ENVIRONMENTAL ASSESSMENT

REDUCING CANADA GOOSE DAMAGE THROUGHOUT THE COMMONWEALTH OF MASSACHUSETTS

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ANIMAL AND PLANT HEALTH INSPECTION SERVICE
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In Cooperation with:

UNITED STATED DEPARTMENT OF INTERIOR
UNITED STATES FISH AND WILDLIFE SERVICE

And the

MASSACHUSETTS DIVISION OF FISHERIES AND WILDLIFE

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LIST OF APPENDICES

ACRONYMS

AP	Atlantic Population
AI	Avian Influenza
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BO	Biological Opinion
CBC	Christmas Bird Count
CDC	Centers for Disease Control and Prevention
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
DNC	4,4'-dinitrocarbanilide
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	United States 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
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
HDP	4, 6-dimethyl-2-pyrimidinol
HP	High Pathogenic
INAD	Investigational New Animal Drug
LC_{50}	Lethal Concentration
LD_{50}	Lethal Dose
MBTA	Migratory Bird Treaty Act
MDAR	Massachusetts Department of Agricultural Resources
MDCR	Massachusetts Department of Conservation and Recreation
MESA	Massachusetts Endangered Species Act
DWSP	Division of Water Supply Protection
MDFG	Massachusetts Department of Fish and Game
MDFW	Massachusetts Division of Fisheries and Wildlife
MGL	Massachusetts General Law
MOU	Memorandum of Understanding
N	Nitrogen
NAP	North Atlantic Population
NAS	National Audubon Society
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWCO	Nuisance Wildlife Control Officer
NWRC	National Wildlife Research Center
P	Phosphorus
PAC	Problem Animal Control
ROD	Record of Decision
SJBP	Southern James Bay Population
SOP	Standard Operating Procedures

T&E	Threatened and Endangered
US	United States
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

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

The purpose of this Environmental Assessment (EA) is to evaluate activities conducted by WS to manage damage and threats to agricultural resources, property, natural resources, and threats to humans caused by Canada geese in the Commonwealth of Massachusetts where a request for assistance is received and when a depredation permit has been issued by the United States Fish and Wildlife Service (USFWS). This EA will assist in determining if the proposed management of goose damage to address the need for action could have a significant impact on the human environment for both humans and other organisms. The EA will also assist with identifying and addressing issues associated with goose damage management and analyzes alternative approaches to address those issues and the need for action. In addition, this EA will be a planning document to coordinate efforts with other federal, Commonwealth, and local agencies. The public involvement process associated with the development of the EA will inform the public of the proposed activities and will allow for public input into the process. This EA analyzes the potential effects of goose damage management when requested, as coordinated between WS, the USFWS, and the Massachusetts Division of Fisheries and Wildlife (MDFW).

More specifically, WS, in cooperation with the USFWS, is preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of activities, and 5) evaluate and determine if there are any potentially significant or cumulative adverse effects from the proposed program. The analyses contained in the EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, public involvement, information in WS' programmatic Final Environmental Impact Statement (FEIS) (USDA 1997)[2], and the FEIS completed by the USFWS for the management of resident Canada geese (USFWS 2005).

This EA evaluates the need for action to manage damage associated with Canada geese in the Commonwealth, the potential issues associated with goose damage management, and the environmental consequences of conducting different alternatives to address the need for action and the identified issues. The issues and alternatives were initially developed by WS, the USFWS, and the MDFW. To assist with the identification of additional issues and alternatives to managing damage associated with geese in Massachusetts, the EA will be made available to the public for review and comment prior to a Decision[3]. Under the proposed action, WS would respond to requests for assistance to resolve and prevent goose

[1]The USDA-APHIS-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 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c).

[2]WS has prepared a programmatic FEIS that further addresses WS' activities to manage damage associated with wildlife, including detailed discussion of program activities, a risk assessment of methods, and discussion of issues (USDA 1997). Information from WS' programmatic FEIS has been incorporated by reference into this EA.

[3]After the development of the EA by WS and after public involvement in identifying new issues and alternatives, WS will issue a Decision. Based on the analyses in the EA after public involvement, 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.

damage and threats on federal, Commonwealth, municipal, and private lands in Massachusetts. The EA evaluates activities that are currently being conducted or have been conducted previously by WS when requested. The EA also addresses the potential effects of managing goose damage by WS on areas where additional requests for assistance may be received in the future. Because WS mission is to conduct a coordinated damage management program in accordance with plans, goals, and objectives developed to reduce damage and threats of damage associated with wildlife, and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur when requested. Thus, this EA anticipates those additional efforts and the analyses are intended to apply to actions that may occur in any locale and at any time within Massachusetts as part of a coordinated program.

In addition, the EA will evaluate the issuance of depredation permits by the USFWS to WS and to other entities pursuant to the Migratory Bird Treaty Act (MBTA) for the "*take*" of Canada geese to alleviate damage or the threats of damage. For the purposes of the MBTA, "*take*" has been defined as "*...to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess,...ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried,...any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof...*" (16 U.S.C 703a).

1.2 NEED FOR ACTION

Across the United States, human populations have expanded and land has been transformed to meet varying human needs. As the landscape has been altered to meet human needs, wildlife habitat has been substantially changed. Those human needs often compete with wildlife and have inherently increased the potential for negative interactions between wildlife and people. Negative interactions between people and wildlife occur when wildlife cause damage to resources and threaten human safety. Some species of wildlife, including Canada geese, have adapted to and thrive in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between humans and wildlife that lead to requests for assistance to reduce damage to resources and to lessen the threat to human safety. WS' programmatic FEIS summarizes the relationship of wildlife values and wildlife damage in this way (USDA 1997):

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

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. Biological carrying capacity is the land or habitat's ability 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 community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those persons directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the habitat may have

a biological carrying capacity to support higher populations of wildlife, 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, including lethal methods, 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 (Leopold 1933, Berryman 1991, The Wildlife Society 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for wildlife damage management is derived from those specific threats to resources. Those wildlife species have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage, deposit feces) 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 seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, how damage is defined is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where the 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 but could also include a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

Wildlife management is often based on balancing wildlife populations and human perceptions, in a struggle to preserve rare species, regulate species' populations, oversee consumptive uses of wildlife, and conserve the environment that provides habitat for wildlife resources. Increasingly, cities, towns, parks, airports, and private properties have become sites of some of the greatest challenges for wildlife management (Adams et al. 2006). When the presence of a prolific, adaptable species such as the Canada goose is combined with human expansion, land management conflicts often develop. Long thought of as a spectacular sight during the spring and fall migration, Canada geese are now frequently and abundantly present in cities and towns throughout Massachusetts and across the United States. Wildlife, including Canada geese, is generally regarded as providing ecological, educational, economic, recreational, and aesthetic benefits (Decker and Goff 1987), and there is enjoyment in knowing wildlife exists and contributes to natural ecosystems (Decker et al. 2001).

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

As populations of resident Canada geese have increased, the amount of damage occurring to resources and threats posed by geese has also risen (USFWS 2005). During the development of the FEIS that

evaluated the management of resident Canada goose populations, the resident Canada goose population in the eastern United States (*i.e.*, the Atlantic Flyway) had reached one million geese and the population had increased an average of 2% annually during the ten years prior to the development of the FEIS (USFWS 2005). Since 1999, the number of geese observed along routes surveyed during the breeding season in Massachusetts has shown annual increases (Sauer et al. 2011). The close association of Canada geese with human activities in addition to the increases occurring in the resident Canada goose population has led to greater instances of situations where people consider the behavior of geese has risen to a level where damage to resources or unacceptable risks to human safety have occurred. Although most damage occurring in Massachusetts happens during the spring and summer, damage and the threat of damage associated with geese can occur throughout the year. At the time the resident Canada goose population management FEIS was developed, the MDFW estimated the agency received an average of 85 requests for assistance with damage associated with geese annually (USFWS 2005).

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

The need for action to manage damage associated with Canada geese in Massachusetts arises from requests for assistance[4] received to reduce and prevent damage from occurring to four major categories. Those four major categories include agricultural resources, natural resources, property, and threats to human safety. Most requests for WS' assistance are associated with suburban areas where geese congregate on public or private ponds and forage on lawns and mowed areas associated with parks, beaches, golf courses, schools, business campuses, and residences. The major problems are associated with the impacts of feces and grazing damage to lawns and other areas (including sidewalks, driveways, and swimming pools).

Table 1.1 lists WS' technical assistance projects involving goose damage or threats of goose damage to those four major resource types in Massachusetts from the federal fiscal year[5] (FY) 2006 through FY 2010. Technical assistance is provided by WS to those persons requesting assistance with resolving damage or the threat of damage by providing information and recommendations on goose damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA.

The technical assistance projects conducted by WS are representative of the damage and threats that are caused by Canada geese in Massachusetts. As shown in Table 1.1, WS has conducted 159 technical assistance projects in Massachusetts that addressed damage and threats associated with geese. Most

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

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

requests for assistance were associated with goose damage to property. Over 69% of the requests received by WS for technical assistance involved goose damage to property, although many of those requests also involved health concerns related to disease transmission from droppings.

Table 1.1 - Technical assistance requests for goose damage received by WS, FY 2006 - FY 2010

	Resource Category				
Fiscal Year	**Agriculture**	**Natural Resources**	**Property**	**Human Safety**	**TOTAL**
2006	5	0	28	5	**38**
2007	0	2	9	3	**14**
2008	3	1	25	3	**32**
2009	7	2	22	4	**35**
2010	5	0	26	9	**40**
TOTAL	**20**	**5**	**110**	**24**	**159**

Therefore, the need for action for WS and the USFWS is to respond to requests for assistance associated with Canada geese while the need for action for those persons seeking assistance is associated with damage to resources and threats to human safety occurring from geese. Geese can be found statewide throughout the year; therefore, damage or the threats of damage can occur wherever geese are present in the Commonwealth if conditions occur where the tolerance of damage or threats of damage have exceeded the thresholds of individual people. Additional information on the need for action associated with resident Canada goose populations can be found in the resident Canada goose management FEIS developed by the USFWS in cooperation with WS (USFWS 2005). More specific information on the need for action associated with goose damage or threats of goose damage are discussed in the following subsections of the EA:

Need to Resolve Damage to Agricultural Resources

The most common damage to agricultural resources associated with geese is crop consumption (*i.e.*, loss of the crop and revenue), but also consists of unacceptable accumulations of feces on pastures, trampling of emerging crops, and increased erosion and runoff from fields where the cover crop has been grazed (USFWS 2005). Soil compaction resulting in reduced production and quality of potato crops and damage to commercial sod grass due to excess grazing and droppings has been reported. Canada geese graze a variety of crops, including alfalfa, barley, beans, corn, soybeans, wheat, rye, oats, spinach, and peanuts (Atlantic Flyway Council 1999, Nichols 2003, USFWS 2005, Haramis and Kearns 2006). A single intense grazing event by Canada geese in fall, winter, or spring can reduce the yield of winter wheat by 16-30% (Fledger et al. 1987), and reduce growth of rye plants by more than 40% (Conover 1988). However, some studies have shown that grazing by geese during the winter may increase rye or wheat seed yields (Clark and Jarvis 1978, Allen et al. 1985). Canada geese were found to significantly impact wild rice (*Zizania aquatica*) by grazing, and considerable reduction in the local goose population produced recovery of rice and other vegetation (Haramis and Kearns 2006). The principal agricultural crops grown in Massachusetts by total acreage are pasture/hay, vegetables, berries, field corn, and sweet corn (USDA 2009*a*). Over a three year period in the early 1990s, damage to cranberry bogs in Massachusetts associated with Canada geese was estimated at nearly $120,000 per year (USFWS 2005).

Canada geese are also a concern to livestock producers. Waterfowl droppings in and around livestock ponds, hayfields, and pasture can affect water quality, contaminate feed, and could be a source of a number of different types of bacteria, creating concerns about potential disease interactions between Canada geese and livestock. The transmission of diseases through drinking water is one of the primary concerns for 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 <1,000 fecal coliform/100 ml for adult animals and < 1 fecal coliform/100 ml for young animals (Mancl 1989). Although no direct links have been made, salmonella outbreaks have occurred in cattle on farms in northern Virginia when large numbers of geese were present. Salmonella causes shedding of the intestinal lining and severe diarrhea in cattle. If undetected and untreated, salmonella can kill cattle and calves.

Waterfowl are the acknowledged natural reservoirs for a variety of avian influenza viruses (Davidson and Nettles 1997). Avian influenza (AI) circulates among those birds without clinical signs and is not an important mortality factor in wild waterfowl (Davidson and Nettles 1997). 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, USDA 2008). For example, the threat of disease transmission to poultry producers associated with Canada geese has been a concern with many poultry companies which have advised producers to keep wild ducks and geese away from buildings housing chickens (USFWS 2005).

Need to Reduce Threats to Human Safety

Birds can play an important role in the transmission of zoonotic diseases where humans may come into contact with fecal droppings of those birds. 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 some disease-causing agents associated with birds may also be contracted from other sources. The presence of disease causing organisms in goose feces is a result of the pathogens being present in the environment in which the geese live. Disease-causing organisms do not originate with Canada geese (*i.e.*, geese do not produce disease-causing organisms) but those geese can act as reservoirs for disease causing organisms that are of concern to human safety. Of concern, is the ability of Canada geese to obtain disease causing organisms and transporting those organisms to other areas, especially to areas with a high amount of human activity. With the ability to fly and move from one location to another, geese can obtain a disease causing organism at one location and transfer the disease causing organism from that location to another location. The risk of disease transmission from birds to humans is likely very low. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms are known to occur increases the likelihood of disease transmission. Canada geese can be closely associated with human habitation where interaction with geese or fecal droppings can occur. Geese often exhibit gregarious behavior which can lead to accumulations of fecal droppings in areas where birds forage or loaf. Accumulations of feces can be considered a threat to human health and safety due to the close association of geese with human activity. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where humans may come in direct contact with fecal droppings.

Geese may impact human health through the distribution and incubation of various pathogens and through nutrient loading. For instance, a foraging Canada goose defecates between 5.2 and 8.8 times per hour (Bedard and Gauthier 1986). Kear (1963) recorded a maximum fecal deposition rate for Canada geese of 0.39 pounds per day (dry weight). Public swimming beaches, private ponds, and lakes can be affected by goose droppings. There are several pathogens involving waterfowl which may be contracted by humans; however, the risk of infection is believed to be low (Centers for Disease Control and Prevention (CDC) 1998). The primary route of infection is through incidental contact with contaminated material. Direct contact with fecal matter is not a likely route of transmission of waterfowl zoonoses unless ingested directly. Although intentional contact with feces is not likely, transmission can occur when people unknowingly contact and ingest contaminated material. Therefore, the risk to human health from zoonoses is low and a direct link of transmission from geese to humans is difficult to determine, especially given that many pathogens occur naturally in the environment or can be attributed to

contamination from other sources. However, the presence of disease causing organisms in goose feces increases the risks of exposure and transmission of zoonoses wherever people may encounter large accumulations of feces from geese. Fleming et al. (2001) reviewed the impacts of Canada geese on water quality by addressing pathogens and nutrient loading and identified a number of hazards that geese are associated with. The USFWS has documented threats to public health from geese and has authorized the take of geese to reduce this threat in the resident Canada goose FEIS (USFWS 2005).

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum* and was not known to cause disease in humans until as late as 1976 (CDC 1998). A person can be infected by drinking contaminated water or from contact with the fecal material of infected animals (CDC 1998). Exposure can occur from swimming in lakes, ponds, streams, and pools, and from swallowing water while swimming (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and produce life threatening infections, especially in people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis is recognized as a disease with implications for human health (Smith et al. 1997). Canada geese in Maryland were shown to disseminate infectious *Cryptosporidium parvum* oocysts in the environment (Graczyk et al. 1996). Kassa et al. (2001) found that *Cryptosporidium* was the most common infectious organism found in 77.8% of goose fecal samples from sites comprised primarily of parks and golf courses, indicating that occupational exposure to this pathogen is very plausible although the risk to humans is relatively low.

Giardiasis (*Giardia lambia*) is an illness caused by a microscopic parasite that has become recognized as one of the most common causes of waterborne disease in humans in the United States during the last 15 years (CDC 1999). Giardiasis is contracted by swallowing contaminated water or from placing contaminated surfaces into the mouth. Symptoms of giardiasis include diarrhea, cramps, and nausea (CDC 1999). Canada geese in Maryland were shown to disseminate infectious *Giardia* spp. cysts in the environment (Graczyk et al. 1998). Kassa et al. (2001) also found *Giardia* spp. in goose feces at numerous urban sites.

Salmonella (*Salmonella* spp.) may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea.

Chlamydia psittaci, which can be present in diarrhetic feces of infected waterfowl, can be transmitted if it becomes airborne (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl, herons, and rock pigeons are the most commonly infected wild birds in North America (Locke 1987).

Campylobacteriosis is an infectious disease caused by bacteria of the genus *Campylobacter*. In persons with compromised immune systems, *Campylobacter* occasionally spreads to the bloodstream and causes a serious life-threatening infection, but normally causes diarrhea and is one of the most common diarrhea illnesses in the United States (CDC 2007). Canada geese have been found to be a carrier of *Campylobacter* and can spread the bacteria in their feces (Kassa et al. 2001).

Escherichia coli (*E. coli*) are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of *E. coli* with the majority of serological types being harmless (Sterritt and Lester 1988). Probably the best known serological type of *E. coli* is *E. coli* O157:H7, which is usually associated with cattle (Gallien and Hartung 1994). Recent research has demonstrated that Canada geese can disseminate *E. coli* into the environment which can elevate fecal coliform densities in the water column (Hussong et al. 1979, Alderisio and DeLuca 1999, Cole et al. 2005). Many communities monitor water quality at swimming beaches and lakes, but lack the financial

resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards, the beaches are temporarily closed which can adversely affect the enjoyment of those areas by the public, even though they may not have been able to determine the serological type of the *E. coli*. Unfortunately, linking the elevated bacterial counts to the frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link those animal sources of coliform bacteria to fecal contamination (Simmons et al. 1995, Jamieson 1998). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998, Alderisio and DeLuca 1999). Also, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir. Cole et al. (2005) found that geese may serve as a vector of antimicrobial resistance genes, indicating that they not only harbor and spread zoonotic diseases like *E. coli* but may spread strains that are resistant to current control measures.

Roscoe (1999) conducted a survey to estimate the prevalence of pathogenic bacteria and protozoa in resident Canada geese in New Jersey and found no *Salmonella* spp., *Shigella* spp., or *Yersinia* spp. isolated from any of the 500 Canada goose samples. However, Roscoe (1999) did report finding *Cryptosporidium* spp. in 49 (10%) of the 500 geese, and *Giardia* sp. in 75 (15%) of the geese. Additionally, the United States Geological Survey (USGS) conducted field studies in New Jersey, Virginia, and Massachusetts to determine the presence of organisms that could cause disease in humans exposed to feces of Canada geese at sites with a history of high public use and daily use by geese (USGS 2000). *Salmonella* spp., *Listeria* spp., *Chlamydia* spp., and *Giardia* spp. were isolated from goose feces collected in those States but occur at low frequencies (USGS 2000). The USGS (2000) concluded that the low frequency of disease causing organisms found in goose droppings showed the risks of disease transmission to humans was minimal at the four sites sampled in Massachusetts, New Jersey, and Virginia during the summer and early fall of 1999.

While transmission of diseases or parasites from geese 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, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun et al. 2000). In worst case scenarios, infections may even be life threatening for people with compromised or suppressed immune systems (Roffe 1987, Graczyk et al. 1998). Even though many people are concerned about disease transmission from feces, the probability of contracting a disease from feces is believed to be small. However, human exposure to fecal droppings through direct contact or through the disturbance of accumulations of fecal droppings where disease organisms are known to occur increases the likelihood of disease transmission. Canada geese are closely associated with human habitation and they often exhibit gregarious roosting and nesting behavior. This gregarious behavior leads to accumulations of fecal droppings that can be considered a threat to human health and safety due to the close association of those species of birds with human activity. Accumulations of bird droppings in public areas are aesthetically displeasing and are often in areas where humans may come in direct contact with fecal droppings.

As stated previously, a common concern among those persons requesting assistance is the threat to human health and safety from disease transmission which has only been heightened from recent, widely publicized zoonoses events like the spread of the West Nile Virus and Avian Influenza. However, requests are also received for assistance from a perception of a threat of physical harm from aggressive waterfowl. Canada geese thrive in urban habitat created by humans from a constant supply of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created food

sources, readily available water supplies, and the few predators found in urban areas often increase the survival rates and carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor to wildlife species in and around urban areas is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the unlimited amount of food, water, and shelter found within urban habitats.

Financial costs related to human health threats involving geese may include testing of water for *coliform* bacteria, cleaning and sanitizing beaches regularly of feces, contacting and obtaining assistance from public health officials, and implementing non-lethal and lethal methods of wildlife damage management. 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.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by humans 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 humans and human activity, a loss of apprehension occurs that can lead those species to exhibit threatening behavior toward humans. 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 humans, or abnormal behavior. Though geese attacking humans occurs rarely, aggressive behavior by geese does occur, especially during nest building and the rearing of eggs and chicks. Canada geese aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Smith et al. 1999). This is a significant threat because resident Canada geese often nest in high densities in areas used by humans for recreational purposes such as parks, beaches, and sports fields (VerCauteren and Marks 2004). Additionally, slipping hazards can be created by the buildup of feces from geese on docks, walkways, and other areas of foot traffic.

Need to Reduce Threats to Aviation Safety

In addition to threats of zoonotic diseases, birds also pose a threat to human safety from being struck by aircraft. Birds struck by aircraft, especially when ingested into engines, can lead to structural damage to the aircraft leading to catastrophic engine failure. 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). Collisions between aircraft and wildlife are a concern throughout the world because 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 transport industry as a whole (Conover et al. 1995).

Generally, bird collisions occur when aircraft are near the ground. From 1990-2008, approximately 59% of reported bird strikes to civilian aircraft in the United States occurred when the aircraft was at an altitude of 100 feet above ground level or less (Dolbeer et al. 2009). Additionally, 72% occurred less than 500 feet above ground level and about 92% occurred under 3,000 feet above ground level (Dolbeer et al. 2009). From 1990-2008, birds were involved in nearly 97% of the reported wildlife strikes to civil aircraft in the United States (Dolbeer et al. 2009).

From May 1990 to March 2011, 1,768 wildlife strikes were reported to the Federal Aviation Administration (FAA) in Massachusetts, with 32 strikes involving Canada geese (FAA 2011). Thirteen of these strikes, over 40.6%, resulted in damage to the aircraft (FAA 2011). The number of bird strikes actually occurring is likely to be much greater, since it is estimated that only 20-25% of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 1995, Linnell et al. 1996, Linnell et al. 1999, Cleary et al.

2000). Waterfowl were involved in the greatest number of damaging strikes (31%) in which the bird species was identified when compared to all other bird groups (Dolbeer and Wright 2008). 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 8-15 lbs which exceeds the 4-lb bird certification standard for engines and airframes); flocking behavior (which increases the likelihood of multiple bird strikes); attraction to airports for grazing; and year-around presence in urban environments near airports (Seubert and Dolbeer 2004).

From 1990-2008 there were 1,181 reported strikes involving Canada geese in the United States, resulting in nearly $51 million in damage and associated costs to civil aircraft (Dolbeer et al. 2009). 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 (Dolbeer et al. 2009). Though the aircraft was destroyed after sinking in the river, all 150 passengers and 5 crew members survived. In addition to civil aviation, the United States Air Force (USAF) reports that Canada geese have caused nearly $93 million in damage to aircraft and have been involved in 139 strikes since the beginning of their recording period through December 2009, averaging over $669,000 in damages per strike (USAF 2010). In 1995, a Boeing 707 E38 AWACS jet taking off from Elmendorf Air Force Base in Alaska ingested at least 13 geese into the number 1 and 2 engines and crashed, killing all 24 crew members.

Bird strikes cause an estimated seven fatalities involving civilian and military aircraft each year (Linnell et al. 1996). For the period 1990-2000, waterfowl (geese and ducks) comprised 11% of all bird-aircraft strikes to civil aviation reported to the FAA for which the bird species or group was reported (Cleary et al. 2002). For the period 1990-2000, more than 50% of Canada Goose-aircraft strikes resulted in damage to the aircraft, and 28.5% resulted in a negative effect on the flight (Cleary et al. 2002). WS receives requests for assistance regarding bird damage management at airports and military airbases in Massachusetts.

Need to Reduce Damage to Property

Geese may cause damage to aircraft, landscaping, piers, yards, boats, beaches, shorelines, parks, golf courses, driveways, athletic fields, ponds, lakes, rafts, porches, patios, gardens, foot paths, swimming pools, play grounds, school grounds, and cemeteries (USFWS 2005). Property damage most often involves goose fecal matter that contaminates landscaping and walkways, often at golf courses and water front property. Fecal droppings and the overgrazing of vegetation can be aesthetically displeasing. Businesses may be concerned about the negative aesthetic appearance of their property caused by excessive droppings and excessive grazing, and are sensitive to comments by clients and guests. Costs associated with property damage include labor and disinfectants to clean and sanitize fecal droppings, implementation of wildlife management methods, loss of property use, loss of aesthetic value of flowers, gardens, and lawns consumed by geese, loss of customers or visitors irritated by walking in fecal droppings, repair of golf greens, and replacing grazed turf. The costs of reestablishing overgrazed lawns and cleaning waterfowl feces from sidewalks has been estimated at more than $60 per bird (Allan et at. 1995). In a survey of the Massachusetts Golf Course Owners Association, 84% of the respondents reported at least some damage or threats of damage at golf courses in the Commonwealth associated with geese (USFWS 2005).

Between 1990 and 2008, a total of 1,181 reports of aircraft striking Canada geese in the United States have been reported to the FAA with over 51% of those strikes resulting in damage to the aircraft (Dolbeer et al. 2009). Nearly 27% of the reported goose strikes resulted in a negative effect on the flight of the

aircraft (*e.g.*, aircraft had to make an emergency landing). Of the 1,181 reported aircraft strikes involving geese, 509 of those reports involved aircraft striking multiple geese (Dolbeer et al. 2009). Reported goose strikes in the United States from 1990 through 2008 have resulted in 59,087 hours of aircraft down time and resulting in nearly $51 million in repair costs (Dolbeer et al. 2009). The emergency landing of U.S. Airways Flight 1549 in the Hudson River in early 2009 after the aircraft ingested Canada geese into both engines (National Transportation Safety Board 2009, Marra et al. 2009) has increased the public's awareness of the dangers associated with aircraft striking wildlife (Dolbeer et al. 2009). The USAF has reported that aircraft striking Canada geese have resulted in nearly $93 million in damages to military aircraft (USAF 2010).

Need to Protect Natural Resources

Geese can also negatively impact natural resources. Large concentrations of geese have affected water quality around beaches and in wetlands by acting as nonpoint source pollution. There are four forms of nonpoint source pollution: sedimentation, nutrients, toxic substances, and pathogens. Large concentrations of waterfowl can remove shoreline vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds, and reservoirs (USFWS 2005). WS has assisted cooperators in Massachusetts with managing goose damage to wetland mitigation sites where excessive grazing on emergent vegetation necessitated re-planting of the site at significant costs. Overabundant resident Canada geese can negatively impact crops and habitats that are maintained as food and cover for migrant waterfowl and other wildlife.

The severe grazing of vegetation along levees results in the loss of turf which holds soil on manmade levees. Heavy rains on bare soil levees results in erosion which would not have occurred if the levee had been vegetated. Excessive numbers of Canada geese have been reported to be sources of nutrients and pathogens in water. Canada geese are attracted to waste water treatment plants because of the water and available grasses. Sewage treatment plants in Massachusetts are required to test water quality of effluents before release from finishing ponds into the environment. Coliform bacteria causes acidic pH levels in the water and lowers dissolved oxygen which kills aquatic organisms (Cagle 1998). Also, fecal contamination increases nitrogen levels in the pond resulting in algae blooms. Oxygen levels are depleted when the algae dies resulting in the death of aquatic invertebrates and vertebrates.

Nutrient loading has been found to increase in wetlands in proportion to increases in the numbers of roosting geese (Manny et al. 1994, Kitchell et al. 1999). In studying the relationship between bird density and phosphorus (P) and nitrogen (N) levels in Bosque Del Apache National Wildlife Refuge in New Mexico, Kitchell et al. (1999) found an increase in the concentration of both P and N correlated with an increase in bird density. Scherer et al. 1995 stated that waterfowl metabolize food very rapidly and most of the phosphorus contributed by bird feces probably originates from sources within a lake being studied. In addition, assimilation and defecation converted the phosphorus into a more soluble form and, therefore was considered a form of internal loading. Waterfowl have contributed substantial amounts of P and N into lakes through feces creating excessive aquatic macrophyte growth and algae blooms (Scherer et al. 1995) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for goose damage management to reduce threats to human safety and to resolve damage to property, natural resources, and agricultural resources on federal, Commonwealth, tribal, municipal, and private land within the Commonwealth of Massachusetts wherever such

management is requested by a cooperator. This EA discusses the issues associated with conducting goose damage management in the Commonwealth to meet the need for action and evaluates different alternatives to meet that need while addressing those issues. In addition, this EA evaluates the permitting of goose take through the issuance of depredation permits by the USFWS to WS and to other entities within the Commonwealth.

The methods available for use under the alternatives evaluated are provided in Appendix B. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with geese in the Commonwealth. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with geese from occurring when permitted by the USFWS. In addition, this EA evaluates the permitting of take by the USFWS to other entities to address goose damage in the Commonwealth.

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

The MBTA does allow for the lethal take of those bird species listed in 50 CFR 10.13 when depredation occurs through the issuance of depredation permits or the establishment of depredation orders. Under authorities in the MBTA, the USFWS is the federal agency responsible for the issuance of depredation permits or the establishment of depredation orders for the take of those protected bird species when damage or threats of damage are occurring. Information regarding migratory bird permits can be found in 50 CFR 13 and 50 CFR 21.

The USFWS is a cooperating agency on this EA to analyze cumulative take of geese from the issuance of depredation permits to entities within the Commonwealth and to ensure compliance with the NEPA. The USFWS has jurisdiction over the management of migratory birds and has specialized expertise in identifying and quantifying potential adverse effects to the human environment from bird damage management activities. The analyses in this EA would ensure the USFWS compliance with the NEPA for the issuance of depredation permits for the take of Canada geese in the Commonwealth to WS and to other entities.

Native American Lands and Tribes

Currently, WS does not have a Memorandum of Understanding (MOU) or signed cooperative service agreement with any Native American tribes in Massachusetts. If WS is requested by a tribe to conduct goose damage management activities, this EA would be reviewed and supplemented, if appropriate, to insure compliance with the NEPA.

Federal, Commonwealth, County, City, and Private Lands

Under two of the alternatives, WS could continue to provide goose damage management activities on federal, Commonwealth, county, municipal, and private land in Massachusetts when a request is received for such services by the appropriate property owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by geese, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA would cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, actions taken on federal lands have been analyzed

in the scope of this EA.

Period for which this EA is Valid

If the analyses in this EA indicates an Environmental Impact Statement (EIS) is not required, this EA would remain valid until WS determines that new needs for action, changed conditions, new issues, or new alternatives having different 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 each year to ensure that activities conducted under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no involvement in goose damage activities by WS is selected, no annual analyses would occur based on the lack of involvement by WS. Annual monitoring of activities ensures the EA remains appropriate to the scope of goose damage management activities conducted by WS in Massachusetts.

Site Specificity

This EA analyzes the potential impacts of goose damage management and addresses activities on all private and public lands in Massachusetts where activities occurred previously under a MOU, cooperative service agreement, and in cooperation with the appropriate public land management agencies. The EA also addresses the potential impacts of goose damage management on areas where additional MOUs, cooperative service agreements, or other comparable documents may be signed in the future. 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 goose damage management efforts could occur. Thus, this EA anticipates that potential expansion and analyzes the impacts of such efforts as part of the alternatives.

Canada geese can be found statewide throughout the year in Massachusetts. Planning for the management of goose damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. Although some of the sites where goose damage could occur can be predicted, all specific locations or times where such damage would occur in any given year cannot be predicted. The threshold triggering an entity to request assistance from WS to manage damage associated with Canada geese is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever goose damage and the resulting damage management activities occur, and are treated as such. Chapter 2 of this EA identifies and discusses issues relating to goose damage management in Massachusetts. The standard WS Decision Model (Slate et al. 1992, USDA 1997) would be the site-specific procedure for individual actions conducted by WS in Massachusetts (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and SOPs described in this EA and adopted as part of any decision associated with this EA.

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

Summary of Public Involvement

Issues related to goose damage management as conducted by WS in Massachusetts were initially developed by WS in consultation with the USFWS and the MDFW. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public through legal notices published in local print media, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of threats and damage associated with Canada geese in Massachusetts, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS will provide for a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS 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 raised after publication of public notices would be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a Decision or publication of a notice of intent to prepare an EIS. New issues or alternatives identified from the public involvement process would be fully considered.

1.4 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The management of migratory birds is the responsibility of the USFWS. As the authority for the management of bird populations, the USFWS was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The MDFW is responsible for managing wildlife in the Commonwealth, including geese. Any activities to reduce and/or prevent Canada goose damage in Massachusetts would be coordinated with the USFWS and the MDFW which ensure WS' actions are incorporated into population objectives established by those agencies for goose populations in the Commonwealth. The USFWS and the MDFW reviewed the EA to identify issues, alternatives, and to ensure compliance with Commonwealth laws and regulations.

Based on the scope of this EA, the decisions to be made are: 1) should WS continue to conduct Canada goose damage management to alleviate damage to agriculture, property, natural resources, and threats to human safety, 2) should WS conduct disease surveillance and monitoring in the goose population when requested by the MDFW and the USFWS, 3) should WS implement an integrated wildlife damage management strategy, including technical assistance and direct operational assistance, to meet the need for goose damage management in Massachusetts, 4) if not, should WS attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, 5) should the Migratory Bird Program in USFWS Region 5 issue a depredation permit to WS and other entities to conduct Canada goose damage management activities, and 6) would the proposed action result in adverse impacts to the environment requiring the preparation of an EIS.

1.5 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS

***WS' Programmatic Final Environmental Impact Statement*:** WS has developed a programmatic FEIS that addresses the need for wildlife damage management in the United States (USDA 1997). The FEIS contains detailed discussions of potential impacts to the human environment from wildlife damage

management methods used by WS. Pertinent information available in the FEIS has been incorporated by reference into this EA.

Resident Canada Goose Management Final Environmental Impact Statement: The USFWS has issued a FEIS addressing the need for and potential environmental impacts associated with resident goose damage management activities titled "*Resident Canada Goose Management*" (USFWS 2005). The FEIS also contains detailed analyses of the issues and methods used to manage Canada goose damage. A Record of Decision (ROD) and Final Rule were published by the USFWS on August 10, 2006 (Federal Register Vol. 71, No. 154: 45964- 45993). On June 27, 2007, WS, as a cooperating agency, issued a ROD and adopted the USFWS FEIS (Federal Register Vol. 72, No. 123: 35217).

***WS' Environmental Assessment - Statewide Wildlife Damage Management at Airports in Massachusetts*:** In 2002, the WS program in the Commonwealth developed an EA to address the need to reduce threats associated with wildlife at airports (USDA 2002). The EA evaluated the issues associated with managing wildlife threats, including threats associated with geese, at airports and developed alternatives to address those issues. Based on the analyses in the EA, a Finding of No Significant Impact (FONSI) was issued selecting the proposed action in the EA to address the identified need. The proposed action evaluated an integrated approach using lethal and non-lethal methods to address the need for action. The analyses in the EA would remain appropriate for WS' activities conducted to reduce threats associated with wildlife, including geese, at airports in the Commonwealth. The analyses in that EA will be discussed in this assessment to ensure WS' activities to address goose damage are evaluated cumulatively. A cumulative assessment of activities conducted by WS in the Commonwealth will ensure those activities are not sufficient to warrant the preparation of an EIS.

***Atlantic Flyway Resident Canada Goose Management Plan*:** The Canada Goose Committee under the Atlantic Flyway Technical Section of the Atlantic Flyway Council set overall population goals for resident Canada geese in the Atlantic Flyway (Atlantic Flyway Council 1999). The management plan set specific management objectives to achieve the desired population levels of resident Canada geese.

1.6 AUTHORITY OF FEDERAL AND COMMONWEALTH AGENCIES

WS' Legislative Authority

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

United States Fish and Wildlife Service Authority

The USFWS mission is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Responsibilities are shared with other federal, Commonwealth, tribal, and local entities; however, the USFWS has specific responsibilities for the protection of threatened and endangered (T&E) species under the Endangered Species Act (ESA), migratory birds, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters that the USFWS administers for the management and protection of those resources. The USFWS also manages lands under the National Wildlife Refuge System.

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory

under the MBTA and those that are listed as threatened or endangered under the ESA. The take of migratory birds is prohibited by the Act. However, the USFWS can issue depredation permits for the take of migratory 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. Under the permitting application process, the USFWS requires applicants to describe, prior non-lethal damage management, techniques that have been used. In addition, the USFWS can establish depredation orders that allow for the take of those migratory birds addressed in the orders when those bird species are causing or about to cause damage without the need for a depredation permit.

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

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

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

United States Environmental Protection Agency (EPA)

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) which regulates the registration and use of pesticides, including repellents and reproductive inhibitors available for Canada geese.

Massachusetts Department of Fish and Game

The Massachusetts Department of Fish and Game (MDFG) was established under Massachusetts General Law (MGL) Part 1, Title XIX, Chapter 131 and is within the Executive Office of Energy and Environmental Affairs. Chapter 131 also provides the MDFG authority to manage fish and wildlife in the Commonwealth. This authority is exercised through the MDFW.

Massachusetts Division of Fisheries and Wildlife

Established under MGL Part 1, Title XIX, Chapter 131, Section 1A, the MDFW was created under the MDFG. It is under the supervision of the Fisheries and Wildlife Board which appoints the Director of Fisheries and Wildlife. The Director, subject to the approval of the Fisheries and Wildlife Board, may appoint an assistant director and may employ such experts, clerks and other employees necessary for the Division's operations. The director, under control of the board, directs and supervises all matters relative to the division and its employees, carries out the policies of the board. The director also has the power, notwithstanding any other provisions of Chapter 131, but subject to federal law, rules and regulations, to take or in writing authorize other persons to take and possess wildlife at any time or in any manner for purposes of observation, research, control or management. At the director's discretion, fees for permits or licenses may be excused to persons so authorized from any licensing provision of Chapter 131.

Massachusetts Department of Agricultural Resources, Division of Regulatory and Consumer Services, Pesticide Bureau

The Pesticide Bureau carries out the day to day responsibilities of regulating pesticides in the Commonwealth of Massachusetts. The Bureau also acts as support staff for the Pesticide Board and subcommittee. The major functions of the Bureau are broken down into specific programs. The Pesticide Bureau is responsible for enforcing all pesticide regulations and laws, both Commonwealth and federal. The Bureau is responsible for carrying out provisions of the Massachusetts Pesticide Control Act. Through cooperative agreements with the EPA, the department also implements provisions of the FIFRA.

1.7 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes authorize, regulate, or otherwise affect WS' and USFWS' activities. WS and the USFWS comply with those laws and statutes and consults 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.

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 U.S.C. 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with 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 Implementation of the NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to the NEPA and the CEQ regulations, this EA documents the analyses resulting from federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that 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 proposed actions. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

The 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.

This EA will assist WS and consulting agencies in determining whether potential environmental impacts caused by the alternatives might be significant, requiring the preparation of an EIS. The development of this EA documents the incorporation of environmental planning into the actions and decision-making process to ensure compliance with the NEPA requirement for the activities proposed in the Commonwealth. When WS' direct management assistance is requested by another federal agency,

compliance with the NEPA would be the responsibility of the other federal agency.

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

The MBTA provides the USFWS regulatory authority to protect families of migratory birds. The law prohibits any "*take*" of migratory bird species by any entity, except as permitted by the USFWS. Under permitting guidelines in the Act, the USFWS may issue depredation permits to requesters experiencing damage caused by bird species protected under the Act. All actions conducted in this EA would be in compliance with the regulations of the MBTA, as amended.

Due to an increasing resident Canada goose population and an increase in damage complaints received, the USFWS developed an EIS that analyzed issues and alternatives associated with managing resident goose populations (USFWS 2005). Based on the analyses in the FEIS, several depredation orders were established to address goose damage which allow for the take of geese without the need for a depredation permit (see 50 CFR 21.49, 50 CFR 21.50, 50 CFR 21.51, 50 CFR 21.52, and 50 CFR 21.61). In addition, the USFWS has established a population control order under 50 CFR 21.61 which allows States to implement additional measures to manage Canada goose damage in a State.

Endangered Species Act

Under the ESA, all federal agencies will seek to conserve T&E species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a) (2)).

Federal Insecticide, Fungicide, and Rodenticide Act

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 integrated into the WS program in Massachusetts are registered with and regulated by the EPA and the MDFW and/or the Massachusetts Department of Agricultural Resources (MDAR), and used by WS in compliance with labeling procedures and requirements. No toxicants are currently used or registered for use in managing geese or reducing goose damage. There are several repellents that are registered for use in reducing goose damage to vegetation in Massachusetts (see Appendix B). Methyl anthranilate and anthraquinone are the two most common active ingredients for repellents available for dispersing geese from areas where damage or threats are occurring. In addition, OvoControl G containing the active ingredient nicarbazin has been registered by the EPA as a reproductive inhibitor for geese. However, OvoControl G is not currently registered in the Commonwealth.

Investigational New Animal Drug (INAD)

The United States Food and Drug Administration (FDA) can grant permission to use investigational new animal drugs commonly known as INAD (see 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. Alpha-chloralose as a method for resolving waterfowl damage and threats to human safety are discussed in Appendix B of this EA.

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

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

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

There is potential for audible effects on the use and enjoyment of a historic property when methods such as pyrotechnics, firearms, and other noise producing methods are used at or in close proximity to such sites for purposes of resolving damage caused by waterfowl. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve damage or the threat of damage, which means, such use would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of 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. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

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

This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. 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.

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

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and

policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations. All activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS would employ only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, the MDAR, the FDA, by MOUs with land managing agencies, and by WS' Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS' program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). WS would properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

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

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS has considered the impacts that this proposal might have on children. The proposed activities would occur by using only legally available and approved methods where it is highly unlikely that 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. Additionally, since the proposed goose damage management program is directed at reducing human health and safety risks at locations where children are sometimes present, it is expected that health and safety risks to children posed by geese would be reduced.

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 MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Executive Order and is currently waiting for USFWS approval. WS would abide by the MOU once it is finalized and signed by both parties.

The Native American Graves and Repatriation Act of 1990

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

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "*Every enclosed workplace shall be so constructed, equipped, and*

maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected." This standard includes birds that may cause safety and health concerns at workplaces.

Depredation Orders for Canada Geese

As discussed previously, the USFWS developed an EIS to evaluate alternatives to address increasing resident goose population across the United States and to reduce associated damage (USFWS 2005). In addition, several depredation orders were established to manage damage associated with resident Canada geese without a depredation permit from the USFWS when certain criteria are occurring. Under 50 CFR 21.49, resident Canada geese can be lethally taken at airports and military airfields without the need for a depredation permit by airport authorities or their agents when those geese are causing damage or posing a threat of damage to aircraft. A Canada goose nest and egg depredation order has also been established that allows the nests and eggs of those geese causing or posing a threat to people, property, agricultural crops, and other interests to be destroyed without the need for a depredation permit once the participant has registered with the USFWS (see 50 CFR 21.50). A similar depredation order was established to manage damage to agricultural resources associated with Canada geese. Under 50 CFR 21.51, Canada geese can be lethally taken without a permit from the USFWS in those states designated, including Massachusetts, when geese are causing damage to agricultural resources. 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 under 50 CFR 21.52. Under the depredation orders for Canada geese, no individual federal depredation permit is required to take geese once the criteria of those orders have been met. However, a Commonwealth issued permit is still required to lethally take geese.

Inland Fisheries and Game and Other Natural Resources (MGL c.131: Regulations 321 CMR 1.00 to 11.00)

This law establishes the MDFG and under it the Division of Fisheries and Wildlife. It also provides for the Fisheries and Wildlife Board and the Director of the Division of Fisheries and Wildlife and designates their responsibilities and powers. Regulations established pursuant to this statute regulate trapping, hunting, problem animal management and wetlands protection.

Massachusetts Endangered Species Act (MESA) (M.G.L c.131A and regulations 321 CMR 10.00)

The Massachusetts Endangered Species Act (MGL c.131A and regulations 321 CMR 10.00) protect rare species and their habitats by prohibiting the "*take*" of any plant or animal species listed as Endangered, Threatened, or Special Concern by the MDFW. "*Take*" is defined as, "*in references to animals to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct, and in reference to plants, means to collect, pick, kill, transplant, cut or process or attempt to engage or to assist in any such conduct. Disruption of nesting, breeding, feeding or migratory activity may result from, but is not limited to, the modification, degradation or destruction of habitat.*" Permits for taking rare species for scientific, educational, conservation, or management purposes can be granted by the MDFW.

Massachusetts Pesticide Control Act (MGL c.132B)

The purpose of the Massachusetts Pesticide Control Act is "*...to conform the laws of the commonwealth to the* [FIFRA], *Public Law 92-516, as amended,....and to establish a regulatory process in the commonwealth"*. The Act provides "*...exclusive authority in regulating the labeling, distribution, sale,*

storage, transportation, use and application, and disposal of pesticides in the commonwealth...".

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 will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues. Additional descriptions of affected environments will be incorporated into the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Canada geese can be found throughout the year across the Commonwealth of Massachusetts (Mowbray et al. 2002) where suitable habitat exists for foraging, loafing, roosting, and nesting. Geese are capable of utilizing a variety of habitats in the Commonwealth but generally use areas adjacent to or near bodies of water with relatively short vegetation. Nesting habitat could include wetlands, ponds, meadows, gravel bars along rivers, islands, agricultural fields, along irrigation ditches, reservoirs, sewage lagoons, city lakes, golf courses, subdivisions, highway medians, and on top of city buildings (Mowbray et al. 2002). Geese are also known to loaf, roost, nest, and forage in similar habitat near water bodies preferring areas that are open with short vegetation which allows geese to detect approaching predators (Mowbray et al. 2002). During the migration periods, geese often roost on or near bodies of water but are known to travel to other areas to forage, such as agricultural fields. Since geese can be found throughout the Commonwealth, requests for assistance to manage damage or threats of damage could occur in areas occupied by geese.

Therefore, the areas of the proposed action include, but are not limited to, property on or adjacent to airports, golf courses, athletic fields, recreational areas, swimming beaches, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, and cemeteries. The affected environment could also include areas where geese negatively impact wildlife, including T&E species; and public property where geese are negatively impacting historic structures, cultural landscapes, and natural resources. The proposed action may be conducted on properties held in private, local, Commonwealth, or federal ownership throughout the Commonwealth. Goose damage management would be conducted when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document has been signed between WS and the cooperating entity. In addition, only those geese identified by WS as causing damage or posing a threat of damage would be addressed during damage management activities when requested.

Activities related to goose damage management at airports within the Commonwealth was addressed in a separate EA (USDA 2002). The evaluations of WS' activities to reduce threats associated with geese at airports in the Commonwealth will remain as addressed in that assessment (USDA 2002).

2.2 ISSUES ADDRESSED IN THE ANALYSIS OF 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 relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. Issues related to managing damage associated with resident Canada geese which were addressed in the USFWS FEIS on the management of resident Canada geese (USFWS 2005) were also considered in the preparation of this EA. Issues related to managing damage associated with geese in Massachusetts were developed by WS in consultation with the USFWS and the MDFW. The 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, are discussed in detail in Chapter 4. The issues analyzed in detail in the EA are the following:

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the population of target species. Methods[6] used to resolve damage or threats to human safety can involve altering the behavior of target species and may require the use of lethal methods when appropriate. Under the proposed action, WS would incorporate non-lethal and lethal methods described in Appendix B in an integrated approach in which all or a combination of methods may be employed to resolve a request for assistance. WS would recommend both non-lethal and lethal methods, as governed by federal, Commonwealth, and local laws and regulations.

Non-lethal methods can disperse or otherwise make an area unattractive to target species that are causing damage which reduces the presence of those species at the site and potentially the immediate area around the site. Lethal methods would be employed to remove an individual or those individuals responsible for causing damage or threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods generally follows the process described in WS' programmatic FEIS (USDA 1997). Magnitude is described in WS' programmatic FEIS as "*...a measure of the number of animals killed in relation to their 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 data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' take is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (USDA 1997).

WS' proposed action incorporates an adaptive approach to resolve damage and reduce threats to human safety by targeting individual geese or groups of geese using non-lethal and lethal methods after applying the WS' Decision Model (Slate et al. 1992, USDA 1997) to identify possible techniques. Lethal methods may be used to reinforce non-lethal methods to reduce damage to a level that is more acceptable to the requester. Under the proposed action alternative, lethal take (killing) of Canada geese by WS would only occur at the request of a cooperator seeking assistance and only after the take of geese has been permitted by the USFWS pursuant to the MBTA. The effects on goose populations in Massachusetts from implementation of the identified alternatives, 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 Atlantic Flyway Breeding Waterfowl Plot Survey, published literature, and harvest data. Further information on particular sources of information is

[6]A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management (Alternative 3), can be found in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does listing of methods imply that all methods would be used to resolve every request for assistance.

provided below.

Breeding Bird Survey

Bird populations can be monitored by using trend data derived from data collected during the BBS. Under established guidelines, observers count birds at established survey points along roadways for a set duration along a pre-determined route. The number and species of birds observed and heard within a quarter of a mile of the survey points are recorded. 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. 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 USGS, Patuxent Wildlife Research Center (Sauer et al. 2011). 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, as a result 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.

Estimates of population trends from BBS data are derived primarily from route-regression analysis (Geissler and Sauer 1990) and are dependent upon a variety of assumptions (Link and Sauer 1998). The statistical significance of a trend for a given species is reflected in the calculated P-value (*i.e.*, the probability of obtaining the observed data or more extreme data given that a hypothesis of no change is true). The level of statistical significance (*e.g.*, 0.01, 0.05, 0.10) can vary and is often set by those persons conducting the analysis. Often BBS or other geographically large survey data is not statistically significant at the local level because of relatively smaller sample size (*i.e.*, fewer routes surveyed), more routes with zero observations of a particular bird species which results in larger statistical variance and low P-values set for statistical significance. The data reported from the BBS has a statistical level of significance set at $P<0.05$ (Sauer et al. 2011).

Christmas Bird Count

The CBC is conducted in December and early January annually by numerous volunteers under the guidance of the National Audubon Society (NAS). The CBC reflects the number of birds frequenting a location during the winter months and is based on 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 can be used as an indicator of trends in the population. Researchers have found that population trends reflected in CBC data tend to correlate well with those from censuses taken by more stringent means (NAS 2010).

Atlantic Flyway Breeding Waterfowl Plot Survey

The Atlantic Flyway Technical Section initiated the Atlantic Flyway Breeding Waterfowl Plot Survey during 1989 across 11 northeast states ranging from New Hampshire to Virginia. The survey collects breeding population abundance data used to support effective management of eastern waterfowl breeding populations. Prior to the initiation of the survey, populations of waterfowl in the eastern part of the continent were managed based on data collected for mid-continent populations. The Atlantic Flyway Breeding Waterfowl Plot Survey has been described in detail by Heusmann and Sauer (1997, 2000), and involves monitoring 1-km plots apportioned randomly across physiographic strata. Plots are monitored once each year during the April/May nesting period by ground and/or aerial surveys. Observers record numbers and species of all waterfowl seen on the plot.

Annual Harvest Estimate

The populations of several migratory bird species are sufficient to allow for annual harvest seasons that typically occur during the fall migration periods of those species. Migratory bird hunting seasons are established under frameworks developed by the USFWS and implemented in the Commonwealth by the MDFW. For geese, take can also occur under several depredation orders established by the USFWS. Therefore, the take of geese can occur during annual hunting seasons and under the depredation orders that allows geese to be taken to alleviate damage and to alleviate threats of damage. For many migratory bird species considered harvestable during a hunting season, the number of birds harvested during the season is reported by the USFWS and/or the MDFW in published reports.

Canada Geese in Massachusetts

There are four primary migratory routes in North America, each of which has a Flyway Council governing migratory game bird management. Those councils are comprised of representatives from member States and Canadian Provinces which make recommendations to the USFWS on the management of waterfowl populations. The flyway system is divided into four administrative units; the Atlantic, Mississippi, Central, and Pacific Flyway Councils. The Commonwealth of Massachusetts is considered part of the Atlantic Flyway Council designated for the management of migratory birds, including Canada geese.

The WS program has received requests for assistance to manage damage and threats to human safety associated with Canada geese throughout the Commonwealth of Massachusetts. There are two behaviorally distinct types of Canada goose populations that may be present in the Commonwealth, depending on the time of year. The two distinct types of geese that could be present are generally termed "*resident*" and "*migratory*" geese.

Resident Canada Geese

Canada geese are considered residents when one of the following criteria are met: 1) nests and/or resides on a year round basis within the contiguous United States; 2) nests within the lower 48 States in the months of March, April, May, or June; or 3) resides within the lower 48 States and the District of Columbia in the months of April, May, June, July, August (see 50 CFR 21.3; Rusch et al. 1995, Ankney 1996, USFWS 2005).

Resident Canada geese become sexually mature and breed at two to three years of age and have a relatively high nesting success compared to migrant Canada geese (USFWS 2005). The highest concentration of breeding Canada geese in Massachusetts occurs in urban areas, but birds can be observed throughout the Commonwealth. Resident Canada geese primarily nest from March through May each year. In Massachusetts, resident Canada geese nest in traditional sites (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). Those areas provide optimal habitat for Canada geese.

In Massachusetts, 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 (Welty 1982). Portions of a flock of geese can be flightless from about one week before and two weeks after the primary molt period due to the asynchronous molting by individual birds. Non-breeding resident Canada geese which have failed nesting attempts sometimes move to other areas in late spring

prior to molting (Nelson and Oetting 1998).

The first management plans for Canada geese in the Atlantic Flyway were developed in 1989, to help manage harvest and manage human/goose conflicts. The Atlantic Flyway Resident Canada Goose Management Plan outlines the main goals relating to Canada geese in the Atlantic Flyway (Atlantic Flyway Council 1999). The main subject areas covered in the Plan as they relate to population management focus on population objectives, harvest management, and population control. Population objectives as outlined in the management plan were to reduce the resident Canada goose population in the Atlantic Flyway to 650,000 geese by 2005. To relieve damage and conflicts the management plan recommended allowing a wide variety of effective and efficient options for damage relief, including the adoption of a federal depredation order or conservation order to allow States to manage goose populations. In addition, the plan called for the maximum opportunities for the use and appreciation of resident Canada geese that are consistent with population goals. The plan also called for the management of resident Canada goose populations to be compatible with management criteria established for migrant geese and to annually monitor populations, harvest, and conflict levels to evaluate the effectiveness of the management plan (Atlantic Flyway Council 1999).

During the development of the resident Canada goose management FEIS, the USFWS and the States estimated the resident Canada goose population at 3.2 million geese in the United States; about 30% to 35% above the number States believed to be acceptable based on their needs to manage conflicts and problems caused by resident Canada geese (USFWS 2005). In the Atlantic Flyway, resident Canada geese consist of several subspecies that were introduced and established during the early 1900s after extirpation of native birds (Delacour 1954, Dill and Lee 1970, Pottie and Heusmann 1979, Benson et al. 1982). The spring 2010 estimate for the Atlantic Flyway resident Canada goose population was estimated at 969,900 (±180,600) geese, which is 3.6% fewer than the 2009 estimate of 1,006,100 (±147,200) (USFWS 2010) but was nearly 50% above the population objective recommended by the Atlantic Flyway Council in their resident Canada goose management plan (Atlantic Flyway Council 1999).

The number of resident Canada geese observed along routes surveyed in the Commonwealth from 1966 through 2009 during the BBS has shown an increasing trend (Sauer et al. 2011). In Massachusetts, the number of resident geese observed has shown a statistically significant upward trend between 1966 and 2009 estimated at 9.4% annually (Sauer et al. 2011). Between 1999 and 2009, the trend has shown an increasing trend estimated at 11.0% annually in the Commonwealth (Sauer et al. 2011). The resident Canada goose population in Massachusetts was estimated at 29,422 (±6,444) geese in 2010, a decrease of 3.5% from the 2009 estimate of 30,472 (±11,176) geese (Klimstra et al. 2010). However, the 2010 breeding population estimate of 29,422 geese (Klimstra et al. 2010) exceeds the statewide population objective of 20,000 birds established in 1999 (Atlantic Flyway Council 1999) by over 47%.

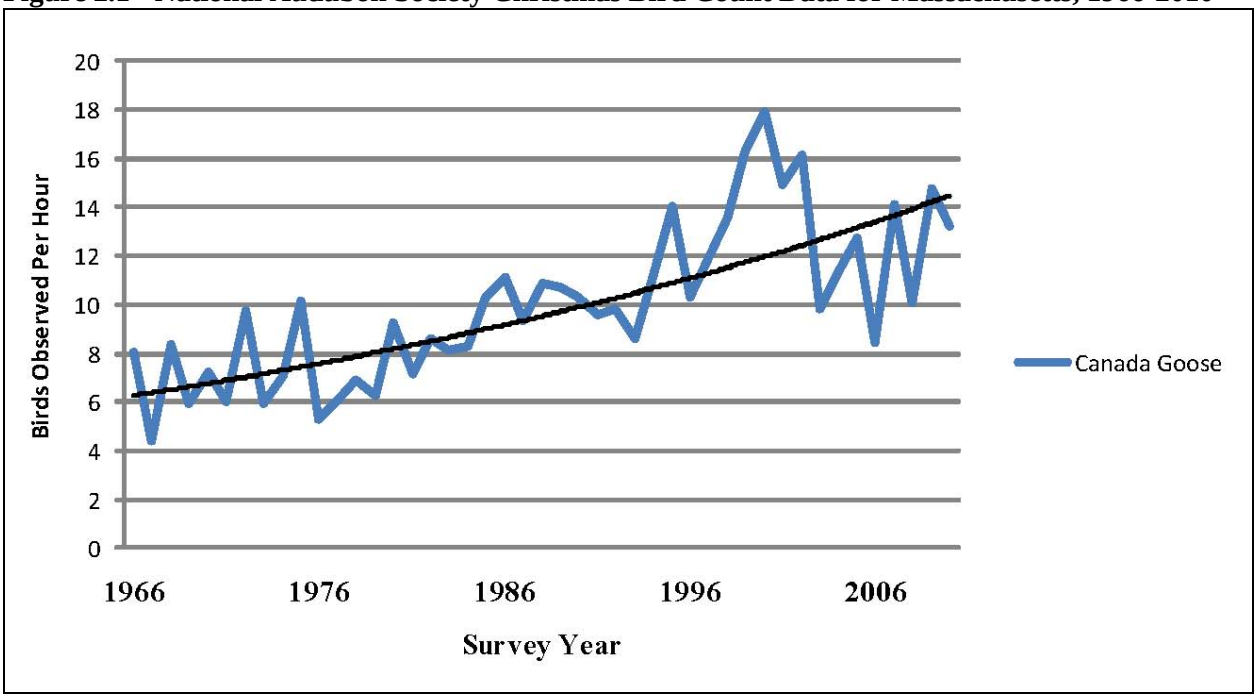
Migratory Canada Geese

Canada geese are endemic to North America, where they occur in each state of the United States (except Hawaii), each Province of Canada, and many States of Mexico. Most authorities currently recognize 11 subspecies of Canada geese, which differ primarily in body size and color (Bellrose 1980). Canada goose migrations may encompass up to 3,000 miles, like that of the Richardson's Canada goose (*B. c. hutchinsii*) which nests as far north as Baffin Island, Nunavut, Canada and winters as far south as the eastern States of Mexico. Migrant geese nest across the arctic, subarctic, and boreal regions of Canada and Alaska and range in size from the 2 to 4 pound cackling Canada goose (*B. c. minima*) to the 7 to 10 pound dusky Canada goose (*B. c. occidentalis*).

In the Atlantic Flyway, migratory Canada geese consist primarily of three distinct populations. Those

populations include the North Atlantic Population (NAP), Atlantic Population (AP), and the Southern James Bay Population (SJBP) (USFWS 2010). The wintering migratory population in Massachusetts is mostly comprised of geese from the NAP and the AP. As shown in Figure 2.1, the number of geese observed in areas surveyed during the CBC conducted annually in the Commonwealth has shown a general increasing trend from 1966 through 2010 (NAS 2010).

Figure 2.1 - National Audubon Society Christmas Bird Count Data for Massachusetts, 1966-2010



Geese in the NAP principally nest in Newfoundland and Labrador. They generally commingle during winter with other Atlantic Flyway Canada geese, although the NAP has a more coastal distribution than other populations. The total NAP was estimated at 156,600 (±86,100) geese in 2010, a nearly 13% decrease from the 2009 estimated population of 179,700 (±89,300) geese (see Table 2.1). The number of indicated breeding pairs (singles plus pairs) in the NAP range was estimated to be 54,600 (±29,100) during the spring 2010 survey which was 2% more than the 2009 estimate. Indicated pair estimates have decreased an average of 2% per year during the 2001 to 2010 survey period (USFWS 2010).

The AP of Canada geese nest throughout much of Quebec, especially along Ungava Bay, the eastern shore of Hudson Bay, and on the Ungava Peninsula. The AP winters from New England to South Carolina, with the largest concentrations on the Delmarva Peninsula. In 2010, the number of breeding pairs of geese for the AP was estimated to be 154,100 pairs (±24,600), 13% fewer than the 2009 estimate (USFWS 2010). The total spring population of AP geese was estimated at 776,200 geese (±108,200) and was 29% lower than in 2009 (USFWS 2010). In 2010, 57% of indicated pairs were observed as singles, slightly higher than the 18 year average, indicating a near average nesting effort for the nesting season. Breeding pair estimates indicate no trend from the 2001 to 2010 survey period (USFWS 2010).

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 to Mississippi, Alabama, Georgia, and South Carolina. In 2010, the number of breeding geese for the SJBP was estimated to be 76,400 (±19,000) geese, 10% higher than the 2009 estimate (USFWS 2010). Indices of the SJBP have increased an average of 2% per year since 2001. Breeding pair estimates appeared similar to the previous

5 years on Akimiski Island and the mainland. The total spring population of SJBP geese was estimated at 87,300 (±20,400) geese and was 13% higher than in 2009 (USFWS 2010). In 2010, biologists expected gosling production to be average or below average, but still anticipate a fall flight improved from the very poor production year of 2009 (USFWS 2010).

Table 2.1 Abundance Indices for Atlantic Flyway Canada Goose Populations, 2002 to 2010

Year	Migratory Population Segment			Atlantic Flyway Resident Population[a]
	North Atlantic Population[a,b]	Atlantic Population[a,b]	Southern James Bay Population[a]	
2002/03	60,800	156,900	90,200	1,126,700
2003/04	67,800	174,800	75,200	1,048,700
2004/05	51,300	162,400	42,200	1,167,100
2005/06	49,200	160,200	128,900	1,144,000
2006/07	69,900	195,700	64,800	1,128,000
2007/08	41,900	169,700	92,300	1,024,900
2008/09	53,700	176,100	69,200	1,006,100
2009/10	54,600	154,000	76,400	969,900

[a] Surveys conducted in spring

[b] Number of breeding pairs

As discussed previously, the NAP, AP, and SJBP of Canada geese could be found in the Commonwealth under those conditions where geese present could be considered migratory. Under field conditions, distinguishing geese between population segments can be difficult. Determining whether a Canada goose, present in the Commonwealth during spring and fall migration or in winter, is migratory or a resident (*i.e.*, present in the Commonwealth year round) can also be difficult under field conditions, although because of behavior differences, not impossible. Therefore, for the purposes of this analyses, those Canada geese present in the Commonwealth from September through March will be considered to be migratory geese. The effects on the Canada goose population in Massachusetts from implementation of the identified alternatives, including the proposed action, are analyzed in Chapter 4.

Issue 2 - Effectiveness of Canada Goose Damage Management Methods

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, how accurately practitioners diagnoses the problem, the species responsible for the damage, and how actions are implemented to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of current technology, funding, and workforce. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[7]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS Directives and policies.

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

The goal is to reduce damage, risks, and conflicts with wildlife as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term since new individuals may immigrate to the area, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean individual management actions 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 species' populations.

Based on the evaluation of the damage situation under the proposed action, the most effective methods would be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods is considered as part of the decision-making process for each damage management request based on the continual evaluation of methods and results under WS' Decision Model (Slate et al. 1992, USDA 1997).

Issue 3 - Effects on Non-target Wildlife Species Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently capture or kill non-target wildlife. To reduce the risks of adverse effects to non-target wildlife, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing non-target species. Before initiating management activities, WS would select locations which are extensively 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 B.

The ESA of 1973 states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)].

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS has consulted with the USFWS on programmatic activities under Section 7 of the ESA concerning potential impacts of methods available for use by WS on T&E species. The USFWS issued a BO on WS' programmatic activities in 1992 (USDA 1997).

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that 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."*

According to the American Veterinary Medical Association (AVMA) (1987), suffering is described as a

"…highly unpleasant emotional response usually associated with pain and distress." However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* Because suffering carries with it the implication of a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game (CDFG) 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain and identifying the causes that elicit pain responses in humans would *"…probably be causes for pain in other animals…"* (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (CDFG 1991).

The AVMA states "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild animals. The AVMA states that "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but 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 waterfowl has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *"…neither medical nor veterinary curricula explicitly address suffering or its relief"* (CDFG 1991). Research suggests that some methods can cause "*stress*" (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The decision-making process involves 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 goose damage management activities. This could occur through translocation of geese or through removal and euthanasia.

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

Issue 5 - Effects on the Aesthetic Values of Canada Geese

One issue is the concern that the proposed action or the alternatives would result in the loss of aesthetic benefits of Canada geese to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the

mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public shares a similar bond with animals and/or wildlife in general and in modern societies a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals and birds as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

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

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

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support lethal removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want agencies to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Issue 6 - Effects of Management Methods on Human Health and Safety

An additional issue often raised is the potential risks to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees use and recommend only those methods which are legally available, selective for target species, and effective to resolve the wildlife conflict. Still, some concerns exist regarding the safety of methods despite their legality. As a result, WS will analyze the potential for proposed methods to pose a risk to members of the public or employees of WS.

In addition to the potential risks to the public associated with methods available under the alternatives, risks to employees are also an issue. WS' employees are potentially exposed to damage management

methods as well as subject to workplace accidents. Selection of methods, as part of an integrated approach, includes consideration for public and employee safety.

Safety of Chemical Methods Employed

The issue of using chemicals methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would be limited to immobilizing drugs, reproductive inhibitors, and repellents. A list and description of chemical methods available for use under the identified alternatives can be found in Appendix B and will be discussed further in Chapter 4. The use of chemical methods is regulated by the EPA through the FIFRA, by the FDA, and by Commonwealth laws and regulations. WS' use of chemical methods is further discussed in WS' programmatic FEIS (USDA 1997).

Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce damage and threats to safety caused by geese, if misused, could potentially be hazardous to human safety. Non-chemical methods are also discussed in detail in Appendix B. The cooperator requesting assistance is made aware through a MOU, cooperative service agreement, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator to resolve the goose damage management request.

Effects of Not Employing Methods to Reduce Threats to Human Safety

An additional issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that geese can pose. The risks to human safety from diseases associated with goose populations were addressed previously. The low risk of disease transmission from geese does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concern is raised with inadequately addressing threats to human safety associated with aircraft striking geese at airports in the Commonwealth. Geese have the potential to cause severe damage to aircraft and can threaten the safety of passengers (USDA 2002). Limiting or preventing the use of certain methods to address the potential for aircraft striking geese could lead to higher risks to passenger safety. This issue will be fully evaluated in Chapter 4 in relationship to the alternatives.

Issue 7 - Effects on the Regulated Harvest of Canada Geese

Another issue commonly identified is a concern that goose damage management activities conducted by WS would affect the ability to harvest geese during the regulated hunting season by reducing local goose populations. Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to reduce or alleviate damage caused by geese are used to reduce the goose densities through dispersal in areas where damage or threats of damage are occurring. Similarly, lethal methods used to reduce damage associated with geese could lower goose densities in areas where damage is occurring resulting in a reduction in the availability of geese during the regulated harvest season. WS' goose damage management activities would primarily involve populations in areas where hunting access is restricted (*e.g.*, urban areas) or has been ineffective. The use of non-lethal or lethal methods often disperses geese from areas where damage is occurring to areas outside the damage area which could serve to move geese from those less accessible areas to places accessible to hunters.

2.3 ISSUES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Additional issues were also identified by WS, the MDFW, and the USFWS during the scoping process of this EA that were considered but will not receive detailed analyses for the reasons provided. The following issues were considered but will not be analyzed in detail:

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

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

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions may 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 impacts of managing damage and threats to human safety associated with Canada geese in the Commonwealth to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire Commonwealth would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA that the proposed action could have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Massachusetts would continue to conducted goose damage management in a very small area of the Commonwealth where damage is occurring or likely to occur.

WS' Impact on Biodiversity

The WS program does not attempt to eradicate any species of native wildlife in the Commonwealth. WS operates in accordance with applicable international, federal, and Commonwealth laws and regulations enacted to ensure species viability. Methods available are employed to target individual geese or groups of geese identified as causing damage or posing a threat of damage. Any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. WS operates on a small percentage of the land area in Massachusetts and only targets those geese identified as causing damage or posing a threat. Therefore, impacts on biodiversity associated with goose damage management would not adversely affect biodiversity in the Commonwealth.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. Establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied the plaintiffs' motion for a preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is 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 wildlife damage management actions.

Canada Goose Damage Management Should Not Occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based (USDA 1997). Funding for Canada goose damage management activities is derived from federal appropriations and through cooperative funding. Activities conducted in the Commonwealth for the management of damage and threats to human safety from geese would be funded through cooperative service agreements with individual property owners or associations. Therefore, funding for damage management activities is derived primarily from those entities requesting assistance from WS.

Cost Effectiveness of Management Methods

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

Impacts of Avian Influenza on Bird Populations

AI is caused by a virus in the Orthomyxovirus group. Viruses in this group vary in the intensity of illness they may cause (*i.e*., virulence). Wild birds, in particular waterfowl and shorebirds, are considered to be the natural reservoirs for AI (Clark and Hall 2006). Most strains of AI rarely cause severe illness or death in birds although the H5 and H7 strains tend to be highly virulent and very contagious. However, even the strains which do not cause severe illness in birds are a concern for human and animal health officials because the viruses have the potential to become virulent and transmissible to other species through mutation and re-assortment (Clark and Hall 2006).

Recently, the occurrence of highly pathogenic (HP) H5N1 AI virus has raised concern regarding the potential impact on wild birds, domestic poultry, and human health should it be introduced into the United States. It is thought that a change occurred in a low pathogenicity AI virus of wild birds, allowing the virus to infect chickens, followed by further change into the HP H5N1 AI. HP H5N1 AI has been circulating in Asian poultry and fowl resulting in death to those species. HP H5N1 AI likely underwent further change allowing infection in additional species of birds, mammals, and humans. More recently, this virus moved back into wild birds resulting in mortality of some species of waterfowl, and other birds. This is only the second time in history that highly pathogenic form of AI has been recorded in wild birds. Numerous potential routes for introduction of the virus into the United States exist including: illegal movement of domestic or wild birds, contaminated products, infected travelers, and the migration of infected wild birds. WS has been one of several agencies and organizations conducting surveillance for AI virus in migrating birds. The nationwide surveillance effort has detected some instances of low pathogenic AI viruses, as was expected given that waterfowl and shorebirds are considered to be the natural reservoirs for AI. Tens of thousands of birds have been tested, but there has been no evidence of the HP H5N1 virus in North America. To date, evidence does not exist that AI is negatively affecting migratory bird populations in the United States.

Canada Goose Damage Should Be Managed By Problem Animal Control (PAC) Agents

PAC agents also referred to as nuisance wildlife control operators (NWCOs) could be contacted to reduce goose damage for property owners or when deemed appropriate by the resource owner. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to contract with a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally take birds. As described in Appendix B, the lethal removal of geese with firearms by WS to alleviate damage or threats would occur using a rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996). To address lead exposure from the use of shotguns, the standard conditions of depredation permits issued by the USFWS pursuant to the MBTA for the lethal take of birds requires the use of non-toxic shot. To alleviate concerns associated with lead exposure in wildlife, WS would only use non-toxic shot as defined in 50 CFR 20.21(j) when using shotguns to take all birds pursuant to depredation permits issued by the USFWS.

Since FY 2006, the take of Canada geese by WS in the Commonwealth has occurred from the use of firearms, particularly shotguns, just over 50% of the time. WS' personnel do regularly utilize rifles to lethally take Canada geese. To reduce risks to human safety and property damage from bullets passing through geese, the use of rifles is applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through birds. Geese that are removed using rifles are taken within areas where retrieval of all bird carcasses for proper disposal is highly likely (*e.g.,* open grassy feeding sites). With risks of lead exposure occurring primarily from ingestion of shot and bullet fragments, the retrieval and proper disposal of goose carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead.

However, 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 occur that lead from bullets deposited in soil from shooting activities could lead to contamination of water, either ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e*., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

WS' assistance with removing birds 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 if a depredation permit is issued or under existing depredation orders. The amount of lead deposited into the environment may be lowered by WS' involvement in goose damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the bird carcass which limits 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 further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures goose carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures carcasses are removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that are deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water. As stated previously, when using shotguns, only non-toxic shot would be used by WS. It should also be noted that since FY 2006, over 49% of all Canada geese lethally taken in Massachusetts were live captured and humanely euthanized using carbon dioxide or cervical dislocation.

Impacts of Dispersing Geese to other Areas

Another issue often raised is that the dispersal of geese from one location to alleviate damage or conflicts can result in new damage or conflicts at a new location. While the original complainant may see resolution to the goose damage when the birds are dispersed, the recipient of the geese may see the goose problem as imposed on them. Thus, on the whole, there is no resolution to the original goose problem (Mott and Timbrook 1988). Bird species are usually dispersed using a combination of harassment methods including pyrotechnics, propane cannons, and electronic distress calls (Booth 1994). A similar continuing conflict can develop when severe habitat alteration is used to disperse geese. This concern is heightened in large metropolitan areas where the likelihood of dispersed geese finding a new location and not coming into conflict is very low. WS has minimized the impact of dispersing geese in urban/suburban areas by creating a management option to reduce the number of geese using a location that are responsible for creating the conflict problem.

In urban areas, WS often works with the community or municipal leaders to address goose damage involving large concentrations of geese that are likely affecting several people. Therefore, WS often consults not only with the property owner where roosts are located but with community leaders to allow for community-based decision-making on the best management approach. In addition, when seeking funding for goose damage management activities, funding is often provided by the municipality where the geese are located which allows for goose damage management activities to occur within city limits where the damage is occurring. This allows for geese that have been dispersed and begin to cause damage or pose threats to be addressed effectively and often times, before those geese become well-established in a new location. The community-based decision-making approach to goose damage management in urban areas is further discussed under the proposed action alternative in Chapter 3. Therefore, this issue was not analyzed further.

A Site Specific Analysis Should be Made for Every Location Where Goose Damage Management Could Occur

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

The analysis in this EA was driven by the issues raised during the scoping process during the development of the EA. In addition to the analysis contained in this EA, WS' personnel use the WS Decision Model (Slate et al. 1992, USDA 1997) described in Chapter 3 as a site specific tool to develop the most appropriate strategy at each location. The WS Decision Model is an analytical thought process used by WS' personnel for evaluating and responding to wildlife damage management requests.

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 and allows for a better cumulative impact analysis. If a determination is made through this EA that the proposed action could have a significant impact on the quality of the human environment, then an EIS would be prepared.

Effects on Human Health from Consumption of Geese Donated

Of concern under this issue is the consumption of waterfowl meat donated to charitable organizations after being lethally taken by WS. Of recent concern is the potential for lead bullet fragments to be present in meat that has been processed for human consumption. In addition, the potential for the spreading of zoonotic diseases or other contaminants in geese processed and donated for human consumption is also a concern.

In order to address potential health concerns associated with consuming geese, Canada geese donated for human consumption may be tested for exposure to substances such as organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. The entity selecting the capture/euthanize (and donation for charitable consumption) program would be responsible for all costs associated with legal and appropriate donation for human consumption. Poultry processing facilities utilized for this process would be in compliance with existing USDA regulations pertaining to the processing and handling of fowl (*e.g.*, turkeys, chickens).

Geese immobilized using alpha-chloralose would not be donated for human consumption with disposal of carcasses occurring by deep burial or incineration. Geese taken by any method for disease sampling or in an area where zoonotic diseases of concern are known to be prevalent and of concern to human health after consuming processed goose meat would not be donated for consumption and would be disposed of by deep burial or incineration.

WS' activities to alleviate damage or threats associated with geese in the Commonwealth would only occur after receiving a request for direct operational assistance. Therefore, the decision to process geese for human consumption that were taken by WS would be the sole responsibility of the entity requesting assistance. WS would not process and/or donate processed goose meat to charitable organizations and would not be involved with the processing and/or donation of the meat to charitable organizations.

Final Disposition of Euthanized Geese that are not Donated

Geese that are euthanized by WS would be either donated for human consumption by the entity requesting assistance or buried in accordance with the standard conditions of the USFWS Migratory Bird Depredation Permit and in accordance with local and Commonwealth laws. Geese live captured using alpha-chloralose and euthanized would not be donated for human consumption with disposal of carcasses occurring by deep burial or incineration. Disposal of all carcasses would occur in accordance with WS Directive 2.515.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives which were 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, USDA 1997) and based on information in the resident Canada goose management FEIS developed by the USFWS (USFWS 2005). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs for goose damage management in Massachusetts 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 Canada geese in the Commonwealth:

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

This alternative, the no action/proposed 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 caused by Canada geese in the Commonwealth. A major goal of the program would be to resolve and prevent goose damage and to reduce threats to human safety. To meet this goal, WS, in coordination with the USFWS and the MDFW, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding.

The adaptive approach to managing damage associated with geese would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques. WS would work with those persons experiencing goose damage in addressing those geese responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as geese begin to cause damage. Goose damage that has been ongoing can be difficult to resolve using available methods since those birds are conditioned to feed, roost, loaf, and are familiar with a particular location. Subsequently, making that area unattractive through the use of available methods can be difficult to achieve once damage has been ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity. The USFWS could continue to issue depredation permits to WS and when necessary, to those entities experiencing goose damage when requested by the entity and when deemed appropriate by the USFWS.

Under this alternative, WS would respond to requests for assistance by: 1) taking no action if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by geese, or 3) provide technical assistance and direct operational assistance to a property owner or manager experiencing damage. The take of geese can only legally occur through the issuance of a depredation permit by the USFWS at levels specified in the permit or under the depredation orders when certain conditions are met. When applying for a depredation permit, the requesting entity submits with the application the number of geese requested to be taken to alleviate the damage. Therefore, under this alternative, the USFWS could: 1) deny an application for a depredation permit when requested to alleviate goose damage, 2) could issue a depredation permit at the take levels requested, or 3) could issue permits at levels below those take levels requested.

Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use contractual services of WS (*i.e.*, direct operational assistance), or take no action.

The property owner or manager may choose to apply for their own depredation permit from the USFWS to lethally take geese, when necessary, as required by the implementing regulations of the MBTA for

depredation control (50 CFR 21.41). The USFWS requires non-lethal methods be used and shown ineffective or impractical before the USFWS would issue a depredation permit. In this situation, WS would evaluate the damage and complete a Migratory Bird Damage Report which would include information on the extent of the damages, the number of geese present, and a recommendation for the number of geese 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 to authorize the lethal take of a specified number of geese as part of an integrated approach. Upon receipt of a depredation permit, the property owner or manager or appropriate subpermittee may commence the authorized activities and must submit a written report of their activities upon expiration of their permit. Permits may be renewed annually as needed to resolve damages. Property owners or managers could conduct management using those methods legally available. Those methods discussed in Appendix B that are available for use to manage goose damage would be available to all entities except for alpha-chloralose. In addition, geese could be addressed under the existing depredation orders when the criteria of those orders have been met without the need for a depredation permit from the USFWS.

In anticipation of damage management activities, WS would annually submit an application for a depredation permit to the USFWS estimating the maximum number of geese that could be lethally taken to alleviate damage in the Commonwealth through direct operational assistance projects. The number of geese anticipated to be lethally taken by WS would be based on previous requests for assistance received to manage damage associated with geese. Therefore, the USFWS could: 1) deny WS' application for a depredation permit, 2) issue a depredation permit for the take of geese at a level below the number requested by WS, or 3) issue a depredation permit for the number of geese requested by WS.

WS' Decision Model is the implementing mechanism for a damage management program under the proposed action alternative that is adapted to an individual damage situation that allows for the broadest range of methods to be used to address damage or the threat of damage in the most effective, most efficient, and mostly environmentally conscious way available. When a request for direct operational assistance is received to resolve or prevent damage caused by geese, WS conducts site visits to assess damage or threats, identifies the cause of the damage, and applies the decision model described by Slate et al. (1992) and in WS' programmatic FEIS (USDA 1997) to apply methods to resolve or prevent damage using those methods available.

Non-lethal methods include, but are not limited to: habitat/behavior modification, nest destruction, lure crops, visual deterrents, dogs, live traps, exclusionary devices, frightening devices, chemical immobilization, reproductive inhibitors, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS include: live-capture followed by euthanasia, the recommendation of take during hunting seasons, and shooting. However, listing methods neither implies that all methods would be used or recommended by WS to resolve requests for assistance nor does listing of methods imply that all methods would be used to resolve every request for assistance. Euthanasia would occur through the use of cervical dislocation or by asphyxiation using carbon dioxide once geese are live-captured using other methods. Carbon dioxide is an acceptable form of euthanasia for birds while cervical dislocation is a conditionally acceptable[8] method of euthanasia (AVMA 2007). The use of firearms could also be used to euthanize birds live-captured and is considered a conditionally acceptable method for free-ranging wildlife (AVMA 2007).

Lethal and non-lethal methods are intended to be short-term attempts at reducing damage occurring at the

[8] The AVMA (2007) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

time those methods are employed. Long-term solutions to managing goose damage would include limited habitat manipulations and changes in cultural practices which are addressed further below and in Appendix B.

Non-lethal methods can disperse or otherwise make an area unattractive to geese causing damage; thereby, reducing the presence of geese at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially when the requesting entities has used non-lethal methods and found those methods to be inadequate to resolving the damage or threats of damage. Non-lethal methods are used to exclude, harass, and disperse target wildlife from areas where damage or threats are 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. The use of non-lethal methods in an integrated approach has proved effective in dispersing birds. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since those species are unharmed. The continued use of non-lethal methods often leads to the habituation of birds to those methods which can decrease the effectiveness of those methods (Avery et al. 2008*a*, Chipman et al. 2008). For any management methods employed, the proper timing is essential in effectively dispersing those birds causing damage. Employing methods soon after damage begins or soon after threats are identified increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of goose damage.

Lethal methods would be employed to resolve damage associated with those geese identified by WS as responsible for causing damage or threats to human safety only after receiving a request for the use of those methods. The use of lethal methods would result in local population reductions in the area where damage or threats were occurring since geese would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove those birds that have been identified as causing damage or posing a threat to human safety. The use of lethal methods would result in local reductions of geese in the area where damage or threats were occurring. The number of geese removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of geese involved with the associated damage or threat, and the efficacy of methods employed. Under the proposed action, the lethal methods being considered are shooting with firearms, the live-capture of birds that are subsequently euthanized, and the recommendation of hunting as a population management tool.

Most lethal methods are intended to reduce the number of geese present at a location since a reduction in the number of geese at a location leads to a reduction in damage which is applicable whether using lethal or non-lethal methods. The intent of non-lethal methods is to harass, exclude, or otherwise make an area unattractive to geese which disperse those geese to other areas which can lead to a reduction in damage at the location where those geese were dispersed. The intent of using lethal methods is similar to the objective trying to be achieved when using non-lethal methods which is to reduce the number of geese in the area where damage is occurring which can lead to a reduction in the damage occurring at that location.

Although the use of firearms can reduce the number of geese using a location (similar to dispersing geese), the use of a firearm is most often used to supplement and reinforce the noise associated with non-lethal methods. The capture of geese using live-traps and subsequently euthanizing those geese is employed to reduce the number of geese using a particular area where damage is occurring. Similarly,

the recommendation that geese be harvested during the regulated hunting season is intended to manage those populations in an area where damage is occurring.

Often of concern with the use of lethal methods is that geese that are lethally taken would only be replaced by other geese either during the application of those methods (other geese that move into the area) or by geese the following year (increase in reproduction that could result from less competition). As stated previously, the use of lethal methods are not intended to be used as population management tools over broad areas (except for hunting). The use of lethal methods are intended to reduce the number of geese present at a location where damage is occurring by targeting those geese causing damage or posing threats. Since the intent of lethal methods is to manage those geese causing damage and not to manage the entire goose population, those methods are not ineffective because geese return the following year.

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

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

WS may recommend geese be harvested during the regulated hunting season in an attempt to reduce the number of geese causing damage in a local area. Managing goose populations over broad areas could lead to a decrease in the number of geese causing damage. Establishing hunting seasons and the allowed take during those seasons is the responsibility of the MDFW under frameworks developed by the USFWS. WS does not have the authority to establish hunting seasons or to set allowed harvest numbers during those seasons.

Appendix B contains a thorough discussion of the methods available for use in an integrated wildlife damage management approach to address requests for assistance to manage damage or reduce threats to human safety. WS' programmatic FEIS contains additional discussion on adaptive management using an integrated approach to address damage to resources and threats to human safety (USDA 1997). As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those persons experiencing damage associated with geese.

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting goose damage management as part of an integrated approach to managing damage. Technical assistance would occur as described in Alternative 2 of this EA. Technical assistance is further discussed in WS' programmatic FEIS (USDA 1997).

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

From FY 2006 through FY 2010, WS conducted 159 technical assistance projects in Massachusetts that involved Canada goose damage to agricultural resources, property, natural resources, and threats to human safety.

Operational Damage Management Assistance

Operational damage management assistance includes damage management activities that are directly conducted or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there is a written cooperative service agreement between WS and the entity requesting assistance. The initial investigation defines the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of WS' personnel are often required to effectively resolve problems, especially if restricted-use chemicals are necessary or if the problems are complex. Operational damage management occurs when WS' employees are directly involved with employing methods when requested to resolve damage associated with geese.

To address the anticipated needs of all property owners/managers with goose damages in the Commonwealth that may request WS' assistance with lethal methods to alleviate their damages, WS would submit an application for a one-year depredation permit to the USFWS estimating the maximum number of geese to be lethally taken as part of an integrated approach. WS would not submit a Migratory Bird Damage Report for their own application. 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 geese that would be taken to address unpredicted and emerging goose damages/conflicts. Each year, WS would submit an application for renewal of their permit, and through the use of adaptive management principles, would adjust numbers of geese 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 those applications annually, and issue permits as allowed by regulations. All alterations in the number of geese to be taken would be checked against the impacts analyzed in this EA. All management actions by WS would comply with appropriate federal, Commonwealth, and local laws.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, WS provides lectures, courses, and demonstrations to producers, homeowners, Commonwealth and municipal agents, colleges and universities, and other interested groups. Consulting agencies frequently cooperate with other entities in education and public information efforts. Additionally, technical papers are presented at

professional meetings and conferences so that other wildlife professionals and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) provides scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. For example, research biologists from the NWRC were involved with developing and evaluating nicarbazin for reducing the hatchability of Canada goose eggs. Biologists are also currently evaluating diazacon as a reproductive inhibitor in wildlife. NWRC biologists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management research.

WS' Decision-Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' programmatic FEIS provides further discussion and examples of how the Decision Model is used to address damage and threats associated with wildlife (USDA 1997). WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model, most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

Community Based Decision-Making

The WS program in Massachusetts follows the "*co-managerial approach*" to solving wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of geese and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This would include non-lethal and lethal methods under the proposed action alternative with the appropriate methods determined using the WS Decision Model. WS and other wildlife management agencies may facilitate discussions at local community meetings when resources are available. Resource owners and others directly affected by goose damage or conflicts in the Commonwealth have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on all available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision is made. By involving decision-makers in

the process, damage management actions can be presented to allow for decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in the EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage geese often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on goose damage management activities. This process allows decisions on goose damage management activities to be made based on local input.

Community Decision-Makers

The decision-maker(s) for a local community or communities (*e.g.*, homeowner or civic association) would be a community president, a Board's appointee, or a governing Board. Those positions are popularly elected residents of the local community who oversee the interests and business of the local community. Those persons would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision-making. If no community president, Board appointee, or governing Board represents the affected resource then WS would provide technical assistance to the individual or locally appointed decision-maker. Identifying the decision-maker for local business communities is more complex since building leases or owners may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS would provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Direct control would be provided by WS only if requested by the local community decision-maker, when funding is provided, and if the requested direct operational assistance was compatible with WS' recommendations.

Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy issues, WS can not disclose cooperator information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others are involved in the decision-making process is a decision made by that individual.

Public Property Decision-Makers

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

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

Under this alternative, WS would provide those cooperators requesting assistance with managing damage and threats associated with Canada geese with technical assistance only. Technical assistance would provide those cooperators experiencing damage or threats associated with geese with information,

demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to resolve or prevent damage is the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use by private entities. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; those strategies are based on the level of risk, need, and the practicality of their application. In some instances, wildlife-related information provided to the requestor results in tolerance/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 recommend or loaned by WS. Similar to Alternative 1 and Alternative 3, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with geese in the Commonwealth except for alpha-chloralose. No reproductive inhibitor is currently registered for use to manage goose damage in the Commonwealth. If a reproductive inhibitor becomes registered in the Commonwealth, the recommendation of the use of the inhibitor to those persons experiencing damage would be dependent on the availability of product to the public.

The WS program regularly provides technical assistance to individuals, organizations, and other federal, Commonwealth, and local government agencies for managing goose damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Since FY 2006, WS has conducted 159 technical assistance projects that involved goose damage to agricultural resources, property, natural resources, and threats to human safety. Technical assistance could also be provided as part of the application process for issuing a depredation permit by the USFWS under this alternative when deemed appropriate.

Those persons experiencing damage or are concerned with threats posed by geese could seek assistance from other governmental agencies, private entities, or conduct damage management on their own. Those entities could implement a goose damage management program using those methods legally available listed in Appendix B or could take no action. In situations where non-lethal methods have been ineffective or impractical, WS would advise the property owner or manager of appropriate lethal methods to supplement non-lethal methods. In order for the property owner or manager to use lethal methods, they would have to apply for their own depredation permit to take geese from the USFWS, if required, or when certain conditions are met, the use of lethal methods could be employed pursuant to the depredation orders. When a depredation permit is required, WS would evaluate the damage and complete a Migratory Bird Damage Report which would include information on the extent of the damages, the number of geese present, and a recommendation for the number of geese 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 to the entity requesting the permit authorizing the lethal take of a specified number of geese.

Canada geese could be lethally taken during the annual harvest seasons, under depredation permits issued by the USFWS, and pursuant to depredation orders established by the USFWS when certain criteria of those orders are met. This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or other private entities. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent goose damage as permitted by federal, Commonwealth, and local laws and regulations

or those persons could take no action.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

This alternative precludes any and all activities by WS to reduce threats to human health and safety, and alleviate damage to agricultural resources, property, and natural resources. WS would not be involved with any aspect of goose damage management in the Commonwealth. All requests for assistance received by WS to resolve damage caused by geese would be referred to the MDFW, the USFWS, municipalities, and/or to private entities.

Despite no involvement by WS in resolving damage and threats associated with Canada geese in the Commonwealth, those persons in Massachusetts experiencing damage caused by geese could continue to resolve damage by employing those methods legally available and permitted for use. Canada geese could continue to be lethally taken in Massachusetts pursuant to depredation orders or through the issuance of depredation permits by the USFWS and the MDFW. In addition, Canada geese could be lethally taken during the regulated harvest seasons in the Commonwealth. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of alpha-chloralose which can only be used by WS. Currently, no reproductive inhibitors are registered for use to manage goose damage in the Commonwealth.

Property owners or managers could conduct goose damage management using shooting or any non-lethal method that is legally available. However, under this alternative property owners/managers may have difficulty obtaining permits to use lethal damage management methods. The USFWS needs professional recommendations on individual damage situations before issuing a depredation permit for lethal take, and the USFWS does not have the mandate or the resources to conduct wildlife damage management work. Commonwealth agencies with responsibilities for migratory birds would likely have to provide this information if depredation permits are to be issued. If the information were provided to the USFWS, following the agency's review of a complete application package for a depredation permit from a property owner or manager to lethally take geese, the permit issuance procedures would follow that described in Alternative 1 and Alternative 2.

In some cases, methods employed by property owners or managers could be contrary to the intended use of some of the methods or in excess of what is necessary. Inappropriate use of some non-lethal methods may result in injury to humans, damage to property, and increased risk to non-target species. Those problems may occur because Commonwealth agencies, businesses, and organizations have less technical knowledge and experience managing wildlife damage than WS.

3.2 EXAMPLES OF CANADA GOOSE DAMAGE MANAGEMENT PROJECTS

Nest/Egg Treatments

Nest/egg treatments have been recommended as part of WS' technical assistance program in the Commonwealth. Nest treatments include visiting the site during the nesting season of geese and removing or destroying the nest and/or eggs of geese in the area where damages were occurring. Nest/egg treatment projects are most commonly conducted in public recreation areas, residential developments, golf courses, and industrial/business parks. For Canada geese, three egg treatment techniques are currently available to render goose eggs unviable. Those techniques include oiling, puncturing (addling), and shaking and are most useful when the presence of adult geese can be tolerated but goslings are not desired (USDA 2009*b*). Oiling involves coating eggs with 100% corn oil which prevents air from permeating the egg membrane, effectively destroying the embryo and preventing the

egg from hatching. Treated eggs are placed intact back into the nest, where the goose will often continue to incubate the eggs. Puncturing involves using a long, thin metal probe into the pointed end of the egg. Best results are attained by placing slow steady pressure. Once the probe passes through the shell, the tip is placed against the inside of the shell, and swirled with a circular motion. The puncturing tool may be an awl, ice pick, chicken/turkey basting tools, a turkey lacer, or any sturdy, thin metal probe (USDA 2009*b*). Shaking involves shaking eggs vigorously to dislodge the embryo from the egg wall, which destroys the embryo and prevents hatching. Each egg is shaken forcefully, one at a time, for 5-10 minutes, and placed back in the nest. This technique is very time consuming and requires a great deal of physical effort. As with oiling, the goose often continues to incubate the non-viable eggs when they are placed back into the nest intact. By placing eggs back into nests once rendered unviable, geese will often continue to incubate the eggs through the breeding season which prevents re-nesting. If eggs are removed from the nest, geese will often attempt to renest.

When oiling or addling occurs through direct operational assistance, the WS program in Massachusetts would adhere to the following protocol: 1) visiting the nests every 7-10 days for a 6-8 week period (last week of March to middle of May); and 2) WS would treat only those eggs that are less than 14 days old.

Dog Harassment

Dog harassment of geese has not been directly used by the WS program in Massachusetts, but is a common practice recommended through technical assistance to private individuals who have the ability to use dogs. Dog harassment is most effective in areas with no water bodies or with single, small (less than two acres) water bodies. This technique requires an ongoing program augmented with other goose damage techniques. Dog harassment projects are most commonly conducted in public recreation areas, golf courses, and industrial facilities. The procedure includes using dogs such as border collies or Labrador retrievers to encourage geese to leave an area. Dog harassment usually occurs after the nesting season but before post-nuptial molt and then again after the molt and into the fall. WS recommends the cooperator visit each site at least three days a week. Dog harassment is recommended and would only be conducted by WS in areas where egg treatment has been done in order to reduce the possibility of young being present during harassment. WS also emphasizes dog harassment activities during the resident Canada goose hunting season.

Harassment with Pyrotechnics and Propane Cannons

Harassment of geese with pyrotechnics and/or propane cannons is regularly utilized by the WS program in Massachusetts. It is also a common practice to recommend those methods through technical assistance to private individuals and government agencies in need of an effective method to disperse Canada geese causing damage and to reduce threats to human health and safety. Those methods imitate the sound of firearms, particularly shotguns, used for legal hunting or depredation. They are most effective in areas where legal hunting is common or where depredation to reinforce harassment is regularly conducted. Harassment projects using pyrotechnics are most commonly conducted in public recreation areas, cemeteries, golf courses, industrial facilities, and condominium and apartment complexes. Harassment projects using propane cannons are most commonly conducted in agricultural fields, airports, and landfills. The procedure includes using pyrotechnics and propane cannons to encourage geese to leave an area whenever they are observed, particularly before the nesting season, just after spring plantings or during the spring and fall migrations. WS recommends the cooperator maintain a "*No Tolerance*" policy for Canada geese, utilizing pyrotechnics or propane cannons until all geese leave the area since a few individuals will often attract other geese to an area.

Lethal Reinforcement to Harassment with Firearms or through Live Capture and Euthanization

Canada geese often become habituated to harassment methods such as human disturbance, chasing with vehicles and dogs, pyrotechnics, and propane cannons and either fail to respond, disperse for a short period of time and return or simply disperse a short distance and resume their activities. In such cases it is generally helpful to reinforce such harassment through lethal means, re-instilling the natural fear of humans to the remaining members of the flock. It is common practice to recommend reinforcement of harassment through technical assistance to private individuals and government agencies that are experiencing increased damage or threats to human health and safety due to habituation to harassment techniques. The two most common methods recommended through technical assistance are legal harvest during the hunting seasons and use of shotguns under depredation permits issued by the USFWS. Other lethal methods may be recommended under special circumstances. Those recommendations may include use of rifles, air rifles, or live capture through lawful methods such as hand capture, hand nets, net guns and larger net launchers followed by euthanization using AVMA approved methods.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

Non-lethal Methods Implemented Before Lethal Methods

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

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine 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 (Alternative 1) is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered before lethal methods by WS (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.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by geese in the Commonwealth. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS. No lethal take of geese would occur by WS. The use of lethal methods could continue to be used under this alternative by those persons experiencing damage by geese when permitted by the USFWS. The non-lethal methods used or recommended by WS under this alternative would be identical to those identified in any of the alternatives. Non-lethal methods would be employed by WS in an integrated approach under this alternative.

Exclusionary devices can be effective in preventing access to resources in certain circumstances. The primary exclusionary methods are fencing and other barriers. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agriculture, or natural resources from geese across large areas. The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage caused by geese those methods would be used or recommended under the proposed action.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal information to the MDFW, USFWS, local animal control agencies, or private businesses or organizations. However, under this alternative; property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods, especially in urban areas.

Property owners or managers could conduct management using shooting or any non-lethal method that is legal. Property owners or managers might choose to implement WS' non-lethal recommendations, implement lethal methods, or request assistance from some private or public entity other than WS. Property owners/managers frustrated by lack of WS' assistance with the full range of goose damage management techniques may try methods not recommended by WS (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary.

The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from geese those methods would be used or recommended under the proposed action. For those requests that can be resolved using non-lethal methods as determined by WS through the use of the WS Decision Model, WS would employ or recommend only non-lethal methods under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses.

Trap and Translocate Geese Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Canada geese would be live-captured using corral traps, nets, or through the use of alpha-chloralose (WS only). All geese live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and approved by the MDFW prior to live-capture. Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. However, translocation of wildlife, including geese, could only occur under the authority of the MDFW and the USFWS. Therefore, the translocation of geese by WS would only occur as directed by the MDFW and the USFWS. By policy, the MDFW does not allow the capture and translocation of resident Canada geese in the Commonwealth (H. Heusmann, MDFW pers. comm. 2011). Since WS does not have the authority to translocate geese in the Commonwealth unless permitted by the MDFW and the USFWS, this alternative was not considered in detail. In addition, the translocation of geese could occur under any of the alternatives analyzed in detail either by WS or another entity.

Translocation of birds causing damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally ineffective because problem geese are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally

already occupied, and translocation would most likely result in goose damage problems at the new location. Also, hundreds or thousands of geese 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 (WS Directive 2.501) because of stress to the translocated animal, poor survival rates, and difficulties in adapting to new locations or habitats (Nielsen 1988).

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with geese. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating goose damage. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Reducing Damage by Managing Canada Goose Populations through the Use of Reproductive Inhibitors

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

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

Although male Canada geese have been successfully sterilized to prevent production of young, this method is only effective if the female does not form a bond with a different male. In addition, vasectomies can only prevent the production of the mated pair. The ability to identify breeding pairs for isolation and to capture a male bird for sterilization becomes increasingly difficult as the number of birds increases (Converse and Kennelly 1994). Geese have a long life span once they survive their first year (Cramp and Simmons 1977, Allan et al. 1995). Leg-band recovery data indicates that some geese live longer than 20 years. The sterilization of resident geese would not reduce the damage caused by the overabundance of the goose population since the population would remain relatively stable for many years. Keefe (1996) estimated sterilization of a Canada goose to cost over $100 per bird.

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and

population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Currently, the only reproductive inhibitor registered with the EPA is nicarbazin which is registered for use on Canada geese, feral domestic waterfowl, domestic Muscovy ducks, and pigeons. However, products containing the active ingredient nicarbazin for managing reproduction in Canada geese, feral domestic waterfowl, and domesticated Muscovy ducks were not registered for use in Massachusetts at the time this EA was developed.

Compensation for Goose Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by goose damage. Under such an alternative, WS would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. Analysis of this alternative in WS' programmatic FEIS 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.

3.4 STANDARD OPERATING PROCEDURES

SOPs improve the safety, selectivity, and efficacy of wildlife damage management activities. The current WS program in the Commonwealth of Massachusetts uses many such SOPs which are discussed in detail in Chapter 5 of WS' programmatic FEIS (USDA 1997). Those SOPs would be incorporated into activities conducted by WS when addressing goose damage and threats in the Commonwealth.

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

- The WS Decision Model, which is designed to identify effective wildlife damage management strategies and their impacts, is consistently used and applied when addressing goose damage.
- EPA-approved label directions are followed for all pesticide use. The registration process for chemical pesticides is intended to assure minimal adverse effects to the environment when chemicals are used in accordance with label directions.
- 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 released safely.
- WS has consulted with the USFWS and the MDFW to determine the potential risks to T&E species in accordance with the ESA and the MESA.
- All personnel who use chemical methods are trained and certified to use such substances or are supervised by trained or certified personnel.
- All personnel who use firearms are trained according to WS' Directives.
- The use of non-lethal methods is considered prior to the use of lethal methods when managing goose damage.

- Management actions are directed toward specific geese posing a threat to human safety, causing agricultural damage, causing damage to natural resources, or causing damage to property.

- WS employs methods and conducts activities for which the risk of hazards to public safety and hazards to the environment have been determined to be low according to a formal risk assessment (USDA 1997). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.

- During the use of live-capture methods, WS' personnel would be present on site to monitor the application of the method to address any live-captured wildlife immediately to minimize the amount of time they are restrained.

3.5 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

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

- Lethal take of Canada geese by WS would be reported to the USFWS and the MDFW annually to evaluate population trends and the magnitude of WS' take of geese in the Commonwealth.

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

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

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

- Preference is given to non-lethal methods, when practical and effective. 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 - Effectiveness of Canada Goose Damage Management Methods

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

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

Issue 3 - Effects on Non-target Wildlife Species Populations, Including T&E 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.

- Personnel would use lures, 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.

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

- Personnel would be present during the use of all live-capture methods to ensure non-target species are released immediately or are prevented from being captured.

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

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

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

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

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

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

- WS' personnel would be present during the use of all live-capture methods to ensure geese captured would be addressed in a timely manner to minimize the stress of being restrained.

- WS' use of euthanasia methods would follow those recommended by WS' directives (WS Directive 2.505) and the AVMA (AVMA 2007).

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

Issue 5 - Effects on the Aesthetic Values of Canada Geese

- Management actions to reduce or prevent damage caused by geese would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- All methods or techniques applied to resolve damage or threats to human safety would be agreed upon by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.

- Preference is 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 6 - Effects of Management Methods on Human Health and Safety

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

- Shooting would be conducted during time periods when public activity and access to the control areas are restricted. 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 and WS Directive 2.430.

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

- WS' employees who employ alpha-chloralose participate in approved continuing education to maintain certified to use immobilizing drugs.

- WS would adhere to all established withdrawal times for geese when using immobilizing drugs for the capture of waterfowl that are agreed upon by WS, the MDFW, and veterinarian authorities. Although unlikely, in the event that WS is requested to immobilize geese either during a period of time when harvest of geese is occurring or during a period of time where the withdrawal period could overlap with the start of a harvest season, WS would euthanize the animal.

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

Issue 7 - Effects on the Regulated Harvest of Canada Geese

- Management actions to reduce or prevent damage caused by geese in the Commonwealth would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

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

- WS' activities to manage damage and threats caused by geese would be coordinated with and conducted under permits issued by the USFWS and/or the MDFW.

- WS' lethal take (killing) of geese would be reported to and monitored by the USFWS and the MDFW to ensure WS' take is considered as part of management objectives for geese in the Commonwealth.

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

- WS would continue to recommend the use of hunting to address local goose populations in areas where hunting is permitted.

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 T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further.

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

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative 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 MDFG, the USFWS, and the MDAR.

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

A common issue is whether damage management actions would adversely affect the viability of the target species' population. Canada geese are considered a harvestable waterfowl species with annual hunting seasons occurring in Massachusetts under frameworks established by the USFWS and implemented in the Commonwealth by the MDFW. In addition, geese can be lethally taken through the issuance of depredation permits and through depredation orders established by the USFWS. Therefore, the take of geese can occur during annual hunting seasons and under depredation permits or orders that allow geese to be taken to alleviate damage and threats of damage.

WS maintains ongoing contact with USFWS and the MDFW and submits annual migratory bird activity reports to the USFWS. The USFWS monitors the total take of geese from all sources and factors in survival rates from predation, disease, and other mortality data. Ongoing contact with USFWS and the MDFW assures local, Commonwealth, and regional knowledge of wildlife population trends are considered. As discussed previously, the need for action discusses damage and threats associated with Canada geese.

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

Under the proposed action/no action alternative, WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance with managing damage and threats associated with geese in the Commonwealth. WS would employ those methods described in Appendix B in an adaptive approach that would integrate methods to effectively reduce damage and threats associated with geese.

The issue of the effects on the Canada goose population arises from the use of methods to address the need for reducing damage and threats. Methods employed in an integrated approach to reduce damage and threats are categorized into non-lethal and lethal methods. As part of an integrated approach to managing damage and threats, WS could apply both lethal and non-lethal methods when requested by those persons experiencing damage or threats of damage.

Non-lethal methods can disperse or otherwise make an area unattractive to geese causing damage; thereby, reducing the presence of geese at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance has already attempted to disperse geese using non-lethal harassment methods, WS would not necessarily employ those methods again during direct operational assistance since those methods have already been proven to be ineffective in that particular situation. Non-lethal methods are used to exclude, harass, and disperse target wildlife from areas where damage or threats are occurring. When effective, non-lethal methods would disperse geese from the area resulting in a reduction in the presence of those geese at the site where those methods were employed. However, geese responsible for causing damage or threats are moved to other areas with minimal impact on the statewide population. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g*., nesting locations, food sources) would be unavailable for extended durations or over a wide geographical area that long-term adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since those species are unharmed. The use of non-lethal methods would have no adverse impacts on Canada goose populations in the Commonwealth.

Lethal methods would be employed to resolve damage associated with those geese identified by WS as responsible for causing damage or threats to human safety only after receiving a request for such assistance and only after a permit has been issued for the take of geese by the USFWS, when required. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring since geese would be removed from the population. Lethal methods are often employed to reinforce non-lethal methods and to remove birds that have been identified as causing damage or posing a threat to human safety. The use of lethal methods would therefore result in local reductions of geese in the area where damage or threats were occurring. The number of geese removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of geese involved with the associated damage or threat, and the efficacy of methods employed.

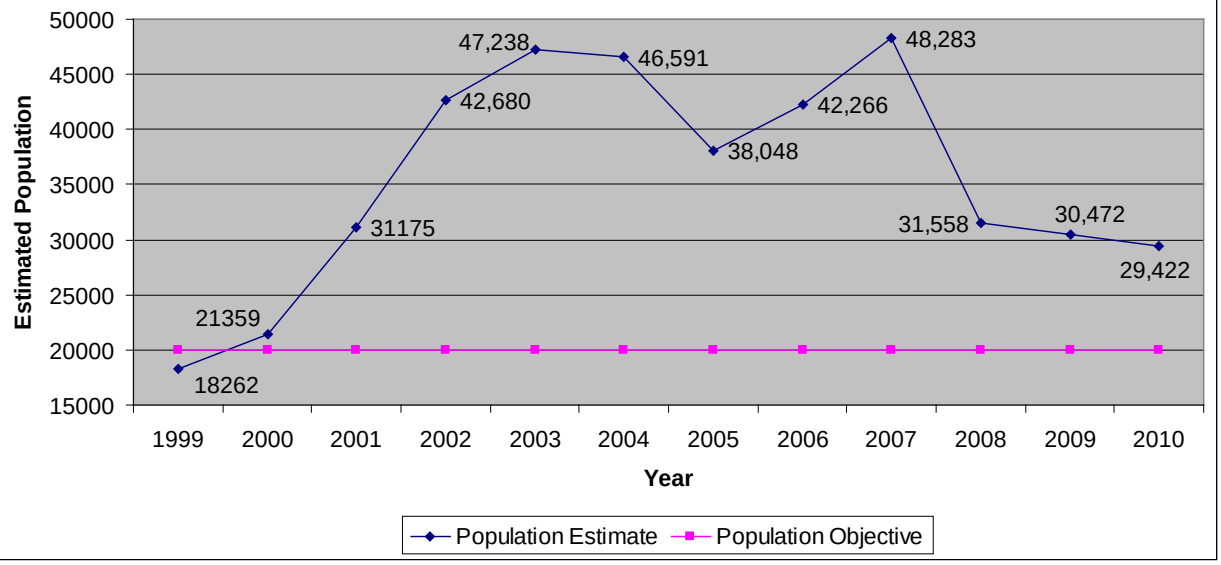
Resident Canada Geese

As discussed previously, Canada geese are considered resident in the Commonwealth when nesting and/or residing on a year around basis within the Commonwealth, when nesting in the Commonwealth during the months of March, April, May, or June, or residing in the Commonwealth during the months of April, May, June, July, August (Rusch et al. 1995, Ankney 1996, USFWS 2005). Most requests for

assistance received by WS occur under the criteria where geese present in the Commonwealth are considered resident.

The annual Atlantic Flyway Breeding Waterfowl Plot Survey population estimates for resident Canada geese in the Commonwealth from 1999 through 2010 (Klimstra et al. 2010) are shown in Figure 4.1. The estimates for 1999 to 2001 were based on the 1993-2002 method of calculating total indicated birds [total indicated birds = (2×pairs) + singles + groups]. The estimates for 2002-2010 were based on the post-2002 method of calculating total indicated birds [total indicated birds = 2×(pairs + singles) + groups]. In 2002, when the revised method for calculating estimates was initiated, the resident goose population in the Commonwealth was estimated at 42,680 geese (Klimstra et al. 2010). The population peaked at 48,283 in 2007 and in 2010 the resident goose population was estimated at 29,422 geese in the Commonwealth (Klimstra et al. 2010). The MDFW estimated the statewide population in 2005 at 39,500 geese based on a mark and re-sight surveys (H. Heusmann, MDFW pers. comm. 2011). In 1999, the population objective for resident Canada geese in the Commonwealth was established at 20,000 individuals (Atlantic Flyway Council 1999, USFWS 2005).

Figure 4.1 Resident Canada Goose Population Estimates and Population Goal in Massachusetts from 1999 to 2010



As resident goose populations have increased across the United States, the number of requests for assistance to manage damage associated with geese has also increased (USFWS 2005). Under the selected alternative in the resident Canada goose FEIS developed by the USFWS, several mechanisms were established to allow the States to further manage resident goose populations and goose damage (USFWS 2005). An additional mechanism to address increasing resident goose populations was increased opportunities to address resident geese during regulated hunting seasons.

As was discussed previously in this EA, Canada geese can be harvested during regulated hunting seasons in the Commonwealth. Under frameworks developed by the USFWS, the MDFW allows Canada geese to be harvested during a September hunting season, the regular waterfowl season, and during a late Canada goose season. To manage increasing populations of resident geese across their range, the USFWS established a framework that allowed the States to implement a harvest season in September which is

intended to target resident geese specifically. During the September hunting season in 2008, an estimated 4,600 geese were harvested statewide (Raftovich et al. 2010). The USFWS estimates that 4,200 geese were harvested in the Commonwealth during the 2009 September season for geese (Raftovich et al. 2010). During the regular waterfowl season, an estimated 7,300 geese were harvested in the Commonwealth in 2008 compared to 9,400 geese harvested in the 2009 (Raftovich et al. 2010). During the late goose season in the Commonwealth, the USFWS estimated 1,200 geese were harvested during the 2008 season while 2,900 geese were harvested during the 2009 season (Raftovich et al. 2010).

The take of geese under the depredation orders discussed previously that allow for the take of Canada geese once certain conditions have been met must be reported to the USFWS. Therefore, the cumulative impacts of the proposed action on resident Canada geese populations are based upon the anticipated WS' take, hunter harvest, and authorized take by other entities (*e.g.*, agricultural producers, municipalities, homeowners associations, airports) through the issuance of depredation permits or under the depredation orders. The cumulative take of geese in Massachusetts from 2000 through 2010 is shown in Table 4.1.

Table 4.1 – Cumulative Take of Canada Geese in Massachusetts, 2000-2010

Year	WS' Take[1]	Hunter Harvest[2]			Depredation Take[3]	Total Take	% WS Take to Total Take
		September	Regular	Late			
2000	26	2,800	5,300	3,200	96	**11,422**	0.23%
2001	10	2,300	6,500	3,000	121	**11,931**	0.08%
2002	31	2,800	8,700	1,300	174	**13,005**	0.24%
2003	27	3,800	5,200	3,900	361	**13,288**	0.20%
2004	33	4,100	7,100	4,000	226	**15,459**	0.21%
2005	8	4,300	4,400	3,900	204	**12,812**	0.06%
2006	151	3,800	6,200	3,100	243	**13,494**	1.12%
2007	218	2,600	6,100	2,300	355	**11,573**	1.88%
2008	262	4,600	7,300	1,200	471	**13,833**	1.89%
2009	309	4,200	9,400	2,900	34†	**16,843†**	1.83%
2010	379	N/A*	N/A	N/A	N/A	**N/A**	N/A
TOTAL	**1,454**	**35,300**	**66,200**	**28,800**	**2,285**	**133,660**	**0.8%‡**

[1]WS' take is reported by federal fiscal year

[2]Adapted from harvest reports from the USFWS

[3]Data provided by the USFWS (P. Labonte, USFWS pers. comm. 2010).

†Information is currently incomplete

* N/A=Information is currently not available

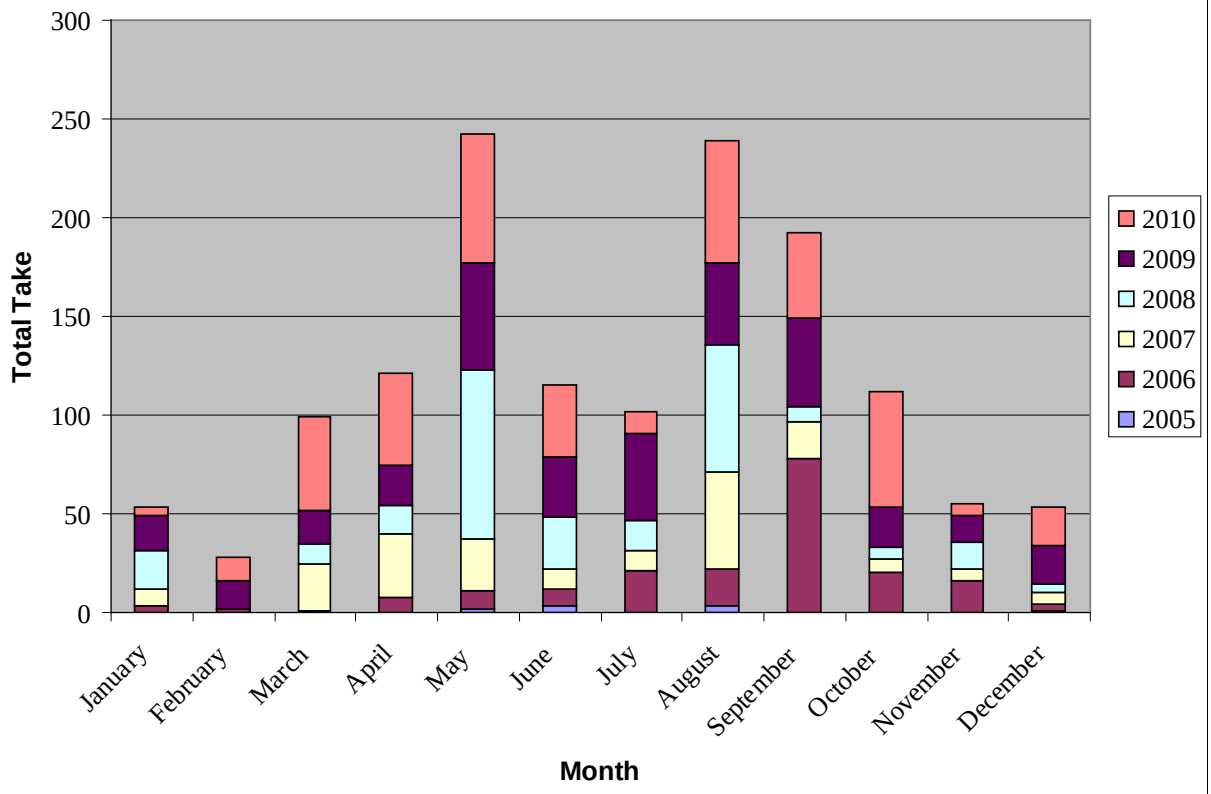
‡Does not include WS' take during FY 2010 since harvest data is incomplete

As shown in Figure 4.2, most requests for assistance received by WS to address damage caused by Canada geese occurs during those months when geese present in the Commonwealth are considered resident. From January 2005 through December 2010, over 58% of geese taken by WS in Massachusetts have been taken during the time of year when geese are considered resident birds (*i.e.*, April through August). Therefore, WS' take will be analyzed here as if all birds taken were resident geese. The take of geese by WS did occur during those periods of time from FY 2005 through FY 2010 when geese present in the Commonwealth could be geese that are not present in the Commonwealth through the year. Distinguishing resident and migratory geese is not possible through visual identification. However, based on those requests received and the type of damage occurring, those geese addressed by WS from FY 2005 through FY 2010 were likely resident geese (*i.e.*, present in the Commonwealth all year).

WS lethally removed a total of 1,319 Canada geese in Massachusetts from FY 2006 through FY 2010 which is an average of 264 geese taken by WS annually. With the population of geese estimated at

30,472 geese in the Commonwealth during 2009, WS' take of 309 geese in FY 2009 to alleviate damage and reduce threats would represent 1.0% of the estimated statewide breeding population. WS' highest level of take occurred in FY 2010 when 379 geese were lethally taken in the Commonwealth. With a statewide breeding population estimated at 29,422 geese in 2010, the take of 379 geese by WS would have represented 1.3% of the estimated population. However, the 2010 population could range from a low of 22,978 geese to a high of 35,866 geese based on a standard error of ±6,444 geese (Klimstra et al 2010). Therefore, the take of 379 geese by WS during FY 2010 could have ranged from 1.1% to 1.6% of the estimated breeding population in the Commonwealth.

Figure 4.2 Lethal Take of Canada Geese In Massachusetts by Month and Calendar Year from January 2005 to December 2010



As part of an integrated approach, WS has also employed pyrotechnics, human presence, the noise associated with the discharge of a firearm, and other non-lethal methods to disperse 10,940 geese between FY 2006 and FY 2010. Of the total number of geese addressed by WS from FY 2006 through FY 2010, over 89.2% were addressed using non-lethal methods. The highest number of geese addressed using non-lethal methods occurred in FY 2010 when 4,083 geese were dispersed using harassment methods. Of the total number of geese addressed in FY 2010 to alleviate damage or threats of damage, over 91.5% were addressed using non-lethal methods.

From 2000 through 2009, a total of 35,300 geese were harvested in the Commonwealth during the September hunting season intended to target resident populations of Canada geese. The highest level of take during the September season occurred during the 2008 season when an estimated 4,600 geese were

harvested in the Commonwealth. Based on a resident goose population of 31,558 geese estimated in the Commonwealth during 2008, the take of 4,600 geese during the September season in 2008 which is intended to target resident geese would represent 14.6% of the estimated statewide population. Despite harvesting nearly 15% of the estimated resident Canada goose population in the Commonwealth, the number of geese estimated to be present in the Commonwealth during the breeding season the following year in 2009 decreased only 3.4% to 30,472 geese. The take of geese by WS, the take of geese during the September season, and the take of geese under depredation permits and orders in the Commonwealth are most likely geese that meet the criteria for resident geese. The take of geese by WS to alleviate damage has been of low magnitude when compared to the overall take of geese in the Commonwealth. When compared to the total take of geese in the Commonwealth, WS' take from FY 2006 through FY 2009 has ranged from 1.1% to 1.9% of the total take of geese in any given year. Overall, WS' take of geese to alleviate damage from FY 2006 through FY 2009 represented 1.7% of the total take of geese that has occurred in the Commonwealth from 2006 through 2009. WS' take of geese to alleviate damage has been a minor component of the total number of geese taken in the Commonwealth during the regulated harvest seasons and the take of geese under depredation permits or depredation orders.

Despite the increasing levels of take that occurred on the resident population during 2005 and 2006 in the Commonwealth, the breeding population estimate continued to increase from 2006 through 2007. Beginning in 2008 and continuing to 2010, the number of geese observed during the Atlantic Flyway Breeding Waterfowl Plot Survey has shown a declining trend (Klimstra et al. 2010). However, the estimated statewide breeding population in 2010 remains 47% above the population objective of 20,000 geese in the Commonwealth. The percentage of geese that are taken during the regular waterfowl season and during the late season that would be considered resident birds in the Commonwealth is unknown. The number of geese estimated to have been harvested during the regular waterfowl season in the Commonwealth from 2007 through 2009 has increased annually. The current levels of take during those periods when geese taken are resident in the Commonwealth have not resulted in declines in the resident goose population in the Commonwealth that have reached the population objective.

Based on previous requests for assistance, WS anticipates up to 1,500 geese total could be lethally take by WS annually in the Commonwealth based on previous requests for assistance and in anticipation of the need to address additional requests for assistance, including take that could occur at airports which was analyzed in a separate analysis (USDA 2002) to ensure cumulative take is evaluated. The EA evaluating the need for and issues associated with alleviating strike hazards at airports in the Commonwealth evaluated an annual take of up to 500 geese to alleviate those risks (USDA 2002). However, the total take of geese to alleviate risks of aircraft strikes and the take of geese under this proposed action alternative would not cumulatively exceed 1,500 geese annually. Of those 1,500 geese, up to 500 could be taken during those periods when geese present in the Commonwealth could be considered as migratory geese. As mentioned previously, those geese addressed by WS during those months when geese present in the Commonwealth could be considered migratory will be considered migratory despite the possibility that some of the geese taken could be resident geese (*i.e.*, present in the Commonwealth throughout the year). In addition, the nests and/or eggs of resident Canada geese could be destroyed by WS as part of an integrated approach to managing damage. Under the proposed action alternative, up to 1,000 nests could be destroyed annually by WS. WS' take of nests and/or eggs would only occur when permitted by the USFWS and the MDFW through the issuance of depredation permits. WS' take of nests and/or eggs would not exceed 1,000 annually and would not exceed the level permitted under depredation permits.

No nest treatment of resident Canada geese would occur by WS without a depredation permit issued by the USFWS and co-signed by the MDFW or as subpermittees on a permit issued by the MDFW. Therefore, WS take would only occur at the discretion of the USFWS and MDFW after population objectives for geese are considered.

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

The use of nicarbazin as a reproductive inhibitor is being considered for use in this EA despite the lack of products containing the active ingredient being currently registered for use in the Commonwealth. Label requirements of OvoControl® G restrict the application of the product to urban areas which limits the extent of the products use for reducing localized waterfowl populations. Based on current information, WS' use or recommendation of nicarbazin formulated under the trade name OvoControl® G would not adversely affect goose populations in Massachusetts since WS' activities would not be additive to those activities that could occur in the absence of WS' use of the product. The resultant reduction in local goose populations from the use of nicarbazin would be dependent on many variables since geese must consume an appropriate dose of nicarbazin daily to achieve the desired effects of limiting egg hatch. However, given that the effects of nicarbazin are only temporary if birds are not fed an appropriate dose of nicarbazin daily, the reduction in the population could be fully reversed if treated bait is no longer supplied and other conditions (*e.g.*, food, disease) are favorable for population growth.

Based upon past requests for WS' assistance and an anticipated increase in future requests for services, WS anticipates that no more than 1,500 Canada geese total would likely be killed by WS annually under the proposed action, of which up to 500 could be considered migratory geese. WS anticipates the number of requests to address damage associated with resident Canada geese would increase at municipal parks, golf courses, public beaches, and other public use areas where geese congregate. All take of geese by WS occurs under depredation permits issued by the USFWS. Therefore, the take of geese by WS is considered as part of the management objectives for geese in the Commonwealth and across the flyway.

Based on the 2010 resident goose population estimate in the Commonwealth of 29,422 geese, the take of 1,500 geese by WS would represent 5.1% of the estimated statewide population, if all 1,500 geese were taken during the period when geese would be considered resident geese. Therefore, even if the resident Canada goose population in the Commonwealth stabilizes at 20,000 geese, the population goal for Massachusetts established by the Atlantic Flyway Council, WS' take of up to 1,500 geese annually would only represent 7.5% of the estimated population. Since 2007, survey data of resident goose populations in the Commonwealth indicate the population has decreased 39.1% or slightly more than 13.0% per year. As stated previously, the population goal in Massachusetts is 20,000 resident Canada geese. All take of Canada geese by WS occurs under depredation permits issued by the USFWS and co-signed by the MDFW. WS' take of up to 1,500 geese annually would be dependent upon the USFWS authorizing the take at that level annually and MDFW concurrence of the authorization. Take by WS would not exceed the permitted take allowed under depredation permits issued by the USFWS. With management authority for migratory birds, the USFWS can adjust allowed take through the regulated harvest season and take under depredation permits and orders to meet population objectives. Therefore, all take by WS is

authorized by the USFWS, with concurrence of the MDFW, and is considered as part of population objectives for geese.

Migratory Canada Geese

As discussed previously, the NAP, SJBP, and the AP of Canada geese could be found in the Commonwealth under those conditions where geese present in the Commonwealth would be considered migratory. Under field conditions, distinguishing geese between population segments can be difficult. Determining whether a Canada goose present in the Commonwealth is migratory or a resident (*i.e.*, present in the Commonwealth throughout the year) can also be difficult under field conditions. Therefore, for the purposes of this analyses, those Canada geese present in the Commonwealth from September through March will be considered as migratory geese, although resident geese regularly begin nesting in March throughout the Commonwealth and nesting geese can be clearly identified as being resident.

Frameworks have been established by the USFWS and implemented by the MDFW to allow for the harvest of geese in the Commonwealth during those months when geese present in the Commonwealth could be migratory. The September season is intended to manage populations of resident geese. Although migratory geese could be present in the Commonwealth during September, the majority of geese present in the Commonwealth are likely geese that nested within the Commonwealth. This is based on band recovery data, collar observations, and radio satellite data which indicate that the September season is virtually entirely free of migratory birds (H. Heusmann, MDFW pers. comm. 2011). The September hunting season originally ended September 10, then was moved to September 15, and finally until September 25 each year due to evidence indicating that most migrant geese did not leave Canada before early October (H. Heusmann, MDFW pers. comm. 2011). Dunn and Jacobs (2000) found that from 1992 through 1999, 4.1% of the banded geese harvested in Pennsylvania during a special September season were identified as migrant geese from either the SJBP (n=24) or the AP (n=5) of Canada geese. In 2008, an estimated 8,500 geese were taken during the regular and late hunting seasons for geese in the Commonwealth (Raftovich et al. 2010). An estimated 12,300 geese were harvested in both seasons during the 2009 season (Raftovich et al. 2010).

From FY 2006 through FY 2010, a total of 591 geese were lethally taken by WS in the Commonwealth during the period when geese present in the Commonwealth could be considered migratory (September through March) or approximately 119 geese per year. This represents 44.8% of the 1,319 geese taken by WS during the same time period. However, based on increasing requests for assistance to manage geese, WS may be required to lethally take geese during those months when geese could be considered migratory, if deemed appropriate through the use of the WS Decision Model. WS anticipates that requests for the lethal take of geese during those months when geese are considered migratory would occur primarily at airports where geese can pose a threat to human safety and to property. However, requests could be received to reduce damage or threats to other resources. Based on an increase in the number of requests received for the lethal take of geese during those periods of time when geese present in the Commonwealth would be considered migratory, WS may take up to 500 geese during those periods when geese could be considered migratory, including geese that could be lethally taken at airports within the Commonwealth (USDA 2002).

All take by WS occurs through the issuance of a depredation permit issued by the USFWS which is reported annually to the USFWS. All take of geese during the hunting seasons occur under frameworks established by the USFWS. Take by other entities in the Commonwealth occurs under depredation permits or depredation orders established by the USFWS with the requirement that take be reported to the USFWS. Therefore, the permitting of the take by the USFWS and the MDFW ensures cumulative take is

considered as part of management objectives for Canada geese. WS' cumulative take of up to 500 geese that could be considered migratory annually would have represented almost 5.9% of the number of geese harvested in the Commonwealth during the 2008 regular and late harvest seasons, and less than 4.1% of the number of geese harvested in the Commonwealth during the 2009 regular and late hunting seasons. According to Lindberg and Malecki (1994) resident geese were harvested proportionally more than their availability in the population while migrants were harvested proportionally less than their availability in Crawford County, Pennsylvania during 1988 and 1989.

WS does not use traditional hunting methods, such as decoys, blinds, camouflage and calls, to take Canada geese to address requests for assistance. Those methods are not allowed under USFWS depredation permits. Because of this, it is highly likely that WS' direct operational assistance is even more likely to proportionally remove resident geese than migratory geese. In fact, during the migratory periods of FY 2006 through FY 2010, over 41.1% of all lethal take of Canada geese by WS involved live capture methods such as hand nets and net guns. Live capture during the migratory period requires close access to geese that have the ability to fly, indicating that individuals captured are comfortable with close human contact. This behavior is usually displayed by resident Canada geese, usually in urban and suburban settings.

No take of migratory geese would occur by WS without a depredation permit issued by the USFWS. Therefore, WS take would only occur at the discretion of the USFWS after population objectives for geese are considered.

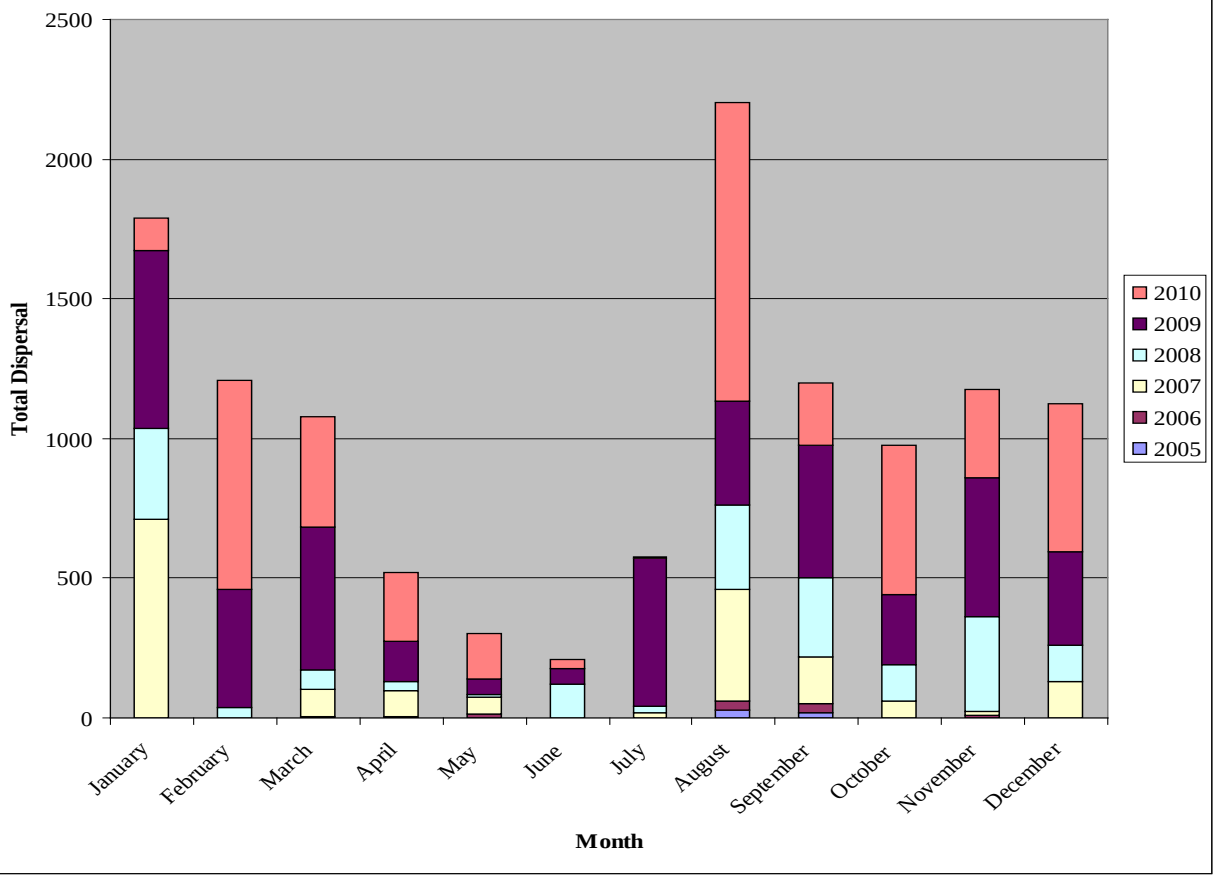
It should also be noted that WS non-lethal harassment activities, in contrast to lethal take, tended to be greatest during the period when geese could be considered migratory and just after the end of the molt when geese resume flying as shown in Figure 4.3. During the migratory period, this may be attributed to increased vigilance and avoidance of humans exhibited by both migratory and resident flocks of geese due to hunting activity and the presence of larger flocks, either migrating in spring and fall or feeding on limited food resources during the winter. Increased dispersal of resident geese after the annual molt, particularly in August, may be attributed to adult and hatch year geese dispersing to new feeding areas due to depletion of food resources at molt sites resulting in increase conflict with humans.

During the CBC conducted in 2010, observers counted 37,185 geese in the Commonwealth (NAS 2010). CBC data compiled since the 2001 survey conducted in the Commonwealth, indicates an average of 37,637 geese have been observed during the CBC conducted annually. If WS had lethally taken 500 migratory Canada geese, the take would have represented 1.3% of the average number of geese observed annually in the Commonwealth during the CBC conducted since 2001. Between the surveys conducted during the CBC from 2001 through 2010, the fewest number of geese counted was 21,748 geese observed in 2006 while the highest number recorded was 53,685 geese in 2002. If WS had lethally taken 500 migratory geese in 2002 and in 2006, the take would have ranged from 0.9% to 2.3% of the geese observed during those years. 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 population estimates of wintering bird populations. However, the information is presented in this analysis and compared to WS' take to indicate the low magnitude of take proposed by WS when compared to the number of geese observed in the Commonwealth during the CBC which would be considered a minimum population estimate given the survey parameters of the CBC and the survey only covering a small portion of the Commonwealth. Therefore, WS' proposed cumulative take of up to 500 migratory geese could be considered of low magnitude when compared with the number of geese that are observed annually in the Commonwealth.

All take by WS occurs through the issuance of a depredation permit issued by the USFWS which is

reported annually to the USFWS. All take of geese during the hunting seasons occur under frameworks established by the USFWS. Take by other entities in the Commonwealth occurs under depredation permits or depredation orders established by the USFWS with the requirement that take be reported to the USFWS. Therefore, the permitting of the take by the USFWS ensures cumulative take is considered as part of management objectives for Canada geese. No take of migratory geese would occur by WS without a depredation permit issued by the USFWS and the MDFW. Therefore, WS' take would only occur at the discretion of the USFWS and the MDFW after population objectives for geese are considered.

Figure 4.3 Non-Lethal Dispersal of Canada Geese In Massachusetts by Month and Calendar Year from January 2005 to December 2010



Wildlife Disease Surveillance and Management

As part of surveillance activities for wildlife diseases, it may be necessary for WS to obtain biological samples from geese (usually a tracheal or cloacal sample taken with a cotton swab). Geese sampled for disease surveillance (if not taken during wildlife damage management projects or from hunter harvest) would be captured live using non-lethal nets or traps. Captured geese would be carefully and humanely restrained (usually in commercial poultry crates) and released unharmed at the capture site after the samples are obtained. There is a possibility that some geese may be injured or killed by capture devices (such as rocket or cannon net assemblies). However, the threat of birds being killed or injured during disease sampling activities is expected to be very minimal to nonexistent. Most samples would involve

geese harvested during the hunting seasons. Therefore, no additional take would occur outside of the take that would already have occurred from the hunting season.

If a disease outbreak is detected and localized, the decision may be made to reduce or depopulate a local population of Canada geese in an attempt to manage the disease and reduce the chance of transmission to other wildlife and/or humans. Although it is normally difficult to depopulate an entire local population of birds due to their ability to fly, the annual molt could make this a viable option for Canada geese during a period each year. However, cumulative annual take would not exceed the levels analyzed previously for resident and migratory geese.

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

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

Under a technical assistance only alternative, those persons experiencing threats or damage associated with geese in the Commonwealth could apply for a depredation permit from the USFWS to lethally take geese despite WS' lack of direct involvement in the management action. In addition, take could occur under the depredation orders when the criteria for those orders are met. Therefore, under this alternative the number of geese lethally taken would likely be similar to the other alternatives since take could occur through the issuance of depredation permits by the USFWS or under depredation orders. WS' participation in a management action would not be additive to an action that could occur in the absence of WS' participation.

With the oversight of the USFWS through the issuance of depredation permits and orders for the take of geese and input from the MDFW, it is unlikely that goose populations would be adversely impacted by implementation of this alternative. Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the MDFW, USFWS, municipal authorities, and/or private entities. If direct operational assistance is 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 waterfowl populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USDA 1997, USFWS 2001, FDA 2003). Effects and hypothetical risks of illegal killing of geese under this alternative would probably be similar to Alternative 3.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would not conduct Canada goose damage management activities in the Commonwealth. WS would have no direct involvement with any aspect of addressing damage caused by geese and would provide no technical assistance. No take of geese by WS would occur in the Commonwealth. Canada geese could continue to be lethally taken to resolve damage and/or threats occurring through the issuance of depredation permits by the USFWS or under depredation orders established by the USFWS.

Local goose populations could decline, stay the same, or increase depending on actions taken by those persons experiencing damage. Some resource/property owners may hunt geese or allow other hunters access to hunt geese during the hunting season. The USFWS would continue to issue depredation permits for the take of Canada geese to alleviate damage in the Commonwealth. Resource/property owners may obtain depredation permits from the USFWS that allows them to lethally take Canada geese outside of the hunting season and in those areas where hunting is not allowed. Canada goose populations could continue to increase where hunting pressure was low or when an insufficient number of geese are removed under depredation permits issued by the USFWS or the depredation orders. Some local populations of geese would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of geese out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in impacts similar to the proposed action.

Since the take of Canada geese by those persons experiencing damage could occur despite no involvement by WS and geese would continue to be harvested during the regulated season at the discretion of the USFWS and the MDFW, the potential effects on the goose population in the Commonwealth would be similar among all the alternatives for this issue. Since WS' involvement in goose damage management would only occur after the USFWS has issued a permit for such action, WS' involvement would not be additive to take that could occur since the cooperator requesting WS' assistance could conduct goose damage management activities without WS' direct involvement if permitted by the USFWS or if the take occurred pursuant to a depredation order. Therefore, any actions to resolve damage or reduce threats associated with geese could occur by other entities despite WS' lack of involvement under this alternative.

Issue 2 - Effectiveness of Canada Goose Damage Management Methods

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

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

Under the proposed action, WS would continue the use of an adaptive approach using an integration of methods to resolve goose damage. WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance. WS only provides assistance after a request has been received and a cooperative service agreement or other comparable document has been signed by WS and the requesting entity in which all methods used to address geese causing damage are agreed upon. Methods employed to manage goose damage, whether non-lethal or lethal, are often temporary with the duration dependent on many factors, including goose densities in the area, the availability of suitable habitat in the area, and the availability of methods. WS employs only those methods as agreed upon by the requestor after available methods are discussed.

A common issue raised is that the use of lethal methods is ineffective because additional geese are likely

to return to the area, either after removal occurs or the following year when birds return to the area to nest which gives the impression of creating a financial incentive to continue the use of only lethal methods. This assumes geese only return to an area where damage was occurring if lethal methods are used. However, the use of non-lethal methods is also often temporary which could result in geese returning to an area where damage was occurring once those methods are no longer used. The common factor when employing any method is that geese would return if suitable habitat continues to exist at the location where damage was occurring and goose densities are sufficient to occupy all available habitats. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continue to exist. In the case of Canada geese, WS primarily receives requests to reduce or prevent damage caused by geese considered resident in the Commonwealth. Therefore, any method that disperses or removes geese from areas would only be temporary if habitat continues to exist the following year when geese return to nest.

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

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

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

Redistribution methods are often employed to provide immediate resolution to damage occurring until long-term approaches can be implemented or have had time to reach the desired result. The USFWS has evaluated and implemented long-term approaches to managing resident Canada goose populations with the intent of reducing damage associated with resident Canada geese (USFWS 2005). Scaring geese and physical barriers are often short-term solutions that move geese to other areas where damages or threats could occur (Smith et al. 1999). Some short-term methods may become less effective in resolving damage as the goose population increases and become more acclimated to human activity (Smith et al. 1999). Long-term solutions to resolving damage would require management of the population (Smith et al. 1999). Cooper and Keefe (1997) found that fencing and harassment with dogs are the only effective short-term approaches to reducing goose damage but likely redistribute the problem elsewhere. Hunting,

goose removal, and egg destruction were identified as long-term solutions to resolving goose damage over larger geographical areas by reducing local goose populations (Cooper and Keefe 1997). An integrated approach to resolving goose damage is likely the most effective (Smith et al. 1999).

Cooper (1991) reported the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and significantly reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. In addition, Dolbeer et al. (1993) demonstrated that an integrated approach (including removal of offending birds) reduced bird hazards at airports and substantially reduced bird collisions with aircraft by as much as 89%. Jensen (1996) also reported that an integrated approach that incorporated the removal of geese, reduced goose-aircraft collisions by 80% during a two year period.

The use of only non-lethal methods to alleviate damage involving other bird species has had similar results requiring constant application and re-application. Recent research has indicated that non-lethal harassment programs can reduce waterfowl numbers at specific sites, but those programs do little to reduce the overall population of nuisance waterfowl locally and may shift the problem elsewhere. Preusser et al. (2008) found that 12 of 59 geese banded at a study site in Orange County, New York that were hazed regularly were observed at an unmanaged location 1.2 km away on 161 occasions during 2004. This is similar to findings by Holevinski et al. (2007) who documented hazed radio-marked geese moved an average of 1.18 km at an urban site in Brighton, New York.

Capture and euthanization of nuisance geese to reinforce hazing methods while conducting nest and egg destruction programs may be the most successful management strategy available. Recent research at an airport in the United Kingdom found that through the capture of approximately 287 geese each year over a period of three years, combined with the oiling of 2,980 eggs and hazing geese from problem roost sites, reduced goose movements over the airfield by 63% (Baxter and Robinson 2007).

Chipman et al. (2008) found that crows could be dispersed from roost locations using non-lethal methods but crows would return to the original roost site within 2 to 8 weeks. The re-application of non-lethal methods to disperse crow roosts was required every year to disperse crows from the original roost or from roosts that had formed in other areas where damages were occurring (Chipman et al. 2008). Some short-term methods may become less effective in resolving damage as a bird population increases, as birds become more acclimated to human activity, and as birds become habituated to harassment techniques (Smith et al. 1999, Chipman et al. 2008). Non-lethal methods often require a constant presence at locations when geese are present and must be repeated daily until the desired results are achieved which can increase the costs associated with those activities. During a six-year project using only non-lethal methods to disperse crows in New York, the number of events required to disperse crows remained similar amongst years and at some locations, the number of events required to harass crows increased from the start of the project (Chipman et al. 2008). Long-term solutions to resolving bird damage often require management of the population (Smith et al. 1999) and identifying the habitat characteristics which attract birds to a particular location (Gorenzel and Salmon 1995).

Although crows are not specifically addressed in this EA, the discussion of those examples of management methods employed to address crow damage are likely representative of the results achieved by those methods when applied to geese given the intent and application of those methods are similar.

As addressed previous, the methods available for resolving damage would be similar across all the alternatives analyzed. Under the proposed action, the use of alpha-chloralose could occur by WS when deemed appropriate. Since all methods, except alpha-chloralose, would be available under all the

alternatives and when those methods are used as intended with consideration for the behavior of the target species, those methods would be considered effective.

Two chemicals commonly registered with the EPA as goose repellents are methyl anthranilate and anthraquinone. Methyl anthranilate naturally occurs in grapes and is used to flavor food, candy, and soft drinks. Anthraquinone naturally occurs in plants like aloe and is also used to make dye. Both products claim to be unpalatable to geese. Several products registered for use to reduce goose damage contain methyl anthranilate and anthraquinone. Formulations containing those chemicals are liquids that are applied directly to susceptible resources, primarily turf. Methyl anthranilate is effective for about four days depending on environmental conditions which is a similar duration experienced when applying anthraquinone as geese continue 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.

The reproductive inhibitor known as nicarbazin has been registered for use to manage Canada goose populations on a local scale by reducing the likelihood that eggs laid will hatch. 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).

Nicarbazin, as a reproductive inhibitor for geese, has been registered with the EPA as a pesticide pursuant to the FIFRA under the trade name OvoControl® G (Innolytics, LLC, Rancho Sante Fe, CA). 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 ready-to-use bait for geese in urban areas and at airports only. 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.

Nicarbazin has been studied as a reproductive inhibitor to reduce the number of geese at problem sites (VerCauteran et al. 2000). Recent testing by the NWRC has shown it to be effective in reducing the hatchability of eggs in Canada geese. Population management from the use of reproductive inhibitors to decrease the hatchability of eggs laid occurs through a reduction in the recruitment of new birds into the population by limiting reproductive output. A reduction in the population occurs when the number of birds being recruited into the population cannot replace those individuals that die from other causes each year which equates to a net loss in the number of individuals in the population leading to a reduction in the overall population. Although not generally considered a lethal method since no direct take occurs, reproductive inhibitors can result in the reduction of a target species' population. WS' use or recommendation of nicarbazin would target local goose populations identified as causing damage or threatening human safety. Although a reduction in local goose populations would likely occur from constant use of nicarbazin, the actual reduction in the local population annually would be difficult to derive prior to the initiation of the use of nicarbazin.

One of the difficulties in calculating an actual reduction in a targeted population prior to application of the bait is that consumption of nicarbazin treated bait as currently formulated does not appear to completely eliminate egg hatch in geese. Previous studies on nicarbazin as a reproductive inhibitor has shown

variability in hatch rates of target species fed treated baits (VerCauteren et al. 2000, Bynum et al. 2005, Yoder et al. 2006). Those studies indicated that some of the birds provided treated bait in controlled, laboratory studies continued to produce viable eggs despite those birds being provided no other food besides treated bait. Birds provided treated bait continued to lay viable eggs (although at a reduced rate) adds a level of uncertainty into determining the rate a population reduction could occur from the use of nicarbazin. However, several studies on nicarbazin have shown that when sufficient levels (which appears to vary by bird species) of the components in nicarbazin are absorbed into the bloodstreams of birds, the hatchability of eggs is reduced. In addition, geese must consume bait treated with nicarbazin daily in the correct dosage throughout the breeding season to achieve the highest level of effectiveness in reducing egg hatch. Resident Canada geese generally nest from February through June each year (USFWS 2005).

To reduce the hatchability of eggs, target avian species must consume a sufficient dose daily for the entire duration of the breeding season. The nicarbazin label for geese requires the applicator to condition geese to feed at a particular location and at the same time daily during an acclimation period. Acclimation is achieved when geese return to the same location and at the same time daily to feed on bait. The label also requires the applicator to remove any uneaten bait. Under field conditions, ensuring geese consume a sufficient dose of nicarbazin is difficult and unlike the cage studies, geese cannot be forced to consume treated bait daily nor is nicarbazin treated bait the only food source available to free-ranging geese. Therefore, variability is likely to exist when attempting to determine the rate of population decline that might occur from the use of nicarbazin to manage local geese populations.

Since the effects of nicarbazin on egg hatch are reversible if no longer provided for consumption, the reduction in a local population of geese from the use of nicarbazin can be maintained at appropriate levels where damages or threats are resolved by increasing or decreasing the amount of nicarbazin treated bait available to target geese. Although localized goose populations would likely 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).

Translocating geese to areas where they can be hunted has been found to be an effective method to reduce conflicts with geese at problem sites. Hall and Groniger (2002) found that translocated geese are subject to higher hunting mortality by about 8% than non-relocated geese and that hunting as a management tool reduced the population of geese at Truckee Meadows in Nevada from about 2,000 to 400 geese. Holevinski et al. (2006) found that more translocated adult geese (23.8%) and juvenile geese (22.0%) in New York were harvested than control geese when translocated to an area open to hunting; and that only 7 of 177 translocated geese returned to the original capture site.

Lethal methods are used as a part of an integrated approach when non-lethal methods alone are ineffective. The proposed action has the greatest potential of successfully reducing Canada goose conflicts and damage and allows those methods determined to be effective when using WS' Decision Model to be applied to resolve requests for assistance.

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

With WS providing technical assistance but no direct management under this alternative, entities requesting goose damage management would either take no action, which means conflicts and damage would likely continue or increase in each situation as goose numbers are maintained or increased, or implement WS' recommendations for non-lethal and lethal control methods. Methods of frightening or

dispersing geese have been effective at specific sites. In most instances, those methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. 1991, Swift 1998). Of the non-lethal techniques commonly used by the public to reduce conflicts with geese (*e.g.*, feeding ban, habitat modification, live swan, methyl anthranilate, fencing, harassment with dogs, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many include reducing water levels in wetlands and are not biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce goose population size (Smith et al. 1999). Population reduction would be limited to applicable Commonwealth and federal laws and regulations authorizing take of geese, including legal hunting and take pursuant to depredation permits. However, individuals or entities that implement management may not have the experience necessary to efficiently and effectively conduct the actions.

Under an alternative in which WS would only provide technical assistance to those persons requesting assistance, those methods described in Appendix B would be recommended and demonstrated, except for alpha-chloralose. WS would recommend methods using the WS Decision Model based on information provided by those persons requesting assistance or through site visits. WS would describe and demonstrate the correct application of those lethal and non-lethal methods available. If those persons receiving technical assistance apply methods as recommended and demonstrated by WS, those methods when employed to resolve goose damage are reasonably anticipated to be effective in resolving damage occurring. Under this alternative, those persons requesting assistance would be provided information on goose behavior to ensure methods are applied when the use of those methods are likely to be most effective. For example, if live-capture of geese is recommended using corral traps, WS would provide information to those persons requesting assistance on the appropriate times to employ those methods to ensure geese can be live-captured.

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

Alternative 3 – No Canada Goose Damage Management Conducted by WS

The methods available to those persons experiencing damage under this alternative would be similar to those methods that would be available under the other alternatives. The only method that would not be available under this alternative would be the use of alpha-chloralose which is restricted to use by WS only. WS would not be directly involved with application of any methods to resolve damage caused by geese in the Commonwealth under this alternative. The recommendation of methods and the use of methods would be the responsibility of other entities and/or those persons experiencing damage. When available methods are employed as intended, a reasonable amount of effectiveness is expected. If methods are employed incorrectly due to a lack of knowledge of the correct use of those methods or if methods are employed without consideration of the behavior of geese causing damage, those methods being employed are likely to be less effective.

Since those methods available for resolving goose damage would be available to those persons experiencing damage or threats, the effectiveness of those methods when used as intended would be

similar among the alternatives. Those non-lethal methods discussed in Appendix B would be available to those persons experiencing goose damage despite WS' lack of involvement under this alternative. The use of lethal methods under this alternative would continue to be available, including the use of firearms and live-capture followed by euthanasia. Nest destruction and egg oiling/addling would continue to occur under this alternative when permitted by the USFWS. Since WS would not be involved with any aspect of goose damage management under this alternative, the use of methods and the proper application of methods would occur as decided by the persons experiencing damage or by other entities providing assistance.

Issue 3 - Effects on Non-target Species Populations, Including T&E Species

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

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

The potential adverse effects to non-targets occur from the employment of methods to address goose damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. Personnel from WS are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-targets exist when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that 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 is large enough. Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets in the vicinity of those methods when employed are also likely dispersed from the area. Therefore, non-targets may be dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Other non-lethal methods available for use under this alternative include drop nets, cannon nets, rocket nets, live traps, repellents, immobilizing drugs, and reproductive inhibitors. Nets are virtually selective for target individuals since activation occurs by attending personnel, with handling of wildlife occurring immediately after deployment of the net. Therefore, any non-targets captured using nets can be 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 cannon or 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 are 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 can be abandoned if non-target use of the area is high.

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

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

The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods are employed of both target and non-target species. Therefore, any use of non-lethal methods has similar results on both non-target and target species. Though non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. Overall, potential impacts to non-targets from the use of non-lethal methods only would not adversely impact populations since those methods are often temporary.

Since OvoControl® G would be commercially available to those persons 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. Under the proposed action, WS could use or recommend nicarbazin under the trade name OvoControl® G as part of an integrated approach to managing damages associated with geese if the product becomes registered for use in Massachusetts. 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 persons experiencing damage could become a certified applicator and apply the bait themselves when the appropriate depredation permits are received.

Exposure of non-target wildlife to nicarbazin could occur either 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 OvoControl® G are intended to mitigate risks to non-target wildlife from direct consumption of treated bait (EPA 2005). The label requires an acclimation period that habituates geese to feeding in one location at a certain time period. During baiting periods, the applicator must be present on site until all bait has been consumed. Non-target risks are further minimized by requirements that bait can only be distributed in bait pans or through broadcast application (by hand or mechanical feeders). All unconsumed bait must also be retrieved daily which further reduces threats of non-target consuming treated bait.

In addition, nicarbazin is only effective in reducing the hatch of eggs when blood levels of DNC are sufficiently elevated in a bird species. When consumed by birds, nicarbazin is broken down into the two

base components of DNC and HDP which are then rapidly excreted. To maintain the high blood levels required to reduce egg hatch, birds must consume nicarbazin daily at a sufficient dosage that appears to be variable depending on the bird species (Yoder et al. 2005, Avery et al. 2006). For example, to reduce egg hatch in Canada geese, geese must consume nicarbazin at 2,500 ppm compared to 5,000 ppm required to reduce egg hatch in pigeons (Avery et al. 2006, Avery et al. 2008*a*). In pigeons, consuming nicarbazin at a rate that would reduce egg hatch in Canada geese did not reduce the hatchability of eggs in pigeons (Avery et al. 2006). With the rapid excretion of the two components of nicarbazin (DNC and HDP) in birds, non-target 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 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 affects 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 affects of nicarbazin, geese 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 goose carcass and consumed for reproduction to be affected. Based on the risks and likelihood of wildlife consuming a treated goose carcass daily and receiving the appropriate levels of DNC and HDP daily to negatively impact reproduction, secondary hazards to wildlife from the use of nicarbazin are extremely low (EPA 2005).

Although some risks to other non-target species besides bird species does occur from the use of OvoControl® G, those risks are likely to be minimal given the restrictions on where and how bait can 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 OvoControl® G and the limited locations where bait can 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, except for alpha-chloralose 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 geese under this alternative would include the recommendation of take by private entities during the hunting season, shooting, and euthanasia after live capture. The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts are anticipated from use of this method. Methods used for euthanasia would be limited to cervical dislocation or carbon dioxide

administered in an enclosed chamber after geese have been live-captured. Since live-capture of geese using other methods occurs prior to the administering of euthanasia chemicals, no adverse effects on non-targets would occur under this alternative. WS' recommendation that geese be harvested during the regulated season by private entities to alleviate damage would not increase risks to non-targets. Shooting is essentially selective for target species and non-target take is not likely and would not increase based on WS' recommendation of the method.

While every precaution is taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by wildlife, the use of such methods can result in the incidental take of unintended species. Those occurrences are rare and should not affect the overall populations of any species under the current program. WS' take of non-target species during activities to reduce damage or threats to human safety associated with Canada geese in Massachusetts is expected to be extremely low to non-existent. No non-targets have been taken by WS during prior goose damage management activities in the Commonwealth. WS would monitor annually the take of non-target species to ensure program activities or methodologies used in goose damage management do not adversely impact non-targets. Methods available to resolve and prevent goose damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the USFWS and the MDFW 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 to be minimal to non-existent.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. 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 and endangered in Massachusetts as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the Commonwealth along with common and scientific names.

The New England Field Office of the USFWS has developed a website[9] which provides up-to-date species occurrence information and provides an outline for action agencies to assist in determining whether consultation for projects is needed under Section 7 of the ESA. WS would review the website and the online measures on a site-by-site basis to determine if any T&E species are located within the project area in order to conclude with a determination of effects. If T&E species are not present in the project area based on review of the website, WS would conclude the project would have "*no effect*" on T&E species based on the absence of those species in the project area; therefore, no further consultation would occur with the USFWS as indicated by the website and pursuant to Section 7 of the ESA. If, after review of the procedures on the website, WS determines T&E species may be present in a project area based on information provided on the website, WS would follow those procedures outlined on the website to conclude with a determination of effects and the need for further consultation pursuant to Section 7.

Commonwealth Listed Species: WS has obtained and reviewed the list of T&E or species of special concern (see Appendix D) designated by the Commonwealth of Massachusetts and has determined that the proposed WS' activities would have no effect on any species listed as vulnerable or threatened and endangered. If WS' activities are requested that may be beneficial to species listed by the

[9]The New England Field Office website for endangered species consultation could be found at www.fws.gov/newengland/endangeredspec-consultation.htm during the development of this EA.

Commonwealth as vulnerable, threatened, or endangered by enhancing reproduction or survival of individuals through reduction of harassment, competition, or predation associated with geese, WS would initiate consultation with the Commonwealth prior to start of any action.

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

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be employed by those persons requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations. Under this alternative, the implementation or consideration of the use of measures recommended by or demonstrated by WS through technical assistance would be the responsibility and at the discretion of those persons experiencing goose damage.

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

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

Those persons experiencing damage from geese may implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. Potential impacts from providing only technical assistance could be greater than those described in the proposed action if those persons experiencing damage do not implement methods or techniques correctly. Incorrectly implemented methods or techniques recommended by WS could lead to an increase in non-target take.

If requestors are provided technical assistance but do not implement any of the recommended actions, the potential impacts to non-targets would be lower compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential impacts to non-targets. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

The ability to reduce negative impacts caused by Canada geese to wildlife species and their habitats, including T&E species, would be variable based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 3 since WS would be available to provide information and advice to those persons seeking assistance.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with Canada goose damage management activities in Massachusetts. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Geese would continue to be taken during the regulated harvest season, under depredation orders, and through depredation permits issued by the USFWS and the MDFW. Risks to non-targets and T&E species would continue to occur from those persons who implement goose damage management activities on their own or through recommendations by other federal, Commonwealth, and private entities. Although some risk occurs from those persons that implement goose damage management in the absence of any involvement by WS, those risks are likely low and are similar to those under the other alternatives.

The ability to reduce negative impacts caused by geese would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. The risks to non-targets and T&E species would be similar across the alternatives since those methods described in Appendix B are available across the alternatives, except for alpha-chloralose. If those methods available are applied as intended, risks to non-targets would be minimal to non-existent. If methods available are applied incorrectly or applied without knowledge of goose behavior, risks to non-target wildlife would be higher under this alternative. If frustration from the lack of available assistance causes those persons experiencing goose damage to use methods that are not legally available for use, risks to non-targets would be higher under this alternative. People have resorted to the use of illegal methods to resolve wildlife damage that have resulted in the lethal take of non-target wildlife (USDA 1997, White et al. 1989, USFWS 2001, FDA 2003).

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

A common issue often raised is concerns about the humaneness of methods available under the alternatives for resolving Canada goose damage and threats. As stated previously, most of those methods available for use to manage goose damage would be available under any of the alternatives, when permitted by the USFWS and the MDFW. The humaneness of methods available for use in the Commonwealth, as the use of those methods relates to the alternatives, is discussed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Goose Damage (Proposed Action/No Action)

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS which are generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), nest destruction, exclusion devices, frightening devices, cage traps, nets, and repellents.

As discussed in Chapter 2, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on

the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS is to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a live 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 is to effectively address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of cage traps, nets, 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 are from injuries to animals while restrained and from the stress of the animal while being restrained or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

If geese are to be live-captured by WS, WS' personnel would be present on-site during capture events or methods would be checked frequently to ensure geese captured are addressed timely and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary. The presence of WS' personnel on-site also ensures geese live-captured are addressed immediately to minimize the stress associated with the handling of geese and to prevent injury.

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

Alpha-chloralose is used by WS as a sedative to live-capture geese and other waterfowl and does not cause euthanasia. When using alpha-chloralose, WS' personnel would be present on site to retrieve birds that become sedated. Some concern occurs that geese may drown if sedation occurs while they are loafing on water. WS would ensure that a boat and/or a canoe are available for quick retrieval of birds that become sedated while in the water.

Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods and immobilizing drugs, the stress of animals is likely temporary.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to

resolve or prevent goose damage and threats. Lethal methods would include shooting and euthanizing methods. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (see WS Directive 2.430 and WS Directive 2.505). The euthanasia methods being considered for use under the proposed action are cervical dislocation and carbon dioxide. The AVMA guideline on euthanasia lists cervical dislocation and carbon dioxide as acceptable methods of euthanasia for free-ranging birds which can lead to a humane death (AVMA 2007). The use of cervical dislocation or carbon dioxide for euthanasia would occur after the animal has been live-captured and away from public view. Although the AVMA guideline also lists gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (AVMA 2007). WS' personnel that employ firearms to address goose damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death. Use of cervical dislocation, carbon dioxide, and shooting as a method of euthanasia allow Canada goose meat to be salvaged for human or animal consumption.

Some people have concerns over the potential for separation of goose family groups through management actions. This could occur through harassment (*e.g.*, pyrotechnics, dogs) and lethal control methods. However, it is not uncommon for family units to experience change. Bellrose (1980) cites several sources which list annual mortality rates of juvenile geese ranging from 7 to 19% during the hatching to fledgling stage. Biologists believe that juvenile birds have a good likelihood of survival without adult birds once the juvenile reaches fledgling stage, which occurs by July for most juvenile birds in Massachusetts. Therefore, molting juvenile geese that escape capture would most likely survive to adulthood (Mississippi Flyway Council Technical Section 1996). Separated adults form new pair bonds and readily breed with new mates (Moser et al. 1991).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Those methods discussed in Appendix B to alleviate goose damage and/or threats in the Commonwealth, except for alpha-chloralose, could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods are used by WS as humanely as possible are listed in Chapter 3.

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

The issues of humaneness of methods under this alternative are likely to be perceived to be 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 requestor employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target Canada geese and to ensure methods are used in such a way as to

minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of geese or improperly identifying the damage caused by geese along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action.

Those persons requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured wildlife could experience suffering and if not addressed timely, could experience distress. The amount of time an animal is restrained under the proposed action would be shorter compared to a technical assistance alternative if those requestors implementing methods are not as diligent or timely in checking methods. Similar to Alternative 3, it is difficult to evaluate the behavior of individual people and what may occur under given circumstances. Therefore, only the availability of WS' assistance can be evaluated under this alternative since determining human behavior can be difficult. If those persons seeking assistance from WS apply methods recommended by WS through technical assistance as intended and as described by WS, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of geese would likely be higher.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under this alternative, WS would have no involvement in any aspect of Canada goose damage management in the Commonwealth. Those persons experiencing damage or threats associated with geese could continue to use those methods legally available when permitted by the USFWS, the MDFW, and other federal, Commonwealth, and local regulations. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the general 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 a humane method could be employed in inhumane ways if employed by those persons inexperienced in the use of those methods or if those persons are 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 general public to use to resolve damage and threats caused by geese. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those persons experiencing goose damage apply those methods considered to be 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 persons employ humane methods in ways that are inhumane, the issue of method humaneness could be greater under this alternative if those persons experiencing goose damage are not provided with information and demonstration on the proper use of those methods. However, the level at which people would apply humane methods inhumanely under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives. Similar to Alternative 2, the lack of understanding of goose behavior or

proper method use could lead to situations where methods are employed that could be perceived as inhumane.

Issue 5 - Effects on the Aesthetic Values of Canada Geese

People often enjoy viewing, watching, and knowing Canada geese exist as part of the natural environment and gain aesthetic enjoyment in such activities. Those methods available to alleviate damage are intended to disperse and/or remove geese. Non-lethal methods are intended to exclude or make an area less attractive which disperses 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 geese as it relates to the alternatives are discussed below.

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

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

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

The use of lethal methods would result in temporary declines in local populations resulting from the removal of geese to address or prevent damage and threats. The goal under the proposed action is to respond to requests for assistance and to manage those geese responsible for the resulting damage. Therefore, the ability to view and enjoy geese would still remain if a reasonable effort is made to locate geese outside the area in which damage management activities occurred. Those geese removed by WS are those geese that could be removed by the person experiencing damage with the appropriate depredation permit issued by the USFWS, under depredation orders, or during the regulated hunting season.

All activities are conducted by WS where a request for assistance has been received and only after agreement for such services have been agreed upon by the cooperator. Some aesthetic value would be gained by the removal of geese and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high densities of geese. Any removal of geese by WS using lethal methods in the Commonwealth would occur after the appropriate depredation permits are received from the USFWS and the MDFW.

Since those geese removed by WS under this alternative could be removed through a depredation permit issued to the resource owner/manager, removed under depredation orders, or removed during the hunting season, WS' involvement in taking geese would not likely be additive to the number of geese that could be taken in the absence of WS' involvement. In many cases, WS acts as the agent of the property owner or manager under a depredation permit issued to the owner or manager. In those cases, the take of geese could occur by the property owner or manager and WS' actions would not be additive to the number of geese that could be taken in the absence of WS' involvement.

WS' take of geese from FY 2006 through FY 2010 has been of low magnitude when compared to the total mortality from other sources. WS' activities are not likely additive to the geese that would be taken

in the absence of WS' involvement. Although geese removed by WS are no longer present for viewing or enjoying, those geese would likely be taken by the property owner or manager under the depredation permit issued to the owner or manager by the USFWS, through a depredation order, or during hunting seasons. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of geese, WS' goose damage management activities conducted pursuant to the proposed action would not adversely affect the aesthetic value of geese. The impact on the aesthetic value of geese and the ability of the public to view and enjoy geese under the proposed action would be similar to the other alternatives and is likely low.

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

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

Under this alternative, the effects on the aesthetic values of geese would be similar to those effects addressed in the proposed action. Those persons requesting assistance have often reached a tolerance-level that has exceeded the economic threshold of that individual and therefore, the social acceptance level of geese has reached a level where assistance is requested. Based on recommendations, methods are likely to be employed by the requestor based on those recommendations that would result in the dispersal and/or removal of a goose population responsible for damage or threatening safety.

The impacts on aesthetics from a technical assistance program would only be lower than the proposed action if those individuals experiencing damage are not as diligent in employing those methods as WS would be if conducting an operational program. If those persons experiencing damage abandoned the use of those methods, then geese would likely remain in the area and available for viewing and enjoying for those persons interested in doing so. Similar to the other alternatives, the geographical area in which damage management activities occurs is not such that geese would be dispersed or removed from such large areas that opportunities to view and enjoy geese would be severely limited since geese can be found statewide in suitable habitat.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under the no goose damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of geese in Massachusetts. Those persons experiencing damage or threats from geese would be responsible for researching, obtaining, and using all methods as permitted by federal, Commonwealth, and local laws and regulations. The degree to which damage management activities would occur in the absence of assistance by any agency is unknown but likely lower compared to damage management activities that would occur where some level of assistance was provided. Canada geese would continue to be dispersed and lethally taken under this alternative in the Commonwealth. Lethal take would continue to occur during the regulated harvest season, through depredation orders, and

through the issuance of depredation permits from the USFWS. The potential impacts on the aesthetic values of geese could be similar to the proposed action if similar levels of damage management activities are conducted by those persons experiencing damage or threats. If no action is taken or if activities are not permitted by the USFWS, then no impact on the aesthetic value of geese would occur under this alternative.

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

Those persons experiencing damage or threats would continue to use those methods they feel appropriate to resolve goose damage or threats, including lethal take. WS' involvement in goose damage management is therefore, not additive to the geese already taken in the Commonwealth. The impacts to the aesthetic value of geese would be similar to the other alternatives.

Issue 6 - Effects of Management Methods on Human Health and Safety

Concerns are often raised regarding the effects that methods can have on human safety, either from direct exposure of the public to the method or indirectly from the public when encountering geese. The issue of human safety is discussed as it relates to each alternative in the following subsections.

Safety of Chemical Methods Employed

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

Chemical methods currently available under the proposed action would include repellents and immobilizing drugs. The immobilizing drug alpha-chloralose would only be available for use by WS' employees. Repellents could be used by WS or recommended by WS under this alternative. Reproductive inhibitors may also be available under the proposed action and may be employed by or recommended for use by WS. Currently, the only reproductive inhibitor for waterfowl is a commercially available product with nicarbazin as the active ingredient. However, no products containing the active ingredient nicarbazin is currently registered for use in Massachusetts. Chemical methods available under the proposed action are further described in Appendix B.

Alpha-chloralose is an immobilizing agent available only for use by WS. The FDA has approved the use of alpha-chloralose as an INAD (INAD #6602) to be used for the immobilization and capture of certain species of birds by trained WS' personnel. Alpha-chloralose is administered to target individuals, either as a tablet or liquid solution contained within a bread ball or as a powder formulated on whole kernel corn. Application of either form occurs by hand with applicators present on site for monitoring. Application of the tablet or liquid solution form in bread baits occurs by hand and targets individual geese or small groups of geese. Alpha-chloralose formulated on whole corn is placed on the ground in designated areas where target geese are pre-conditioned to feed using a pre-bait. All unconsumed baits are retrieved. Since applicators are present at all times during application of alpha-chloralose, the risks to human safety are low. All WS' employees using alpha-chloralose are required to successfully complete a training course on the proper use and handling of alpha-chloralose. All WS' employees who use alpha-

chloralose would wear the appropriate personal protective equipment required to ensure the safety of employees.

The risks to human safety associated with repellents under the proposed action would be similar to those risks addressed in the no WS involvement alternative and the technical assistance only alternative. Repellents could be recommended to those persons requesting assistance or employed by WS as part of an integrated approach to managing goose damage. When repellents are applied according to label instructions, no adverse effects to human safety should occur. If repellents are used by WS, the appropriate protective equipment would be used to ensure the safety of employees. Repellents are not likely to be used over large areas, where negative accumulations would threaten human safety, or where repeated use of repellents results in accumulation of chemicals at the application site. Repellents are registered and evaluated by the EPA which ensures the use of those products would not adversely affect the environment.

The reproductive inhibitor nicarbazin is currently not registered for Canada geese in Massachusetts. However, it is discussed in this assessment to evaluate the potential use of the chemical if a product becomes registered for use in the Commonwealth. Based on the product-use profile and the potential reproductive hazards associated with non-targets, products containing nicarbazin as the active ingredient are classified as restricted-use pesticides by the EPA. Restricted-use pesticides can only be purchased and/or applied by those persons who have successfully completed an applicators course to use restricted-use pesticides. The MDAR administers training and testing required for applicators to purchase and apply restricted-use pesticides in the Commonwealth. If a product containing nicarbazin as the active ingredient is registered in the Commonwealth for geese, WS may consider the use of the product and could employ the product as part an integrated approach under the proposed action.

Nicarbazin, as it is currently registered in other states, is commercially available as a restricted-use pesticide formulated on a bait product that can be delivered in bait pans or through broadcast applications. The product is registered for use only in urban areas in places where human activities are likely to occur. However, the label requires an acclimation process to condition birds to feed at a specific location at a specific time. All unconsumed bait must be retrieved. Therefore, the risks to human safety are minimal since unconsumed bait is retrieved and not left unattended for long periods of time. Since an acclimation period is required, birds can be conditioned to feed during periods of time when human activities in the area are minimal or can be conditioned to feed in locations away from human activity, which should minimize any exposure hazard that might occur from exposure to the bait. Bait would have to be handled to cause exposure. If nicarbazin becomes available in Massachusetts, the recommendation of the product and the potential use by WS would adhere to all label requirements of the product and permitting requirements of the MDAR and/or the MDFW, which should assure that risks to human safety are minimal. Risks to human safety would be similar to those described under Alternative 2 and Alternative 3 since the use pattern of nicarbazin would be similar amongst the alternatives.

Of additional concern with the use of immobilizing drugs and reproductive inhibitors is the potential for human consumption of meat from geese that have been immobilized using alpha-chloralose or have consumed nicarbazin. Since geese are harvested during a regulated harvest season and consumed, the use of immobilizing drugs and potentially reproductive inhibitors is of concern. The intended use of immobilizing drugs is to live-capture geese. Geese are conditioned to feed during a period in the day when consumption of treated bait ensures geese do not disperse from the immediate area where the bait is applied. The use of immobilizing drugs and reproductive inhibitors targets geese in urban environments where hunting and the harvest of geese does not occur or is unlikely to occur (*e.g.*, due to city ordinances preventing the discharge of a firearm within city limits). Alpha-chloralose is primarily used to target geese that are incapable of flight which reduces the risks that target birds would leave the immediate area

once treated bait is consumed. However, it could be possible for target geese to leave the immediate area where baiting is occurring after consuming bait and enter areas where hunting could occur. To reduce this risk, withdrawal times are often established. A withdrawal time is the period of time established between when the animal consumed treated bait to when it is safe to consume the meat of the animal by humans. Withdrawal periods are not well defined for free-ranging wildlife species for all drugs. In compliance with FDA use restrictions, the use of alpha-chloralose is prohibited for 30 days prior to and during the hunting season on geese and other game birds that could be hunted. In the event that WS is requested to immobilize geese or use nicarbazin either during a period of time when harvest of geese is occurring or during a period of time where a withdrawal period could overlap with the start of a harvest season, WS would not use immobilizing drugs or nicarbazin. In those cases other methods would be employed.

All WS' personnel who handle and administer immobilizing drugs, nicarbazin, and repellents would be properly trained. WS' employees handling and administering immobilizing drugs are required to be trained according to WS Directive 2.430. Training and adherence to agency directives would ensure the safety of employees administering any chemical methods. Geese euthanized by WS after the use of immobilizing drugs would be disposed of by deep burial or incinerated to ensure the risks to human safety from euthanized geese are minimal (see WS Directive 2.515). All euthanasia would occur in the absence of the public to further minimize risks. SOPs which further reduce risks to human safety are further described in Chapter 3 of this EA.

No adverse effects to human safety have occurred from WS' use of chemical methods to alleviate Canada goose damage in Massachusetts from FY 2006 through FY 2010. The risks to human safety from the use of chemical methods, when used appropriately and by trained personnel, is considered low. Based on a thorough Risk Assessment, APHIS concluded that when chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997).

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

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. WS would only provide technical assistance to those persons requesting assistance with goose damage and threats. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use.

The use of chemical methods could be recommended under this alternative. Chemical methods available would include repellents and nicarbazin (if registered for use in the Commonwealth). Most repellents are applied directly to the affect resources (*e.g.*, vegetation) and require ingestion of the chemical by foraging on treated resources or through direct contact with treated areas to achieve the desired affects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources and to disperse birds from areas where the repellents are applied. The active ingredients of repellents that are currently registered for use to disperse geese include products containing methyl anthranilate and anthraquinone. Methyl anthranilate (grape derivative) and anthraquinone (plant extract) are naturally occurring chemicals. Repellents, when used according to label directions, are generally regarded as safe especially when the ingredients are considered naturally occurring. Some risk of exposure to the chemical occurs to the applicator and to others from the potential for drift as the product is applied. Some repellents also have restrictions on whether application can occur on edible plants with some restricting harvest for a designated period after application. All restrictions on harvest and required personal protective equipment would be included on the label and if followed, would minimize risks to human

safety associated with the use of those products.

Reproductive inhibitors are formulated on bait and are administered to target wildlife through hand-baiting and the subsequent consumption of treated bait. Therefore, the concern, outside of transport and storage, is the risks directly to the handler and support staff during the handling and distributing the bait on the ground for consumption.

Threats to human safety from the use of nicarbazin would likely be minimal if label directions are followed. The use pattern of nicarbazin would also ensure threats to public safety are minimal. The label requires an acclimation period which assists with identifying risks, requires the presence of the applicator at the location until all bait is consumed, and requires any unconsumed bait to be retrieved. The EPA has characterized nicarbazin as a moderate eye irritant. The FDA has established a tolerance of nicarbazin residues of 4 parts per million allowed in uncooked chicken muscle, skin, liver, and kidney (21 CFR 556.445). The EPA characterized the risks of human exposure as low when used to reduce egg hatch in Canada geese. The EPA also concluded that if human consumption occurred, a prohibitively large amount of nicarbazin would have to be consumed to produce toxic effects (EPA 2005). Based on the use pattern of the nicarbazin and if label instructions are followed, risks to human safety would be low with the primary exposure occurring to those persons handling and applying the product. Safety procedures required by the label, when followed, would minimize risks to handlers and applicators.

Given the use profile of many chemical methods to manage damage and threats associated with geese, the risks to human safety from the use of those methods are low when those methods are applied according to label requirements (USDA 1997). The cooperator requesting assistance is also made aware of threats to human safety associated with the use of those methods. SOPs for methods are discussed in Chapter 3 of this EA. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available, except for alpha-chloralose. If misused or applied inappropriately, any of the methods available to alleviate goose damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

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

Similar to Alternative 2, immobilizing drugs would not be available under this alternative to those persons experiencing damage or threats from geese. If a reproductive inhibitor containing the active ingredient nicarbazin becomes registered for use in the Commonwealth, those persons with the appropriate applicators license and permission of the MDFW could purchase and apply the chemical to reduce damage. Since most methods available to resolve or prevent goose damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Safety of Non-Chemical Methods Employed

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

The non-chemical methods available under an integrated approach would be the same as those methods available under all the alternatives as permitted by the USFWS and/or the MDFW. When requested under this alternative, WS would directly employ methods to alleviate or prevent goose damage from occurring in the Commonwealth. WS would also recommend non-chemical methods as part of a technical assistance program in an integrated approach to managing goose damage. WS' required training and directives ensure that those persons employing methods are properly trained and knowledgeable in the use of those methods. WS' would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from geese. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under the other alternatives. The use of non-lethal methods as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Non-chemical methods available for use under this alternative are discussed in Appendix B. As described previously, non-chemical methods do not result in direct take of geese, except for firearms and nest destruction. Most non-chemical methods involve the harassment or live-capturing of geese. Though some risks from harassment methods may occur, those risks are minimal when those methods are used appropriately and as intended. Firearms and cannon/rocket nets may also pose a risk to human safety when not handled or applied appropriately. All methods would be employed in areas where human activities would be minimal, when possible. WS would continue to employ methods according to all SOPs described in Chapter 3.

One measure which further reduces the risks to human safety when WS is directly involved with applying those methods is the knowledge and training received by WS' personnel. WS' employees who would conduct goose damage management activities are knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. That knowledge is incorporated into the decision-making process inherent with the WS' Decision Model that is applied when addressing threats and damage caused by geese. When employing lethal methods, WS' employees would consider risks to human safety when employing those methods based on location and method. Risks to human safety from the use of methods is likely greater in urban areas when compared to rural areas that are less densely populated. Consideration is also given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property is controlled and monitored, the risks to human safety from the use of methods is likely less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases.

Safety issues may arise from the misuse of firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms to conduct official duties are required to attend an approved firearms safety

training course. The use of firearms by WS' employees would occur pursuant to WS Directive 2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities. WS and cooperating agencies would work closely with cooperators requesting assistance to ensure all safety issues are considered before firearms are deemed appropriate for use. After evaluation of the damage or threat of damage associated with the request for assistance using the WS' Decision Model, the WS employee would determine which methods were appropriate for reducing damage or threats of damage at that particular location based on information provided and requested from the requesting entity. Those methods determined to be appropriate to resolve the request for assistance would be agreed upon with the cooperator to ensure the safe use of those methods prior to the application of those methods. Only those methods agreed upon through a MOU, cooperative service agreement, or other comparable agreement would be employed to resolve a particular request for assistance. A risk assessment conducted during the development of WS' programmatic FEIS, determined the risks to human safety from the use of firearms was low based on the use profile of the method (USDA 1997).

The use of restraining devices has also been identified as a potential issue. Restraining devices include live-traps and nets. Those devices pose minimal risks to the public when used appropriately. Restraining devices are typically set in areas where human activity is minimal to ensure public safety. Restraining devices rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices used to capture wildlife, including geese, require direct contact to cause bodily harm. If restraining devices are left alone, those methods pose no risks to human safety outside of those risks associated to the person or persons applying the method. Again, restraining devices are not located in high-use areas to ensure the safety of the public and pets. An APHIS risk assessment in WS' programmatic FEIS concluded that threats to human safety from the use of devices to restrain wildlife were low (USDA 1997).

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

Under the technical assistance alternative, WS would only recommend the use of available non-chemical methods for managing damage caused by geese. Recommendations would be made based on the appropriate decision-making process and on information provided by the requester or from a site visit. The implementation of non-chemical methods would be the sole responsibility of the requester. WS would not be directly involved with managing damage caused by geese in the Commonwealth. Non-chemical methods available for use under the technical assistance only alternative are addressed in Appendix B.

Since those non-chemical methods discussed in Appendix B would be similar across the alternatives, the risks to human safety under a technical assistance alternative would be similar to those discussed in the no involvement by WS alternative (Alternative 3) if methods are applied appropriately and in consideration of human safety.

Risks to human safety from the use of non-lethal methods were considered low when evaluated in a formal risk assessment conducted as part of the development of WS' programmatic FEIS (USDA 1997). Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and live-capture methods were considered low based on their use profile for

alleviating damage associated with wildlife (USDA 1997). Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Under a technical assistance only alternative, the use of nets (*e.g.*, rocket nets, cannon nets) would not be available to the general public but could be employed by other federal and Commonwealth agencies. Personnel employing nets are present at the site during application to ensure the safety of the public and operators. Although some fire and explosive hazards exist with rocket nets during ignition and storage of the explosive charges, safety precautions associated with the use of the method, when adhered to, pose minimal risks to human safety and primarily occur to the handler. Nets would not be employed in areas where public activity is high which further reduces the risks to the general public. Nets would be employed in areas where public access is restricted whenever possible to reduce risks to human safety. Overall, nets would pose minimal risks to the public.

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

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

If non-chemical methods are employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods are employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods.

Given the use profile of many methods to manage damage and threats associated with geese, the risks to human safety from the use of those methods are low (USDA 1997). The cooperator requesting assistance is also made aware of threats to human safety associated with the use of those methods. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available. If misused or applied inappropriately, any of the non-chemical methods available to alleviate goose damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Under the no involvement in goose damage management by WS alternative, WS would not be involved with any aspect of managing damage associated with geese in the Commonwealth, including technical

assistance. Due to the lack of involvement in managing damage caused by geese, no impacts to human safety from the use of non-chemical methods would occur directly. This alternative would not prevent those entities experiencing threats or damage from geese from conducting damage management activities in the absence of WS' involvement when permitted by the USFWS and/or the MDFW. Non-chemical methods discussed in Appendix B would be available to those persons experiencing damage or threats and could be used to take geese if permitted by the USFWS and/or the MDFW. The direct burden of implementing permitted methods would be placed on those persons requesting assistance.

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

Effects of not Employing Methods to Reduce Threats to Human Safety

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

Under the adaptive damage management alternative, methods deemed appropriate to resolve threats to human safety associated with geese would be employed by WS. Threats to human safety may not be completely eliminated under this alternative. However, under this alternative, a higher level of assistance would be provided since WS could employ methods to address requests to reduce threats to human safety. Although measuring the reduction in threats to human safety by implementing the proposed action are difficult, it is reasonable to predict that using the adaptive damage management program employing integrated methodologies would lower the degree of risks of threats to human safety given that the expertise of WS in managing damage and threats would likely result in a reduction in the time necessary to resolve the threat. Reducing the time necessary to resolve the threat decreases the potential exposure time of the threat to the public which results in a reduction in the risks of interaction resulting in a human safety threat. Therefore, the duration of exposure would likely be shortened under this alternative by the use of integrated methods which would result in a reduction in the threat to human safety.

This alternative would allow personnel from WS that are trained in the use of appropriate methodologies for addressing threats and are trained in the appropriate handling of methods to ensure the safety of the handler and the public to address threats to human safety associated with geese. The other alternatives would place the immediate burden of resolving threats to human safety on those persons experiencing damage or threats of damage which are not likely to be trained in the proper use of methods which would increase the threat of injury or disease transmission to the handler and to the public.

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

Under this alternative, WS would provide assistance to requestors by providing information regarding geese, on the availability of methods, and the proper use of methods available to the requestor. Methods recommended would be based on WS' decision-making process either through information gathered

during a site visit or from information provided by telephone. Based on information gathered from a site visit or provided by telephone, WS would recommend methods using the WS Decision Model.

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

Given the expertise of WS in the behavior of wildlife and the knowledge in the effective use of available methods, the potential threats to human safety under this alternative is likely lower than Alternative 3 for those persons requesting assistance from WS but likely similar to higher compared to the proposed action alternative. Under this alternative, those persons requesting assistance would be responsible for implementing and using methods to resolve damage or threats of damage which places the requestor at a higher risk of exposure to disease and injury if not trained appropriately. The degree in which the risk is higher is unknown and is likely highly variable.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

Threats to human safety often occur due to interactions between people and geese where a concern arises from transmission of zoonotic diseases, from physical interactions that result in injuries, from unsafe work conditions, and/or from threats of aircraft striking geese. In the absence of an effective program to address human safety associated with geese, the risks associated with potential disease transmission and injuries would also likely increase. Risks to human safety associated with geese were discussed in Chapter 1 of this EA.

Under this alternative, no assistance would be provided by WS to those persons experiencing damage or threats associated with geese in the Commonwealth. In the absence of any assistance, those persons experiencing threats to human safety would be directly responsible for obtaining and employing the appropriate methods. Those persons employing methods could be at a higher risk of exposure to zoonotic diseases and injury since no guidance or recommendations would be made by WS. Dolbeer and Suebert (2007) reported that despite the continued high population of resident Canada geese in the United States, aircraft strikes with geese declined from 115 in 1998 to 67 in 2007, likely due to aggressive Canada goose management programs implemented at airports and in urban areas. WS provides assistance to many civilian and military airports in the Commonwealth to manage threats to aviation safety from geese. Under this alternative, WS would provide no assistance in reducing threats to aviation safety from geese, requiring those persons experiencing threats to aircraft safety to be responsible for obtaining and employing the appropriate methods to reduce those threats. Risks to human safety under this alternative would likely be greater than those risks in the other alternatives.

Issue 7 - Effects on the Regulated Harvest of Canada Geese

Another common concern is the potential effects of damage management activities on the ability to harvest target species during the regulated hunting season in the Commonwealth. Canada geese have a socio-cultural value as a migratory game bird sought by waterfowl hunters who often pass the tradition on to family members or are members of sportsman's or hunting clubs providing social interaction with other sportsmen.

Methods intended to disperse or remove target species from an area where damage is occurring could reduce the opportunities to harvest geese during the regulated harvest season. Canada geese can be harvested in the Commonwealth during an early September season, the regular waterfowl season, and a late season.

Alternative 1 - Continuing the Current Integrated Approach to Managing Canada Goose Damage (Proposed Action/No Action)

The magnitude of take of geese addressed in the proposed action would be low when compared to the goose mortality from all known sources. When WS' proposed take of geese was included as part of the known mortality of geese and compared to the estimated goose population, the impact on the goose population was below the level of removal required to lower population levels. The USFWS and the MDFW would determine the number of geese taken annually by WS through the issuance of depredation permits. Also, those geese removed by WS are those that could be removed by the person experiencing damage when permitted by the USFWS and the MDFW.

The magnitude of take addressed in the proposed action would be low when compared to the mortality of geese from all known sources. When WS' proposed take of geese was included as part of the known mortality from 2006 through 2010 and compared to the estimated population of geese, the impact on the population was consistent with management goals set by the USFWS and MDFW.

Canada goose damage management activities conducted by WS would occur after consultation and approval by the USFWS. With oversight by the USFWS, the number of geese allowed to be taken by WS would not limit the ability of those persons interested to harvest geese during the regulated season. All take by WS would be reported to the USFWS annually to ensure take by WS is incorporated into population management objectives established for goose populations. Based on the limited take proposed by WS and the oversight of by the USFWS and the MDFW, WS' take of up to a total of 1,500 Canada geese annually, of which 500 could be taken during periods when geese present in the Commonwealth could be considered migratory, would have no effect on the ability of those persons interested to harvest geese during the regulated harvest.

Additionally, WS often conducts activities in areas where hunting is not a viable option such as urban parks, schoolyards and athletic fields, and airports. In those cases, geese being lethally removed are not available for hunting and those dispersed may actually move to areas where hunting is allowed. Therefore, the ability to hunt geese may actually increase if a reasonable effort is made to locate geese outside the area in which damage management activities occurred.

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

Under the technical assistance only alternative, WS would have no direct impact on goose populations in the Commonwealth. If WS recommends the use of non-lethal methods and those non-lethal methods are employed by those persons experiencing damage, geese are likely to be dispersed from the damage area to areas outside the damage area which could serve to move those birds from those less accessible areas to places accessible to hunters. Although lethal methods could be recommend by WS under a technical assistance only alternative, the use of those methods could only occur after the property owner or manager received a depredation permit from the USFWS, under depredation orders, or take could occur during the regulated hunting season. WS' recommendation of lethal methods could lead to an increase in the use of those methods. However, the number of geese allowed to be taken under a depredation permit, under depredation orders, and during the regulated hunting seasons is determined by the USFWS and the MDFW. Therefore, WS' recommendation of shooting or hunting under this alternative would not limit the ability of those persons interested to harvest birds during the regulated season since the USFWS and

MDFW determines the number of geese that may be taken during the hunting season, under depredation permits, and under depredation orders.

WS would have no impact on regulated goose hunting since WS would not lethally remove geese under this alternative. However, resource/property owners may remove geese under depredation permits and depredation orders issued by the USFWS resulting in impacts similar to the proposed action and the other alternatives. The recommendation of non-lethal methods could disperse or exclude geese from areas under this alternative which could limit the ability of those persons interested to harvest geese in the damage management area. However, the goose population would be unaffected by WS under this alternative.

Alternative 3 – No Canada Goose Damage Management Conducted by WS

WS would have no impact on regulated goose hunting under this alternative. WS would not be involved with any aspect of goose damage management. The USFWS and the MDFW would continue to regulate goose populations through adjustments in allowed take during the regulated harvest season and through depredation orders or permits.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

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

Under Alternative 1 and Alternative 2, WS could address damage associated with geese either by providing technical assistance only (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 1) in the Commonwealth. WS would be the primary agency conducting direct operational goose damage management in the Commonwealth under Alternative 1. However, other federal, Commonwealth, and private entities could also be conducting goose damage management in the Commonwealth. The take of geese requires a depredation permit from the USFWS pursuant to the MBTA, which requires permit holders to report all take occurring under the permit. Take of Canada geese could also occur under the established depredation orders.

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct goose damage management activities at adjacent sites within the same time frame. The potential cumulative impacts analyzed below could occur either as a result of WS' damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the USFWS, and the MDFW, activities of each agency and the take of geese would be available. Goose damage management activities in the Commonwealth would be monitored annually to evaluate and analyze activities to ensure they are within the scope of analysis of this EA.

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

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on goose populations when targeting those geese responsible for damage. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. Those activities include, but are not limited to:

- Natural mortality of geese
- Human-induced mortality of geese through private damage management activities
- Annual harvest of Canada geese during regulated hunting seasons
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

All those factors play a role in the dynamics of goose populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992, USDA 1997). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

With management authority over goose populations, the USFWS and the MDFW can adjust take levels, including the take of WS, to ensure population objectives for geese are achieved. Consultation and reporting of take by WS would ensure the USFWS and the MDFW considers any activities conducted by WS. WS' take of geese in Massachusetts from FY 2006 through FY 2010 was of a low magnitude when compared to the total known take. The USFWS and the MDFW considers all known take when determining population objectives for geese and can adjust the number of geese that can taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the USFWS and the MDFW. Any goose population declines or increases that are associated with damage management activities would be the collective objective for goose populations established by the USFWS and the MDFW through the regulation of take. Therefore, the cumulative take of geese annually or over time by WS would occur at the desire of the USFWS and the MDFW as part of management objectives for geese in the Commonwealth.

No cumulative adverse impacts are expected from WS' goose damage management actions based on the following considerations:

1. Historical outcomes of WS' damage management activities on wildlife

Goose damage management activities are conducted by WS only at the request of a cooperator to reduce damage that is occurring or to prevent damage from occurring and only after methods to be used are agreed upon by all parties involved. WS annually monitors activities to ensure any potential impacts are identified and addressed. WS works closely with Commonwealth and federal resource agencies to ensure damage management activities are not adversely impacting goose populations and that WS' activities are considered as part of management goals established by those agencies. Historically, WS' activities to manage damage associated with geese in Massachusetts have not reached a magnitude that would cause adverse impacts to goose populations in the Commonwealth.

2. SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions on geese, and are tailored to respond to changes in wildlife populations which could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs are

defined through SOPs, and implementation is insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992, USDA 1997).

Issue 2 - Effectiveness of Canada Goose Damage Management Methods

As discussed in Chapter 2, the effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented which is based on how accurately practitioners diagnosis the problem, the species responsible for the damage, and how actions are implemented to correct or mitigate risks or damages. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

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

Correlated with the effectiveness of methods at reducing or alleviating damage are the costs associated with applying methods to reduce damage or threats. If methods are ineffective at reducing or alleviating damage or if methods require re-application after initially being successful, the costs associated with applying those methods increases. An analysis of cost-effectiveness in many bird damage management situations is difficult or impossible to determine because the value of benefits may not be readily calculable and personal perspectives differ about damage. For example, the potential benefit of eliminating geese from defecating on public beaches could reduce incidences of illness among an unknown number of users. Since some bird-borne diseases are potentially fatal, or severely debilitating, the value of the benefit may be high. However, no studies of disease problems with and without bird damage management have been conducted, and, therefore, the number of cases prevented because of damage management are not possible to estimate. Also, it is rarely possible to conclusively prove that Canada geese are responsible for individual disease cases or outbreaks which were discussed in this EA in Chapter 1.

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

In regards to the effectiveness of methods used, Avery (2002) cited studies where lethal damage management reduced losses to crops (Elliott 1964, Larsen and Mott 1970, Palmer 1970, Plesser et al. 1983, Tahon 1980, Glahn et al. 2000 as cited in Avery 2002) and those lethal methods posed little danger to non-target species (Glahn et al. 2000). Avery (2002) also stated that it seems reasonable that local, short-term crop protection can be achieved through reduction in depredating bird populations; however, quantification of the relationship between the numbers of birds killed and the associated reduction in crop

damage is lacking. Avery (2002) also stated that studies demonstrating economic benefit from the use of lethal methods are lacking but did not state that lethal methods to resolve damage are not economically effective. Many publications indicate that the use of non-lethal methods require repeated application to achieve the desired result (see Smith et al. 1999, Gorenzel et al. 2000, Gorenzel et al. 2002, Avery et al. 2008*b*, Chipman et al. 2008). Long-term solutions to resolving bird damage often require management of the population (Smith et al. 1999) and identifying the habitat characteristics which attract birds to a particular location (Gorenzel and Salmon 1995).

The CEQ does not require a formal, monetized cost-benefit analysis to comply with the NEPA (40 CFR 1508.14) and consideration of that issue is not essential to making a reasoned choice among the alternatives being considered. WS' programmatic FEIS (USDA 1997) states:

"Cost effectiveness is not, nor should it be, the primary goal of the APHIS WS program. Additional constraints, such as the environmental protection, land management goals, and others, are considered whenever a request for assistance is received. These constraints increase the cost of the program while not necessarily increasing its effectiveness, yet they are a vital part of the APHIS WS Program."

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie NF, et al., the court denied plaintiffs' motion for preliminary injunction. In part the court found that it was only necessary to show that damage from wildlife is threatened, to establish a need for wildlife damage management (U.S. District Court of Utah 1993).

As stated in the EA, WS only provides assistance after a request has been received and a cooperative service agreement or other comparable document has been signed by WS and the requesting entity in which all methods used to address geese causing damage are agreed upon. Methods employed to manage goose damage, whether non-lethal or lethal, are often temporary with the duration dependent on many factors discussed in the EA. WS employs only those methods as agreed upon by the requestor after available methods are discussed.

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

Issue 3 - Effects on Non-target Species Populations, Including T&E Species

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

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to impact non-target wildlife through the lethal take or non-lethal capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by the applicator. Capture methods are employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that are employed to confine or restrain wildlife that are subsequently euthanized using humane methods since translocation is currently not allowed by the MDFW. With all live-capture devices, non-target wildlife captured can be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods are essentially selective for target species since identification of the target is made prior to the application of the method. Therefore, the use of those methods would not impact non-target species.

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

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according the WS and Department of Transportation regulations. The amount of chemicals used or stored by WS would be minimal to ensure human safety. Based on this information, WS' use of chemical methods, as part of the proposed action, would not have cumulative impacts on non-targets.

All label requirements of nicarbazin and alpha-chloralose would be followed to minimize non-target hazards. As required by the label for nicarbazin and alpha-chloralose, an acclimation period occurs and sites are monitored for non-target use as outlined in the label. Once sites are baited, applicators are present on site until all bait is consumed. If non-target species are observed feeding on bait, those sites are abandoned. All unconsumed bait must be retrieved after application.

Repellents may also be used or recommended by the WS program in Massachusetts to manage goose damage. The active ingredient in numerous commercial repellents is methyl anthranilate which has been categorized by the EPA as "*generally recognized as safe*". Methyl anthranilate is a derivative of grapes and used as a flavoring in food and as a fragrance in cosmetics. Other repellents available contain the active ingredient anthraquinone, which is a naturally occurring plant extract. Characteristics of those chemicals and potential use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use in WS' programs in Massachusetts when used according to label requirements.

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

The methods described in Appendix B all have a high level of selectivity and can be employed using SOPs to ensure minimal impacts to non-targets species. No non-targets were taken by WS during goose damage management activities conducted from FY 2006 through FY 2010. Based on the methods available to resolve goose damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively impact non-target species. Under the proposed action alternative, WS would following those procedures outlined by the website maintained by the USFWS to conclude with a determination of effects on a site-by-site basis and would consult with the USFWS based on the procedures outlined on the website, when required. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

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

Methods involving the use of live-capture devices, chemicals, and euthanasia methods occur while WS' personnel are present at the site to ensure any wildlife confined or restrained are addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured geese would be applied according to AVMA guidelines for free-ranging wildlife. Shooting would occur in limited

situations and personnel would be trained in the proper use of firearms to minimize pain and suffering of geese taken by this method.

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

Issue 5 - Effects on the Aesthetic Values of Canada Geese

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

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

Canada goose population objectives are established and enforced by the USFWS and the MDFW through regulating the take of geese during the statewide hunting season, through depredation orders, and through the issuance of depredation permits after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of the goose population since all take by WS occurs at the discretion of the USFWS and the MDFW. Since those persons seeking assistance could remove geese from areas where damage is occurring through the established depredation orders or through depredation permits issued by the USFWS and the MDFW, WS' involvement would have no effect of the aesthetic value of geese in the area where damage was occurring. When a depredation permit has been issued by the USFWS to a property owner and/or manager that is experiencing damage caused by geese, the removal of geese under that permit would likely occur whether WS was involved with taking the geese or not. Under the established depredation orders, take can occur without the need for a depredation permit when certain conditions are met. Take can also occur during the regulated hunting season for geese in the Commonwealth.

Therefore, the activities of WS are not expected to have any cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager and a permit has been issued by the USFWS and the MDFW who are responsible for regulating a resident wildlife species like Canada geese.

Issue 6 - Effects of Management Methods on Human Health and Safety

Non-Chemical Methods

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and

safety. All non-chemical methods are used after careful consideration of the safety of those persons employing methods and to the public. All capture methods are employed where human activity is minimal to ensure the safety of the public. All methods are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document between WS and the cooperating entity. SOPs also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS' non-chemical methods, when used as intended, poses a low risk to human safety (USDA 1997). Firearms used to alleviate or prevent damage, though hazards do exist, are employed to ensure the safety of employees and the public.

WS has received no reports or documented any adverse effects to human safety from WS' goose damage management activities conducted from FY 2006 through FY 2010. Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods to ensure the safety of the applicator and to the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively impact human safety.

Chemical Methods

Chemical methods available for use under the proposed action are repellents, reproductive inhibitors, and immobilizing drugs. Immobilizing drugs are administered to target individuals using methods that ensure the identification of the target animal. The immobilizing drugs discussed in Appendix B require consumption of the drug by the target animal. WS' personnel are present at bait sites during the application of treated bait which reduces the risks to human safety. All unconsumed bait is also retrieved after each baiting session which further reduces risks to human safety. Immobilized geese may be euthanized using cervical dislocation or carbon dioxide. Those methods of euthanasia are further described in Appendix B. Euthanasia methods would only be administered after geese have been properly restrained. WS' personnel are required to attend training courses and are required to be certified in the use of immobilizing drugs and euthanasia methods to ensure proper care and handling occurs, to ensure the proper doses are administered, and to ensure human safety. WS' personnel would continue to be trained in the proper handling and administering of immobilizing drugs and euthanasia methods to ensure human safety.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according to FDA, Department of Transportation, and the Drug Enforcement Agency regulations, including the directives of WS. The amount of chemicals used or stored by WS would be minimal to ensure human safety.

Repellents available for use to disperse geese from areas of application must be registered with the EPA according to FIFRA. Many of the repellents currently available for use have active ingredients that are naturally occurring and are generally recognized as safe. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and applicator. When repellents are applied according to label requirements, no adverse affects to human safety are expected.

Nicarbazin was not registered for use as a goose reproductive inhibitor in the Commonwealth during the development of this EA. However, since the method is registered with the EPA in accordance with the FIFRA, WS is considering the use of nicarbazin in anticipation of the product being registered for use. As with other chemical methods, the primary hazards from the use of nicarbazin occurs to those persons that handle and apply the product. The label requires that personnel applying the product be present at the site of application until the entire product has been consumed. All unconsumed bait must be retrieved after each baiting session which reduces the risks to the public. Based on the use patterns of nicarbazin,

the cumulative impact from the use of the product appears to be minimal. As with chemical methods registered with the EPA, the use of those products according to label requirements minimizes cumulative risks, including risks to human safety.

No adverse effects have been report to or identified by WS from the use of chemical methods during goose damage management conducted by WS from FY 2006 through FY 2010. When chemical methods are applied as intended and when safety guidelines are followed, no adverse affects to human safety are expected. The primary risk of exposure to chemical methods occurs to handlers and applicators. WS' personnel who use and apply chemical methods would be trained according to federal, Commonwealth, and local laws and regulations, including WS' directives. Based on this information, the use of chemical methods as part of the proposed action by WS would not have cumulative impacts on human safety.

Issue 7 - Effects on the Regulated Harvest of Canada Geese

As discussed previously in this EA, the magnitude of WS' goose take for damage management purposes from FY 2006 through FY 2010 was low when compared to the total take of geese and when compared to the estimated statewide population. Since all take of geese is regulated by the USFWS and the MDFW, the take of geese by WS that would occur annually and cumulatively would occur pursuant to goose population objectives established by the USFWS and the MDFW. WS' take of up to 1,500 Canada geese annually, of which no more than 500 would be taken during those months when geese could be considered migratory geese to alleviate damage would be a minor component to the known take that occurs annually. With oversight of goose take, the USFWS and the MDFW maintains the ability to regulate take by WS to meet management objectives for geese in the Commonwealth. Therefore, the cumulative take of geese is considered as part of the USFWS and MDFW objectives for goose populations in the Commonwealth. Any changes in the population of Canada geese in the Commonwealth would occur at the direction and the discretion of the USFWS and the MDFW since all take by WS occurs only when a depredation permit has been issued for the take by the USFWS and co-signed by the MDFW.

CHAPTER 5: LIST OF PREPARERS, CONSULTANTS, AND REVIEWERS

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APPENDIX A
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APPENDIX B
CANADA GOOSE DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE MASSACHUSETTS WS PROGRAM

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

A variety of methods are potentially available to the WS program in Massachusetts relative to the management or reduction of damage from geese. Various federal, state, and local statutes and regulations and WS directives govern WS' use of damage management tools and substances. WS develops and recommends or implements damage management strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics. The following methods and materials are recommended or used in technical assistance and direct damage management efforts of the WS program in Massachusetts.

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without significantly increasing a resource owner's costs or diminishing his/her ability to manage resources pursuant to goals. Resource management recommendations are made through WS technical assistance efforts.

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

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

Removal of water bodies would likely reduce the attractiveness of an area to geese. Urban/suburban geese tend to feed near bodies of water with a distant view over short grass (Conover and Kania 1991).

Draining/removal of water bodies are considered unreasonable and aesthetically unacceptable. The draining of wetlands is strictly regulated by the U.S. Army Corps of Engineers and the Department of Environmental Protection. A U.S. Corp of Engineers Section 404 permit may be necessary before actions are taken to drain bodies of water or wetlands.

Lure Crops: Lure crops are food resources planted to attract wildlife away from more valuable resources (*e.g.*, crops). This method is largely ineffective for urban geese since food (turf) resources are readily available. For lure crops to be effective, the ability to keep birds from surrounding fields would be necessary, and the number of alternative feeding sites must be minimal (Fairaizl and Pfeifer 1988). Additionally, lure crops reduce damage for only a short time (Fairaizl and Pfeifer 1988) and damage by geese is generally continuous. The resource owner is limited in implementing this method contingent upon ownership of, or otherwise ability to manage the property. Unless the original goose-human conflict is resolved, creation of additional goose habitat could increase future conflicts.

Lure crops may be planted on some land held in private ownership, such as conservation clubs, throughout Massachusetts. These plantings may provide some additional food or act as an attractant for geese. However, it is highly unlikely they contribute to conflicts with geese or act as significant goose attractants.

Modify Human Behavior: Artificial feeding of geese by people attracts and sustains more birds in an area than could be supported by natural food supplies. This unnatural food source exacerbates damage by geese. The elimination of feeding of geese is a primary recommendation made by WS, and many local municipalities and homeowners associations have adopted policies and ordinances prohibiting it. Some parks have posted signs, and there have been efforts made to educate the public on the negative aspects of feeding geese. However, sometimes people do not comply, and the policies are poorly enforced in some areas.

Alternatively, some entities do not prohibit the feeding of geese because the goose population in the location has not exceeded the public's tolerance for damage. It is unlikely that the feeding of geese in these locations would significantly contribute to conflicts with waterfowl in other communities or locations.

Alter Aircraft Flight Patterns: In cases where the presence of geese at airports results in threats to human safety, and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering operations at airports to decrease the potential for hazards is not feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities make this practice prohibitive.

Some military airbases can restrict sorties for short periods of time when this type of management action does not impact mission critical operations. Altering flight schedules at military airbases has been implemented to decrease the potential hazard caused by flocking species of birds such as geese.

Removal of Domestic Waterfowl: Flocks of urban waterfowl are known to act as decoys and attract migrating waterfowl (Crisley et al. 1968, Woronecki 1992). Rabenold (1987) and Avery (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of domestic waterfowl from ponds removes birds that act as decoys in attracting other waterfowl. Domestic and feral waterfowl could also carry diseases which threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of the enjoyment of their presence.

PHYSICAL EXCLUSION AND DETERRENTS

Physical exclusion and deterrents restrict the access of wildlife to resources and/or alter behavior of target animals to reduce damage. These methods provide a means of appropriate and effective prevention of goose damage in many situations. When T&E species exist on a site, certain methods will not be incorporated in management plans.

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

Barrier Fence: The construction or placement of physical barriers has limited application for geese. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles, boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing have all been used to limit the movement of geese. The application of this method is limited to areas that can be completely enclosed and do not allow geese to land inside enclosures. Similar to most abatement techniques, this method has been most effective when dealing with small numbers of breeding geese and their flightless young along wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit goose nesting has entrapped young and resulted in starvation (Cooper 1998). The preference for geese to walk or swim, rather than fly, during this time period contributes to the success of barrier fences. Geese that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing. However, site specific habitat alterations have merit, provided that landscape designs are based on biological diversity and human safety objectives.

Surface Coverings: Geese may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993). Overhead wire grids have been demonstrated to be most applicable on ponds $\leq$ two acres, but wire grids may be considered aesthetically unappealing to some people. Wire grids render a pond unusable for boating, swimming, fishing, and other recreational activities. The expense of maintaining wire grids may be burdensome for some people.

Balls approximately five inches in diameter can be used to cover the surface of a pond. A “ball blanket” renders a pond unusable for boating, swimming, fishing, and other recreational activities.

Visual Deterrents: Reflective tape has been used successfully to repel some birds from crops when spaced at three to five meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrich and Craven 1990). Flagging is impractical in many locations and has met with some local resistance due to the negative aesthetic appearance presented on the properties where it is used. Other studies have shown reflective tape ineffective (Bruggers et al. 1986, Dolbeer et al. 1986, Tobin et al. 1988, Conover and Dolbeer 1989). While sometimes effective for short periods of time, reflective tape has proven mostly ineffective in deterring resident geese.

Dogs: 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 1998). Although dogs can be effective

in keeping waterfowl off individual properties, they do not contribute to a solution for the larger problem of overabundant waterfowl populations (Castelli and Sleggs 2000). Swift (1998) and numerous individuals in New Jersey have reported that when harassment with dogs ceases, the number of geese return to pre-treatment numbers. WS has recommended and encouraged the use of dogs where appropriate.

Repellents: To use chemical repellents for goose damage management in Massachusetts, State regulations governing use of restricted chemicals must be followed.

Methyl Anthranilate is an artificial grape flavoring used in foods and soft drinks for human consumption that is the active ingredient in many bird repellents. Repellents containing the active ingredient methyl anthranilate could be used or recommended by WS to reduce goose damage. Methyl anthranilate has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[10]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[11]), 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 unwanted birds. Cummings et al. (1995) reported that methyl anthranilate repelled Canada geese from grazing turf for 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. Methyl anthranilate is water soluble therefore, moderate to heavy rain or daily watering and/or mowing render methyl anthranilate ineffective.

Another potentially more cost-effective method of methyl anthranilate application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site. Applied at a rate of about .25 l/acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

Anthraquinone is a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998).

Hazing: In some locations and circumstances, hazing geese is a useful component of a goose damage management program. Hazing reduces losses in those instances when the affected geese move to more acceptable areas. Achieving that end has become more difficult as the local goose population increases. Birds hazed from one area where they are causing damage, frequently move to another area where they cause damage (Brough 1969, Conover 1984, Summers 1985, Swift 1998). Smith et al. (1999) noted that others have reported similar results, stating: "*...biologists are finding that some techniques (e.g., habitat modifications or scare devices) that were effective for low to moderate population levels tend to fail as flock sizes increase and geese become more accustomed to human activity*." Generally speaking, birds

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

tend to habituate to hazing techniques (Zucchi and Bergman 1975, Blokpoel 1976, Summers 1985, Aubin 1990).

Scarecrows: The use of scarecrows has had mixed results. Effigies depicting alligators, humans, floating swans and dead geese have been employed, with limited success for short time periods in small areas. An integrated approach (swan and predator effigies, distress calls and non-lethal chemical repellents) was found to be ineffective at scaring or repelling nuisance waterfowl (Conover and Chasko 1985). While Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada Goose use of agricultural fields in rural areas, their effectiveness in scaring geese from suburban/urban areas is severely limited because geese are not afraid of humans as a result of nearly constant contact with people. In general, scarecrows are most effective when they are moved frequently, alternated with other methods, and are well maintained. However, scarecrows tend to lose effectiveness over time and become less effective as waterfowl populations increase (Smith et al. 1999).

Distress Calls: Aguilera et al. (1991) found distress calls ineffective in causing migratory and resident geese to abandon a pond. Although, Mott and Timbrook (1988) reported distress calls as effective at repelling resident geese 100 meters from the distress unit, the birds would return shortly after the calls stopped. The repellency effect was enhanced when pyrotechnics were used with the distress calls. In some situations, the level of volume required for this method to be effective in urban/suburban areas would be prohibited by local noise ordinances. A similar device, which electronically generates sound, has proven ineffective at repelling migrant waterfowl (Heinrich and Craven 1990).

Lasers: The use of lasers as non-lethal avian damage control tools, have recently been evaluated for a number of species (Blackwell et al. 2002); research on this potential tool has been conducted in a replicated format only for double-crested cormorants (Glahn et al. 2000). In experimental situations, Canada geese have exhibited avoidance reactions to lasers under low light conditions (Blackwell et al. 2002), and a field test of lasers at a Pennsylvania site demonstrated effectiveness of lasers in dispersing large flocks of geese off of a lake, with nearly no habituation to the technique (Cepek et al. 2001). The integrated use of lasers as part of goose damage management programs by WS in Massachusetts may increase program effectiveness, and would be incorporated as appropriate. Wide scale public use of lasers is not typically recommended at this time, pending additional research (on effectiveness and impacts) on its use as a goose damage management tool. In some situations (neighborhoods, schools, hospitals), use of lasers may enhance integrated control programs since they are silent and do not fire a projectile.

Lasers are available with a power of 5 mW (moderate power) and 68 mW (low power). The difference between the lasers is beam intensity and diameter (Glahn et al. 2000). The lasers do not appear to present any detectable ocular hazards to cormorants but do present human safety concerns (Glahn et al. 2000). Both the Desman and Dissuader laser devices which would be used by WS to disperse birds are classified as Class-IIIB lasers (OSHA 1991). Lasers in lower ranges of Class-IIIB do not produce hazardous diffuse reflection unless someone intentionally stares at the laser closer to the diffuser. The lasers can cause temporary flash blindness, afterimage, and glare in people. It is recommended that lasers not be pointed a people (Glahn et al. 2000). The cost of lasers may be a disadvantage to their use (Glahn et al. 2000).

Pyrotechnics: Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15mm screamer shells effective at reducing resident and migrant Canada geese use of areas of Colorado. However, Mott and Timbrook (1988) and Aguilera et al. (1991) doubted the efficacy of harassment and believed that moving the geese simply redistributed the problem to other locations. Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban

areas required continuous harassment throughout the day with frequent discharges of pyrotechnics. The waterfowl usually returned within hours. A minority of resident Canada Goose flocks in Virginia showed no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada geese in Virginia have shown quick response to pyrotechnics during winter months suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Shultz et al. (1988) reported fidelity of resident Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is partially dependent on availability of alternative loafing and feeding areas. Although one of the more effective methods of frightening geese away, more often than not they simply move geese to other areas. There are also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, and trigger dogs to bark incessantly, annoy and possibly injure people. Use of pyrotechnics in certain municipalities would be constrained by local firearm discharge and noise ordinances.

Propane Cannons: Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for migrant geese in agricultural settings, resident geese in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

POPULATION MANAGEMENT

Potential methods of managing the local goose population include capture and relocation, contraception, egg destruction, hunting, shooting, and capture and euthanize. The advantages of lethal damage management by WS are that it would be applied directly to the problem population, its effects are obvious and immediate, and it carries no risk that the birds will return or move and create conflicts elsewhere. The primary disadvantage is that it is sometimes more socially controversial than other techniques. The use of lethal methods to reduce goose damage can be very effective at alleviating damage and the most economical approach to reducing damage when compared to non-lethal methods (Cooper and Keefe 1997). Additionally, capture and removal of geese is the most cost efficient lethal method to reduce damage, except for hunting (Cooper and Keefe 1997). Moreover, the use of lethal methods has longer effectiveness than non-lethal methods because it would likely take months to years before the original local population level of geese returned. Lethal methods would also reduce conflicts among resource owners whereas non-lethal actions only move the geese among resource owners (*i.e.*, spread the damage) (Cooper and Keefe 1997, Smith et al. 1999), and possibly leave resource owners with the fewest financial means burdened with the geese and the damage.

Capture and Relocation: Geese are live captured through the use of non-chemical (panel nets, rocket nets, drive traps, net guns, dip nets, by hand) or chemical (alpha-chloralose) methods. Upon capture, birds are transferred to waterfowl crates for relocation to suitable habitat away from the capture site. To discourage the return of geese to capture sites the primary wing feathers of relocated geese are typically clipped. Geese with clipped wings are able to fly after their next molting. Currently, relocation of wildlife, including Canada geese, is banned in Massachusetts without the authorization of the Director of MDFW. If requested and appropriate, WS would consult with the USFWS and the MDFW for authorization before conducting relocation activities. WS would also coordinate the capture, transportation, and selection of suitable relocation sites with the MDFW.

Smith (1996) reported that groups of juvenile geese relocated from urban to rural settings can effectively eliminate these geese from urban areas, retain them at the release site, include them in the sport harvest, and expose them to higher natural mortality. Smith (1996) also reported that multiple survival models

indicated that survival estimates of relocated juveniles were half of those of urban captured and released birds.

Ultimately, the relocation of resident geese from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997, Powell et al. 2003), and has been accepted by the general public as a method of reducing waterfowl populations to socially acceptable levels (Fairaizl 1992). In addition, the removal of geese posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local geese and decrease the number of flights through the airport operations airspace; and resulted in increased air safety at the Minneapolis-St. Paul International Airport (Cooper 1991).

Relocation of resident geese has the potential to spread disease into populations of other and/or migrating waterfowl.

Sterilization: Sterilization has not been proven to be an effective method for reducing goose damage. Although, Canada geese have been successfully vasectomized to reduce to prevent gosling production, this method is only effective if the female does not form a bond with a different male. In addition, vasectomies can only prevent the production of the mated pair. The ability to identify breeding pairs for isolation and to capture a male goose for vasectomization becomes increasingly difficult as the number of geese increase (Converse and Kennelly 1994). Canada geese have a long life span once they survive their first year (Cramp and Simmons 1977, Allan et al. 1995); leg-band recovery data indicate that some geese live longer than 20 years. The sterilization of resident Canada geese would not reduce the damage caused by the overabundance of the goose population since the population of Canada geese would remain relatively stable. Keefe (1996) estimated sterilization to cost over $100 per goose.

Nicarbazin (OvaControl–G™) is an EPA registered chemical reproductive inhibitor that can be used to reduce Canada goose egg production and viability. Nicarbazin is registered for use at site specific locations in highly populated urban areas. The user of this chemical product must adhere to all EPA use restrictions. VerCauteren et al. (2000) examined the use of nicarbazin to reduce Canada goose egg production and viability, and found that nicarbazin did experimentally reduce egg viability, but that there were difficulties in delivery methods and acceptance of treated feed. Canada geese have a long life span once they survive their first year (Cramp and Simmons 1977, Allan et al. 1995); leg-band recovery data indicate that some geese live longer than 20 years. The use of nicarbazin would not reduce the damage caused by the overabundance of the goose population since the population of Canada geese would remain relatively stable.

Nicarbazin is not currently registered for use in Massachusetts. If and when this chemical method becomes available for use, and prior to WS operational use of this method, WS will review and update this EA for NEPA compliance, as appropriate.

Nest/Egg Destruction: Egg addling, oiling, freezing, egg replacement, or puncturing can be effective in reducing recruitment into the local population (Christens et al. 1995, Cummings et al. 1997). Throughout the Canada goose nesting season, goose eggs may be treated or destroyed to eliminate reproduction on the site, which may slow the growth of the local population and increase the effects of goose harassment activities. Geese typically lay one egg every 1-2 days for a total of 4-8 eggs/nest; the incubation period for goose eggs is approximately 28 days.

While egg removal/destruction can reduce production of young, merely destroying an egg does not reduce a population as quickly as removing immature or breeding adults (Cooper and Keefe 1997). Similar to other species of long-lived waterfowl which require high adult mortality to reduce populations (Rockwell

et al. 1997), it is likely that adult resident Canada geese must be removed to reduce the population to a level deemed acceptable to communities. Approximately five eggs must be removed to have the effect of stopping one adult from joining the breeding population (Rockwell et al. 1997, Schmutz et al. 1997). Keefe (1996) estimated egg destruction to cost $40 for the equivalent of removing one adult goose from the population. 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 waterfowl egg destruction is only fractionally effective in attaining population reduction objectives, and that nest/egg destruction is not an efficient or cost-effective damage management or population reduction approach.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective but time-consuming method because problem bird species are highly mobile and can easily return to damage sites from long distances, or because of high populations. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from obtaining oxygen (see egg oiling below). Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has proven effective in some applications.

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

The Mississippi Flyway Giant Canada Goose Management Plan (Mississippi Flyway Council Technical Section 1996), states that to effectively reduce resident goose populations, an increase in adult and immature mortality rates, combined with reproductive control, is necessary. Reproductive control alone cannot reduce the population in an acceptable time; treatment of 95% of all eggs each year would result in only a 25% reduction over 10 years (Allan et al. 1995). In contrast, reducing annual survival of resident Canada geese by just 10% would reduce a predicted growth rate of more than 15%/year to a stable population, assuming moderate recruitment (Atlantic Flyway Council 1999). In addition, nest destruction is estimated to cost significantly more than other forms of population management (Cooper and Keefe 1997). Egg destruction, while a valuable tool, has fallen short as a single method for reducing local goose populations. Many nests cannot be found by resource managers in typical urban-suburban settings due to the difficulties in gaining access to search the hundreds of private properties where nests may occur. In

addition, geese which have eggs oiled in successive years may learn to nest away from the water making it more difficult to find nests.

Capture with Alpha-chloralose: Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981). Alphachloralose is typically delivered as well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is generally not soluble in water and, therefore, should remain unavailable to aquatic organisms. Factors supporting the determination of this low potential included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an INAD by the FDA, rather than as a pesticide.

Alpha-chloralose may be used only by WS personnel to live capture geese. Pursuant to FDA restrictions, geese 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.

Toxicants: All pesticides are regulated by the EPA. There are currently no toxicants registered with the EPA for use on geese and therefore none would be used by WS.

Hunting: WS sometimes recommends that resource owners consider legal hunting as an option for reducing goose damage. Although legal hunting is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of resident geese. Legal hunting also reinforces harassment programs (Kadlec 1968). 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 geese in the Minneapolis-St. Paul Metro Area of Minnesota (Cooper and Keefe 1997). They reported goose densities during the summer in hunted areas of the Metro Area (which comprised only 23% of the area) were significantly lower (three times lower) than densities in unhunted areas. Similarly, Conover and Kania (1991) reported that Canada geese were more likely to cause damage in areas that goose hunting was prohibited. Even in urban/suburban areas (*e.g.*, golf courses and green spaces) there may be locations where controlled hunting would be effective in reducing goose damage. In Massachusetts, Canada geese are legally harvested during three different seasons.

Shooting: Shooting geese can be highly effective in removing birds from specific areas and in supplementing harassment. Shooting is the practice of selectively removing target birds. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques. Shooting is used to reduce goose problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. In Massachusetts, shooting Canada geese, pursuant to USFWS

regulations authorizing such take, is conducted primarily by farmers, airport personnel, municipal and county park personnel, and others.

Capture and Euthanize: The most efficient way to reduce the size of resident goose population is to increase mortality among adult geese. Nationwide, hunting is the major cause of goose mortality, but geese may seldom be available to hunters in an urban-suburban environment (Conover and Chasko 1985, Smith et al. 1999). For purposes of lethal control, geese are usually captured with panel nets, rocket nets, drive traps, net guns, dip nets, and/or by hand. Panel nets as described by Costanzo et al. (1995) are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround geese into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces, and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways). Rocket netting involves the setting of bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the birds to escape. Rocket netting may take place anytime during the year. Using a net gun to capture geese can be conducted anytime during the year by firing a net from a shoulder mounted gun. Geese that are captured and euthanized would be buried, incinerated, or processed for charitable donation by the requesting resource or property manager.

APPENDIX C
FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES IN MASSACHUSETTS

Animal species listed in this Commonwealth and that occur in this Commonwealth

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
T	Plover, piping except Great Lakes watershed (*Charadrius melodus*)
E	Plymouth Red-Bellied Turtle (*Pseudemys rubriventris bangsi*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Sturgeon, shortnose (*Acipenser brevirostrum*)
E	Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*)
T	Tiger beetle, northeastern beach (*Cicindela dorsalis dorsalis*)
T	Tiger beetle, Puritan (*Cicindela puritana*)
T	Turtle, bog (=Muhlenberg) northern (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf (*Alasmidonta heterodon*)
E	Whale, blue (*Balaenoptera musculus*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Whale, right (*Balaena glacialis (incl. australis)*)
E	Whale, Sei (*Balaenoptera borealis*)

Animal species listed in this Commonwealth that do not occur in this Commonwealth

Status	Species
E	Butterfly, Karner blue (*Lycaeides melissa samuelis*)
E	Curlew, Eskimo (*Numenius borealis*)
E	Puma (=cougar), eastern (*Puma (=Felis) concolor couguar*)
E	Wolf, gray Lower 48 Commonwealths, except where delisted and where EXPN. Mexico. (*Canis lupus*)

Animal listed species occurring in this Commonwealth that are not listed in this Commonwealth

Status	Species
T	Sea turtle, green except where endangered (*Chelonia mydas*)

Plant species listed in this Commonwealth and that occur in this Commonwealth

Status	Species
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
E	Gerardia, sandplain (*Agalinis acuta*)
T	Pogonia, small whorled (*Isotria medeoloides*)

Plant species listed in this Commonwealth that do not occur in this Commonwealth

Status	Species
T	Amaranth, seabeach (*Amaranthus pumilus*)
E	Chaffseed, American (*Schwalbea americana*)

APPENDIX D
SPECIES THAT ARE COMMONWEALTH LISTED AS THREATENED, ENDANGERED, OR OF SPECIAL CONCERN IN THE COMMONWEALTH OF MASSACHUSETTS

Common Name	Scientific Name	MA Status	Fed Status	Notes
VERTEBRATES:				
Fish				
American Brook Lamprey	*Lampetra appendix*	T		
Shortnose Sturgeon	*Acipenser brevirostrum*	E	E	
Atlantic Sturgeon	*Acipenser oxyrinchus*	E		
Lake Chub	*Couesius plumbeus*	E		
Eastern Silvery Minnow	*Hybognathus regius*	SC		
Bridle Shiner	*Notropis bifrenatus*	SC		
Northern Redbelly Dace	*Phoxinus eos*	E		
Longnose Sucker	*Catostomus catostomus*	SC		
Burbot	*Lota lota*	SC		
Threespine Stickleback	*Gasterosteus aculeatus*	T		1
Amphibians				
Jefferson Salamander	*Ambystoma jeffersonianum*	SC		2
Blue-Spotted Salamander	*Ambystoma laterale*	SC		3
Marbled Salamander	*Ambystoma opacum*	T		
Eastern Spadefoot	*Scaphiopus holbrookii*	T		
Reptiles				
Loggerhead Seaturtle	*Caretta caretta*	T	T	
Green Seaturtle	*Chelonia mydas*	T	T	
Hawksbill Seaturtle	*Eretmochelys imbricata*	E	E	
Kemp's Ridley Seaturtle	*Lepidochelys kempii*	E	E	
Leatherback Seaturtle	*Dermochelys coriacea*	E	E	
Wood Turtle	*Glyptemys insculpta*	SC		
Bog Turtle	*Glyptemys muhlenbergii*	E	T	
Blanding's Turtle	*Emydoidea blandingii*	T		
Diamond-backed Terrapin	*Malaclemys terrapin*	T		
Northern Red-bellied Cooter	*Pseudemys rubriventris*	E	E	4
Eastern Box Turtle	*Terrapene carolina*	SC		
Eastern Wormsnake	*Carphophis amoenus*	T		
Eastern Ratsnake	*Pantherophis alleghaniensis*	E		
Copperhead	*Agkistrodon contortrix*	E		
Timber Rattlesnake	*Crotalus horridus*	E		
Birds				
Common Loon	*Gavia immer*	SC		
Pied-Billed Grebe	*Podilymbus podiceps*	E		
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	E		
American Bittern	*Botaurus lentiginosus*	E		
Least Bittern	*Ixobrychus exilis*	E		
Bald Eagle	*Haliaeetus leucocephalus*	E		
Northern Harrier	*Circus cyaneus*	T		
Sharp-Shinned Hawk	*Accipiter striatus*	SC		

Common Name	Scientific Name	MA Status	Fed Status	Notes
Peregrine Falcon	*Falco peregrinus*	E		
King Rail	*Rallus elegans*	T		
Piping Plover	*Charadrius melodus*	T	T	
Upland Sandpiper	*Bartramia longicauda*	E		
Roseate Tern	*Sterna dougallii*	E	E	
Common Tern	*Sterna hirundo*	SC		
Arctic Tern	*Sterna paradisaea*	SC		
Least Tern	*Sternula antillarum*	SC		
Barn Owl	*Tyto alba*	SC		
Long-Eared Owl	*Asio otus*	SC		
Short-Eared Owl	*Asio flammeus*	E		
Sedge Wren	*Cistothorus platensis*	E		
Golden-Winged Warbler	*Vermivora chrysoptera*	E		
Northern Parula	*Parula americana*	T		
Blackpoll Warbler	*Dendroica striata*	SC		
Mourning Warbler	*Oporornis philadelphia*	SC		
Vesper Sparrow	*Pooecetes gramineus*	T		
Grasshopper Sparrow	*Ammodramus savannarum*	T		
Henslow's Sparrow	*Ammodramus henslowii*	E		
Mammals				
Water Shrew	*Sorex palustris*	SC		
Rock Shrew	*Sorex dispar*	SC		
Indiana Myotis	*Myotis sodalis*	E	E	
Small-Footed Myotis	*Myotis leibii*	SC		
Southern Bog Lemming	*Synaptomys cooperi*	SC		
Sperm Whale	*Physeter catodon*	E	E	
Fin Whale	*Balaenoptera physalus*	E	E	
Sei Whale	*Balaenoptera borealis*	E	E	
Blue Whale	*Balaenoptera musculus*	E	E	
Humpback Whale	*Megaptera novaeangliae*	E	E	
Northern Right Whale	Eubalaena glacialis	E	E	
INVERTEBRATES:				
Sponges				
Smooth Branched Sponge	*Spongilla aspinosa*	SC		
Flatworms				
Sunderland Spring Planarian	*Polycelis remota*	E		
Segmented Worms				
New England Medicinal Leech	*Macrobdella sestertia*	SC		
Snails				
New England Siltsnail	*Floridobia winkleyi*	SC		
Walker's Limpet	*Ferrissia walkeri*	SC		
Coastal Marsh Snail	*Littoridinops tenuipes*	SC		
Slender Walker	*Pomatiopsis lapidaria*	E		
Boreal Marstonia	*Marstonia lustrica*	E		
Boreal Turret Snail	*Valvata sincera*	E		

Mussels				
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	E	
Triangle Floater	*Alasmidonta undulata*	SC		
Swollen Wedgemussel	*Alasmidonta varicosa*	E		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Yellow Lampmussel	*Lampsilis cariosa*	E		
Tidewater Mucket	*Leptodea ochracea*	SC		
Eastern Pondmussel	*Ligumia nasuta*	SC		
Creeper	*Strophitus undulatus*	SC		
Crustaceans				
Intricate Fairy Shrimp	*Eubranchipus intricatus*	SC		
Agassiz's Clam Shrimp	*Eulimnadia agassizii*	E		
Northern Spring Amphipod	*Gammarus pseudolimnaeus*	SC		
American Clam Shrimp	*Limnadia lenticularis*	SC		
Taconic Cave Amphipod	*Stygobromus borealis*	E		
Piedmont Groundwater Amphipod	*Stygobromus tenuis tenuis*	SC		
Coastal Swamp Amphipod	*Synurella chamberlaini*	SC		
Insects				
Dragonflies				
Spatterdock Darner	*Rhionaeschna mutata*	SC		
Subarctic Darner	*Aeshna subarctica*	T		
Comet Darner	*Anax longipes*	SC		
Ocellated Darner	*Boyeria grafiana*	SC		
Spine-Crowned Clubtail	*Gomphus abbreviatus*	E		
Harpoon Clubtail	*Gomphus descriptus*	E		
Midland Clubtail	*Gomphus fraternus*	E		
Rapids Clubtail	*Gomphus quadricolor*	T		
Cobra Clubtail	*Gomphus vastus*	SC		
Skillet Clubtail	*Gomphus ventricosus*	SC		
Umber Shadowdragon	*Neurocordulia obsoleta*	SC		
Stygian Shadowdragon	*Neurocordulia yamaskanensis*	SC		
Brook Snaketail	*Ophiogomphus aspersus*	SC		
Riffle Snaketail	*Ophiogomphus carolus*	T		
Ski-tipped Emerald	*Somatochlora elongata*	SC		
Forcipate Emerald	*Somatochlora forcipata*	SC		
Coppery Emerald	*Somatochlora georgiana*	E		
Incurvate Emerald	*Somatochlora incurvata*	T		
Kennedy's Emerald	*Somatochlora kennedyi*	E		
Mocha Emerald	*Somatochlora linearis*	SC		
Riverine Clubtail	*Stylurus amnicola*	E		
Zebra Clubtail	*Stylurus scudderi*	SC		
Arrow Clubtail	*Stylurus spiniceps*	T		
Ebony Boghaunter	*Williamsonia fletcheri*	E		
Ringed Boghaunter	*Williamsonia lintneri*	E		
Damselflies				
Tule Bluet	*Enallagma carunculatum*	SC		

Attenuated Bluet	*Enallagma daeckii*	SC		
New England Bluet	*Enallagma laterale*	SC		
Scarlet Bluet	*Enallagma pictum*	T		
Pine Barrens Bluet	*Enallagma recurvatum*	T		
Beetles				
Twelve-Spotted Tiger Beetle	*Cicindela duodecimguttata*	SC		
Hentz's Redbelly Tiger Beetle	*Cicindela rufiventris hentzii*	T		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	E	T	
Bank Tiger Beetle	*Cicindela limbalis*	SC		
Cobblestone Tiger Beetle	*Cicindela marginipennis*	E		
Barrens Tiger Beetle	*Cicindela patruela*	E		
Puritan Tiger Beetle	*Cicindela puritana*	E	T	
Purple Tiger Beetle	*Cicindela purpurea*	SC		
American Burying Beetle	*Nicrophorus americanus*	E	E	
Butterflies and Moths				
Coastal Heathland Cutworm	*Abagrotis nefascia*	SC		
Barrens Daggermoth	*Acronicta albarufa*	T		
Drunk Apamea Moth	*Apamea inebriata*	SC		
New Jersey Tea Inchworm	*Apodrepanulatrix liberaria*	E		
Straight Lined Mallow Moth	*Bagisara rectifascia*	SC		
Hessel's Hairstreak	*Callophrys hesseli*	SC		
Frosted Elfin	*Callophrys irus*	SC		
Bog Elfin	*Callophrys lanoraieensis*	T		
Gerhard's Underwing	*Catocala herodias gerhardi*	SC		
Precious Underwing Moth	*Catocala pretiosa pretiosa*	E		
Waxed Sallow Moth	*Chaetaglaea cerata*	SC		
Melsheimer's Sack Bearer	*Cicinnus melsheimeri*	T		
Chain Dot Geometer	*Cingilia catenaria*	SC		
Unexpected Cycnia	*Cycnia inopinatus*	T		
Three-Lined Angle Moth	*Digrammia eremiata*	T		
Imperial Moth	*Eacles imperialis*	T		
Early Hairstreak	*Erora laeta*	T		
Persius Duskywing	*Erynnis persius persius*	E		
Sandplain Euchlaena	*Euchlaena madusaria*	SC		
Dion Skipper	*Euphyes dion*	T		
The Pink Streak	*Faronta rubripennis*	T		
Phyllira Tiger Moth	*Grammia phyllira*	E		
Slender Clearwing Sphinx Moth	*Hemaris gracilis*	SC		
Barrens Buckmoth	*Hemileuca maia*	SC		
Buchholz's Gray	*Hypomecis buchholzaria*	E		
Pine Barrens Itame	*Itame* sp. 1	SC		5
Pale Green Pinion Moth	*Lithophane viridipallens*	SC		
Twilight Moth	*Lycia rachelae*	E		
Pine Barrens Lycia	*Lycia ypsilon*	T		
Barrens Metarranthis	*Metarranthis apiciaria*	E		
Coastal Swamp Metarranthis	*Metarranthis pilosaria*	SC		

Northern Brocade Moth	*Neoligia semicana*	SC		
Dune Noctuid Moth	*Oncocnemis riparia*	SC		
Pitcher Plant Borer	*Papaipema appassionata*	T		
Ostrich Fern Borer	*Papaipema* sp. 2	.SC		6
Chain Fern Borer	*Papaipema stenocelis*	T		
Water-willow Stem Borer	*Papaipema sulphurata*	T		
Mustard White	*Pieris oleracea*	T		
Pink Sallow Moth	*Psectraglaea carnosa*	SC		
Southern Ptichodis	*Ptichodis bistrigata*	T		
Orange Sallow Moth	*Rhodoecia aurantiago*	T		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Oak Hairstreak	*Satyrium favonius*	SC		
Spartina Borer	*Spartiniphaga inops*	SC		
Faded Gray Geometer	*Stenoporpia polygrammaria*	T		
Pine Barrens Zale	*Zale* sp. 1	SC		7
Pine Barrens Zanclognatha	*Zanclognatha martha*	T		

PLANTS:

Aceraceae (Maples)				
Black Maple	*Acer nigrum*	SC		
Adiantaceae (Cliff Ferns)				
Fragile Rock-Brake	*Cryptogramma stelleri*	E		
Alismataceae (Arrowheads)				
Estuary Arrowhead	*Sagittaria montevidensis* ssp. *spongiosa*	E		
Wapato	*Sagittaria cuneata*	T		
River Arrowhead	*Sagittaria subulata*	E		
Terete Arrowhead	*Sagittaria teres*	SC		
Apiaceae (Parsleys, Angelicas)				
Hemlock Parsley	*Conioselinum chinense*	SC		
Saltpond Pennywort	*Hydrocotyle verticillata*	T		
Canadian Sanicle	*Sanicula canadensis*	T		
Long-Styled Sanicle	*Sanicula odorata*	T		
Aquifoliaceae (Hollies)				
Mountain Winterberry	*Ilex montana*	E		
Araceae (Arums)				
Green Dragon	*Arisaema dracontium*	T		
Golden Club	*Orontium aquaticum*	E		
Araliaceae (Ginsengs)				
Ginseng	*Panax quinquefolius*	SC		
Asclepiadaceae (Milkweeds)				
Purple Milkweed	*Asclepias purpurascens*	E		
Linear-Leaved Milkweed	*Asclepias verticillata*	T		
Aspleniaceae (Spleenworts)				
Mountain Spleenwort	*Asplenium montanum*	E		
Wall-Rue Spleenwort	*Asplenium ruta-muraria*	T		

Asteraceae (Asters, Composites)				
Lesser Snakeroot	*Ageratina aromatica*	E		
Eaton's Beggar-ticks	*Bidens eatonii*	E		
Estuary Beggar-ticks	*Bidens hyperborea*	E		
Cornel-leaved Aster	*Doellingeria infirma*	E		
New England Boneset	*Eupatorium novae-angliae*	E		
Purple Cudweed	*Gamochaeta purpurea*	E		
New England Blazing Star	*Liatris scariosa* var. *novae-angliae*	SC		
Lion's Foot	*Nabalus serpentarius*	E		
Sweet Coltsfoot	*Petasites frigidus* var. *palmatus*	E		
Sclerolepis	*Sclerolepis uniflora*	E		
Large-Leaved Goldenrod	*Solidago macrophylla*	T		
Upland White Aster	*Solidago ptarmicoides*	E		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Rand's Goldenrod	*Solidago simplex* ssp. *randii* v. *monticola*	E		
Eastern Silvery Aster	*Symphyotrichum concolor*	E		
Crooked-Stem Aster	*Symphyotrichum prenanthoides*	T		
Tradescant's Aster	*Symphyotrichum tradescantii*	T		
Betulaceae (Birches, Alders)				
Mountain Alder	*Alnus viridis* ssp. *crispa*	T		
Swamp Birch	*Betula pumila*	E		
Boraginaceae (Borages)				
Oysterleaf	*Mertensia maritima*	E		
Brassicaceae (Mustards)				
Lyre-Leaved Rock-cress	*Arabidopsis lyrata*	E		
Smooth Rock-cress	*Boechera laevigata*	T		
Green Rock-cress	*Boechera missouriensis*	T		
Purple Cress	*Cardamine douglassii*	E		
Long's Bitter-cress	*Cardamine longii*	E		
Fen Cuckoo Flower	*Cardamine pratensis* var. *palustris*	T		
Cactaceae (Cacti)				
Prickly Pear	*Opuntia humifusa*	E		
Campanulaceae (Bluebells, Lobelias)				
Great Blue Lobelia	*Lobelia siphilitica*	E		
Caprifoliaceae (Honeysuckles)				
Hairy Honeysuckle	*Lonicera hirsuta*	E		
Snowberry	*Symphoricarpos albus* var. *albus*	E		
Broad Tinker's-weed	*Triosteum perfoliatum*	E		
Downy Arrowwood	*Viburnum rafinesquianum*	E		
Caryophyllaceae (Pinks, Sandworts)				
Nodding Chickweed	*Cerastium nutans*	E		
Michaux's Sandwort	*Minuartia michauxii*	T		
Large-leaved Sandwort	*Moehringia macrophylla*	E		
Silverling	*Paronychia argyrocoma*	E		
Chenopodiaceae (Saltworts)				

Fogg's Goosefoot	*Chenopodium foggii*	E		
American Sea-blite	*Suaeda calceoliformis*	SC		
Cistaceae (Rockroses, Pinweeds)				
Bushy Rockrose	*Crocanthemum dumosum*	SC		
Beaded Pinweed	*Lechea pulchella* var. *moniliformis*	E		
Clusiaceae (St. John's-worts)				
Creeping St. John's-wort	*Hypericum adpressum*	T		
Giant St. John's-wort	*Hypericum ascyron*	E		
St. Andrew's Cross	*Hypericum hypericoides* ssp. *multicaule*	E		
Convolvulaceae (Morning Glories)				
Low Bindweed	*Calystegia spithamaea*	E		
Crassulaceae (Sedums)				
Pygmyweed	*Tillaea aquatica*	T		
Cupressaceae (Cedars, Junipers)				
Arborvitae	*Thuja occidentalis*	E		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Cyperaceae (Sedges)				
River Bulrush	*Bolboschoenus fluviatilis*	SC		
Foxtail Sedge	*Carex alopecoidea*	T		
Back's Sedge	*Carex backii*	E		
Bailey's Sedge	*Carex baileyi*	T		
Bush's Sedge	*Carex bushii*	E		
Chestnut-colored Sedge	*Carex castanea*	E		
Creeping Sedge	*Carex chordorrhiza*	E		
Davis's Sedge	*Carex davisii*	E		
Glaucescent Sedge	*Carex glaucodea*	E		
Handsome Sedge	*Carex formosa*	T		
Slender Woodland Sedge	*Carex gracilescens*	E		
Gray's Sedge	*Carex grayi*	T		
Hitchcock's Sedge	*Carex hitchcockiana*	SC		
Shore Sedge	*Carex lenticularis*	T		
Glaucous Sedge	*Carex livida*	E		
False Hop Sedge	*Carex lupuliformis*	E		
Midland Sedge	*Carex mesochorea*	E		
Michaux's Sedge	*Carex michauxiana*	E		
Mitchell's Sedge	*Carex mitchelliana*	T		
Few-fruited Sedge	*Carex oligosperma*	E		
Few-flowered Sedge	*Carex pauciflora*	E		
Variable Sedge	*Carex polymorpha*	E		
Schweinitz's Sedge	*Carex schweinitzii*	E		
Dioecious Sedge	*Carex sterilis*	T		
Walter's Sedge	*Carex striata*	E		
Fen Sedge	*Carex tetanica*	SC		
Hairy-fruited Sedge	*Carex trichocarpa*	T		
Tuckerman's Sedge	*Carex tuckermanii*	E		

Cat-tail Sedge	*Carex typhina*	T		
Wiegand's Sedge	*Carex wiegandii*	E		
Engelmann's Umbrella-sedge	*Cyperus engelmannii*	T		
Houghton's Flatsedge	*Cyperus houghtonii*	E		
Wright's Spike-rush	*Eleocharis diandra*	E		
Intermediate Spike-sedge	*Eleocharis intermedia*	T		
Tiny-fruited Spike-rush/Spike-sedge	*Eleocharis microcarpa* var. *filiculmis*	E		
Ovate Spike-rush or Spike-sedge	*Eleocharis ovata*	E		
Few-flowered Spike-sedge	*Eleocharis quinqueflora*	E		
Three-angled Spike-sedge	*Eleocharis tricostata*	E		
Slender Cottongrass	*Eriophorum gracile*	T		
Dwarf Bulrush	*Lipocarpha micrantha*	T		
Capillary Beak-rush or Beak-sedge	*Rhynchospora capillacea*	E		
Inundated Horned-sedge	*Rhynchospora inundata*	T		
Short-beaked Bald-sedge	*Rhynchospora nitens*	T		
Long-beaked Bald-sedge	*Rhynchospora scirpoides*	SC		
Torrey's Beak-sedge	*Rhynchospora torreyana*	E		
Northeastern Bulrush	*Scirpus ancistrochaetus*	E	E	
Long's Bulrush	*Scirpus longii*	T		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Papillose Nut-sedge	*Scleria pauciflora*	E		8
Tall Nut-sedge	*Scleria triglomerata*	E		
Dryopteridaceae (Wood Ferns)				
Braun's Holly-fern	*Polystichum braunii*	E		
Smooth Woodsia	*Woodsia glabella*	E		
Elatinaceae (Waterworts)				
American Waterwort	*Elatine americana*	E		
Empetraceae (Crowberries)				
Broom Crowberry	*Corema conradii*	SC		
Equisetaceae (Horsetails)				
Dwarf Scouring-rush	*Equisetum scirpoides*	SC		
Ericaceae (Laurels, Blueberries)				
Great Laurel	*Rhododendron maximum*	T		
Mountain Cranberry	*Vaccinium vitis-idaea* ssp. *minus*	E		
Eriocaulaceae (Pipeworts)				
Parker's Pipewort	*Eriocaulon parkeri*	E		
Fabaceae (Beans, Peas, Clovers)				
Large-bracted Tick-trefoil	*Desmodium cuspidatum*	T		
Wild Senna	*Senna hebecarpa*	E		
Fagaceae (Oaks, Beeches)				
Bur Oak	*Quercus macrocarpa*	SC		
Yellow Oak	*Quercus muehlenbergii*	T		
Fumariaceae (Fumitories)				

Climbing Fumitory	*Adlumia fungosa*	SC		
Gentianaceae (Gentians)				
Andrew's Bottle Gentian	*Gentiana andrewsii*	E		
Spurred Gentian	*Halenia deflexa*	E		
Slender Marsh Pink	*Sabatia campanulata*	E		
Plymouth Gentian	*Sabatia kennedyana*	SC		
Sea Pink	*Sabatia stellaris*	E		
Grossulariaceae (Currants)				
Bristly Black Currant	*Ribes lacustre*	SC		
Haemodoraceae (Redroots)				
Redroot	*Lachnanthes caroliana*	SC		
Haloragaceae (Water-milfoils)				
Alternate-flowered Water-milfoil	*Myriophyllum alterniflorum*	E		
Farwell's Water-milfoil	*Myriophyllum farwellii*	E		
Pinnate Water-milfoil	*Myriophyllum pinnatum*	SC		
Comb Water-milfoil	*Myriophyllum verticillatum*	E		
Hydrophyllaceae (Waterleaves)				
Broad Waterleaf	*Hydrophyllum canadense*	E		
Hymenophyllaceae (Filmy-ferns)				
Weft Bristle-fern	*Trichomanes intricatum*	E		
Iridaceae (Irises)				
Sandplain Blue-eyed Grass	*Sisyrinchium fuscatum*	SC		
Slender Blue-eyed Grass	*Sisyrinchium mucronatum*	E		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Isoetaceae (Quillworts)				
Acadian Quillwort	*Isoetes acadiensis*	E		
Lake Quillwort	*Isoetes lacustris*	E		
Juncaceae (Rushes)				
Weak Rush	*Juncus debilis*	E		
Thread Rush	*Juncus filiformis*	E		
Black-fruited Woodrush	*Luzula parviflora* ssp. *melanocarpa*	E		
Lamiaceae (Mints)				
Purple Giant-hyssop	*Agastache scrophulariifolia*	E		
Downy Wood-mint	*Blephilia ciliata*	E		
Hairy Wood-mint	*Blephilia hirsuta*	E		
Gypsywort	*Lycopus rubellus*	E		
False Pennyroyal	*Trichostema brachiatum*	E		
Lentibulariaceae (Bladderworts)				
Resupinate Bladderwort	*Utricularia resupinata*	T		
Subulate Bladderwort	*Utricularia subulata*	SC		
Liliaceae (Lilies)				
Devil's-bit	*Chamaelirium luteum*	E		
Linaceae (Flaxes)				
Sandplain Flax	*Linum intercursum*	SC		
Rigid Flax	*Linum medium* var. *texanum*	T		

Lycopodiaceae (Clubmosses)				
Foxtail Clubmoss	*Lycopodiella alopecuroides*	E		
Mountain Firmoss	*Huperzia selago*	E		
Lythraceae (Loosestrifes)				
Toothcup	*Rotala ramosior*	E		
Magnoliaceae (Magnolias)				
Sweetbay Magnolia	*Magnolia virginiana*	E		
Melastomataceae (Meadow Beauties)				
Maryland Meadow Beauty	*Rhexia mariana*	E		
Moraceae (Mulberries)				
Red Mulberry	*Morus rubra*	E		
Nymphaeaceae (Water Lilies)				
Tiny Cow-lily	*Nuphar microphylla*	E		
Onagraceae (Evening Primroses)				
Many-fruited False-loosestrife	*Ludwigia polycarpa*	E		
Round-fruited False-loosestrife	*Ludwigia sphaerocarpa*	E		
Ophioglossaceae (Grape Ferns)				
Adder's-tongue Fern	*Ophioglossum pusillum*	T		
Orchidaceae (Orchids)				
Putty-root	*Aplectrum hyemale*	E		
Arethusa	*Arethusa bulbosa*	T		
Autumn Coralroot	*Corallorhiza odontorhiza*	SC		
Ram's-head Lady's-slipper	*Cypripedium arietinum*	E		
Small Yellow Lady's-slipper	*Cypripedium parviflorum* var. *makasin*	E		
Showy Lady's-slipper	*Cypripedium reginae*	SC		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Dwarf Rattlesnake-plantain	*Goodyera repens*	E		
Small Whorled Pogonia	*Isotria medeoloides*	E	T	
Lily-leaf Twayblade	*Liparis liliifolia*	T		
Heartleaf Twayblade	*Listera cordata*	E		
Bayard's Green Adder's-mouth	*Malaxis bayardii*	E		
White Adder's-mouth	*Malaxis monophyllos* var. *brachypoda*	E		
Crested Fringed Orchis	*Platanthera cristata*	E		
Leafy White Orchis	*Platanthera dilatata*	T		
Pale Green Orchis	*Platanthera flava* var. *herbiola*	T		
Hooded Ladies'-tresses	*Spiranthes romanzoffiana*	E		
Grass-leaved Ladies'-tresses	*Spiranthes vernalis*	T		
Cranefly Orchid	*Tipularia discolor*	E		
Three Bird Orchid (Nodding Pogonia)	*Triphora trianthophora*	E		
Oxalidaceae (Wood-sorrels)				
Violet Wood-sorrel	*Oxalis violacea*	E		
Poaceae (Grasses)				

Annual Peanutgrass	*Amphicarpum amphicarpon*	E		
Purple Needlegrass	*Aristida purpurascens*	T		
Seabeach Needlegrass	*Aristida tuberculosa*	T		
Reed Bentgrass	*Calamagrostis pickeringii*	E		
New England Northern Reedgrass	*Calamagrostis stricta* ssp. *inexpansa*	E		
Tufted Hairgrass	*Deschampsia cespitosa* ssp. *glauca*	E		
Commons's Panic-grass	*Dichanthelium ovale* ssp. *pseudopubescens*	SC		
Mattamuskeet Panic-grass	*Dichanthelium dichotomum ssp. mattamuskeetense*	E		
Rough Panic-grass	*Dichanthelium scabriusculum*	T		
Wright's Panic-grass	*Dichanthelium wrightianum*	SC		
Hairy Wild Rye	*Elymus villosus*	E		
Frank's Lovegrass	*Eragrostis frankii*	SC		
Saltpond Grass	*Leptochloa fusca* ssp. *fascicularis*	T		
Sea Lyme-grass	*Leymus mollis*	E		
Woodland Millet	*Milium effusum*	T		
Gattinger's Panic-grass	*Panicum philadelphicum* ssp. *gattingeri*	SC		
Long-Leaved Panic-grass	*Panicum rigidulum* ssp. *pubescens*	T		
Philadelphia Panic-grass	*Panicum philadelphicum ssp. philadelphicum*	SC		
Drooping Speargrass	*Poa saltuensis* ssp. *languida*	E		
Bristly Foxtail	*Setaria parviflora*	SC		
Salt Reedgrass	*Spartina cynosuroides*	T		
Shining Wedgegrass	*Sphenopholis nitida*	T		
Swamp Oats	*Sphenopholis pensylvanica*	T		
Small Dropseed	*Sporobolus neglectus*	E		
Northern Gama-grass	*Tripsacum dactyloides*	E		
Spiked False-oats	*Trisetum spicatum*	E		
Podostemaceae (Threadfeet)				
Threadfoot	*Podostemum ceratophyllum*	SC		
Polygonaceae (Docks, Knotweeds)				
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Strigose Knotweed	*Persicaria setacea*	T		
Sea-beach Knotweed	*Polygonum glaucum*	SC		
Pondshore Knotweed	*Polygonum puritanorum*	SC		
Seabeach Dock	*Rumex pallidus*	T		
Swamp Dock	*Rumex verticillatus*	T		
Portulacaceae (Spring Beauties)				
Narrow-leaved Spring Beauty	*Claytonia virginica*	E		
Potamogetonaceae (Pondweeds)				
Algae-like Pondweed	*Potamogeton confervoides*	T		
Frie's Pondweed	*Potamogeton friesii*	E		
Hill's Pondweed	*Potamogeton hillii*	SC		
Ogden's Pondweed	*Potamogeton ogdenii*	E		

Straight-leaved Pondweed	*Potamogeton strictifolius*	E		
Vasey's Pondweed	*Potamogeton vaseyi*	E		
Pyrolaceae (Shinleaf)				
Pink Pyrola	*Pyrola asarifolia* ssp. *asarifolia*	E		
Ranunculaceae (Buttercups)				
Black Cohosh	*Actaea racemosa*	E		
Purple Clematis	*Clematis occidentalis*	SC		
Golden Seal	*Hydrastis canadensis*	E		
Tiny-flowered Buttercup	*Ranunculus micranthus*	E		
Bristly Buttercup	*Ranunculus pensylvanicus*	SC		
Rosaceae (Roses, Shadbushes)				
Small-flowered Agrimony	*Agrimonia parviflora*	E		
Hairy Agrimony	*Agrimonia pubescens*	T		
Bartram's Shadbush	*Amelanchier bartramiana*	T		
Nantucket Shadbush	*Amelanchier nantucketensis*	SC		
Roundleaf Shadbush	*Amelanchier sanguinea*	SC		
Bicknell's Hawthorn	*Crataegus bicknellii*	E		
Sandbar Cherry	*Prunus pumila* var. *depressa*	T		
Northern Prickly Rose	*Rosa acicularis* ssp. *sayi*	E		
Northern Mountain-ash	*Sorbus decora*	E		
Barren Strawberry	*Waldsteinia fragarioides*	SC		
Rubiaceae (Bedstraws, Bluets)				
Northern Bedstraw	*Galium boreale*	E		
Labrador Bedstraw	*Galium labradoricum*	T		
Long-leaved Bluet	*Houstonia longifolia*	E		
Salicaceae (Willows)				
Swamp Cottonwood	*Populus heterophylla*	E		
Sandbar Willow	*Salix exigua ssp. interior*	T		
Scheuchzeriaceae (Pod-grasses)				
Pod-grass	*Scheuchzeria palustris*	E		
Schizaeaceae (Climbing Ferns)				
Climbing Fern	*Lygodium palmatum*	SC		
Scrophulariaceae (Figworts)				
Sandplain Gerardia	*Agalinis acuta*	E	E	
Winged Monkey-flower	*Mimulus alatus*	E		
Common Name	**Scientific Name**	**MA Status**	**Fed Status**	**Notes**
Muskflower	*Mimulus moschatus*	E		
Swamp Lousewort	*Pedicularis lanceolata*	E		
Hairy Beardtongue	*Penstemon hirsutus*	E		
Sessile Water-speedwell	*Veronica catenata*	E		
Culver's-root	*Veronicastrum virginicum*	T		
Sparganiaceae (Bur-reeds)				
Small Bur-reed	*Sparganium natans*	E		
Verbenaceae (Vervains)				
Narrow-leaved Vervain	*Verbena simplex*	E		

Violaceae (Violets)				
Sand Violet	*Viola adunca*	SC		
Britton's Violet	*Viola brittoniana*	T		
Viscaceae (Christmas-mistletoes)				
Dwarf Mistletoe	*Arceuthobium pusillum*	SC		

1. Trimorphic freshwater population only.
2. Including triploid and other polyploid forms within the Ambystoma jeffersonianum/Ambystoma laterale complex.
3. Ditto
4. This species is listed by the U. S. Fish and Wildlife Service as P. r. bangsi (Plymouth Redbelly Turtle) in 50 CFR 17.11.
5. Undescribed species near I. inextricata
6. Undescribed species near P. pterisii
7. Undescribed species near Z. lunifera
8. Includes the two varieties of this species that occur in Massachusetts: s.p. var. pauciflora and s.p. var. caroliniana.