



Contractor's Quality Control/ Quality Assurance Certification

I hereby certify that this submittal, inclusive of all equipment and materials contained herein, is in compliance with the contract drawings, specifications, technical requirements, comprehensive agreement, and all other contractor documents and can be installed/ utilized as stated in submittal.

Quality Manager:

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Signature

04.01.2020

Date



NESTING BIRD MANAGEMENT AND CONTROL PLAN

I-64 Hampton Roads Bridge-Tunnel Expansion Project

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Appendix B: Technical Assistance Report-Effective Bird Dispersal and Deterrent Techniques
Appendix C: USDA APHIS Wildlife Services Fact Sheets
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Document History:

Issue Date	Description	By	Revision
October 23, 2019	Final Draft	DJV	HRCP
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March 27, 2020	Revision 5 submitted to VDOT	HRCP	VDOT

1. INTRODUCTION

1.1 PURPOSE AND NEED

- i. The Hampton Roads Bridge Tunnel Expansion Project (HRBT Project) is a major transportation infrastructure project located along existing I-64 and the HRBT in Virginia. Hampton Roads Connector Partners (HRCP) is working with the Virginia Department of Transportation (VDOT or Department), federal agencies and state agencies to advance the design, approvals, and multi-year construction of the Project. Current conditions at the South Island construction site include extensive nesting by marine colonial bird species. Coordination with Virginia Department of Game and Inland Fisheries (VDGIF) and with the United States Fish and Wildlife Service (USFWS) Virginia Field Office (Appendix A) has occurred, as described below in more detail. For purposes of limiting bird/human interaction events between marine birds nesting and roosting at the site and construction and maintenance sites, we have developed this “Nesting Bird Management and Control Plan” (Plan) to be implemented immediately, during construction.
- ii. Construction activities occurred at South Island commencing in early 2019 to perform geotechnical borings and continued into late 2019. Bird nesting control and bird management will be implemented prior to the 2020 bird nesting season begins and will apply to the existing South Island facility during construction. April is the beginning of bird nesting season and for purposes of this plan active avian management and control will be initiated before each April 1 and actively continue yearly thereafter until September 1.
- iii. Construction proposed to occur on the South Island includes in-water island expansion activities. Creation of the South Island Launch Pit (SIP), and Tunnel Approach Structure (TAS) will result in the excavation of approximately 260,000 cubic yards of sandy material and expansion of the South Island from about 21.5 acres to about 25.5 acres.
- iv. The purpose of this HRCP Plan is to:
 - 1) Describe the proposed methods to control and manage nesting birds throughout construction according to accepted techniques, in locations where control is needed;
 - 2) Set up a process for monitoring;
 - 3) Provide a toolbox of bird management techniques for use by HRCP, and
 - 4) When to use them.

This document also identifies those responsible for various steps in the Plan over time to implement, keep records, train personnel, and identify experts to help guide and train into the future. Finally, this plan identifies a process that should control efforts needed to be adaptively managed to improve effectiveness.

2. BIRD MANAGEMENT MEASURES

The goal of the Plan is to discourage nesting on the HRBT South Island as a means of reducing impacts to the nesting bird population that have historically used the HRBT South Island for nesting. HRCP will discourage nesting on South Island during the construction project by using methods described in this bird management plan while adhering to requirements of state and federal regulations. This HRCP Plan incorporates VDGIF recommendations for understanding bird habitat, nesting areas, and nesting bird behavior on the South Island. The Plan identifies methods that HRCP will use to achieve a balance between limiting impacts to nesting birds while achieving goals of the HRBT Project, to the extent possible under contract agreement with VDOT.

2.1 SOUTH ISLAND BIRD SPECIES AND THEIR PREFERRED NESTING HABITAT

- i. Gibson, et. al (2017) with Virginia Tech (VT) completed a VDOT funded field study in 2017 and included results in “Final Report: An assessment of potential conservation measures to benefit colonial nesting water birds using South Island of Hampton Roads Bridge Tunnel”, (VT Report) identifying four species of terns [royal tern (*Thalasseus maxima*) ROTE, sandwich tern (*Thalasseus sandvicensis*) SATE, gull-billed tern (*Gelochelidon nilotica*) GBTE, and common tern (*Sterna hirundo*) COTE], and black skimmer (*Rynchops niger*) BLSK breeding on South Island.
- ii. The VT Report identified three species of gulls [laughing gull (*Leucophaeus atricilla*) LAGU, herring gull (*Larus argentatus*) HERG, and great black-backed gull (*Larus marinus*) GBBG] breeding on South Island. Other less prevalent breeding species included the American oystercatcher (*Haematopus palliatus*) AMOY, snowy egret (*Egretta thula*) SNEG, Canada goose (*Branta canadensis*) CANG and killdeer (*Charadrius vociferous*) KILL. VT also noted that no federally listed species are documented but one state-listed threatened species occurs on South Island (GBTE). The 2017 field study identified the above list of birds using the Island for nesting during that year. VT also observed another eight bird species that may have exhibited nesting behavior on South Island that did not appear to be nesting, and others that were occasionally present. These other birds observed by VT scientists on South Island are listed below:
 - Double-crested cormorants (*Phalacrocorax auritus*) DCCO
 - European starling (*Sturnus vulgaris*) EUST
 - Peregrine falcon (*Falco peregrinus*) PEFA
 - Rock doves (*Columba livia*) RODO
 - Ruddy turnstones (*Arenaria interpres*) RUTU
 - Sanderlings (*Calidris alba*) SAND

Preferred nesting habitat for the five targeted colonial nesting water birds include the following:

- ROTE: Male and female select a ground nest site on a sandy beach, barrier island, or dredge-spoil island. Nests are small, unlined depressions in the sand, made by digging with the feet and finishing the shape with the belly. Adults defecate around the nest rim. At roughly 14 days of age, young leave the nest site and join groups of flightless young referred to as crèches

- SATE: Virginia is the northern extent of the Sandwich Tern nesting range. They nest in ROTE colonies but in much smaller numbers. Nest is built by both sexes in a shallow scrape, sometimes lined with bits of debris. Flightless young will join ROTE crèches several days after hatching.
- GBTE: Nests mostly on beaches and islands, and reportedly along salt marshes in the past. A colonial breeder and colonies usually small and not as densely packed as some of the terns. Nest site is open ground, or sometimes on a gravel roof. Nest is built by both sexes as a shallow depression often with a rim of soil with an addition of plant material and debris.
- COTE: Common Terns nest in colonies on the ground in areas with loose sand, gravel, shell, or cobble pebbles typically less than 350 feet from the water. They tend to choose areas with scattered, low-growing vegetation to provide cover for chicks. Males and females make a small scrape on the ground. Females add dead vegetation that has washed onshore, shell fragments, bones, stones, and sometimes plastic to the nest scrape before and after laying eggs.
- BLSK: These birds also nest in colonies with a nesting site on the ground in open, sandy beach, shell bank, sandbar or sometimes on a gravel roof. The nest is a shallow scrape in the sand.

2.2 MANAGEMENT EFFORTS TO LIMIT IMPACTS TO NESTING BIRDS

This Plan will be implemented by HRCP well before the month of April 2020 in anticipation of migrating birds arriving by April 1 looking to establish nests. Bird control efforts will occur as needed and are expected to continue through the remainder of each summer until September 1 and every year until construction is complete.

2.2.1 METHODS TO MANAGE AND CONTROL BIRD USE AT SOUTH ISLAND FROM SCIENTIFIC LITERATURE

- i. The HRCP Plan begins with habitat removal especially in areas formally densely inhabited by nesting water birds. The plan then moves to the installation of passive and active deterrents, exclusion and dispersal techniques, devices and measures. Habitat modification (i.e., paving) is the most important method to deter the use of the island for nesting and was implemented September 2019, prior to the 2020 bird season. HRCP will employ those control tools outlined in the Donaldson (No date) Virginia Transportation Research Council's "Technical Assistance Report: Effective Bird Dispersal and Deterrent Techniques For Virginia Department Of Transportation Project Sites" and the Seamans and Gosser (2016) report the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS) 2003: "Bird Dispersal Techniques" publications (Appendix B and Appendix C, respectively). Other documents as cited in this Plan and from previously noted publications will be used by HRCP such that most control tools (except that chemical methods will not be used) listed below will be available and implemented as needed, subject to regulatory conditions.
- ii. This section and Table 1 below lists the bird management tools to be implemented by April 1 of each construction year on South Island before and during construction.

Table 1 Bird Nesting and Control Management Techniques to be used at the HRBT Construction Site

Technique ⁵	Type	Areas Applied	When to Implement	References
*Paving/Sealing Painting of Concrete	Habitat Modification	All paveable areas Concrete pads poured on site will be painted black	Immediately	6
Wire Grid	Exclusion	All riprap above Highest Astronomical Tide; flat building surfaces	Immediately	1,2,3,6
Spikes/Moving bird structures	Landing Deterrent	All flat building and structure surfaces	Immediately	1,2,4
Coils	Exclusion	Along guide rails and barriers	Immediately	1,2,4
Trained Dogs	Landing Deterrent/Predation Deterrent/Dispersal	All areas, especially in evenings, mornings and weekends	Immediately	
Tarps/Flagging	Landing/Nesting Deterrent	To completely cover temporary spoil piles, dumpsters, and attractive substrates/food sources	As needed	
Pyrotechnics	Auditory Deterrent/Dispersal Technique	Areas of bird congregation where dogs cannot access	As needed, in conjunction with VDOT/Navy	7,8
Biosonics	Auditory Deterrent	Areas of bird congregation where dogs cannot access	As needed, in conjunction with VDOT/Navy	7,9
Effigies	Landing Deterrent/Predation Deterrent	Building rooftops, temporary spoil piles, mobile equipment	As needed	7,11
Lasers/Lights	Visual Deterrent	Encourage bird to leave an area	As needed coordinate with VDOT/Navy	12
Goal Netting	Exclusion	limit bird access around buildings and other structures.	As Needed	13

Notes for Table 2: Take of migratory birds is regulated by the Migratory Bird Treaty Act, and instructions for required management and control included as a permit condition.

Additional notes: *Hazing Site Map showing paved and to be paved areas - Appendix E.

1. As noted by APHIS comments or Bird Dispersal Techniques document.
2. As noted by VDOT Technical Assistance Report.
3. Overhead lines have been shown to be effective on gulls and terns (Gorenzel and Salmon, 2008) and blackbirds, starlings, ducks, geese, swans, pigeons/doves, owls, thrushes, and sparrows (Cleary and Dickey, 2010).
4. Anti-perching devices have been shown to be effective on diving birds, gulls, and terns (Gorenzel and Salmon, 2008) and all studied bird groups (Cleary and Dickey, 2010).
5. Balloons will not be used.
6. As noted by APHIS comments or APHIS Bird Dispersal Techniques document 22.
7. As noted in VDOT Technical Assistance Report.
8. Pyrotechnics have been shown to be effective on all studied bird groups (Cleary and Dickey, 2010).
9. Biosonics have been shown to be effective on gulls and terns (Gorenzel and Salmon, 2008) and geese (Cleary and Dickey, 2010)
10. Trained dogs have been shown to be effective on all studied bird groups. Dogs used on South Island, would only be used in areas where no construction is occurring and only limited access to traffic. Dogs may be used during the day or night.
11. Cleary and Dickey (2010) maintain that effigies have been shown to be effective on all studied bird groups, but other research states that efficacy varies depending on species (Belland and Martin, 2011).
12. birdcontrolgroup.com
13. For use in targeted areas only following consultation with VDGIF; increased monitoring for entanglement required

- iii. HRCP will use tools listed above (and included in appendices) as needed to limit bird nesting on the island appropriately. Due to safety and security issues associated with incoming aircraft and vehicles, some methods may be used after coordination with VDOT and the US Navy to inform them of use. Please note that previous coordination between VDOT, VDGIF and USFWS has occurred and has not precluded the use of Tools listed in Table 2 to limit bird nesting on South Island for purposes of preventing adult bird and chick mortality.
- iv. The Virginia Tech report (Gibson, et. al. page 140) recommended implementation of devices that reduce the ability of water birds to land on horizontal surfaces. The devices listed included: angled metal flashing or stone, spike-strips, or networks of wire grid that would reduce the physical ability of birds to access specific locations. In addition, the report noted that these exclusion devices could be combined with visual devices created to induce a behavioral response in birds (e.g., scarecrows). Grid exclusion devices will be affixed with securely fastened Mylar Tape to introduce physical movement that will visually disturb the birds. We believe the Mylar Tape is a necessary component of the wire grid devices to further minimize the attractiveness of riprap areas to roosting and nesting birds.

2.2.2 METHODS TO MANAGE AND CONTROL NESTING BIRDS BY USDA- APHIS WILDLIFE SERVICES

- i. The mission of USDA APHIS Wildlife Services (WS) is to provide Federal leadership and expertise to resolve wildlife conflicts allowing people and wildlife to coexist. APHIS-WS has a history of working with VDOT and Virginia DGIF to resolve human/wildlife conflicts and to protect human health and safety along I-64. Within the past year, APHIS-WS was in correspondence with VDOT and provided input on VDOT's plans to manage birds at the South Island construction site. The following is a summary of recommendations noted in an April 12, 2019 email exchange between Amy Golden (VDOT) and Jennifer Cromwell (Assistant State Director, USDA APHIS-WS):
 - Install exclusionary structures or barriers onto concrete structures and around the Tunnel Opening to reduce gull nesting and minimize laughing gulls from accessing the I-64 tunnel;
 - Install exclusionary fencing or barriers around any remaining non-paved nesting areas;
 - Maintain coil wire exclusion devices installed by WS and VDOT along the railings and walls above the HRBT tunnel entrance and exit; and

Note: HRCP has acknowledged the above APHIS-WS comments and suggestions and will implement most of the suggested measures, including the methods in Appendix C unless otherwise noted.

- ii. Please also note, this plan focuses on the management/control of nesting birds on South Island. Should bird activity be observed in other HRCP construction areas HRCP may apply the same techniques as described in this report to eliminate bird use and achieve the goal of this plan.

2.3 BIRD HABITAT REMOVAL AND EXCLUSION MEASURE DEVICE DESCRIPTIONS

2.3.1 ASPHALT PAVING OF ATTRACTIVE NESTING HABITAT AREAS

The first and most important bird management measure was to remove nesting habitat on the South Island before bird season in early 2020. A formal paving plan was completed, and the areas paved this past September 2019 are shown in Appendix E, South Island Nesting Bird Habitat Paving and Management Plan. Areas that cannot be paved due to slope or other reasons, will be evaluated for installation of alternative exclusion devices. Although paved areas will limit nesting birds, resting, roosting and feeding birds may continue to use the sites. If indicated by observation of birds roosting or resting in the paved areas on South Island additional exclusion or deterrent methods may be employed.

2.3.2 ANTI-ROOSTING BIRD SPIKES

Plastic anti-roosting spikes will be installed on permanent fixtures such as building roofs, ledges/parapets, utility boxes and smaller areas (e.g., fire hydrants) as pictured below. These spikes create an uneven surface preventing birds from landing. Our intention is to use plastic spikes made of a polycarbonate plastic that will not injure birds. It is planned that each spike segment will be epoxied onto the corresponding surface. Alternatives such as flexible or moving wires or springs can be used as an alternative should spikes not work well. Installation of spikes are shown in the pictures below in Figures 2 and 3 with a picture of flexible wires in Figure 3. A manufactured anti-roosting spike is provided by TowerGuard. This device deters gulls, cormorants, osprey and hawks creating both a visual and physical barrier for railings and flat surfaces.

Figure 1 Bird Spikes on Building to Prevent Roosting

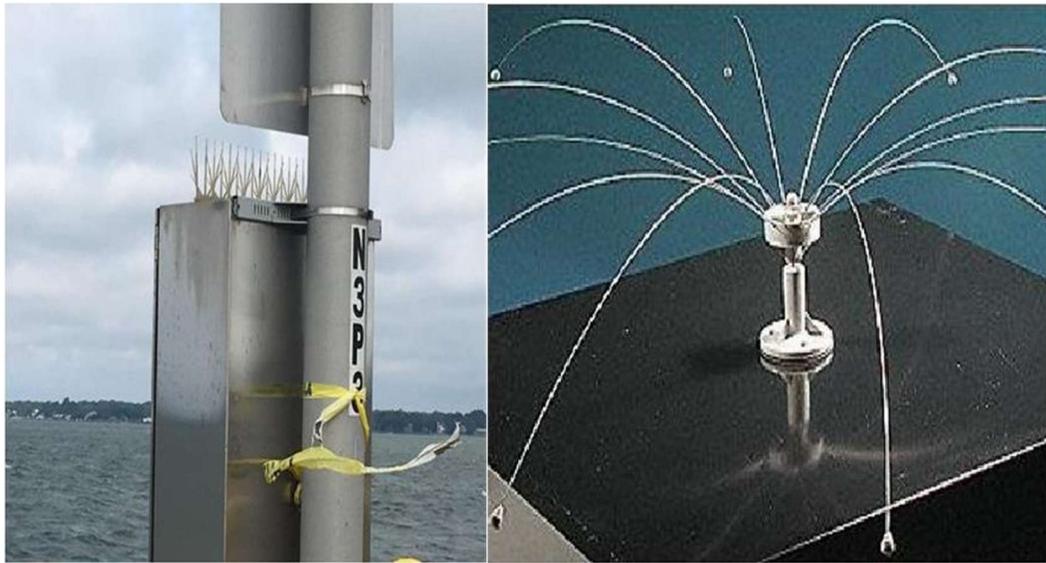
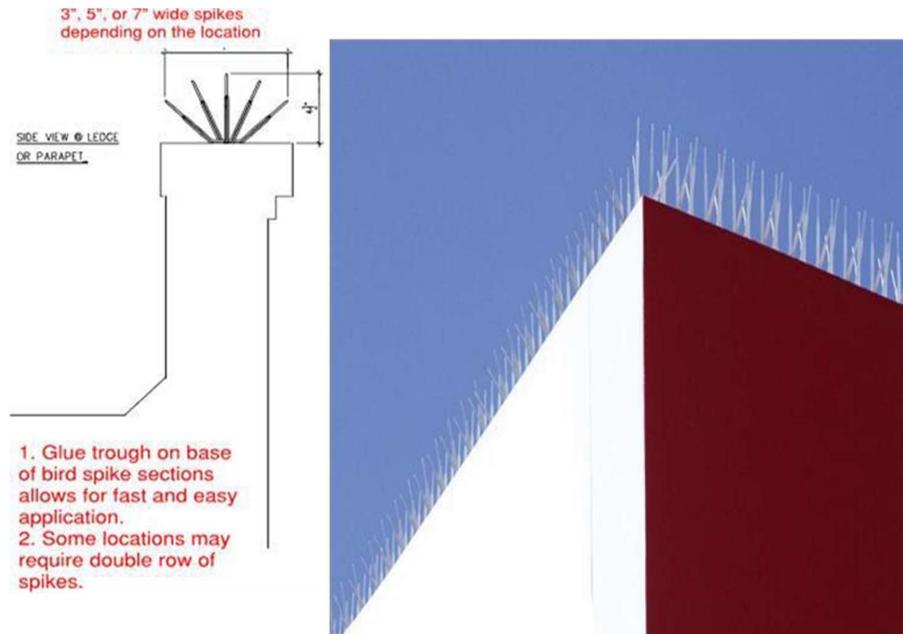


Figure 2 Moveable Bird Spikes



2.3.3 COIL WIRE ANTI-ROOSTING MEASURES

As noted by APHIS-WS (Section 2.2.2) and in the 2016 APHIS-WS Bird Dispersal Techniques publication, to prevent birds from roosting or resting on bridge, roadway and tunnel structures, coil wire will be installed or continued to be used as permanent management measures each year along the railings and walls above the HRBT tunnel entrance and exit lanes along linear areas that are uneven. These coil wires come in varying sizes up to 25-foot lengths and will be installed with epoxy and straps as deemed appropriate for the application. Should epoxy be unsuccessful over the long term, end posts and clips with self-tapping mechanisms (i.e., special concrete screws) may be used to affix coil wires onto appropriate structures. Figure 3 below shows an example of coil wire strapped to a railing.

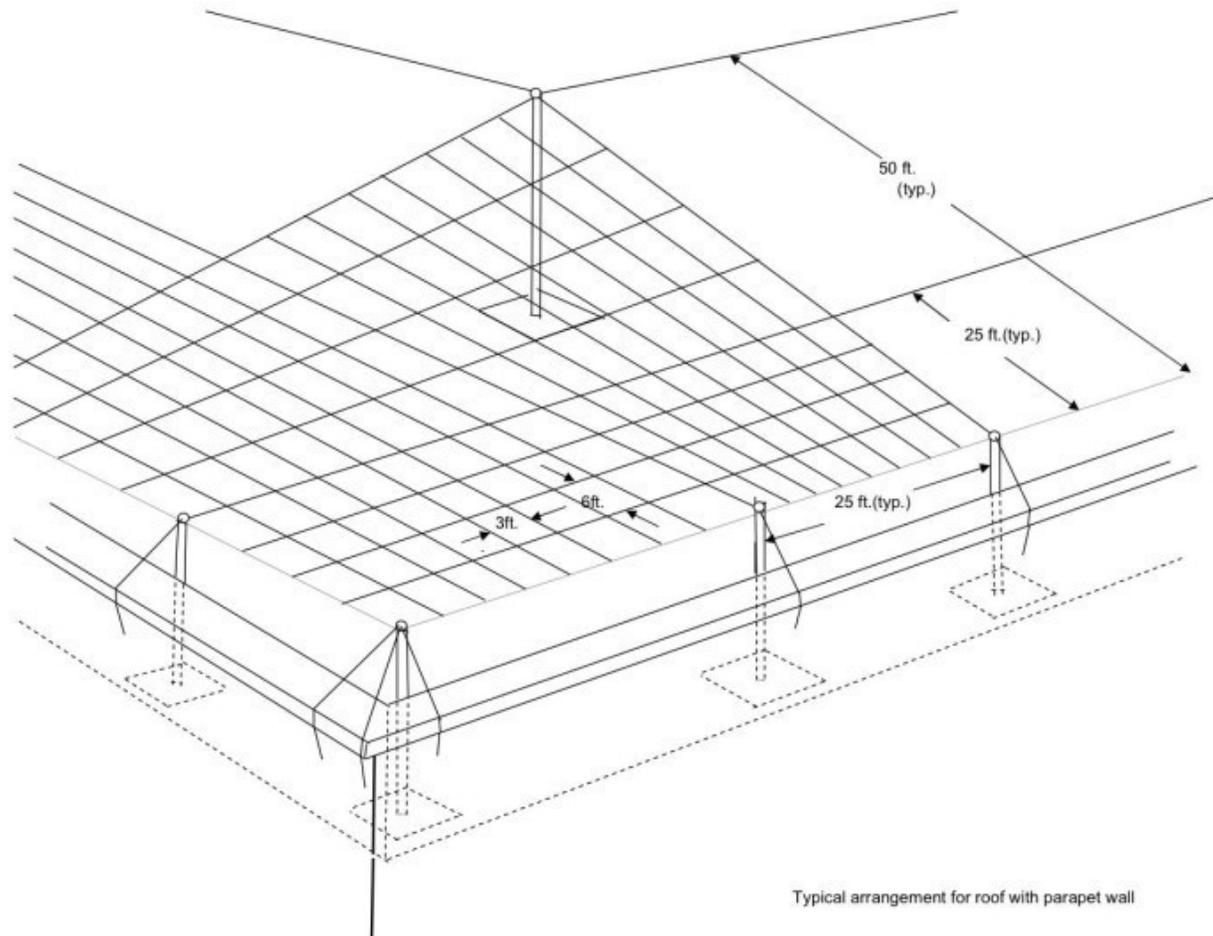
Figure 3 Coil wires installed with straps on railing



2.3.4 OVERHEAD LINES (WIRE GRIDS) BIRD CONTROL MEASURES

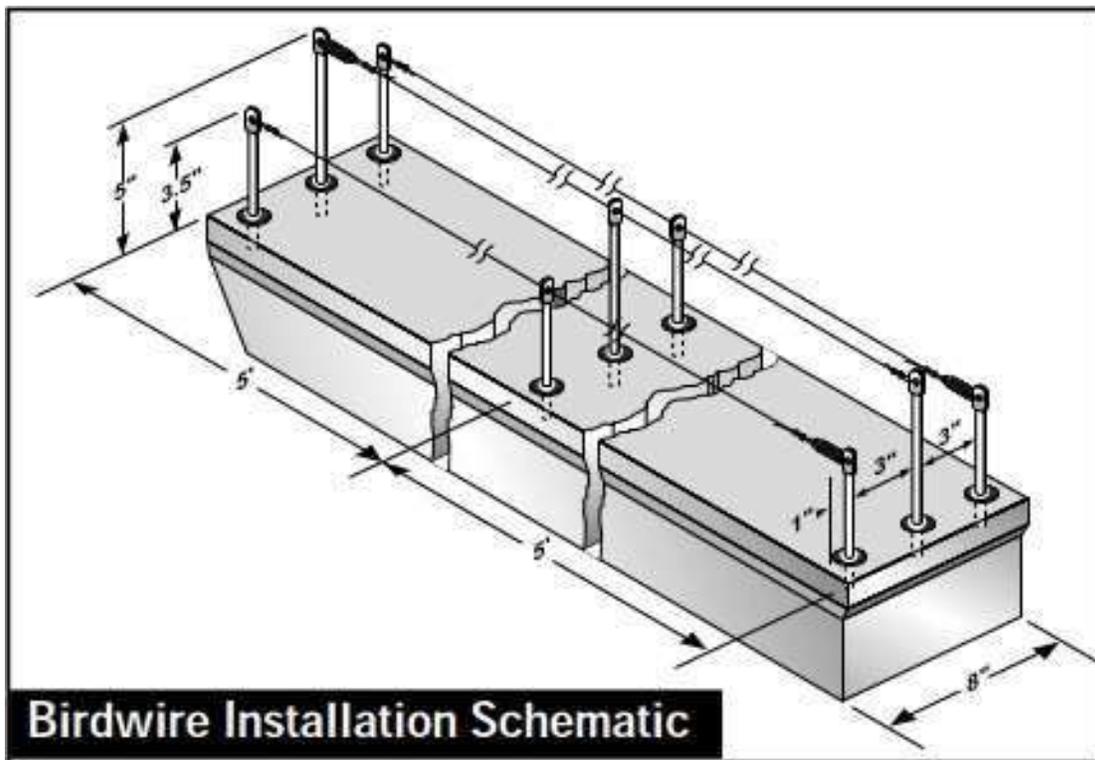
- i. Riprap is found along the water's edge and cannot be paved, but it is often attractive to birds. All riprap above the high tide line will be treated with exclusion measures by anchoring poles and exclusion materials over the riprap. Riprap is used by perching seabirds and this shoreline zone outside of the intertidal area will require implementation. HRCP has several options for excluding birds from riprap areas or where paving cannot take place. According to the manufacturer's website (birdbarrier.com) Bird Barrier offers the latest technology in total bird exclusion of large and small birds, including gulls. Grid wire/Birdwire (Figure 4/5) with mylar flash tape is another option and would be attached to hang from the wires to catch the sunlight and visibly deter the birds. The wire will be erected four to six (4-6) feet above the ground grid and will consist of a plane of wires in a 5-foot by 5-foot size wire grid tensed on posts founded in the armor stones. The height of the grid system will allow the dogs to go below and perform bird management on the riprap. Any modifications to the grid wire system size or consideration for removal of the grid wire would first require coordination with VDOT and VDGIF. The maintenance and inspections of the grid wire system and mylar tape is discussed in Section 3.2.

Figure 4 Gridwire Application to Riprap



- ii. The intertidal zone will not be treated, as it is not attractive for nesting birds because of tidal fluctuations and wave run up and will not support roosting birds for extended periods.
- iii. According to the manufacturer, Bird Barrier/Birdwire (Figure 5) can be used to deter a wide variety of birds (pigeons and larger) from landing on light to medium pressure (see "Bird Pressure" in company introduction) exposed ledges. The tensioned wires de-stabilize the landing platform causing the birds to take their business elsewhere. The Birdwire components can be used in combination to cover any width ledge.

Figure 5 Birdwire Installation on Building Roof



- iv. HRCP will also assemble exclusion devices in paved areas to supplement exclusion of birds as needed, in a manner consistent with the wire grid explained above. The poles will be metal stakes driven through pavement. Alternatively goal netting or tarps may be considered for use in targeted areas where exclusion is necessary but cannot be accomplished with wire grids (e.g. around buildings). Our treatment of riprap areas will continue on South Island or in other areas where birds are appearing in construction zones. As HRCP becomes more familiar with the success of employed devices/methods, they will test other methods, for example potentially developing a prefabricated mobile system that can be moved relatively quickly over paved areas if needed.
- v. In all areas wire grid assembly methodology will include inserting epoxied metal poles into a drilled hole and closely stringing a wire grid to eliminate spaces large enough for a flying bird to enter. We believe proper design/assembly and maintenance of the wired exclusion devices with the addition of brightly colored Mylar Tape to introduce movement will effectively discourage attempts of birds to land on or between the wires.

2.4 OTHER BIRD MANAGEMENT SOLUTIONS

- i. Additional tools will be implemented as needed. Should initially implemented tools shown in Table 2 become less successful, other management tools will be evaluated and implemented as needed to achieve the objectives of this plan. Some of the tools proposed could require coordination with VDOT and US Navy before they are applied. HRCP will continue to be in correspondence with VDOT regarding tools applied. The addition of any new adaptive management measures to deter birds would first require coordination with VDOT and VDGIF, as described in more detail in Section 4.
- ii. Trained dogs will be used in sections of the island where active construction has been completed or where active construction is not currently occurring. Construction is sequenced and will not occur simultaneously in all locations. According to the Virginia Tech report (Gibson, et.al.) "...dogs (Converse et al. 2012) have been successful, dogs may be more effective, efficient, and safely used on South Island than raptors. If implemented, the timing and species targeted by trained dogs and handlers would be related to project phase and to maximize effectiveness, including use of dogs during the day and at night.
- iii. Detailed information regarding additional management and control tools "in the toolbox" that may be implemented by HRCP are included in Appendix B (bird management and control techniques cited/adopted from the VDOT Technical Assistance Report: Effective Bird Dispersal and Deterrent Techniques for Virginia Department of Transportation Sites) and includes their success with certain species of birds. The HRBT site is unique to many bird management locations in that it is in a marine environment, so again, some techniques proposed may be re-evaluated and reviewed with stakeholders to be sure the methods employed will achieve the goals of the Plan. No single one measure alone will meet the needs of bird management on South Island. Multiple measures will be implemented for example grid wire and dogs, see Appendix C.

3. MONITORING AND MAINTENANCE, INDICATIONS OF NEED FOR METHOD RE-EVALUATION

HRCP will monitor devices before and during the nesting period (April 1 to September 1) and perform maintenance which will include periodic inspections, monitoring and repairs of all bird management and control structures/devices necessary to keep birds from perching and nesting on South Island. For example, if birds are observed regularly perching on an area where bird spikes had been installed, another bird spike or other means will be installed in that area (See Section 4-Adaptive Management).

3.1. PAVEMENT MAINTENANCE AND MANAGEMENT

- i. The management of the paved areas is one of the most important efforts and one of the most difficult (Figures 6 and 7). Paving and repairs are part of maintenance necessary on a daily or weekly basis depending on construction activities on these paved areas. At the end of the year, all paved areas need to be inspected and repaved/patched/sealed as necessary before the following year of bird control. If birds are regularly seen in a paved area, the area should be immediately inspected to determine the reason birds are finding the area attractive, and the attraction removed.

Figure 6 Heavy equipment on pavement often creates cracks and depressions



Figure 7 Heavy equipment effects on pavement



- i. The use of black shiny patching sealant may be used strategically to repair cracks in pavement but sparingly to not encourage sand, debris and vegetation to stick to it thereby frustrating sand/shell/vegetation removal efforts.
- ii. Concrete pours taking place on South Island will be painted black to help deter birds from this area.

3.2. OTHER MAINTENANCE

- i. Devices that use Mylar tape or other methods to exaggerate movement will be regularly monitored and if the moving elements are no longer functioning additional brightly colored tape should be securely fastened with Mylar tape being replaced if needed.
- ii. Daily removal of trash, sand, gravel and other accumulated potential nesting material is required for all existing paved surfaces in preparation for, during, and at the close of each bird nesting season. This means that all paved areas will be subject to daily sweeping and removal of debris prior to and during each subsequent bird season until the project is complete. If sweeping does not result in limiting bird use, other methods will be used.
- iii. Other potential issues that could require maintenance may include the following:
 - Replacement of brightly colored Mylar tape tied securely on grid wire system if it has been removed by weather/wind;
 - Should epoxy fail to hold spikes or metal stakes, other methods such as braces/screws or concrete will be considered;
 - If a bird defeats the overhead wire grid system by flying or walking into the area underneath the wire, immediately determine the area open to birds and reassemble or repair appropriately;
 - Additional fortification of grid or implementation of another type of exclusion device if birds can fly through or under grid to gain access to areas under the wires;
 - Should one or more bird species defeat the plastic spikes, then a taller or broader spike could be used in that area so perching will not occur.

4. ADAPTIVE MANAGEMENT

As stated in Section 2.4, HRCP will initiate collaboration with VDOT and VDGIF for any new adaptive management technique. Given the time sensitive nature of employing adaptive management VDOT and VDGIF will provide timely input on such requests to collaborate. VDOT will indicate their approval or lack of objection to the implementation of any new adaptive management techniques.

- i. Adaptive management is defined by the US Department of Interior as the “systematic approach for improving resource management by learning from management outcomes”. For the South Island bird management program, adaptive management includes the implementation of alternative management and control methods or improving current methods to achieve the goals of the Plan (keep birds away, limit nesting and limit fatalities) and complete the Project safely. Below are some possible indicators that bird management and control efforts may need improvement. If the following occurrences are evident, adaptive management techniques will take place:
 - Birds continue to defeat exclusion devices and enter areas that should allow no access;
 - Roosting or resting, and/or nesting occurs in paved areas due to presence of nesting materials like sand and gravel, vegetation, shell and rock fragments, etc.;
 - Increase in congregations of birds on bridge and tunnel structures;
 - Birds have laid eggs in an area with deployed exclusion or deterrent systems.
- ii. It is essential to develop a detailed maintenance schedule as the first step to adaptive management; assign tasks to a person-in-charge and to be sure maintenance of devices and observations are taking place. The person-in-charge must be capable of understanding when a method or device has failed and aware of the essential need and rapidity of applying adaptive management efforts. This person must be aware of contacts to call if eggs, nests, chicks or injured adult birds are observed.
- iii. Bird habituation is common. Habituation is a type of learning in which an animal stops responding to a stimulus in the absence of any reward or punishment. In the context of bird management and deterrents, habituation is the process by which a bird no longer reacts to sights or sounds or other measures that were originally frightening or excluding the birds (Bird Hazing Manual – Techniques and Strategies for Dispersing Birds from Spill Sites, University of California Agriculture and Natural Resources Publication #21638, 2008). Variation and additional management methods must be implemented to rout tenacious birds determined to defeat management efforts. HRCP will attempt to thwart determined efforts of birds by rotating management methods, alternate appearance and type of management devices and by using different combinations of devices noted in Table 1.
- iv. If a nest with a viable egg is discovered (i.e. an active nest), VDOT will be notified immediately. Additional adaptive management measures will then be applied so that the area will not have a repetitive abundance of nest/eggs again. No viable eggs or active nests will be removed or handled until a USFWS permit is obtained.

- v. Lastly, seasonal weather must be considered. During inclement weather, for example high winds and/or heavy rain, certain tools should not and cannot be used. Since weather conditions may limit bird management effectiveness, HRCP must be aware of marine climate extremes in the Chesapeake Bay and prepare for such seasonal events for implementation of adaptive management and maintenance of devices as needed.
- v. Goal netting or tarps may be used to limit bird access around buildings and other structures. Any utilization of goal netting will be accompanied by an increase in monitoring to be sure entanglement does not occur.

5. EGG AND INJURED BIRD NOTIFICATION AND HANDLING PROTOCOL

Active nests, mobile broods, and injured birds will not be handled or removed without the appropriate permit authorization. Handling and removal of active nests, mobile broods, and adults will be done by VDOT's bird monitor or its agent. HRCP is not authorized to handle or remove active nests, chicks, or injured birds.

5.1 NEST AND EGG HANDLING PROTOCOL

- i. Any partially or fully constructed nests without eggs present (i.e. an inactive nest) will be removed by HRCP. Permit authorization is not necessary for removal of inactive nests.
- ii. If a nest with an egg or chick is discovered (i.e. an active nest) HRCP will delineate a 50-foot buffer with traffic cones or other appropriate methods and notify the VDOT bird monitor. HRCP will provide location information and photos to assist in identification of the species. If an active nest is determined to be that of a GBTE, VDOT's bird monitor will notify VDGIF. Neither VDOT's bird monitor nor their agent are authorized to handle or remove an active GBTE nest, regardless of receipt of USFWS permit authorization. Because there are no mechanisms to allow the direct take of this species, all gull-billed tern nests and broods will be left in place with sufficient buffers and borders established to minimize and avoid disturbance and mortality from construction activities.
- iii. Should adaptive management or other unique circumstances necessitate activity in the vicinity of an active nest VDGIF will recommend any further adaptive management for VDOT and HRCP. All parties will work together following the best recommendations of VDGIF.
- iv. In the absence of appropriate permit authorization active nests will remain in place with no handling or removal. For nests deemed active that are later believed to be inactive, VDOT's bird monitor will consult with VDGIF to determine if the nest is no longer active and can be removed to preclude further nesting attempts.
- v. Upon receipt of permit authorization from USFWS, if active nests are found for any species other than GBTE, the nests and eggs will be removed to preclude further nesting attempts. VDOT's bird monitor or its agent will complete documentation and remove the egg(s) within four (4) hours.

5.2 INJURED BIRD HANDLING PROTOCOL

- I. If an injured bird is encountered HRCP will notify VDOT's bird monitor and provide location information and photos to assist in identification of the species.
- II. VDOT's bird monitor will contact the licensed wildlife organization listed below or other VDGIF approved licensed wildlife organizations for the purpose of their collection of the injured bird for any species other than GBTE.

Alton's Keep Wildbird Rescue and Rehabilitation Center
Harley (Tommy) White
1913 Whaleyville Blvd.,
Suffolk VA

757.416.4098

- III. In the absence of appropriate permit authorization injured birds will remain in place until the approved wildlife rehabilitator can collect the individual(s).
- IV. Upon receipt of permit authorization from USFWS, VDOT's bird monitor or its agent may possess and transport the injured bird for any species other than GBTE to the approved wildlife organization should they indicate they are unable to collect the individual.
- V. If an injured bird is determined to be a GBTE VDOT's bird monitor will contact VDGIF. Neither VDOT's bird monitor nor their agent is authorized to possess and transport the individual. It's presumed that VDOT's bird monitor would then contact the permitted wildlife rehabilitator to capture and transport the injured bird to the rehabilitation facility.

5.3 CHICK HANDLING PROTOCOL

- I. Should chicks other than GBTE hatch on South Island VDGIF and the USFWS have determined that these animals are not candidates for wildlife rehabilitation and successful release back to the wild. VDGIF has further indicated that there are no zoological facilities in Virginia able to rear dependent chicks. As a result VDGIF has concluded that all non-GBTE chicks should be euthanized. HRCP will notify VDOT's bird monitor who, following initial training by VDGIF, will ensure the agreed upon techniques are followed for humane euthanasia.
- II. Should GBTE chicks hatch on South Island HRCP will notify VDOT's bird monitor who will in turn work with VDGIF to develop the appropriate next steps to ensure safety and productivity of the birds while having a minimal impact on project construction.

6 TRAINING OF MAINTENANCE PERSONNEL

- i. As part of orientation for onsite construction workers new to the HRBT project, workers will be made aware and trained to actively look for bird maintenance/management issues during their daily construction activities. Such understanding of the monitoring process and maintenance vigilance will assist in the success of this Plan.
- ii. Please note that only HRCP's bird management activities are addressed in this Bird Management Plan. HRCP will notify VDOT of all active nests, eggs, chicks and injured birds.

7 INSPECTIONS, RECORDKEEPING AND ANNUAL MEETING

- i. VDGIF, accompanied by a designated VDOT representative, will inspect bird management devices and methods employed by HRCP including a visit in late winter to observe material and deployment methods. The agency will visit the South Island twice per month thereafter for inspections during the bird nesting season. VDOT/VDGIF must coordinate all site visits in advance and provide at least a 24-hour notice to HRCP prior to accessing the HRBT site. All VDGIF persons and other visitors will be required to attend the project Site Safety Orientation Training prior to accessing the project site. VDGIF and other visitors will be required to provide and wear their own complete, project-required personnel protective equipment (PPE).
- ii. All HRCP employees and subcontractors will be made aware of and informed about bird management and control activities during construction. HRCP will coordinate with a VDOT bird monitor on a daily, weekly and monthly basis while active bird management activities are occurring (as necessary). HRCP will provide a weekly report to VDOT that includes bird management measures for the week, including all bird incidents that may arise or failures and corrective action and adaptive management of bird control devices.
- iii. Adaptive management documentation must include justification for device or method changes and reported to the VDOT bird monitor. Should sub-contractors be used to implement adaptive management techniques, the contractor's qualifications must be submitted to the VDOT bird monitor and made available for review along with information regarding effectiveness of the implemented tool(s) to become part of the record.
- iv. Lastly, maintenance activities (such as daily sweeping) will also be recorded in HRCP's/VDOT's logs and included in VDOT's annual report. "Lessons-learned", records of construction worker training and construction maintenance of bird control measures will be summarized by HRCP towards the end of the construction period and then transferred to VDOT when the Project is complete.

- v. VDOT will organize an annual meeting to include HRCP and VDGIF to review the previous season's data and the need for additional adaptive management to be employed before and during the next season. Discussions will include but not be limited to changes in protocols, review of the techniques toolbox, suggestions for new techniques, etc. to incrementally improve processes, limit bird deaths and human/wildlife interactions, abandon poor success rate devices and other options to achieve the plan's goals.

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APPENDICES

APPENDIX A:
FEBRUARY 24, 2020 and JUNE 14, 2018
USFWS LETTERS TO VDOT



United States Department of the Interior

FISH AND WILDLIFE SERVICE



Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

June 14, 2018

Ms. Angel N. Deem
Environmental Division Director
Virginia Department of Transportation
1401 East Broad Street
Richmond, VA 23219

Re: Final Assessment Review - South
Island of the Hampton Roads Bridge
Tunnel, VA

Dear Ms. Deem:

We have reviewed the final "Assessment of Potential Conservation Measures to Benefit Colonial Nesting Waterbirds using the South Island of the Hampton Roads Bridge Tunnel," (Assessment) dated March 30, 2018 and the revised transmittal letter dated June 7, 2018.

The Virginia Department of Transportation (VDOT) has considered impacts to migratory birds during project planning, as outlined in the Assessment. The Assessment was developed and revised by experts at Virginia Tech over the course of a year with two meetings and requests for comments from the Virginia Department of Game and Inland Fisheries, Virginia Department of Historic Resources, Virginia Department of Conservation and Recreation, Army Corps of Engineers, National Marine Fisheries Service, and Naval Station Norfolk personnel.

The U.S. Fish and Wildlife Service appreciates VDOT's efforts to voluntarily reduce impacts to migratory birds and their habitats by vetting a wide variety of options for managing the colonial nesting waterbirds that currently inhabit the south tunnel island of the Hampton Roads Bridge Tunnel. The Solicitor's Opinion M-37050 dated December 22, 2017, issued by the Principal Deputy Solicitor of the Department of the Interior, establishes that the Migratory Bird Treaty Act does not prohibit the incidental take of migratory birds. The take of birds, eggs, or nests occurring as the result of an activity, the purpose of which is not to take birds, eggs, or nests, is not prohibited by the Migratory Bird Treaty Act. From the U.S. Fish and Wildlife Service's perspective, continued conservation efforts for migratory birds by VDOT are purely voluntary.

Ms. Deem

Page 2

If you have any questions, please contact Alison Whitlock of this office at (804) 824-2410, or via email at alison_whitlock@fws.gov.

Sincerely,



Cindy Schulz
Field Supervisor
Virginia Ecological Services

cc: VDGIF, Henrico, VA (Attn: Ray Fernald)
VDGIF, Henrico, VA (Attn: Ruth Boettcher)
VDOT, Hampton, VA (Attn: Jim Utterback)
VDOT, Richmond, VA (Attn: Scott Smizik)
VDOT, Richmond, VA (Attn: Steve Begg)



United States Department of the Interior



FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

February 24, 2020

Ms. Angel N. Deem
Environmental Division Director
Virginia Department of Transportation
1401 East Broad Street
Richmond, VA 23219

Re: South Island of the Hampton Roads Bridge
Tunnel, VA - Regulatory Requirements
Pertaining to Migratory Birds

Dear Ms. Deem:

We are writing in regards to regulatory requirements associated with migratory birds relative to any activities conducted as part of the Hampton Roads Bridge Tunnel project. This letter further clarifies requirements initially described in a letter from our office dated June 14, 2018.

The Migratory Bird Treaty Act (50 C.F.R. §§ 703-712; MBTA) *does not* require a permit for hazing migratory birds or removing unoccupied nests or nesting material (except Bald or Golden Eagles), provided that take (including possession) of eggs, chicks, or adults does not occur. Further, no specific requirements exist for mitigation or creation of alternative nesting habitat if project-related activities reduce or impact existing nesting habitat. Further, the Solicitor's Opinion M-37050 dated December 22, 2017, issued by the Principal Deputy Solicitor of the Department of the Interior, establishes that the MBTA prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same, apply only to intentional actions directed at migratory birds, their nests, or their eggs.

The MBTA *does* require a take permit to purposefully destroy or relocate an active nest (eggs or dependent young present). The U.S. Fish and Wildlife Service's Migratory Bird Program recommends submitting an application for take if the potential exists for nesting to occur within the project area in which you are operating, as hazing and nest material removal alone could be insufficient to prevent egg laying.

In addition, we wanted to clarify that the MBTA Good Samaritan provision states: "Any person who finds a sick, injured, or orphaned migratory bird may, without a permit, take possession of the bird in order to immediately transport it to a permitted rehabilitator" (50 CFR 21.3 l(a)). The U.S. Fish and Wildlife Service's Nest Destruction Memo (enclosed) clarifies the application of the MBTA to the destruction and relocation of migratory bird nests and provides guidance for advising the public regarding this issue. The Good Samaritan provision *does not apply to regularly recurring actions* where

INTERIOR REGION 1 • NORTH ATLANTIC-APPALACHIAN

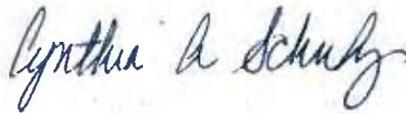
CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS
NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, VERMONT
VIRGINIA, WEST VIRGINIA

a single entity purposefully removes nests (e.g., a company that needs to purposefully remove nests from electrical distribution poles). For these situations, a permit is recommended.

Finally, if Federal funds are associated with this project, we recommend that you engage in further discussion with the Federal agency providing those funds about what additional responsibilities exist under Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds (EO). Under this EO, Federal agencies have responsibilities to implement the four international migratory bird conventions and the Migratory Bird Treaty Act through section 3 of the EO.

If you have any questions related to this correspondence or additional questions about regulatory requirements for migratory birds, please contact Caleb Spiegel, Acting Permits Branch Chief, Migratory Bird Program, North Atlantic Appalachian Regional Office at (413) 253-8541 or via email at caleb_spiegel@fws.gov.

Sincerely,



Date: 2020.02.24

12:15:22 -05'00'

Cindy Schulz
Field Supervisor
Virginia Ecological Services

Enclosure

cc: VDGIF, Henrico, VA (Attn: Ruth Boettcher)
VDGIF, Henrico, VA (Attn: Ray Fernald)
VDGIF, Henrico, VA (Attn: Rebecca Gwynn)
VDOT, Hampton, VA (Attn: Jim Utterback)
VDOT, Richmond, VA (Attn: Steve Begg)
VDOT, Richmond, VA (Attn: Amy Golden)
VDOT, Richmond, VA (Attn: Scott Smizik)



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington D.C. 20240



In Reply Refer To:
FWS/DMBM/AMB/068029

Memorandum

To: Regional Directors

From: Assistant Director, Migratory Birds /sgd/ Jerome Ford 6/14/2018

Subject: Destruction and Relocation of Migratory Bird Nest Contents

The purpose of this memorandum is to clarify the application of the Migratory Bird Treaty Act (50 C.F.R. §§ 703-712; MBTA) to the destruction and relocation of migratory bird¹ nests and provide guidance for advising the public regarding this issue. This Memo replaces Migratory Bird Permit Memorandum MBPM-2 on Nest Destruction (Apr 15, 2003). This memo does not supersede or apply to other Federal, State, or Tribal laws and regulations, including the Endangered Species Act (16 U.S.C. §§ 1531; ESA) and the Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668–668d; Eagle Act).

BACKGROUND:

The MBTA protects migratory birds, including migratory bird nests, eggs, and chicks. The prohibitions of the MBTA include *possession, transport, import, export, purchase, sale, barter, and take*. The regulatory definition of take, as defined by 50 C.F.R. § 10.12, means to *pursue, shoot, wound, kill, trap, capture, or collect, or attempt thereof*. This memo clarifies the Service's interpretation of how these prohibitions apply to migratory bird nests, eggs, and chicks.

The MBTA does not prohibit the destruction of an inactive² migratory bird nest, provided that no possession occurs during the destruction and no permit or other regulatory authorization is required (see Policy #1 below). Additionally, the Service should make every effort to inform the public of how to

¹ A list of species protected by the MBTA can be found at 50 C.F.R § 10.13

² An active nest is one that contains viable eggs and/or chicks. A nest becomes active when the first egg is laid and remains active until fledged young are no longer dependent on the nest. Nests that are empty, contain non-viable eggs, or are being built but do not yet have an egg in them are considered inactive.

minimize the risk of killing migratory bird species whose nesting behaviors make it difficult to determine occupancy status or continuing nest dependency (e.g., cavity and burrow nesting species).

On December 22 2017, the Department of Interior released M-Opinion 37050 (Opinion) regarding whether incidental take (the taking of migratory birds that results from an activity, but is not the purpose of the activity) is prohibited under the MBTA. The Opinion concludes that “the MBTA’s prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control” (M-Opinion, pg. 41). The Opinion clarifies that the MBTA does not prohibit the incidental or unintentional take of migratory birds and/or their active nest contents.

Therefore, an individual or entity may destroy an active nest while conducting any activity where the intent of the action is not to kill migratory birds or destroy their nests or contents. However, because the MBTA specifically protects migratory bird nests, eggs, chicks, and adults from possession and transport without a permit, individuals and entities cannot, in most cases, take reasonable protective actions (such as removing eggs and chicks prior to nest destruction or relocating nests) without first obtaining authorization to do so.

Currently, there are two mechanisms explained in Policy #2 and Policy #3 below for the temporary possession and transport of healthy, unaffected birds for the purpose of removing them from imminent danger (i.e., immediate threat of mortality). Policy #2 explains in more detail the Service’s Good Samaritan provision included in the Rehabilitation regulation (50 C.F.R. § 21.31(a)). Policy #3 outlines the permitting mechanism under the Special Purpose regulation (50 C.F.R. § 21.27) for active nest situations that fall outside the Good Samaritan provision.

POLICY:

1. Inactive Nest Destruction

A permit or other regulatory authorization is not required under the MBTA to destroy an inactive migratory bird nest³, provided no possession occurs during or after the destruction. The MBTA does not authorize the Service to issue permits in situations where the prohibitions of the Act do not apply, such as the destruction of inactive nests.

The public should be made aware that, due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated risk of unknowingly killing them. For example, it is difficult to detect whether or not the nest of a cavity-nesting species, such as a burrowing owl or a bank swallow, is active. Before destroying this type of nest, we recommend consulting with an expert (e.g., USDA-Wildlife Services, Wildlife Professionals, Environmental Consultants, or Rehabilitation experts) who can help determine nest activity.

³ An inactive nest is one that is empty, contains non-viable eggs, or is being built but does not yet have an egg in the nest.

Inactive nests may be protected by federal statutes other than the MBTA, such as nests of bird species federally listed as threatened or endangered under the ESA as well as nests of bald eagles and golden eagles, which are protected under the Eagle Act. State, Tribal, and local laws may also protect inactive bird nests. The Service should make every effort to ensure awareness regarding these possible additional protections and should inform the public of factors that will help minimize the likelihood that bird deaths would occur should nests be destroyed (i.e., when active nesting season normally occurs).

2. Good Samaritan Provision

For active nests, an individual or entity whose activity unintentionally or incidentally destroys an active nest, or is likely to do so, may collect the eggs or chicks and temporarily possess them for the purposes of transport to a federally-permitted rehabilitator under the Good Samaritan authorization in the rehabilitation regulation (50 C.F.R. § 21.31(a)). This Good Samaritan provision states: “Any person who finds a sick, injured, or orphaned migratory bird may, without a permit, take possession of the bird in order to immediately transport it to a permitted rehabilitator” (50 C.F.R. § 21.31(a)). The Service interprets the definition of “finds” to include encountering birds that become sick, injured, or orphaned while conducting activities where the intention is not to kill migratory birds or destroy their nests. “Finds” also applies when a planned activity is likely to cause or is about to cause destruction of an active nest resulting in the death, injury, or orphaning of eggs or chicks because, if nest destruction is imminent, any egg or chick in that nest can be considered orphaned. The Good Samaritan provision applies to the landowner of where the action is taking place and anyone designated to act on their behalf (e.g., wildlife professionals, pest-control contractors, rehabilitators, etc.). The Good Samaritan provision does not apply to regularly re-occurring actions where a single entity purposefully removes nests (e.g., a company that needs to purposefully remove nests from electrical distribution poles). For these situations a permit is recommended (see #3 below).

If the landowner is not comfortable with collecting the eggs or chicks, they may designate someone else to conduct the work on their behalf. After the eggs or chicks are collected, a federally-permitted rehabilitator may accept them as orphaned birds, consistent with their rehabilitation permit. All requirements and conditions of a rehabilitation permit apply. Rehabilitators have discretion as to what they will and will not accept and to determine the fate of any eggs or chicks accepted, including euthanasia. If a rehabilitator is unavailable or will not accept the eggs or chicks, the landowner (or the person acting on their behalf) may take the eggs or chicks to a licensed veterinarian who may temporarily possess, transfer, or euthanize the eggs or chicks without a permit (50 C.F.R. § 21.12(c)).

The Service can provide contact information for federally-permitted rehabilitators. The Service does not maintain or provide information on contractors, such as wildlife professionals, contractors, or pest control companies. Finally, the Service will provide information for voluntary reporting of active nest destruction in our Injury and Mortality Reporting System.

3. Special Purpose Permits

Permits are required to relocate a nest rather than destroy it, as possession of any nest is prohibited under the MBTA without prior authorization. Permits may also be appropriate for entities with ongoing projects that regularly need to intentionally remove or destroy nests. In these cases, permits can authorize possession of nests for various purposes, including active and inactive nest relocation, collection of nest contents for humane disposal, a combination thereof, or other compelling justifications. The Service can issue Special Purpose permits (50 C.F.R. § 21.27) to individuals or entities in these situations. In the case of utilities, authorization to destroy or relocate active and inactive nests is covered by applying for a specific type of special purpose permit: Special Purpose – Utility (<https://www.fws.gov/forms/3-200-81.pdf>).

Biologically, the success of nest relocation varies widely based on a number of factors, such as the distance moved, the presence of chicks, the nesting substrate, and the tolerance of the species and individual birds. Service biologists can provide technical assistance as to whether or not nest relocation is likely to succeed. Nest relocation should only be recommended for consideration when likely to result in success or when there are no other viable alternatives to achieve a conservation outcome. Relocation permit conditions will include short-term monitoring requirements by the person doing the nest relocation to ensure adults return to attend to the nest and an alternative protocol in the event nest abandonment occurs (such as collection and transport to a rehabilitator or veterinarian for euthanasia).

4. Other Permits and Authorizations

Other situations where there is purposeful take of active nests may fall under different permit types or regulatory authorizations. The Service will advise when a different permit or authorization may be appropriate.

APPENDIX B:
TECHNICAL ASSISTANCE REPORT:
EFFECTIVE BIRD DISPERSAL AND
DETERRENT TECHNIQUES FOR
VIRGINIA DEPARTMENT OF
TRANSPORTATION PROJECT SITES

Technical Assistance Report

EFFECTIVE BIRD DISPERSAL AND DETERRENT TECHNIQUES FOR VIRGINIA DEPARTMENT OF TRANSPORTATION PROJECT SITES

Bridget Donaldson
Associate Principal Research Scientist
Virginia Transportation Research Council

Purpose and Approach

For some projects conducted by the Virginia Department of Transportation (VDOT), dispersing and/or deterring birds from a work site is required prior to construction and maintenance activities. Situations requiring these measures range from single nests on a VDOT structure to thousands of birds occupying a VDOT staging or construction site. This can create project delays, particularly when protected birds have established nesting sites on VDOT project areas.

This report provides findings from a literature review conducted for VDOT's Environmental Division on bird dispersal and deterrent methods that are known to be effective. Techniques that are broadly applicable for groups of birds found in Virginia are listed and described first, followed by recommendations that are specific to a work site for VDOT's Hampton Roads Bridge Tunnel (HRBT) project.

Bird dispersal methods typically have a different objective than bird deterrent methods. Bird dispersal, also known as hazing, includes the use of techniques intended to frighten birds from a site they are currently occupying. The use of deterrents, also referred to as exclusion methods, involves discouraging or preventing birds from occupying a site.

Although literature on various bird dispersal and deterrent methods is abundant, most research efforts have focused on the response of a bird species to a single dispersal or deterrent technique. The most helpful resources for the purpose of this report were documents and manuals compiled from reviews of these species- and deterrent-specific methods. These include a bird hazing manual produced by the Agricultural and Natural Resources Department of the University of California (Gorenzel and Salmon, 2008); a guidebook for addressing wildlife hazards at airports (Cleary and Dickey, 2010) and a report on bird harassment and deterrent techniques for the use at airports (Belland and Martin, 2011) (both under the Federal Aviation Administration's Airport Cooperative Research Program); and a report on bird dispersal and deterrent techniques produced by the U.S. Department of Agriculture (Seamans and Gosser, 2016). The information provided in subsequent sections was largely gathered from these sources and focuses on the techniques that are relevant to bird groups in Virginia.

Effective Dispersal and Deterrent Methods

Bird dispersal or hazing techniques are typically separated into audio, visual, and predatory (or active pursuit) categories. Bird deterrent or exclusion methods include lines or wires placed parallel to and above the exclusion area, chemical repellents or irritants, devices that prevent a bird from perching, and effigies (objects that mimic humans or predators) (Cleary and Dickey, 2010; Gorenzel and Salmon, 2008; Seamans and Gosser, 2016).

Bird deterrent and dispersal information is organized into two tables and includes only those measures that have been shown to be effective for bird groups found in Virginia. Specifically:

- Table 1 provides descriptions of only the techniques known to be effective for groups of birds that occur in Virginia. (Figure 1 illustrates several of these methods.)
- Table 2 is specific to the HRBT project, with information on only the techniques known to be effective for the bird groups that occur on the HRBT South Island.



Figure 1. Bird Dispersal and Deterrent Photographs. From Gorenzel and Salmon (2008). Used with permission. Pyrotechnic/CAPA launcher (top left); broadcast call device (top center); anti-perching springs/coils (top right); pyrotechnic/screamer banger rocket (middle left); trained dog (middle center); pyrotechnic propane cannon (bottom left); overhead lines (bottom center); effigy/scarecrow (bottom right).

Table 1. Select Bird Dispersal and Deterrent Techniques Known to Be Effective for One or More Bird Groups in Virginia. Dickey (2010; Gorenzel and Salmon (2008); and Seamons and Gosser (2016).

Technique		Description	Operation and Deployment	Advantages	
Dispersal Method	Audio: Pyrotechnics¹	Bird bombs, screamers, and screamer banger rockets	Pyrotechnic cartridges fired from a modified starter pistol.	The pistol is fired in the direction of the target birds, but in high winds it should be fired down- or cross-wind.	Inexpensive, readily available, can be used to supplement other devices.
		Shell crackers	Shotgun-launched projectiles that explode with a loud bang and flash about 300 ft from the operator.	Single-barrel shotguns are used. Should never be fired into a strong wind. Use minimum number of rounds necessary.	Relatively inexpensive. Longer range and louder bang than bird bombs and screamers.
		CAPA launchers and rockets	Hand-held flare gun fitted with a removal liner in the barrel.	Small rockets travel up to 1,000 ft before detonating with a loud report of 150 dB. Should be used only after first using shorter range pyrotechnics.	Longest range of any pyrotechnic. Has a loud report.
		Propane cannons	Produce a loud blast by filling a bellows with propane gas then rapidly transferring the gas to a firing chamber. Used for shore bird hazing.	Cannons should be placed where birds congregate. Can be timed to go off at specific intervals. Minimum spacing of 600 to 700 ft between cannons.	Inexpensive to operate once deployed. Widely available.
	Audio: Biosonics²	Distress and alarm calls	Use of an animal's natural vocalizations to influence the behavior of that species.	Recordings of alarm and distress calls are available for various bird groups. Birds typically respond to only their own species' calls. Calls can be broadcast from portable units.	Slower habituation compared to most other audio or visual techniques.
		Bird wailers	Electronic device that broadcasts a programmable variety of sounds at random through multiple speakers.	Speakers broadcast a circle of sounds. Can operate remotely. Common deterrent method at airports.	Natural alarm and distress calls delay habituation. Inexpensive to operate.
	Predators³	Trained dogs	Properly trained dogs that chase birds off the site. (Minimal research is available on bird groups other than waterfowl.)	Dogs can be housed on site in some cases to provide constant control.	Successful with waterfowl in urban and suburban areas.

Table 1. Select Bird Dispersal and Deterrent Techniques Known to Be Effective for One or More Bird Groups in Virginia. Adapted from Cleary and Dickey (2010; Gorenzel and Salimon (2008); and Seamons and Gosser (2016).

Dispersal Method		Technique	Description	Operation and Deployment	Advantages	Disadvantages
Audio: Pyrotechnics ¹	Bird bombs, screamers, and screamer banger rockets	Pyrotechnic cartridges fired from a modified starter pistol.	The pistol is fired in the direction of the target birds, but in high winds it should be fired down- or cross-wind.	Inexpensive, readily available, can be used to supplement other devices.	Potential fire and safety hazard. Short duration of effect in most cases.	
	Shell crackers	Shotgun-launched projectiles that explode with a loud bang and flash about 300 ft from the operator.	Single-barrel shotguns are used. Should never be fired into a strong wind. Use minimum number of rounds necessary.	Relatively inexpensive. Longer range and louder bang than bird bombs and screamers.	Fire hazard. Labor intensive and short duration of effect in most cases.	
	CAPA launchers and rockets	Hand-held flare gun fitted with a removal liner in the barrel.	Small rockets travel up to 1,000 ft before detonating with a loud report of 150 dB. Should be used only after first using shorter range pyrotechnics.	Longest range of any pyrotechnic. Has a loud report.	Relatively expensive. Labor intensive and short duration of effect in most cases.	
Audio: Biosonics ²	Propane cannons	Produce a loud blast by filling a bellows with propane gas then rapidly transferring the gas to a firing chamber. Used for shore bird hazing.	Cannons should be placed where birds congregate. Can be timed to go off at specific intervals. Minimum spacing of 600 to 700 ft between cannons.	Inexpensive to operate once deployed. Widely available.	Birds may habituate to cannons in 1 to 3 days. Must be supplemented with other hazing devices.	
	Distress and alarm calls	Use of an animal's natural vocalizations to influence the behavior of that species.	Recordings of alarm and distress calls are available for various bird groups. Birds typically respond to only their own species' calls. Calls can be broadcast from portable units.	Slower habituation compared to most other audio or visual techniques.	Species-specific; not all species give alarm or distress calls.	
Audio: Predators ³	Bird wailers	Electronic device that broadcasts a programmable variety of sounds at random through multiple speakers.	Speakers broadcast a circle of sounds. Can operate remotely. Common deterrent method at airports.	Natural alarm and distress calls delay habituation. Inexpensive to operate.	Expensive to purchase.	
	Trained dogs	Properly trained dogs that chase birds off the site. (Minimal research is available on bird groups other than waterfowl.)	Dogs can be housed on site in some cases to provide constant control.	Successful with waterfowl in urban and suburban areas.	Dogs that remain on site may lose interest in chasing the birds.	

Table 1 (continued).

Technique	Description	Operation and Deployment	Advantages	Disadvantages	
Deterrent Method	Overhead Lines⁴	Wire or monofilament lines strung in a grid or parallel pattern over the intended exclusion area. Typically serve as a psychological barrier rather than a physical exclusion.	The lines should be 0.15 mm or less in diameter. Stainless steel wire is the most durable. Wires are typically strung parallel to and about 3 ft above the exclusion.	Very effective for gulls. Effective over nesting sites. Once installed, little maintenance required.	Installation is labor intensive. Not practical for large areas. Mortality is possible if birds fly into lines.
	Anti-perching⁵	Anti-perching devices, such as spikes and coils, are intended to prevent birds from landing. Devices can include pointed objects or flexible/moving wire and springs.	Best use of these devices is to prevent birds from perching on structures.	Low maintenance.	Birds may move to unprotected sites unless all desired areas of exclusion are treated.
	Chemical Repellents⁶	Methyl anthranilate (MA) and anthraquinone (AQ) have been shown to be effective. MA induces pain; affected birds may exhibit erratic behavior, alarming and deterring other birds.	Chemicals are added to bait or applied on the ground.	Effectiveness can vary based on distance to cover/escape or weather.	Can be lethal if too much is ingested.
	Effigies⁷	Include scarecrows and predator-mimicking devices (hawk or owl).	Best used for short-term and local response. No set rules with regard to the number per area.	Inexpensive and low maintenance.	Habituation occurs rapidly unless other measures are used in combination.

¹ Pyrotechnics have been shown to be effective on all studied bird groups (Cleary and Dickey, 2010).

² Biosonics have been shown to be effective on gulls and terns (Gorenzel and Salmon, 2008) and geese (Cleary and Dickey, 2010).

³ Trained dogs have been shown to be effective on all studied bird groups (falconry has been shown to have more limited success).

⁴ Overhead lines have been shown to be effective on gulls and terns (Gorenzel and Salmon, 2008) and blackbirds, starlings, ducks, geese, swans, pigeons/doves, owls, thrushes, and sparrows (Cleary and Dickey, 2010).

⁵ Anti-perching devices have been shown to be effective on diving birds, gulls, and terns (Gorenzel and Salmon, 2008) and all studied bird groups (Cleary and Dickey, 2010).

⁶ The chemical repellents methyl anthranilate and anthraquinone have been shown to be effective on all studied bird groups (Cleary and Dickey, 2010).

⁷ Cleary and Dickey (2010) maintain that effigies have been shown to be effective on all studied bird groups, but other research states that efficacy varies depending on species (Belland and Martin, 2011, 2011).

Table 2. Effective Dispersal and Deterrent Methods for the Hampton Roads Bridge Tunnel Project Target Birds

Bird Group	HRBT Target Species	Dispersal Methods	Deterrent Methods
Gulls	Laughing, herring, great black-backed	Pyrotechnics and biosonics (distress/alarm calls). Birds first approach source of alarm call, circle overhead, then fly away when call stops. Firing pyrotechnics when birds are circling overhead hastens dispersal. ¹	Overhead lines are effective on gulls. Effective gull projects included 0.15 mm (or smaller) stainless steel wire spaced 1 to 40 ft apart up to 10 ft above the intended exclusion area. ^{1,2} Vegetation removal can help prevent nesting.
Terns	Royal, sandwich, gull-billed black skimmers	Pyrotechnics (CAPA rockets) and biosonics. ¹	Little research is available.
Shorebirds	Oystercatcher, killdeer	Shorebirds take flight in response to pyrotechnics ^{1,2} but may not leave immediate vicinity; persistent firing may be required. ¹	Chemicals MA and AQ, effigies, dogs, and anti-perching devices. ²
Waterfowl	Canada goose	Pyrotechnics, including propane cannons, ^{1,2} effigies, ² and biosonics. ¹	Overhead lines ^{1,2} (effective spacing between lines for Canada geese is 20 ft), dogs, ² and anti-perching devices. ²
Hérons and egrets	Snowy egret	Pyrotechnics. ^{1,2}	Chemicals MA and AQ, effigies, dogs, and anti-perching devices. ²
Doves	Rock dove	Pyrotechnics are effective on doves. ^{2,4}	Overhead lines, chemicals MA and AQ, effigies, dogs, and anti-perching devices. ²
Starlings	European starling	Pyrotechnics are effective on European starlings, ^{2,4} as are balloons (helium filled and painted with large eyes). ⁵	Overhead lines, chemicals MA and AQ, dogs, and anti-perching devices. ²

¹ Gorenzel and Salmon (2008).

² Cleary and Dickey (2010).

³ Loomacres Wildlife Management (2017).

⁴ Thiele et al. (2012).

⁵ Balloons may deflate with time, deteriorate in sunlight, and be easily damaged (e.g., winds greater than 15 mph), and tethers will need to be checked regularly (Bishop et al., 2003; Gorenzel and Salmon, 2008).

Dispersal and Deterrent Methods to Consider for the Hampton Roads Bridge Tunnel Project

For VDOT's HRBT project, bird deterrent strategies will be needed for the South Island each nesting season (approximately February to August) for five consecutive nesting seasons. Table 2 lists the dispersal and deterrent methods that have been shown to be effective consistently for the bird groups that occupy the South Island.

It is important to note that although the methods listed in Table 1 include those that have shown to be effective consistently with particular bird groups, timing, variation, and persistence are key elements for bird dispersal strategies. The most effective bird dispersal schemes use multiple methods together. Deploying a variety of hazing tools rapidly and in a coordinated manner (either in combination or rotation) creates the strongest response and minimizes habituation. Changing the location of deployment also decreases the habituation effect

(Gorenzel and Salmon, 2008; Seamons and Gosser, 2016). Finally, weather, such as high winds and other inclement conditions, can have an impact on safety, equipment selection and operation, and the effectiveness of the hazing method (Gorenzel and Salmon, 2008).

Conclusions for the HRBT Project

- *A combination of pyrotechnics and distress calls has been shown to be an effective dispersal technique for gulls and terns, the primary HRBT target bird groups.* Pyrotechnics are effective for all HRBT target species. Deploying pyrotechnics with distress calls reinforces the danger denoted by the call. Deployment considerations for pyrotechnics and distress calls include using repeated exposures, mixing different types of pyrotechnics, using actual distress call recordings of the target species, and varying the location and timing of deployment. Tables 1 and 2 provide pyrotechnic and distress call deployment information.
- *Overhead lines, effigies (such as scarecrows), anti-perching devices, and trained dogs have been shown to be effective deterrent techniques for the HRBT target bird species.* Tables 1 and 2 provide operation and deployment information on these methods (see Table 2 for effective spacing of overhead lines). If vegetation is used for nesting or cover at South Island, vegetation removal can also be an effective deterrent for nesting gulls. Although the chemical deterrents methyl anthranilate (MA) and anthraquinone (AQ) have been shown to be effective for some of the target bird groups, use of these chemical deterrents may be inadvisable because of the state-listed bird species in the area.

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APPENDIX C:
USDA APHIS WILDLIFE SERVICES
MANAGED GULL DAMAGE AND BIRD
DISPERSAL TECHNIQUES

Gulls

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Figure 1. Ring-billed Gull (*Larus delawarensis*)

Human-Wildlife Conflicts

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Abundant gull (Figure 1) populations in North America have led to a variety of conflicts with people. Gulls cause damage at aquaculture facilities and other properties, and often collide with aircraft. Their use of structures on and near water results in excessive amounts of bird droppings on boats and docks. Their presence near outdoor dining establishments, swimming beaches, and recreational sites can lead to negative interactions with people. Large amounts of gull fecal material pollutes water and beaches resulting in drinking water contamination and swim bans. A combination of dispersal techniques, exclusion and limited lethal control may reduce damage to an acceptable level.

Aquaculture

Gulls feeding at fish hatcheries, mariculture beds, and baitfish production sites may result in significant losses for aquaculture producers. They may also impact salmonid fry, especially at passage facilities associated with dams in the Pacific Northwest.

Gulls loafing at seafood processing facilities may create a nuisance for employees and contaminate seafood products with fecal material at outdoor staging areas while items are awaiting processing.



Figure 2. Gulls at a Chicago area beach.

Structures

Gulls nesting on rooftops often indirectly damage the roof, as well as the building, due to accumulations of nesting material in rooftop drains that prevent the draining of water from the roof. The resulting backup of rainwater may lead to structural damage to the roof, including leakage, water damage and rot, mold, and excessive water weight on roof support structures.

Human Health and Safety

Gull use of structures on and near water results in excessive amounts of bird droppings on boats and docks in marinas, and the presence of gulls near outdoor dining establishments, swimming beaches, and recreational sites creates negative interactions with people. Research has documented that gulls can be a source of fecal contamination (i.e., *Escherichia coli* and *Salmonella* isolates) in water and beaches, resulting in contamination of drinking water and swim bans (Figure 2). In addition, buildup of droppings, nesting materials, and feathers on rooftops near ventilation intakes can result in unwanted odors and the intake of irritants affecting the respiratory health of workers and creating an unsanitary work environment. Large numbers of gulls flocking around landfills is a distraction and safety risk to heavy equipment operators and truck drivers.

Gulls are frequently involved in collisions with aircraft resulting in dangerous conditions for people both in the aircraft and on the ground (Figure 3). From 1990-2015, gulls were involved in at least 10,586 bird strikes with 2,188 of those strikes involving multiple birds. Fifteen of those strikes resulted in injuries to 22 people. Their large size, looping flight, flocking behavior, and propensity to feed and loaf on grasslands and paved surfaces at coastal airports make them a significant strike threat.

During the nesting season, especially after chicks hatch, gulls may dive and strike people on the head if they come too close to nests. This behavior is problematic near nesting colonies where people may be working on rooftops, performing building maintenance or security.

Natural Resources

Gulls may be detrimental to some shorebird and waterbird species of concern because they prey on eggs and chicks. For example, predation by Laughing, Herring, and Great Black-backed Gulls contributes to declines or lower productivity of some species along the Atlantic Coast. Gulls are a primary predator of nests and chicks of terns, skimmers, and other colonial nesting birds from the Chesapeake Bay to Maine.



Figure 3. Gulls on an airport.

Nuisance

Gulls habituate to the presence of people and may become a nuisance for sunbathers or diners at outdoor establishments when food is accessible.

Damage Identification

Because of their gregarious nature, gulls are easily observed and identified. Nuisance complaints are determined from visual observations, noise and fecal droppings.

Management Methods

No single management method to prevent gull conflicts works all the time or in all settings. Wildlife management methods should be integrated so that one method enhances the effect of another. For example, frightening devices often are more effective when done in conjunction with habitat modification (e.g., removal of food resources or roosting habitat) to make a site less attractive to gulls. Likewise, exclusion devices, such as overhead wires, work better when combined with covering or removing food resources.

Local gull populations often are large, and birds may fly 15 miles or more from roosting or nesting sites to feed. This mobile strategy often means that feeding sites are visited by only a portion of the gull population each day. Therefore, exclusive use of lethal control is not an effective, long-term method for preventing gull damage at those sites. Limited lethal control combined with frightening devices and habitat modification can reduce human-gull conflicts at feeding sites to socially acceptable levels.

Habitat Modification

Modifying human behavior, habitats, and cultural systems is an essential part of effective, long-term gull damage

management. Efforts and activities should focus on reducing the availability of food, water, and loafing areas that attract gulls.

Gulls alter their behavior to take advantage of available food sources. Prohibiting the feeding of gulls and other wildlife by customers, guests, and employees will help reduce gull attractants. Feeding of other species, such as feral cats, must be eliminated in areas where gull conflicts occur. Preventing the unintentional feeding of gulls also requires effective waste management, such as promptly removing garbage, keeping dumpsters and trash receptacles closed, covering garbage trucks, regularly cleaning docks and piers, and removing waste/rejected fruits and vegetables at processing sites.

Gulls shift their feeding patterns to take advantage of changes in naturally occurring foods. Hatches or spikes in the populations of terrestrial or marine invertebrates can contribute to large concentrations of feeding gulls. Strategic use of insecticides to prevent outbreaks of grasshoppers and beetles can help to manage these attractants on and near sensitive areas, such as airfields. Managing the grass height at airfields is important for reducing the availability of natural foods and attractiveness of loafing sites. Grass height should be maintained at 6 to 10 inches throughout the year.

Freshwater attracts gulls, especially rain events in marine environments. To reduce gull abundance, grasslands and paved surfaces should be properly graded to prevent standing water after storms. Wetland and stormwater mitigation projects, such as those at airfields, should be conducted offsite whenever possible, and water retention and movement should utilize underground designs and configurations that minimize bird use.

Exclusion

Exclusion involves physically blocking bird access to a site and is an important part of gull damage management. The use of various exclusion tools and techniques is dictated by the location and gull species involved. Like habitat management, physical exclusion can provide a long-term, nonlethal solution for deterring bird use. Because the cost

of materials, construction and maintenance can be expensive, exclusionary methods are most practical for small areas and a limited number of species. Laughing Gulls will walk and fly under exclusionary netting and overhead wires. Also, Herring and Ring-billed Gulls have been seen walking under netting and overhead wires to gain access to food. Unfortunately, exclusion that adequately stops bird access also can restrict the movement of people, equipment and other wildlife. Some physical exclusion devices may be an impediment to the intended use of a site, and some landowners, managers and users may consider the aesthetic impacts of physical exclusion devices to be unacceptable.

Wires, netting, and monofilaments are available for excluding birds from protected areas. Coils, spikes, elevated wires or electrified strips can be used to exclude gulls from perching or loafing on narrow surfaces, such as ledges, signs, and guard rails. The effectiveness of these approaches can be enhanced through original design features, such as sloping ledges, that reduce the attractiveness of these surfaces.

Pier pilings, lamp posts, and outdoor furniture are attractive loafing spots for gulls, especially when food may be found nearby. These point surfaces, or areas that may be attractive to a few individual gulls can be protected through a variety of devices. Pointed caps can be installed on pier pilings and posts to prevent perching. Spider-like wire spindles are effective and can be enhanced with motors that create a rotating or sweeping effect.

Perching deterrents are available in a wide variety of designs. Porcupine wire (e.g., Nixalite™, Catclaw™) and coil wire are mechanical repellents that can be used to exclude gulls and other birds from ledges, railings and other roosting or loafing surfaces. The sharp points on porcupine wire may inflict temporary discomfort on the birds as they try to land, which deters them from roosting or loafing. Electric shock bird control systems, although expensive, can be effective in deterring gulls and other birds from roosting on ledges, window sills and other similar structures.

Work areas at agricultural and fisheries processing facilities must be secured to prevent gulls from

contaminating food with fecal droppings or other items. To effectively exclude gulls, these areas should be fully enclosed with entry points protected by strips (or “curtains”) of heavy plastic sheeting. Loading and temporary storage areas outside should be protected with overhead wire grid systems to prevent gull access. The same exclusion approaches can be effective at trash transfer stations. Overnight capping or tarping of the active face of landfills can prevent feeding by gulls outside of landfill operation hours, especially during times of year when daylight persists after normal work hours and in well-lit systems where gulls may be active at night.

Netting and wire or monofilament wire grids are often recommended to exclude gulls from resources with large surface areas, such as spillways, industrial rooftops, reservoirs, aquaculture facilities, retention/detention ponds, and landfills. Netting may be suspended over these facilities using a tent-like or wire-based support structure, but this approach may be cost-prohibitive for large areas.

Most gull species can be excluded from ponds, fields or other areas using an overhead wire grid with hanging streamers or other objects (Figure 4) to increase the grid's visibility to birds. The objective is to discourage birds from feeding and loafing, while preventing bird injury or death. Overhead wire grids require little maintenance other than ensuring proper wire tension and replacing broken wires. The grid spacing varies with the type of bird species being



Figure 4. Parallel overhead wires can be installed to prevent gull use of an area.

excluded. For example, overhead wires spaced about 10 feet apart successfully repel Herring and Ring-billed Gulls, but not Laughing Gulls. Laughing Gulls are not repelled by overhead wires, but will often walk and fly under them. Wire grids can make a pond unusable for boating, swimming, fishing, and other recreational activities. Additionally, maintenance under the wires may be burdensome.

Gulls can be excluded from small water bodies using large numbers of floating plastic balls. This system may not be practical in fisheries systems where access to water by sunlight and employees is required. A containment system is required for airport settings where the balls may present a FOD (Foreign Object Damage) hazard if they are blown out of the pond area.

Unnecessary signs, posts, pilings, and other structures that provide suitable gull loafing sites should be removed. Angled window ledges, bulkheads, and tunnel entrances, pointed posts or poles, and angled or beveled sign tops can reduce the attractiveness of loafing sites and reduce the need for exclusion devices.

Exclusion devices should not be installed over water if injury or accidental take of eagles and threatened and endangered species is anticipated.

Frightening Devices

The use of frightening devices to disperse gulls is an essential part of gull damage management (Figure 5). To be successful, frightening devices must be used at unpredictable frequencies, lengths of time, and locations. When possible, pursuing dispersed birds and reinforcing harassment with limited lethal control can help to improve the effectiveness of frightening devices.

Pyrotechnics are one of the most commonly used tools for dispersing gulls. These wildlife control explosives include a variety of different products, such as shell crackers, 15-mm pyrotechnics (e.g., screamers and bangers), and long range pyrotechnics (e.g., CAPA rounds). Pyrotechnics can be very effective, especially when combined with limited lethal re-enforcement. Users should be trained in the safe use and handling of these tools to prevent injury and fires.



Figure 5. A solar-powered bird strobe sits atop a pole to deter bird use in an area.

Permits from the Bureau of Alcohol, Tobacco, and Firearms are required for the use of some classes of pyrotechnics by individuals and non-governmental entities.

Live animals including falcons and dogs have been used to disperse gulls and other birds. This specialized approach requires an experienced handler, multiple work animals, and the ability to control the animals so they do not become a hazard in sensitive environments.

Remote-controlled vehicles, including boats, land vehicles, and unmanned aircraft systems, can be effective for dispersing gulls and other birds. They allow for more controlled dispersals than live animals, and can reach gulls located in, and over large grasslands and lakes. These devices require experienced operators, and care should be taken to coordinate radio frequencies with the appropriate officials on or nearby sensitive areas, such as airports and military installations.

Propane exploders are noise-making devices that can be activated by timer or remote control. Birds quickly habituate to propane exploders if their use is predictable. The devices must be moved frequently and only triggered when necessary.

Electronic devices that use bird alarm or distress calls are commercially available for gull dispersal. Bird calls can be broadcasted from stationary units or vehicles, and combined with sirens and alarms. Gull dispersal using distress calls is often a two-stage process whereby gulls

may first come closer to investigate and then disperse as a result of the call and combination of other sounds and tools. Directed sound or acoustic hailing devices, such as Long Range Acoustical Devices (LRAD) offer another non-lethal tool for gull dispersal, though evaluations of their effectiveness are ongoing. As with other devices, gulls will habituate to the sounds unless reinforcement occurs.

Gull effigies have been used effectively to reinforce dispersal efforts, especially at gull loafing sites. Effigies may consist of taxidermy specimens, freshly killed gulls, or artificially reproduced likenesses. Effigies are displayed either in a prone position or hanging with the head down to represent a dead or dying gull. This technique should be used in conjunction with other techniques to re-enforce and extend the duration of dispersal activities. A migratory bird depredation or salvage permit is required for possession of gull carcasses.

Although the use of a laser to alter bird behavior was first introduced nearly 30 years ago, new developments have made it possible to use affordable hand-held lasers to frighten and disperse birds from their roosts or loafing areas. Results have shown that several bird species, including gulls, have avoided laser beams during field trials. Best results are achieved under low-light conditions (i.e., sunset through dawn) and by targeting structures or trees close to roosting birds, thereby reflecting the beam. Use caution not to point laser beams directly at human or bird eyes. Caution must be exercised when using lasers around airports and aircraft.

Repellents

Bird repellents can help reduce bird foraging on treated plants, the use of temporary pools of standing water, or perching on building ledges and similar locations.

Methyl anthranilate (MA), an artificial grape flavoring food additive, is a commercially-available repellent for waterfowl and gulls registered by the U.S. Environmental Protection Agency (EPA) and marketed under various trade names. It may be applied to turf or other plants to reduce foraging by birds, such as Canada geese. It is also used to prevent waterfowl and gulls from using temporary pools of water.

Results on the effectiveness of MA appear to be mixed based on various research trials.

MA may also be applied using a fog-producing machine such that the MA-laden fog drifts over the area to be protected. The fog is an irritant to the birds, but is harmless to people. Fogging uses a smaller volume of the MA product in contrast to the turf application, thereby reducing the cost of each application. Several treatments 1 to 4 days apart may be required for the removal of nuisance birds to acceptable levels. As with the turf application, it is likely that additional applications may be required to address problems with migrating or non-resident birds. In some states, the use of fogging is restricted to landfills, non-fish bearing bodies of water, and temporary pools of standing water on paved areas or construction sites at or near airports.

A number of tacky or sticky tactile repellent products that reportedly deter birds from roosting on structural surfaces are commercially available. However, limited research has been done on the effectiveness of these products. The repellency of tactile products is generally short-lived because dust accumulates on the surface. Tactile repellents can melt in hot weather often dripping down the sides of buildings or cause other aesthetic problems that require expensive clean-up. Small non-target birds may also be injured or killed after becoming stuck in these substances.

Fertility Control

Conflicts associated with nesting gulls and localized gull populations can be managed by reducing population growth through fertility control. Removing eggs and/or nests can be an effective method of encouraging some species of breeding gulls to relocate to an alternative nesting location. To be effective, all nest material and eggs should be removed at least every 2 weeks to prevent chicks from hatching. Nest removal is labor intensive, and re-nesting can occur when management is done early in the nesting season. As is the case for other migratory birds, permits are required to remove gull nests that contain eggs.



Figure 6. Oiling Ringed-billed Gull eggs.

Egg oiling also prevents hatching (Figure 6). The oil inhibits the exchange of gases and causes asphyxiation of developing embryos. Egg oiling is 96 to 100 percent effective in reducing hatchability. The EPA has ruled that use of food grade corn oil for this purpose is exempt from registration requirements under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. Addling (shaking) and puncturing eggs also prevents egg hatching.

With oiling, addling, and puncturing, adult birds often remain on the nest, incubating treated eggs. If the treatment occurs later in the nesting season, birds that continue to incubate treated eggs may have lower energy reserves and likely will not re-nest.

Egg oiling, in conjunction with dispersal efforts, helps reduce the growth rate of local gull populations and associated conflicts. It is often easier to disperse adults from a site if they do not have young. For example, from 2007-2017, egg oiling of nests at ring-billed gull colonies within Chicago, Illinois, resulted in fewer hatch-year gulls using beaches and was likely a factor in reducing the number of swim advisories and swim bans issued at beaches due to elevated *Escherichia coli* levels.

Toxicants

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including gulls. For more than 40 years, DRC-1339 has been used to manage local populations of starlings, blackbirds, gulls, and pigeons at feedlots, dairies, airports, and in urban areas. DRC-1339 is registered for use only by trained U.S. Department of Agriculture employees to manage gull populations depredating native colonial nesting bird species or damaging property or crops.

Trapping

Rocket nets and cannon nets can effectively capture small groups of gulls over bait (Figure 7). Rocket nets can cause gulls to avoid an area for several weeks or longer, if they eluded initial capture attempts. Individual gulls can be captured with net guns, if they can be approached within the net gun's range. Remotely-activated net launchers or bow nets can be used to capture individuals that are baited to a site or sitting on a nest. Nesting gulls also can be captured using various trap designs or hand nets at night with the aid of spotlights or night vision devices.



Figure 7. Cannon net trap with gulls.

Shooting

Shooting is conducted with shotguns or air rifles. Shooting is most commonly used to reinforce harassment, to remove a single offending bird, or to remove a limited number of birds that cannot be dispersed or taken using other methods. However, shooting programs implemented at airports have effectively removed large numbers of birds. Non-toxic shot generally is required due to shooting over water or wetlands. Local, state, and federal regulations in regards to the use of firearms and take of gulls must be reviewed and followed.

Other Methods—Dispersing Colonies

Dispersing and relocating gull nesting colonies is difficult and success varies by species. Numerous dispersal methods have been used with the most effective ones being nest and egg destruction, egg oiling, and overhead wire grids. Mylar flags, distress calls, effigies, shooting, tethering raptors to areas within the nesting colony and other methods were less effective or logistically difficult.

Wire grids or parallel lines placed over nesting colonies on rooftops have been used to disperse Ring-billed and Herring Gulls. Gulls can be dispersed in 1 to 3 years. Most Herring Gull nesting colonies on rooftops show a reduction in the numbers only after multiple years of dispersal efforts (e.g., up to 6 years in northern Ohio). In one case, a mixed Ring-billed and Herring Gull nesting colony in Toronto, Canada was dispersed in 2 years. Laughing Gulls, however, were unaffected by overhead wire grids.

A Black-headed Gull nesting colony on an island off the coast of Suffolk, England, was reduced and then stabilized to 15 to 35 percent of the original population size after 5 years of harassment using shooting, distress calls, trapping and nest and egg treatment. Egg oiling is usually more effective when combined with removal of breeding adults.

Handling

Translocation

Capture and translocation of gulls usually is not an effective or practical method for moving gull colonies.

Euthanasia

Euthanasia of gulls may be done by cervical dislocation or by administering isoflurane or carbon dioxide gas to birds placed in a sealed container. Care should be taken to minimize stress and handling prior to euthanasia. Confined areas must be large enough to avoid stress to the birds as much as possible.

Disposal

Take of migratory birds is regulated by the Migratory Bird Treaty Act, and instructions for disposition of carcasses are usually provided under U.S. Fish and Wildlife Service permit conditions.

Economics

The economic impacts of gull damage are widespread, but seldom quantified. Gulls may cause direct losses through collisions with aircraft, foraging on aquaculture products and other crops, fouling drinking and swimming water. Costs may also be associated with disinfecting feces, nesting and loafing activities, and subsequent damage abatement.

Fecal droppings present hazards for slipping and fouling of safety rails used as perches. Cleaning is needed to prevent damage to structures and to remove this residue which may pose health risks. Cleaning can represent a significant repetitive expense. The corrosive nature of the feces may also decrease the lifespan of construction and roofing materials, increasing replacement frequency, and therefore increasing building construction and maintenance costs. Shellfish and produce processing facilities must sometimes prevent gull fecal contamination

of food processing activities by moving those activities indoors.

Several studies have suggested a link between Ring-billed Gull fecal droppings and elevated fecal coliform bacteria levels in water at beaches resulting in the issuance of swim advisories. Beach management agencies often implement integrated damage management strategies to improve sand and water quality, and to avert associated economic losses that have been estimated as high as \$15 million per year for the City of Chicago.

Gulls are also one of the most common groups of birds involved in collisions with civil aircraft, accounting for 12 percent of all known wildlife species struck by aircraft and causing a minimum of \$58 million in reported economic losses to the aviation industry from 1990-2015.

Finally, management actions employed to prevent or reduce measurable damages impose costs that otherwise would not be incurred. Examples of these management costs include preventative maintenance, partial or total exclusion, such as wire grids, erecting pole barns and plastic curtains, active control and administrative costs.

Species Overview

Identification

The term “gull” refers to bird species that belong to the family Laridae. Gulls nest colonially, sometimes with other colonial nesting species interspersed within the breeding colony. Gulls often are associated with oceans, seas and large freshwater water bodies.

Twenty-four different species of gulls can be found across North America. The eight gull species most often associated with human-wildlife conflicts in the United States include the following:

- Herring Gull (*Larus argentatus*)
- Laughing Gull (*Leucophaeus atricilla*)



Figure 8. Laughing Gull (*Leucophaeus atricilla*)

- Ring-billed Gull (*Larus delawarensis*)
- Great Black-backed Gull (*Larus marinus*)
- California Gull (*Larus californicus*)
- Franklin's Gull (*Leucophaeus pipixcan*)
- Bonaparte's Gull (*Chroicocephalus philadelphia*)
- Glaucous-winged Gull (*Larus glaucescens*)

Physical Description

Male and female gulls of the same species are similar in appearance. Gulls are distinguished by their webbed feet, and adults generally have white body plumage with the amount of black and brown plumage on the wings and back varying among species and age classes. Juvenile birds have varying amounts of black or brown mottled body plumage interspersed with varying amounts of white feathers. Gulls range in size from the diminutive Bonaparte's Gull (11 inches long, 38 inch wingspan, and about half a pound) to the largest species, the Great Black-backed Gull (24 inches long, 65 inch wingspan and up to 4 pounds).

Range

Gulls are found throughout North America usually near water bodies, such as oceans, estuaries and freshwater lakes.



Figure 9. California Gull (*Larus californicus*).



Figure 10. Glaucous-winged Gull (*Larus glaucescens*) nesting on rooftop.

The Herring Gull is a year-round resident on the Great Lakes and east coast of North America from Newfoundland to North Carolina. Winter distribution is associated with coastal areas and large water bodies along the Atlantic, Pacific and Gulf coasts, the Caribbean islands and Mississippi River Valley.

The Laughing Gull (Figure 8) breeding range stretches from Maine to Texas along the coast. Laughing Gulls generally winter along the southern Atlantic coast from North Carolina to the Gulf Coast and eastern and western Central American coasts.

The Ring-billed Gull's (Figure 1) breeding range is primarily Lake Champlain in Vermont and the St. Lawrence River drainage of New York, Quebec and Ontario, the Great Lakes region and westward into the northern Rockies and western Canadian provinces. Its wintering range is the Atlantic and Pacific coasts, lower Mississippi River Valley and southern Great Plains.

The Great Black-backed Gull, common in the northeastern United States, breeds locally along the Atlantic Coast from Cape Hatteras, North Carolina, north to Labrador and Baffin Island, and locally around the Great Lakes. In winter, this species may be found throughout its breeding range and south to South Carolina. In addition, it winters in increasing numbers along the Gulf of Mexico.

The California Gull (Figure 9) is found throughout the interior western region of North America from California in the south to Northwest Territories in the north.

The Franklin's Gull's breeding range is primarily within portions of Saskatchewan, Manitoba and parts of North Dakota. There are other small breeding colonies scattered in the northern Rockies. The primary winter range is along the Pacific coast of Chile and Peru.

Bonaparte's Gull winters in large flocks in coastal areas along the Atlantic, Gulf and Pacific Coasts and eastern Great Lakes, but breeds around ponds, bogs, bays, and fiords in the taiga and boreal forests of Alaska and Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan and Manitoba.

The Glaucous-winged Gull (Figure 10) is an abundant resident along the northwestern coast of North America where it breeds along coastal islands and cliffs from the Bering Sea and Aleutian Islands, Alaska, south to Oregon. It casually nests in freshwater in British Columbia, Washington and Oregon.

Voice and Sounds

Gulls have a wide variety of calls that vary based on the age of the bird and situation in which a call is made. Calls are given for courtship, breeding, alarm, feeding and in some cases for no apparent associated behavior.

Reproduction

Most gulls are gregarious nesters on sand and gravel-covered shorelines, islands and flat rooftops. They require only a small territory, and colonies often contain thousands of nesting pairs. Bonaparte's and Great Black-backed Gulls are the exception. They are solitary breeders or breed in small colonies away from human settlements. Sexually mature gulls generally return and nest in the region where they learned to fly. Gull nests vary by species. In general, they are built of grasses and other vegetation which may include sticks. Nests are found on the ground or on rooftops. Gulls produce 3 to 5 eggs per nest. Most species of gulls reach breeding age in 2 to 3 years, but some do not breed until they are 4 to 5 years old.

Like other migratory birds, gulls generally breed in the northern parts of their range and winter in the southern portions of North America. However, species such as Ring-billed Gulls do move hundreds of miles eastward and westward within just a few days during the summer.

Most gull species nest in large colonies that include hundreds or thousands of nests. Most large colony nesting sites are on islands, but some western gull species will nest in large colonies adjacent to remote freshwater lakes. Depending on gull species, nest sites tend to be sparsely vegetated or have no vegetation.

Mortality

Gulls are generally long-lived birds that may survive for 10 to 30 years. Annual survival rates range from 70 to 94 percent with juvenile birds having lower survival than adults.

Population Status

Between 1966 and 2012, some gull populations (e.g. Herring and Franklin's Gull) in the United States appeared to decline, while others (e.g., Ring-billed and California Gull) remained stable. General species status is of low conservation concern for Herring, Ring-billed, Laughing and Great Black-backed Gulls. Many gull species are considered overabundant or common.

Typically, high gull densities are recorded in localized areas, such as urban rooftop nesting colonies and landfills.

Habitat

Gulls may be found in any water body in North America. In addition, gulls loaf and forage in open spaces, such as plowed or grassy fields and parking lots.

Behavior

Gulls often spend nights in open water or secluded areas (e.g., islands, rooftops) that are not prone to predation. They fly inland to feed and loaf during the day. Gulls are active all day with daily activity peaking at dawn and dusk. Gulls will fly at night, especially around roosting areas on large water bodies.

Gulls are migratory birds with some species migrating long distances between nesting and wintering areas. Although most gulls migrate on a north-south gradient between nesting and wintering areas, Ring-billed Gulls migrate to the Great Lakes region for nesting and eastward to the mid-Atlantic coast for the winter. Gull nesting and feeding activities generally are associated with wetland habitats. These habitats are important stopping points during migration.

Food Habits

Gulls are adaptable, opportunistic, omnivorous feeders that readily switch food types based on availability and accessibility. Gulls forage on land and on the water, feeding on aquatic animals, terrestrial invertebrates, small vertebrates, carrion, plant remains, refuse (Figure 11), and human food. Gulls forage on eggs and young of other nesting waterbirds. For instance, Herring and Great Black-backed Gulls eat shorebird chicks and waterfowl ducklings. Bonaparte and other western gull species eat young salmon, contributing to smaller runs of smolts. Herring Gulls have developed a feeding strategy of dropping bivalves onto hard surfaces to break the shell and access the soft tissues inside. Adult Ring-billed Gulls nesting in the Great Lakes have been known to travel an average of 15 miles to exploit human-related food sources. Smaller

species, such as Ring-billed, Laughing, and Franklin's Gulls, forage in the air on flying insects.

Legal Status

Gulls are classified as a migratory bird species and are protected by federal and, in most cases, state laws. In the United States, gulls may be taken only with a permit issued by the U.S. Fish and Wildlife Service. Occasionally, an additional permit is required from the state wildlife management agency. Permits are issued only after dispersal and other non-lethal damage management methods have been employed and proven ineffective at resolving the conflicts. No federal permit is needed, however, to frighten or mechanically exclude gulls.



Figure 11. Ring-billed Gulls feeding at a landfill in Virginia.

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Figure 7. Photo by USDA
Figure 8. Photo by Jenny Washburn, USDA-Wildlife Services
Figure 9. Photo by Martin Lowney, USDA-Wildlife Services
Figure 10. Photo by Kevin Keirn
Figure 11. Photo by Dust'n Lundsford, USDA-Wildlife Services

Glossary

Colonial Nesting: A large group of nesting birds that may be made up of one or two species all nesting within close proximity of one another.

Mariculture: Mariculture is a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, an enclosed section of the ocean, or in tanks, ponds or raceways which are filled with seawater.

Omnivore: An animal that eats both plants and animals.

Roost: Location where birds rest or sleep either during the day or at night.

Key Words

Aquaculture, Bird strike, Exclusion, Frightening device, Fertility control, Gull, Laridae, Toxicant

Disclaimer

Wildlife can threaten the health and safety of you and others in the area. Use of damage prevention and control methods also may pose risks to humans, pets, livestock, other non-target animals, and the environment. Be aware of the risks and take steps to reduce or eliminate those risks.

Some methods mentioned in this document may not be legal, permitted, or appropriate in your area. Read and follow all pesticide label recommendations and local requirements. Check with personnel from your state wildlife agency and local officials to determine if methods are acceptable and allowed.

Mention of any products, trademarks, or brand names does not constitute endorsement, nor does omission constitute criticism.

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Appendix

Damage Management Methods for Gulls

Type of Control	Available Management Options
Exclusion	<ul style="list-style-type: none"> • Overhead wires • Netting • Anti-perching devices
Fertility Control	<ul style="list-style-type: none"> • Oiling of eggs • Removing nests and eggs • Adding or puncturing eggs
Frightening Devices	<ul style="list-style-type: none"> • Propane cannons, pyrotechnics, and other noise making devices • Species-specific distress calls • Effigies • Remote-controlled vehicles and dogs
Habitat Modification	<ul style="list-style-type: none"> • Covering food sources including landfill face • Closing refuse containers • Removing sources of food from open areas
Repellents	Methyl anthranilate-based products marketed under various trade names
Shooting	Shotguns or air rifles; Allowed with proper Federal and State permits
Toxicants	DRC-1339; Registered for use only by trained USDA employees
Trapping	Cannon/rocket nets and nest traps; Allowed with proper Federal and State permits

Bird Dispersal Techniques

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Figure 1. Photo of a frightened wild turkey (*Meleagris gallopavo*).

Human-Wildlife Conflicts

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Conflicts between humans and birds likely have existed since agricultural practices began. Paintings from ancient Greek, Egyptian, and Roman civilizations depict birds attacking crops. In Great Britain, recording of efforts at reducing bird damage began in the 1400s, with books on bird control written in the 1600s. Even so, the problem persists. Avian damage to crops remains an issue today, but we also are concerned with damage to homes, businesses, and aircraft, and the possibility of disease transmission from birds to humans or livestock.

Successful dispersal techniques should capitalize on bird sensory capabilities. If birds cannot perceive the dispersal technique, it will not be effective in dispersing birds.

Birds rely primarily on their vision and hearing to find food, avoid predators, and locate mates. Bird vision is quite different from human vision; birds can see colors that humans cannot perceive (including the ultraviolet range), and they detect and use polarized light. Bird response to scare devices (Figure 1) that rely on vision

may depend on the visibility of the object to the bird, as “visual noise” could be ignored. With regard to hearing, birds generally are capable of hearing frequencies between 1,000 to 3,000 Hertz, which is narrower than normal human capabilities. Since this range does not include the ultrasonic range, ultrasonic devices will not scare birds. Birds also use tactile (touch) and olfactory (smell) senses, but to a lesser degree. Devices based on these senses are not generally used for dispersal.

Not only must birds be able to perceive a dispersal technique, they also must interpret the technique as a threat to their safety. A technique that worked initially may fail later as birds habituate to it and no longer perceive the technique as threatening. For some species, the introduction of limited lethal control reinforces non-lethal dispersal techniques, as the birds again perceive the non-lethal technique as potentially dangerous. For other species, changing techniques is necessary, because they may not react to the death of a flock member and therefore still not interpret the scare technique as a threat. In either case, changing techniques and using multiple techniques in an integrated manner are essential for deterring birds from sensitive areas.

No single technique or tool will deter birds in every instance or situation; there is no silver bullet. Successful bird dispersal involves a combination of tools and timing of use, as well as the skill and persistence of biologists and wildlife control operators (WCOs). The following sections offer overviews of various techniques that have been used to mitigate bird problems in various situations, as well as examples that highlight successful bird dispersal programs.

Habitat Modification

All birds need some combination of food, water, cover, and space to survive. Modify one or more of these features, and birds will often move to an area that better suits their needs. Management of vegetation can affect food, cover, and in some cases, space. Before starting to manage vegetation, survey the location to identify the species

present. You must be aware of the birds in the area because the height and density of vegetation may attract or deter birds, depending on the species. Tall and dense vegetation may interfere with the birds' ability to capture prey. In addition, other species may avoid taller vegetation because it hinders their ability to detect approaching predators. For those species, tall vegetation may reduce some bird conflicts.

Some birds, however, prefer tall vegetation for nesting and feeding. For example, European starlings (*Sturnus vulgaris*) frequent areas with tall grass when in large flocks, but avoid these same areas when alone or in small flocks. On the other hand, brown-headed cowbirds (*Molothrus ater*) prefer short grass because, although there may be fewer insects available, the birds have easy access to them. Before modifying herbaceous vegetation, try to understand why a bird is using the area. For example, if birds are feeding on insects you may want to use an insecticide to remove the food source. If birds such as eastern meadowlarks (*Sturnella magna*) are nesting in taller vegetation, you could mow the vegetation to remove nesting habitat, but realize this may make the area attractive to those birds (e.g. American robin [*Turdus migratorius*]) that prefer feeding in shorter grass.

It also is possible to change the attraction of an area by working directly with the plants that attract offending birds. For example, not all herbaceous vegetation is equally desirable as a food source. Chemical makeup and mineral content of vegetation will influence the foraging on grasses by Canada geese (*Branta canadensis*). By planting turf grasses that are not desired by grazing birds (e.g., high-endophyte fescue, centipedegrass, St. Augustine grass, and zoysiagrass), a landowner can make an area unattractive for birds which, in turn, can make birds easier to scare away using an audio or visual scare technique. Likewise, a landowner can plant trees or shrubs that do not provide food for birds. In cases where long established trees are the attraction, thin or prune the vegetation back by about a third to make the area less desirable.

Exclusion Techniques

Exclusion methods may be divided into two categories: area and ledge. The exclusion of birds from areas typically involves using nets or wires suspended to prevent bird access. The mesh size of the net depends on the species you are attempting to exclude. Netting with a $\frac{3}{4}$ -inch mesh will keep most pest birds from accessing protected areas. Failure to install nets properly, however, can increase surface areas for nesting or loafing. In addition, poorly installed nets can trap birds, leading to the death of birds and increased damage to the protected area while birds try to escape. When nets are hung over high value crops such as blueberries or grapes, the manner in which birds are attacking the crop (e.g., from the ground up or from the top down) will influence how the net should be deployed and the ultimate success or failure of the netting.

Use overhead lines made of wire, nylon strings, or monofilament to prevent birds from using specific areas. The exact reasons why lines work are unknown but the placement of lines in grid, parallel, or random patterns has worked to prevent bird access to food, loafing, or nesting areas. Spacing of the lines varies by the species that is to be excluded. In general, wider spacing of about 10 feet is effective for birds with wingspans of around 2 feet, whereas narrower spacing has worked for birds of smaller wingspan. Various species of gulls (*Laridae*), geese, sparrows (*Passeridae*), and swallows (*Hirundinidae*) have been excluded from feeding or loafing areas. However, some species, such as mallard ducks (*Anas platyrhynchos*), have not been deterred from using protected areas as they are willing to pass through even narrow overhead grids.

Birds can be deterred from small water bodies such as retention ponds by covering the water surfaces with floating discs or balls. This technique will reduce evaporation, however, and may change water chemistry by preventing air from mixing with the water.

You can exclude birds from loafing or nesting on ledges in several ways using a variety of products (Figure 2). Metal flashing, wood, or stone placed on ledges at a 45° angle or more will exclude birds. Additionally, products are available

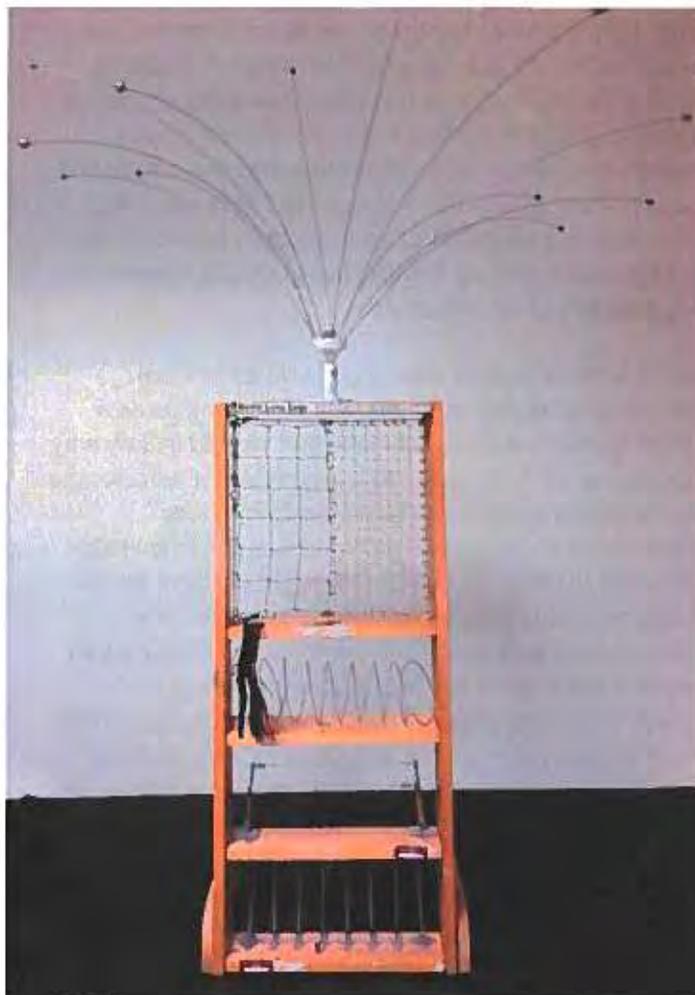


Figure 2. Top to bottom. Daddy long legs, netting (different mesh sizes), bird coil, bird wire, and bird spikes.

that make a bird uncomfortable when it tries to use a ledge or some similar perching area by causing minimal amounts of pain. A variety of anti-perching spikes are available that work (in theory) either by preventing birds from perching on the spike with their feet or by pricking birds that attempt to land on them.

Unfortunately, no single device will be effective against all species of birds. In general, larger birds require different devices than smaller birds due to the ability of different sized birds to fit within a series of spikes or grasp them in a manner that allows them to perch. Some larger hawks

(Accipitridae) have learned to grab hold of the spikes and use them as a perch.

As with any mechanical device, to be effective, spikes must be maintained and used against species for which they are intended. For example, when a series of ledges are involved, if spikes on lower ledges are covered with material dropping down from upper ledges, they will be ineffective. Some birds actually learn to drop nesting material onto the spikes so that the spikes help to form a base for the nest. Maintenance of the sites will prevent this from happening.

Shock strips produce a slight electrical shock to birds that land on them. They should remain effective as long the strips have electrical power and the area is kept clean enough to prevent the strips from shorting out.

Frightening Techniques

A wide variety of acoustical and visual tools and methods are available or under development to frighten birds. Not all devices have been through scientific testing, so the consumer must determine whether product claims are logical and whether the product is likely to work under the conditions of the problem facing the consumer.

Auditory Techniques

Birds are attuned to sounds in their environment, including bioacoustic sounds such as alarm or distress calls. Birds make alarm calls when they observe a predator that presents a threat. Birds make distress when they are injured or traumatized. Either call tends to be species-specific, although some birds in mixed flocks react to calls from other species within the flock. How a bird reacts to calls depends in part upon the time of year in relation to breeding, frequency of predation risk, distance to escape cover, approach of the predator, type of habitat, and behavior of flock members. When used at the correct time and place, both types of calls may cause birds to disperse, although many species are first attracted toward the call to learn what danger is present. High quality recordings of

alarm and distress calls are available. Use them at a volume that birds are accustomed to hearing. It is not helpful to play calls louder than how the birds normally hear or perceive the call.

Birds habituate to repeated alarm and distress calls in the absence of any threat. Calls are more effective in dispersing birds when used with other methods (e.g., pyrotechnics, limited lethal control) that present a clear threat. Activating acoustic devices only when birds are present may prolong their period of effectiveness.

Generic sounds, whether recordings of actual events (e. g., gunshot, car horn) or synthetically made noises, may show immediate results, but birds tend to habituate quickly to them unless the sounds cause or are accompanied by pain or discomfort. As with bioacoustics, integrate other control activities that represent a threat into programs using sounds. Devices that produce ultrasonic sounds are not effective because birds do not hear within the ultrasonic range.

Pyrotechnics are a commonly used and effective bird dispersal tool. Pyrotechnics are specially designed explosives that may be fired from shotguns or adapted firearms (e.g., starter pistols) that shoot only pyrotechnics. Common pyrotechnics include shell crackers, screamers, bird bangers, and bird bombs. Each of these produces a loud sound; some also produce a flash of light and puff of smoke as they are fired or explode. Screamers usually make a wavering noise, leave a trail of smoke, and fly erratically. Bird bangers create a blast that mimics the sound of a shotgun. The most effective type of pyrotechnic for any given situation depends upon the location where it is to be fired, the types of birds to be scared, and the range that is required to reach the birds. Although mixing different types of pyrotechnics can slow habituation, eventually most birds become habituated, especially if the site being defended is highly attractive to the birds and the same style of pyrotechnics is used repeatedly. In such situations, some species of birds may again react to pyrotechnics if limited lethal control via a shotgun or rifle is used against the flock. Research has shown limited lethal control works well against gulls, but not as well against crows (Corvidae) or blackbirds (Icteridae). Local and

national restrictions on the purchase, storage, and transport of pyrotechnics may preclude use by some people. Local ordinances may also limit use of pyrotechnics. Care must be taken because pyrotechnics can cause fires and leave debris behind that can cause damage to equipment or aircraft.

Propane cannons or gas exploders generate a blast that sounds like a shotgun from a stationary location. Cannons may be timed to go off at specific intervals, or be remotely fired by observers when birds are near the cannons. Although propane cannons are effective in some situations, habituation is common, especially with cannons timed to go off at specific intervals. The time to habituation may be extended by moving the cannons periodically, by firing cannons only when birds are present, and by integrating other scare tactics to supplement cannons.

Visual Techniques

Visual deterrents stimulate either an innate avoidance or a learned response that often is reinforced by another control technique. Bright lights such as spot lights, strobe lights, and flashing lights can be used to disperse birds for short periods of time. Products that use sunlight to create bright reflections also purportedly disperse birds. Although there have been reports of initial success in keeping birds away for a few days, numerous studies with a variety of species have failed to demonstrate success for human-made lights or reflected sunlight (except for lasers, see below) in continually dispersing birds.

Red or green lasers have been effective at scaring some species of birds. Red lasers work best in the dark while green lasers work both in dark and low-light conditions. It is unclear whether birds that do not react fail to see the laser (birds perceive colors differently than humans) or they do not recognize it as a threat. The reaction of some species, such as Canada geese and American crows (*Corvus brachyrhynchos*), may be diminished under increased ambient lighting or where there are no alternative roost areas. Use lasers with caution due to their range and potential to affect human vision. Be careful to keep laser beams from striking the cockpit of an aircraft as they can cause flash blindness. This could result in hazardous situations for

people on the aircraft and the ground and a visit from law enforcement officers.

People of many cultures have used scarecrows, dead birds, predator-like devices, and effigies of various other types over the centuries. Simulated predators, like plastic owls and hawks, often are used unsuccessfully to keep birds from roosting or nesting in specific areas. Two-dimensional cutouts of coyotes (*Canis latrans*) have shown some initial success but birds quickly habituate to them. Taxidermy mounts of coyotes, when routinely moved around airports that also employ other control methods, have been effective against Canada geese. Birds quickly learn that effigies left in the same location over a prolonged period do not represent a threat. The use of effigies has met with mixed success. Canada geese initially may react to plastic goose effigies but usually habituate within a short period. Effigies consisting of actual carcasses and artificial decoy-like vulture effigies hung by their feet in conspicuous locations where they move in the wind have been used to displace turkey (*Cathartes aura*) and black (*Coragyps atratus*) vultures from roosts for extended periods. Gull effigies have repelled gulls from loafing areas but have shown limited to no success when used in nesting colonies or at highly desired feeding sites. Human effigies (scarecrows) have been used for hundreds of years, but usually are of limited value in deterring birds unless they are enhanced by adding movement or integrating additional control measures, such as limited lethal control.

Flagging and other materials that move in the wind have shown mixed effects as visual repellents. Mylar® ribbon or tape has effectively deterred some species of birds, including blackbirds, gulls, house sparrows (*Passer domesticus*), and Canada geese, from agricultural crops and loafing areas. However, other species, such as American robins, gray catbirds (*Dumetella carolinensis*), house finches (*Carpodacus mexicanus*), American gold finches (*Carduelis tristis*), and mourning doves (*Zenaidura macroura*), have ignored this device. The reaction of gulls varies, as they avoid Mylar-style flagging when it is used in loafing areas but ignore it when it is used in established nesting colonies. In general, birds exhibit a neophobic response to flashing pie pans, aluminum foil, colored ribbon, plastic bags, and any other items suspended to blow in the



Figure 3. Balloons that have features similar to predators may frighten birds.

breeze. As with the other items mentioned above, unless birds recognize the object as a threat to their safety, they will ignore it or in some cases make use of a device. For example, gulls may incorporate Mylar flags within their nesting material.

Kites or balloon/kite combinations that take the form of simulated predators (Figure 3) have been reported to deter birds successfully from some areas, and they provide an option in areas that regulate noise levels from acoustic bird deterrents. However, kites and balloon/kite combinations are labor intensive to use, may be limited by weather conditions, and have a shrinking sphere of influence as birds habituate to them unless other techniques also are used.

Auditory-Visual Techniques

Remote controlled vehicles, including boats and aircraft, have successfully scared birds because they can be deployed in a threatening manner. Using these requires a level of skill (especially for aircraft), time and money to develop. Weather conditions may limit their use.

Dogs have been used successfully to disperse birds, especially waterfowl in urban and suburban areas (Figure 4). Properly trained dogs provide motivated harassment that birds recognize as threats. Dogs can be trained to remain within a given area and in some cases may be

housed there to provide constant control. Dog handlers are required when dogs are taken to various sites where they chase away targeted birds. Birds often return after the dogs leave the site. Even where dogs remain, they may lose interest in chasing the birds; this allows birds to return to the site. As with any bird dispersal technique, dogs are most effective when used with other control activities.

Falconry, the use of live raptors under the control of a handler, has been used in a variety of places to scare birds away. Many raptors present an innate threat to birds, which either hide or disperse when a raptor is visible and hunting. Falconry is expensive and requires extensive training, permits are required, multiple raptors are needed to cover large areas, weather conditions can restrict when raptors can fly, and dedicated personnel are necessary to make a system work. Due to some of the limitations inherent with a falconry program, other techniques to frighten birds should be integrated into any falconry program.

Compressed air may be used directly or indirectly to displace birds from roosting, loafing, or feeding areas. Air blown directly onto birds through a tube or hose may initially force them to move. Compressed air may be used indirectly by causing hoses to move erratically within sight of the birds. Air forced through lightweight hoses causes them to move unpredictably, making birds avoid the area. Some birds, however, quickly learn to vacate the protected area temporarily when they hear the noise of the air compressor or air coming out of the tube, only to return when the air is turned off. As with other devices, birds may learn to avoid only the points where the air or hoses are applied, therefore air or hoses should be used as part of an integrated system.

High-pressure water sprayers have been used effectively to disperse roosts. Some birds learn to associate the sound of the sprayer pump with being sprayed and will leave the roost before being sprayed. If the sprayer cannot reach portions of the roost due to dense vegetation and other obstructions, use other scare devices as well.

Repellents

Most chemical bird repellents are irritants. Avitrol® (4-aminopyridine) is listed by the U.S. Environmental Protection Agency as a chemical frightening agent, although the chemical is lethal to any birds that ingest it. Before dying, affected birds make distress calls, engage in irregular flight, and/or show other signs of distress that frighten the rest of the flock away from the area.

Polybutene-based products are marketed as tactile repellents. When in contact with the feet of birds, these products make them uncomfortable. Gels, tars, or similar material should be used with caution because some break down in high heat and stain or run. They are less effective when dirt or other material coat the surface of the products.

Application of repellents to grass can help disperse birds from areas where they are a problem. A variety of products are available on the market, but only two active ingredients, methyl anthranilate (MA) or anthraquinone (AQ), are registered for use on turf. Products that have MA elicit an immediate response, as MA is a chemical irritant that produces pain when it contacts the eyes, nostrils, or mouths of birds. Products containing AQ are secondary repellents because birds experience intestinal discomfort after eating treated food and then associate the food with the discomfort, leading to avoidance of the food. In controlled studies,

both MA and AQ have shown promise as bird repellents, although results have been mixed since repellency is impacted by a variety of factors such as availability of alternative food, distance to escape cover, or weather. Additionally, because changes in formulation and application techniques may affect efficacy of repellents, applicators should check current literature to determine if their intended application is likely to succeed.

MA also may be used as an irritant when it is used as the active ingredient in foggers. A bird that contacts MA through its nose, eyes, or mouth experiences distress and often leaves the area to avoid the chemical. Naphthalene (moth balls or moth flakes) has been suggested as a means to keep birds from enclosed areas, but when tested, birds (especially starlings) were not discouraged from using treated sites.

Sulfur-based products repel mammals, but their effectiveness as bird repellents is unclear. Snow geese (*Chen caerulescens*) appear to avoid fields treated with high concentrations of the sulfur-based Deer Away® Big Game Repellent, but starlings were not deterred from nest boxes treated with the same product.

Bird Management Examples

Urban Crow Roost Management

Thousands of American crows may congregate in urban winter roosts that create large amounts of fecal contamination of walkways, cars, and other property, as well as night-long cacophony. In some instances, as many as 70,000 crows have been recorded in a single winter roost. Before efforts at reducing the impact of the crows begins, it is critical to set an objective that all parties within the affected area agree with. In the case of crow roosts, the objective may be to splinter the flock into small groups, or to move the crows to alternate areas largely uninhabited by people. It also is necessary to be sure that the birds are not moved to an area in which they could become a significant threat to human health and safety (e.g., moving birds into areas with increased risk of striking aircraft or vehicles).



Figure 4. Border collie herding Canada geese (*Branta canadensis*).

Dispersing urban crow roosts requires coordination from multiple entities, including city management, law enforcement, public relations, and the agency conducting the work. The media are likely to be interested, and it is wise to provide a media spokesperson on the first night of harassment.

A combination of tools such as recorded crow distress calls played through loud speakers, pyrotechnics, red-beam lasers designed for bird harassment, and spotlights can be used to break up roosts. During the first few days of the roost dispersal program, biologists and technicians should set up any specialized equipment at the principal crow roost before the crows begin to arrive at dusk. As the flock begins to trickle in, use a battery of tools to harass (scare away) the crows. Visit the principle roost each night until the birds abandon the site or splinter into smaller roosts (usually after 5 to 10 nights). During the first winter or two of roost dispersal at the main sites, it may be necessary to conduct routine hazing every night for several weeks. Once the crows abandon the original roosting site, hazing may be reduced to several nights every 2 to 3 weeks.

Beginning with the first night of hazing, it is important that mobile teams drive through nearby neighborhoods to search for the formation of new roosting locations. When pursued and harassed, crows tend to seek the cover of coniferous trees. Because they can hide more easily in pines, listening for crows can be as effective as visual searches. Once a roosting location is found, you can use the same tools to harass the crows until they disperse. Encourage residents to report the locations of crow roosts directly to the agency conducting the work. Persistence is fundamental to a successful management of urban crow roosts.

Urban Canada Goose Management

Canada geese, when congregating in large numbers within public areas or on lawns, can create problems due to their droppings and, in some cases, their aggressive behavior towards people. All concerned parties should agree on the goal(s) of any management program before it is initiated. In the case of a non-lethal control program, the goal simply may be to reduce but not eliminate all geese within the

area. Studies have shown that when local geese are harassed, they often travel less than 2 kilometers (1¼ miles) from the site and regularly return within hours of harassment.

Once objectives have been determined, a goose harassment program should use a number of methods, such as chases by border collies, remote control boats, kayak chases, and pyrotechnics. Goose behavior, and the effectiveness of any control program, is dependent on breeding condition, migration, and molt. A pair of geese is much more difficult to scare away once an active nest is established. Trained personnel must visit each site of concern multiple times each week from May through October to prevent habitual use by geese. Initially, multiple visits each day are necessary to ensure that geese do not return. When conducting the hazing program, make sure that all geese have left the area and do not merely circle back to the site. If the person hazing leaves too quickly, the geese will return within minutes. Geese always should be hazed away from busy roadways or airports.

Curious bystanders often inquire about the hazing. When using a dog, it is helpful to fit the dog with a flotation vest with a logo or other marking that will let people know that the dog and hazer are authorized and will prevent the dog from tiring as quickly when swimming.

Repeat non-lethal goose management as often as necessary from year to year to make the site as inhospitable as possible to the geese. No-feeding ordinance, low fencing or wires around ponds, and vegetation or rip rap at the water's edge can enhance the effectiveness of goose harassment efforts.

Conclusion

Bird dispersal techniques are a vital part of safely and efficiently reducing bird conflicts with humans. The bird must perceive a technique as a threat if it is to be effective. No single technique can solve all bird conflicts, but an integrated use of multiple techniques, each enhancing the other, generally provides relief. When

possible, decreasing the attractiveness of the site by removal of food, water, or shelter helps to reduce conflicts as well as enhance the effectiveness of dispersal tools. Engaging municipal leaders and public agencies facilitates obtaining permissions, special authorities, and budgetary decisions from communities and organizations. Municipal leaders also can aid in establishing no-feed ordinances and positive public relations. Ultimately, the skill, knowledge, and persistence of those charged with reducing the conflict, and patience of the public will play a key role in successfully dispersing birds.

Acknowledgements

Figure 1. Photo by T.W. Seamans, USDA-APHIS-WS and Reconyx

Figure 2. Photo by Stephen M. Vantassel

Figure 3. Photo by John Humphrey, USDA-APHIS-WS

Figure 4. Photo by Stephen M. Vantassel

We thank Thurman Booth for establishing the basis for this manuscript and J. Cepek, T. DeVault, and B. Washburn for their reviews.

Glossary

Bioacoustics: The study of biological sounds that combines the fields of biology and acoustics.

Effigies: A three-dimensional figure or dummy of a person or animal

Habituate: A degradation in response to repeated stimulation such that the animal no longer reacts to the deployment of a scare tactic.

Innate: Existing in, belonging to, or determined by factors present in an individual from birth.

Neophobic: The tendency of an animal to avoid or retreat from an unfamiliar object or situation.

Ultrasonic: Of or relating to acoustic frequencies above the range audible to the human ear (above approximately 20,000 hertz).

Key Words

Auditory techniques, Chemical techniques, Frightening techniques, Habitat modification, Scare tactics, Visual techniques

Disclaimer

Wildlife can threaten the health and safety of you and others in the area. Use of damage prevention and control methods also may pose risks to humans, pets, livestock, other non-target animals, and the environment. Be aware of the risks and take steps to reduce or eliminate those risks.

Some methods mentioned in this document may not be legal, permitted, or appropriate in your area. Read and follow all pesticide label recommendations and local requirements. Check with personnel from your state wildlife agency and local officials to determine if methods are acceptable and allowed.

Mention of any products, trademarks, or brand names does not constitute endorsement, nor does omission constitute criticism.

Citation

Seamans, T.W. and A. Gosser. 2016. Bird dispersal techniques. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center. Ft. Collins, Colorado. 12p.

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Citation

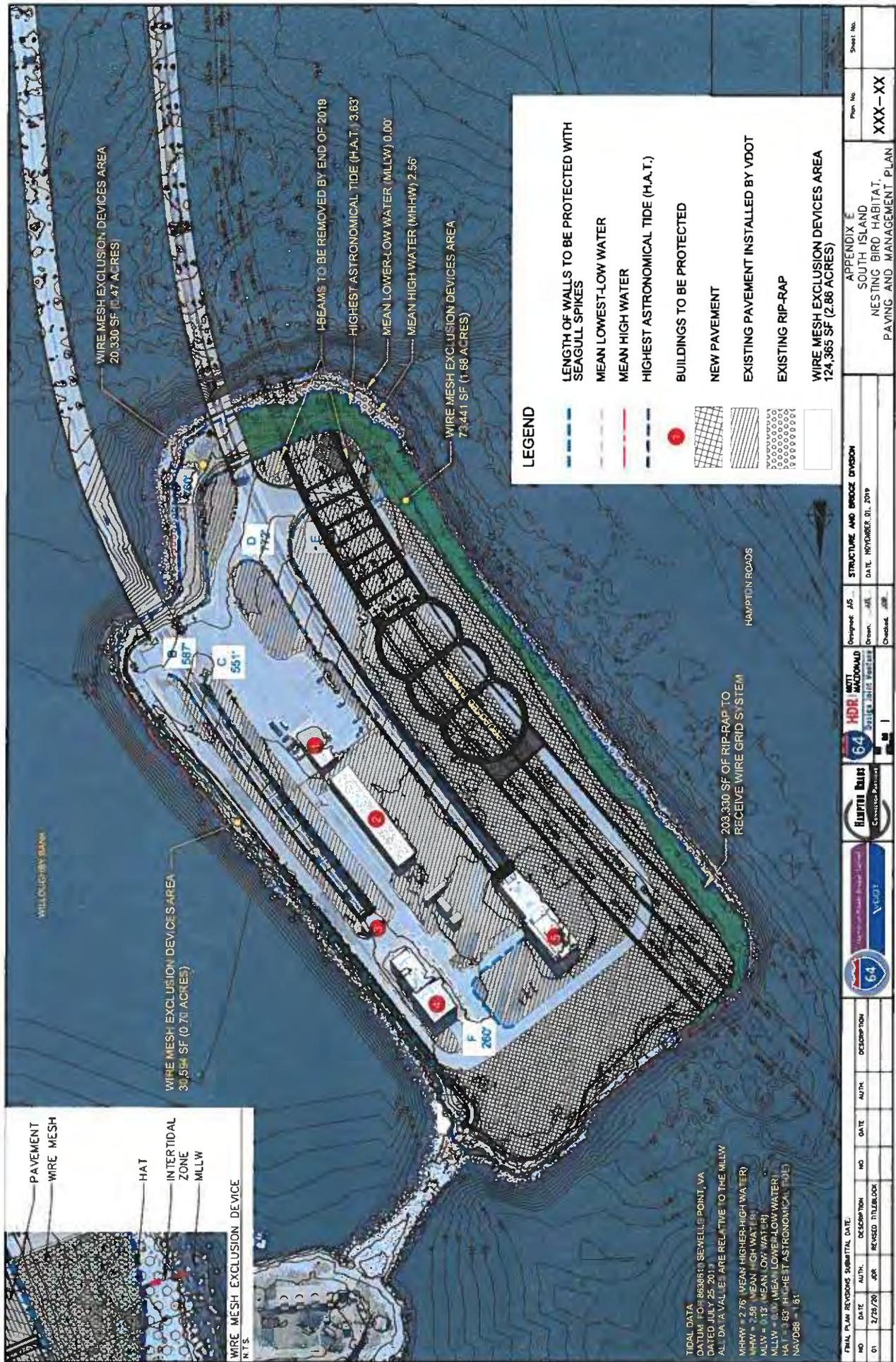
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Washburn, B. E., and T. W. Seamans. 2012. Foraging preferences of Canada geese among turgresses: implications for reducing human-geese conflicts. *Journal of Wildlife Management* 76:600 – 607.

Internet Center for Wildlife Damage Management (<http://icwdm.org>). Accessed 17, November, 2014.

National Wildlife Control Training Program (<http://wildlifecontroltraining.com>) Accessed 17, November, 2014.

**APPENDIX D:
SOUTH ISLAND NESTING BIRD
HABITAT PAVING AND
MANAGEMENT PLAN**



PAVEMENT
WIRE MESH

HAT
INTERTIDAL ZONE
MLLW

WIRE MESH EXCLUSION DEVICE
NTS

WIRE MESH EXCLUSION DEVICES AREA
 3,154 SF (0.73 ACRES)

WIRE MESH EXCLUSION DEVICES AREA
 20,330 SF (0.47 ACRES)

WIRE MESH EXCLUSION DEVICES AREA
 73,441 SF (1.68 ACRES)

WIRE MESH EXCLUSION DEVICES AREA
 124,365 SF (2.86 ACRES)

I-BEAMS TO BE REMOVED BY END OF 2019

HIGHEST ASTRONOMICAL TIDE (H.A.T.) 3.63'

MEAN LOWER-LOW WATER (MLLW) 0.00'

MEAN HIGH WATER (MHHW) 2.56'

203,330 SF OF RIP-RAP TO RECEIVE WIRE GRID SYSTEM

HAMPTON ROADS

- LEGEND**
- LENGTH OF WALLS TO BE PROTECTED WITH SEAGULL SPIKES
 - MEAN LOWEST-LOW WATER
 - MEAN HIGH WATER
 - HIGHEST ASTRONOMICAL TIDE (H.A.T.)
 - BUILDINGS TO BE PROTECTED
 - NEW PAVEMENT
 - EXISTING PAVEMENT INSTALLED BY VDOT
 - EXISTING RIP-RAP
 - WIRE MESH EXCLUSION DEVICES AREA

TIDAL DATA
 DATUM (TO: 863681) SEWELLS POINT, VA
 DATED JULY 25 2013
 ALL DATA VALUES ARE RELATIVE TO THE MLLW

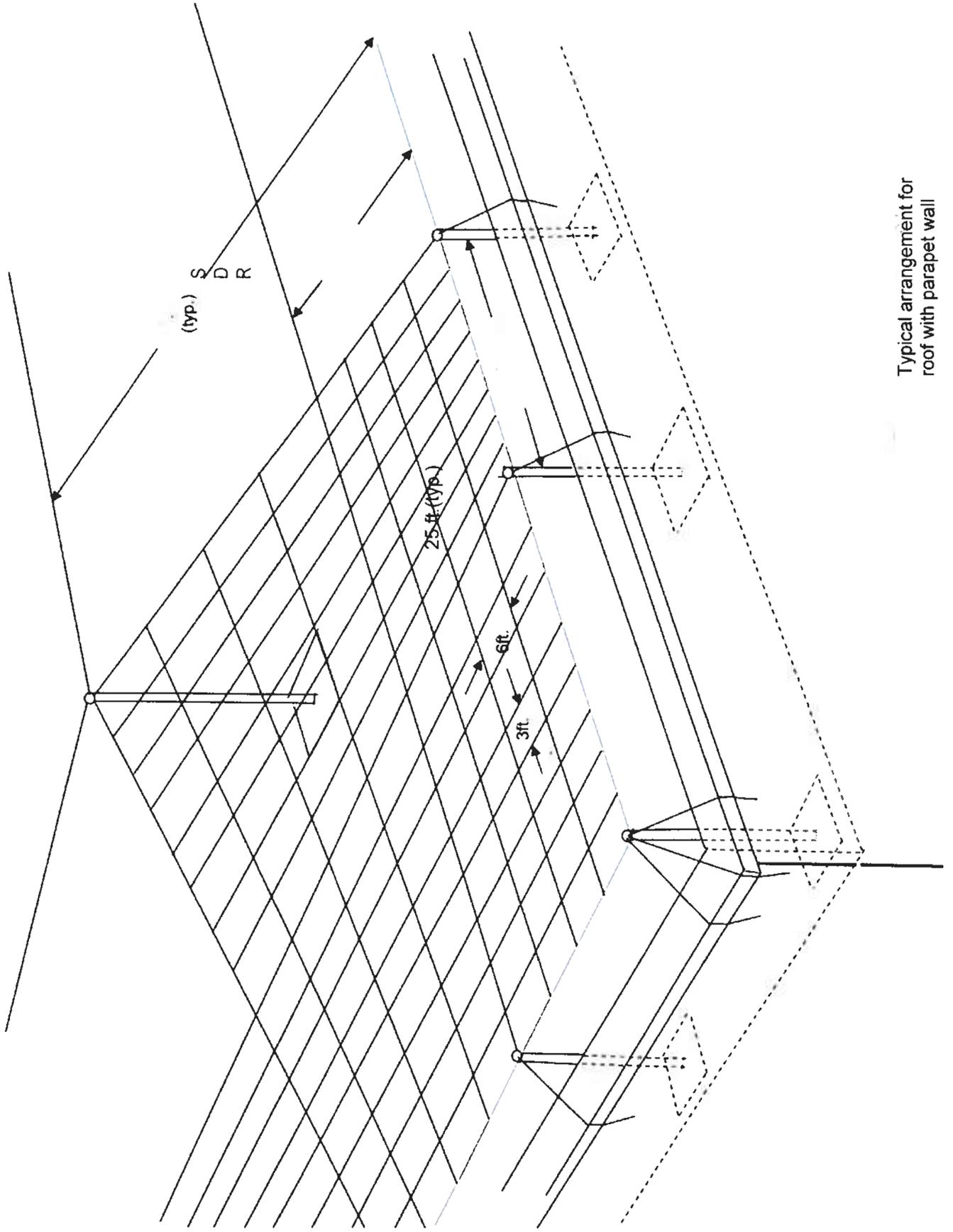
MHHW = 2.75' (MEAN HIGHER-HIGH WATER)
 MHW = 2.59' (MEAN HIGH WATER)
 MLLW = 0.13' (MEAN LOW WATER)
 MLLW = 0.00' (MEAN LOWER-LOW WATER)
 HAT = 3.63' (HIGHEST ASTRONOMICAL TIDE)
 NAVD83 = 1.81'

NO	DATE	AUTH.	DESCRIPTION	NO	DATE	AUTH.	DESCRIPTION
01	3/29/20	JOR	REVISED TITLE BLOCK				

Project: J65	Drawn: J65	Checked: J65	DATE: NOVEMBER 01, 2019	STRUCTURE AND BRIDGE DIVISION SOUTH ISLAND NESTING BIRD HABITAT PAVING AND MANAGEMENT PLAN
Sheet No.	XXX-XX	Sheet No.		

**APPENDIX E:
BIRD DEVICES/MANUFACTURER
INFORMATION**

GRID WIRE INSTALLATION LAYOUT



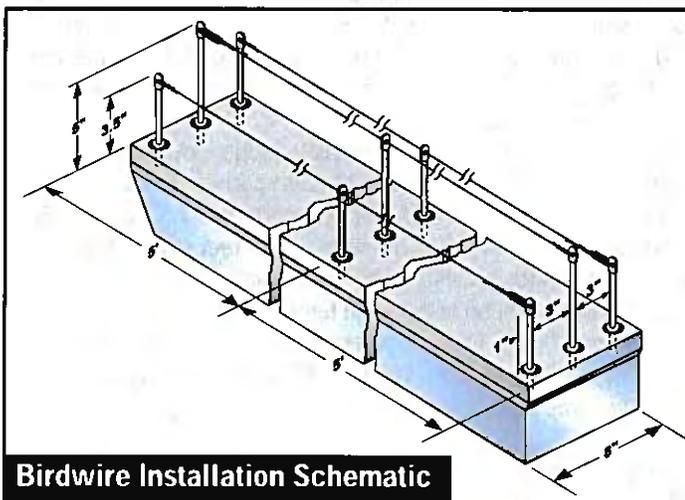
Birdwire™

Bird Barrier America, Inc.
20925 Chico Street
Carson, CA 90746
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East Coast: (800) NO BIRDS (662-4737)
Fax (310) 527-8005
E-mail: bbsales@birdbarrier.com
Web: www.birdbarrier.com

CSI Division: 10296
Bird Barrier Birdwire

MR-Manufacturer

Bird Barrier America, Inc. manufactures Birdwire's extensive line of components from the finest stainless steel and ultra-violet stabilized plastics.



PR-Product Presentation

Bird Barrier's Birdwire system is used worldwide to deter pigeons and larger birds from roosting on exposed building ledges, parapets, window sills, pipes and roof peaks. The system features hard-to-see ultra violet protected, nylon coated stainless steel wire spring-tensioned between stainless steel posts.

Very Discreet

The advantages of Birdwire include its wide array of installation options, and the fact that it is extremely hard to see, even close up. It is the clear choice for high pedestrian, high-end structures like historic buildings, hotels, museums, shopping centers and residences.

Many Options and Configurations

Birdwire posts are available in various lengths and configurations, allowing for installation on literally any building situation. Special clamps allow for installation on pipes, rain gutters, skylights, roof peaks, narrow ledges, corners and literally any surface where pest birds are posing a problem. Stainless steel split

pins can replace posts on window ledges where opposing walls face one another.

UA-Uses, Applications

Bird Barrier Birdwire can be used to deter a wide variety of birds (pigeons and larger) from landing on light to medium pressure (see "Bird Pressure" in company introduction) exposed ledges. The tensioned wires de-stabilize the landing platform, causing the birds to take their business elsewhere. The Birdwire components can be used in combination to cover any width ledge. Birdwire is not recommended for swallows, sparrows or starlings. Birdwire requires knowledgeable installers, as the many attachments, springs and wires make up a product line which cannot just be pulled out of the box and mounted ready-to-go onto a surface. Other Bird Barrier ledge products (The Coil and BirdPoint) are much easier to install. See their product descriptions elsewhere within Bird Barrier's product line (see other Bird Barrier screens).

AI-Assembly, Installation

Bird Barrier's Birdwire is run in long sections along the length of the ledge, pipe, gutter or other mounting surface. Bird Posts are mounted to the building by drilling in to the substrate, or by attaching stick-on bases with Bird Barrier Super Bond. The posts should be placed no more than 5 feet apart. Ledges of 1 to 2 inches wide require only one row of Birdwire. Wider ledges, however, will require a row every two and a half inches. A 9 inch ledge, for example, would require 3 rows for total protection.

MF-Materials, Finishes

All components of the Birdwire system are made from stainless steel or ultra-violet stabilized plastic. The wire itself is very thin braided stainless steel wire coated with a ultra-violet stabilized nylon coating.

TS-Technical Support

Bird Barrier's knowledgeable field representatives are available to assist in any aspect of evaluation, product recommendation and even local certified installation. Call 800-503-5444, or fax drawings and other pertinent information to 310-527-8005. Free literature, job evaluation worksheets and installation information is available.

SPECIFICATION GUIDELINES

General

1.1 Description

1.1.1 Install Bird Barrier Birdwire on exposed ledges where birds loaf but do not nest, to prevent loafing and damage from droppings.

1.2 Quality Assurance

1.2.1 Obtain technical literature from manufacturer or distribu-

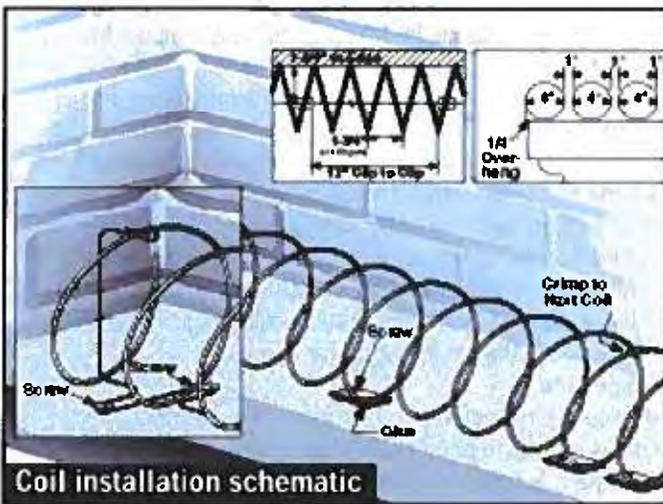


Bird Barrier America, Inc.
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Carson, CA 90746
Phone (310)527-8000, (800) 503-5444
East Coast: (800) NO BIRDS
Fax (310) 527-8005
E-mail: bbsales@birdbarrier.com
Web: www.birdbarrier.com

CSI Division: 10296
Bird Barrier Coil

MR-Manufacturer

Bird Barrier America, Inc. manufactures the patented Coil from high-grade Stainless Steel in the United States.



PR-Product Presentation

The Bird Barrier Coil is universal in its applications. It is an extendible coil specifically designed to stretch out over long, narrow areas; ledges, I-beams, roof edges, tops of walls, and parapets, to name just a few. The unique shape and instability of the Coil prevents pigeons and larger birds from landing on or in between the coils.

Made from Stainless Steel, the Bird Barrier Coil will not rust or corrode. It can be fastened with screws and coil clips to wood, or with Bird Barrier Bond and where holes can not or should not be drilled. This same clip can be nailed if need be.

The Bird Barrier Coil does not hurt the birds, will not gather leaves or other debris, is easy to install, and requires no regular maintenance.

The Coil is recommended for light and medium pressure situations only (see introduction for explanation of bird pressure).

4" Coil

Material: 302 Stainless Steel, .057" wire
Width: 4" (10cm)
Height: 4" (10cm)
Length: 25 feet when stretched out
Mounting Clip: 1" square, 302 Stainless Steel (screw or glue)

5" Coil

Material: 302 Stainless Steel, .0625" wire
Width: 5" (12.5cm)
Height: 5" (12.5cm)
Length: 25 feet when stretch out
Mounting Clip: 1" square, 302 Stainless Steel

UA-Uses, Applications

Bird Barrier Coil can be used to deter a wide variety of birds (pigeons and larger) from landing on light pressure (see company introduction), exposed ledges. The flimsy Coil de-stabilizes the landing platform, causing the birds to take their business elsewhere. The Coils can be used in combination to cover any width ledge, and up to one inch can be left unprotected between Coils or a back wall. The Coil is not recommended for swallows, sparrows or starlings. The Coil is very fast to install and very hard to see from 20 feet or more.

AI-Assembly, Installation

Bird Barrier Coil (4" or 5") is fastened to the structure with 1" clips which are glued, screwed or nailed to the building every 12". Bird Barrier Bond (cure time 2 hours), or Bird Barrier Super Bond (cure time 1 hour) will fasten the Coil Clips to any clean, dry, stable surface (Bonds sold separately, clips included). The 25' Coil does not require any assembly, and is packaged in a plastic bag the size of a softball.

MF-Materials, Finishes

Bird Barrier Coils are constructed of 302 Stainless Steel for non corrosive, non staining application. The Coil Clips are also made of 302 Stainless Steel.

TS-Technical Support

Bird Barrier's knowledgeable field representatives are available to assist in any aspect of evaluation, product recommendation and even local certified installation. Call 800-503-5444, or fax drawings and other pertinent information to 310-527-8005. Free literature, job evaluation worksheets and installation information is available.

SPECIFICATION GUIDELINES

General

1.1 Description

1.1.1 Install Bird Barrier Coil on exposed ledges where birds loaf but do not nest, to prevent loafing and damage from droppings.



TowerGuard™



WHERE TO USE Long, exposed ledges, parapets, signs, beams, pipes, railings

TARGET BIRD Gulls, Cormorants, Vultures, Osprey, Hawks and Owls and other large birds

BIRD PRESSURE Light - Heavy

MATERIAL UV Stabilized Plastic, polyester line, some metal parts

INSTALLATION Secure posts to the structure. Run wire or polyester cord loosely through the holes in the posts.

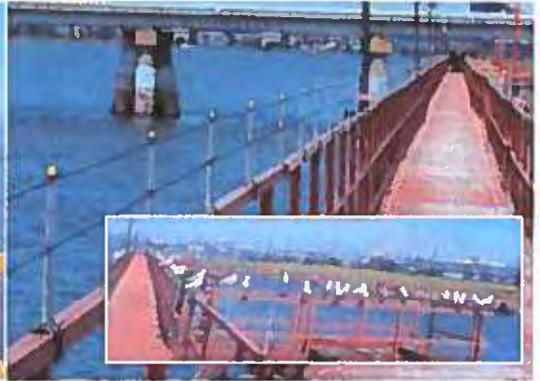
INSTALLATION LEVEL Easy



Crossarm installation to deter Ospreys.



Installation on railings to deter Vultures and California Condors.



An installation on a pier to keep Gulls and Cormorants from perching

How it Works

Tower Guard deters Gulls, Cormorants, Vultures, Osprey, Hawks and Owls and other large birds. It creates both a visual and physical barrier for railings and flat surfaces. Birds are looking for a low "cost of energy" perch that is easy and safe. As they view the Guard, they see that it takes away the perch and it is too small and unstable to land on.

Removable

By pulling a simple pin, the posts can be easily removed from the bases. This allows for maintenance on antennas and railing where access is important.

Material

Made from the same plastic that the telecom industry uses for its outdoor boxes. It's well documented to withstand UV degradation for many years.

Non-Metal Options

For sensitive applications (radar and radio sites), the Tower Guard system can be installed without metal parts. Use the polyester cord (not the metal Birdwire), and replace the Post Locking Pin with a short length of polyester cord, knotted as shown on the opposite page.

Mounting Options

The V base can fit on a round or square railing. These can be attached with plastic cable ties, metal hose clamps or with nails/screws on a wood structure.



The round/flat base can be placed on beams with magnets, metal parapets with a washer and adhesive, and on wood with nails or screws.

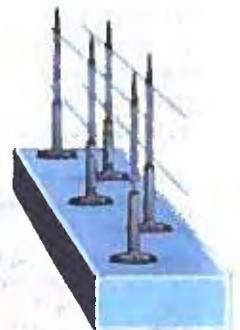
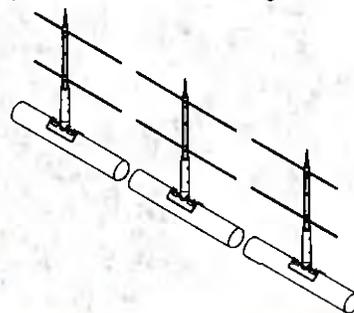


Safety Tip

In areas where people may come in contact with the posts, a version with a yellow rounded safety cap is an option.

Placement

Flat Surface - Posts should be no more than 2 in. from the outer edge. They should be no more than 5 ft. apart from each other. When running multiple rows, stagger the posts as shown in the diagram.



Railing - Posts should be no more than 5 ft. apart from one another.

Flourescent GridTwine's Chemical Properties

Polyethylene, being a paraffin hydrocarbon, is inherently chemically inert and is highly resistant to a wide range of chemicals at ordinary temperatures. It does not generally rot or absorb water. Polyethylene fibers have a high resistance to acids and alkalids of all concentrations. They are insoluble in most common organic solvents at room temperature.

Flourescent GridTwine's Electrical Properties

Polyethylene is an outstanding electrical insulator, especially to high frequency currents.

Effects of Insects and Micro-organisms

The fibers are not digested by insects and are completely resistant to bacteria, mildew and other micro-organisms. This makes Flourescent GridTwine virtually rot-proof.

SPECIFICATION GUIDELINES

General

1.1 Description

1.1.1 Install Bird Barrier GridWire systems utilize innovative wire patterns designed to disrupt the soaring flight patterns of gulls, geese and other large aquatic birds. These systems are designed to capitalize on the non-agile, gliding flight patterns. These systems are site specific and must be designed accordingly.

1.2 Quality Assurance

1.2.1 Obtain technical literature from manufacturer or distributor, telephone consultation and plan/photograph evaluation.

1.2.2 Utilize installation companies in your area who are fully skilled and certified to use Bird Barrier products.

1.3 Submittals

1.3.1 Submit manufacturer's samples, catalog cuts, shop sketches and other descriptive material.

1.4 Product Handling

1.4.1 Protect Bird Barrier GridWire and hardware systems from damage before, during and after installation.

1.4.2 If damage occurs to Bird Barrier GridWire, make all replacements immediately.

Products

2.1 Acceptable Manufacturer

2.1.1 Bird Barrier America, Inc., 20925 Chico Street, Carson, CA 90746. Phone 800-503-5444, 310-527-8000, Fax 310-527-8005, Web: www.birdbarrier.com

Material

Flourescent GridTwine

Material: Ultra-violet stabilized polyethylene plastic
Construction: 3 x 7 ply. Three groups of seven strands are wrapped into a tight, rope-like group of 21.

Breaking Strength: 48 pounds per strand

Size: 2 mm

Quantity: 2,500 feet per roll

Color: flourescent orange

GridWire

Material: High-density 302/304-grade stainless steel 7/7 braided wire.

Size: .96 mm

Quantity: 500 feet per roll

2.3 Mounting Systems

2.3.1 Solid steel: for anchor point attachments use Bird Barrier eye-bolts with lock nuts.

2.3.2 Steel I-beams: for anchor point attachments use Bird Barrier eye-bolts with lock nuts or heavy duty girder clamps.

2.3.3 Sheet metal: use Bird Barrier eye bolt with lock nuts for anchor point attachments.

2.3.4 Brick, concrete and stone: for anchor point attachments use Bird Barrier expanding corner net bolts.

2.3.5 Wood: for anchor point attachments use Bird Barrier screw eyes.

2.3.6 Perimeter support system shall be sufficient to withstand the tension of the proposed grid system.

2.3.7 Upon completion of installing anchor point attachments, the 2mm Flourescent GridTwine is attached to the cable stop spacer by wrapping the twine/wire around the spacer and crimping with two 2.5mm copper ferrules. On longer runs of twine, three 2.5mm copper ferrules are recommended at each termination point.

The .96mm GridWire is attached to the cable stop spacer by wrapping the wire around the spacer and crimping with two 1mm copper ferrules. On longer runs of wire, three 1mm copper ferrules are recommended at each termination point.

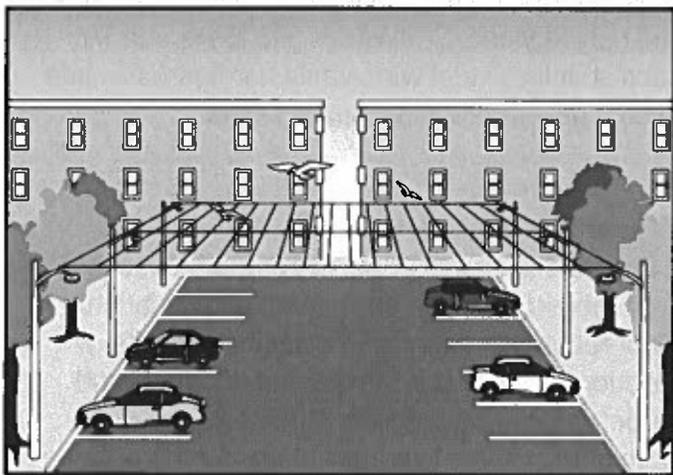
GridWire Systems

Bird Barrier America, Inc.
20925 Chico Street
Carson, CA 90746
Phone (310) 527-8000, (800) 503-5444
East Coast: (800) NO BIRDS
Fax (310) 527-8005
E-mail: bbsales@birdbarrier.com
Web: www.birdbarrier.com

CSI Division: 10290
Bird Barrier stainless steel GridWire, Fluorescent GridTwine and Installation Hardware Systems

MR-Manufacturer

Bird Barrier America, Inc. manufactures Fluorescent GridTwine from ultra-violet stabilized strands of polyethylene plastic. GridWire consists of .96mm stainless steel braided wire. The use of either wire or twine is a distinction made by personal preferences and job applications. Installation hardware is available in both galvanized and stainless steel options.



PR-Product Presentation

Bird Barrier's Fluorescent GridTwine and GridWire systems utilize innovative wire patterns designed to disrupt the soaring flight patterns of gulls, geese and other large aquatic birds. These systems are site and species specific and are designed to capitalize on the non-agile, gliding flight patterns of these birds.

Strong, Versatile Systems

The Fluorescent GridTwine is a strong, cabled twine made from high density, ultra-violet stabilized polyeth-

ylene. GridTwine is comprised of 3 braided sets of 7 wrapped strands each, for a total circumference of 2mm.

Gridwire consists of high-density 302/304-grade 7/7 stainless steel braided wire measuring .96 mm in thickness. This composition allows for overall strength combined with flexibility.

Visible Deterrence

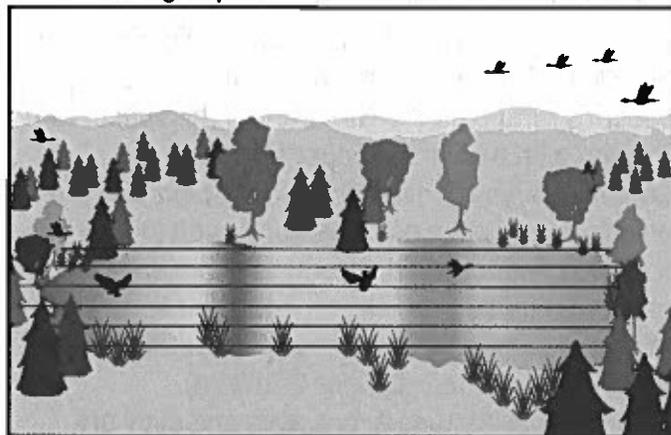
Fluorescent GridTwine is bright fluorescent orange in color, designed to attract the attention of the birds and serve as a visual deterrent as well as a flight interruptor. When using Gridwire, mylar flash tape should be attached to hang from the wires to catch the sunlight and visibly deter the birds.

Sizes Available

Fluorescent GridTwine is available in 2500' rolls. GridWire is available in 500' rolls.

Many Uses

Fluorescent GridTwine/GridWire can be configured to exclude birds from open areas including: ponds, rooftops, courtyards, reservoirs, outdoor dining areas, water treatment facilities, fish hatcheries, parking lots, and other large open areas.



Installation Hardware

The Fluorescent GridTwine and GridWire systems both offer comprehensive hardware options for any mounting surface including: stone, concrete, steel, wood, and brick. A cable support is installed securely to the building or perimeter. Specialized tools for attaching the hardware are also available from Bird Barrier.

APPENDIX F: BIRD INFORMATION

COLONIAL NESTING WATERBIRD INFORMATION SHEET

The information provided below may assist Hampton Roads Bridge-Tunnel workers in how to identify nests, eggs and chicks of many colonial nesting birds that use South Island and other Project construction areas. The objective for each worker is to recognize nests and eggs as soon as possible for proper removal without delays or interruptions in daily work tasks. It is important that nest and eggs are removed before eggs hatch as the chicks begin to run about in just a few days. Upon observation, if possible, snap a photo and text or describe the location and appearance of the nest/eggs/chicks to the HRCP Environmental Manager (EM) immediately, who will notify VDOT. A 50-foot buffer will be placed around the nest/egg while VDOT is notified. Within 4 hours VDOT will respond on site and will have a qualified and authorized bird monitor remove nests, eggs and chicks.

If eggs, nests or chicks are observed, immediately call the Environmental Manager:

Environmental Manager: Carissa Agnese:(757)373-7344,or
EH&S Director: John Cassidy:(949)514-7146

The South Island supports over 15 species of nesting birds, one of which is protected in Virginia. These birds range from large to small, vary in color and predominantly nest on the ground. Nesting sites and nests are very different than birds seen on land, and may be quite large (gulls) or simply consist of a scrape in the soil or a few pieces of shell and stones gathered together (terns). Some of the birds like to nest in sand/soil and may just lay an egg on bare ground, roofs or machinery.



Figure 1 a. tern with eggs; b. gull nest; c. black skimmer with eggs



Figure 2 d. oystercatcher with chick; e. sandwich tern; f. gull-billed tern and fledgling

For more information see: Gibson, D. K.L, Hunt, D.H. Catlin, J.D. Fraser, S.J. Ritter, and S.M. Karpanty. 2017. Final Report: An assessment of potential conservation measures to benefit colonial nesting waterbirds using South Island of the Hampton Roads Bridge Tunnel. Virginia Tech, Blacksburg VA. 153 pp

Upon discovering any nests, eggs or chicks, notify your supervisor and advise him/her to call the HRCP Environmental Monitor immediately.