

(15) Airport Cooperative Research Program (ACRP) Report 125: Balancing Airport Stormwater and Bird Hazard Management

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Airports are subject to a variety of environmental requirements that drive the need for stormwater best management practices (BMPs) to control the quantity and quality of stormwater discharging from their property. The U.S. Federal Clean Water Act of 1972 (with its subsequent amendments) identified the need to address water quality issues, which led to the implementation of federal, state and local regulatory programs requiring the management of stormwater quality and quantity. Airports have historically incorporated BMPs to comply with these requirements, such as stormwater detention ponds and vegetated swales, many of which have exposed open water, vegetation, and other design characteristics that attract wildlife. Research shows that 10 of the 15 bird species most hazardous to aircraft are highly attracted to these types of water features (DeVault, et al. 2011). Airports are challenged with implementing required stormwater BMPs while ensuring the safety of aircraft operations in accordance with FAA advisory circulars (ACs) and Federal Aviation Regulations (FARs). Therefore, the “Bird Strike Risk Analysis and Stormwater Management Decision Tool” designed for this ACRP Report, is intended to assist airports with evaluating opportunities to balance stormwater management and bird strike hazard management for water-dependent bird species. Airports need to balance aviation growth and development with resource management while minimizing public safety risk. This tool provides airport personnel with a means of assessing the potential risk of a bird strike associated with a current or proposed stormwater BMP following the FAA protocols for Aviation Safety Management Systems (SMS). The tool assesses risk as a product of severity and likelihood. The risk of a bird strike is assumed to increase if the severity (extent of aircraft damage) or likelihood of a strike increases. Strike severity is affected by the size or number of birds struck. The likelihood of a strike is affected by the history of bird observations, the proximity of those sightings to the movement areas, the species strike history, and the proximity of the stormwater BMP to the movement areas. This tool also examines how existing mitigation strategies and additional techniques may be used to mitigate bird strike risk. The Risk Analysis portion of the tool takes the above data and calculates an overall risk. The stormwater management decision portion of the tool provides a framework for considering wildlife risk, along with other influential factors, into the decision-making process when managing existing BMPs and selecting new BMPs. Environmental Resource Solutions, Inc. was the principal investigator for this ACRP Report. As such, Amy will present the findings and the research process, as well as the final product – a risk assessment tool designed in Microsoft Excel to aid airport planners, biologists, and engineers in the stormwater design process without increasing the wildlife attractants at or around the airport.

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ACRP

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ACRP Report 125: Balancing Airport Stormwater and Wildlife Hazard Management: Analysis Tools and Guidance

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Problem Statement

Airports are required to manage the quantity and quality of stormwater on site while ensuring the safety of aircraft operations. Many stormwater management options can create potential aviation wildlife hazards. In addition, airports are faced with potentially conflicting federal, state, and local stormwater and wildlife management regulations and guidance. Research is therefore needed to develop proactive tools and guidance to assist airports in making decisions that balance stormwater management and wildlife hazard management.



Tool Overview

Safety Management Systems (SMS) Approach to Tool Development

- SMS Risk Process Steps:
 - Step 1 - Describe the system;
 - Step 2 - Identify the hazards;
 - Step 3 - Determine the risk;
 - Step 4 - Assess and analyze the risk;
 - Step 5 - Treat the Risk;
 - Step 6 - Manage the Risk
- Risk is the product of Likelihood & Severity
- Result is a Risk Matrix

Tool allows the user to assess the potential risk associated with attraction of water dependent birds to a selected stormwater BMP at an airport.

Risk Matrix

Severity Factors (hazard)		Likelihood (Frequency) Factors - (Proximity to aircraft)				
Severity Levels		Quantitative (Occurrence)				
		5	4	3	2	1
		FREQUENT	PROBABLE	REMOTE	EXTREMELY REMOTE	IMPROBABLE
NEGLIGIBLE	1	5.0	4.0	3.0	2.0	1.0
MINOR	2	10.0	8.0	6.0	4.0	2.0
MAJOR	3	15.0	12.0	9.0	6.0	3.0
HAZARDOUS	4	20.0	16.0	12.0	8.0	4.0
CATASTROPHIC	5	25.0	20.0	15.0	10.0	5.0

High ≥ 15	Moderate $> 5 < 15$	Low ≤ 5
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5X5 Matrix with: 5 Severity Factors and 5 Likelihood Factors

Project Specific Risk Matrix

Risk Matrix

Severity Factors (hazard of birds volume/mass of birds attracted)				Likelihood (Frequency) Factors - (Proximity to aircraft)												
Severity Levels		Relative Hazard Score - Species		BMP - Perimeter Irregularity	BMP - Apparent Slope to Water's Edge	BMP - Proximity of Water Bodies (from each other)	BMP - Percentage of Stormwater Vegetation Coverage	FREQUENT	PROBABLE	REMOTE	EXTREMELY REMOTE	IMPROBABLE				
		5						4		3		2		1		
		daily - weekly sightings (year round)						daily to weekly sightings - seasonal only		weekly to monthly sightings		weekly to monthly sightings (seasonal only)		Annual sightings		History of Observations
		on the runway or RPZ in flight						on the runway on the ground		on the AOA		within airport property		off airport property		Proximity of Bird Sightings
		>75%						50-75%		10-50%		5-10%		<5%		Percentage of Total Airport Bird Strikes Associated with Species
		> 2 SD above national average						Between 1 and 2 SD above national average		Within 1 SD of national average		Between 1 and 2 SD below national average		< 2 SD below national average		History of Total Bird Strikes per Operations Compared to National Average
AOA		<5000 ft		5000 - 10,000 ft		10,000 ft - 5 mi		> 5 miles		Proximity of BMP to Airport Movement Areas						
NEGLIGIBLE	1	1	< 12	Irregularity <= 1.1	1:1	None within 5 mi	100%	5.0	4.0	3.0	2.0	1.0				
MINOR	2	2	> 12 < 24	1.1 < Irregularity <= 2.8	2:1	3.75 - 5 mi	0%	10.0	8.0	6.0	4.0	2.0				
MAJOR	3	3	> 24 < 36	2.8 < Irregularity <= 4.6	3:1	2.5 - 3.75 mi	less than 16.5% OR greater than 83%	15.0	12.0	9.0	6.0	3.0				
HAZARDOUS	4	4	> 36 < 48	4.6 < Irregularity <= 6.4	4:1	1.25 - 2.5 mi	16.5% to 32.9% OR 66.1% to 83%	20.0	16.0	12.0	8.0	4.0				
CATASTROPHIC	5	5	>48	Irregularity > 6.4	>=5:1	< 1.25 mi	33% to 66%	25.0	20.0	15.0	10.0	5.0				

Severity Factors (5)

- **Species:** Select species of greatest concern and tool auto-populates standardized relative hazard score (Devault et. al., 2011)
- **BMP – Perimeter Irregularity:** The ratio of the pond perimeter to the perimeter of a perfect circle of equal area
- **BMP – Apparent Slope to Water’s Edge:** Horizontal run (H): Vertical rise (V)
- **BMP- Proximity of Water Bodies (from each other):** Distance between additional water bodies (i.e. natural or manmade ponds/wetlands/rivers) in the vicinity of the surface water being evaluated in the tool. Use closest water body
- **BMP – Percentage of stormwater vegetation coverage:** $ow:ew$ is the ratio of area of open water to area of emergent and woody vegetation

Likelihood Factors (5)

- **History of Observations**: How often the species of concern is observed by airport staff
- **Proximity of Bird Sightings**: Where the species are being observed in relation to the runway
- **History of Strikes**: Total percentage of strikes from strike database for species being evaluated (only evaluate strike data within the last 5 years)
- **History of total bird strikes per operations compared to the national average**: Is your bird strike rate (strikes/operations) within 1 or 2 SD of the national average.
- **Proximity of BMP to airport movement areas**: Where is the BMP in relation to the AOA (using FAA recommended separation distances from AC 150/5200-33B)

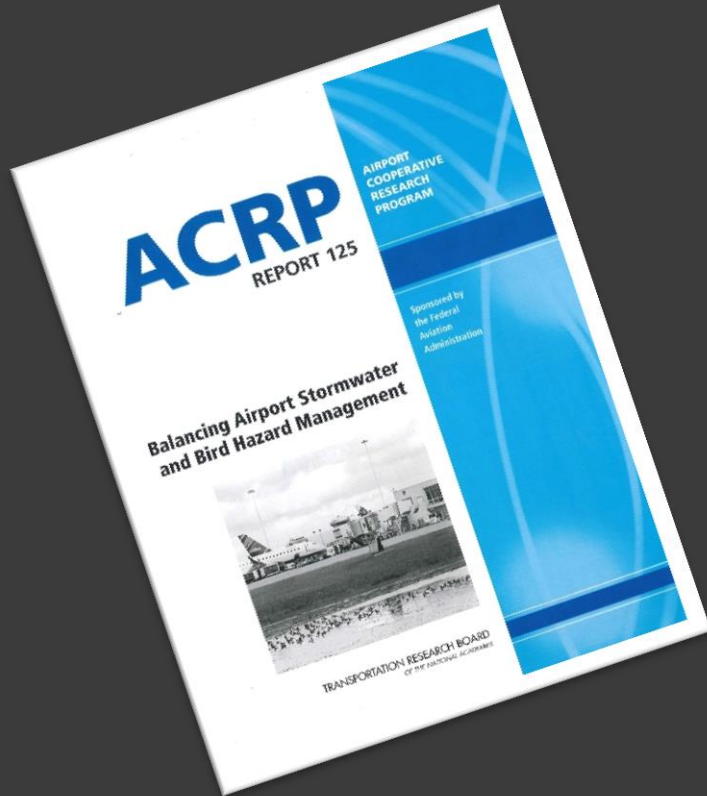
Mitigations (aka Controls)

- Mitigations, both existing and new, impact initial and residual risk, respectively.
- Hierarchy of Mitigations include:
 - Elimination (most effective)
 - Substitution
 - Engineering
 - Warnings
 - Administrative (least effective)
- Failure Modes and Effects Analysis (FMEA) concepts were used to determine the risk reductions that can be applied for Mitigations
- Risk reduction increases if the mitigation is ongoing as opposed to applied at the time of sighting only (e.g. an effigy on display is “ongoing” whereas shooting to kill is “upon sighting only”)

Not Practical



For additional information:



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<http://www.trb.org/Main/Blurbs/172035.aspx>

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