding Pogonia	PE
Triplasis purpurea	Purple Sandgrass	PE
Trollius laxus	Spreading Globeflower	PE
Utricularia radiata	Small Swollen Bladderwort	PE
Vernonia glauca	Tawny Ironweed	PE
Viburnum nudum	Possum-haw	PE
Villosa fabalis	Rayed Bean Mussel	PE
Viola brittoniana	Coast Violet	PE
Amaranthus cannabinus	Waterhemp Ragweed	PR
Andromeda polifolia	Bog-rosemary	PR
Aplectrum hyemale	Puttyroot	PR
Baccharis halimifolia	Eastern Baccharis	PR
Cakile edentula	American Sea-rocket	PR
Carex disperma	Soft-leaved Sedge	PR
Carex lasiocarpa	Slender Sedge	PR
Castanea pumila	Allegheny Chinkapin	PR
Collinsia verna	Spring Blue-eyed Mary	PR
Cyperus schweinitzii	Schweinitz's Flatsedge	PR
Eleocharis olivacea	Capitate Spike-rush	PR
Gaultheria hispidula	Creeping Snowberry	PR
Juncus filiformis	Thread Rush	PR
Juncus gymnocarpus	Coville's Rush	PR
Ledum groenlandicum	Common Labrador-tea	PR
Lupinus perennis	Lupine	PR
Lygodium palmatum	Hartford Fern	PR
Malaxis bayardii	Bayard's Malaxis	PR
Menziesia pilosa	Minniebush	PR
Opuntia humifusa	Prickly-pear Cactus	PR
Orontium aquaticum	Golden Club	PR
Packera anonyma	Plain Ragwort	PR
Panicum commonsianum var. *euchlamydeum*	Cloaked Panic-grass	PR
Potamogeton robbinsii	Flat-leaved Pondweed	PR
Potamogeton zosteriformis	Flat-stem Pondweed	PR
Pyrularia pubera	Buffalo-nut	PR
Rotala ramosior	Tooth-cup	PR
Sagittaria subulata	Subulate Arrowhead	PR
Schizachyrium scoparium var. *littorale*	Seaside Bluestem	PR
Schoenoplectus fluviatilis	River Bulrush	PR
Sedum telephioides	Allegheny Stonecrop	PR
Solidago roanensis	Tenessee Golden-rod	PR
Tipularia discolor	Cranefly Orchid	PR
Trautvetteria caroliniensis	Carolina Tassel-rue	PR
Trillium nivale	Snow Trillium	PR
Utricularia purpurea	Purple Bladderwort	PR
Wolffiella gladiata	Bog-mat	PR
Xyris montana	Northern Yellow-eyed Grass	PR

Zizania aquatica	Indian Wild Rice	PR
Aconitum uncinatum	Blue Monkshood	PT
Actaea podocarpa	Mountain Bugbane	PT
Ammophila breviligulata	American Beachgrass	PT
Aneides aeneus	Green Salamander	PT
Arceuthobium pusillum	Dwarf Mistletoe	PT
Aristida purpurascens	Arrow-feathered Three Awned	PT
Asio otus	Long-eared Owl	PT
Asplenium bradleyi	Bradley's Spleenwort	PT
Bidens bidentoides	Swamp Beggar-ticks	PT
Bouteloua curtipendula	Tall Gramma	PT
Camassia scilloides	Wild Hyacinth	PT
Carex alata	Broad-winged Sedge	PT
Carex aquatilis	Water Sedge	PT
Carex cryptolepis	Northeastern Sedge	PT
Carex diandra	Lesser Panicled Sedge	PT
Carex flava	Yellow Sedge	PT
Carex oligosperma	Few-seeded Sedge	PT
Carex paupercula	Bog Sedge	PT
Carex prairea	Prairie Sedge	PT
Carex schweinitzii	Schweinitz's Sedge	PT
Carex sterilis	Sterile Sedge	PT
Carex tetanica	A Sedge	PT
Carex wiegandii	Wiegands Sedge	PT
Chamaesyce polygonifolia	Small Sea-side Spurge	PT
Chrysopsis mariana	Maryland Golden-aster	PT
Circus cyaneus	Northern Harrier	PT
Cypripedium reginae	Showy Lady's-slipper	PT
Dodecatheon radicatum	Jeweled Shooting-star	PT
Eleocharis intermedia	Matted Spike-rush	PT
Eleocharis robbinsii	Robbins' Spike-rush	PT
Ellisia nyctelea	Ellisia	PT
Erigenia bulbosa	Harbinger-of-spring	PT
Eriophorum viridicarinatum	Thin-leaved Cotton-grass	PT
Etheostoma camurum	Bluebreast Darter	PT
Etheostoma maculatum	Spotted Darter	PT
Etheostoma tippecanoe	Tippecanoe Darter	PT
Euthamia tenuifolia	Grass-leaved Goldenrod	PT
Fimbristylis annua	Annual Fimbry	PT
Gaylussacia brachycera	Box Huckleberry	PT
Haliaeetus leucocephalus	Bald Eagle	PT
Hypericum densiflorum	Bushy St. John's-wort	PT
Hypericum majus	Larger Canadian St. John's-wort	PT
Ichthyomyzon greeleyi	Mountain Brook Lamprey	PT
Ilex opaca	American Holly	PT
Juncus alpinoarticulatus ssp. *nodulosus*	Richardson's Rush	PT
Juncus arcticus var. *littoralis*	Baltic Rush	PT
Juncus brachycephalus	Small-headed Rush	PT
Juncus torreyi	Torrey's Rush	PT

Lathyrus japonicus	Beach Peavine	PT
Lathyrus ochroleucus	Wild-pea	PT
Linnaea borealis	Twinflower	PT
Lobelia dortmanna	Water Lobelia	PT
Lycopodiella appressa	Southern Bog Clubmoss	PT
Magnolia tripetala	Umbrella Magnolia	PT
Magnolia virginiana	Sweet Bay Magnolia	PT
Melica nitens	Three-flowered Melic-grass	PT
Minuartia glabra	Appalachian Sandwort	PT
Minytrema melanops	Spotted Sucker	PT
Myotis leibii	Eastern Small-footed Myotis	PT
Myrica gale	Sweet-gale	PT
Myriophyllum tenellum	Slender Water-milfoil	PT
Najas gracillima	Bushy Naiad	PT
Neotoma magister	Allegheny Woodrat	PT
Notropis dorsalis	Bigmouth Shiner	PT
Noturus miurus	Brindled Madtom	PT
Nymphoides cordata	Floating-heart	PT
Oenothera argillicola	Shale-barren Evening-primrose	PT
Pandion haliaetus	Osprey	PT
Panicum tuckermanii	Tuckerman's Panic-grass	PT
Percina bimaculata	Chesapeake Logperch	PT
Percina evides	Gilt Darter	PT
Phemeranthus teretifolius	Round-leaved Fame-flower	PT
Phoxinus erythrogaster	Southern Redbelly Dace	PT
Plethobasus cyphyus	Sheepnose Mussel	PT
Poa paludigena	Bog Bluegrass	PT
Potamogeton confervoides	Tuckerman's Pondweed	PT
Potamogeton richardsonii	Red-head Pondweed	PT
Potentilla anserina	Silverweed	PT
Pseudemys rubriventris	Eastern Redbelly Turtle	PT
Ptelea trifoliata	Common Hop-tree	PT
Ribes triste	Red Currant	PT
Ruellia strepens	Limestone Petunia	PT
Salix candida	Hoary Willow	PT
Salix serissima	Autumn Willow	PT
Scirpus pedicellatus	Stalked Bulrush	PT
Scleria pauciflora	Few Flowered Nutrush	PT
Sorex palustris punctulatus	Southern Water Shrew	PT
Spiraea betulifolia	Dwarf Spiraea	PT
Streptopus amplexifolius	White Twisted-stalk	PT
Symphyotrichum depauperatum	Serpentine Aster	PT
Symphyotrichum novi-belgii	New York Aster	PT
Utricularia intermedia	Flat-leaved Bladderwort	PT
Viola appalachiensis	Appalachian Blue Violet	PT
Vittaria appalachiana	Appalachian Gametophyte Fern	PT
Cypripedium calceolus var. *pubescens*	Large Yellow Lady's-slipper	PV
Hydrastis canadensis	Golden-seal	PV
Panax quinquefolius	Wild Ginseng	PV

Aeschynomene virginica	Sensitive Joint-vetch	PX
Agalinis decemloba	Blue-ridge False-foxglove	PX
Agrostis altissima	Tall Bentgrass	PX
Arctostaphylos uva-ursi	Bearberry Manzanita	PX
Asclepias rubra	Red Milkweed	PX
Berberis canadensis	American Barberry	PX
Buchnera americana	Bluehearts	PX
Carex adusta	Crowded Sedge	PX
Carex backii	Rocky Mountain Sedge	PX
Carex barrattii	Barratt's Sedge	PX
Carex chordorrhiza	Creeping Sedge	PX
Carex hyalinolepis	Shore-line Sedge	PX
Carex sartwellii	Sartwell's Sedge	PX
Chamaecyparis thyoides	Atlantic White Cedar	PX
Commelina erecta	Slender Day-flower	PX
Commelina virginica	Virginia Day-flower	PX
Coreopsis rosea	Pink Tickseed	PX
Crassula aquatica	Water Pigmy-weed	PX
Critesion pusillum	Little Barley	PX
Crotonopsis elliptica	Elliptical Rushfoil	PX
Cynoglossum boreale	Northern Hound's-tongue	PX
Cypripedium candidum	Small White Lady's-slipper	PX
Desmodium sessilifolium	Sessile-leaved Tick-trefoil	PX
Dichanthelium leibergii	Leiberg's Panic-grass	PX
Dichanthelium spretum	Eaton's Witchgrass	PX
Diphasiastrum sabinifolium	Fir Clubmoss	PX
Draba reptans	Carolina Whitlow-grass	PX
Echinacea laevigata	Smooth Coneflower	PX
Elatine americana	Long-stemmed Water-wort	PX
Eleocharis tricostata	Three-ribbed Spike-rush	PX
Eleocharis tuberculosa	Long-tubercled Spike-rush	PX
Elodea schweinitzii	Schweinitz's Waterweed	PX
Erianthus giganteus	Sugar Cane Plumegrass	PX
Eriocaulon decangulare	Ten-angle Pipewort	PX
Eriocaulon parkeri	Parker's Pipewort	PX
Eryngium aquaticum	Marsh Eryngo	PX
Eupatorium leucolepis	White-bracted Thoroughwort	PX
Euphorbia obtusata	Blunt-leaved Spurge	PX
Fimbristylis puberula	Hairy Fimbry	PX
Galactia regularis	Eastern Milk-pea	PX
Galactia volubilis	Downy Milk-pea	PX
Gentiana catesbaei	Elliott's Gentian	PX
Gentianopsis virgata	Lesser Fringed Gentian	PX
Helianthus angustifolius	Swamp Sunflower	PX
Hottonia inflata	American Featherfoil	PX
Hydrocotyle umbellata	Many-flowered Pennywort	PX
Hypericum adpressum	Creeping St. John's-wort	PX
Hypericum crux-andreae	St Peter's-wort	PX
Hypericum denticulatum	Coppery St. John's-wort	PX

Hypericum gymnanthum	Clasping-leaved St. John's-wort	PX
Ilex glabra	Ink-berry	PX
Itea virginica	Virginia Willow	PX
Juncus greenei	Greene's Rush	PX
Koeleria macrantha	Junegrass	PX
Leiophyllum buxifolium	Sand-myrtle	PX
Lemna obscura	Little Water Duckweed	PX
Lemna valdiviana	Pale Duckweed	PX
Lespedeza stuevei	Tall Bush Clover	PX
Limosella australis	Awl-shaped Mudwort	PX
Lobelia nuttallii	Nuttall's Lobelia	PX
Ludwigia sphaerocarpa	Spherical-fruited Seedbox	PX
Micranthemum micranthemoides	Nuttall's Mud-flower	PX
Muhlenbergia capillaris	Short Muhly	PX
Onosmodium virginianum	Virginia False-gromwell	PX
Ophioglossum vulgatum	Adder's Tongue	PX
Phoradendron leucarpum	Christmas Mistletoe	PX
Platanthera cristata	Crested Yellow Orchid	PX
Platanthera leucophaea	Prairie White-fringed Orchid	PX
Polygala lutea	Yellow Milkwort	PX
Populus heterophylla	Swamp Cottonwood	PX
Potamogeton praelongus	White-stemmed Pondweed	PX
Prenanthes racemosa	Glaucous Rattlesnake-root	PX
Proserpinaca pectinata	Comb-leaved Mermaid-weed	PX
Ranunculus hederaceus	Long-stalked Crowfoot	PX
Rhododendron calendulaceum	Flame Azalea	PX
Rhynchospora fusca	Brown Beaked-rush	PX
Rhynchospora gracilenta	Beaked-rush	PX
Ruellia caroliniensis	Carolina Petunia	PX
Sabatia campanulata	Slender Marsh Pink	PX
Sagittaria filiformis	An Arrow-head	PX
Schoenoplectus heterochaetus	Slender Bulrush	PX
Scutellaria serrata	Showy Skullcap	PX
Sisyrinchium fuscatum	Sand Blue-eyed Grass	PX
Smilax pseudochina	Long-stalked Greenbrier	PX
Sparganium natans	Small Bur-reed	PX
Spiraea virginiana	Virginia Spiraea	PX
Spiranthes magnicamporum	Ladies'-tresses	PX
Trifolium reflexum	Buffalo Clover	PX
Triglochin palustris	Marsh Arrowgrass	PX
Utricularia resupinata	Northeastern Bladderwort	PX
Vitis rupestris	Sand Grape	PX
Adiantum aleuticum	Aleutian Maidenhair Fern	TU
Aletris farinosa	Colic-root	TU
Amelanchier humilis	Serviceberry	TU
Amelanchier obovalis	Coastal Juneberry	TU
Amelanchier sanguinea	Roundleaf Serviceberry	TU
Andropogon glomeratus	Bushy Bluestem	TU
Antennaria solitaria	Single-headed Pussy-toes	TU

Arabis hirsuta	Western Hairy Rock-cress	TU
Aristida dichotoma var. *curtissii*	Three-awned Grass	TU
Aristida longespica var. *geniculata*	Spiked Needlegrass	TU
Asclepias variegata	White Milkweed	TU
Carex buxbaumii	Brown Sedge	TU
Carex crawfordii	Crawford's Sedge	TU
Carex haydenii	Cloud Sedge	TU
Carex limosa	Mud Sedge	TU
Carex longii	Long's Sedge	TU
Carex lupuliformis	False Hop Sedge	TU
Carex meadii	Mead's Sedge	TU
Castilleja coccinea	Scarlet Indian-paintbrush	TU
Chasmanthium latifolium	Wild Oat	TU
Chenopodium capitatum	Strawberry Goosefoot	TU
Coeloglossum viride	Long-bracted Green Orchid	TU
Corallorhiza wisteriana	Spring Coral-root	TU
Crataegus brainerdii	Brainerd's Hawthorne	TU
Crataegus mollis	Downy Hawthorne	TU
Cuscuta cephalanthi	Button-bush Dodder	TU
Cuscuta coryli	Hazel Dodder	TU
Cuscuta polygonorum	Smartweed Dodder	TU
Cystopteris laurentiana	Laurentian Bladder-fern	TU
Desmodium glabellum	Tall Tick-trefoil	TU
Desmodium nuttallii	Nuttalls' Tick-trefoil	TU
Dichanthelium annulum	Serpentine Panic-grass	TU
Dichanthelium boreale	Panic-grass	TU
Dichanthelium commonsianum var. *commonsianum*	Cloaked Panic Grass	TU
Dichanthelium lucidum	Shining Panic-grass	TU
Dichanthelium villosissimum var. *villosissimum*	Long-haired Panic-grass	TU
Dichanthelium yadkinense	Yadkin River Panic-grass	TU
Elatine minima	Small Waterwort	TU
Epilobium palustre	Marsh Willow-herb	TU
Eupatorium rotundifolium	A Eupatorium	TU
Filipendula rubra	Queen-of-the-prairie	TU
Gentiana alba	Yellow Gentian	TU
Gentiana saponaria	Soapwort Gentian	TU
Gentiana villosa	Striped Gentian	TU
Goodyera tesselata	Checkered Rattlesnake-plantain	TU
Gratiola aurea	Golden Hedge-hyssop	TU
Gymnocarpium appalachianum	Appalachian Oak Fern	TU
Houstonia purpurea var. purpurea	Purple Bluets	TU
Hypericum drummondii	Nits-and-lice	TU
Juncus biflorus	Grass-leaved Rush	TU
Lathyrus palustris	Vetchling	TU
Lemna turionifera	A Duckweed	TU
Leucothoe racemosa	Swamp Dog-hobble	TU
Lonicera hirsuta	Hairy Honeysuckle	TU

Luzula bulbosa	Southern Wood-rush	TU
Lythrum alatum	Winged-loosestrife	TU
Malaxis monophyllos var. *brachypoda*	White Adder's-mouth	TU
Meehania cordata	Heartleaf Meehania	TU
Muhlenbergia cuspidata	Plains Muhlenbergia	TU
Nuphar microphylla	Yellow Cowlily	TU
Oxydendrum arboreum	Sourwood	TU
Oxypolis rigidior	Stiff Cowbane	TU
Packera plattensis	Prairie Ragwort	TU
Panicum flexile	Wiry Witchgrass	TU
Panicum longifolium	Long-leaf Panic-grass	TU
Paronychia fastigiata var. *nuttallii*	Forked-chickweed	TU
Parthenium integrifolium	American Fever-few	TU
Phlox pilosa	Downy Phlox	TU
Phyla lanceolata	Lance Fog-fruit	TU
Physalis virginiana	Virginia Ground-cherry	TU
Platanthera ciliaris	Yellow-fringed Orchid	TU
Platanthera hookeri	Hooker's Orchid	TU
Platanthera peramoena	Purple-fringeless Orchid	TU
Pluchea odorata	Shrubby Camphor-weed	TU
Poa languida	Drooping Bluegrass	TU
Podostemum ceratophyllum	Riverweed	TU
Polygala polygama	Racemed Milkwort	TU
Polygonella articulata	Eastern Jointweed	TU
Polygonum amphibium var. *stipulaceum*	A Water Smartweed	TU
Polygonum ramosissimum	Bushy Knotweed	TU
Potamogeton filiformis	Slender Pondweed	TU
Potamogeton illinoensis	Illinois Pondweed	TU
Potamogeton oakesianus	Oakes' Pondweed	TU
Pycnanthemum verticillatum var. *pilosum*	Hairy Mountain-mint	TU
Ranunculus flammula	Lesser Spearwort	TU
Ratibida pinnata	Gray-headed Prairie Coneflower	TU
Rhamnus alnifolia	Alder-leaved Buckthorn	TU
Rhynchospora recognita	Small Globe Beaked-rush	TU
Ribes lacustre	Swamp Currant	TU
Rosa virginiana	Virginia Rose	TU
Rubus cuneifolius	Sand Blackberry	TU
Rubus setosus	Small Bristleberry	TU
Rumex hastatulus	Heart-winged Sorrell	TU
Salix petiolaris	Meadow Willow	TU
Samolus parviflorus	Pineland Pimpernel	TU
Saxifraga micranthidifolia	Lettuce Saxifrage	TU
Scleria triglomerata	Whip Nutrush	TU
Scutellaria saxatilis	Rock Skullcap	TU
Senna marilandica	Wild Senna	TU
Sisyrinchium albidum	Blue-eyed Grass	TU
Solidago rigida	Hard-leaved Goldenrod	TU
Spiranthes tuberosa	Little Ladies'-tresses	TU
Stachys hyssopifolia	Hyssop Hedge-nettle	TU

Stylosanthes biflora	Pencilflower	TU
Symphyotrichum dumosum	Bushy Aster	TU
Symphyotrichum ericoides	White Heath Aster	TU
Symphyotrichum firmum	Firm Aster	TU
Taxus canadensis	American Yew	TU
Tradescantia ohiensis	Ohio Spiderwort	TU
Trillium flexipes	Declined Trillium	TU
Triosteum angustifolium	Horse-gentian	TU
Tripsacum dactyloides	Eastern Gamma-grass	TU
Uvularia pudica	Mountain Bellwort	TU
Viburnum trilobum	Highbush-cranberry	TU
Viola renifolia	Kidney-leaved White Violet	TU
Viola tripartita	Three-parted Violet	TU
Vitis cinerea var. baileyana	A Pigeon Grape	TU
Wolffia borealis	Dotted Water-meal	TU

[2] In the Commonwealth of Pennsylvania, plants, wild birds and mammals, and fish, amphibians, reptiles, and aquatic organisms fall under the jurisdiction of three different authorities. Each authority, as outlined below, has different definitions for listing status.

Plant Status Codes and Definitions:
Native Plant Species Legislative Authority: Title 17 Chapter 45, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Conservation and Natural Resources.

PE (Pennsylvania Endangered): Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PT (Pennsylvania Threatened): Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.

PR *(Pennsylvania Rare)*: Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification. Disjunct: significantly separated from their main area of distribution, Endemic: confined to a specialized habitat, Limit of Range: at or near the periphery of their natural distribution, Restricted: found in specialized habitats or habitats infrequent in Pennsylvania.
PX *(Pennsylvania Extirpated)*: Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.

PV *(Pennsylvania Vulnerable)*: Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU *(Tentatively Undetermined)*: A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.

N: No current legal status exists, but is under review for future listing.

Wild Birds and Mammals Status Codes and Definitions:
Wild Birds and Mammals Legislative Authority: Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990, Pennsylvania Game Commission.

PE *(Pennsylvania Endangered)*: Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.

PT *(Pennsylvania Threatened)*: Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish, Amphibians, Reptiles, and Aquatic Organisms Status Codes and Definitions:
Fish, Amphibians, Reptiles, and Aquatic Organisms Legislative Authority: Title 30, Chapter 75, Fish and Boat Code, revised February 9, 1991; Pennsylvania Fish Commission.

PE *(Pennsylvania Endangered)*: All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT *(Pennsylvania Threatened)*: All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

PC: Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.

N: No current legal status, but is under review for future listing.