CHAPTER 4

FEASIBILITY AND EFFICACY ANALYSIS

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4.0 EVALUATION OF FEASIBILITY AND EFFECTIVENESS OF ALTERNATIVES

Methods and alternatives for addressing the need to reduce bird-aircraft collisions at JFK are provided in this chapter. As described in Chapter 3, evaluation of the possible methods to achieve the goals of the JFK bird hazard reduction program was considered in a tiered manner. This section contains the first tier of analysis. Throughout this chapter, the feasibility and effectiveness of the proposed methods are identified. To avoid unnecessary duplication of material in the EIS, this section only contains an evaluation of new methods, new applications for previously evaluated methods (e.g., off airport uses by WS), and a review of methods for which there is substantive new information regarding feasibility or efficacy. Methods that were eliminated from inclusion in the final alternatives of the original EA because they were not feasible, not likely to be effective and/or had unacceptable environmental impacts are not considered here unless there is new information or a new use for the method which warrants reevaluation. The methods that are deemed feasible and effective will be advanced for analysis of their environmental impacts in Chapter 6.

4.1 FEASIBILITY OF IMPLEMENTATION

Feasibility of each bird hazard management method was determined through review of information in the literature, case studies at other locations, data from research conducted at JFK, information from professionals in the field of wildlife hazard management at airports, experience of WS and the JFKWMU, and analysis of the specific conditions under which the method would have to be implemented. An alternative was classified as unfeasible if there were technical aspects associated with its implementation that render it impractical. Such aspects may include physical conditions that prevent implementation of a particular alternative, regulatory restrictions the use of specific management techniques, land use (for off-airport sites), and airport operation and safety requirements.

4.2 EFFECTIVENESS

Throughout the discussion of alternatives, “effectiveness” is evaluated with respect to both operational and ultimate effectiveness. Operational Effectiveness refers to how well the method “works” in reducing what are assumed to be conditions that contribute to the underlying reasons for the bird strike hazard (e.g., reducing bird use of a particular site, reducing the number of birds near JFK). Ultimate effectiveness refers to the extent to which a method is expected to achieve the goal of the program, namely reducing bird strikes at JFK. For example, a method for hazing birds from a site might be effective in getting birds to leave, but if they start using a site only a short distance away which still results in bird attempts to fly over JFK, it is not ultimately effective in reducing bird strike hazards.

As discussed in Chapter 3, due to limitations in the information available, the feasibility and effectiveness analysis in this section is not intended to rank methods, but rather to establish

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whether or not a method is appropriate for use in managing bird hazards at JFK. Sources of information for the analysis are discussed below.

4.2.1 Literature Study and Case Review

An extensive literature study and a case review were conducted to provide a broad picture of all possible alternatives to reduce the bird hazards using studies from within the United States as well as abroad. The literature review was augmented by discussions and meetings with parties involved in the problem at JFK, experts in the area of bird hazard management and data from research conducted at JFK.

4.2.2 Analysis of the Bird-Aircraft Interaction Hazard

At the time the original EIS was prepared, a detailed study was made of the specific aspects of the bird hazard at JFK. This included the geographic, temporal, seasonal, species-specific and aircraft specific statistical distribution of different types of gull-aircraft interactions at JFK as well as the physical environment of the area and the population characteristics of the Laughing Gull Colony in Jamaica Bay. In 2002, WS completed an airport hazard assessment detailing the type and nature of bird hazards at JFK (USDA 2002). The National Wildlife Research Center continues to monitor the impact of the supplemental on-airport shooting program on bird strikes at JFK, and the Laughing Gull colony in Jamaica Bay. The USFWS monitors gull populations on a regional level. The National Wildlife Research Center also reviews current data on the status of Regional Laughing Gull population. This information is provided to JFK and the BHTF annually Washburn et al. 2009, Washburn and Tyson 2010). The findings of the available literature on bird hazard management from sites other than JFK were interpreted for the specific situation at JFK in light of the information on the nature of the JFK bird hazard. Based on this information, a professional assessment was made of the probable general level of effectiveness or feasibility of alternatives.

4.2.3 Computer Simulation of the Jamaica Bay Laughing Gull Colony

A computer model was developed for the original EIS which simulated the population dynamics including reproductive age and survival characteristics of a Laughing Gull population representative of the one in Jamaica Bay. The model enabled managers to compare the relative impacts of various lethal methods for reducing the Jamaica Bay gull colony. The computer model used information on the characteristics of the laughing gull population to estimate the size of each subsequent Laughing Gull generation as well as the total size of the population after a number of generations. It should be emphasized that the population size estimates generated by the model were not intended to reflect the actual number of gulls in the population, but were intended as a means to determine relative impact of methods on the gull colony. Predicting the absolute, rather than the relative effects of bird hazard management methods would require more refined input values than were available for Laughing Gulls. However, the model was useful as a general assessment of the relative impacts of different methods for reducing the Jamaica Bay Laughing Gull colony. Details on the model were provided in the 1994 FEIS Section 3.1.3.3.

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4.3 EVALUATION OF METHODS FOR ALTERNATIVE 1: ORIGINAL PROGRAM/ NO-ACTION ALTERNATIVE

Under the No-action Alternative, the JFKWMU would continue to implement the bird hazard reduction measures selected in the Records of Decision for the EIS. This would include efforts to manage all bird hazards at the airport and JFKWMU and BHTF efforts to work with landowners/managers to reduce off-airport factors that contribute to bird hazards at JFK. It would not include WS involvement in off-airport bird hazard management activities for JFK, except for technical assistance (advice).[13] WS would discontinue involvement in off-airport projects specifically conducted for JFK that are currently addressed in other NEPA analyses (e.g., USDA 2004, 2005, 2009). The current program consists of 7 major elements: vegetation management, water management, insect control, sanitation management, building and facilities management, wildlife control measures including the supplemental on-airport shooting program, and monitoring. The current program is described in detail in Chapter 2. Facets of this program are addressed below where there is additional research to supplement existing material.

4.3.1 On-Airport Methods

Vegetation Management

Vegetation management to reduce food and cover (destination utility) at airports is one of the primary long-term nonlethal methods which may be used to reduce bird strikes at airports (Washburn and Seamans 2004). General strategies include managing the height of vegetation and managing for vegetation types which provide little cover, nesting habitat or food for birds. Vegetation may also be managed to reduce the amount of insect and mammal prey for birds. Bird response to specific vegetation heights varies by species (Seamans et al. 2007*a*, Washburn and Seamans 2007). Species such as gulls and geese often prefer short grass areas for grazing and loafing. Short grass makes it easier for birds to find insect food and move along the ground and provides unobstructed visibility for the detection of predators. However, longer grass and unmanaged sites may be more attractive to species like Red-winged Blackbirds, Song Sparrows and Field Sparrows, cottontail rabbits and black-tailed jackrabbits. The vegetation management strategy used at a specific airport will vary depending upon the nature of the wildlife hazards at the site.

Long-grass management and identification and use of alternative groundcovers continue to be goals for vegetation management at JFK. However, “long grass management” as currently practiced at JFK is not the same as that recommended in the original EIS. The original EIS recommended excluding airside areas from grass cutting from May 1 through August 1. This was a continuation of the long-grass management started in 1984 after a two month study at JFK determined that fewer Laughing Gulls used areas with tall grass (> 46 cm) than areas with short vegetation (5 cm; Buckley and McCarthy 1994).

[13] WS technical assistance is categorically excluded from additional NEPA analysis in APHIS NEPA implementing regulations (7 CFR 372.5(c), 60 Fed. Reg. 6,000, 6,003, (1995)).

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However, this practice led to the establishment of forbs, woody plants and vegetation much taller than recommended (>45 cm). Plant species such as bayberry which provide food and cover for birds became established, thereby aggravating problems with bird species other than gulls and creating cover for rodents and rabbits which are food for raptors. Litter and construction debris accumulated in the tall vegetation and the combination of factors made it virtually impossible to mow (Barras et al. 2000*a*).

In response to difficulties with site management and increasing concerns about bird and rodent use of unmown areas and related risks to aircraft, JFK worked with the National Wildlife Research Center to conduct a comparison of plots with shorter (15 – 25 cm) vegetation and uncut areas (Barras et al. 2000*a*). The study determined that bird use (birds per 5-minute interval) was higher in uncut plots than in the cut plots. Thirty three rodents from three species were captured in uncut plots but only 12 individuals of one rodent species were captured in the mown areas. Plant species in the mown area were primarily grasses with fewer forbs and woody plants than the uncut areas. The authors recommended that JFK switch to a regime which maintains plant height at 15 – 25 cm and JFK has adopted this strategy in its current vegetation management program.

The airport has worked with the National Wildlife Research Center to test 3 mixes of tall fescue that had been inoculated with an endophyte (fungus) and clover (L. Francoeur, JFKWMU, pers. comm.). Research indicates that the fungus may be repellent to mammals (Coley et al. 1995, Conover 1998) and birds (Conover 1991, Conover and Messmer 1996, Washburn et al. 2005*a*, Washburn et al. 2007) following repeated consumption. Unfortunately, none of the seed mixes have grown well at JFK (L. Francoeur, JFKWMU, pers. comm.).

The use of habitat management at JFK involves a continual process of evaluation and modification of habitat management practices in response to current hazards. For example, just as areas with short grass are attractive to bird species like gulls and geese, areas with no grass have also proven to be attractive to wildlife such as diamondback terrapins which lay their eggs in sandy soil and ground-nesting birds, such as American Oystercatchers and Willet. Consequently, JFK is investigating means of establishing vegetation on these sites to reduce nesting. Sites targeted for vegetation establishment include areas located along the approach end Runway 4L (Kilo Extension) and along the southern side of Runway 31L between Runways 4L and 4R. When selecting vegetation for this area, care must be taken to avoid plants which would provide food and cover for new bird species. The current lack of vegetation in this area is largely attributable to the poor soil/fill used to create this section of runway. To date, JFK has been unable to identify and establish plant species which meet the criteria of viability in poor soils at JFK and minimal utility to birds.

Another example of adaptive habitat management involves current efforts to remove bayberry from airport property. The original long-grass management strategy implemented at JFK resulted in the establishment of plant species such as bayberry which provide food and cover for birds, thereby aggravating problems with bird species other than gulls and creating cover for rodents and rabbits which are food for raptors. As

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discussed above, JFK has modified the current long-grass management strategy and is currently working to eliminate bayberry from JFK property.

Harassment and Frightening Devices

Falconry: In the original EIS, falconry was rejected as a means of reducing the Laughing Gull colony because of the limitations (weather) on the use of the falcons, and on concerns that either the falcons and/or the harassed gulls would actually increase potential hazards to aircraft, especially if the presence of the falcons caused the gulls to tower. There have also been some concerns that the falcons may also present a strike risk to aircraft. One of the hybrid falcons (Gyr – Barbary falcon hybrid) used to harass birds at JFK was struck by an aircraft in 2007 over runway 31R.

In 1996, the PANYNJ started using a falconry program as part of their integrated bird hazard management program, primarily for the removal of non-gull species. It was hoped that the presence of real predators would enhance the efficacy of the ongoing bird harassment program. Falconers also use traditional bird harassment techniques (e.g., pyrotechnics, distress calls) to discourage bird use of the airport. The program has generated positive publicity for the airport, but maintaining permits, and animal care and handling are time and labor intensive and expensive. However, addition of the falconry program has not resulted in a measurable decrease in bird strikes beyond that which was already achieved through the implementation of the supplemental on-airport shooting program (Dolbeer 1998*b*). Bird strike rates from 1996 – 1998 were within the range observed during 1991-1995 when falconry was not used at JFK.

In summary, JFK has been using falconry for several years, so this is a feasible, but labor intensive and expensive, management alternative. However, as indicated by Dolbeer (1998*b*), the addition of the falconry program did not result in a measurable decrease in bird strike rates. Use of the falconry program does not appear to result in any benefits that cannot be achieved using methods that are less time and labor intensive and less expensive to implement.

Propane Exploders: Permanently placed propane exploders have been used at JFK from 1989-2004. From August to October 2004, the JFKWMU and National Wildlife Research Center evaluated the impact of propane exploders on bird behavior and bird activity at JFK (Washburn et al. 2006). Results of the study indicated that the number of birds observed near active propane exploders was similar to the number of birds near inactive exploders. The use of permanently placed propane exploders did not significantly alter bird behavior or reduce the threat of bird strikes. One possible exception was large flocks of starlings (40-300 individuals) which were observed 8 times near active propone exploders and 14 times near inactive exploders. However, sample size was too limited to make definitive conclusions regarding the use of propane exploders to repel large groups of starlings. Based on the findings of the study, stationary propane exploders were determined to be operationally and ultimately ineffective in reducing bird strikes, and use of the stationary exploders was discontinued.

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The poor efficacy of the permanently placed exploders is similar to that observed for other systematically detonating propane exploders (Bomford and O'Brien 1990, Gilsdorf et al. 2002). In generally, frightening devices like propane exploders are more effective if the devices are moved frequently and the timing of the detonation is altered. Pairing frightening devices with other stimuli (e.g., visual deterrents like pop-up scarecrows, physical deterrents such as high pressure water cannons, or using motion activated systems) is likely to provide greater efficacy, especially if used for applications such as deterring birds from a short-term attractant such as temporary pools of water (Marsh et al. 1992, Gilsdorf et al. 2002, Millikin and Matsuda 2004, Washburn et al. 2006).

Harassment Reinforced with Limited Lethal Removal

As discussed in Section 2.2.6, harassment reinforced with limited lethal removal (shooting or trapping and euthanasia) has been one of the primary methods used by the JFKWMU to address bird strike hazards at JFK. In 1996 efforts of the JFKWMU were augmented during the busiest months of the year by the addition of a private falconry firm which has been using harassment with pyrotechnics (screamers and bangers), harassment with falconry and limited lethal removal with falconry to help reduce bird strike hazards at JFK. Overall, harassment with limited lethal removal has been a feasible and operationally and ultimately successful method for addressing hazards associated with many bird species at JFK.

Despite the overall success of the program established in 1994, it has not been completely operationally successful in meeting the need to reduce hazards from non-gull species and changes in the risks posed by gull species other than Laughing Gulls. As noted in Sections 1.6 and 1.7, populations of Canada Geese, Atlantic Brant, Mute Swans and Double-crested Cormorants have been increasing. Aircraft engines are designed to withstand the ingestion of a 4-lb. bird into the engine without resulting in uncontained damage or fire (Dolbeer and Eschenfelder 2002). All four species are near or in excess of the maximum body weight aircraft engines are designed to withstand, and Canada Geese, brant, and cormorants are known to travel in large flocks. Consequently, and as demonstrated by the 1995 collision between an Air France Concorde and a pair of Canada Geese at JFK, risk of severe damage and threats to human safety from collisions with these species are high. In 2001, concerns regarding the hazards to aircraft posed by increasing numbers of large bodied birds, specifically Canada Geese, Atlantic Brant, Double-crested Cormorants and Mute Swans, prompted the JFKWMU to request assistance from the supplemental on-airport shooting program in using lethal methods to remove these species if they attempted to enter JFK airspace in the same manner as the program responds to gull strike hazards. In 2008 and 2009, an experimental fall shooting program was conducted from 8 September to 14 November 2008, and evaluated as a potential means to primarily address late fall hazards from Herring Gull, but also hazards from Great Black-backed Gulls, Ring-billed Gulls, geese, Mute Swans and cormorants (Washburn et al. 2009).

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In addition to management of hazards associated with Canada Geese, Atlantic Brant, Double-crested Cormorants and Mute Swans, the JFKWMU has also requested assistance from the supplemental on-airport shooting program in reducing hazards from Rock Doves. This request was made because average annual strikes from Rock Doves have been higher since the completion of the EIS (4.2 strikes/year, range 1-8 strikes/year; Fig. 1-23) than before the completion of the EIS (1.5 strikes/year, range of 0-5 strikes/year) for 1979-1993.

Trapping and Euthanasia

Red-winged Blackbirds, Brown-headed Cowbirds, House Sparrows, starlings, crows and Rock Pigeons pose hazards to aircraft at JFK. On rare occasions, Rock Pigeons, European Starlings and House Sparrows have caused damage through fecal accumulations on airport buildings and jetways. Bird feces are highly acidic and can be corrosive to paint and metal surfaces. Bird feces can also have corrosive effects on monuments and decorative stonework on buildings (Gómez-Heras et al. 2004). Microbes within bird excrement also can cause damage to materials for buildings and monuments (Channon 2004, Bassi and Chiatante 1976). Habitat modification and exclusion are the primary methods used to address problems with fecal accumulations. In addition to the methods used to address bird strike hazards from all other bird species, live-trapping and euthanasia may also be used to remove these species from JFK. Decoy traps similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972) are the primary live trap used at JFK. Traps are provided with sufficient food and water to assure bird survival until they can be removed. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. The first birds to enter the traps are attracted by the feed. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. When in use, decoy traps are monitored daily or more frequently, as appropriate, to remove and euthanize excess birds and to replenish bait and water. Trap location and the amount of time the traps are set are designed to minimize bird traffic through the AOA and to prevent minimize risk of attracting new birds from the area surrounding JFK.

Bird Tracking and Warning Systems

This method involves the use of radar systems to provide real-time identification of bird hazards so that aircraft can take measures to avoid the hazard in the same manner as they currently use this information to avoid hazards such as hail and extreme turbulence associated with thunderstorms. The EIS considered the use of bird tracking and warning systems as a means of reducing bird-strike hazards at JFK but did not include the alternative among the methods to be used because the technique was still in the early stages of research and development. However, the EIS also noted that research in this area was ongoing and would be monitored an incorporated by the airline industry and airport operators as appropriate.

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Since the completion of the EIS, radar technology has improved considerably and there has been increasing research into the use of this technology to provide real-time information on bird strike hazards and to improve existing models which predict locations and periods of greatest bird strike risk (e.g., the U.S. Air Force Bird avoidance model, Lovell and Dolbeer 1999). JFK and the National Wildlife Research Center are part of a multi-agency effort to validate the ability of digital avian radar systems to accurately detect and track birds hazardous to aviation (NWRC 2008*a*). A radar system was installed at JFK in January 2010 and is currently under evaluation (Nohara et al. 2011) and appear promising as an aid to bird hazard management at JFK. Validation data for JFK is especially important because of the combination of high air traffic, large numbers of migratory birds and the high density of tall structures which may impact radar performance. Another objective of the multi-agency research effort is to develop an integrated representation of networked radar systems. The integrated system would allow airport personnel to view a composite of multiple radar images instead of needing to review individual displays from each radar covering a portion of the area of interest.

Supplemental On-airport Shooting Program

As noted in Section 1.6, the supplemental on-airport shooting program that started in 1991 has been effective in reducing gull strikes (Figs. 1-2 to 1-4, Dolbeer et al. 2003, Washburn et al. 2009). In the first year of the program, strikes with Laughing Gulls and all gulls, were reduced 62% and 48%, respectively (Washburn et al. 2009). From 1992 – 2008, fewer gulls attempted to fly over JFK and the rate of gulls shot per person-hour of effort has declined from 16.6 for the first year of the program (1991) to 2.5 – 7.9 for 1993 – 2008 (Table 4-1; Washburn et al. 2009).

The size of the Laughing Gull colony also decreased from a high of 7,629 nests recorded during a ground-based survey in 1990 to a low of 1,280 nests in 2008 (95% CI = 1,276-1,430; Washburn and Tyson 2010, Brown et al. 2001*b*). The 2008 estimate of nests was the lowest estimate since aerial surveys began in 1992. Weather conditions prohibited the count in 2009, but by 2010 the nest count had increased to 2,932 (Washburn and Tyson 2010). While the supplemental on-airport shooting program has resulted in some of the reduction of the Laughing Gull colony, environmental factors independent of the supplemental on-airport shooting program are also having an impact. The sharp decline in nesting on East High Meadow (beginning in

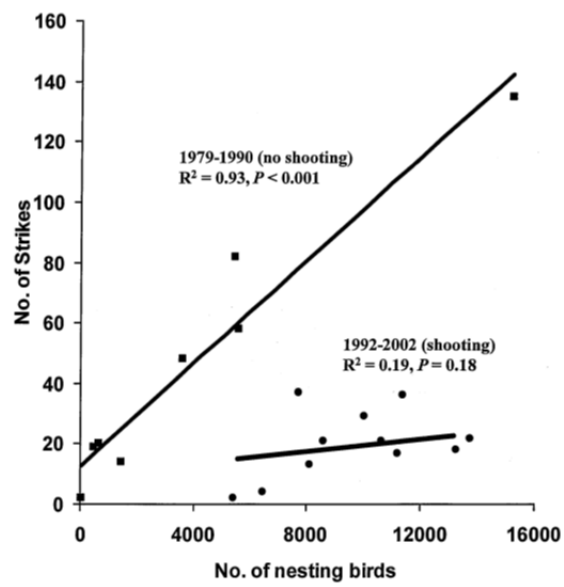

Figure 4-1. Linear correlation between the number of nesting Laughing Gulls in JBWR, and the number of strikes with Laughing Gulls at JFK 1979 – 1990 and 1992 – 2002. Figure from Dolbeer et al. 2003.

Table 4-1. Person-hours expended, shots fired, and gulls killed at John F. Kennedy International Airport, May-August 1991-2007. Table from Washburn et al. 2009.

	Shooting statistics				Number of gulls killed						
Year	Dates	No. of days	Person-hours	Shots fired [a]	Laugh-ing	Herring	Gr. blk-back	Ring-billed	Total	Gulls killed/ person- hour[b]	Gulls killed/ 100 shots[c]
1991	20 May-8 Aug	62	896	27,047	14,191	508	128	59	14,886	16.6A	55.0A
1992	15 May-4 Aug	61	1,310	31,183	11,847	1,338	150	131	13,466	10.3B	43.2B
1993	25 May-9 Aug	52	1,195	20,492	6,496	554	121	169	7,340	6.1CD	35.8C
1994	21 Jun-5 Aug	31	717	12,510	3,688	184	73	36	3,981	5.6CDE	31.8CD
1995	20 Jun-17 Aug	42	861	16,216	6,167	430	97	65	6,759	7.9BC	41.7B
1996	19 Jun-9 Aug	34	657	7,651	1,970	191	57	45	2,263	3.4CDE	29.6CDE
1997	12 Jun-1 Aug	35	733	11,391	3,242	198	44	56	3,540	4.8CDE	31.1CDE
1998	9 Jun-7 Aug	43	791	9,008	2,920	230	52	16	3,218	4.1CDE	35.7C
1999	11 May-6 Aug	60	1,208	11,585	2,841	405	96	37	3,379	2.8CDE	29.2CDE
2000	9 May-10 Aug	61	1,091	15,010	3,606	447	126	40	4,219	3.9CDE	28.1DEF
2001	15 May-10 Aug	60	1,123	13,753	3,194	480	107	42	3,823	3.4CDE	27.8CDE
2002	20 May-23 Aug	70	1,301	17,791	3,676	1,072	372	69	5,189	4.0CDE	29.2DE
2003	19 May-5 Sept	74	1,542	20,647	4,879	700	197	48	5,824	3.8CDE	28.2EF
2004	18 May-1 Oct	94	1,590	18,664	3,482	509	122	72	4,185	2.6E	22.4F
2005	16 May-19 Aug	68	1,237	15,908	3,699	559	237	63	4,558	3.7CDE	28.7DEF
2006	15 May-18 Aug	69	1,349	17,306	4,866	914	187	101	6,068	4.5CDE	35.1CD
2007	14 May-17 Aug	69	1,367	13,892	4,334	763	180	158	5,435	4.0CDE	39.1C
2008	12 May-15 Aug	67	1,452	12,494	2,911	470	186	133	3,699	2.5G	29.6CDE
Total		1,052	20,420	292,548	88,009	9,952	2,532	1,340	101,832	5.2	34.8

[a] Steel shot used in all years: in 1991-1998, 2 ¾-inch shells with #4 shot; 1999, 2 ¾-inch shells, about 50% with #4 and 50% with #2 shot; 2000, about 68% 3-inch and 32% 2 ¾ inch shells, all with #2 shot; 2001-2007, 3-inch shells with #2 shot.
[b] Number of gulls killed/person-hour is different among years ($F = 50.2$; 16, 2654 df; $P < 0.01$); yearly means with different letters are different ($P < 0.05$).
[c] Ratio of shots killing gulls to shots not killing gulls is different among years ($F = 56.8$; 16, 2654 df; $P < 0.01$); yearly means with different letters are different ($P < 0.05$).

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Only six nontarget birds were lethally taken in the course of intentionally removing 105,629 gulls and additional target birds during the period of 1991 – 2009.1997) and Silver Hole (beginning in 2000) is likely related to tidal flooding and marsh erosion (Washburn and Tyson 2010 Hartig et al. 2002). For example, in June 2000 and 2001, the National Wildlife Research Center was unable to establish ground plots at Silver Hole because the marsh was partially inundated with water. In June 2004, visual surveys from a boat indicated that Silver Hole and East High Meadow were almost completely inundated (Washburn and Tyson 2010). The decline in Laughing Gull strikes at JFK is not entirely attributable to the reduction in the size of the Laughing Gull colony. From 1979 – 1990, prior to the implementation of the supplemental on-airport shooting program, there was a strong correlation between the size of the Laughing Gull colony and Laughing Gull strikes at JFK ($R^2 = 0.93$, $P < 0.001$). However, for the period of 1992 – 2002 there has been no correlation between the size of the colony and the number of gulls struck (Figure 4-1; Dolbeer et al. 2003). Declines in Laughing Gull strikes were greater than would be predicted given the size of the colony. For example, the Laughing Gull strike rate in 2002 was 3% of 1988-1990 levels, but the Laughing Gull colony had only declined 42% from the level observed in 1990 (Dolbeer et al. 2003). Dolbeer et al. (2003) and Washburn et al. (2009) interpreted this discrepancy and the decline in birds shot per man-hour of effort as indicating that Laughing Gulls were changing flight patterns in order to avoid the airport.

Shooting appears to have a generalized hazing effect on gulls in the JFK-Jamaica Bay area with gulls responding significantly more frequently to active shooters than to simulated shooting stations or to concealed observers (Barras et al. 2000*b*). However, during a study by Barras et al. (2000*b*) of Black-backed, Herring and Laughing Gull response to shooting stations, simulated shooting stations (person and firearm at station but no shooting) and concealed observers, Laughing Gulls exhibited less avoidance of the shooting stations than the other species. The authors hypothesized that the difference might be attributable a higher the proportion of immature birds and naïve birds in the Laughing Gull population. The higher proportion of immature birds would be expected given the proximity of the breeding colony. The higher proportion of or naïve birds may have resulted from immigrants from the surrounding area arriving in response to the reductions caused by the supplemental on-airport shooting program.

The number of strikes involving Herring Gulls, Ring-billed Gulls and Greater Black-backed Gulls has also declined since the start of the supplemental on-airport shooting program (Fig. 1-3; Dolbeer et al. 2003). The decline in strikes involving these species has occurred despite the fact that, unlike Laughing Gulls which are generally only present when the supplemental on-airport shooting program is in use, these gull species are present during most of the year (Fig. 1-10). Also unlike Laughing Gulls, the number of gulls killed and the number of gulls killed per person-hour of effort has not declined for these species.

The level of Herring Gull, Ring-billed Gull and Greater Black-backed Gull take is far lower than that that for Laughing Gulls (average of 558, 138, and 71 gulls per year, respectively) and unlikely to result in substantial reductions in the state, regional or

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national populations of these species (Dolbeer et al. 2003). For example, Blokpoel and Tessier (1986) estimated there were 1.4 million nesting Ring-billed Gulls in the Great Lakes and upper St. Lawrence River, and BBS data for the period of 1980 – 2007 indicate a stable population trend (USFWS Region 5 -0.2% per year, $P = 0.92$; Sauer et al. 2008) for this species in the Northeastern U.S. (Dolbeer et al. 2003). The number of Herring Gulls and Great Black-backed Gulls nesting along the Atlantic Coast from Virginia to Maine has been estimated at over 200,000 Herring Gulls and 60,000 Greater Black-backed Gulls (Andrews 1990, Dolbeer et al. 2003). BBS data for the period of 1980 – 2006 in USFWS Region 5 indicate populations of these species have been relatively stable ($\leq$ -2.9% per year, $P \geq 0.61$; Sauer et al. 2007). Additionally, Lock (1990) estimated there were approximately 25,000 Ring-billed Gulls, 250,000 Herring Gulls and 136,000 Greater Black-backed Gulls nesting in the Atlantic provinces of Canada (Dolbeer et al. 2003). Given the relative abundance of these species and current population trends it is unlikely that the decline in strikes is attributable to declines in populations of these species and it seems likely that the supplemental on-airport shooting program has also influenced the behavior of the other gull species at JFK (Barras et al. 2000*b*, Dolbeer et al. 2003).

The establishment of the Laughing Gull colony at Gateway NRA in approximately 1978 was part of a population return to traditional breeding range. At the time of European settlement, Laughing Gulls nested extensively from Maine to Florida and along the Gulf Coast (Burger 1996). Egging and hunting for clothing decorations led to sharp declines in the population. By 1900, Laughing Gulls were no longer breeding in New York. Protection under the Migratory Bird Treaty in 1918 and use of food sources provided by humans (e.g., garbage dumps) contributed to subsequent population increases. Recent increases in nesting in the southern portions of Laughing Gull historic range may be attributable to competition from larger gull species including Herring Gulls and Great Black-backed Gulls (Burger 1996).

When possible, WS has recovered the gulls taken by the supplemental on-airport shooting program and collected data on age, gender and sex of the gulls taken. For Laughing Gulls, 90% of the birds were $\geq$ 2 years old (adults), 8% were 1 year old, and 2% were hatching-year birds (Washburn et al. 2009). In contrast, the proportion of adult birds was much lower for the other three gull species struck at JFK (46-71%). Subadults comprised 24-53% of recovered gulls for the other 3 gull species and 1-10% of recovered gulls were hatching-year birds (Washburn et al. 2009).

The high proportion of adult Laughing Gulls may be attributable to the proximity of the large breeding colony in Gateway NRA. Of the female Laughing Gulls 2 and $\geq$3 years of age, 54 and 88%, respectively, had laid eggs. Data collected for the supplemental on-airport shooting program provided the first documented evidence of nesting in 2 year old Laughing Gulls although it had been suspected that 2 year old birds were nesting (Burger 1996, Washburn et al. 2009). Seventy-six adult gulls shot at JFK had been color-marked at the Gateway NRA Laughing Gull colony during the same year (7.3% of all marked gulls; K. M. Brown, Cornell University, Ithaca, New York, pers. comm.). Additionally 62 of 668 chicks and 29 of 154 adults banded at the Laughing Gull Colony have been

Evaluation of Methods for Alternative 1: Original Program Alternative - cont.

shot and recovered at JFK. Given the relatively high proportion of breeding adult Laughing Gulls killed, the distance to the next closest Laughing Gull colony (65.8 miles), and the occurrence of marked birds from the colony among the birds shot at JFK, the Laughing Gull colony appears to be the source of the majority of the Laughing Gulls attempting to fly over JFK (Washburn et al. 2009).

As might be anticipated given the proximity of the Laughing Gull colony to the airport and that the supplemental on-airport shooting program was primarily developed to address problems with Laughing Gulls, Laughing Gulls appeared to be more vulnerable to shooting compared to their vulnerability to being struck by aircraft. From May-September 1991-2008, Laughing Gulls comprised 86% of gulls shot but only 60% of gulls involved in bird strikes (Washburn et al. 2009).

The supplemental on-airport shooting program does not appear to be having the same impact on non-gull species strikes as gull strikes. Strikes involving bird species other than gulls have been highly variable since the completion of the EIS but there does appear to have been a slight increase in the number of non-gull species struck per year (Dolbeer et al. 2003; Fig. 4-2). Of particular concern is the increasing number of large-bodied birds such as Canada Geese, Atlantic Brant and Double-crested Cormorants that have been shot at JFK each year since the airport received permits to take these species.

4.3.2 On-Board Deterrent Devices

At the time the EIS was completed, it was determined that radar, lights and microwave sources did not have utility in deterring birds from in-flight aircraft. However, the EIS also noted that research in this area was ongoing and would be monitored an incorporated by the airline industry and airport operators as appropriate.

Research by Lyne et al. (1998) and Kelly et al. (1999) indicated that most birds killed as a result of striking aircraft primarily had injuries to the underside of their bodies. Birds startled by approaching aircraft would bank and momentarily expose their undersides to aircraft. The authors interpreted the injury pattern as indicating that birds attempted to avoid aircraft but did not have sufficient time to successfully complete the maneuver. On-board deterrent devices might provide a means of increasing the distance at which birds detect approaching aircraft and give birds more time to avoid aircraft.

Blackwell and Bernhardt (2004) evaluated bird response to pulsing and not pulsing (steady) 250-W white aircraft landing lights mounted on a moving vehicle. European Starlings, Canada Geese, Mourning Doves and Herring Gulls exhibited little to no avoidance response. Brown-headed cowbirds exhibited a significant avoidance response to steady lights during one test of the system but did not respond to steady or pulsing lights in subsequent tests. The authors determined that the response of the cowbirds warranted additional testing and development of lighting systems to increase bird avoidance of aircraft and suggested that future research should include review of differences in bird species perception of and response to light of varying wavelengths

Evaluation of Methods for Alternative 1: Original Program Alternative - cont.

Implementation of this method would be the responsibility of individual airlines. The lead and cooperating agencies in the production of the EIS are aware that, in spite of a relative lack of formal analysis of the method, some airlines are already trying these devices on their aircraft. Implementation of this method at JFK would require either voluntary compliance on the part of the air-carriers or a requirement imposed by the FAA. Current data are not sufficient to warrant establishment of a requirement by the FAA, and most airlines are unlikely to incur the cost of changing the lighting systems on their aircraft until more substantive peer-reviewed data is available on the efficacy of the method. Consequently, the original EIS' determination to not include this method in the current program remains valid.

4.3.3 Evaluation Summary – Alternative 1: No-action Alternative

Technical Implementation Feasibility

This alternative is comprised of the bird hazard management activities currently conducted at JFK and, as such, is feasible.

Efficacy

Operational Effectiveness: The bird hazard reduction procedures utilized at JFK are the standard ones recommended in the literature, and can be effective in dispersing birds that are roosting, loafing, and feeding on the grounds at airports and reducing the number of birds flying through JFK airspace (Cleary and Dolbeer 2005). The current procedures do appear to be effective in deterring gulls from using resources at JFK and flying through JFK airspace, and are likely contributing to the decline in the Laughing Gull Colony in Jamaica Bay. As such, the current program is successful in reducing gull hazards at JFK.

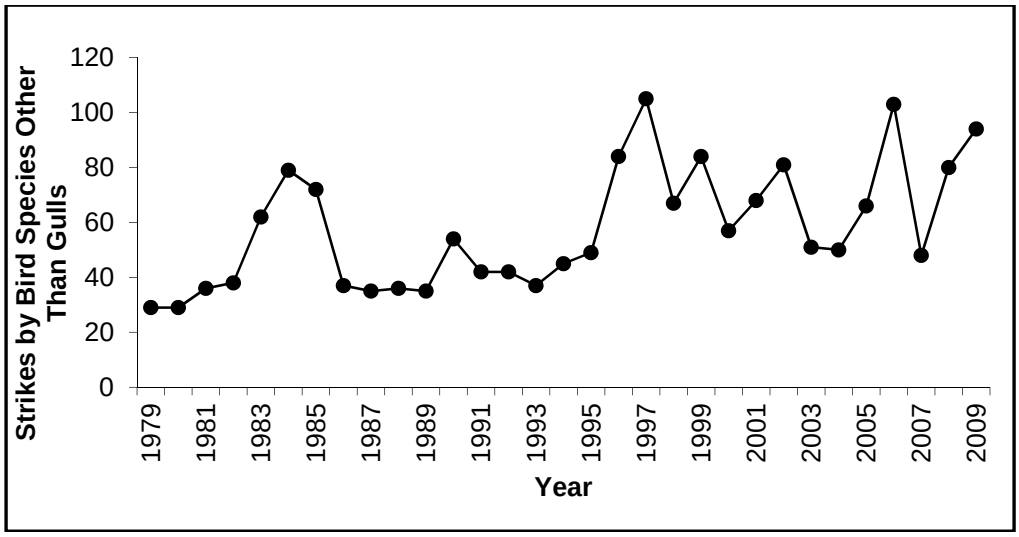

Figure 4-2. Total annual bird strikes at JFK involving species other than gulls.

Evaluation of Methods for Alternative 1: Original Program Alternative - cont.

Although the program has been effective in reducing gull strikes at JFK, there are some concerns about the method. From 1991–2008, 101,832 gulls (88,009 Laughing Gulls, 9,952 Herring Gulls, 2,532 Great Black-Backed Gulls and 1,340 Ring-billed Gulls) have been killed during implementation of the supplemental on-airport shooting program (Washburn et al. 2009). Concerns about the humaneness of shooting thousands of Laughing Gulls each year warrants a re-examination of alternatives for long-term reduction of the hazards associated with the presence of the Laughing Gull colony near JFK (e.g., relocation of the Laughing Gull Colony).

The program established in 1994 has been only moderately successful in addressing hazards from non-gull species. The JFKWMU has increased lethal take of nongull species and added new methods (e.g., on-airport nest and egg destruction) to address changing bird strike hazards at the airport.

Ultimate Effectiveness: The current integrated bird strike management program has been effective in reducing strikes by all gull species, especially Laughing Gulls. Although overall strikes with Herring Gulls have also declined since the initiation of the integrated bird strike management program, Herring Gulls have replaced Laughing Gulls as the species most commonly struck at JFK. Differences between Laughing Gulls and Herring Gulls in the seasonal pattern of strikes may indicate that additional refinement of the gull hazard management program may be warranted to best address conflicts with all gull species.

The need for modifications to the non-gull bird hazard management program in place when the EIS was completed is an indication that the original non-gull hazard management methods and on-airport strategy for addressing problems with non-gull species were only moderately effective in reducing strike hazards from non-gull species. The lack of a marked increase in non-gull strike rates at JFK can be attributed to the JFK bird strike hazard management program. However, despite modifications to on-airport efforts to reduce bird strikes involving non-gull species, the annual number of strikes involving non-gull species has remained steady and/or increased slightly since the completion of the EIS (Fig. 4-2).

4.4 EVALUATION OF METHODS FOR ALTERNATIVE 2: ADD ADDITIONAL NONLETHAL METHODS ON AND OFF-AIRPORT ALTERNATIVE

4.4.1 On-Airport Methods

Implement Wildlife Hazard Monitoring Program

The FAA manual on bird hazard management at airports (Cleary and Dolbeer 2005) notes that, “The importance of accurate monitoring and record keeping cannot be overemphasized. Without consistently maintained records of wildlife activity, wildlife strikes, and wildlife management actions, the proper evaluation of a program is impossible. Without evaluation, no assessment of the effectiveness of a program can be made. Furthermore, without accurate records and proper evaluation, it might be difficult

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

to justify and defend certain management actions, such as wildlife removal, or to defend the airport during litigation in the aftermath of a damaging wildlife strike…" Baxter and Robinson (2007) emphasized the importance of knowledge of bird movements and bird attractants at off airport sites in developing a targeted and effective airport hazard management program.

There are two general types of wildlife hazard evaluations used at airports, Wildlife Hazard Assessments and Hazard Monitoring Programs. A WHA follows guidance given in Federal Aviation Regulations Part 139.337(c). It "must be conducted by a wildlife damage management biologist who has professional training and/or experience in wildlife hazard management at airports or an individual working under direct supervision of such an individual. The WHA must contain at least the following:

(1) An analysis of the events or circumstances that prompted the assessment.
(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.
(3) Identification and location of features on and near the airport that attract wildlife.
(4) A description of wildlife hazards to air carrier operations.
(5) Recommended actions for reducing identified wildlife hazards to air carrier operations."

A hazard monitoring program is comprised of only point (2), above, and is often coupled with other direct management actions and objectives. Bird and mammal monitoring surveys are usually conducted 2-4 times per month on equally spaced days, and an annual report analyzing the observation data is submitted. Monitoring programs are essential for airports with an active wildlife hazard management program as they provide baseline data on wildlife presence, and a yardstick by which management actions may be measured and assessed. Monitoring programs allow managers to identify trends in wildlife activity, prevent future events through more focused wildlife hazard management, use funding and resources more efficiently, and more easily justify funding needs. Implementation of a wildlife hazard monitoring program was recommended in the 2002 WHA for JFK (USDA 2002).

A monitoring program may be used when communicating the need for off-airport bird hazard management activities to the public and owners and managers of off-airport sites. Implementation of a wildlife hazard monitoring program would give the public an increased degree of assurance that decisions to conduct bird hazard management activities, especially activities conducted off-airport, are based on sound science. This method has been described in the alternative on expanded nonlethal bird hazard management methods. However, because of the importance of monitoring in the development and maintenance of effective bird hazard management programs, it is recommended for inclusion in all the alternatives.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Technical Implementation Feasibility

Similar hazard monitoring programs are in use at civil and military airports across the country. In New York State, wildlife hazard monitoring programs are in use at Albany International Airport, La Guardia Airport, the 914th Airlift at Niagara Falls, and Westchester County Airport, so this method is technically feasible. For JFK, implementation of this method would likely require hiring of additional JFKWMU personnel to complete the work, obtaining assistance from WS, or contracting with a qualified private company for completion of the work.

Efficacy

Operational Effectiveness: This method will enable managers to identify new wildlife hazards and adjust the application of existing bird hazard management methods to best achieve goals of reducing bird attractants at JFK and bird movements through JFK airspace. Standardized data on bird movements may help convince off-airport land owners and managers and the public of the need for off-airport bird hazard management and facilitate implementation of off-airport programs. This type of information could also be used to help optimize the allocation of management resources to most efficiently respond to bird strike hazards.

Ultimate Effectiveness: Strategies which facilitate the prompt and effective response to existing and developing bird hazards at JFK should achieve the goal of reducing bird strikes at JFK. This may be especially true for bird hazard management actions which require the assistance of off-airport landowners and managers.

Improve Recording of Nonlethal Harassment Activities

The JFKWMU and contractors have not maintained a single consistent record system for tracking use of nonlethal methods. The system used by the JFKWMU was not developed specifically to track wildlife management activities, which makes it difficult to utilize the data. As discussed in Section 1.6, bird strike information is not the only indicator of the magnitude of bird hazards. An effective bird hazard management program may be able to respond to increased risks from a bird species by increasing the amount of effort and the number of birds dispersed while still preventing bird strikes or keeping bird strike rates at low levels. In these instances, bird strike rates would not reflect the change in bird hazards. However, a long-term database on the number of birds dispersed for a particular species and the number of dispersal incidents would show the change in bird hazard. The JFKWMU also does not retain records on the number of pyrotechnics used for longer than a period of a few years. As with records of bird dispersals, data on pyrotechnics use can be indicators of the effort required to reduce bird hazards. This method is included in the alternative involving expanding the use of nonlethal techniques to address, but, because of the importance of accurate information on the nature of bird hazards and hazard management activities, this method is recommended for inclusion in all alternatives.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

This data can also be used to document need for changes in permits (e.g., increases in requests for lethal take for a particular species) issued by regulatory agencies and document JFK's commitment to the use of practical and effective nonlethal bird hazard management techniques to regulatory agencies and members of the public.

Technical Implementation Feasibility

As with standardized bird hazard monitoring programs, civil and military airports across the country maintain long-term records of bird harassment activities. The WS Management Information System (MIS) was specifically developed to track nonlethal and lethal wildlife management activities and is used to guide management, analyze impacts of program actions and to prepare public reports on program activities. Therefore, this method is technically feasible. Implementation of this type of data collection system would require establishment of an appropriate database for records storage, training, and time for data collection and entry.

Efficacy

Operational Effectiveness: This type of data collection will improve the ability of the JFKWMU to detect changes and adjust the application of bird hazard management methods and resources to address bird hazards at JFK. This type of data may also be used to document reasoning for requests to change lethal take of birds on permits from the USFWS and NYSDEC. Data on JFK commitment to and on-airport use of nonlethal harassment methods may help improve public tolerance of on-airport lethal bird hazard management techniques and proposals to manage on-airport hazards by working to manage bird use of off-airport attractants.

Ultimate Effectiveness: Strategies which facilitate the prompt and effective response to existing and developing bird hazards at JFK should achieve the goal of reducing bird strikes at JFK.

Lasers

Lasers are a relatively new technique used to frighten and disperse birds from their roosts or loafing areas. Although the use of a laser (the term of "laser" is an acronym for Light Amplification by Simulated Emission of Radiation) to alter bird behavior was first introduced nearly 30 years ago (Lustick 1973), it received very little attention until recently when it was tested by the National Wildlife Research Center. Results have shown that several bird species, such as Double-crested Cormorants, Canada Geese, other waterfowl, gulls, vultures, and American Crows have all exhibited avoidance of laser beams during field trails (Glahn et al. 2001, Blackwell et al. 2002). However, some bird species such as Brown-headed Cowbirds, Rock Pigeons and European Starlings either fail to respond to lasers or exhibit much less avoidance response than species such as Canada Geese and Mallards (Blackwell et al. 2002). In laboratory tests, motion activated laser systems reduced Canada Goose use of treated plots by 83% (Werner and Clark

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

2006). The repellent or dispersal effect of a laser is due to the intense and coherent mono-wavelength light that, when targeted at birds, can have substantial effects on behavior and may cause changes in physiological processes (APHIS 2001). Best results are achieved under low-light conditions (i.e., sunset through dawn) and targeting structures or tree proximate to roosting birds, thereby reflecting the beam. Initially, there appeared to be little evidence of birds becoming habituated to lasers (APHIS 2001). However, subsequent use of the devices in the field indicates that species such as vultures and Canada Geese do eventually become accustomed to the device (M. Lowney and J. Suckow, WS, pers. comm.). Testing of lasers to deter Peregrine Falcons from nesting in an abandoned hanger at JFK also appeared to indicate a degree of habituation (C. Nadareski, NYCDEP, pers. comm.).

Technical Implementation Feasibility

JFKWMU personnel have been experimenting with the use of lasers to repel birds at JFK. The beam of light created by the laser devices can extend as far as 800 yards. The FAA does have concerns regarding the risk of flash blindness and afterimage created when a laser beam interferes with the vision of the pilot or air crewmember and glare when the laser beam illuminates the windshield of an aircraft. Consequently, the FAA has issued notification requirements and use requirements for outdoor laser operations that may affect aircraft operations (FAA 2004, 2006). Because of the restrictions on the time of day when lasers are most effective, and safety restrictions regarding laser use, opportunities for use of this method have been and are likely to be limited.

Efficacy

Operational Effectiveness: Data from studies noted above indicate that lasers can be effective means of harassing some bird species away from a site. Lasers have been successfully used at JFK to disperse starling roosts. This method has the potential to reduce bird use of airport property, but is unlikely to be useful in deterring bird flights through JFK airspace. The restrictions on environmental conditions under which lasers may be used mean that the application of this method at JFK is limited.

Ultimate Effectiveness: Like many other methods which involve the use of harassment to reduce hazards to aircraft, the ultimate efficacy of this method will depend on the response of the birds harassed. Harassment generally results in more birds in the air which can actually result in a short term increase the risk of bird strikes until birds depart the vicinity of the airport. If the use of lasers results in birds “towering” high into the air, this type of harassment may be especially hazardous to aircraft. Coordination with air traffic control may be used to minimize risks that birds will flush from sites on-airport into the path of approaching or departing aircraft. Biologists will need to understand species specific response to this method before regularly incorporating the use of lasers into JFKWMU operations.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Paintballs

Paintballs have been used at Fountain and Pennsylvania Avenue Landfills to harass Canada Geese, Atlantic Brant, and Herring Gulls since 2007. The method has also been used at JFK to harass Canada Geese and Atlantic Brant. Paintballs are a relatively new technique which is used to haze birds to leave an area. The method is often used on large birds which have habituated to other hazing methods. It is the adverse conditioning of habituated birds which makes paintballs particularly effective as a non-lethal tool. The paintballs are shot in the direction of loafing birds and few actually hit the birds. A hazing affect can be achieved in most instances without hitting the bird. However, a few birds such as Canada Geese which have habituated to other hazing methods (e.g. pyrotechnics) sometimes must be struck by the paintball to get them to leave the site. Sometimes striking the ground in front of the habituated bird is enough to get them to disperse.

Paintballs were historically used in forestry to mark trees. The tool was modified in the 1980's for a sporting competition between competing armed teams trying to capture flags or territory without being "marked". Since then paintballs have become a training tool for the military and law enforcement and non-lethal suppression of violent persons. Paintballs are approximately 5/8 inch in diameter and resemble a gelatin capsule. They are discharged from a CO_2 powered paintball marker. The paintballs are made of non-toxic, biodegradable, water soluble mineral oil and a dye. The paintballs infrequently break when striking the soft feathers of birds. However, there is some variability among the integrity of paintballs due to range and different manufacturers. They may break when striking the ground or other hard objects. The effective range of paint balls for harassing birds is about 50 yards.

More than 42,000 birds have been hazed with paintballs at the Fountain and Pennsylvania Avenue Landfills over 3 years from October 2007 to September 2010 (USDA, unpub. data). Canada Geese, Atlantic Brant, and Herring Gulls comprised 95% of the birds hazed with paintballs. Only 3 Herring Gulls have been killed by paintballs while hazing. At JFK, about 500 Canada Geese and Atlantic Brant were harassed in 2009 (L. Francoeur, JFK Airport, pers. commun.). No birds were killed with paintballs at JFK.

Technical Implementation Feasibility

WS staff has been experimenting with paintballs at the two landfills to haze birds. The paintball guns have an effective range of about 50 yards to propel a paintball. The method is considered non-lethal to larger bodied birds. Birds at both landfills are intensively harassed year round using a variety of non-lethal methods. The hazing techniques used were pyrotechnics, foot chase, vehicle chase, eye-spot balloons, bird kites, cap guns, horns, yelling, and clapping. Paintball guns are considered firearms by WS policy. As such, employees must receive firearms training before using the method. Also, employees are subject to requirements of the Lautenberg Domestic Confiscation Law and random drug testing.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Efficacy

Operational Effectiveness: Paintballs can be effective for scaring birds away from a site. The method may deter some birds from returning. The effectiveness of hazing with paintball guns can be enhanced when coupled with the use of pyrotechnics. In our experience, some birds, particularly Canada Geese, become habituated to hazing and paintballs is one of the few effective methods to disperse them. Other birds, such as Atlantic Brant, are difficult to disperse during intense feeding times prior to migration while building up fat reserves. Paintballs can move brant away from some areas and reduce the need to resort to lethal methods. The method has limited range and some birds may only disperse short distances before returning. Other birds appear to leave the site for long periods of time.

Ultimate Effectiveness: Like many non-lethal methods which are used to harass birds to protect aviation safety, the ultimate effectiveness is dependent on the response of the birds harassed. Harassment puts birds in the air for the short term which increases risk to aviation but in the long term may move birds out of the area and thus reduce risk to aviation. Coordination with air traffic control may be necessary to minimize risk of flushing birds into the path of approaching or departing aircraft.

Capture and Relocation

Capture and relocation involves live capture of raptors using methods such as pole traps, bal-chatri traps or other live-capture devices and then relocating the bird(s) to new locations (See Capture and Relocation in Section 4.4.2 for details). Capture and relocation has been used with some success on and off airport to address problems with raptors. Harassment techniques (e.g., pyrotechnics) generally are not effective in dispersing resident raptors from airports and killing raptors on airports to reduce strikes is generally not a recommended action because of their protected status, beneficial attributes (except when on airports) and popularity with the public. (See also Section 4.4.2 regarding relocation of other species).

In a Toronto Canada raptor relocation project, 969 raptors (primarily migratory birds) were translocated approximately 38 miles from the airport. Only 2% of the relocated birds returned within 90 days of release (McIlveen et al. 1992, 1993). Red-tailed Hawks relocated over 48 miles from an airfield in Omaha, Nebraska did not return, but there was a return rate of over 50% for Red-tailed Hawks translocated from an airport in Portland, Oregon (Bruggeman 2000, Fukuda and Hallett 2000). At O'Hare International Airport in Chicago, 214 Red-tailed Hawks were captured on and around the airport and released at 12 sites located between 35 and 145 miles from the airport (Schafer et al. 2002). Only 15.9% of the birds returned to O'Hare and Red-tailed Hawk strike rates declined 3-fold during the course of the study. Time between release and return to the airport averaged 108.6 days (range 2 – 369 days). Return rates were substantially lower for hatch-year birds (3.2%) than for after-hatch-year birds (25.6%). Authors hypothesized that the older birds may have greater site fidelity than transient and juvenile birds. Neither

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

translocation distance nor direction appeared to affect bird return rates. Nineteen of 22 birds with radio collars dispersed from release sites within 5 days, indicating there may be low risk of saturating a release sites with translocated birds.

Technical Implementation Feasibility

WS wildlife hazard management programs in other states have also been using or experimenting with raptor relocation, so the method is technically feasible.

Efficacy

Operational Effectiveness: Data from studies noted above indicate that capture and relocation can be an effective means of addressing problems with some species. Efficacy may vary considerably between species and among individuals within species depending on age and experience with the airport area. The tendency of some individual birds and bird species to return to the capture site will limit utility of the method. Although this method has the potential to reduce bird use of airport property, but is unlikely to be useful in deterring bird flights through JFK airspace.

Ultimate Effectiveness: As noted above, capture and relocation does appear to have potential to reduce bird hazards to aircraft at JFK. Applicability of this method at JFK will depend on the number and species of bird involved and the availability of suitable release sites. Release sites would be chosen based on recommendations of the USFWS and NYSDEC.

Barriers

The fence at JFK was constructed with a gap between the bottom of the fence and the ground. This gap allows some animals, including diamond-backed terrapins, access to the airport. Some of these animals are struck by aircraft and the carcasses may attract birds which are a hazard to aircraft (Section 1-8). Improvements to the fencing or installation of a drift fence closer to the runways may prevent terrapin mortalities and help to reduce bird strike hazards.

Technical Implementation Feasibility

Airport wildlife hazard management programs commonly use and recommend barriers to reduce hazards at airports, so this method is technically feasible. Nonetheless, JFK has already started to implement this recommendation by hardening the bottom of the fence and are planning to install terrapin deterrents between the fence and the water.

Efficacy

Operational Effectiveness: As noted above, barriers are a commonly used method for reducing wildlife hazards at airports (Cleary and Dolbeer 2005)

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Ultimate Effectiveness: Although this method could reduce problems with access by mammals and the terrapins, risks from these species are low and primarily related to bird scavenging of carcasses of animals crushed by vehicles (Section 1.8). Prompt carcass removal is an effective and less expensive way to address these risks but would not prevent these species from being killed which is also undesirable. These types of risks are relatively rare and the magnitude of the risk reduction may not warrant the cost of installation at this time although risks associated with these species may change.

Repellents

Bird repellents may be used to reduce bird feeding on plants, repel birds from temporary pools of standing water, and have been used as a tactile repellent to prevent perching on building ledges and similar locations. The use of methyl anthranilate to deter bird use of standing water was addressed in the 1994 FEIS and is discussed as part of the current program in Chapter 2 of this supplement. A newer, potentially more cost effective method of MA application is the use of a fog-producing machine (Vogt 1997, RJ Advantage 2009). 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. In contrast to the turf application, the manufacturer estimates that a one gallon container of concentrate 40% MA) for use in fogging applications ($189) is sufficient to treat up to 16 acres depending on airflow (RJ Advantage 2009). The technical bulletin states that several treatments 1-4 days apart may be required for removal of all nuisance birds. As with the turf application, it's likely that additional applications would be required to address problems with migrating or non-resident birds. In New York, the fogging application is restricted to use at landfills, non-fish bearing bodies of water and temporary pools of standing water on paved areas or construction sites at or near airports.

Technical Implementation Feasibility

Label restrictions on application and the close proximity of natural bodies of water will limit the use of fogging applications on-airport. Use of fogging applications may not be acceptable or may be restricted within the AoA because the fog form a visual obstruction and because of concerns regarding the impact of methyl anthranilate on engine parts if fog is ingested into engines. Used in this manner, methyl anthranilate would be similar to other harassment devices used to deter bird use. However, logistics of setting up and running fogging machine may make this method more difficult to use than some other harassment devices.

Operational Effectiveness: Used with the fogging application, methyl anthranilate is anticipated to have similar efficacy and limitations as more commonly used harassment techniques. Added to the mix of tools available to the JFKWMU, this method may be used to help reduce problems with bird habituation to other harassment systems.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Ultimate Effectiveness: Like many non-lethal methods which are used to harass birds to protect aviation safety, the ultimate effectiveness is dependent on the response of the birds harassed. Harassment puts birds in the air for the short term which increases risk to aviation but in the long term may move birds out of the area and thus reduce risk to aviation. Coordination with air traffic control may be necessary to minimize risk of flushing birds into the path of approaching or departing aircraft.

Remote Controlled Aircraft

An additional method for harassing birds which was suggested for use at JFK during the review period include chasing birds with remote controlled aircraft. Advantages could potentially include less travel through the airfield and a novel source of harassment which cannot be readily associated with the presence of people or vehicles. However, additional testing is needed before a decision can be made to use this method at JFK. Anecdotes from some RC Modeling clubs include incidents of RC aircraft being attacked by birds (mobbing or territory defense responses) which would be undesirable on airport. Logistical considerations including coordination with aircraft movements, and impacts of turbulence generated by aircraft will also need to be addressed. However, the agencies are aware of the method and may include it at JFK if future data indicate it is a feasible and effective choice for use at JFK.

4.4.2 Off-Airport Methods

As discussed in the EIS, off-airport bird hazard management methods are intended to reduce bird use of off-airport sites which result in bird flights through JFK airspace. At the time the EIS was completed the primary concern was the movement of gulls between Jamaica Bay and feeding and loafing sites in the NYC area which resulted in gull flights over JFK or through aircraft approach and departure lanes. Since completion of the EIS, waterfowl (Canada Goose, Atlantic Brant, Mute Swan, duck) movements between Jamaica Bay and feeding and loafing sites at parks, golf courses, ponds and grassy areas in the NYC area have also become a source of concern (USDA 2002). In addition to hazards associated with movement of gulls and waterfowl between Jamaica Bay and the NYC area, there are also concerns regarding species which may establish large roost sites in the area around JFK. If these roost sites are located in the approach and departure lanes of JFK, movements of birds to and from these sites may be a substantial risk to aircraft using JFK. Birds from these locations may attempt to use JFK property for feeding or loafing, thereby exacerbating on-airport risks to aircraft and increasing the need for on-airport bird hazard management activities. Bird species which may cause these types of problems include migrating and over-wintering groups of blackbirds, European Starlings and crows, and year-round resident groups of Rock Pigeons.

Methods discussed for off-airport hazard management may be applied to hazards located anywhere within the 5 mile radius of JFK. The FAA requires that airports such as JFK consider and work to reduce wildlife hazards within a 5 mile radius of the airport (FAA AC No:150/5200-33B). Although a hazard may be located within 5 miles of the radius, conditions outside the 5-mile radius may contribute to the problem. Conversely, management activities, especially

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

nonlethal techniques such as harassment also have the potential to cause problems for landowners/managers outside the 5-mile radius. For example, an integrated nonlethal resident Canada Goose management project which used harassment to reduce goose numbers at treatment sites resulted in significant increases in Canada Goose numbers at untreated sites within 1.8 miles from the treatment site (Preusser et al. 2008). Consequently, we are defining the off-airport zone where bird hazard management activities may be conducted as the 7 mile radius around JFK. Methods proposed in this alternative could be conducted in portions of Gateway NRA discussed in Section 2.3.1.

As noted in Chapter 2, there is an abundance of locations within the 7 mile radius of JFK which may be attractive to Canada Geese, Atlantic Brant, Mute Swans, Double-crested Cormorants, ducks and roosting/foraging flocks of blackbirds, crows, starlings and Rock Pigeons. Bird populations can be highly dynamic in their use of these spaces, especially if harassment or other bird hazards management activities cause them to discontinue use of a site. To address these issues, managers need to have the flexibility to promptly address changes as they occur. The high number of locations which may be involved in the bird hazard problem and the need for flexibility precludes a case-by-case analysis of each individual site. Instead, we have provided a general review of methods which may be suitable for use in eliminating bird use of off-airport attractants. As described in Chapter 3, the Decision Model process will be used to work with landowners or managers to develop site-specific management plans. On public lands and lands held by landowner associations, the development of site specific management plans will be conducted in accordance with the landowner or manager's established procedures for public involvement in decision-making.

Effective implementation of off-airport bird hazard management methods requires information on bird use of off airport sites such as that provided by the hazard monitoring program recommended in Section 4.4.1 or research like the cooperative Canada Goose movement study conducted by the NY WS program, the National Wildlife Research Center and the FAA (Seamans et al. 2009). Information on bird movements allows airport biologists to optimize use of resources for bird hazard management. The cooperative Canada Goose movement study monitored movements of resident Canada Geese banded within approximately 5 miles of JFK (Seamans et al. 2009). During the study, researchers monitored the area in a 7.2 mile radius around JFK for banded birds. At the conclusion of the study, approximately 45% of the birds remained within approximately 5 miles of JFK. Geese were observed within 3 miles of their banding location 95% of the time. Geese which remained within the study area were re-sighted at an average straight-line distance of the original banding site of 2.2 miles. Observation and shooting of banded geese at JFK confirms beliefs that at least some of the Canada Geese that contributing to bird strike hazards at JFK use city parks and other sites within Gateway NRA (Seamans et al. 2009, Section 1.7.2).

Habitat Modification

Habitat modification is one of the preferred alternatives for long-term resolution of bird hazard problems. Off-airport habitat modifications which can be used to reduce site use by the species discussed above include the same methods of vegetation height

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

management, plant selection, landscape design, pruning, elimination of roost trees, and water, and insect management analyzed in the EIS for use at JFK. The advantage of these methods is that they can provide long-term resolution of damage problems. Unlike harassment methods which may require a long-term commitment to deter return of birds to the site, once completed, habitat modifications which eliminate the bird attractant at a site may not have to be repeated. Also unlike harassment, removing the habitat attractants reduces the likelihood that the birds will try to return to the site. Exceptions to this include grass cutting and other types of vegetation or insect management which may need to be repeated at regular intervals. Even habitat management practices which do require regular maintenance are unlikely to need the frequency of attention as harassment programs.

The primary disadvantage of habitat modification is that the methods necessary to deter bird use may be contradictory to intended use of the sites. For example, planting vegetation to reduce the size of open grassy areas and decrease waterfowl and gull activity is going to be impractical for sports fields, parks, highway rights-of-way and many other areas used for recreational activities.

Gateway National Recreation Area

Jamaica Bay National Wildlife Refuge was established specifically to provide habitat for wildlife. For example, ponds on Rulers Bar Hassock within Gateway NRA were originally designed for shorebirds. However, the ponds are also used by Canada Geese, Atlantic Brant, and waterfowl. Fountain and Pennsylvania Avenue Landfills are being restored as coastal natural areas that will be placed under management of Gateway NRA and as such will provide habitat for numerous wildlife species. Habitat modifications to reduce utility of the refuge for species such as gulls, geese, and swans may also diminish the utility of the site for other bird species and is generally contradictory to the establishment of the site as a wildlife refuge. Stakeholders may also consider the impacts of removing or adding vegetation or eliminating ponds and wetlands aesthetically unacceptable.

Alteration of habitat through man-made actions or natural maturation of seral stages has resulted in changes in wildlife species using a habitat. Man-made habitat alterations would most likely alter the intended purpose of the affected section of Gateway NRA. For example, maintaining long grass in park areas and playing fields may be contrary to the intended purpose of the site (e.g., recreation). However, there may be times Gateway NRA may choose to alter habitat to achieve specific wildlife management goals consistent with its plans and policies. Natural maturation of habitat will occur on Gateway NRA (e.g., Pennsylvania and Fountain Avenue Landfills) and wildlife species will respond appropriately through increases or decreases in abundance. For example, as upland areas predominated by grass and forbs matures toward a shrubland habitat Canada Goose use of the habitat would be expected to decrease since life requirements are no longer being met. However, habitat modification at Gateway NRA to protect natural and cultural resources from impairment has priority over recreational uses.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Habitat alteration would benefit JFK by reducing the abundance of some bird species that threaten aviation safety. This would be a difficult, albeit possible, action with limited applicability. However, some habitat alteration actions would alter the intended use of the recreation area and may be inconsistent with policies and management plans for Gateway NRA. Furthermore, habitat alteration does not result in a steady state. The habitat will continue to mature along a natural progression of seral stages and wildlife species occurring at each stage (and associated risks to aircraft) will vary in accordance with habitat changes.

Technical Implementation Feasibility

Technical implementation feasibility of habitat management methods will vary depending on the specific characteristics and uses of each site.

Efficacy

Operational Effectiveness: Habitat modifications can be an effective means of reducing target wildlife species use of a specific site and are one of the wildlife hazard management practices recommended in the FAA Manual on Wildlife Hazard Management at Airports (Cleary and Dolbeer 2005). Pre-control review of alternate sites available to the target species and changes in bird activity after habitat modification will have to be carefully monitored. It is possible that, unless precautions are taken to also eliminate attractants at nearby sites, birds may shift their activity to areas which result in equal or greater risks to aircraft. Also, habitat alteration of many sites will be impractical because it would preclude the intended purpose of the site.

Ultimate Effectiveness: An operationally effective off-airport control program could reduce the number of birds flying through JFK airspace, and thus could be effective in reducing the potential for bird strikes at the airport. Ultimate efficacy will depend on the behavior of the birds once the attractant has been eliminated.

Exclusion

Exclusion involves physically blocking bird access to a site. Like habitat management, physical exclusion can provide a long-term nonlethal solution for deterring bird use of a structure at a site. As with habitat modification, installation of an effective exclusion system will reduce the likelihood that the birds will try to return to the site. Because of the cost involved in materials, construction and maintenance and the physical limitations of the systems, these methods are generally only practical for small areas and a limited number of species. Exclusion adequate to stop bird movements can also restrict movements of people, equipment and other wildlife (Fuller-Perrine and Tobin 1993). As with habitat modification, some physical exclusion devices may be an impediment to the intended use of a site and some landowners, managers and users may consider the aesthetic impacts of physical exclusion devices to be unacceptable. Physical exclusion

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

methods may be prohibitively expensive for some locations. Physical exclusion methods which may be useful at off-airport sites include:

Bird Barriers

Bird proof exclusions can be effective but are often cost-prohibitive, particularly because of the aerial mobility of birds which require overhead barriers as well as conventional perimeter netting. Buildings, hangers and display planes could be "bird proofed" using hardware cloth or netting, where feasible, to eliminate roosting and nesting areas. Heavy plastic strips hung vertically in open doorways have been successful in some situations in excluding birds (Johnson and Glahn 1994).

Perching deterrents

Perching deterrents are available in a wide variety of designs (Internet Center for Wildlife Damage Management 2009). Porcupine wire (e.g., Nixalite™, Catclaw™) and coil wire are mechanical repellent methods that can be used to exclude pigeons and other birds from ledges and other roosting surfaces (Williams and Coorigan 1994). The sharp points inflict temporary discomfort on the birds as they try to land, which deters them from roosting. Drawbacks of this method are that some pigeons have been known to build nests on top of porcupine wires and the method can be expensive to implement if large areas are involved. Electric shock bird control systems are available from commercial sources and, although expensive, can be effective in deterring pigeons and other birds from roosting on ledges, window sills and other similar portions of structures (Williams and Corrigan 1994).

Avery and Genchi (2004) tested the efficacy of 5 perching deterrent devices in reducing Brown-headed Cowbird, Fish Crow, Great Horned Owl, Barred Owl and Black Vulture use of FAA Low Level Wind-shear Alert System sensor units. None of the devices tested was 100% successful in deterring every bird species, and efficacy of systems depended on the size of the bird to be deterred. However some systems did substantially reduce bird use of the devices and resulted in marked reductions in data transmission failure rates. Study findings emphasized the importance of customizing systems to maximize impacts on specific species causing the greatest problems.

Surface Coverings

Some bird species may be excluded from ponds, fields or other areas using overhead wire grids (Pochop et al 1990, Fairaizl 1992, Lowney 1993). These lines should be made visible to the birds by hanging streamers or other objects at intervals along the wires. The objective is to discourage bird feeding activities and not cause bird injury or death. Overhead wire networks generally require little maintenance other than maintaining proper wire tension and replacing broken wires, and the spacing varies with the species being excluded. They have also been demonstrated to be most applicable on areas less than two acres, but may be considered unsightly or aesthetically unappealing to some people. In addition, wire grids can render a pond unusable for boating, swimming,

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

fishing, and other recreational activities. Installation costs are about $1,000 per surface acre for materials. The expense of maintaining wire grids may be burdensome for some people.

Floating mats and balls approximately five inches in diameter can be used to cover the surface of a pond. Floating mats and "ball blankets" renders a pond unusable for boating, swimming, fishing, and other recreational activities. This method is very expensive, costing about $80,000 - $130,000 per surface acre of water.

Gateway National Recreation Area

Exclusion as a management tool has limited applicability at Gateway NRA. Most of the recreation area is natural habitat and exclusion is most successful at deterring bird use of man-made sites/structures. Most methods intended to exclude target species in natural areas would likely have unacceptable impacts on nontarget species. A few exclusion methods would be technically feasible (i.e. bird barrier) at altered sites but would have limited applicability due because of incompatibility of many methods with intended site use (e.g., recreation) or because the visual impact of the device is detrimental to the overall park experience.

Technical Implementation Feasibility

Technical implementation feasibility of physical exclusion methods will vary depending on the specific characteristics and uses of each site. Overhead wire grids have been used successfully by NYC to deter bird use of the reservoir system. Perching deterrents and careful placement of nesting structures may help to reduce bird activity at specific points near JFK. In the past, nest structures placed in close proximity were removed during the non-breeding season to reduce risks to birds and aircraft.

Efficacy

Operational Effectiveness: Physical exclusion can be an effective means of reducing target wildlife species use of a specific site and are one of the wildlife hazard management practices recommended in the FAA Manual on Wildlife Hazard Management at Airports (Cleary and Dolbeer 2005). Pre-control review of alternate sites available to the target species and monitoring of changes in bird activity after habitat modification will be needed. It is possible that, unless precautions are taken to also eliminate attractants at nearby sites, birds may shift their activity to areas which result in equal or greater risks to aircraft.

Ultimate Effectiveness: An operationally effective off-airport control measure could reduce the number of birds flying through JFK airspace, and thus could be effective in reducing the potential for bird strikes at the airport. Ultimate efficacy will depend on the behavior of the birds once the attractant has been eliminated.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Harassment and Frightening Devices

Harassment and frightening devices are those methods used to frighten birds away from an attractive resource. Harassment may be used in areas where physical exclusion and habitat management are not acceptable or feasible because of intended use of the site, perceived adverse aesthetic impacts of the habitat modification or exclusion device, or other site characteristics. Harassment may also be used as a short-term management alternative until more permanent methods (e.g., elimination of perching or nesting sites) can be implemented (Seamans and Helon 2006). Hazing with pyrotechnics, dogs, and lasers has become a popular means of repelling Canada Geese from urban and suburban sites such as parks, golf courses and cemeteries where there are problems with damage to vegetation and fecal contamination (Castelli and Sleggs 2000, Swift 2000, York et al. 2000, Holvinski et al. 2007, Preusser et al. 2008). WS in NY has successfully helped cities and towns use nonlethal harassment programs to reduce problems with winter roosting flocks of crows (Chipman et al. 2008). It may be possible to use this method to reduce bird use of areas near JFK which result in flights over the airport and in JFK airspace and approach and departure lanes. Harassment programs are popular with some segments of the public because they do not involve death of the birds. Other individuals oppose harassment because it moves the problem to another site, the individual considers the method to be inhumane, the methods are an annoyance to other people and pets using the site or living near the site, or because harassment programs can be cost prohibitive. The efficacy of harassment programs must often be measured in years and habitat changes that occur concurrently with harassment can mask which strategy is most responsible for changes in bird abundance (Collins 2009). Given the magnitude of the resident Canada Goose population reduction proposed, the issue of large numbers of relocated birds causing problems at new sites is of particular concern for Canada Geese.

Harassment systems do not eliminate the original attractant so birds are likely to try to return to the site and new birds may be attracted to the area unless some form of exclusion or habitat modification can be implemented (Holevinski et al 2007, Preusser et al. 2008). A long-term commitment to a harassment program is usually needed for effective implementation of this method. For example, in an Orange County, NY resident Canada goose harassment project (Preusser et al. 2008), if harassment was discontinued for 2 weeks, it was not unusual to find that at least 45 geese had resumed use of the site (S. Preusser, WS, pers. comm.). Harassment programs rarely have much impact on the total population of birds in a given area and, instead, usually serve as a means of re-distributing birds across the landscape, sometimes to sites where they are associated with equal or greater problems (USDA 2005). In the study of an integrated harassment and egg-oiling program in Orange County, NY, geese did not move far from the areas in which they were being hazed (Preusser et al. 2008). Twelve of the 59 geese banded at one of the parks were observed at an unmanaged location 0.7 miles away on 161 occasions during the same year. While the number of geese utilizing the managed locations dropped, there was a corresponding rise in geese at unmanaged areas within 1.8 miles of the managed locations. Marked geese hazed in a study by Holevinski et al. (2007) in Brighton, NY also moved an average of only 0.7 miles. In their study, when

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

radio-collared geese were tracked from hazing sites after a hazing event, the geese moved to similar conflict sites within the community 80% of the time.

One of the primary concerns regarding the use of harassment programs near JFK is that the programs are likely to result in more bird flights as birds leave the treatment site in search of new foraging locations. Baxter and Robinson (2007) noted that any type of harassment near airports could increase safety concerns from repeatedly forcing geese into the air in the vicinity of airplane approach routes. In a study conducted in Orange County, NY, biologists were able to successfully reduce Canada Geese and goose feces at 5 parks using an integrated nonlethal harassment program that included the use of dogs, people in kayaks, remote controlled boats, pyrotechnics and egg oiling. However, successful implementation of the program required multiple visits to each site per day, especially in the early years of the program. In 2004, WS managed geese for 73 days, and made 364 site visits (x = 1.2 visit/day), hazing an average 175 geese/day. No geese were present at a treatment site on 22 visits. In 2005, geese were managed for 86 days with an average of 109 geese hazed/day. No geese were present at a treatment site on 130 visits. During 2006, geese were managed on 106 days, with an average of 78 geese hazed/day. No geese were present at a treatment site on 475 visits. Collared geese were observed on the airfield of a nearby airport on three occasions and were associated with flocks of up to 20 geese.

Depending upon the quality of habitat and bird familiarity with and fidelity to a site, it may take anywhere from days to weeks to months to years to achieve project goals at particular location (Collins 2009). For example, in the study of Canada Geese in Orange County, NY (Preusser et al. 2008) 16 geese collared at one of the parks in 2004 were hazed from the park 48 times in 2006. This shows a high site fidelity to an area from which they had been harassed for the past 3 years. At Fountain and Pennsylvania Avenue Landfills, it has taken more than three years at a cost of approximately $1.5 million, to see substantial reduction in resident Canada Goose abundance by using harassment. The reduction may also be due to habitat changes (plant establishment and succession) at the site and population management actions (goose removal) on adjacent properties (Collins 2009, Collins and Humberg 2010*a*,*b*). For airport hazard management, methods which require less time to achieve project goals are generally preferred.

An additional limitation to the use of harassment programs is that birds often become accustomed to (habituated to) the frightening stimuli and may cease to respond to the stimulus. Birds may also learn to associate the stimulus with a particular person and vehicle and only attempt to use the site when the person/vehicle has left the site. Alternating and/or mixing frightening devices can help to reduce problems with habituation. Changing the location and the pattern (e.g., frequency of light and sound emission) of the frightening stimulus can also help problems with habituation.
There are fewer problems with physical harassment (e.g., harassment by a person, animal or remote-controlled device) than other forms of harassment because of the actual threat of contact, injury or capture by the source of the harassment).

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

An unknown variable which affects the efficacy of nonlethal programs like harassment is mortality in the target species. Mortality can be natural or human-caused (e.g., hunting) and can contribute to a decline in the number of individuals returning to a site. Harassed birds may move to new sites where they are less familiar with hazards which can lead to increased mortality. Harassment may also move hunted species such as ducks and Canada Geese from urban/suburban areas where hunting is prohibited to sites where hunting is allowed (Smith 1996, Woytek and Hestbeck 1997). However, in a study conducted by Holvinski et al. (2007) in New York State, geese generally didn't move far enough to be exposed to hunting pressure. Radio-collared geese were tracked to locations where hunting was permitted only after 1% of hazing events.

Response of individual species to frightening devices varies. As noted in the EIS, some species, such as Ring-billed Gulls, engage in "towering", forming an upward spiral of flying birds in response to a frightening stimulus. These towers can result in increased numbers of birds at high elevations and increased risks to aircraft. Additionally, harassment with frightening devices is ineffective on some species. Atlantic Brant are non-responsive to most harassment during the late winter and spring when body reserves are low after a long winter and they need to build up fat reserves for spring migration, breeding, and nesting.

Gateway National Recreation Area

As noted above, harassment is being used at Pennsylvania Avenue and Fountain Avenue although the project has been expensive (approximately $500,000 per year) and its efficacy may be at least partially attributable to factors not related to harassment (e.g., habitat change and lethal removal of geese on nearby city property). Harassment on other areas would need to be large in scale and directed at specific wildlife species such as Canada Geese, Atlantic Brant, Mute Swans, and several gull species. The consequences of harassment most likely would be more harmful to aviation safety at JFK as harassed birds would constantly be moved off Gateway NRA and then, because of the quality of the habitat, would repeatedly try to return. During the interim, the birds would try to use other locations including areas where wildlife species are being managed within acceptable goals. Birds harassed from Gateway would likely increase conflict and damage at locations already being managed. For example, the more than 775 resident Canada Geese using Rulers Bar Hassock, which is 1.1 miles from JFK, would spend more time searching for locations where they could feed and rest without being harassed. Most of these birds would travel less than two miles to parks around JFK where resident Canada Goose populations are already being managed within acceptable levels through other methods (e.g., lethal removal). As discussed above, large scale habitat management which would discourage use by geese, gulls and other target species would be inconsistent with the park mission and purpose and have unacceptable impacts on nontarget species. Based on the cost of the harassment at the landfills, the cost of additional harassment would most likely be prohibitive as the program would cover a large geographic area for years or decades.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Conducting harassment on this level in most areas of Gateway NRA would also likely adversely impact established nontarget species and visitor enjoyment of affected areas. Harassment of new bird populations from Fountain and Pennsylvania Avenue Landfills carries lower risk of harmful consequences since the bird populations are smaller, have only recently occupied the sites, and because harassment will diminish over time as the habitat moves towards more mature seral stages (Collins 2009). Management actions at the two landfills are moving as quickly as practical toward establishing forested habitat which would be unattractive to most waterfowl species.

Auditory Scaring Devices

Noise-making devices such as propane cannons, pyrotechnics, electronic guards, sirens, scarecrows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Mott 1985, Shirota et al. 1983, and Arhart 1972). These methods should be reinforced with other scaring devices such as shooting and physical harassment to reduce risk of habituation.

Visual Deterrents

Visual deterrents such as mylar tape (highly reflective surface produces flashes of light that startles birds), reflectors, eye-spot balloons (the large eyes supposedly gives birds a visual cue that a large predator is present), flags, and effigies (scarecrows) sometimes are effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, and Tobin et al. 1988). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Lasers

Lasers are discussed in Section 4.4.1.

Paintballs

Paintballs are discussed in Section 4.4.1

Physical Harassment

Physical harassment generally involves chasing birds from a site by humans (on foot or in boats), dogs, falcons or through the use of remote-controlled aircraft or boats. Radio controlled airplanes facilitate access to flying birds and can combine visual (eyespots painted on the wings) and auditory (engine noise and whistles attached to the aircraft) scare devices. Physical harassment can be particularly valuable in situations where birds have become habituated to visual and auditory deterrents. Disadvantages of the remote control devices are birds in large flocks may not respond well to planes, training is required to become efficient, especially with remote-controlled aircraft, weather

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

conditions may restrict the ability/usefulness of the device, and mechanical up keep of the device. Issues associated with the use of falconry were considered in the EIS as a means of reducing the Laughing Gull colony, and are applicable to use of this method for non-gull species

Technical Implementation Feasibility

Experience from bird damage and nuisance reduction projects in New York and data from the literature indicate that harassment can be used effectively to reduce bird use of a specific site, so it is technically feasible to implement a harassment program. However, implementation of harassment programs can be extremely time and labor intensive. Optimal use of harassment will require information on the movement patterns of the species in question in order to best target harassment efforts. For species like Canada Geese which have an abundance of feeding, loafing and nesting options within the 5 mile radius of JFK, it will likely be necessary to coordinate harassment efforts among multiple landowners and managers, including those which may not have problems at the present time, in order to prevent birds from relocating to another site which will still result in bird-strike hazards at JFK.

Use of auditory frightening devices such as pyrotechnics within city limits is likely to be limited because of safety concerns, problems with noise impacts on individuals using the site and living in the surrounding area, and local regulations. For example, these methods are currently in use at Pennsylvania Avenue and Fountain Avenue Landfills, but these locations are relatively isolated and not open to public use at this time.

Efficacy

Operational Effectiveness: Harassment can be an effective means of reducing target wildlife species use of a specific site and are one of the wildlife hazard management practices recommended in the FAA Manual on Wildlife Hazard Management at Airports (Cleary and Dolbeer 2005). However, because harassment programs do not reduce bird abundance, they may exacerbate problems or create new problems at other locations. Pre-control review of alternate sites available to the target species and changes in bird activity in response to harassment will have to be carefully monitored. If action is not taken to reduce, eliminate or exclude birds from attractants at the site, an on-going long term commitment to harassment will be needed.

Ultimate Effectiveness: Ultimate efficacy of harassment will depend on the movement of birds in response to the harassment effort. For some species such as Canada Geese, increased indirect mortality in harassed birds may contribute to efficacy of the method. Problems with ‘towering” and/or increases in bird flights in JFK airspace in response to harassment may actually increase risks to aircraft during the period required for birds to discontinue use of the site. Similarly, action must be taken to ensure that harassed birds do not relocate to new sites which pose similar or greater problems to aircraft safety. Given the short distances Canada Geese moved in response to harassment as reported by Preusser et al. (2008) and Holevinski et al. (2007) noted above, it is likely that many

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

birds will relocate to sites within the 5 mile radius of JFK where they will still be a risk to aircraft

Capture and Relocation

Relocation has been used with some success for low abundance species such as raptors (Section 4.4.1). Harassment techniques (e.g., pyrotechnics) generally are not effective in dispersing raptors from airports and killing raptors on airports to reduce strikes is generally not a recommended action because of their protected status and beneficial attributes (except when on airports).. Relocation has also been attempted for more abundant species such as waterfowl. In some of the waterfowl relocation programs, the project goals have included making the relocated birds available for hunter harvest. In these programs, the increased mortality in relocated birds, including hunter harvest, likely plays an important role in the general efficacy of this method (Smith 1996, Cooper and Keefe 1997).

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 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. Hall and Groninger (2002) reported mortality rates of 19% for translocated geese in New Mexico (17.6% attributed to hunting). Mortality rates for geese captured and released on site instead of relocated were 14.2% (9.8% attributed to hunting). Woytek and Hestbeck (1997) reported that relocated goslings had higher recovery rates, lower survival and high fidelity to relocation areas in Minnesota than normal wild goslings. Ultimately, the relocation of resident waterfowl from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997), and has been accepted by the general public as a method of reducing waterfowl populations to socially acceptable levels (Fairaizl 1992).

In Minnesota, the removal of waterfowl posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local waterfowl and decrease the number of waterfowl flights through the airport operations airspace at the Minneapolis-St. Paul International Airport (Cooper 1991). Relocation of Canada Geese has also been successfully used as part of an integrated bird hazard management program used for airports in and near Anchorage, Alaska (York et al. 2001). Although relocation of young Canada Geese can be successful, Canada Geese are sufficiently abundant, and the problems associated with this species common enough that few areas are willing to accept Canada Geese.

States like Minnesota and Michigan have used or are using programs which round-up urban waterfowl and give them to farms where the birds spend the rest of their lives. These programs have proven to be expensive for the state and have encountered difficulties with the sites which accept birds running out of room for new birds.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Although individuals opposed to the use of lethal techniques may prefer this alternative, there are some people who feel that committing a wild bird to life in captivity is also inappropriate.

Despite some successes with Canada Geese and raptors, relocation programs face numerous challenges. The method may not be cost effective for abundant species. Many problem bird species are highly mobile and can easily return to damage sites from long distances. Habitats in other areas may already be occupied, and relocation may result in bird damage problems at the new location. Additionally, few areas are likely to accept non-native species such as Rock Pigeons, House Sparrows, Mute Swans, domestic ducks and European Starlings. New York State Environmental Conservation Law prohibits the relocation and/or release of individuals of these species without a permit (§11-0507 and §11-0511). Because of the abundance of resident Canada Geese in the state and associated management problems the NYSDEC generally prohibits goose relocation.

Relocation of resident birds, especially resident waterfowl has the potential to spread disease into populations of other resident birds and/or migrating waterfowl. The American Association of Wildlife Veterinarians, "..discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control." (AAWV undated). Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of concerns pertaining to disease transmission, stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats, and the ability of some species to return to their original site.

Nonlethal methods which may be used to capture birds include:

Clover, funnel, and common pigeon traps are enclosure traps made of nylon netting or hardware cloth and come in many different sizes and designs, depending on the species of birds being captured. The entrances of the traps also vary greatly from swinging-door, one-way door, funnel entrance, to tip-top sliding doors. Traps are baited with grains or other food material, which attract the target birds. WS' standard procedure when conducting trapping operations is to ensure that an adequate supply of food and water is in the trap to sustain captured birds for several days. Active traps are checked at least daily, more frequently in inclement weather, to replenish bait and water and to remove captured birds.

Decoy traps are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Nest box traps are used by WS for corrective damage management and are effective in capturing local breeding and post breeding starlings and other targeted secondary cavity nesting birds (DeHaven and Guarino 1969, Knittle and Guarino 1976).

Mist nets are more commonly used for capturing small-sized birds such as house sparrows, finches, etc. but can be used to capture larger birds such as ducks and ring-neck pheasants. It was introduced in to the United States in the 1950's from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping "pockets" in the net cause birds to entangle themselves when they fly into the net.

Cannon nets/rocket nets/air cannons are normally used for larger birds such as pigeons, feral ducks, gulls and waterfowl and use mortar projectiles to propel a net up and over birds, which have been baited to a particular site. This type of net is especially effective for waterfowl that are flightless due to molting and other birds which are typically shy to other types of capture.

Panel nets as described by Costanzo et al. (1995) are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround waterfowl into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces, and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways).

Alpha chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove waterfowl and other birds causing damage. It is currently registered as an Investigational New Animal Drug for use by WS only. Alpha chloralose may be used to captured Canada Geese and other waterfowl that are a threat to aviation safety. The application of this immobilizing agent can be labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981), but is typically used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts.

Alpha-chloralose is typically used in small quantities as single bread or corn baits which are fed directly to the target birds with minimal hazards to pets and humans. 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 Revised) based on critical element screening.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Consequently, the 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. Bio-accumulation 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 not generally 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, nontarget 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.

Gateway National Recreation Area

Relocation of the species targeted for off-airport management from Gateway NRA would be prohibitive due to the scale of the area and the abundance of the species considered for off-airport management (e.g., Canada Geese, Atlantic Brant, gulls, blackbirds, crows, Rock Pigeons, and European Starlings). Although Canada Geese could be captured during molt in sufficient numbers for program efficacy (Section 4.6), the likelihood of finding locations where hundreds of Canada Geese can be relocated without causing conflicts at the relocation site is low. Additionally, the NYSDEC currently prohibits relocation of Canada Geese. Unless this alternative was coupled with measures to make the habitat less attractive/accessible, a capture and relocation program would likely need to continue indefinitely because returning relocated birds and new birds would continue to occupy habitat within Gateway NRA.

Technical Implementation Feasibility

Feasibility of this method will depend on the species to be relocated. For relatively low-abundance species such as raptors, capture and relocation may be a viable method. Relocating enough resident Canada Geese to achieve the proposed 80% reduction in the population around JFK, would be costly and logistically challenging to implement. The abundance of resident Canada Geese in the state also means that it will be difficult to find sites which will accept additional birds. There is also the risk that relocating large numbers of resident Canada Geese would create new damage problems at or near the release sites. Concerns regarding health risks associated with relocating wildlife and legal restrictions on movement of some waterfowl species (e.g., non-native species such as Mute Swans, domestic ducks) also limit the feasibility of this method.

Efficacy

Operational Effectiveness: Evidence from the literature cited above indicates that capture and relocation may be an effective means of temporarily reducing local waterfowl

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

populations, especially resident Canada Geese, in the area around JFK. Given the amount of available habitat and the relative abundance of resident Canada Geese in New York, the duration of any population reduction is uncertain because some geese return to the site and all the surviving geese continue to reproduce exacerbating the problem.

Ultimate Effectiveness: Methods which reduce the number of birds available to move through JFK airspace are likely to result in reduction in bird strike hazards.

Repellents

Bird repellents may be used to reduce bird feeding on plants, repel birds from temporary pools of standing water, and have been used as a tactile repellent to prevent perching on building ledges and similar locations. The primary use of repellents at off-airport sites would be to reduce goose foraging on lawns, parks and other recreational areas. Products available for use include but are not limited to:

Methyl Anthranilate (MA) is an artificial grape flavoring food additive, and is a registered repellent for waterfowl marketed under the trade names ReJeX-iT and Bird Shield. Results with MA appear to be mixed. Dolbeer et al. (1993) indicated that MA was effective for many bird species, including waterfowl (Dolbeer et al. 1993). Cummings et al. (1995) reported that MA 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. MA is water soluble therefore, moderate to heavy rain or daily watering and/or mowing render MA ineffective. Testing in numerous locations throughout Wisconsin during the 1990s indicated that in many situations MA is cost prohibitive, is only marginally effective in repelling geese, and commonly just causes geese to move to nearby untreated areas. (P. Vagnini, West Bend Parks, Recr. and For. Dept., April, 2000, D. Keuler, Rock River Hills Golf Course, April, 2000, and G. Youngs, Milwaukee County Dept. Parks, Recr. and Culture, March, 2000, pers. comm.).

Turf and water applications of MA are generally considered expensive. For example when used to treat the surface of temporary or non-fish bearing bodies of water, the manufacturer recommends an application rate of 2.5 gallons ($450) of concentrate (40% MA) per acre of pond surface with retreatment required every 3-4 weeks (RJ Advantage 2009). In New York, this application is restricted to non-fish bearing bodies of water and temporary pools of standing water on paved areas or construction sites at or near airports. For turf applications, the manufacturer estimates that a 1 gallon container of concentrate ($118, 14.5% MA) should be sufficient to treat one acre of 1-2 inch long grass. The amount of repellent needed will vary depending on the length of the grass to be treated with more product required for areas of longer grass (e.g., approximately 3 gallons for one acre of 3-4 inch long grass). The label recommends repeating application in 4 days or as warranted by Canada Goose activity. The technical bulletin states that after the second or third application, decreasing quantities of product will be needed and that

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

additional applications may be required if migrating or non-resident birds arrive after the treatment.

Another potentially more cost effective method of MA application is the use of a fog-producing machine (Vogt 1997, RJ Advantage 2009). 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. In contrast to the turf application, the manufacturer estimates that a one gallon container of concentrate 40% MA) for use in fogging applications ($189) is sufficient to treat up to 16 acres depending on airflow (RJ Advantage 2009). The technical bulletin states that several treatments 1-4 days apart may be required for removal of all nuisance birds. As with the turf application, it's likely that additional applications would be required to address problems with migrating or non-resident birds. In New York, the fogging application is restricted to use at landfills, non-fish bearing bodies of water and temporary pools of standing water on paved areas or construction sites at or near airports.

Anthraquinone (Flight Control™) is a non-lethal repellent currently registered in the United States for use on geese. 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, Blackwell et al. 1999). Anthraquinone, 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). Anthraquinone is a secondary repellent and affects birds by causing post-intestinal distress. Sometimes ingestion of anthraquinone-treated food produces vomiting, but often vomiting does not occur and the bird just sits quietly until the discomfort passes. Anthraquinone is not a taste repellent or contact irritant as the birds do not hesitate to eat treated food, and they exhibit no sign that treated food is unpalatable to them. Once the birds experience the adverse consequences they learn to avoid the protected food. Blackwell et al. (1999) demonstrated that efficacy of anthraquinone could be enhanced by using the product in conjunction with use of a plant growth regulator. The plant growth regulator reduced problems with geese learning to forage on new growth at the base of the plants. Reduction of plant growth also reduces the need for mowing and associated loss of treated plant parts. Although anthraquinone has been effective in reducing bird foraging on treated grass in pen studies, it will not necessarily eliminate loafing at the site (Blackwell et al. 1999). Additionally, because anthraquinone uses a learned response, it may not be as effective in situations where damage is caused by a continually changing group of birds as might be expected during migration.

Results of field studies have been mixed. Ayers et al (2010) tested a rainfast anthraquinone formulation (1 gallon/acre) without a growth inhibitor on grass subjected to two different mowing intensities (mowed every 4 days and mowed every 8 days). Goose usage of treated sites (as determined by feces deposited) was reduced 40-70% during the 30 day post-treatment phase even though coverage on grass decreased from approximately 95% to 10% during the observation period. Frequency of mowing did not appear to affect goose use of the sites. Period of efficacy was longer than observed by Dolbeer (1998) and Blackwell et al. (1999). Reasons for the difference may be related to

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

the difference in concentration of product used (Dolbeer (1998) - 0.47 gallon/acre; Blackwell et al. (1999) - 0.24 gallon/acre) or the fact that unlike the pen studies conducted by Dolbeer (1998) and Blackwell et al (1999), geese in the study by Ayers et al. (2010) were able to depart the area to seek alternate food sources. In contrast, in a field study conducted at Dulles International Airport, using anthraquinone with a rainfast "sticker" resulted in no changes in number of feeding or loafing geese (Feather & Associates, unpublished report, April 6, 2000). Product was formulated at greater dilution than in Ayers et al. (2010) but total amount of active ingredient applied per acre was the same.

Tactile repellents - A number of tactile repellent products are on the market, which reportedly deter birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason et al. 1989). The repellency of tactile products is generally short-lived because of dust, and they sometimes cause aesthetic problems and expensive clean-up costs by running down the sides of buildings in hot weather. Tactile repellents are unsuitable for use with waterfowl and are unlikely to be useful on the scale needed to address off-airport problems with flocks of feeding and roosting blackbirds, crows, Rock Pigeons, or House Sparrows. Consequently, this method is not being advanced for further analysis.

Gateway National Recreation Area

The use of repellents in developed areas of the Gateway NRA would result in birds moving and seeking new locations to feed and forage. Therefore, the consequences of this action would be similar to harassing the birds discussed above. Most repellents require multiple applications each season to have the possibility of being effective. Also, repellents are most effective when wildlife species are low in abundance because the animals are more likely to have alternative locations where they can find food and not cause additional conflicts. When wildlife species are high in abundance then repellents are less effective or ineffective.

Technical Implementation Feasibility

Methyl anthranilate and anthraquinone are registered and available for use and are already used by some property managers to reduce goose feeding at parks and other recreational sites. In theory, these products could be used to reduce goose activity at parks and other locations. However, as noted above, these repellents can be relatively expensive and the period of efficacy under environmental conditions can be limited. This is especially true for grass which is subject to fertilization, watering and frequent mowing like that at many parks, golf courses and similar areas. WS experience with these products indicates that may property owners become frustrated with the expense and the hassle of repeated repellent applications. As noted above, fogging systems may have greater potential as a cost-effective repellent application.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Efficacy

Operational Effectiveness: If property managers are able to maintain the cost and application schedule for repellents, these products can reduce goose use of a site. However, several factors can significantly impact repellent efficacy including the availability of alternative resources, the palatability of the food item to be protected, the physical condition of the bird, and the bird's familiarity with the site and food item. For example, repellents may be less effective or ineffective in situations where an animal has few alternative food sources or feeding sites, and in situations where the birds are accustomed to feeding in a particular location. Additionally, if food hand-outs from people comprise a significant portion of bird diets in a given location, treating grass and natural food items may have little impact on bird use of the site.

Ultimate Effectiveness: Methods which reduce the number of birds at sites proven to be associated with bird flights through JFK airspace are likely to result in a reduction in bird strikes.

Human Behavior Management

Human behavior management involves educating and encouraging members of the public to engage in behaviors which minimize the attractants for birds near JFK. These behaviors include encouraging people to not feed birds at parks and other locations associated with bird movements thought JFK airspace, and helping municipalities establish regulations prohibiting bird feeding at parks and other public areas. It also includes public education on the importance of proper waste disposal, encouraging the use of trash receptacles that restrict access by birds, encouraging using covered trash receptacles and making sure the cover is on the receptacle, and recommending proper maintenance of trash receptacles to prevent overflow. All of these activities can reduce the utility of a site for gulls, waterfowl, blackbirds, crows, House Sparrows and Rock Pigeons and can help reduce traffic through and around JFK.

Gateway National Recreation Area

"Do not feed the birds" signs have been posted for years at Rulers Bar Hassock and other locations in the park. However, the public ignores the signs and enforcement is problematic. The feeding of bread, pastries, and other human foods to Canada Geese, gulls, and other birds congregates unnatural concentrations of birds at Rulers Bar Hassock due to habituation to a stable food supply. There have been more than 775 resident Canada Geese observed in parking lots and East and West Ponds on Rulers Bar Hassock during summer months and people can be observed regularly feeding bags of bread to the birds (WS unpublished data). The consequences of stopping the feeding would be substantially harmful due to birds moving to other locations where they may cause conflicts for other landowners, and increase the risk to aviation at JFK similar to those described for harassment programs. If the resident Canada Goose population was permanently removed from Rulers Bar Hassock through a population management

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

action, then the enforcement of no feeding rules would be substantially beneficial to preventing the reestablishment of large resident Canada Goose populations.

Technical Implementation Feasibility

Changes in behavior which involve the landowner or manager are generally easier to implement than changes which require a large scale and consistent shift in behavior by the general public. Consequently, achieving changes in waste management, in terms of the type and maintenance of trash receptacles is more likely than changing the desire of people to feed wildlife. Feeding wildlife is a popular form of relaxation and recreation for many people. For some the allure a moment's connection with nature that they get from feeding wildlife is virtually irresistible, even when ordinances are in place to prohibit feeding wildlife.

Although it may be possible to achieve a reduction in bird attractants at individual locations, the amount of labor required to achieve the shift and problems with getting an adequate portion of the individuals at the site to engage in the behavior limit the technical implementation of this method. Effective implementation of this method will require information on bird movements through JFK airspace so that efforts may be focused on areas posing the greatest risks.

Efficacy

Operational Effectiveness: At sites where elimination of the human food sources requires cooperation from the general public, it may not be possible to achieve a sufficient reduction in food sources to achieve the desired impact on bird behavior. However, in situations where an adequate amount of the attractant can be eliminated, this can be an effective means of reducing bird use of a site.

Ultimate Effectiveness: Reducing bird use of sites identified as being the source or destination of birds flying through JFK airspaces should result in a reduction in bird strike hazards.

Reproductive Inhibitors

Inhibiting reproduction is one way of reducing some bird populations. However, in long-lived species like geese (Cramp and Simmons 1977) exclusive use of contraceptive methods may take a period of years to more than a decade reduce local bird populations. For long-lived species, contraceptive methods may be more effective in maintaining populations at target levels. Contraceptive methods are likely to have a higher probability of success in a relatively short time period when used on shorter-lived species like Rock Pigeons.

Canada Geese have been successfully vasectomized to prevent production of young; this method is only effective if the female does not form a bond with a different male. In a

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

study conducted at the NYC Bronx Zoo, females failed to maintain pair bonds with vasectomized males and did lay fertilized eggs (N. Clum, Assistant Curator of Ornithology, Bronx Zoo, pers. comm., July 2009). 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 vasectomy becomes increasingly difficult as the number of birds increase (Converse and Kennelly 1994). Keefe (1996) estimated mechanical sterilization of a Canada goose to cost over $100 per bird. Additionally, as is the case with most procedures involving anesthesia in wild animals, some birds will likely die from the procedure.

The National Wildlife Research Center has been instrumental in the development and registration of a new product, nicarbazin (OvoControl-GTM; CAS 330-95-0/4,4-dinitrocarbanilide (DNC, CAS 587-90-6)/ 2-hydroxy-4,6-dimethylpyrimidine (HDP, CAS 108-79-2) (1:1)), which is an infertility agent for Canada Geese and Rock Pigeons in urban areas. Nicarbazin is available to certified pesticide applicators and is not restricted to use by WS. Use of baits containing nicarbazin would allow the numbers of small to moderate sized groups of Canada Geese and Rock Pigeons to be controlled by reducing the hatchability of eggs laid by treated birds without requiring the location of each individual nest to be determined (as is the case for egg oiling/addling/destruction). In a field study conducted in Oregon (Bynum et al. 2005), use of nicarbazin reduced hatchability of eggs 35.6% ($P = 0.062$). When considering the success of individual nests at sites rather than flocks as a whole, percent hatchability was significantly reduced 50.7% ($P < 0.001$). Research conducted on captive pairs of Rock Pigeons use of nicarbazin resulted in 59% reduction in the number of eggs hatched (Avery et al. 2007, unpub. report). However, Nicarbazin bait must be consumed for several days to achieve blood levels that affect the hatchability of eggs that are forming and must be consumed each day of the nesting period for best impact on reproduction. This means that feeding sites must be maintained and used over a period of months (March-June for Canada Geese, longer for Rock Pigeons).

Nicarbazin can be expensive to use. For example, the label for pigeons recommends approximately 1 lb. of bait per day for approximately 80 pigeons and 5 lbs. of bait per day for 400 pigeons. At this rate, and an estimated cost of $6.80 per pound, the bait to treat a group of pigeons during a 6 month (180 day) breeding period would cost approximately $1,224 for an 80-bird flock and $6,120 for a 400 bird flock (Innolytics 2009). This cost estimate does not include staff time required to appropriately apply the bait. Pigeons must be conditioned to the baiting program for a period of roughly 5-14 days. The site must be visually observed daily during the conditioning period to ensure that non-target species are not feeding on the bait and to accurately determine the amount of bait to be used. All bait should be consumed within one hour of application. Unconsumed bait must be collected at the end of the feeding period. During observation periods, applicator must remain on-site until all bait is consumed or removed from the site. After the conditioning period, the flock must be visually observed weekly to ensure that adequate amounts of bait are being provided, that all bait is being consumed and that non-target species have not started using the site. The product may not be applied if non-target species are observed eating the bait.

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

Gateway National Recreation Area

The use of reproductive inhibitors would require establishing feeding locations/stations throughout Gateway NRA where resident Canada Geese feed and loaf. The birds would need to be feed for about 4 months per year if nicarbazin was used. The concentration of Canada Geese around feeding stations would result in some minor habitat degradation and possible soil erosion due to excessive grazing. It would be possible for other waterfowl species to consume the reproductive inhibitor which would be encapsultated in artificial corn kernels. Canada Geese are a long-lived species which can live for 20 or more years, especially in urban environments were annual survival rates of adult birds usually exceeds 85%. The use of reproductive inhibitors would not address the risk to aviation caused by resident Canada Geese in a timely manner. Given consideration of cost of product and product application, difficulty in prohibiting nontarget species access to product and time required for a response, the Gateway NRA has chosen exclude this method from further consideration at Gateway NRA.

Technical Implementation Feasibility

Nicarbazin is available for use in Canada Goose and Rock Pigeon damage management in the State of New York. Use of the product would require a prebaiting period and that the bait is available to birds each day of the egg-laying season. The high degree of variability among Canada Geese in their movement patterns, nesting and habitat use complicates use of this product (Vercauteren and Marks 2004) and can make it difficult to get to get the required doses to the geese (see below). The cost of the volume of bait that would be required to treat the majority of the resident Canada Geese or pigeons within the 7 mile radius around JFK would be prohibitive.

Efficacy

Operational Effectiveness: This product would be intended for use in reducing bird use of specific area by reducing the local population of birds at the site. Overall efficacy will depend on the ability to get animals to eat a sufficient amount of the bait at the required interval. The variability in movement patterns of Canada Geese will make it difficult to get the required dose into the geese. Additionally, because geese are long-lived (up to 25 years), it would likely take years to achieve the desired level of population reduction.

Ultimate Effectiveness: The establishment of feeding stations for the duration of the nesting period would serve as an attractant for the target species and may serve to congregate birds at the sites, thereby aggravating problems with bird hazards to aircraft. The method is not expected to result in an immediate decline in the number of adult birds at a site. Even with shorter-lived Rock Pigeons which may show a population response faster than Canada Geese, it is unlikely that this method will result in a prompt reduction in bird strike hazards. Establishment of feeding stations also sends a mixed message to

Evaluation of Methods for Alternative 2: Add Additional Nonlethal Alternative - cont.

the public regarding the appropriateness of bird feeding. Based on these factors, the proposed action is not being forwarded for consideration in the final alternative.

4.5 METHODS EVALUAITON FOR ALTERNATIVE 3: ADD ADDITIONAL ON-AIRPORT LETHAL BIRD HAZARD MANAGEMENT ACTIVITIES TO CURRENT BIRD HAZARD MANAGEMENT PROGRAM

4.5.1 Implement Wildlife Hazard Monitoring Program and Improve Recording of Nonlethal Harassment Activities

Improvements in data collection and program monitoring are essential to the targeted and effective implementation of bird hazard management methods. Recommended improvements in the recording of nonlethal harassment activities and the implementation of a wildlife hazard monitoring program are discussed in Section 4.4.1 and are also recommended for inclusion in this alternative.

4.5.2 On-airport Nest and Egg Destruction

One of the general approaches for bird hazard reduction at JFK involves reducing the utility of JFK and JFK airspace for birds. Despite ongoing harassment programs and lethal removal some bird species have persisted in attempting to nest at JFK including Canada Geese and American Oystercatchers. Unlike programs to manage bird populations which may use egg oiling/egg addling/puncturing as a means of preventing or reducing reproduction while still allowing the birds to remain on site, the goal at JFK is to prevent all birds from using JFK. Starting in 2000, the JFKWMU has destroyed nests and eggs of Canada Geese under permit from the USFWS. The JFKWMU has not needed to destroy Canada Goose eggs or nests since 2001 because of increased on-airport efforts to deter geese including lethal removal of adult geese. In 2001, the JFKWMU received permission from the USFWS to remove nests and eggs of American Oystercatchers (Section 1.7.14). American Oystercatchers are a state-listed species of concern. In 2007, the JFKWMU, under permits from the USFWS and NYSDEC, removed nest and eggs of a Northern Harrier from JFK property.

Technical Implementation Feasibility

This method is currently in use by the JFKWMU and is technically feasible.

Efficacy

Operational Effectiveness: Nest and egg destruction helps to eliminate the utility of JFK property for birds. Birds without nests are also likely to have less site affinity and should be easier to disperse using nonlethal harassment efforts. Bird attempts to re-nest at the site will depend on the availability of alternative nesting sites. Canada Geese nest in the Gateway NRA, at parks, and on private property throughout the NYC area and alternative nesting locations are

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

unlikely to be limited for this species. Similarly, there are alternate nesting locations within Gateway NRA and in the Long Island Sound area for Northern Harriers, American Oystercatchers and Willet which also attempt to nest on airport property. Even if birds attempt to renest, the duration of the renesting activity and associated bird hazards to aircraft are likely to be shorter-lived than bird activity associated with successful nesting attempts including repeated trips to and from nests to provide young with food and risks associated with early flight attempts by fledglings. As with on-airport bird harassment, use of this method is unlikely to address problems with birds traveling through JFK airspace en-route to other locations.

Ultimate Effectiveness: The JFKWMU reports that this method has proven effective in causing birds to discontinue using JFK and has helped to reduce bird strike hazards.

4.5.3 Expand Bird Species Which May Be Targeted by the Supplemental On-airport Shooting Program

As noted in Section 1.7, regional populations of Canada Geese, Atlantic Brant, Mute Swans and Double-crested Cormorants have been increasing. Risk of severe damage and threats to human safety from collisions with these species are high. In 2001, concerns regarding the hazards to aircraft posed by large bodied birds, specifically Canada Geese, Atlantic Brant, Double-crested Cormorants and Mute Swans, prompted the JFKWMU to request assistance from the supplemental on-airport shooting program in using lethal methods to remove these species if they attempted to enter JFK airspace. The intensive on-airport hazard management program responds to hazards associated with these species in the same manner as gull strike hazards and shoots individuals attempting to fly through JFK airspace. Selection of this method would make this modification to the supplemental on-airport shooting program a permanent part of wildlife hazard management program at JFK.

In addition to management of hazards associated with Canada Geese, Atlantic Brant, Double-crested Cormorants and Mute Swans, the JFKWMU has also requested assistance from the supplemental on-airport shooting program in reducing hazards from ducks, Rock Pigeons, blackbirds, starlings and crows. These species were identified for inclusion in this alternative based on size, tendency to fly in flocks and/or strike history, their tendency to fly in flocks (Section 1.7). Additionally, average annual strikes from Rock Pigeons have been higher since the completion of the EIS (4.2 strikes/year, range 1-8 strikes/year; Fig. 1-23) than before the completion of the EIS (1.5 strikes/year, range of 0-5 strikes/year) for 1979-1993.

Technical Implementation Feasibility

This method is currently in use at JFK and is technically feasible. The program involves the use of existing supplemental on-airport shooting program personnel and, except for the cost of ammunition used, has not resulted in increased costs for the bird hazard management program. Increase in time required to pick up carcasses of additional birds does not appear to impact program efficacy. There are sufficient breaks in bird activity that staff can safely recover carcasses without compromising program efficacy.

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

Efficacy

Operational Effectiveness: Use of the supplemental on-airport shooting program to help address risks associated with Canada Geese, Atlantic Brant, Mute Swans and Double-crested Cormorants expands the capacity of the JFKWMU to respond to the substantial threats to aircraft and human safety posed by these species. WS assistance with management of these species and Rock Pigeons, European Starlings, crows and blackbirds helps to free the JFKWMU to address bird hazards in other areas of the airport.

Ultimate Effectiveness: As discussed in Chapter 1, populations of Mute Swans, Canada Geese, Atlantic Brant and Double-crested Cormorants have been increasing. The increased lethal take of these species in recent years may be indicative of increased presence of these species in and approaching JFK airspace. The fact that strikes by these species have not changed substantively since the completion of the EIS despite population increases may be evidence that the current program which includes take of these species by the JFKWMU and the supplemental on-airport shooting program has been effective. Strikes involving Rock Pigeons had generally decreasing trend from a high in 2000 to a low in 2005 and increases in 2006 and 2007. The role of the supplemental on-airport shooting program in this trend is uncertain, especially given the low number of birds taken. WS annual take has been less than 20 birds per year when total take for the airport has averaged 327 birds per year. However it seems reasonable that a bird which is prevented from entering the AOA cannot pose a risk to aircraft, so the inclusion of Rock Pigeons in the supplemental on-airport shooting program can help reduce bird strikes at JFK.

4.5.4 Extend Duration of the Supplemental On-airport Shooting Program

Herring gulls have replaced Laughing Gulls as the primary gull species struck by aircraft at JFK. Herring Gull strike records (Fig. 1-10) show highest strike rates for September and October. However, the current supplemental on-airport shooting program is only generally run from May through August. Extending the period during which the supplemental on-airport shooting Program is conducted into October would allow the airport to use this technique to address late-season hazards from Herring Gulls and the other species listed in Section 4.5.3.

Technical Implementation Feasibility

This method was tried experimentally under USFWS and NYSDEC permit in 2008-2010 is technically feasible.

Efficacy

Operational Effectiveness: This program would involve shooting Herring Gulls as they attempt to enter the airspace above JFK. The goal of the supplemental on-airport shooting program relative to the gull species other than Laughing Gulls, is to prevent bird use of the airspace immediately above JFK. Research by Dolbeer et al. (2003) indicates that even the gull species other than Laughing Gull which have been targeted by the supplemental on-airport shooting program appear to show some evidence of learning to avoid JFK airspace (Barras et al. 2000*b*).

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

Extension of the current supplemental on-airport shooting program into the peak period for Herring Gulls strikes is likely to reduce Herring Gull activity in JFK airspace.

Ultimate Effectiveness: Data indicate the current supplemental on-airport shooting program is part of a successful integrated bird hazard management program at JFK and has likely contributed substantially to increases in gull strike hazards. The current program was designed to emphasize response to hazards associated with the Laughing Gull colony. It seems likely that extension of this program to better match high activity periods for Herring Gulls will help further reduce hazards from Herring Gulls.

4.5.5 On Airport Rodent Control – Rodenticides

As noted in Chapter 1, a number of raptor species are struck at JFK including species which may prey on rodents. Primary raptor species struck at JFK which may consume rodents include Northern Harriers, American Kestrels, Snowy Owls, Barn Owls, Short-eared Owls, and Long-eared Owls. It's possible that these species are being struck as they fly through JFK airspace looking for prey. Strikes involving owls are of particular concern because most owl species, except Snowy Owls and Short-eared Owls only use the airport at night and under low-light conditions when they are difficult or impossible for the JFKWMU to detect and disperse. Snowy Owls and Short-Eared Owls may also be present during the day and may be dispersed when they are seen. Osprey are another raptor species of concern at JFK. However, Osprey at JFK are not feeding on rodents. Instead, Osprey bring their fish to the airfield or FAA radar towers to feed. During the 2001-2002 JFK WHA, the majority of raptors documented were engaged in aerial hunting (43%) followed by flying over the observation area (17%) and perched on manmade structures (16%).

The National Wildlife Research Center conducted a study comparing bird and rodent use of short (15 – 25 cm) vegetation and uncut areas at JFK (Barras et al. 2000*a*). Thirty three rodents from three species (house mouse, meadow vole, and white-footed mouse) were captured in uncut plots but only 12 individuals of one rodent species (house mouse) were captured in the mown areas. Interestingly, more raptors were observed using cut areas than uncut areas despite the higher rodent diversity and numbers in the uncut areas. The authors hypothesized that the pattern may have been attributable to difficulty of locating rodents in the heavier cover of the uncut plots. Barras et al. (2000*a*) suggested maintaining shorter vegetation on the entire airport which, in theory, should reduce the total number of small rodents available and corresponding foraging activity by raptors. Other habitat management practices suggested in Section 4.3.1 such as selecting vegetation less palatable to rodents may also help, but for reasons already discussed, are proving problematical to implement at JFK. Given the presence of raptors which feed on small mammals, toxicants zinc phosphide, chlorophacenone, and diphacenone, are being considered as additional means of reducing rodent populations.

Zinc Phosphide

Zinc phosphide at concentrations of 0.75% to 2.0% on grain, fruit, or vegetable baits, has been used successfully against such species as voles, ground squirrels, prairie dogs, Norway rats,

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

Polynesian rats, cotton rats and nutria. Zinc phosphide is a heavy, finely ground gray-black powder that is partially insoluble in water and alcohol. When exposed to moisture, it decomposes slowly and releases phosphine gas (PH_3). When zinc phosphide comes into contact with dilute acids in the stomach, phosphate (PH3) is released. It is this substance that probably caused death. Animals that ingest lethal amounts of bait usually succumb overnight with terminal symptoms of convulsions, paralysis, coma, and death from asphyxia. If death is prolonged for several days, intoxication that occurs is similar to intoxication with yellow phosphorous, in which the liver is heavily damaged. Prolonged exposure to phosphine can produce chronic phosphorous poisoning.

Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. For many uses of zinc phosphide formulated on grain or grain-based baits, pre-baiting is recommended or necessary for achieving good bait acceptance. Primary toxicity risks to nontarget species from the direct consumption of treated can be minimized through the use of bait stations to prevent access by nontarget species such as birds.

Because zinc phosphide is not stored in muscle or other tissues of poisoned animals, there is no secondary poisoning with this rodenticide. The bait however, remains toxic up to several days in the gut of the dead rodent. Other animals can be poisoned if they eat enough of the gut content of rodents recently killed with zinc phosphide.

Chlorophacenone and Diphacinone

Chlorophacenone and Diphacinone are first-generation anticoagulant rodenticides which require multiple feedings over a period of approximately 3-5 days to kill target animals (Timm 1994). The products depresses factors essential to normal blood clotting and cause increased fragility and permeability of capillaries leading to widespread internal hemorrhage. The products are absorbed primarily from the gastrointestinal tract of a treated animal and to a limited extent through the intact skin. Anticoagulant baits are usually readily accepted by rodents and rodents rarely develop an aversion to anticoagulant baits of good quality. Chlorophacenone and Diphacinone are primarily registered in New York for use in reducing the number of mice and rats (usually house mice, roof rats, and Norway rats) in and around buildings, but formulations both products are also registered for use in managing voles. Some formulations are also registered for use in transport vehicles (ships, trains, aircraft) and in and around related port and terminal buildings, garbage dumps and landfills. There is also a chlorophacenone formulation for the management of voles.

Chlorophacenone and diphacinone are highly toxic to rodents and other mammals, slightly toxic to humans, and minimally toxic to granivorous birds. It is a secondary hazard to predators and scavengers. The need for multiple feedings over a period of several days helps to minimize risks to nontarget species. To reduce risks of nontarget poisoning, bait would be placed in 2 inch diameter, 30 inch long PVC pipe bait stations. Bait stations would be placed out of reach of children and pets. Broadcast applications of bait are prohibited. Applicators must collect and properly dispose of dead animals to reduce risks of secondary poisoning. Ongoing programs to

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

harass and otherwise deter birds and other animals from using JFK will also reduce secondary poisoning hazards to raptors and avian scavengers. Fencing and access restrictions to JFK also help minimize risks to humans and pets.

Technical Implementation Feasibility

The FAA manual on wildlife hazard management at airports (Cleary and Dolbeer 2005) recommends managing rodent populations to reduce attractants for raptors and mammalian predators.

Efficacy

Operational Effectiveness: The FAA manual on wildlife hazard management at airports (Cleary and Dolbeer 2005) recommends managing rodent populations to reduce attractants for raptors and mammalian predators. Rodenticide programs can be effective in reducing local rodent densities.

Ultimate Effectiveness: Based on the findings of Barras et al. (2000*a*), rodent populations in the mown areas of JFK are relatively low. The cost and effort required to conduct a rodent management program may not reduce rodent populations and associated raptor foraging behavior sufficiently to warrant the time and expense of the program. If rodent populations can be reduced sufficiently to impact raptor foraging then this alternative may be effective in reducing bird strikes.

4.5.6 On Airport Eastern Cottontail Rabbit and Black-tailed Jackrabbit Control

Given the absence of any reports of damage to aircraft from rabbit or jackrabbit collisions, rabbits and hares do not pose a direct risk to aircraft at JFK. Jackrabbits are larger than cottontail rabbits and are only likely to be taken by the larger raptors and owls seen at JFK. Washburn et al. (2005*b*) reported that jackrabbits are abundant on the airport and may attract large migrating raptors such as Snowy Owls, Red-tailed Hawks and Rough-legged Hawks. Cottontail rabbits are smaller than jackrabbits and may be preyed upon by a wider range of raptors than jackrabbits. However, cottontail rabbits are generally less common than jackrabbits but the population at JFK has been documented to have dramatic population shifts including one in 2003-2004 when cottontail rabbits outnumbered jackrabbits in the survey (Washburn et al. 2005*b*).

Rabbits and hares are struck by aircraft at JFK (Fig. 1-32) and their carcasses are attractants to a variety of scavengers which, in turn, pose risks to aircraft at JFK. Washburn et al. (2005*b*) recommended that all carcasses of mammals struck at JFK should be removed immediately in order to avoid attracting scavenging birds. The 2001-2002 JFK WHA (USDA 2002) recommended using a shooting program to remove rabbits seen adjacent to runways. The proposed program would include efforts to eliminate the black-tailed jackrabbits (an introduced species) and reduce the cottontail rabbit population.

Evaluation of Methods for Alternative 3: Add Additional On-Airport Use of Lethal Methods - cont.

Technical Implementation Feasibility

It would be technically feasible to implement a shooting program to remove rabbits from JFK property. Although the introduced jackrabbit population has been at JFK for years, the population seems to be primarily restricted to JFK property which should make it easier to remove the population.

Efficacy

Operational Effectiveness: Shooting can be an effective way to reduce rabbit populations in relatively small areas. Duration of efficacy would depend on the rate at which individuals from areas outside JFK move into the site and reproduction of individuals remaining on airport. This issue is less of a concern for black-tailed jackrabbits than for cottontail rabbits because the jackrabbit population appears to be restricted to JFK property. JFK already runs a survey of rabbit and jack rabbits at the airport for use in monitoring population changes which could be used to monitor impact of a shooting program.

Ultimate Effectiveness: Effectiveness of removing rabbits and hares as a means of reducing bird strikes will depend on the extent to which rabbit and hare numbers contribute to hazards at JFK and the relative hazards from raptor species attracted by prey. Hawks and Owls ranked 9th and 13th respectively on the list of 21 most hazardous wildlife species to aircraft (Dolbeer et al. 2000).

4.6 METHODS EVALUATION FOR ALTERNATIVE 4: ADD OFF-AIRPORT LETHAL BIRD HAZARD MANAGEMENT TO CURRENT PROGRAM

Species which may be targeted for off-airport bird hazard management include those species which, because of their body size, abundance, and/or tendency to form migrating, roosting, or foraging flocks pose particular hazards to JFK (i.e., Canada Geese, Mute Swans, Double-crested Cormorants, crows, blackbirds, European Starlings, and Rock Pigeons). These species are also species which are known to move between Gateway NRA and NYC through JFK airspace (e.g., waterfowl) or are known to form feeding and roosting flocks within the 5 mile radius of JFK and which are known to move in and through aircraft approach and departure lanes (e.g., crows, blackbirds, starlings, and Rock Pigeons). This alternative does not include actions to reduce or relocate the Jamaica Bay Laughing Gull Colony (Alternative 5).

4.6.1 Implement Wildlife Hazard Monitoring Program and Improve Recording of Nonlethal Harassment Activities

Improvements in data collection and program monitoring are essential to a targeted and effective bird hazard management program. Recommended improvements in the recording of nonlethal

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

harassment activities and the implementation of a program to regularly monitor bird hazards at JFK are discussed in Section 4.4.1 and are also recommended for inclusion in this alternative.

4.6.2 Harassment with Limited Lethal

Off-airport harassment with limited lethal removal of birds would be conducted in the same manner as on-airport harassment with limited lethal control. Harassment as defined in Section 4.4.2 would be used to remove birds from treatment sites. In the event that birds appear to be habituating to the harassment, shooting may be used to reinforce harassment. Advantages and disadvantages of harassment remain as described in section 4.3.1. Use of lethal methods would reduce problems with habituation.

Gateway National Recreation Area

Harassment with limited lethal removal of birds would not occur on Gateway NRA, in part, because of concerns regarding harassment discussed for Alternative 2. Use of shooting with harassment would need to occur over a longer period of time than the live capture and removal discussed below as would associated impacts on nontarget species and park visitors. Additionally, taking of native birds would be inconsistent with the mission of the property.

Technical Implementation Feasibility

Experience from bird damage and nuisance reduction projects in New York and data from the literature indicate that harassment can be used effectively to reduce bird use of a specific site, so it is technically feasible to implement a harassment program. However, implementation of harassment programs can be extremely time and labor intensive. Optimal use of harassment will require information on the movement patterns of the species in question in order to best target harassment efforts. For species like Canada Geese which have an abundance of feeding, loafing and nesting options within the 5 mile radius of JFK, it will likely be necessary to coordinate harassment efforts among multiple landowners and managers, including those which may not have problems at the present time, in order to prevent birds from relocating to another site which will still result in bird-strike hazards at JFK. Adding the option to reinforce nonlethal method with lethal methods could help reduce the likelihood of problems with birds habituating to harassment methods. However, safety and regulatory constraints are likely to limit access to shooting off-airport. Consequently, this method is only likely to be used in limited circumstances.

Efficacy

Operational Effectiveness: Harassment can be an effective means of reducing target wildlife species use of a specific site and are one of the wildlife hazard management practices recommended in the FAA Manual on Wildlife Hazard Management at Airports (Cleary and Dolbeer 2005). Use of lethal methods can augment and/or extend the efficacy of harassment programs and reduce problems with animals becoming accustomed to the harassment devices. Pre-control review of alternate sites available to the target species and changes in bird activity in response to harassment will have to be carefully monitored. If action is not taken to reduce,

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

eliminate or exclude birds from attractants at the site, an on-going long term commitment to harassment will be needed.

Ultimate Effectiveness: Ultimate efficacy of harassment with limited lethal will depend on the movement of birds in response to the harassment effort. Problems with 'towering" and/or increases in bird flights in JFK airspace in response to harassment may actually increase risks to aircraft during the period required for birds to discontinue use of the site. Similarly, action must be taken to ensure that harassed birds do not relocate to new sites which pose similar or greater problems to aircraft safety.

4.6.3 Nest and Egg Destruction

Off-airport nest and egg destruction would be used to discourage bird use of off-airport nesting sites, and to reduce the local bird population through reduction in reproduction. It is also easier to harass adults from a site if they don't have offspring at the location (Preusser 2008). Successful implementation of this method requires that most nests be found and the eggs destroyed. 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, waterfowl which have nests and eggs destroyed in successive years may learn to nest away from the water making it more difficult to find nests. Unlike egg oiling and addling where birds may continue to incubate eggs that won't hatch, birds subjected to nest and egg destruction may immediately attempt to renest in a new location. Because of the amount of labor involved, nest destruction is estimated to cost significantly more than other forms of population management (Cooper and Keefe 1997). However, for colonial-nesting species such as cormorants, nest removal may be a viable management alternative. The Harbor Herons Conservation Plan (Elbin and Tsipoura 2010) suggests nest removal as a method for reducing adverse cormorant impacts on co-nesting waterbird species. Under this alternative, nest and egg removal could be used as a strategy to reduce cormorant use of sites which contribute to movement patterns through JFK airspace.

In long-lived species like waterfowl and gulls, although 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, Rockwell et. al 1997, USFWS 2005). Modeling of Canada Goose populations estimated that 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 objectives, and that nest/egg destruction is not an efficient or cost-effective damage management or population reduction approach. The Atlantic Flyway Resident Canada Goose Management Plan (Atlantic Flyway Council 1999), states that to effectively reduce resident goose populations,

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

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). Coluccy et al. (2004) found similar findings when modeling the Giant Canada Goose population in the Missouri. Their model indicated that reducing adult survival had a greater impact on the population than any other factor analyzed including nest destruction and removing nesting females. Based on their model, removal of 14% of adult geese was needed to stabilize the state goose population. In contrast, destruction of 71%, nests or removal of 71% of available juvenile geese, or removal of 32% of nesting females would be needed to achieve the same goal.

Gateway National Recreation Area

There are several species of birds that are a major threat to aviation safety that nest within Gateway NRA. Nest and egg destruction would be one method available to reduce the threat of resident Canada Geese, Mute Swans and Herring Gulls to aviation safety at JFK. Double-crested Cormorant management is not currently proposed for Gateway NRA. Resident Canada Geese currently nest in numerous locations on Gateway NRA lands and this option is likely to be time consuming, logistically challenging and expensive to implement. The degree of travel through the wetland areas needed to find Canada Goose nests could also have unacceptable levels of adverse impacts on saltmarsh grasses. In contrast, there are far fewer Mute Swan nests than Canada Goose nests. Egg oiling, addling and puncturing would be more viable alternatives for these species. In previous years, Gateway NRA has already implemented this type of program to reduce the population of non-native Mute Swan and their impacts on natural resources and native species at the park. Herring Gulls nest in colonies on a few discrete islands in Jamaica Bay. Herring Gulls have replaced Laughing Gulls in causing more bird aircraft strikes since 1998 (Figure 1-3). However, the role of the nesting Herring Gulls in strike hazards at JFK is unclear at this time. If future research indicates that the nesting colonies are contributing substantially to strikes at JFK, then this analysis would be supplemented pursuant to NEPA to review management alternatives. As with all methods proposed for Gateway NRA, egg oiling and addling would not be conducted unless permitted by the Gateway NRA supervisor.

Technical Implementation Feasibility

As discussed above, egg and nest destruction can be labor intensive and difficult to implement depending on the size of area to be treated and the nature of the vegetation on the site. As noted above, it is difficult to use nest and egg destruction to reduce local bird populations. Because of the abundance of alternate feeding and nesting sites in the JFK area for most of the species that could be targeted for off-airport bird hazard management, it may be necessary to coordinate management efforts at multiple sites, including those which may not currently have a damage problem in order to prevent birds from relocating to sites where they pose equal or greater hazard to aircraft.

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

Efficacy

Operational Effectiveness: Egg and nest destruction would be used to reduce the destination utility of JFK airspace by discouraging birds from using sites directly within aircraft approach and departure lanes. It would also be used to reduce transgression utility for birds which move through JFK airspace en-route between nesting and foraging sites.

Ultimate Effectiveness: Ultimate efficacy of this method, as with any method which does not reduce the density of adult birds, will depend on the movements of birds in response to the proposed management action. If birds can be encouraged to relocate to sites with fewer risks to aircraft, then this alternative may reduce bird hazards to aircraft at JFK.

For species with young that depend upon adults to bring them food while they're young, egg and nest destruction can reduce the amount of bird movements between nesting and foraging sites. If the path between nesting and feeding sites passes through JFK airspace, this type of reduction may result in a substantial reduction in bird strike hazards to aircraft.

4.6.4 Egg Oiling/Egg Addling/Puncturing

Egg addling is conducted by vigorously shaking an egg numerous times which causes detachment of the embryo from the egg sac. Egg oiling suppresses reproduction of nuisance birds by spraying a small quantity of mineral oil or food grade 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 EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. Egg puncturing also prevents egg hatching. Egg oiling is less labor intensive than egg addling and puncturing. Birds may remain on the nest and try to incubate the treated eggs. Depending on the timing of the treatment, and condition of the birds, the birds which have attempted to incubate oiled or addled eggs may not try to renest.

Egg oiling and egg addling has been used in conjunction with harassment and habitat management programs to reduce goose use of parks and sites in and around airports (York et al. 2001, Baxter and Robinson 2007, Preusser et al. 2008). Egg oiling helps reduce the growth rate of the local population in conjunction with efforts to move remaining birds to locations which pose fewer risks to aircraft. As with egg and nest destruction it is often easier to disperse adults from a site if they don't have young.

Gateway National Recreation Area

The potential use of egg oiling addling and puncturing at Gateway NRA would be the same as for nest and egg destruction discussed above. At present, this method is only proposed for Mute Swans, but could be used on Canada Geese if goose numbers are substantially reduced. Great Black Backed Gulls, Herring Gulls also nest in Gateway NRA. However, the relationship between the nesting colonies and risks to aircraft using JFK is unclear at this time. This method

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

will not be applied to these species at Gateway NRA unless data indicate action is warranted and this document is supplemented in accordance with the NEPA.

Technical Implementation Feasibility

As discussed for egg and nest destruction egg oiling and addling can be labor intensive and difficult to implement depending on the size of area to be treated and the nature of the vegetation on the site. Egg addling/egg oiling is only intended to prevent reproduction and, used alone, will not result in birds moving off site. Difficulties in reducing local populations of long-lived bird species exclusively through the use of egg oiling are as described for nest and egg destruction. Risks of birds moving to another site where they can cause equal or even greater risk to aircraft are lower for egg oiling and egg addling than for nest and egg destruction because birds are less likely to abandon the site while they believe they have eggs to incubate.

Efficacy

Operational Effectiveness: Egg oiling, addling and puncturing is not intended to cause adults to leave the nest site and, consequently, will not necessarily reduce the destination utility of JFK airspace by discouraging birds from using sites directly within aircraft approach and departure lanes. For species which go on foraging trips to obtain food for their young, egg oiling and addling would reduce the number of trips between nesting and foraging sites because adults would not have young to feed. Over the long term, the use of egg oiling and egg addling may reduce the local population of the target species in the vicinity of the airport.

Ultimate Effectiveness: Ultimate efficacy of this method will depend on the degree to which the local problem bird species population is reduced. For species which make foraging trips to obtain food for young, preventing reproduction will reduce the number of foraging trips through JFK airspace and may help reduce bird strike hazards.

4.6.5 Live Capture and Euthanasia

This method involves the use of live capture methods described in Section 4.4.2. However, instead of relocating the birds, all birds captured would be euthanized using cervical dislocation or CO_2 gas. For resident Canada Geese, it may be possible to donate meat from birds collected to public food donation programs.[14] Meat donation would be conducted in accordance with provisions established by the New York State Department of Health and the NYSDEP. Carcasses of birds captured using the avian tranquilizing agent alpha chloralose may not be donated for human consumption. Carcasses that cannot be donated for human consumption are disposed of in accordance with state and federal regulations.

Lethal removal of birds is intended for use in situations where the birds in a particular location are associated with a specific damage problem. For example, the 2001-2002 JFK WHA (USDA 2002) recommended reducing the abundance of geese at Baisley Park, noting that geese that use

[14] Requirements for the safe donation of goose meat for human consumption had not been finalized at the time the draft supplemental EIS was completed.

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

the park would often fly between the park and Jamaica Bay directly through JFK airspace. However, the hazard assessment also noted that, because of the high density of geese in the surrounding area, reducing goose densities at this park was likely to require a long-term commitment. At the Minneapolis St. Paul International Airport, Cooper (1991) determined that certain groups of geese from the surrounding area attempted to move onto the airport more than other groups. Removing these groups would substantially reduce goose strike hazards at the airport. Canada Geese at some sites in Orange County, NY studied by Preusser et al. (2008) showed a high degree of site fidelity despite several years of attempts to harass the birds from their preferred locations. In situations where birds associated with a damage problem exhibit this type of site fidelity live capture and removal can be an effective damage management technique. As with capture and relocation, a long-term commitment to bird removal may be needed. Unless habitat modification is implemented, new birds will continue to be attracted to the site.

Live capture and euthanasia, similar to the use of on-airport trapping and euthanasia (Section 4.3.1), may be used to reduce problems associated with locally abundant resident bird species such as European Starlings, blackbirds and Rock Pigeons.

Gateway National Recreation Area

The live capture and euthanasia of resident Canada Geese would be the most efficient means of reducing the number of resident Canada Geese on Gateway NRA and associated risks to aviation safety. In the summer of 2009, more than 775 Canada Geese were observed by personnel with WS and the NYCDEP at Rulers Bar Hassock. Geese coming from this island frequently cross Runway 13R/31L near the 13R approach or fly parallel along the 13R/31L runway and cross the north-south runways 4/22 R and L before exiting the east side of the airport. Also, geese come from the island and cross the Kilo Extension. The sites of the now-closed Pennsylvania Avenue and Fountain Avenue Landfills, are located west of the airport, and are within the approach and departure pathways for JFK. The two sites have been deeded to the National Park Service. However, NYC is responsible for environmental restoration. During 12 months in federal fiscal year 2009 (October 2008 to September 2009), an average of 15 Canada Geese were observed per survey at the landfills. Tagged Canada Geese from the landfills have been observed or shot at JFK. Gateway NRA permitted WS to remove resident Canada Geese from the landfills in 2010 (100 geese) and would continue to do so under this alternative.

The geese would be captured during the molt in mid-June to mid-July using panel traps (Constanzo et al.1995). This system captures molting geese quickly, rarely catches non-target wildlife, results in negligible habitat damage, and has minimal impact on nontarget species. Some wild birds will swim, walk or run away from where the capture of the geese is occurring and resume normal feeding, loafing, or other activities. A permit must be issued by Gateway NRA before this method could be used.

Technical Implementation Feasibility

This alternative is technically feasible. The live-capture and removal methods proposed in this section have been used by WS programs across the country to address bird damage management problems and reduce bird hazards to aircraft. Pannel traps (geese at Rikers Island) and

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

euthanasia and decoy-type cage traps and euthanasia (Rock Pigeons, starlings, crows, blackbirds) have successfully been used to reduce bird strike hazards at LaGuardia and JFK. To prevent tampering with the trap and harassment of captured birds, live traps set off-airport will need to be placed in locations that will minimize access to the capture device.

Efficacy

Operational Effectiveness: In situations where bird hazards to aircraft are associated with the activities of a specific set of birds, live capture and removal can reduce the number of birds moving through JFK airspace. Use of this method does not affect the original habitat factors which attracted birds to the problem area, so eventual recolonization of the site through immigration or reproduction of remaining individuals is likely. Magnitude and duration of impact will depend on the quality of habitat at the site where birds are removed, the landscape scale that the program is implemented over (i.e., size of area treated), the number of birds of the problem species using the area surrounding the treatment site, and the degree to which the target species explores and occupies new areas.

In 2009, NYC implemented a resident Canada Goose population reduction program to protect aviation safety, water supplies from fecal contamination, public and private property from damage to turf and ornamental plantings, and loss of land use due to excessive fecal deposits (Collins and Humberg 2010*a,b*). In 2009, 1,235 resident Canada Geese were removed from 17 sites. In 2010, an additional 1,676 geese were removed from 19 sites. Nine of the capture sites used in 2009 had no geese during the 2010 survey or had so few geese that additional removals were not warranted. In 2010, the number of geese counted at the remaining 8 sites where goose removal had been conducted in 2009 declined from 1,213 geese in 2009 to 593 geese in 2010, a 51% reduction (Collins and Humberg 2010*b*). The absence or low number of geese at 9 sites and substantial reductions at the remaining 8 sites approximately 1 year after initial removals were conducted indicates that this method can be successful in reducing resident Canada Goose use of specific locations.

Ultimate Effectiveness: Ultimate efficacy of this method will depend on the degree to which the local problem bird species population is reduced. Methods which substantially reduce bird movements through JFK airspace should result in a reduction in bird strike hazards.

An experimental Canada Goose removal project was conducted at Riker's Island, NY in an effort to reduce bird strike hazards at LaGuardia Airport in New York, NY (R. Dolbeer, WS, unpub. data). From July 2002 to June 2004, there were 9 Canada Goose strikes at LaGuardia Airport and an average goose strike rate of 0.38 strikes per month. Site evaluations revealed that Canada Goose hazards were linked to a group of geese using Riker's Island. In June 2004, 2005 and 2006, 518, 288 and 200 Canada Geese were captured per year, respectively, and removed from Rikers Island. From July 2004 to September 2006, there were only 3 goose strikes, 1occurred in August 2004, another in September 2004, and the last in April 2006. Strike rate per month dropped to 0.11 strikes per month.

In 2009, NYC initiated a resident Canada Goose population reduction program, in part, to reduce risks to aircraft using JFK and LaGuardia Airports. It is difficult to determine program efficacy

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

after only one year of implementation (Collins and Humberg 2010*a*). There was a 4-fold reduction in resident Canada Geese observed at LaGuardia airport, but there was no decrease in resident Canada Geese observed at JFK. The difference may have been attributable to differences in the way the goose removals were implemented around the two airports. It was possible to conduct resident Canada Goose removals on all sides of LaGuardia airport. In contrast, a substantial portion of the perimeter of JFK is adjacent to Gateway NRA which did not allow goose removals in 2009. More than 775 resident Canada Geese molted at Rulers Bar Hassock within Gateway NRA, only 1.1 miles from JFK. However, the number of resident Canada Geese shot at JFK did decrease in 2009. A similar decrease was not observed at LaGuardia. Findings from LaGuardia were confounded by the fact that staff at LaGuardia received new equipment which may have improved the efficacy of lethal removal actions.

4.6.6 Shooting

Normally shooting is conducted with shotguns or air rifles. Shooting is most commonly used to reinforce harassment, remove a single offending bird or to remove limited numbers of birds which cannot be removed using other methods. However, the program implemented at JFK has shown that shooting programs can also be effectively implemented to remove large numbers of birds. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997 Revised). It is selective for target species and animals are killed as quickly and humanely as possible. Shooting would be conducted in accordance with all applicable state, federal and local laws and regulations governing the use of firearms.

Firearm use is very sensitive matter and a public concern because of safety issues relating to the misuse of firearms and the potential for accidents when firearms are used in urban suburban areas. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 2 years thereafter (WS Directive 2.615). WS employees who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Gateway National Recreation Area

This method is not under consideration for use at Gateway NRA.

Technical Implementation Feasibility

WS personnel are trained in the safe and effective use of firearms in wildlife damage management. Use of this method is technically feasible. However, due to the extent of development and human activity in the area around JFK and associated safety concerns, and local regulations on firearms use, the number of situations where shooting would be appropriate for bird damage management are likely to be limited.

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

Efficacy

Operational Effectiveness: In situations where bird hazards to aircraft are associated with the activities of a specific set of birds, shooting may be effectively used to reduce the local population. Reductions in the local population of target birds will reduce the number of individuals flying through JFK airspace. However, shooting may most practical when limited numbers of birds are encountered or for the removal of limited numbers of individuals left after other nonlethal and lethal removal efforts have been attempted. Initiation of shooting can cause the remaining birds to flush from the site. Like harassment discussed above and in Section 4.4, methods which cause birds to flush from a site may cause at least a short-term increase in hazards to aircraft.

Use of this method does not affect the original habitat factors which attracted birds to the problem area, so eventual recolonization of the site through immigration or reproduction of remaining individuals is likely. Magnitude and duration of impact will depend on the quality of habitat at the site where birds are removed, the number of birds of the problem species using the area surrounding the treatment site, and the degree to which the target species explores and occupies new areas.

Ultimate Effectiveness: There are some concerns that this method could result in short-term increases in hazards to aircraft because it may cause birds to flush from a site in response to sound of the firearm and/or the death of adjacent individuals. Ultimate efficacy of this method will depend on the extent to which a particular group of birds consistently contributes to aircraft hazards and the degree to which the local problem bird species population is reduced.

4.6.7 Avicides

Avian toxicants can be used to reduce the number of birds using an area. DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, and crows. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (West et al. 1967, Besser et al. 1967, Decino et al. 1966). Blanton et al. (1992) reported that DRC-1339 was a very effective, selective, and safe means of urban pigeon population reduction. Under this alternative DRC-1339 could be used to reduce local populations of starlings, crows, blackbirds, and pigeons.

DRC-1339 was developed as an avicide because of it is much less toxic to mammals than birds. Additionally, DRC-1339 is only highly toxic to certain birds species (sensitive species) but only slightly toxic to other birds, including predatory birds (non-sensitive species). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens are highly sensitive to DRC-1339. Many other bird species such as raptors, sparrows, and eagles are classified as non-sensitive. Numerous studies show that, used properly, DRC-1339 poses minimal risk of primary poisoning to nontarget and T&E species (USDA 1997 Revised). Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are very low (USDA 1997 Revised – Appendix P).

All pesticide use for bird hazard management at JFK would be conducted in accordance with label directions and applicable state, federal and local regulations on the storage, use and disposal of pesticides. DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997 Revised). Appendix P of USDA (1997 Revised) contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion. That assessment concluded that no adverse effects are expected from use of DRC-1339.

Gateway National Recreation Area

This method is not under consideration for use at Gateway NRA under this alternative.

Technical Implementation Feasibility

DRCE-1339 is labeled for use in removing populations of starlings, crows, blackbirds, pigeons and gulls. WS personnel are trained in the safe and effective use of DRC-1339. This method is technically feasible. This product is not registered by New York State for use on Laughing Gulls.

Efficacy

Operational Effectiveness: In situations where bird hazards to aircraft are associated with the activities of a specific set of birds, avicide can be effectively used to reduce the local population. Reductions in the local population of target birds will reduce the number of individuals flying through JFK airspace.

This method does require the use of a prebaiting period to familiarize birds with the bait and baiting area and to monitor for nontarget species. Depending on movement patterns of birds and the options for placement of the bait station, this method may result in a slight short-term increase in bird activity and associated hazards to aircraft. However, unlike the use of the chemical contraceptive, nicarbazin, discussed above, duration of baiting is relatively short and is more likely to concentrate activity of existing birds at the site than attract new birds from the outside area to the bait location.

Use of this method does not affect the original habitat factors which attracted birds to the problem area, so eventual recolonization of the site through immigration or reproduction of

Evaluation of Methods for Alternative 4: Add Off-Airport Use of Lethal Methods - cont.

remaining individuals is likely. Magnitude and duration of impact will depend on the quality of habitat at the site where birds are removed, the number of birds of the problem species using the area surrounding the treatment site, and the degree to which the target species explores and occupies new areas.

Ultimate Effectiveness: There are some concerns that this method could result in short-term increases in hazards to aircraft because the bait will concentrate birds in a specific area and has a low, but real, chance of attracting a limited number of new birds to the site. Overall, changes in risks of bird strikes are likely to be minimal because of the short duration of the baiting period and, in some cases, can be minimized by placing bait locations in areas which minimize bird movement through JFK airspace. For example, in situations where a group of blackbirds regularly tried to go from a roost location on one side of the airport, across JFK airspace to feeding areas on another side of the airport, the bait station could be placed on the side of the airport closes to the roost site. Ideally birds will stop at the roost site and will not continue their usual flight across JFK, which could actually reduce bird strike hazards. Ultimate efficacy of this method will depend on the extent to which a particular group of birds consistently contributes to aircraft hazards and the degree to which the local problem bird species population is reduced.

4.7 METHODS EVALUATION FOR ALTERNATIVE 5: ADD REDUCTION OR RELOCATION OF THE LAUGHING GULL COLONY TO CURRENT BIRD HAZARD MANAGEMENT PROGRAM

As noted in the 1994 FEIS, the proximity of the Laughing Gull Colony to the runways at JFK contributes substantially to risks associated with this species. Prior to the implementation of the integrated bird hazard management program including the supplemental on-airport shooting program, Laughing Gull strike rates at JFK increased concurrently with increases in the size of the Laughing Gull colony (Section 4.3.1). Reduction of the Laughing Gull colony was proposed as a means of reducing Laughing Gull strike hazards. The 1994 FEIS used a model of Laughing Gull population dynamics to evaluate the potential efficacy of nonlethal and lethal methods for reducing the Laughing Gull colony. The only method that was implemented as a result of the 1994 FEIS with the potential to reduce the Laughing Gull colony was the supplemental on-airport shooting program (Section 4.3.1). Implementation of the supplemental on-airport shooting program was proposed as a short-term means of reducing gull strikes at JFK with relocation of the Laughing Gull colony proposed as a long-term solution. The final ROD from the USFWS added the provision that colony relocation efforts would only be implemented if other methods failed to adequately reduce strikes from Laughing Gulls.

4.7.1 Impact of the On-Airport Methods for Reducing Laughing Gull Colony and Laughing Gull Strikes

The size of the Laughing Gull colony has decreased from a high of 7,629 nests recorded during a ground-based survey in 1990 to a low of 1,346 nests in 2007 (95% CI = 1,276-1,430; Washburn and Tyson 2010). The supplemental on-airport shooting program has contributed to the

Evaluation of Methods for Alternative 5: Relocation of Laughing Gull Colony - cont.

reduction in the Laughing Gull colony, but environmental factors have also had an impact, especially in recent years. The sharp decline in nesting on East High Meadow (beginning in 1997) and Silver Hole (beginning in 2000) is likely related to tidal flooding and marsh erosion (Washburn and Tyson 2010).

As noted above (Sections 1.6 and 4.3), Laughing Gull strikes have declined since the implementation of the supplemental on-airport shooting program in 1991 and the Integrated Bird Hazard Management Program developed as a result of the 1994 FEIS. Declines in Laughing Gull strikes have been greater than would be predicted given the size of the colony. Dolbeer et al. (2003) and Washburn et al. (2009) have hypothesized that Laughing Gulls may be changing flight patterns in order to avoid flying over the airport. However, during a study by Barras et al. (2000*b*) Laughing Gulls exhibited less avoidance of the shooting stations than the other gull species. The authors hypothesized that the difference might be attributable a greater proportion of immature birds and naïve birds in the Laughing Gull population than in the other gull populations. A relatively high proportion of immature Laughing Gulls would be expected given the proximity of the breeding colony. The proportion of young or naïve birds may have been influenced by immigrants from the surrounding area which arrived in response to reductions caused by the supplemental on-airport shooting program.

Brown et al. (2001*a*) used data from a chick marking study and assumptions from a diet study to contended that the majority (60-90%) of Laughing Gulls shot at JFK were failed and/or nonbreeding birds and that efforts to decrease reproduction at the colony and relocate the colony could potentially result in even more nonbreeding birds and increased hazards to aircraft. However, direct observations of the age and breeding status of birds collected by the supplemental on-airport shooting program do not appear to support this conclusion. Data from Washburn et al. 2009 on the 75,668 Laughing Gulls taken at JFK by the supplemental on-airport shooting program and recovered for analysis, indicate that the Laughing Gull colony appeared to be the source of most Laughing Gulls attempting to fly over the airport. Of the 2 yr. and >3 year old females examined, 54% and 88% respectively had laid eggs. Ninety percent of the total Laughing Gulls shot from 1991-2008 were in adult plumage and >95% of the birds in adult plumage examined in 1991 and 1992 had well developed brood patches (Dolbeer et al. 1992, Washburn et al. 2009).

From 1991-2008, 90,592 Laughing Gulls have been shot by the supplemental on-airport shooting program. Washburn et al. (2009) noted that while the supplemental on-airport shooting program has been effective in reducing strikes it has not been effective in dispersing the colony from its present location. Washburn et al. (2009) recommended that a preferable long-term solution to the Laughing Gull problem would be to develop a plan to relocate the colony. Although Brown et al. (2001*a*) asserted that there was no evidence indicating that direct efforts to reduce or eliminate the Laughing Gull colony were needed to reduce total reported strikes at JFK, they also recommended evaluation of relocation of the Laughing Gull colony to address animal welfare concerns and the concerns regarding the long-term impacts of the JFK program on regional Laughing Gull population. For these reasons, relocating the Laughing Gull Colony has been included as a management alternative.

Evaluation of Methods for Alternative 5: Relocation of Laughing Gull Colony - cont.

4.7.2 Off-Airport Methods Analyzed in the 1994 FEIS for Relocation of the Laughing Gull Colony

The 1994 FEIS contains a detailed analysis of alternatives for reducing the Jamaica Bay Laughing Gull Colony. Methods available and the feasibility of the proposed methods remain as analyzed in the 1994 FEIS. This alternative is a combination of the Nonlethal Gull Hazard Control: Off-Airport Alternatives (1994 FEIS Section 3.3) and the Lethal Gull Control Alternative (1994 FEIS Section 3.5) that were determined to be feasible, effective and environmentally acceptable. Specific methods that could be used to reduce the Jamaica Bay Laughing Gull Colony that were identified in the 1994 FEIS include nest and egg destruction, egg oiling, avicides, shooting on-colony and the use of dead-gull models. The only change in this analysis is that alpha chloralose would no-longer be considered for use as a toxicant. As discussed in Section 4.4.2, alpha chloralose is currently only registered for use as an immobilizing agent. The avicide DRC-1339 is now federally registered for use on Laughing Gulls in New York, but is not registered for use by the state. Consequently, this product continues to be unavailable for use under this alternative.

4.7.3 Efficacy of Off-Airport Methods for Relocating the Laughing Gull Colony

Additional information has become available over the last two decades which shows the difficulty in dispersing gull colonies (Blokpoel and Tessier 1992). The level of difficult varies depending upon the species to be dispersed. Ring-billed Gull nesting colonies on roof tops have been dispersed, usually in 1 year (Blokpoel and Tessier 1992, Forbes et al. 1995, Ickes et al. 1998). Most Herring Gull colonies on roof tops only showed a reduction in the number of nesting gulls after 6 years of dispersal efforts (Ickes et al. 1998). However, Belant and Ickes (1996) were able to disperse a mixed Ring-billed and Herring Gull nesting colony in two years. A Black-headed Gull nesting colony on an island was reduced substantially and then stabilized at 1/6 to 1/3 of the original population after 5 years (Thomas 1972).

There is no published data on dispersing Laughing Gull nesting colonies. A Laughing Gull project in Virginia has reduced the number of nesting gulls from a peak of 7,129 nests to 1,886 nests on South Island after 6 years of egg oiling (D. Allaben, USDA, Wildlife Services, pers. comm.). Additionally, up to 1,000 gulls were killed annual at a nearby project which probably confounded the results of the number of Laughing Gull nests remaining after 6 years. Some Laughing Gulls which historically nested on South Island were believed to have moved to Plum Island and Grandview Beach about 1 mile away.

The 1994 FEIS analyzed a number of habitat alteration methods to move the Laughing Gull nesting colony and concluded the adverse environmental impacts were unacceptable. Flooding of the nesting colony was not considered in the earlier analysis. Habitat alteration may be the most likely way to cause a Laughing Gull nesting colony to disperse (B. Washburn, USDA National Wildlife Research Center and D. Allaben, USDA Wildlife Services, pers. comm.). They both reported flooding of Laughing Gull nests caused colonies to move. Severe spring storms and high tides flooded numerous nests on Virginia's barrier islands in 2010 which resulted in Laughing Gulls colonies being abandoned or moving to upland areas (D. Allaben, USDA Wildlife Services, pers. comm.). A Laughing Gull nesting colony at Barnegat Light in

Evaluation of Methods for Alternative 5: Relocation of Laughing Gull Colony - cont.

New Jersey apparently moved to Jamaica Bay after elevated spring tides displaced nesting Laughing Gulls due to a major jetty construction project (Washburn and Tyson 2010). Flooding of the Laughing Gull nesting colony in Jamaica Bay is impractical and unreasonable.

Numerous techniques have been attempted to disperse nesting gull colonies. The most effective methods appeared to be, either singly or in combination, nest and egg destruction and overhead wire grids. Nest and egg destruction or oiling has been used to disperse or reduce the number of nesting Ring-billed and Herring Gulls (Blokpoel and Tessier 1986, Blokpoel and Tessier 1992, Ickes et al. 1998, Thomas 1972,). Forbes et al. (1995) and Belant and Ickes (1996) have used overhead wire grids over nesting colonies to disperse Ring-billed and Herring Gulls in 1-3 years. Laughing Gulls are unaffected by overhead wires (Dolbeer et al. 1988). Pochop et al. (2001) has used parallel lines at 5m spacing with hanging ropes, similar to a curtain, to reduce the number of nesting Ring-billed Gulls on an island. Other techniques have been used with less success such as mylar flags (Belant and Ickes 1997), distress calls, effigies, shooting, and other methods (Thomas 1972) at dispersing nesting colonies or were logistically difficult such as tethering raptors to areas within a gull nesting colony (Blokpoel and Tessier 1986). The 1994 FEIS analyzed wire barriers and concluded it was not feasible due to the many technical problems and large expansive area of the nesting colony.

When gull nesting colonies were dispersed there was an alternative location for the colony. There is potentially an alternative location for Laughing Gulls to nest if the colony was moved from Jamaica Bay. Dispersed gull nesting colonies in urban areas tended to move to nearby roof tops (Belant and Ickes 1996, Blokpoel and Tessier 1992). Dispersed gull nesting colonies on islands moved to parts of the island without control methods or to nearby islands (Pochop et al. 2001). Habitat on Long Island and the NYC vicinity was surveyed using Geographic Information Systems and ground truthed to verify potential Laughing Gull nesting habitat. Nesting habitat of the appropriate plant species was located in Great South Bay which is near Jamaica Bay (B. Washburn et al. 2010).

4.8 METHODS EVALUAITON FOR ALTERNATIVE 6: INCREASE INTEGRATED BIRD HAZARD MANAGEMENT – PROPOSED ACTION

The previous alternatives described nonlethal and lethal alternatives for use on and off-airport in the reduction of bird hazards to aircraft that were feasible and effective to a varying degree. No one alternative will be sufficient to address all bird hazards at JFK and the efficacy of some methods is likely to be substantially improved if the methods are combined. This alternative involves the use of the feasible and effective methods identified for use in alternatives 1-5 above. Selection of this alternative would give managers access to the full range of viable alternatives for reducing bird strike hazards at JFK.

Gateway National Recreation Area

Under this alternative habitat modification, exclusion, harassment and frightening devices, human behavior management, nest and egg destruction, egg oiling/egg addling, and live capture

Evaluation of Methods for Alternative 6: Increase Integrated Bird Hazard Management - cont.

and euthanasia could occur at Fountain and Pennsylvania Avenue Landfills and Rulers Bar Hassock. Use of human behavior management, exclusion devices and repellents could be used at other locations within the park. These actions may be implemented by NPS, WS or contractors as permitted by NPS. Additional management actions (e.g., management of Herring Gulls as discussed in Alternative 4 for egg oiling/addling/puncturing, would only occur after additional environmental review as required by NEPA and National Parks Service policies.

Technical Implementation Feasibility

The feasibility of the methods to be included in this alternative have been discussed above. By definition all elements would be feasible for implementation, because this is one of the criterion used for inclusion of methods in this alternative.

Efficacy

Operational Effectiveness: Use of an integrated bird hazard management program was identified in the EIS as the best means of reducing bird strike hazards at JFK and provides examples of projects which used integrated strategies to reduce problems with gulls. The literature also includes examples of the use of integrated programs to reduce conflicts with the species causing problems at JFK including a project to reduce Canada Goose activity in Orange County, NY (Preusser et al. 2008); projects to reduce bird hazards to aircraft at airports in Anchorage AK (York et al. 2000, 2001), a project to reduce hazards at an airport in Minneapolis MN (Cooper 1991), and a project to reduce Canada Goose hazards to aircraft at an airport in the UK (Baxter and Robinson 2007). Access to a wide variety of management methods is especially important when working to address off-airport factors contributing to bird strikes at JFK. Access to the widest possible range of damage management methods will better enable biologists to accommodate the individual needs and characteristics of off-airport sites while still effectively addressing the factors which are contributing to bird strike hazards at JFK.

Ultimate Effectiveness: The effectiveness of the different potential alternatives that could be included in the IMP is discussed in the preceding sections under each individual alternative. The effectiveness of the combined elements within the IMP is likely to be greater than the sum of the parts. Combination of nonlethal elements such as habitat management which can provide long-term solutions but which may take time to implement, with a lethal method like live-capture and removal allows for an immediate response to risks to human health and safety while also providing for long-term resolution of the issue.

Table 4-2. Alternatives Analysis Methodology. List does not include methods that were eliminated from inclusion in the final alternatives in the SEIS unless new data or application to new species warrants additional review of the method.

Tier 1				Tier 2			Tier 3
Alternatives Considered	**Criterion: Feasible (F)/ Effective (E)**			**Feasible and Effective Alternatives Warranting Environmental Analysis**		**Criterion: Environmental Compatibility**	**Low-Impact Alternatives Available for Selection in Preferred Alternative**
	F	**E**					
Alternative 1: Continue Current Bird Hazard Management Activities (No-action Alternative)							
On-Airport:							
Vegetation Management	Mod.	High		Vegetation Management		Mod.	Vegetation Management
Water Management	Mod.	High		Water Management		Mod.	Water Management
Waste Management	Mod.	High		Waste Management		High	Waste Management
Insect Management	High	High		Insect Management		Mod.	Insect Management
Building Management	Mod.	High		Building Management		High	Building Management
Harassment with limited lethal via shooting	High	Mod		Harassment with limited lethal via shooting		High	Harassment with limited lethal via shooting
Harassment with limited lethal via falconry	High	Low					
Trapping and Euthanasia	Mod.	Mod.		Trapping and Euthanasia		Mod.	Trapping and Euthanasia
Barriers and Exclusion Devices	Mod.	High		Barriers and Exclusion Devices		High	Barriers and Exclusion Devices
Frightening Devices	High	Variable		Frightening Devices		High	Frightening Devices
Repellents	Mod.	Mod.		Repellents		Mod.	Repellents
Supplemental On-airport Shooting Program	High	High		Supplemental On-airport Shooting Program		Mod.	Supplemental On-airport Shooting Program
On-Board Bird Deterrent Devices	Low	**					
Bird Tracking and Warning Systems	Mod.	**					
Bird Hazard Management Research	High	High		Bird Hazard Management Research		High	Bird Hazard Management Research
Off-Airport							
Consultation/Coordination with Off-Airport Landowners/Managers	High	Mod.		Consultation/ Coordination with Off-Airport Landowners/ Managers		High	Consultation/ Coordination with Off-Airport Landowners/ Managers
Bird Hazard Management Research	High	High		Bird Hazard Management Research		High	Bird Hazard Management Research
Alternative 2: Add Additional Nonlethal Bird Hazard Management to Current Program							
On-Airport							
Implement Bird Hazard Monitoring Program	Mod.	Mod.		Implement Bird Hazard Assessment Protocol		High	Implement Bird Hazard Assessment Protocol
Improve Recording of Nonlethal Harassment Activities	Mod.	Mod.		Improve Recording of Nonlethal Harassment Activities		High	Improve Recording of Nonlethal Harassment Activities
Lasers	Mod.	Low		Lasers		High	Lasers
Paintballs	High	High		Paintballs		High	Paintballs
Repellent	Low	Mod		Repellent		Mod.	Repellent
Relocation	Mod.	Mod.		Relocation		High	Relocation
Off-Airport							
Habitat Management	Var.	Mod.		Habitat Management		Var.	Habitat Management
Exclusion	Var.	High		Exclusion		Var.	Exclusion
Harassment (non lethal)	Mod.	Mod.		Harassment (non lethal)		Mod	Harassment (non lethal)
Relocation	Low	High		Capture and Relocation		Mod.	Capture and Relocation
Repellents	Low	Low					

Tier 1				Tier 2				Tier 3
Alternatives Considered		**Criterion: Feasible (F)/ Effective (E)** F	E	**Feasible and Effective Alternatives Warranting Environmental Analysis**		**Criterion: Environmental Compatibility**		**Low-Impact Alternatives Available for Selection in Preferred Alternative**
Manage Human Behavior		Low	Mod.	Manage Human Behavior		High		Manage Human Behavior
Reproductive Inhibitors		Low	Low					
Alternative 3: Add Additional On-Airport Lethal Bird Hazard Management Activities to Current Program								
Implement Bird Hazard Monitoring Program		Mod.	Mod.	Implement Bird Hazard Assessment Protocol		High		Implement Bird Hazard Assessment Protocol
Improve Recording of Nonlethal Harassment Activities		Mod.	Mod.	Improve Recording of Nonlethal Harassment Activities		High		Improve Recording of Nonlethal Harassment Activities
Increase Length of Supplemental On-airport Shooting Program		High	High	Increase Length of Supplemental On-airport Shooting Program		High		Increase Length of Supplemental On-airport Shooting Program
Increase Species Taken by Supplemental Shooting Program		High	High	Increase Species Taken by Supplemental Shooting Program		High		Increase Species Taken by Supplemental Shooting Program
On-airport Nest/egg Destruction		High	Low	On-airport Nest/egg Destruction		Mod.		On-airport Nest/egg Destruction
Rodent Control - Toxicants		Mod.	Mod.	Rodent Control - Toxicants		Mod.		Rodent Control - Toxicants
Rabbit Control – shooting		High	High	Rabbit Control – shooting		Mod.		Rabbit Control – shooting
Alternative 4: Add Off-Airport Lethal Bird Hazard Management to Current Program								
Implement Bird Hazard Monitoring Program		Mod.	Mod.	Implement Bird Hazard Assessment Protocol		High		Implement Bird Hazard Assessment Protocol
Improve Recording of Nonlethal Harassment Activities		Mod.	Mod.	Improve Recording of Nonlethal Harassment Activities		High		Improve Recording of Nonlethal Harassment Activities
Harassment with Limited Lethal		Low	Low	Harassment with Limited Lethal				
Egg and Nest Destruction		Mod.	Low	Egg and Nest Destruction		Mod.		Egg and Nest Destruction
Egg Oiling/Addling/Puncturing		Mod.	Low	Egg Oiling/Addling..		Mod.		Egg Oiling/Addling..
Live Capture and Lethal Removal		Mod	High	Live Capture and Lethal Removal		Mod.		Live Capture and Lethal Removal
Shooting		Low	Mod.	Shooting				Shooting
Avicides		Mod.	Mod.	Avicides		Mod.		Avicides
Alternative 5: Add Reduction/Relocation of Laughing Gull Colony to Current Program								
Implement Bird Hazard Monitoring Program		Mod.	Mod.	Implement Bird Hazard Assessment Protocol		High		Implement Bird Hazard Assessment Protocol
Improve Recording of Nonlethal Harassment Activities		Mod.	Mod.	Improve Recording of Nonlethal Harassment Activities		High		Improve Recording of Nonlethal Harassment Activities
Nest/Egg Destruction		Mod.	Low	Nest/Egg Destruction		Mod.		Nest/Egg Destruction
Egg Oiling/Addling		Mod.	Low	Egg Oiling/Addling		Mod.		Egg Oiling/Addling
Avicide		Low	Mod.	Avicide		Mod.		Avicide
Shooting On-Colony		High	Mod.	Shooting On-Colony		Mod.		Shooting On-Colony
Synthetic Dead Gull Models		High	Low	Synthetic Dead Gull Models		High		Synthetic Dead Gull Models
Alternative 6: Increase Integrated Bird Hazard Management –Proposed Action								
Implement Alternatives 1-5		Mod.	High	Implement Alternatives 1-5		Mod.		Implement Alternatives 1-5

** There is insufficient information on the feasibility and/or efficacy of these methods to warrant implementation of these methods at the present time.

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CHAPTER 5

AFFECTED ENVIRONMENT

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5.0 AFFECTED ENVIRONENT

This section provides information on the environment in and around JFK including information on wildlife, water quality, air quality, and parkland. It also provides information on the coastal zone management programs which guide resource management in the Jamaica Bay Area. This section updates information provided in the 1994 FEIS.

5.1 ECOLOGICAL ENVIRONMENT

5.1.1 Wildlife and Plants

The NYC area, including Gateway NRA, supports an amazing diversity of wildlife and plant species (NYCDEP 2007, NPS 2008). This supplement focuses on the management of hazards to aircraft from birds using the area in and around JFK. The 1994 FEIS Table 4-1 contains a list of bird species observed by the JFKWMU during the period of 1957-1992. Appendix C includes a list of all bird strikes (Includes all reported strikes plus carcasses found within 200 feet of centerline of active runway for which an alternative source of mortality could not be identified) recorded for JFK during the period of 1994-2009. New bird species struck by aircraft or found by the JFKWMU during the period of 2004-2009, or observed during the 2001-2002 WHA (USDA 2002) that were not in the 1994 FEIS are listed below in Table 5-1. Detailed information on the species which have been identified as posing particular hazards to aircraft at JFK and which are targeted by bird hazard management activities are discussed in detail in Section 1.7 and in Chapter 6 discussions of environmental impacts. This section identifies wildlife and plant species which may be of particular concern when planning bird hazard management activities because of their status as state or federally-listed threatened and endangered species or species of conservation concern. It also considers bird species which nest in and near the area used by the Jamaica Bay Laughing Gull colony.

Table 5-1. Bird species observed on or near JFK in addition to those listed in Table 4-1 of the 1994 FEIS. Data collected from bird strike records (1994-2009), JFKWMU bird take reports, and the 2001-2002 WHA (USDA 2002).

Coot, American	Ovenbird
Cormorant, Great	Owl, Barred
Crow, Fish	Phoebe, Eastern
Cuckoo, Yellow-billed	Sandpiper, Least
Duck, Ring-necked	Sparrow, Chipping
Eagle, Bald	Swift, Chimney
Grackle, Boat-tailed	Teal, Blue-winged
Grebe, Pied-billed	Teal, Cinnamon
Grebe, Red-necked	Tern, Forster's
Gyrfalcon	Tern, Roseate
Heron, Green	Towhee, Eastern
Heron, Little Blue	Warbler, Pine
Heron, Tri-colored	Warbler, Yellow
Merganser, Common	Waterthrush, Northern
Merganser, Hooded	Whip-poor-will
Oriole, Baltimore	

Threatened and Endangered Species

The Natural Heritage Program database, JFK strike records, the Jamaica Bay Watershed Protection Plan (NYCDEP 2007), WS surveys at Fountain Avenue and Pennsylvania Avenue Landfills, and records kept by the Gateway NRA were reviewed to determine the likelihood that state or federally listed species would be at or near JFK. The search provided no records of state or federally-listed threatened or endangered mammals, fish, or mollusks at or near JFK. There are state and federally-listed bird, reptile and amphibian species in the vicinity of JFK (Table 5-2). Gateway NRA has participated in a program to re-establish the Northeastern Beach Tiger Beetle at Sandy Hook, but no beetles were observed in 2009 and 2010 surveys. The Natural Heritage Database and the Gateway NRA herbarium records also indicate that some state and federally-listed plant species may be found at or near JFK (Table 4-2a-c).

Table 5-2. State and Federally-listed animals and plants known to occur in and around JFK.

a. State- and Federally-Listed Birds			
Common Name	**Federal Status**	**State Status**	**Observed at or near JFK**
Peregrine Falcon		E	W X confirmed breeder
Black Rail		E	(very rare)
Piping Plover	T	E	W * (confirmed breeder, rare)
Roseate Tern	E	E	X (occasional breeder, rare)
Black Tern		E	(uncommon)
Short-eared Owl		E	W X * (confirmed breeder, uncommon)
Loggerhead Shrike		E	(very rare)
Pied-billed Grebe		T	W X* ● (confirmed breeder, uncommon)
Least Bittern		T	● (confirmed breeder, rare)
Bald Eagle		T	(rare)
Northern Harrier		T	W X * ● (confirmed breeder, uncommon)
King Rail		T	(very rare)
Upland Sandpiper		T	W X * ● (breeder pre-1993, rare)
Common Tern		T	W X * ● (confirmed breeder, abundant)
Least Tern		T	W * ● (breeder pre-1970, common)
Sedge Wren		T	(very rare)
Henslow's Sparrow		T	(very rare)
Red Knot		C	* (use bay during migration)
Common Loon		SC	X (uncommon)
American Bittern		SC	X (breeder pre-1970, rare)
Osprey		SC	X ● (confirmed breeder, common)
Sharp-shinned Hawk		SC	(uncommon)

Cooper's Hawk		SC	X (rare)
Northern Goshawk		SC	(rare)
Red-shouldered Hawk		SC	(rare)
Black Skimmer		SC	X * (confirmed breeder, abundant)
Common Nighthawk		SC	X (rare)
Whip-poor-will		SC	(rare)
Red-headed Woodpecker		SC	(rare)
Horned Lark		SC	X (breeder pre-1993, rare)
Golden-winged Warbler		SC	(rare)
Cerulean Warbler		SC	(rare)
Yellow-breasted Chat		SC	(rare)
Vesper Sparrow		SC	(rare)
Grasshopper Sparrow		SC	(breeder pre-1993, very rare)
Seaside Sparrow		SC	● (confirmed breeder, uncommon)

X - Involved in bird strikes during the period of 1994-2007 (Appendix C).
W - Wildlife Services' surveys of Pennsylvania Avenue and Fountain Avenue Landfills and surrounding water (Collins 2009).
* - Listed in the "Natural Heritage Report on Rare Species and Ecological Communities" as occurring at or near JFK
● - NYSDEC Breeding Bird Atlas 2000-2005 surveys
E - Endangered; T - Threatened; SC - Species of Concern; C - Candidate
( ) – Gateway NRA records in Jamaica Bay, from airport boundary to north shore of Breezy Point Tip

b. State- and Federally-Listed Reptile and Amphibians

Common Name	Federal Status	State Status	Observed at JFK or Jamaica Bay
Mud Turtle		E	(introduced and confirmed established)
Eastern Tiger Salamander		E	(uncertain: rare or absent)
Atlantic Hawksbill Sea Turtle	E	E	(uncertain: rare or absent)
Atlantic Ridley Sea Turtle	E	E	** (uncertain: rare or absent)
Leatherback Sea Turtle	E	E	** (uncertain: rare or absent)
Green Sea Turtle	T	T	**
Loggerhead Sea Turtle	T	T	**
Spotted Turtle		SC	(introduced and confirmed established)
Wood Turtle		SC	
Eastern Box Turtle		SC	(introduced and confirmed established)
Eastern Hognose Snake		SC	(introduced but not confirmed established)

Eastern Spadefoot Toad		SC	(introduced but not confirmed established)

E - Endangered; T - Threatened; SC - Species of Concern; C - Candidate
** - Listed as being seen in Jamaica Bay – Jamaica Bay Plan or USACE 2002.
( ) - Gateway NRA records.

d. State- and Federally-Listed Plants

Common Name	Federal Status	State Status	Observed at JFK or Jamaica Bay
Seabeach Amaranth	T	E	* NPS
Silvery Aster		E	*
Side-oats Grama		E	*
Smartweed Dodder		E	NPS
Yellow Flatsedge		E	* NPS
Coast Flatsedge		E	*
Retrorse Flatsedge		E	* NPS
Round-leaf Boneset		E	NPS
Late Boneset		E	*
Scirpus-like Rush		E	*
Prostrate Juniper		E	NPS
Gypsy-wort		E	NPS
Four-flowered Loosestrife		E	NPS
Sweetbay Magnolia		E	NPS
Green Parrot's-feather		E	*
Cut-leaved Evening-primrose		E	NPS
Stiff Cowbane		E	*
Few-flowered Panic Grass		E	NPS
Velvet Panic Grass		E	*
Slender Beadgrass		E	NPS
Willow Oak		E	NPS
Black-eyed-susan		E	NPS
Seaside Bulrush		E	*
Seaside Goldenrod		E	NPS
Prairie Wedgegrass		E	*
Narrow-leaf Sea-blite		E	NPS
Roland's Sea-blite		E	*
Northern Gerardia		T	NPS (cannot confirm variety)
Saltmarsh Aster		T	* NPS
Smooth Bur-marigold		T	NPS
Dune Sandspur		T	* NPS
Red Pigweed		T	NPS
Slender Crabgrass		T	*
Fringed Boneset		T	*
Carolina Cranesbill		T	NPS
Swamp Sunflower		T	*
Velvety Lespedeza		T	*
Swamp Lousewort		T	*
Opelousa Smartweed		T	*
Northern Gamma Grass		T	*
Southern Arrowwood		T	NPS

* - Listed in the "Natural Heritage Report on Rare Species and Ecological Communities" as occurring at or near JFK
NPS – Presence in Jamaica Bay confirmed by Gateway NRA
E - Endangered; T - Threatened; SC - Species of Concern; C - Candidate; P - Protected; R - Rare

Breeding Birds

At least 73 species of birds are confirmed to nest at Gateway NRA (Davis 2002). The Audubon Society has identified Jamaica Bay as one of its Important Bird Areas (http://www.audubon.org/bird/iba/index.html) noting that the area has supported breeding populations of special concern, threatened or endangered species including but not limited to Piping Plovers, Laughing Gulls, Roseate Terns, Common Terns, Forster's Terns, Least Terns and Black Skimmers. Breeding birds listed by the New York State Breeding Bird Atlas for the area of Jamaica Bay including JoCo Marsh, Silver Hole Marsh and East High Meadow and the southeast portion of JFK include Canada Geese, Osprey, Northern Harriers, American Kestrels, Barn Owls, Ring-necked Pheasants, Clapper Rails, Killdeer, American Oystercatchers, Willets, Upland Sandpipers, Laughing Gulls, Rock Pigeons, Northern Flickers, American Crows, American Robins, Gray Catbirds, Northern Mockingbirds, Brown Thrashers, European Starlings, Saltmarsh Sparrows, Song Sparrows, Northern Cardinals, Red-winged Blackbirds, Eastern Meadowlarks, Boat-tailed Grackles, and House Sparrows during 2000 or 2003 (Appendix E, http://www.dec.state.ny.us/cfmx/extapps/bba/).

In 2007, approximately 200 Forster's Terns were nesting on JoCo Marsh along with Common Terns, American Oystercatchers, Willett, Osprey, Seaside Sparrow, Clapper Rail, Boat-tailed Grackle, Red-winged Blackbird, Canada Goose, Saltmarsh Sparrows and Song Sparrows (D. Riepe, American Littoral Society, pers. comm.). Additional information from the NYSDEC Breeding Bird Atlas on birds in the vicinity of JFK is provided in Appendix E.

Ecological Services Provided by Birds

Birds serve many important functions in ecosystems. These roles also provide benefits to humans. "Ecosystem services" is the term used to describe natural processes that benefit humans. The United Nations Millennium Ecosystem Assessment defines Ecological Services as natural ecological processes which benefit society (Whelan et al. 2008, Wenny et al. 2011). For birds, these services may include pest control (Philpott et al. 2009, Xiong et al. 2010), bird-plant mutualisms such as pollination and seed dispersal (Anderson et al. 2011, Breitbach et al. 2010, Garcia et al. 2010, Wenny et al. 2011), scavenging and nutrient cycling (Fujita and Kioke 2009, DuPont et al. 2011), and as ecosystem engineers (e.g., birds construct structures or modify habitats that are later used by other species; Wenney et al. 2011). Ecosystem services can also include cultural services such as spiritual enrichment, cognitive development, reflection, recreation and aesthetics.

The impact of the proposed action on these functions is addressed in Chapter 6 through analyses of impacts on target and nontarget species populations and sociological issues. Actions which would not have a substantial adverse impact on bird populations are not expected to have an adverse impact on the ecosystem function provided by the species. However, the agencies also acknowledge that in some cases, overabundant species actually can have an adverse impact on ecosystem function. For example, high densities of geese may adversely impact habitat such as saltmarsh or saltmarsh restorations sites, to the determent of other species. In these instances, reductions in a population may have beneficial impacts and, provided the action does not jeopardize species viability, will not compromise ecosystem function. Impacts of reductions on cultural services will vary depending upon circumstance and individual perceptions and are addressed for each management alternative in Chapter 6.

5.1.2 Habitat

Salt Marsh Islands

The salt marsh complex is the most productive and ecologically important area within the Gateway NRA. The marshes are described in 1994 FEIS Section 4.1.2.1. Algal beds noted in the 1994 FEIS as occurring near the islands are primarily comprised of *Ulva lactuca*, which is an important food for brant. The algal beds add structural complexity to the otherwise bare planes of mud flats and sandbars, and thus are important habitat (food and cover) for small fishes and invertebrates. The algal beds to some extent substitute for the eelgrass beds, which existed in Jamaica Bay but disappeared decades ago due to pollution and disease (G. Frame, Gateway NRA, pers. comm.).

The Laughing Gull colony site comprises three principal salt marsh islands: JoCo Marsh, Silver Hole Marsh and East High Meadow. Standardized photographs from the Jamaica Bay Laughing Gull survey have been used by the NYSDEC to estimate the rate of marsh erosion (Washburn and Tyson 2010*)*. All three islands, but especially Silver Hole and East High Meadow, have lost much area during the last decade due to erosion and other causes (NYCDEP 2007). JoCo lost less area, probably because a large portion of JoCo has a higher elevation compared with the other two islands. Throughout the entire Jamaica Bay, saltmarsh islands are disappearing at an accelerating rate. The current rate of annual loss of saltmarsh islands is approximately 40 acres per year. The total remaining area of saltmarsh islands in Jamaica Bay in 2005 was less than 1,000 acres. (Frame and Adamo 2005)

In 2000, the Gateway NRA gathered a Blue Ribbon Panel of wetland ecologists to investigate the loss of the marsh islands. The panel concluded that numerous interrelated factors are contributing to loss of the marsh islands (NPS 2001). Detailed studies of the bay ecosystem relative the marshes and marsh loss were conducted in 2000 – 2001 (Tanacredi et al. 2002). In 2003, the Gateway NRA in cooperation with the City of New York, volunteers, and collaborators from universities and government agencies initiated an experimental restoration program at Big Egg Marsh. The program involved applying sand to raise the elevation of the marsh at least 20 cm above the plane of the highest

remnant tussocks of smooth Cordgrass. After the sand was distributed the site was planted with smooth cordgrass. Subsequent monitoring and management indicate the project has been successful (Frame et al. 2005). The U.S. Army Corps of Engineers, in cooperation with the NYCDEP and NYSDEC, Gateway NRA, PANYNJ, the Natural Resource Conservation Service and the Harbor Estuary Program, have also conducted marsh restoration projects at Elder's Point East (completed in 2006) and Elder's Point West (completed in 2010). Each island currently has approximately 30 acres of saltmarsh. The NYCDEP Jamaica Bay Watershed Protection Plan has the restoration of salt marsh islands in the bay as one of its primary objectives (NYCDEP 2007). Unless the loss of salt marshes can be stopped or reversed, it seems likely that there will be increasing wildlife use of higher elevation marshes such as JoCo March located at the end of the JFK runways.

High densities of geese (migrant Canada Geese, resident Canada Geese, Brant, Snow Geese) forage in Jamaica Bay. Although these species are a natural part of the local ecosystem, at their current density, they are posing significant challenges for saltmarsh preservation and restoration (G Frame, Gateway NRA, unpub. rep., 2011). Over the last few years Gateway NRA staff and volunteers have made regular observations of gull and goose numbers at the marsh and foraging behavior. At Big Egg Marsh, almost all sections of tall Smooth Cordgrass (*Spartina alterniflora*) tussocks interspersed with soft black mud were subject to goose foraging, resulting in under-mining and subsequent washing away of the grass tussocks. Geese plucked smooth cordgrass seedlings (< 1 year old) and ate sparse green sprouts of Smooth Cordgrass (several centimeters tall, growing from rhizomes) and herbs. Goose impacts were especially severe at marsh edges, where Canada Geese and Brant lingered at the water edge, digging at the submerged roots. As the water edge moved inland during the incoming tide, these geese followed. Snow Geese, in contrast, were usually seen feeding above the water edge.

In spring, particularly in April and May, migratory Brant and lesser numbers of resident Canada Geese turned to grazing the new flush of Smooth Cordgrass. The geese walked throughout the low marsh when the tide was out. They bit off the leaves, and ingested huge quantities of the tender young grass, but did not seem to cause any lasting damage to the plants. In summer, only resident Canada Geese remained in abundance. As upland lawns desiccated, these geese fed in the saltmarshes, eating the younger grass leaves and digging among the roots. They also ate Sea Lettuce (*Ulva lactuca*) on the mudflats. In autumn, the returning migratory brant joined the resident Canada Geese in feeding heavily on Sea Lettuce until these algal plants disappeared in December. Then both species shifted to feeding in the low marsh, mainly rooting. Both species also grazed upland lawns.

One estimate of goose impacted area in the Big Egg Marsh restoration site was based on the generalization that year-round, during 2004 and 2005, there were about 10 to 20 new "eat-out" holes per acre per day. A conservative hole-size of 30 cm diameter was used in the calculation. The resulting estimate is that geese, primarily Brant and resident Canada Geese, dug out vegetation from 6.2 % to 12.4 % of the restoration area each year. This area did not remain entirely bare, however, since germinating seeds and rhizomes from

nearby plants filled in some of the area (Frame 2007). At Elders Point East Island saltmarsh restoration, 2,000 or more "eat-out" holes were counted throughout the marsh in several hours during a winter visit. These holes were where planted Smooth Cordgrass plugs were dug (partially or entirely) out of sand by geese (G.W. Frame, Gateway NRA, pers. observ.). And at the newly-restored Elders Point West Island, about half the replanted Smooth Cordgrass tussocks had "eat-out" holes (compounded with tide-scoured erosion holes) around their perimeter in winter 2011, which will require backfilling with sand or replanting of some tussocks (Melissa Alvarez, USACE, pers. observ.; William P. Bowman, Land Use Ecological Services, pers. observ.).

Eelgrass Plantings

The NYCDEP is working with Gateway NRA and the Cornell Cooperative Extension program on a pilot project to restore eelgrass in the bay to help improve ecosystem health in the bay. Small experimental plots have been established at varying water depths to see if it can survive present-day water quality (NYCDEP 2010). Eelgrass helps to stabilize sediments, reduce erosion and can also help to remove nitrogen from the water. It also provides shelter for fish and shellfish and is a preferred food for Atlantic Brant. Foraging by Snow Geese, Atlantic Brant, Canada Geese and Mute Swans can cause substantial damage to eelgrass plots. The ultimate success of the plantings may depend on whether sites may be found with sufficient water clarity that eelgrass can be planted at depths out of reach of the geese and swans. If successfully established and if they can be protected from year-round grazing by resident Canada Geese and non-native Mute Swans, the eelgrass beds may provide a preferred foraging location for overwintering brant. Conflicts with brant at JFK are primarily associated with brant foraging on cultivated grasses near the airport because of shortages of preferred food in the bay. Increased availability of a preferred food at locations that are not immediately adjacent to JFK may help to reduce brant movements through JFK airspace to locations with cultivated grass in the city.

5.1.3 Gateway National Recreation Area Special Management Programs and Priority Species

Gateway NRA contains valuable wildlife habitat ranging from ocean beaches to maritime forests. The US Congress directed NPS to conserve the natural resources, fish, and wildlife of Jamaica Bay. To meet this directive, the Gateway NRA conducts special management programs to preserve and restore maritime vegetation communities including saltgrass vegetation (Frame et al. 2005, Houston 2004, NPS 2001, Stalter et al. 1995). Gateway NRA also has an "Invasive Plant Management Plan" currently is in preparation to address the removal of non-native plants throughout Gateway NRA. The goal is to restore and create appropriate maritime vegetation communities on sites that predominately are dredged sediments, urban soils, and submerged lands. These restored habitats will range from wetlands (saltmarshes and freshwater ponds) to dunes, upland grasslands, and forests.

Gateway NRA also focuses on protecting animal and plant species that are identified under federal and state Endangered Species legislation (NPS 2009, Section 5.1.1). Federally-listed

species that were regularly present during the last two decades and which receive special protection management and monitoring include Piping Plover, Roseate Tern, and Seabeach Amaranth. Northeastern Beach Tiger Beetles were reintroduced to Sandy Hook, but surveys in 2009 and 2010 resulted in no sightings. Restoration of amphibians and reptiles within the national park began three decades ago, but is less active now.

The Gateway NRA continues to monitor the federally delisted, but still state-listed Bald Eagle (threatened) and Peregrine Falcons (endangered). Other state-listed species with special management and monitoring include Northern Harrier, Upland Sandpiper, Common Tern, Least Tern, Osprey, Black Skimmer, Grasshopper Sparrow, Red Knot, Black-crowned Night-Heron, and Yellow-crowned Night-Heron.

The Natural Heritage Programs of New York and New Jersey list species of plants and animals that are rare or imperiled in various ways and/or in various locations in the state. Gateway NRA actively protects these species, so far as they are known to NPS staff. The routine NEPA compliance for all projects within Gateway NRA includes a review of Natural Heritage species to determine if any exist at the project site. If any are present the project is modified to avoid impacts, or if that is unavoidable, mitigation is prescribed to offset any losses. Gateway NRA does manage or monitor Seabeach Knotweed which is listed as rare by the Natural Heritage Program. This plant is both monitored and protected by Gateway NRA, because it occurs on sandy beaches in association with threatened and endangered bird nesting sites. The Seabeach Knotweed is censused annually, along with the Seabeach Amaranth (federally-listed threatened, state-listed endangered). The Gateway NRA also protects the Laughing Gull breeding colony because it is unique in Jamaica Bay and in New York State.

5.1.4 Climate Change

The public draft of the National Fish Wildlife and Plants Climate Adaptation Strategy (NFWPCAS) notes that the climate is changing (NFWPCAS Steering Committee 2012). Impacts of the change will vary depending upon species and ecosystem. In addition to increases in air and water temperature, impacts on coastal ecosystems may include sea and lake level changes, alterations in precipitations patterns and associated delivery of freshwater, nutrients and sediments, and changes in water chemistry.

The draft NFWPCAS notes that marsh islands are already being lost in the Mid-Atlantic due to sea level rise and associated flooding and erosion. This threatens habitat used by a variety of species including some associated with aircraft hazards at JFK such as American Oystercatchers. Similarly, a model of impacts on the Jamaica Bay indicates that unless management actions are undertaken, accretion of material in saltmarshes is not likely to keep pace with rising water levels and additional erosion and loss of saltmarsh is likely (Kracauer-Hartig 2002). Species abundance and movement patterns are likely to shift in response to environmental changes. For example, if loss of habitat in JoCo, East High Meadow and Silver Hole continues, the Laughing Gull colony may decline or even abandon the site, even if there is no or only limited lethal removal of Laughing Gulls at JFK. Changes in plant and algal growth could impact forage availability for Atlantic Brant and associated foraging on cultivated grasses near JFK.

Effective and responsible management of bird hazards at JFK will require close coordination among agencies and organizations responsible for natural resources management and bird hazards at JFK. Ongoing monitoring of wildlife hazards and conditions contributing to hazards will be needed in order to adjust strategies to meet changes. The BHTF will be instrumental in facilitating this communication. Implementation of an ongoing bird hazard monitoring system as proposed in most of the alternatives will also aid agencies in detecting and adapting to changes in bird hazard and abundance.

5.2 WATER QUALITY

Jamaica Bay is the westernmost back-barrier lagoon system along the south shore of Long Island. The Jamaica Bay topographic watershed includes about 113 square miles (NYSDEP 2007). The 1994 FEIS reported that the water circulation patterns and current velocity strengths in Grass Hassock Channel and Grassy Bay had been altered by the dredge and fill activities associated with the initial construction of JFK, and that the flushing rate for the area had been reduced from approximately 10 days to 35 days. However 2001 studies by Lamont Doherty Earth Observatory concluded that in Grassy Bay (adjacent to the airport) the top 5 meters of water exchanges weekly (Tancredi et al. 2002).

Primary sources of pollution include discharges from Water Pollution Control Plants, combined sewer outfalls, and storm sewers. Leachate from the three closed landfills that border the bay also contribute to water quality concerns (NYCDEP 2007). The Gateway NRA Water Quality Program monitors park waters for public health and overall quality. The program provides the basis for evaluating health conditions at public bathing beaches and collecting baseline data for management decisions throughout the Gateway NRA (USDI 2004). Water quality conditions vary substantially between the central bay, the tributaries, and the north and south sides of the bay. The Jamaica Bay Watershed Plan contains detailed information on water quality in Jamaica Bay and, where available, comparisons to conditions in 1995 and is summarized below (NYCDEP 2007).

- Dissolved inorganic nitrogen and total nitrogen levels for Jamaica Bay during 2001-2005 were below 1995-1996 levels. However, they are still well above the limiting concentrations for algal growth. The city continues to make substantial investments in nitrogen control upgrades for wastewater treatment facilities that are expected to reduce nitrogen loads discharged into Jamaica Bay by almost 50% over the next 10 years (NYCDEP 2010).

- Average dissolved oxygen in the bay is above NYSDEC minimum standards but is highly variable among and within years. There are periods where dissolved oxygen levels decline below standard. There is an increasing trend to higher dissolved oxygen levels in surface water than bottom waters which may be attributable to algal blooms in highly nutrient-enriched water conditions. In 2005, dissolved oxygen levels were lowest in the eastern portion of the bay (Grassy Bay) and increased moving westward. General trends in dissolved oxygen indicate that dissolved oxygen concentrations have stayed the same or improved slightly over the period of 1995-2005. Dissolved oxygen levels in the tributaries have gone below regulatory standards more frequently than in the main basin.

However, conditions in Bergen Basin have improved since 1995 and factors contributing to problems in Thurston Basin are being corrected.

- In the bay, average fecal coliform concentrations peaked in 1990 (200 CFU/100 ml), were at their lowest level in 1998 (23 CFU/100 ml), and had a geometric mean in 2005 of 24 CFU/100ml. Although, in general, fecal coliform levels in Jamaica Bay stay below the standard for safe use for swimming and recreation, under wet weather conditions the Bay experiences localized degradation and some areas may temporarily exceed regulatory limits. Coliform levels have been higher in the tributaries. Bergen Basin displayed the most chronic coliform problem in 1995, but cessation of Jamaica WPCP effluent discharges to Bergen Basin have resulted in substantial improvements

- Chlorophyll α concentrations can be used as an indicator of the amount of algae in the water. Chlorophyll α concentrations have increased in Jamaica Bay over the last 18 years. These conditions have coincided with prolonged algal blooms and reports of nuisance algae in the tributaries to the bay.

5.3 SEDIMENT QUALITY

As with water quality, the Jamaica Bay Protection Plan provides detailed information on sediments in Jamaica Bay (NYCDEP 2007). Although levels of sediment contaminants in the bay have improved since the 1960s and 1970s, there are still areas which are highly contaminated. A review of sediment samples collected in 1998 indicated that 20% of Jamaica Bay's sediments were classified as highly toxic and an additional 32% were classified as toxic.

5.4 PARKLAND

Parkland is defined as areas that are designated by local, state or federal laws or regulations as parkland as well as other private or public areas that are used for outdoor recreational purposes typically associated with a park environment. Over 8.2 million people live in NYC, and over 45 million additional people visit annually (NYC & Co. 2010). The federal, state, city, and municipal parklands provide greatly valued opportunities to interact with nature and enjoy outdoor recreation for residents and visitors. Parkland areas within the city also provide an outdoor classroom and enhance educational opportunities for city residents. Each park has unique features which make it important, especially to residents who live in the vicinity of the park. However, two city parks, Central Park and Prospect Park, receive especially high visitation because they can be readily accessed using the subway system.

The largest section of parkland in the project area is administered by the Gateway NRA which is divided into 3 management units. Land areas in the Gateway NRA include: Jamaica Bay Unit = 6,192 acres, Staten Island Unit = 945 acres, Sandy Hook Unit = 1,956 acres. Water areas in the Gateway NRA: Jamaica Bay Unit = 12,367 acres, Staten Island Unit = 1,119 acres, Sandy Hook Unit = 2,747 acres.

The Jamaica Bay Laughing Gull Colony is located within the Jamaica Bay Unit of the Gateway NRA. The Jamaica Bay Unit comprises the Jamaica Bay Wildlife Refuge, Floyd Bennett Field, Fort Tilden, Spring Creek, Riis Park, Breezy Point Tip, and Plumb Beach. In addition to the land and water areas discussed above, 1,246 acres, or 20% of the total land area in the Jamaica Bay Unit is paved.

There are numerous city and county parkland areas within the 7 mile radius of JFK. Parkland areas most likely to be impacted by the proposed action are those with features preferred by birds which are hazardous to aircraft using JFK, specifically, resident Canada Geese and gulls. These species are particularly attracted to sites with short, cultivated cool-season grasses and fresh water. Human sources of food including feeding and poor rubbish management will also attract geese and gulls. Parks identified as having features which make them likely to contribute to bird hazards include but are not limited to those listed in Table 5-3. Although the sites listed in Table 5-3 have features which make them attractive to waterfowl, especially geese, the proposed action would likely only be conducted at a limited number of locations each year. For example, in the 2009 NYC resident Canada Goose management program (Section 2.5), site evaluations were conducted at 52 NYC-owned properties to assess suitability and need for goose removal. Of the 52 properties assessed, only 17 were selected (Collins and Humberg 2010*a*). Similarly, in 2010, 63 sites were assessed, but removals were only conducted at 19 locations (Collins and Humberg 2010*b*).

Table 5-3. Examples of parks within the 7-mile radius of JFK with features attractive to gulls and Canada Geese where bird hazard management actions may be conducted. Park names in bold are locations where resident Canada Goose removal occurred in 2009 or 2010.

Management Agency			
New York State Parks and Recreation	**New York City Parks and Recreation**	**Nassau County Parks**	**Town/Village Parks and Recreation**
Bayswater State Park	**Alley Pond Park**	Bay Park	Baldwin Harbor Park (Hempstead)
Hempstead Lake State Park	**Baisley Pond Park**	Doxy Creek Fishing Park	Brook Road Park (Hempstead)
Valley Stream State Park	Brooklyn Marine Park	Grant Park	Hewlett Point Park (Hempstead)
	Brookville Park	Halls Pond Park	**Hendrickson Park (Valley Stream)**
	Canarsie Beach Park	Inwood Park	Lido Beach West Town Park (Hempstead)
	Captain Tilley Park	Lister Park	Oceanside Prk (Hempstead)
	Cunningham Park	Lofts Pond Park	Rath Park (Hempstead)
	Douglaston Park Golf Course	Mill Pond Park	Shell Creek Park (Hempstead)
	Flushing Meadow-Corona Park	North Woodmere Park	
	Forest Park	Silver Lake Park	
	Fresh Creek Park	Silver Point County Park	
	Kissena Park	Tanglewood Preserve	

Management Agency			
New York State Parks and Recreation	**New York City Parks and Recreation**	**Nassau County Parks**	**Town/Village Parks and Recreation**
	Marine Park		
	Prospect Park		
	Rockaway Community Park		
	Roy Wilkins Park		
	Spring Creek Park		
	Springfield Park		

5.5 COASTAL ZONE MANAGEMENT

Jamaica Bay and JFK are located within the state and city coastal management zones and any activities undertaken within this zone by federal agencies must be consistent, to the maximum extent practicable, with the approved programs effective in the management zones. Applicable programs include the Federal Coastal Zone Management Program, the New York State Coastal Management Program and the NYC Waterfront Revitalization Program. All alternatives in the 1994 FEIS that were advanced for environmental impact analysis were evaluated in light of the coastal zone management policies. Similarly, all alternatives advanced for analysis in this supplement will be evaluated in context of compatibility with state and city coastal zone management programs. The New York Department of State has provided presumed concurrence with the agency determination that the proposed action is consistent with the provisions of the Coastal Zone Management Act.

5.6 RELEVANT PLANNING DOCUMENTS AND ENVIRONMENTAL ANALYSES

5.6.1 New York State Coastal Zone Management Program and Environmental Impact Statement (NYSDS 2001)

The New York State Coastal Management Program provides the basis for coordinating agency activities and promoting desirable actions through the establishment of 44 policy statements. Each of the policy statements promotes the beneficial use of coastal resources, prevents their degradation, or deals with major activities that substantially affect multiple resources. State agencies are required to adhere to each policy statement as much as legally and physically possible. Any federal agency considering undertaking an activity that may affect coastal resources is required to submit a consistency determination and other necessary information and data to the New York State Department of State. The consistency determination must include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the State's coastal policies. Federal consistency provisions preclude federal agencies from undertaking activities that are not consistent with the State's coastal policies or special management area plans, such as local

Waterfront Revitalization Programs, that are approved elements of the State Coastal Management Program.

5.6.2 New York City Comprehensive Waterfront Plan (NYCDCP 1992)

The NYC Comprehensive Waterfront Plan was prepared to identify ways to restore the NYC waterfront for productive use and the enjoyment of the general public. The plan identified four general classifications for the city's waterfront: 1) Natural Waterfront - beaches, wetlands, wildlife habitats and sensitive ecosystems and the water itself; 2) Public Waterfront - parks, walkways, commercial areas, piers, street ends and waterways that offer public open spaces and waterfront views; 3) Working Waterfront - water dependent maritime and industrial uses and various transportation and municipal facilities; and 4) Redeveloping Waterfront – areas where land uses had changed or where vacant and underutilized properties provided opportunity for beneficial change. Local interests are addressed through separate waterfront plans for each borough of the city including Queens (NYCDEP 1993) and Brooklyn (NYCDEP 1994). Land use projects proposed in the plan could have an impact on wildlife activity near the airport and bird strike hazards.

5.6.3 New York City New Waterfront Revitalization Program (NYCDCP 2002)

The Waterfront Revitalization Program establishes the city's policies for development and use of the waterfront and provides the framework for evaluating the consistency of all discretionary actions in the coastal zone with those policies. It defines a pattern of land and water use that protects the city's sensitive environmental areas, while encouraging development and economic activity in suitable locations. The program is designed to coordinate activities and decisions affecting the coast when there are overlapping jurisdictions of multiple discretionary actions. When a proposed project is located within the coastal zone and requires local, state or federal discretionary action, a determination of the project's consistency with the policies and intend of the Waterfront Revitalization Program must be made.

5.6.4 Jamaica Bay Watershed Protection Plan (NYCDEP 2007)

The Jamaica Bay Watershed Protection Plan was prepared to provide a comprehensive watershed-level approach for the restoration and management of water quality in the bay. The plan evaluates current and future threats to the bay and helps to ensure that remediation and conservation efforts are coordinated in a focused and cost-effective manner. Habitat restoration and land use projects proposed in the plan could have an impact on wildlife activity near the airport and bird strike hazards.

5.6.5 Gateway National Recreation Area General Management Plan

The Gateway National Recreation Area General Management Plan decribes 20-year objectives for the park. The plan provides direction for the development and preservation of the park to meet the current and future needs and interests of visitors and to preserve native ecosystems. The Gateway NRA is currently working on a new General Management Plan (http://www.nps.gov/gate/parkmgmt/gmp.htm). Land use, human activities and wildlife

management conducted at the park can influence bird activity near JFK and associated hazards to aircraft. Some of the alternatives considered for bird hazard management in the 1994 FEIS and this supplement would involve actions conducted on Gateway NRA property.

5.6.6 United States Department of the Interior, National Park Service, Management Policies 2006 (NPS 2006)

This document establishes the general management policies of the U.S. Department of the Interior National Park Service. This volume is the basic Service-wide policy document of the National Park Service. Adherence to policy is mandatory unless specifically waived or modified by the Secretary of the Interior, the Assistant Secretary, or the Director of the National Park Service.

5.6.7 United States Department of the Interior, Fish and Wildlife Service, Final Environmental Impact Statement (FEIS): Double-crested Cormorant Management (USFWS 2003)

The USFWS has issued a FEIS on the management of Double-crested Cormorants (USFWS 2003). The EIS primarily focuses on the management of cormorant damage to aquaculture and natural resources. The Final Rulemaking and Record of Decision on Double-crested Cormorant Damage Management established a Public Resources Depredation Order for the management of cormorant damage to public resources including rare or sensitive plant communities, fish, other wildlife and their habitats in 24 states (FR Vol. 71, No 154, 7 pages 45964-45993). It also expanded the scope of an existing Aquaculture Depredation Order. New York is one of the states authorized to take cormorants under the Public Resource Depredation Order. Impacts of actions taken under the cormorant FEIS are included in the population impacts section of this supplement (Chapter 6).

5.6.8 USDI, Fish and Wildlife Service, Final Environmental Impact Statement (FEIS): Managing Resident Canada Goose Populations (USFWS 2005)

This document contains an analysis of options for the management of conflicts with and damage caused by resident Canada Geese. On August 10, 2007 the USFWS issued Final Regulations for Managing Resident Canada Goose Populations based on the analysis in the FEIS (FR Vol. 71, No 154, 7 pages 45964-45993). The rule authorized states to establish special hunting seasons to manage resident Canada Goose populations and created several depredation orders to facilitate resident Canada Goose damage management. The Airport Control Order authorizes managers at commercial, public, private airports and military air operations facilities and their employees and designated agents to implement management programs when necessary to resolve or prevent threats to public safety from resident Canada Geese. The order is restricted to the period of April 1 to September 15 (March 1 – June 30 for take of nests and eggs) and a 3-mile radius around the airport or military airfield.

Other depredation orders established in the rule include a Nest and Egg Depredation Order, an Agricultural Depredation Order and a Public Health Control Order. The depredation order for nests and eggs authorizes landowners or their designated agents to destroy resident Canada

Goose nests and eggs on property under their jurisdiction when necessary to resolve or prevent injury to people, property, agricultural crops or other interests. The agricultural order authorizes states and tribes to implement a program to allow landowners, operators and tenants actively engaged in commercial agriculture to conduct damage management actions when the geese are damaging agricultural crops and to resolve or prevent injury to agricultural crops or other agricultural interests. The public health order authorizes state and tribal wildlife agencies to conduct resident Canada Goose damage management activities in situations where a public health agency has determined that resident Canada Geese pose an immediate human health risk to the transmission of human or zoonotic pathogens.

The Airport Depredation Order pertains directly to bird hazard management at JFK. However, all actions authorized in the new rule could potentially be implemented in New York State and could contribute to cumulative impacts on the resident Canada Goose population. Impacts of actions authorized under the rules for resident Canada Goose damage management are included in the cumulative impact analysis in Chapter 6.

5.6.9 USDA, APHIS Wildlife Services Environmental Assessment: Reducing Ring-billed Gull, Herring Gull, Great Black-backed Gull, and Double-crested Cormorant Damage Through an Integrated Wildlife Damage Management Program (USDA 2009)

The New York WS program prepared an environmental assessment on the management of damage caused by Ring-billed Gulls, Herring Gulls, Great Black-backed Gulls and Double-crested Cormorants in New York State. The EA analyzed the potential environmental impacts of alternatives for gull and cormorant damage management to protect human health and safety, property, agriculture, other wildlife species, natural resources, and aquaculture. Management of risks to aircraft from gull and cormorant strikes is included in the need for action. The cumulative impact analyses for gulls and cormorants in this document (Chapter 6) include potential take that could occur under this EA.

5.6.10 USDA, APHIS Wildlife Services Environmental Assessment: Reducing Pigeon, Starling, House Sparrow, Blackbird, and Crow Damage through an Integrated Wildlife Damage Management Program (USDA 2005)

The New York WS program prepared an environmental assessment on the management of damage caused by Rock Pigeons, European Starlings House Sparrows, blackbirds (Red-winged Blackbird, Brown-headed Cowbird, Common Grackle), American Crows and Fish Crows in New York State. The EA analyzed the potential environmental impacts of alternatives for bird damage management to protect human health and safety, property, agricultural and natural resources, and livestock. Management of risks to aircraft from these bird species is included in the need for action. The cumulative impact analyses for Rock Pigeons, European Starlings, House Sparrows, blackbirds and crows in this document (Chapter 6) include potential take that could occur under this EA.

5.6.11 USDA, APHIS Wildlife Services Environmental Assessment: Canada Goose Damage Management (USDA 2004)

The New York WS program prepared an environmental assessment on the management of damage caused by resident and migratory Canada Geese in New York State. The EA analyzed the potential environmental impacts of alternatives for goose damage management to protect human health and safety, property, and agricultural and natural resources. Management of risks to aircraft from Canada Geese is included in the need for action. The cumulative impact analysis for Canada Geese in this document (Chapter 6) include potential take that could occur under this EA.

5.6.12 Harbor Herons Conservation Plan (HHCP) of the New York/New Jersey Harbor Estuary Program (Elbin and Tsipoura 2010)

The HHCP provides guidance for the protection and support of the colonial waterbirds that live and breed in the Greater New York Harbor. The plan defines the harbor heron group as including Great Egret, Snowy Egret, Black-crowned Night-Heron, Yellow-crowned Night-Heron, Glossy Ibis, Little Blue Heron, Great Blue Heron, Green Heron, Tricolored Heron, and Cattle Egret. The plan identified human disturbance in and adjacent to nesting and feeding areas, habitat degradation from development of mainland foraging sites, problems caused by invasive and potentially overabundant species, pollutants and toxins, and predators (avian and mammalian) as the primary risks to colonial waterbirds in the area.

Proximity of colonies to airports was also identified as an issue. Some of the harbor heron species have been struck by aircraft at JFK over the period of 1994-2009 including Great Blue Herons (8 strikes), Great Egrets (7 strikes), Glossy Ibis (2 strikes), Black-crowned Night Herons (23 strikes) and Yellow-crowned Night-Herons (Section 1.7.10). The plan made 5 recommendations relative to harbor heron risks at airports: 1) conduct studies on flight lines and flight altitudes respect to colony sites, foraging sites and airport air space; 2) manage vegetation so that it does not attract large-bodied birds to the immediate vicinity of the airport; 3) ensure that potential food sources, such as garbage dumps, are not situated so that birds cross the runways to reach them; 4) set up radar to detect birds approaching aircraft; and 5) research habitat management options for airports to decrease use by high-risk species and increase use by low risk species.

Most of the strategies for addressing airport hazards recommended in the plan are already in use for JFK. The airport is currently part of a FAA research project evaluating radar systems for use in detecting birds and monitoring bird movements (Section 4.3.1). Habitat management has been and will continue to be a key component of the JFK bird hazard management program (Sections 2.1-2.4). Several studies on habitat management to reduce bird hazards have been conducted at JFK (Sections 2.2.8 and 4.3.1) and the airport also incorporates new findings from work conducted in other areas as appropriate. Land use and proposed land uses within the 5 mile radius of JFK are monitored and the PANYNY, New York WS, and/or the NWRC provide advice to landowners/managers when current and proposed uses are likely to contribute to bird hazards at JFK (Section 2.3).

The proposed action is not anticipated to result in loss of harbor heron nesting or feeding habitat. On-airport, habitat is managed to eliminate factors which would attract birds of greatest risk to aircraft, including harbor herons. These practices have been in place for years and continuing

use of these methods will not result in a change in the habitat available to harbor herons. Most of the off-airport habitat management recommendations proposed in the SEIS pertain to management of developed areas and are unlikely to impact harbor herons. Depending on the methods used, efforts to relocate the Laughing Gull colony (Alternative 5) might have had adverse impacts on saltmarsh habitat. However, relocation of the Laughing Gull colony has been eliminated from the proposed action (Alternative 6), and the remaining methods are expected to have little or no adverse impact on saltmarsh habitat (See also Response 14 above). Thinning or removing individual trees may be recommended to make them less attractive to flocking starlings, blackbirds and crows but would not be recommended in areas which support breeding colonies of harbor herons. Some recommendations including saltmarsh restoration at locations not immediately adjacent to JFK and native habitat restoration in bare or disturbed sites would be beneficial to harbor herons.

Harassment is used to reduce bird use of JFK and is also proposed for use off-airport. Relative to the ambient noise generated by JFK, risk of disturbance from on-airport use of harassment is minimal and is unlikely to substantially disturb herons or other birds which have chosen to nest in the vicinity of JFK. Risk of disturbance from off-airport actions might include visits to nesting colony islands to oil/addle/puncture Mute Swan and resident Canada Goose eggs, risks of disturbance from off-airport harassment programs, and risk of disturbance by projects to reduce Double-crested Cormorant hazards. Analysis in Section 6.4.2. indicates that the use of off –site harassment is unlikely to adversely impact nontarget species.

In rare instances, nonlethal methods have not been sufficient to reduce risks and shooting has been used to remove individual birds posing an imminent threat to aircraft at JFK. Over the period of 1994-2009, nine Glossy Ibis were shot at JFK (eight in 2004 and one in 2005). No other herons, ibis, or egrets have been taken at the airport during that interval. Removal of the last freshwater wetland areas in the AOA (near runway 4R) in 2009 eliminated the last of the primary attractants to harbor herons and should reduce the already very low incidence of harbor heron take at JFK. Draft species accounts for the Mid-Atlantic/New England/Maritime Waterbird Conservation Plan (MANEM 2006) indicate that there are approximately 11,000 breeding Glossy Ibis in Bird Conservation Region 30 which includes the Long Island and the Harbor Herons management area. Harbor Herons comprehensive surveys indicate the Glossy Ibis population on islands monitored by Harbor Herons decreased from 2004 to 2007 but increased 7% from 2007 to 2010 (Craig 2010). Most of the increase was attributable to the colony in Jamaica Bay as other major colony sites including Hoffman Island and Canarsie Pol decreased between 2007-2010. Given that Glossy Ibis take has been uncommon and limited relative to total numbers in the region; that there have been habitat modifications at JFK to further reduce the attractiveness of the site to Glossy Ibis; and the trends for the Glossy Ibis colony nesting in Jamaica Bay, the take of Glossy Ibis which has occurred at JFK has not had a substantial adverse impact on the state or regional Glossy Ibis population.

The Harbor Herons plan calls for actions to improve nesting and feeding habitat for Harbor Herons. The SEIS does not include specific recommendations regarding wildlife habitat development adjacent to the airport. However given the number of Herons that have been killed in collisions with aircraft, and that the Harbor Herons plan acknowledges the hazards to herons

from existing airport operations, we anticipate that habitat development and improvement projects will not focus on areas adjacent to JFK.

Based on the information above, we conclude that the proposed bird hazard program is consistent with the HHCP. The proposed action will not have an adverse impact on harbor heron habitat, will not adversely impact harbor heron populations and includes adequate provisions to prevent unacceptable disturbance to nesting herons.

5.6.13 North American Waterbird Conservation Plan (Kushlan et al. 2002)

The North American Waterbird Conservation Plan (Kushlan et al. 2002) provides an overarching continental framework and guide for conserving waterbirds. Regional conservation plans are in various stages of completion and provide additional, more specific, guidance for waterbird conservation. The Mid-Atlantic/New England/Maritimes Region Waterbird Plan is not available yet. The North American Waterbird Conservation Plan (Kushlan et al. 2002) establishes four primary goals for waterbird conservation in North America:

1) To ensure sustainable distributions, diversify and abundance of waterbird species throughout each of their historical or naturally expanding ranges in the lands and waters of North America, Central America and the Caribbean.
2) To protect, restore and manage sufficient high quality habitat and key sites for waterbirds throughout the year to meet species and population goals.
3) To ensure that information on the conservation of waterbirds is widely available to decision-makers, the public, and all those whose actions affect waterbird populations.
4) To ensure that coordinated conservation efforts for waterbirds in the Americas continue, are guided by common principles, and result in integrated and mutually supportive waterbird conservation actions.

Objectives one and two are particularly relevant to the proposed action. Potential impacts on target and nontarget colonial waterbirds and on wildlife habitat are addressed in the SEIS. Based on the analyses in the SEIS, the proposed action will not have a significant adverse impact on state or regional waterbird populations. Although the shooting program at JFK, in combination with environmental factors, has reduced the Laughing Gull colony adjacent to JFK a large and viable colony remains.

Analyses in Chapter 6 indicate the proposed action would not result in substantial loss of habitat used by colonial waterbirds and the plan includes standard operating procedures for the reduction of potential impacts on waterbird habitat. The Harbor Herons plan calls for actions to improve nesting and feeding habitat for Harbor Herons. As noted for the Harbor Herons plan in Response 19, the SEIS does not include specific recommendations regarding wildlife habitat development adjacent to the airport. However given the number of waterbirds that have been killed in collisions with aircraft, we anticipate that habitat development and improvement projects will not focus on areas immediately adjacent to JFK.

All waterbird management for the reduction of bird hazards at JFK is conducted in accordance with applicable state and federal regulations and in close coordination with the NYSDEC and USFWS which are responsible for sustaining healthy waterbird populations.

Based on the above information, we have determined that the proposed action is consistent with the North American Waterbird Conservation Plan.