

## 5.1 Introduction

The wildlife management strategies chapter of the WHMP outlines the range of measures employed to ensure public safety at SFO by reducing the incidence of wildlife-aircraft collisions. These measures are grouped according to four general categories:

1. Wildlife control procedures to discourage, disperse, and remove potentially hazardous wildlife from the airfield vicinity.
2. Habitat modification practices to reduce the attractiveness of lands on and around the airport to potentially hazardous wildlife.
3. Research and development projects to gather data and field-test new equipment and techniques, and to gain understanding of wildlife dynamics as they relate to SFO.
4. Information and education programs to articulate the hazards that wildlife can pose to safe aircraft operation.

Wildlife control procedures and habitat management actions undertaken at SFO are subject to regular field-testing and evaluation by the Airport Wildlife Biologist and Airport Operations staff. It is expected that these measures will evolve over time as more effective applications and new techniques are identified and adopted by SFO. Any recommended changes to the management techniques and protocols presented in this chapter will be incorporated into future updates of the WHMP.

A detailed presentation of the various techniques, approaches, and strategies currently available for wildlife hazard management at SFO is provided below. Much of this chapter is devoted to methods to control birds on the airfield, the primary wildlife-aviation hazard identified. Most mammals at SFO do not represent a significant strike hazard, but they can attract avian predators such as hawks and owls. No large mammals such as deer and coyotes are observed at SFO; rabbits and rodents are the greatest concern. Most mammals at SFO will be managed by manipulating habitat.

## 5.2 Wildlife Control

Each wildlife hazard situation that develops at SFO is analyzed by Airfield Operations staff to determine a practical solution. The initial response for most species will be dispersal by hazing and harassment, followed by lethal control methods when necessary. A key component of successful wildlife control is persistence and innovation. Most control techniques retain their effectiveness if they are used infrequently and in conjunction with other methods. Some methods such as pesticides are only effective and legal for specific species and situations. Other techniques are much more readily available and easy to use. The methods chosen will depend largely on the situation and the species involved. Airfield Operations staff involved in direct control are informed of potential diseases wildlife can carry and take appropriate precautions.

Direct control is classified into non-lethal and lethal techniques. Ongoing, proactive habitat modifications seek to reduce the attractiveness of the airfield and surroundings to potentially hazardous wildlife. As applicable, Airfield Operations staff will utilize hazing and harassment, followed by techniques of physical exclusion and habitat modification in response to the presence of hazardous wildlife on the airfield. In other situations, animals would be removed as humanely as possible by shooting, trapping, or applying registered pesticides and other products. In selecting the management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each hazard situation. The most appropriate response could often be a combination of non-lethal and lethal methods, or could include instances where application of lethal methods alone would be the most appropriate strategy, such as when an animal poses an immediate threat to aircraft and human safety. Most control techniques retain their effectiveness when used judiciously and in conjunction with other methods.

This section includes descriptions of the wildlife control techniques available to reduce potential wildlife hazards at SFO. Airfield Operations staff will select appropriate control methods based on safety of application and on the biological and economical effectiveness of the technique. Not all methods are used currently or continuously, but they may be used if they are applicable to a situation. The control techniques are applied according to relevant laws, pesticide labels approved by the EPA, and permits regulated by state and federal agencies, including the CDFW, USFWS, and USACE. The appropriate technique is selected with consideration to the target species and its ecology. Relevant target species categories are identified for each management strategy as suggested in the 2014 WHA.<sup>15</sup> Integrated management strategies for each of the nine most hazardous species or categories are discussed in separate sections.

### 5.2.1 Personnel and Communications

Airfield Operations assesses and removes hazardous wildlife from the Primary Zone. Staff are equipped with radios and should maintain clear communications with the tower or ground control in accordance with FAA policies when conducting wildlife control activities in the AOA.

SFO staff on patrol should contact the ATCT when necessary to access taxiways and runways to harass problem animals. If an immediate hazard exists that might compromise the safety of aircraft operations at SFO, staff coordinates with the FAA ATCT personnel, which may detain arriving or departing air traffic until the hazard is eliminated. ATCT personnel should continue to notify Airfield Operations if a pilot reports a strike. Airport ramp personnel also notify Airfield Operations if they notice bird remains or blood on an aircraft.

#### Wildlife Patrols

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

Airfield Operations staff responds to wildlife hazards on the airfield and are trained in wildlife identification, proper control techniques, and safety, through training identified in Chapter 7. Airfield Operations staff are supplied with radio-equipped vehicles and wildlife control equipment.

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<sup>15</sup> LSA Associates, Inc. 2014

Patrols at SFO are conducted throughout the day and sometimes at night to monitor for the presence of potentially hazardous wildlife and to remove them when necessary. Patrols are conducted as often as necessary to deter wildlife activity in the area. Patrols are careful when dispersing any wildlife to ensure that none is flushed into the path of any air traffic.

The patrol crew is responsible for recording all hazardous wildlife observed and any dead animals found on the daily wildlife activity report. In cases where no animals are seen, a record indicating that an inspection was conducted and that no animals were observed is made. The Airfield Operations duty supervisor approves forms at the end of each shift. Reports are submitted to the AIRS database. Airfield Operations then submits the data to the FAA during annual 14 CFR Part 139 certification reviews.

The presence of any dead animals found during routine runway inspections that resulted from an aircraft strikes is recorded on FAA Form 5200-7 (see **Appendix C** for a copy of the form). Other wildlife observations and control activities (e.g., notable hazards, animals killed or dispersed, unusual wildlife behavior) are documented on the daily wildlife activity report. Bird or other wildlife remains found within 200 feet of the runway centerline are assumed to be evidence of a strike unless another reason for the animal's death is identified. Such remains are bagged with a written strike report form. Airfield Operations sends unidentified remains (feathers, blood) to the Feather Identification Lab at the Smithsonian Institute for identification. Wildlife strikes may be reported directly to the FAA online at [http://wildlife-mitigation.tc.faa.gov/public\\_html/index.html](http://wildlife-mitigation.tc.faa.gov/public_html/index.html), but a printout of the report is immediately submitted to the wildlife coordinator so that the situation can be further assessed.

Collecting animal remains found on runways during routine runway searches provides information that may otherwise be unavailable, allowing a more accurate assessment of the frequency and species of wildlife inhabiting SFO and of strikes of which pilots may be unaware. Carcasses are disposed of according to depredation permits by burial, incineration, or donation to educational or research institutions.

### Equipment Available to Airport Operations

- **Bird control devices:** Phoenix Wailers (five), located on Runways 10L/R at Taxiway E, Runway 19L/R at Taxiway V, Runway 28L/R at Taxiway P, Runways 28L/R at Taxiway L, and Runway 01L/R at Taxiway G.
- **Animal control devices:** noose, net, small traps, bird spikes, and bird traps.
- **Weapons and ammunition:** 12-gauge shotgun, 12-gauge long barrel, air pellet rifle, pop gun (single-shot), pop gun (10-shot), pop gun (four-shot), cracker shells, air pellets (4.5-millimeter [mm]), bird bombs, whistlers, start six caps, and 9-mm primers.

## 5.2.2 Integrated Pest Management Program

Airport Maintenance coordinates relevant pest control programs with Airfield Operations staff. This includes trapping pigeons (daily) and flocking birds (regularly), and addressing problem birds in and around structures. Monthly Integrated Pest Management (IPM) reports describe current issues and improvement plans. The reports cover pest management options, risk, and implementation timetable; and IPM/sanitation guidelines for the AOA, Superbay hangar, roadways, tenants, and terminal areas. The IPM report is distributed to: custodial, landscape, property management, food court, airfield operations, IPM, paving and grounds, and Airfield Operations staff.

## 5.2.3 Non-Lethal Control Techniques

Non-lethal control devices and techniques that are currently used or may be available for use at SFO are described in this section. These devices and techniques are expected to change over time as newly developed, proven non-lethal methods become available.

### Auditory Frightening Techniques

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Shorebirds, Blackbirds/Starlings, Pigeons*

Auditory scaring devices such as propane exploders, pyrotechnics, and audio distress/predator vocalizations can be effective, but birds quickly learn to ignore scaring devices if their fear of the methods is not reinforced with shooting or other tactics.<sup>16</sup> These devices are labor intensive and must be maintained to be effective. Propane exploders and pyrotechnics should be applied between the target birds and the sensitive areas to push the birds in a safe direction. When discharging pyrotechnics, a fire extinguisher or bottle of water should be carried in case the projectile ignites a fire. All operations personnel needing to use pyrotechnics will be trained in their safe use and operation prior to use.

Hazing and harassment are the primary means used to clear wildlife from the airfield to respond to the immediate safety needs of each arriving and departing aircraft. Each species reacts differently to auditory stimuli. Techniques that may be used to haze birds include pyrotechnic devices (e.g., shell launching pistols, 12-gauge shotguns), remote-controlled propane cannons, and other auditory frightening devices (e.g., vehicle air horns and sirens). Reactions to hazing/harassment are noted, and wildlife are monitored to ensure that they do not relocate onto another Primary Zone location. The results of each dispersal action taken (e.g., species hazed, technique employed, consequence) are entered into the database for future retrieval and evaluation. The techniques and protocols followed for hazing and harassment are expected to change over time as new information, through adaptive management, is integrated into the WHMP.

Frightening or harassment techniques, such as hazing, can quickly repel birds and mammals from problem areas for short-term results. Waterfowl normally disperse immediately. Blackbirds and starlings will usually form a tight flock and move away from the noise, but may circle and return. Gulls habituate rapidly to most auditory stimuli unless they are periodically reinforced with shooting. Hawks usually move away from noises. Pigeons often scatter in all directions. Herons and egrets often rise and fly only a short distance and may need several successive auditory stimuli to leave the airport.

These techniques should only be used on an as-needed basis so that they retain their effectiveness.

### Pyrotechnics

Pyrotechnics are non-lethal, fast-burning or explosive devices such as racket, report, and whistle bombs, cracker shells, and rockets used to deter wildlife. These will only be used by certified personnel.

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<sup>16</sup> Bomford and O'Brien 1990.

### **15-Millimeter Launcher and Cartridges**

Racket, report, and whistle bomb cartridges are shot from a launcher similar to a starter pistol. Reports travel about 40 yards and explode. Whistle and racket cartridges travel up to 100 yards, making noise the entire time. Racket bombs and report cartridges are best for wildlife control, and the 15-mm launcher is the easiest of all pyrotechnics to use.

### **Cracker Shells**

Cracker shells are shot from a 12-gauge shotgun, travel about 75 yards, and explode. The barrel needs to be checked for obstructions after each firing because the wad can get stuck and cause the next shell to explode in the barrel. The shotgun must be cleaned frequently because hard carbon deposits from the black powder in the shell accumulate in the barrel, making it dangerous to fire and ruining the barrel. Cracker shells are not recommended for use initially because of the problems they can present. However, cracker shells should be kept on hand for use, when appropriate.

### **Others**

Rockets are launched from the ground, but are often impractical for use and inappropriate at airports. Flares are launched from a pistol, but are also impractical for extensive use. If strikes become frequent at night, flares and propane cannons could be used to disperse birds prior to airplane arrivals or departures. SFO may purchase these items if they become necessary.

### **Bird Frightening Techniques**

The wildlife hazard patrol crew must determine the most effective methods to disperse different species. Reactions vary by species, time of year, and number present. Generally, the best technique to disperse wildlife is to be positioned between the bird(s) and the active runway. If possible, the staff should be upwind because birds normally take off into the wind, turn, and then fly with the wind when being harassed. Shooters should face away from the runway and shoot at about a 45-degree angle away from the target on the opposite side of the desired escape route. The shooter should get as close to the birds as possible to expedite their departure. In some situations, birds may only circle and move to another part of the airport or return to the same spot. This is especially true of birds that have been hazed frequently. Sometimes, it may be advantageous to have two personnel able to respond to frightening birds, especially to avoid this situation. All debris from pyrotechnics should be retrieved when possible, especially from the runway and taxiways where they become FOD. Intensive hazing may be required in certain locations at certain times of year. For instance, hazing should be intensified in early spring to prevent Canada geese from nesting behind the MLTP. Hazing of birds loafing along the shoreline should be used when birds are flying across flight paths. In many instances, however, it may be safer to allow the birds to remain to avoid frightening them into flight across the flight paths. Additionally, methods to have more control over the direction of frightened loafing birds should be investigated, such as the use of remote control aircraft, boats, or manned watercraft.

### **Bioacoustics**

Bioacoustics are devices that amplify distress alarm calls from relevant bird species and loud irritating sounds, such as dogs barking, shots, and people talking. Each bird species has distinctive distress calls that they use when they are injured or have been caught by a predator. Amplifying these calls will disperse some bird species, while others will investigate the source to determine

whether they can “mob the predator.” Other sounds such as dogs barking can be used to disperse some species, such as birds that do not have specific distress calls that repel them. Bioacoustics are effective only if they are used infrequently and if the source of the alarm call is moved often so that wildlife do not become habituated. The effectiveness of this technique at airports is further reduced when the extreme ambient noise generated by passing aircraft is factored in. Unlike pyrotechnics, the noise level generated by bioacoustic equipment is not very high. It is very difficult to disperse wildlife at airports with a noise source that is much quieter than the ambient noise levels. The acclimation of the birds at SFO to aircraft noise and their habituation to the bioacoustic equipment is evident by the use of the equipment as perching sites. Bird distress or alarm calls and other irritating sounds are available commercially. The playback equipment consists of recorded sounds, amplifiers, and speakers. There are also self-contained units that operate on photovoltaics such as the Phoenix Wailers that are currently used by SFO. Again, the use of this equipment is not recommended as a main dispersal agent, and its use should only be on an as-needed basis after the recommended habitat modifications have been implemented.

## Visual Frightening Devices

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Gulls, Blackbirds/Starlings, Pigeons*

Visual frightening devices supplement other techniques in reducing wildlife numbers, but are usually not effective by themselves. Several are effective for short-term control of problem situations. The use of effigies is generally practical for only small areas, such as hangars and building ledges. Scaring devices, such as helium-filled eye-spot balloons; human, coyote, and raptor effigies and silhouettes; dead bird carcasses; mirrors; and moving disks can be effective, but they must be moved and altered constantly to prevent habituation. Effigies are most effective when they are moved frequently and alternated with other methods.

### Balloons, Hawk Kites, and Model Planes

Helium-filled balloons with eyes on all sides and hawk kites are effective for short-term control; they combine shape and movement to frighten birds. They are especially effective for roost control. They also can be used in fields to deter flocks of small birds from feeding in fields. Use should be sporadic so that birds do not become accustomed to them. Use should be monitored because if these devices break free, they can become air hazards.

### Mylar Tape

Mylar tape has produced mixed results in its effectiveness to frighten birds.<sup>17</sup> Mylar tape can be effective to keep birds away from specific locations. It produces fright by sight and sound when properly installed. On ponds, tape should be stretched tautly between two posts or stakes. Stakes should be 25 to 100 feet apart. When Mylar tape is stretched, it should be twisted several times so that it will seesaw back and forth in the wind. When the wind picks up, the tape will also make a low, irritating hum. Weekly maintenance is required to increase tension and keep the Mylar out of the water. Mylar strips attached to wire or lathe supports at 3- to 12-meter (m) intervals were shown not to discourage gulls from loafing at a landfill but may be an option for other species or

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<sup>17</sup> Dolbeer et al. 1986; Tobin et al. 1988.

circumstances.<sup>18</sup> This method is labor intensive and expensive, but can be effective in dispersing some species of bird (e.g., gulls, waterfowl, blackbirds).

## Lasers

Lasers are a relatively new technique used to frighten and disperse birds from their roosts or loafing areas. Results of recent tests by the National Wildlife Research Center have shown that several birds, including cormorants, waterfowl, geese, gulls, vultures, and crows, exhibit avoidance of laser beams during field trials.<sup>19</sup> They are most effective under low-light conditions, generally between sunset and dawn, and when targeting structures or trees near roosting birds, thereby reflecting the beam. Habituation to lasers has not been observed during field tests.<sup>20</sup> Extreme caution would be used when applying lasers around airfields to prevent interfering with aircraft operations. No damage to the avian eye has been recorded because the avian eye filters most damaging radiation, unlike the human eye.<sup>5</sup>

## Other Non-Lethal Techniques

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

### Dogs

Dogs have proved useful for hazing birds. Birds view dogs as natural predators, retain a fear of physical harm, and do not become habituated to the dog's presence. The dog must be specially trained and under the control of the handler at all times to avoid the dog becoming a hazard in itself and to avoid illegal take of wildlife. Dogs can potentially be useful in preventing nesting behind the MLTP and SFO coordinates with the TSA and San Francisco Police Department (SFPD) to encourage exercising of K-9 units in this area. Hazing with dogs should be intensified at the beginning of the nesting season to prevent nesting. Use of dogs has been shown to be most effective when used consistently.

### Relocation

Relocation of wildlife often involves stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats; the animal also may simply leave the area. However, relocation can be an effective method of reducing the risk of wildlife strikes, particularly for raptor fledglings, to avoid imprinting on the site. Mammals are not relocated to prevent spread of wildlife disease, such as rabies.

### Nest Removal

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle and before the eggs are laid. Proper identification of the nesting species is required to prevent take of non-target species. Prevention of nesting reduces the number of animals that imprint on the airport, reducing the number of birds that return the following year and those foraging on the AOA. This technique is most often used for starlings, pigeons, waterfowl, swallows, and blackbirds.

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<sup>18</sup> Belant and Ickes 1997.

<sup>19</sup> Glahn et al. 2001; Blackwell et al. 2002.

<sup>20</sup> U.S. Department of Agriculture 2001.

## Non-Lethal Traps

### Cage Traps

Cage traps, which are used to capture animals of various sizes, have limited application in capturing most large animals. These devices are used primarily to capture animals for translocation or subsequent euthanasia. Cage traps are normally placed near travelways and baited with food items as attractants. Capture results from mechanical closure of the entry way triggered by the animal upon entry, or by the physical construction of the trap opening that allows one-way access only.

Placement of the devices is dependent on the respective target species' habits and habitat conditions, and is set to minimize exposure to and capture of non-target animals.<sup>21</sup>

Cage traps commonly used include drop-door wire or solid door box traps for small mammals such as foxes or rabbits; and walk-in wire box traps for pigeons and blackbirds. Each trap is checked at least once every 24 hours. Pigeons and blackbirds are euthanized following humane protocols as described under "Lethal Techniques" below.

### San Mateo County Animal Control Assistance

The San Mateo County Animal Care and Control can assist SFO with free-roaming dogs and cats. If a live animal is reported (e.g., foxes or rabbits), Airfield Operations staff capture it and notify the Peninsula Humane Society and/or local SPCA for pick-up.

### Feral Cat Trap-Neuter-Return Program

Feral cats captured at SFO are transported to San Francisco Animal Care and Control for sterilization and then are returned to SFO property. Feral cats do not pose a threat to aircraft as they are rarely observed on the runways or taxiways, and in fact, provide benefits to the wildlife program by a) acting as a predator to birds and small mammals that do cause hazards to aircraft, and b) by preventing the incursion into the airport of unaltered cats that may cause an increase in the feline population and lead to hazards. Research has shown that trap-neuter-return (TNR) programs are effective in reducing feral cat populations.<sup>22</sup>

## 5.2.4 Lethal Techniques

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

The policy of SFO is to use lethal control when other methods have become ineffective, or when there is an immediate threat to public safety. Special circumstances do exist where lethal action may be employed to reduce the population abundance of a wildlife species on or around SFO. These situations usually involve prey species (e.g., small mammals, insects) that provide an attractant food source to larger wildlife that can pose a hazard to aircraft, or involve non-native wildlife species that may pose a hazard to aircraft because of their flocking behavior (e.g., European starling and pigeons). If the need arises, SFO is committed to using lethal control in a reasoned, humane,

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<sup>21</sup> U.S. Department of Agriculture 1997.

<sup>22</sup> Stoskopf and Nutter 2004.

controlled, and efficient manner by trained staff. A permit is required to take most species of wildlife unless they are specifically exempt. For example, lethal action against birds is allowed under an MBTA airport depredation permit issued by the USFWS and will always be conducted in accordance with permit guidelines. A description of lethal control devices and techniques currently available for use at SFO is provided below.

## Egg Addling/Destruction

*Target Species Categories: Canada goose, Ducks*

Egg addling and destruction is the practice of destroying the avian embryo before hatching. Egg addling involves vigorously shaking an egg numerous times and causing detachment of the embryo from the egg sac, thus making the embryo unviable. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, by oiling or spraying the eggs with corn oil that covers the entire egg and prevents the embryo from obtaining oxygen, or by puncturing the shell. When eggs are left intact and replaced in the nest, re-nesting by the bird is often prevented. This method is used for nests found on the on the Primary Zone as authorized in wildlife control permits issued by the USFWS and CDFW. Eggs will be added or destroyed whenever they are encountered in the Primary Zone and are positively identified as protected species. Intensive effort to prevent successful nesting is required at the MLTP in the spring and early summer as nesting is regularly attempted by Canada geese in this location. Nests may be removed after eggs are laid for species not covered under the MBTA such as starlings, pigeons, house sparrows. Eggs are disposed of at the MLTP.

## Traps

Several different styles of traps are available to control wildlife, including cage traps, decoy traps, and snares. Traps are not usually effective at removing large numbers. They must be used according to CDFW regulations, which require that they be checked daily. Measures should be taken to prevent trapping non-target species.

### Quick-Kill Traps

Quick-kill traps include several specialized traps such as body-grip, snap, gopher, and mole traps. These devices either crush captured animals between opposing metal jaws or between the jaw and a wooden or plastic base. These traps are powered by strong metal springs. Quick-kill type traps are designed to cause the quick death of the animals that trigger the devices.<sup>23</sup>

## Shooting

Shooting is a very effective technique for reducing wildlife hazards. It can be used to quickly resolve an imminent wildlife threat to aircraft safety (i.e., an emergency situation) or add to the effectiveness of a hazing program. Wildlife can become accustomed to hazing and harassment techniques, or may not be deterred by their use at all. This is especially true when one device is frequently used to frighten wildlife. It may become necessary to shoot a limited number of individuals to reinforce the dispersal response to hazing and harassment.

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<sup>23</sup> U.S. Department of Agriculture 1997.

Wildlife Operations staff will be provided firearm training and refresher courses (see Chapter 7, Training). The shooter must be fully aware of the backstop, direction of the shot, and species being taken. The shooter must also have in his possession a valid depredation permit for the species being taken except for starlings, pigeons, house sparrows, crows, rabbits, and skunks. Species that are protected as threatened, endangered, or otherwise should not be shot under any circumstances because of their rarity. The shooter must be able to identify different species. Shooting activities will be restricted to the AOA.

## Equipment

Shooters will need a shotgun to carry out duties at the airport associated with wildlife control. An air rifle is also ideal for many situations. On rare occasions, a rifle may have to be used. Extreme caution must be exercised when using a rifle or any firearm, and shooters must be trained in firearm safety and be reliable. A 12-gauge shotgun is the recommended all-purpose gun for the airport and desirable for most species of birds that represent the greatest hazards to aircraft. Steel shot is required in shotgun shells.

## Toxicants

### Pesticides

Pesticides may be applied by qualified and licensed personnel in any circumstance when deemed necessary and where minimal non-target take can be guaranteed. Pesticides have varying levels of lethality for different species. Secondary toxicity is considered when choosing a pesticide. Depending on the action of the pesticide, there may be no threat of secondary toxicity. The status and biology of threatened and endangered species will be considered when using these pesticides to prevent take of protected species. Many of the pesticides are restricted-use pesticides and can only be applied by individuals licensed by the DPR in accordance with all label instructions. Pesticide use at SFO is also governed by the regulations of the city and county of San Francisco. Only pesticides approved by the city and county of San Francisco, or by special exemption for SFO, will be used.

Landscaping staff that use pesticides are trained to use each specific material and are certified for the use of pesticides under EPA- and DPR-approved programs. Furthermore, all certified pesticide applicators participate in continuing education programs to keep abreast of developments and to maintain their certifications. All pesticides are registered with the EPA and DPR. Label directions must be followed.

### Gas Cartridges

Gas cartridges are used to control mammals, specifically those with burrows or dens. Species that would be targeted at SFO include moles and gophers. When ignited, the gas cartridge produces carbon monoxide inside the sealed den, causing the animals to become unconscious and lowering blood pressure to the point of death. Effective application relies on accurate identification of the den sites and timing with the seasonal population cycles. Surveys will be conducted to correctly identify the site being gassed to minimize take of non-targeted species, and their use will be avoided during excessively dry periods to prevent grassland fires. The potential for secondary toxicity from gas cartridges is very low. If the burrow is sealed completely, the carcasses would remain underground, where scavenging animals could not gain access to them. Should the carcass somehow be scavenged, residues in the carcass of the target species should not affect the scavenger or predator.

Carbon monoxide is a common air constituent and only produces the desired effect within the confined space of the burrows or dens.<sup>24</sup> Where burrowing owls are present, gas cartridges will not be used within 160 feet of occupied dens.

## Euthanasia

*Target Species Categories: Blackbirds/Starlings, Pigeons*

In the event that an animal is trapped or found in a debilitated state, euthanasia may be necessary and will be administered in accordance with American Veterinary Medical Association (AVMA) guidelines. IPM personnel are responsible for trapped animals, and Air Operations staff for lethally taken animals.

### Carbon Dioxide Gas

Carbon dioxide (CO<sub>2</sub>) is a common euthanasia agent because of its ease of use, safety, and ability to euthanize many animals in a short time span. The advantages of using CO<sub>2</sub> are: 1) the rapid depressant, analgesic, and anesthetic effects of CO<sub>2</sub> are well established; 2) CO<sub>2</sub> is readily available and can be purchased in compressed gas cylinders; 3) CO<sub>2</sub> is inexpensive, nonflammable, non-explosive, and poses minimal hazard to personnel when used with properly designed equipment; and 4) CO<sub>2</sub> does not result in accumulation of tissue residues.

### Shooting

This method was discussed earlier, but is reiterated here as a form of euthanasia. According to the AVMA, a single shot to the head is a humane method of euthanasia for all species targeted for take by this plan: “[a] properly placed gunshot can cause immediate insensibility and humane death.”<sup>25</sup> Hazardous birds that present a threat to aircraft safety and mammals caught in cage traps, snares, or foothold traps and requiring euthanasia can be dispatched in this manner.

## 5.2.5 Other Alternatives

### Aircraft Flight Schedule Modification

FAA Airport Traffic Control Tower staff may occasionally need to temporarily close a runway if high bird activity poses an imminent risk to aircraft, until Airfield Operations staff can disperse the birds.

## 5.3 Habitat Management

Wildlife are attracted to airports because of the availability of one or more of their essential life cycle elements: food, water, and cover. Examples of water sources include lakes, streams, estuaries, drainage channels, detention ponds, and temporary pools. Food sources might include rodents, insects, worms, reptiles, grass, seeds, fruit, refuse, and handouts. Wildlife find cover in trees, tall grass, bankside vegetation, burrows, buildings, structures, and abandoned machinery.

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<sup>24</sup> U.S. Department of Agriculture 1997.

<sup>25</sup> American Veterinary Medical Association 2001.

Habitat management is the most effective long-term remedial measure for reducing wildlife hazards on or near airports. Habitat management includes the physical removal, exclusion, or manipulation of areas that are attractive to wildlife. All animals require food, water, and cover to survive. Any action that reduces or eliminates one or more of these elements will reduce the attractiveness of the airport to wildlife, which in turn will reduce the numbers of wildlife using the airport.

The long-range goal for SFO is to minimize the risk to aviation safety posed by hazardous wildlife species on and around the airfield. With regard to wildlife habitat, this will be accomplished by: 1) modifying habitats or land uses on SFO-owned lands that are shown to be attractive to hazardous wildlife, and 2) discouraging land use practices on non-SFO lands adjacent to the airport that attract hazardous wildlife, in accordance with FAA AC 150/5200-33B.<sup>26</sup> This section describes activities that SFO undertakes to manage and manipulate hazardous wildlife habitat within the Primary and Secondary Zones to minimize the occurrence of wildlife strikes and unintentional effects to sensitive biological resources.

### 5.3.1 SFO-Owned Property

The Primary Zone is owned entirely by SFO. Because this zone includes the AOA and Runway Protection Zones (RPZ) the potential risk to aviation is high if hazardous wildlife species are present in the area. The Primary Zone is the area of highest priority for wildlife management at SFO.

SFO owns 180 acres of the Secondary Zone that borders SFO, the West-of-Bayshore property (**Figure 4-2**). This area is managed by SFO. If a wildlife attractant determined to pose an unacceptable risk is identified on SFO-owned lands in the Secondary Zone, the airport director and the Airport Wildlife Biologist will meet to discuss modifications to habitats or land uses, or to consider wildlife control efforts. The airport director and the Airport Wildlife Biologist will also consult whenever modifications or new land uses are proposed for SFO-owned lands adjacent to SFO to ensure that new attractants for potentially hazardous wildlife are not created. If a wildlife hazard identified in either the Primary or Secondary Zone involves lands under lease, the lessee will be included in discussions to resolve the wildlife hazard.

### 5.3.2 Water Management

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

Water acts as an attractant for birds and other wildlife. Therefore, eliminating all standing water on the airport is a management goal. There are numerous wetlands around the airport property. Most of these consist of small drainage canals and detention ponds. However, SFO is also surrounded by San Francisco Bay on two sides, with accompanying open water, mudflats, estuaries, and salt marsh habitats. This combination of different habitat types in close proximity to one another is a strong attractant for wildlife throughout the year, especially in spring and fall, when thousands of migratory birds are passing through the area. Winter rains create temporary pools used for drinking and bathing by many species. For many coastal birds, the standing water left after a rainstorm is the most accessible source of fresh water.

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<sup>26</sup> FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports, August 28, 2007.

## Wetlands

There are several wetland types in and around SFO property, including seasonal wetlands, freshwater/brackish marsh, relic saltmarsh, drainage channels, detention ponds, and open water. All of these habitats attract wildlife, especially waterfowl, wading birds, and shorebirds. Vegetation along the edges of wetlands should be maintained in a manner that reduces habitat suitability.

SFO will evaluate options for decreasing tidal marsh habitat immediately adjacent to SFO to decrease movement of shorebirds across airfield. Options may include:

- Dredging mudflats on the southern portion of the airport, near the Millbrae Canal.
- Modifying mudflat vegetation to reduce use by shorebirds.
- Installing exclusion devices (netting, grids, Euro-Matic Bird Balls™) along mudflats to discourage use.

Any required mitigation should be off site to reduce the amount of wetlands on SFO property. Protections for threatened and endangered species and their habitats place constraints on modification or removal of wetlands.

Wetlands behind the MLTP attract Canada geese and other waterfowl to nest each year. SFO is investigating options to eliminate these wetlands by developing the area. Currently, the area is patrolled during the nesting season and birds are intensively hazed and nests and eggs are destroyed.

## Channels and Ponds

Drainage channels and detention ponds have been significantly reduced and altered in recent years. All storm water detention basins located southeast of Runway 1L-19R were filled as part of SFO's Runway Safety Area program. The South Detention Basin located south of Runway 1L was also eliminated during the Runway Safety Area improvements. Functions of this basin were re-routed to a single detention basin located south of runway 1R. This detention basin has steep, concrete sides and currently does not attract hazardous wildlife. If a wildlife attractant develops, SFO should cover these areas with wire grids, barriers, or Euro-Matic Bird Balls™.

- When standing water that may act as an attractant is observed, drainage should be improved by grading, resurfacing, and filling as needed.
- The FAA recommends that stormwater detention ponds be modified to allow a maximum 48-hour detention period for the design storm and to remain totally dry between rainfalls. Examine options to maintain any airfield detention ponds or channels to dry within 48 hours of a storm event.

## Drainage Channel and Stream Side Vegetation

Vegetation growing along the edges of drainage channels or in other wet areas on the airfield may provide habitat for some hazardous wildlife species. Vegetation that grows alongside these ditches within the Primary Zone will be removed or maintained at the lowest possible height where not constrained by environmental regulations, so that nesting, hiding, and foraging habitat is not provided for waterfowl (e.g., mallards). Ditches should be inspected annually for debris and soil build-up that may impede drainage efficiency.

## Temporary Pools

Where pooling conditions are found, the land should be filled or graded such that water consistently drains into channels and detention ponds. Ensure that airport runways, taxiways, and aprons have enough camber so that water does not pool. Persistent pools can be dissipated using sweepers to facilitate evaporation.

### 5.3.3 Exclusion Methods for Ponds

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

#### Grids

Some birds can be excluded from ponds or other areas using overhead wire grids. Overhead wire networks generally require little maintenance other than maintaining proper wire tension and replacing an occasional broken wire. The spacing of the wires varies with the species being excluded. Wire grids have been demonstrated to be most applicable on ponds equal to or less than 2 surface acres.

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 loafing and feeding activities, and not cause bird injury or death. Grid spacing depends on the particular species. Terns, herons, and mergansers require 1- to 2-foot spacing, whereas most gulls and waterfowl are deterred by 10- to 15-foot spacing, 10 feet above the water. Wires can be attached to posts, and several lines can be run from one post to another in a web-like fashion. Once the grid has been installed, the area should be monitored to determine the level of bird activity. If birds are found to be maneuvering through the grid, the lines may need to be moved closer together.

#### Euro-Matic Bird Balls™

Euro-Matic Bird Balls™ are sold through Wildlife Control Technology, Inc. Euro-Matic Bird Balls™ are blow-molded, high-density polyethylene (HDPE), hollow balls that are emptied into a basin to create a floating blanket that will keep waterfowl and gulls from roosting on ponds and other open water. Euro-Matic Bird Balls™ have been tested to withstand high winds and snow, and are intended to be a long-term, relatively maintenance-free solution to roosting problems without the hassles associated with nets and wire grids.

#### Chemical Repellents

Methyl anthranilate, a chemical that is distasteful to many birds, may be effective at repelling birds from ponds. It has been used successfully to keep birds, including mallards and gulls, from pools of water at landfills.<sup>27</sup>

### 5.3.4 Vegetation Management

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

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<sup>27</sup> Dolbeer et al. 1993; Belant et al. 1995.

The most effective approach to reduce vegetation attractants at SFO is to remove all unnecessary trees, shrubs, weeds, and plants and establish non-seeding or small-seeded grass species. The management of airside vegetation to minimize rodents, insects, and seeds is complex, requiring insecticide, herbicide, and rodenticide applications; changes in vegetation cover; and adjustments in mowing schedules (e.g., mowing at night to minimize bird feeding on insects exposed by the mowing).

## Herbicides

Herbicides, such as Roundup®, may be used as part of vegetation management, but are restricted in their location and area of application by the city and county of San Francisco. Herbicides can generally only be used to maintain the visibility of runway landing markers and runway and taxiway signs.

## Grass Management

Other than the paved areas, grass should be the primary cover inside the perimeter of the airport. Unfortunately, grass cover also provides suitable habitat for small mammals that are a primary food source for raptors (e.g., red-tailed hawks). Consequently, active management of grass cover is required to limit its attractiveness to wildlife.

### Grass Type

The type of grass used between the runways and taxiways should have small or no seeds, but should still be able to generate new growth or reseed itself. It needs to withstand drought, flooding, and other normal climatic conditions and have low palatability to grazing birds such as geese. The corridors between runways and taxiways should be mowed and disked before planting to remove unwanted seeds generating weed species. It may be necessary to apply a broadleaf herbicide after the grasses begin to grow to eliminate weedy invasives.

Some varieties of fescue grass contain fungal endophytes that are unpalatable to grazing birds, such as geese, as well as to rodents and deer.<sup>28</sup> These endophytic grasses might also support fewer insect numbers.<sup>14</sup> A recommended tall fescue mix that requires little water, fertilizer, and mowing is the Pacific Living Dwarf Fescue Blend (34% Bonsai 3000 Dwarf Fescue, 33% 2nd Millennium Dwarf Fescue, and 33% Finesse II Dwarf Fescue). This is a three-way blend of dwarf-type fescues, meaning they are lower- and slower-growing in stature, requiring less mowing and maintenance than traditional tall fescues.

### Test Plots

If a new variety of grass is chosen to replace existing grasses, only a section of the airport (i.e., a test plot) should be planted before extensive use to determine that it is not attractive to wildlife and tolerates normal climatic conditions. Test plots will also be used to test the efficacy and practicality of the following strategies or alternatives investigated in the future.

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<sup>28</sup> Cleary and Dolbeer 2005.

## Grass Height

Much research has been conducted on the optimum grass height to deter birds that pose a hazard to aircraft. Because different bird species prefer different grass heights, there appears to be no single grass height that is effective at deterring all wildlife species. Most studies show that a compromise of 7 to 12 inches works best at deterring both small and large bird species. The Airport Wildlife Biologist will continue to follow the most recent grass height studies to determine the best grass height to deter wildlife species at SFO.

## Mowing Times

When possible, grass should be mowed away from active runways, at night, or during the middle of the day, when birds are fairly inactive. Several species of birds are attracted to mowing activities because rodents, insects, and seeds become exposed. To minimize wildlife hazards during mowing, direct communication will be maintained at all times with the ATCT. If birds are attracted to activity, the mowing should stop until the birds have been successfully hazed from the area.

## Unpalatable Products for Grass

Several chemical repellents can be used to discourage birds, particularly geese, from feeding on turf and grass. Methyl anthranilate, a compound with a grape flavor that is distasteful to birds, has had mixed success.<sup>29</sup> Anthraquinone (also called "Flight Control") works by causing digestive tract disturbance after feeding, leading to conditioned aversion to the site.<sup>30</sup> Both products must be sprayed onto the grass. The products need to be reapplied after watering or rain. These methods can be used to temporarily discourage geese from feeding in an area.

## River Rock and Gravel as Ground Cover

River rock or gravel (larger than 2 inches in diameter) is an excellent groundcover because it does not provide wildlife habitat as long as weeds are not allowed to grow, debris is not allowed to build up, and the area is monitored for burrows and nests. It can be used in place of grass, especially around some of the landscaping areas, such as low-growing bushes and trees. River rock and gravel are expensive and uneconomical for use in large areas and are not appropriate immediately adjacent to runways because of the risk from gravel as FOD to aircraft.

## Streamside Vegetation

Cattails and other vegetation growing on the edge of a drainage canal or other wetlands offers excellent wildlife habitat. The vegetation that grows alongside these areas should be removed and maintained at low levels so that habitat is not provided for rabbits, blackbirds, herons, and other animals. Grass or river rock can be used to replace undesirable plants, slow erosion, and conceal low water levels. If ditches have cement foundations, debris and soil buildup should be removed routinely as water flows and plants are unable to get a foothold.

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<sup>29</sup> Dolbeer et al. 1993; Belant et al. 1996.

<sup>30</sup> Dolbeer et al. 1998.

## Landscaping

Landscaping at the airport needs to be aesthetically pleasing to enhance tourism and business. It must, however, coincide with the airport's greater responsibility for air safety. Trees and bushes, regardless of species, offer hunting perches, roosting and loafing sites, and nesting cover. Some species also provide food for birds. Trees within 600 feet of the runway should be removed. Trees up to 2,000 feet from runways should be removed where they are known to be a strong attractant to wildlife and appear to have a significant effect on air safety. Any required permits will be obtained. Ornamental trees and shrubs should be kept to a minimum and consist of varieties that are not wildlife attractants. If tree removal is not feasible, thinning branches in a tree can make it less attractive for roosting because the tree no longer holds heat effectively. Pruning every third limb is the recommended pruning strategy for trees hosting bird roosts.

A list of acceptable trees, shrubs, and groundcover for use at the airport includes plants that do not produce fruit, berries, or have structural characteristics (e.g. branching structure) that may attract wildlife. Plants that may provide wildlife habitat are eliminated from and not planted within the movement areas. The list will be subject to revision whenever new candidates are identified that meet the screening criteria.

### Introduced Soil

Care should be taken to ensure that soil introduced to SFO as fill during construction projects does not introduce unapproved plant species to the airport. When possible, introduced soil should be weed-free. When not feasible, care should be taken to prevent establishment of introduced plants using an appropriate method such as compaction, tilling, vegetation-suppression treatment, covering, or weeding.

### Existing Landscaping

Existing trees, shrubs, and other landscaping are continuously assessed. Any landscaping that is documented to pose a significant wildlife hazard to safe aircraft operations will be immediately removed.

### New Landscaping

- Each new landscaping project within the Primary Zone will be reviewed by the wildlife coordinator before landscaping designs are finalized.
- Landscaped areas within the Primary Zone, including tenant landscaping, will only include shrubs and groundcover. No new trees will be allowed. Tree species are included on the approved plant list for off-airport landscaping projects (i.e. at the West-of-Bayshore property). Species of vegetation must be represented on the Primary Zone plant species list kept by the Maintenance – Landscape division.
- No shrubs will be allowed within 10 feet of the airfield perimeter fence.
- No unbroken rows or clumps of evergreen shrubs will be allowed because of the shelter and insulation that are provided by contiguous crown cover.

## Approved Plant List

CN = California native

### Small shrubs 12-30"

- *Correa* 'Carmine Bells'
- *Correa* 'Wynns Wonder'
- *Baccharis* 'Twin Peaks' CN
- *Ceanothus* 'Yankee Point' CN
- *Grevillea lanigera* 'Coastal Gem'
- *Salvia* 'Dara's Choice' CN
- *Salvia spathacea* CN
- *Coleonema* 'Sunset Gold'
- *Anigozanthos*
- *Clivea miniata*

### Medium sized Shrubs 3'-8'

- *Leucodendrum* 'Safari Goldstrike'
- *Leucodendrum* 'Yaelii'
- *Leucodendrum* 'Summer Red'
- *Leucospermum* 'Veldfire'
- *Grevillea victoriae*
- *Choisya ternata*
- *Choisya* t. 'Sundance'
- *Choisya* 'Aztec Pearl'
- *Arctostaphylos* 'Howard McMinn'
- *Ceanothus* 'Dark Star' CN
- *Ceanothus* 'Joyce Coulter' CN
- *Ceanothus* 'Joan Mirov' CN
- *Ceanothus gloriosus* CN
- *Rhamnus californica* 'Mt San Bruno' CN
- *Rhamnus* 'Eve Case' CN
- *Salvia clevelandii* CN

### Large shrubs 8'-20'

- *Heteromeles* 'Davis Gold' CN
- *Ceanothus* 'Ray Hartman' CN
- *Ceanothus* 'Luis Edmunds' CN
- *Myrica californica* CN
- *Drymis lanceolata*
- *Mahonia lomarifolia*
- *Fremontodendron californica* CN

### Grass/ clumping plants 24-30"

- *Mulenbergia rigens* CN
- *Festuca californica* CN
- *Lomandra* 'Breeze'
- *Cordyline* 'Festival Grass'
- *Acorus* 'Ogon'
- *Libertia peregrinis*

### Large grass-like foliage plants 3'-15'

- *Cordyline australis* 'Torbay Dazzler'
- *Cordyline* 'Red Sensation'
- *Cordyline* 'Electric Pink'
- *Chondropetalum tectorum*
- *Dasylirion longissimum*
- *Xanthorrohea australis* (*pressii*)
- *Phormium* 'Yellow Wave'

### Small succulents 12-30"

- *Cistanthe* 'Jazz Time'
- *Aeonium* 'Sunburst'
- *Aeonium* sp
- *Aloe striata*
- *Aloe saponaria*
- *Agave victoriae*
- *Echeveria* 'Afterglow'
- *Sedum* sp.
- *Dudleya* sp.
- *Aloe spinosissimum*

### Medium succulents 3'-6'

- *Agave vilmoriana*
- *Agave attenuata*
- *Beshornia* sp.
- *Furcraea* sp.

**Large succulents 6-12'**

- *Aloe 'Hercules'*
- *Aloe ferrox*

**Small trees 15-20'**

- *Cercis occidentalis* CN
- *Cotinus coggyriana*
- *Acer circinatum* CN
- *Arbutus unedo*

**Medium trees 20-40'**

- *Arbutus menziesii* CN
- *Arbutus 'Marina'*
- *Aesculus californica* CN

- *Azara microphylla*
- *Casuarina littoralis*
- *Lyonothamnus asplenifolius* CN
- *Melaleuca quinquenervia*

**Large trees 40-100'**

- *Sequoia sempervirens* CN
- *Alnus rhombifolia* CN
- *Populus fremontii* CN
- *Quercus agrifolia* CN
- *Platanus racemosa* CN

### 5.3.5 Structure Management

*Target Species Categories: Canada goose, Cormorants/pelicans, Ducks, Herons, Hawks, Gulls, Owls – barn owl, Shorebirds, Blackbirds/Starlings, Pigeons*

#### Birds and Structures

Human-made structures can provide cover, nest sites, and perches for potentially hazardous wildlife and their prey. These include airfield buildings, aircraft hangars, terminals, light poles, fences, and navigational aids. If wildlife exclusion is considered during the initial design phase for a structure, future costly control measures and design retrofits can often be avoided. To this end, structures should not provide potential nesting, perching, or roosting sites for bird species of concern and should not allow access to mammals.

#### New Structures

The Airport Wildlife Biologist and Integrated Pest Management should participate in the planning phases of airport building projects that could inherently increase wildlife hazards, such as architectural or landscape changes. SFO staff should make every effort to minimize or eliminate designs that may attract wildlife.

#### Existing Structures

All existing structures located in the Primary Zone are monitored periodically as potential attractants to potentially hazardous wildlife. If use of structures by potentially hazardous wildlife is documented and this use is determined to represent a potential hazard to aircraft, a risk evaluation will be conducted to inform future decisions regarding appropriate actions to eliminate or minimize the hazard. Actions may range from the installation of features that deter wildlife from using existing structures (e.g., netting, fencing, spikes) to design modifications that make structures less attractive to wildlife.

## **Airfield Structures**

Airfield structures such as runway lights, ramp and taxiway signs, bioacoustic devices, and light poles are used as hunting and loafing perches for birds such as hawks and gulls. Lights at night attract insects and in turn attract bats and nighthawks. These structures should all be fitted with wire coils, porcupine wire, trip wires, netting, or electric wires to deter bird use.

## **Abandoned Structures**

Structures not pertinent to air operations and no longer in use should be removed. These include abandoned houses, sheds, machinery, and light poles. These structures are attractive to rodents, birds, cats, and rabbits; in turn, these animals attract predators that can become a significant aircraft hazard. As recommended in the 2014 WHA, a non-operational B727 aircraft used for firefighting practice was removed because it had become an attractant to nesting European starlings.

## **Physical Exclusion Devices**

Physical exclusion devices include spike strips, netting, doors, and other devices that deter or prohibit perching or entry. These devices can be effective on a small scale, but are often cost-prohibitive on a large scale. Prevention is often the easiest solution. Making sure that doors are closed whenever they are not in use will prevent some problem situations and is also cost effective. Exclusion devices should be installed when birds are not occupying the area to be excluded. Maintenance of exclusion material, such as repairing holes in netting, is essential for maintaining effectiveness. Heavy plastic strips hung vertically in open doorways have been successful in some situations to exclude birds.<sup>31</sup> These strips allow quick entry for humans or machinery, while keeping birds out.

## **Bird Netting**

Small-gauge netting is an ideal material for permanent exclusion of birds from buildings and overhangs that are attractive for nesting and roosting. Although this method of control can be expensive, the target bird species is permanently excluded from the area. Small-gauge netting may be appropriate if nesting and roosting by birds becomes problematic at some buildings (e.g., Superbay Hangar).

## **Entryway Exclusion**

When possible, doors to large, outdoor buildings, such as the Superbay Hangar, should be kept closed. Doors should be closed 1 hour before sunset when birds attempt to return to roost. Heavy plastic strips can be installed hanging behind the doors to allow normal airport traffic access, but prevent birds from flying through.

## **Anti-Perch Devices**

Airfield signs, posts, navigation aids, and other structures provide attractive perch posts for birds in close proximity to runways and taxiways. Anti-perching devices mounted on these structures can be an effective way of deterring use of these perch posts by birds. Recent anti-perching devices include Daddi long legs bird deterrents, with flexible stainless steel rods that bounce and wave in

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<sup>31</sup> Johnson and Glahn 1994.

the wind, making it difficult for birds to land. If it is determined that these structures are serving as attractants to potentially hazardous wildlife, retrofitting these structures with anti-perching devices will be evaluated.

### **Rodent Control for Buildings**

All buildings should be made rodent proof. All openings larger than the size of a quarter should be covered with 0.25-inch wire mesh. New building plans should incorporate rodent-proof construction. Integrated Pest Management staff should conduct periodic inspections of airport buildings and common tenant buildings such as the rental car facility to determine whether infestations are present and conduct the necessary control to remove the problem. Tenants are responsible for rodent control in their own buildings to be maintained at the same high standards as airport buildings.

### **Animal Deterrent Fencing**

SFO Facilities division maintains a permanent, 8 to 10-foot-high chain link perimeter fence around most of the airfield with 2-3 strands of barbed wire at the top. The fence serves the dual purpose of providing a security barrier for the airport and of excluding medium and large mammals from the airfield. If any breaches in the fence are contributing to hazardous wildlife within the airfield, the breaches will be quickly repaired.

## **5.3.6 Food/Prey-Base Management**

Rodents, rabbits, insects, earthworms, and other invertebrates are highly attractive to many species of birds and mammals and should be controlled where feasible. Handouts, trash, and scattered debris also provide food for wildlife.

### **Rodents**

*Target Species Categories: Herons, Hawks, Owls – barn owl*

Pocket gophers, moles, and other rodents at SFO may be the primary attractants of hawks, owls, herons, and other predators to the airfield. Control programs for these species will reduce SFO's attractiveness to these birds.

SFO staff should consider options to develop a trial program for gopher and vole control on the airfield to reduce the attraction of red-tailed hawks and other predators. This will include determining whether the most effective methods are trapping or the use of toxicants, and reducing large quantities of forbs with large roots preferred by gophers through available methods.

SFO staff should consider developing a trial program for small mammal control on the airfield to reduce the attraction of barn owls and other predators. Options include:

1. Exclusion of areas with hardware cloth or metal fence, dug 12 inches into the ground.
2. Control of prey items:
  - a. Investigate utility of application of milky spore disease to reduce the number of white grubs, which moles may be feeding on (this would likely take a few years to be successful and would require determination of which species of grubs are present).

- b. Control of earthworms, on which moles feed.
- c. Trapping.
- d. Toxicants.
- e. Continually investigate and evaluate new control options.

## Earthworms

Earthworms are very attractive to many species of birds. Heavy rains bring them to the surface where they attract birds; gulls are the most serious risk. Earthworms should be monitored, and, if they appear to be a major attraction to a problem species, an appropriate pesticide should be applied to reduce their abundance on the airfield. The San Mateo County Department of Agriculture Department or University of California Cooperative Extension can help to determine the available and appropriate molluscicide to use.

## Insects

Insects attract many species of wildlife. Insect populations should be monitored periodically by Airfield Operations staff to determine whether there are any in sufficient numbers to attract wildlife. The San Mateo County Department of Agriculture Department or University of California Cooperative Extension can help select the best pesticide or control method.

Grasshoppers have been present in large numbers during the fall season in the past. The presence of large numbers of these large-bodied insects presented an attractant to potentially hazardous wildlife. Recently, maintaining shorter grass heights has appeared to ameliorate the problem. However, if grasshopper population explosion is again observed, SFO staff should consider developing a trial program to reduce grasshopper numbers during the fall season. The program will:

1. Determine whether grasshoppers are laying eggs at the Airport or migrating into the area in fall.
2. Evaluate whether an insecticide or a single-celled protozoan (semaspore bait) can be applied late in summer to reduce numbers of nymphs if grasshoppers are laying eggs at SFO.
3. Evaluate whether an insecticide (e.g., carbaryl) could be applied before grasshoppers arrive in fall to reduce their numbers if grasshoppers are migrating from another area.

## Trash and Debris

*Target Species Categories: Gulls, Blackbirds/Starlings, Pigeons*

Trash and debris are often responsible for attracting species such as gulls and crows. Trash collection sweeps are regularly conducted by Facilities – Maintenance division and should continue to be collected. Trash storage and transportation should be rigorously conducted to avoid spills or open containers that may allow access to trash and debris by wildlife.

## Handouts

*Target Species Categories: Gulls, Blackbirds/Starlings, Pigeons*

The public or any airport employee should not be allowed to feed birds or mammals around the airport. Signs warning of the dangers associated with giving handouts and wildlife hazards, such as

those erected around the view lot, should be posted at other locations around the airport that appear to be attracting birds.

Airport staff and tenants should be educated about the aviation safety reasons for reducing wildlife attractants and enlist their help in reducing wildlife attractants (e.g., trash, cat feeding stations). The program includes:

1. Continuation of 1) the SFO Foreign Object Debris (FOD) Walk, where airport staff volunteers walk runways to pick up debris that may be a hazard to safe aircraft operations (2009 marks the 10th year); and 2) the Airport Director-initiated airport-wide Operation Clean Up, with trash pick-up on the airside, including boarding areas/aprons and ramps
2. In-person education and outreach programs for departments and employees whose duties intersect with the wildlife program conducted by the Airport Wildlife Biologist and Wildlife Coordinator.
3. An online resource with information about wildlife hazard management at SFO and with a contact form for employees to report wildlife problems, attractants, or observations.
4. Planning and Environmental Affairs coordination with local governments and agencies to ensure that surrounding land uses are compatible with airport safety. The PEA will coordinate with C/CAG for consideration of airport safety when developing county-wide land use policies for new development. The PEA will manage and minimize the public's feeding of birds and animals around the Airport, especially around San Francisco Bay access areas such as Bay Front Park (owned by SFO, leased and maintained by City of Millbrae) and other areas near SFO where people congregate and feed animals. Install "Do Not Feed the Birds and Animals" signs for public education purposes if acceptable to land owner and approved by regulatory agencies.

### 5.3.7 Non-Airport Land Use Projects

SFO staff should continue to coordinate with surrounding local jurisdictions to discourage land use practices that are known attractants of potentially hazardous wildlife on non-SFO owned lands in the Secondary Zone, consistent with FAA AC 150/5200-33B.

The Airport Director, Airport Wildlife Biologist, and other SFO staff will participate with local, state, and federal agencies on land use decisions that could possibly increase the attractiveness of the properties surrounding the airport to potentially hazardous wildlife. Proposed land use projects that will likely increase populations of species of concern or their activity within aircraft flight zones will be discouraged. The FAA Regional Airport Division provides technical guidance to airport operators and local/state governments in addressing land use compatibility issues. Guidance on incompatible land uses near airports can be found in FAA AC 150/5200-33B (see **Appendix A** for a full copy of FAA AC 150/5200-33B). The paragraphs below describe some of the SFO's strategies for managing potential wildlife hazards on non-SFO owned properties in the Secondary Zone.

Proposed projects that will likely increase bird numbers near the airport should be discouraged. Incompatible land uses include solid waste disposal facilities,<sup>32</sup> water reservoirs, sewage ponds, parks with human-made ponds, slaughterhouses, and wildlife refuges.

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<sup>32</sup> FAA Order 5200.5A

## Private Lands

Should significant wildlife issues be identified on these lands, SFO would approach the landowner and explain the association between the wildlife issue on their land and the WHMP. If needed, SFO would use the guidance in FAA AC 150/5200-33B and ask for support from the FAA to encourage the landowner to modify any land use or practice found to pose an unacceptable risk to safe aircraft operations.

## Proposed New Land Uses

SFO will use the guidance in FAA AC 150/5200-33B and its technical experience to determine whether a proposed land use may result in a wildlife hazard that is incompatible with safe aircraft operations. If a new land use were proposed that is not recommended by the FAA, SFO would evaluate this land use using the accepted forums. SFO will work with the Cities of South San Francisco, San Bruno, Millbrae, and Burlingame on any proposed land use changes that may be in conflict with safe aircraft operations, such as the location of wetland mitigation sites or wastewater treatment plants in the Secondary Zone.

## 5.4 Research and Development

SFO recognizes that an active research and development program is integral to achieving the objective of reducing wildlife-aviation hazards. Incorporating an adaptive management component into the wildlife hazard program will introduce the flexibility necessary to ensure the program's effectiveness over time. A variety of wildlife management techniques and equipment are currently utilized at SFO, and new techniques and strategies are proposed as part of this updated WHMP. SFO will evaluate these wildlife management techniques and strategies, and retain a list of those techniques that have proven to be successful and those that are ineffective. Those cost-effective methods that achieve positive results without adverse consequences will be considered for incorporation into future updates of this WHMP. As part of this effort, SFO intends to develop a strong network of contacts with other airports and with the aviation/bird strike community to share information about programs, equipment, and techniques. The knowledge gained through research and development will serve to inform future wildlife hazard management decisions at SFO and to guide future operational tactics and management strategies implemented on the airfield.

### 5.4.1 Monitoring

1. Monitor shoreline around runways to determine whether shorebirds and waders are using these areas and flying across the airfield. Describe flight patterns. This would provide justification to authorize shoreline dredging, if warranted, to reduce shorebird presence on the airfield.
2. Monitor the West-of-Bayshore property to determine whether it serves as a wildlife attractant, with considerations to the *San Francisco Garter Snake Recovery Action Plan*.<sup>33</sup>
3. Monitor raptor use of airfield to determine the nature of the attractants (e.g., perch structures, rodents). Then, develop management plan to reduce raptor use of airfield.

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<sup>33</sup> LSA Associates, Inc., 2008.

4. Develop a necropsy program to examine intact bird carcasses for stomach contents to identify dietary attractants.
5. Conduct nesting bird surveys of airport structures during nesting season from January 15 to August 15. Use outreach to educate airport personnel about the importance of reporting nest construction and direct reports to the wildlife tip line and online contact form.
6. Follow a standard protocol for collecting bird observation data that includes monthly distance sampling surveys of 17 point count locations surrounding the airfield and in nearby areas with potential attractants (e.g. West-of-Bayshore and Bayfront Park). Each point should be surveyed once each in the morning, midday, and evening.
7. Conduct nighttime spotlight surveys once per quarter to detect presence of owls and mammals.
8. Develop a program to inventory insect species and abundance both above and below ground in the infield areas.
9. Develop a standardized small mammal trapping study to monitor species and densities using the airfield. Trapping should be conducted twice per year, once after the spring reproductive cycle (e.g. May or June) and once during the fall or winter. Other options include mapping small mammal sign, i.e. burrows, castings, and runs.

## 5.4.2 Internal Communication

The success of the WHMP depends on the support of a variety of internal departments, teams, and individuals. Staff education on the WHMP components will assist in their understanding of how their actions and job may influence the success of the program.

### Tip Line

As discussed previously, SFO has developed an online resource for airport employees and tenants to disseminate information about the wildlife management program, present tips to avoid creating wildlife attractants, and to provide a contact form and tip line telephone number to allow personnel to report hazards, observations, suggestions, or identify unwanted conditions or behaviors. This resource will be regularly promoted through in-person outreach with relevant personnel.

### Bird Strike Reports

Airfield operations should continue to increase the percentage of successfully identified bird strikes to better manage for the most hazardous species. Maintain outreach, education, and training efforts to encourage relevant personnel to collect unidentified bird strike remains and send to the Feather Identification Lab at the Smithsonian Institute for identification.

## 5.4.3 External Audiences and Stakeholders

### Regulatory Agencies

A large group of regulatory agencies interacts with the WHMP to issue permits or to give advice or feedback.

## Adjacent Landowners

Adjacent landowners can have an effect on the WHMP, either positive or negative. SFO staff may meet with adjacent landowners whenever concerns arise about wildlife management practices that may exacerbate the strike hazard.

## General Public

SFO should promote opportunities to provide the public with consistent messages and accurate information about the WHMP, through the SFO Public Affairs Department. SFO's public website should have a webpage to give an overview of the program and provide an update on current issues.

## 5.5 Species-Specific Management

The 2014 WHA recommends various management strategies for each of the nine species or species categories assigned a moderate or high strike hazard ranking.<sup>34</sup> General techniques used across species are detailed above. The following sections discuss specific but adaptive management of each of the nine species or species categories and suggest target outcomes and completion dates where appropriate.

### 5.5.1 Canada Goose

The largest attractant for Canada geese at the Airport is nesting habitat in the open area behind the MLTP. Canada geese attempt to nest each year in this area. Reduction in successful reproduction behind MLTP is the main species-specific management goal for Canada geese.

### Management Goals and Timeline

SFO should attempt to completely prevent successful breeding behind the MLTP every year.

### Management Strategies

- Vegetation management. Investigate elimination of vegetation used as nesting shelter by Canada geese during WHA surveys. Alternatively, investigate the efficacy of growing taller vegetation to deter nesting.
- Eliminate MLTP aquatic habitat. Options for elimination of tidal bay habitat are restricted by environmental protections. Options for the elimination of freshwater ponds and wetlands above the high-tide line include development of the area.
- Exclude Canada geese from MLTP aquatic habitat. Exclusion options include installing fencing along the margins of aquatic and upland habitat, including along the Bay perimeter.
- Nest destruction and egg addling. During the nesting season from March to July, the MLTP should be regularly patrolled and inspected for nests. Nests found without eggs should be destroyed. Nests with eggs should be destroyed using an approved method; by destroying

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<sup>34</sup> LSA Associates, Inc. 2014

eggs, puncturing shells, shaking, or oiling eggs, or whichever legal method is found to be most effective.

## 5.5.2 Cormorants and Pelicans

Cormorants and pelicans are generally attracted by the open water Bay habitat and the fish present that make up their preferred prey base.

### Management Goals and Timeline

Reduce Cormorant and pelican activity across aircraft flight paths. Ongoing.

### Management Strategies

- Remove sand spit (as recommended in the WHA). SFO is investigating options to remove the sand spit that attracts loafing water birds. Environmental and logistical constraints may make removal unfeasible. However, intensive hazing of this or other high-activity areas is often successful in mitigating temporary periods of high and/or hazardous activity.

## 5.5.3 Ducks

Since the elimination of infield area detention ponds during the Runway Safety Area project, ducks now occur most often in the open water Bay habitat. General management techniques such as hazing should be continued. Special attention should be directed to elimination of ponded water on the airfield following storm events to prevent attracting ducks.

## 5.5.4 Herons – Great Blue Heron

Herons are rarely seen on the airfield, but present a significant hazard to aircraft because of their large body size and slow flight.

### Management Goals and Timeline

Eliminate all presence of great blue herons in infield areas. Ongoing.

### Management Strategies

- Following small mammal studies, implement small mammal control measures that are found to be most effective to eliminate the prey base.
- Maintain a zero tolerance policy for great blue herons and shoot on sight in hazardous areas of the infield where they pose a direct and imminent threat to aircraft.

## 5.5.5 Hawks

Hawks are likely attracted to the airfield by small mammal prey items using the infield areas. Hawks present a significant hazard to aircraft due to their large body size and soaring behavior.

## Management Goals and Timeline

Eliminate or reduce the small mammal population in the infield areas to reduce occurrence of hawks on, around, and above the airfield. Dependent on discovery of effective small mammal control.

## Management Strategies

- Once effective small mammal control measures are identified, they should be implemented throughout the airfield, if possible.
- Survey the West-of-Bayshore property for nesting.
- Investigate options for trapping and relocating hawks, especially juveniles.

### 5.5.6 Gulls

Gulls of various species are prevalent in the vicinity of the Airport and are potentially attracted by several sources. Gulls may be attracted by the open water Bay habitat and fish and mollusks, by the infield area grassland habitat for loafing or preying on earthworms, and/or by the manmade structures and trash, debris, or intentional handout sources of food.

## Management Goals and Timeline

Reduce the abundance of gulls in the vicinity of the airfield and eliminate the attraction of gulls to the terminals and airport structures. Ongoing.

## Management Strategies

- Manage infield areas to prevent longstanding ponding water and eliminate earthworms that may emerge following storm events.
- Proactively manage sources of food waste, garbage, and debris in all areas of airport facilities to prevent creation of an attractant
- Proactively prevent intentional feeding of gulls with outreach and education, signage, and enforcement.

### 5.5.7 Owls – Barn Owls

Barn owls are a nocturnal predator that prey most heavily on small mammals and are attracted to the infield grasslands at night to hunt for voles, gophers, and moles. Barn owls may also be attracted to roost or nest in structures on or in the vicinity of the Airport.

## Management Goals and Timeline

Reduce the abundance of owls using the airfield for hunting. Ongoing.

## Management Strategies

- Conduct nighttime patrols quarterly using spotlighting equipment to observe owls entering, leaving, or using the airport.

- Inspect any pellets found and identify prey species and institute small mammal control measures.
- Eliminate, modify, or exclude owls from any identified roosting or nesting structure.

### **5.5.8 Shorebirds**

Shorebirds are mostly observed in the tidal mudflats bordering the Airport to the southeast. Shorebirds are attracted by the open water Bay habitat and tidal marshes and mudflats. Shorebirds are controlled using standard mitigation techniques such as hazing. Elimination or modification of the attractant habitat is currently precluded by protections for endangered species.

### **5.5.9 Blackbirds and Starlings**

Blackbirds and starlings are common at the airport, but the flock size and thus threat to aircraft is highly variable by season. Starlings are currently controlled with standard mitigation strategies including hazing, exclusion, shooting, and trapping and euthanasia. As recommended in the 2014 WHA, a firefighting training plane previously used by European starlings for nesting was removed.

### **5.5.10 Pigeons**

Pigeons were not classified as a moderate or high risk in the 2014 WHA, but vigilance is needed to avoid a hazardous increase in pigeon numbers. Pigeons are currently controlled with standard mitigation strategies with special attention paid to elimination of trash, debris, and handout attractants.

## **6.1 Overview**

Wildlife populations on and in the vicinity of airports are constantly changing in response to changes in land use and environmental factors, and state and federal management policies. In addition, wildlife may adapt or habituate to wildlife hazard management control strategies that were once effective, or develop new behavioral or feeding patterns on or near the airport. New wildlife control technologies might become available, or established products or techniques could be withdrawn or banned. Finally, there may be changes in wildlife control and management personnel at an airport. Any of these factors could materially alter the effectiveness of the wildlife hazard program and its implementation. This chapter outlines the procedures for evaluating the WHMP and its implementation.

## **6.2 WHMP Evaluation**

All FAA-approved WHMPs must be reviewed at least annually or following an event that would normally trigger a wildlife hazard assessment (14 CFR Parts 139.337[b][1-4] and 139.337[f][6]). The WHWG will schedule an annual or triggered meeting to review the effectiveness of the WHMP at reducing wildlife strikes at SFO and to evaluate all wildlife-related projects (see Sections 6.8 and 6.9 in this chapter).

## **6.3 Monitoring and Record Keeping**

Records of wildlife activity, wildlife strikes, and wildlife management actions taken at SFO will be kept by the wildlife coordinator at Airfield Operations division to evaluate the WHMP including:

- Daily logs of wildlife activity.
- Daily logs of wildlife strikes.
- Records of management actions taken.
- Monthly and annual wildlife management reports.
- Records of all personnel training.

All permits required to implement the WHMP will be reviewed semi-annually to ensure that SFO is up to date and in compliance with permit conditions.

## **6.4 Wildlife Strike Database**

The wildlife coordinator will maintain a database of all aircraft-wildlife strikes recorded at SFO. Wildlife strikes will be continually monitored to determine the number of recorded strikes and their

trend. If unacceptable wildlife strike increases are detected, the cause will be determined and the WHMP modified to reflect new directions to resolve the problems.

## 6.5 Airport Expansion

All airport expansion plans will be reviewed by Airfield Operations staff, Integrated Pest Management, and/or the Airport Wildlife Biologist to ensure that new developments would not inherently threaten the overall safety of aircraft operations by increasing wildlife attractions at the Airport.

## 6.6 FAA Involvement

FAA regional coordinators will be invited to comment on the WHMP, and to attend annual meetings to review the plan and provide their input and concurrence.

## 6.7 Annual Review

All FAA-approved WHMPs must be reviewed at least annually or following an event that would normally trigger a wildlife hazard assessment, as required under 14 CFR Parts 139.337[b][1-4] and 139.337[f][6]. The review must include the plan's effectiveness in dealing with known wildlife hazards on and in the vicinity of the Airport, and aspects of the wildlife hazards described in the wildlife hazard assessment that should be reevaluated, per 14 CFR Part 139.337[f][6]. The wildlife Airfield Operations staff and PEA staff responsible for implementing the plan and a subgroup from the SFO's WHWG will conduct the review.<sup>35</sup>

**Appendix B** describes a system (modified from Seubert 1994) for assessing a WHMP. Five assessment categories are evaluated to determine the adequacy of the WHMP and rate how well it is being implemented:

- **Category 1:** Management functions related to wildlife hazards on or in the vicinity of the Airport.
- **Category 2:** Bird control on or in the vicinity of the Airport.
- **Category 3:** Mammal control on or in the vicinity of the Airport.
- **Category 4:** Management of habitat and food sources on Airport property related to wildlife hazards.
- **Category 5:** Land uses and food sources off the Airport that is potentially attractive to wildlife.

For Categories 1 to 4 (activities on the Airport), a series of elements are rated as either "satisfactory," "unsatisfactory," or "not applicable." For Category 5 (off-Airport attractants), elements are scored on a scale of 0 (not present) to 3 (site creates significant wildlife hazard for the Airport; action should be taken). Elements determined to be "unsatisfactory" (Categories 1 to 4) or scored 2 or 3 (Category 5) will be discussed in a summary form.

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<sup>35</sup> Federal Aviation Administration 2005.

SFO uses the system described in **Appendix B** as part of the annual evaluation of the WHMP and its implementation. The review elements that compose each category will be modified to reflect the wildlife hazard management components and strategies relevant to the WHMP.

## 6.8 Airport Wildlife Hazard Working Group

The function of the WHWG is to foster communication and aid in coordination among Airport divisions and with local, State, and federal agencies and private entities. The goals and responsibilities of the WHWG are as follows:

- Conduct meetings annually or in response to a triggering event.
- As part of discussion, cover wildlife strike trends and significant strike events, sources of wildlife causing strike problems, and wildlife control activities.
- Minutes include list of attendees, decisions made by the group, deadlines and responsible parties for tasks, and a list of critical issues that were not resolved.

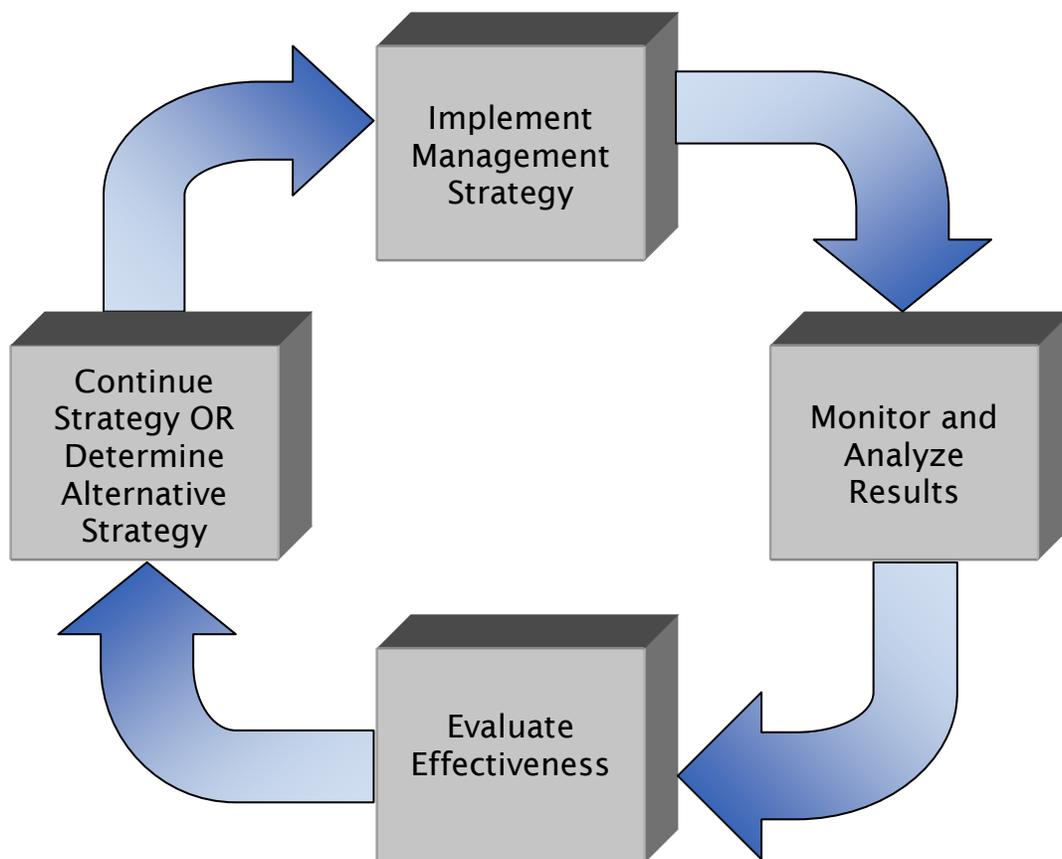
## 6.9 Airport Wildlife Hazard Committee

The Wildlife Hazard Committee (WHC) is composed of personnel and departments involved in direct and continuous implementation of the WHMP and meets monthly to discuss ongoing wildlife issues, trends, and actions. Currently, the WHC is composed of representatives from Airfield Operations, the Wildlife Coordinator, PEA, the Airport Wildlife Biologist, and Integrated Pest Management.

## 6.10 Adaptive Management

Adaptive management is defined in various ways by agencies and researchers. However, all definitions have a common basis in that the management or monitoring strategy is adjusted in response to the trends and outcomes of the strategy as currently applied (see **Figure 6-1**). The monitoring and evaluation program outlined for SFO will serve as the basis for integrating adaptive management into the WHMP. This approach will enable SFO to focus its management and control efforts in areas that have the highest likelihood of reducing wildlife-aviation risk. This will ensure that the WHMP level remains an ongoing and dynamic process that will evolve to meet the changing wildlife hazard management needs at SFO.

**Figure 6-1.** Adaptive Management Model



Training is essential for all Airport staff involved in the WHMP at SFO. Training will provide staff with the knowledge and skills needed to implement the WHMP. The training log is located in **Appendix G**.

### 7.1 Standard Training

All personnel identified in Chapter 2 as having responsibility for direct implementation of the WHMP should receive initial and annual training in the following areas as identified in FAA AC 150/5200-36A:

- Wildlife hazards at airports.
- Laws associated with wildlife control.
- Techniques (e.g., traps, poisons) used for prey-base reduction (only personnel involved in direct control).
- Firearm and pyrotechnic safety, including hands-on training.
- Wildlife identification and dispersal techniques.
- Airport communications and driving safety to operate safely in the AOA.

Relevant staff should receive a minimum of 8 hours of training every 12 months. It is the responsibility of the wildlife coordinator to ensure that Airfield Operations staff obtains required training. The wildlife biologist supports the wildlife coordinator in these efforts. The wildlife biologist will be required to meet the educational and experience qualifications listed in FAA AC 150/5200-36A.

### 7.2 Training Opportunities

- **USDA Courses.** USDA Wildlife Services (WS) has instructors that teach a standardized 1-day course for Airfield Operations staff. The purpose of the course is to familiarize Airport staff with basic bird identification and dispersal techniques. The course also allows hands-on training for Airfield Operations staff with pyrotechnics, considering safety first and foremost. Training instructors and materials can be arranged through WS.
- **Bird Strike Committee USA meetings.** Bird Strike Committee USA (BSC-USA) holds joint meetings annually with Bird Strike Committee Canada at a United States or Canadian airport. This annual meeting provides an excellent forum to discuss the latest issues and techniques in wildlife control for airports. The meeting includes a field trip to the host airport with demonstrations by vendors and wildlife specialists. Information on annual meetings, as well as information on various aspects of wildlife hazard management for airports, can be found at BSC-USA's website <http://www.birdstrike.org>.

- **Hunter safety and firearms courses.** Airfield Operations staff who will be using firearms will be required to complete a hunter safety or firearms safety course, coordinated by Airfield Operations division and the wildlife coordinator.
- **Miscellaneous courses and activities.** Many universities and some community colleges offer courses in ornithology, principles of wildlife management, principles of wildlife damage control, or other related topics. Local Audubon Society chapters or park districts sometimes offer workshops or short courses in field identification of birds. Participation in conservation organization activities, such as winter bird counts and spring migration counts, is an excellent means of building bird identification skills and developing contacts with local wildlife experts.

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