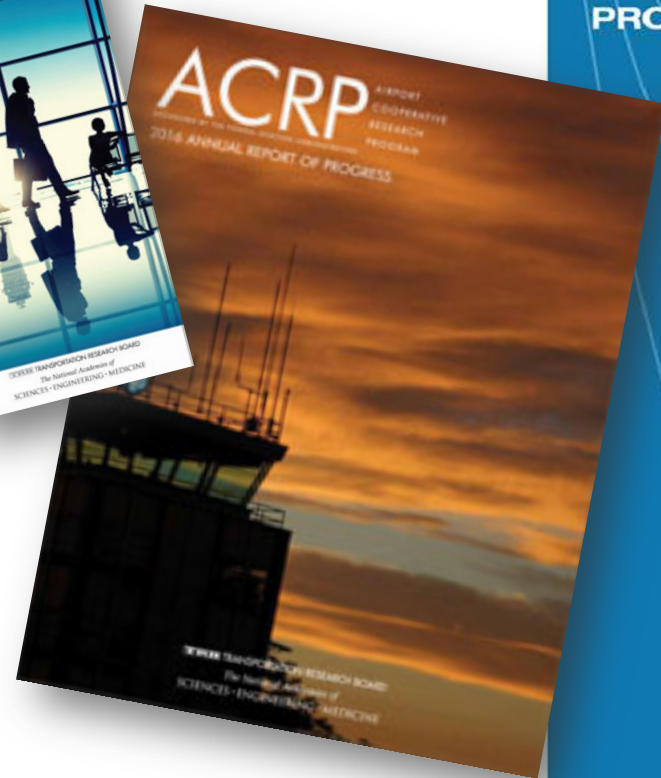


ACRP is an Industry-Driven Program

- ✈ Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- ✈ Seeks out the latest issues facing the airport industry.
- ✈ Conducts research to find solutions.
- ✈ Publishes and disseminates research results through free publications and webinars.



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Opportunities to Get Involved!

- ✈️ ACRP's Champion program is designed to help early- to mid-career, young professionals grow and excel within the airport industry.
- ✈️ Airport industry executives sponsor promising young professionals within their organizations to become ACRP Champions.
- ✈️ Visit ACRP's website to learn more.



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Upcoming ACRP Webinars

February 28th

Legal Research for Airport Programs:
Security Screening

March 14th

Winter Operations: Understanding Aircraft Deicers
and Their Impact on Stormwater Runoff

March 23rd

Advancing Collaborative Decision-Making (CDM)

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



Additional ACRP Publications Available on this Topic

Report 32: Guidebook for Addressing Aircraft/Wildlife Hazards at General Aviation Airports

Legal Research Digest 20: Airport Responsibility for Wildlife Management

Synthesis 26: Current Airport Inspection Practices Regarding FOD (Foreign Object Debris/Damage)

Synthesis 39: Airport Wildlife Population Management

Synthesis 52: Habitat Management to Deter Wildlife at Airports

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



Today's Speakers

Russell P. DeFusco, Ph.D. - BASH, Inc.

Edward T. Unangst, Ph.D. - TEWS, Inc

Joanne Landry, MBA - Landry Consulting LLC

Presenting Report 145

*Applying an SMS Approach to Wildlife
Hazard Management*

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



ACRP Report 145: Applying an SMS Approach to Wildlife Hazard Management

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

ACRP

REPORT 145

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Sponsored by
the Federal
Aviation
Administration

Applying an SMS Approach to
Wildlife Hazard Management



Russell P. DeFusco, PhD, USAF (retired)
BASH Inc.

Edward T. Unangst, PhD, USAF (retired)
TEWS Inc.

Joanne Landry, MBA
Landry Consultants LLC

Russell P. DeFusco, PhD, USAF (retired), Principal Investigator

- Vice-President, BASH Inc.
- Lt Col, USAF (retired)
- Qualified Airport Wildlife Biologist



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Edward T. Unangst, PhD, USAF (retired), Principal Investigator

- Vice-President, TEWS Inc.
- Lt Col, USAF (retired)
- Qualified Airport Wildlife Biologist



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Joanne Landry, MBA Principal Investigator

- Principal, Landry Consultants LLC
- National SMS Expert
- Adjunct Professor, Green River College, Washington State



ACRP

**AIRPORT
COOPERATIVE
RESEARCH
PROGRAM**

ACRP Report 145 Oversight Panel

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Julie M. Schreacke, *American Airlines, DFW Airport, TX, formerly DFW Airport (Chair)*

Michael J. Begier, *U.S. Department of Agriculture, Wildlife Services, Washington, D.C.*

Ken Jacobs, *Tetra Tech AMT, Crownsville, MD*

Paul Khera, *Alaska DOT and Public Facilities, Juneau, AK*

Jeffrey Kolodzinski, *The Port Authority of New York and New Jersey, Jamaica, NY*

John E. Ostrom, *Metropolitan Airports Commission - Minneapolis-St. Paul International Airport, St. Paul, MN*

Seth B. Young, *The Ohio State University, Columbus, OH*

Keri Lyn Lyons, *FAA Liaison*

Christopher J. Oswald, *Airports Council International - North America Liaison*

Bernardo Kleiner, *TRB Liaison*



ACRP Report 145: Applying an SMS Approach to Wildlife Hazard Management

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

A description of an SMS approach to WHM to include:

A glossary of key terms.

A listing of relevant resources and databases.

An overview description of SMS including all four components of SMS.

A comparison of current WHM program standards to those of SMS.

A description of innovative protocols and procedures, in narrative or visual formats for developing WHM programs in the style of SMS.

Applicability to airports regardless of SMS implementation, wildlife program, or Title 14.



ACRP Report 145: Applying an SMS Approach to Wildlife Hazard Management

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Customizable tool(s) and template(s) that are useful for assessing wildlife risk at airports to include:

A resource summary of existing database wildlife hazard descriptions.

Numerical values for severity and likelihood for species derived from the FAA's national Wildlife Strike Database.

An electronic or manual risk analysis template, which includes the incorporation of variables on or off the airport.



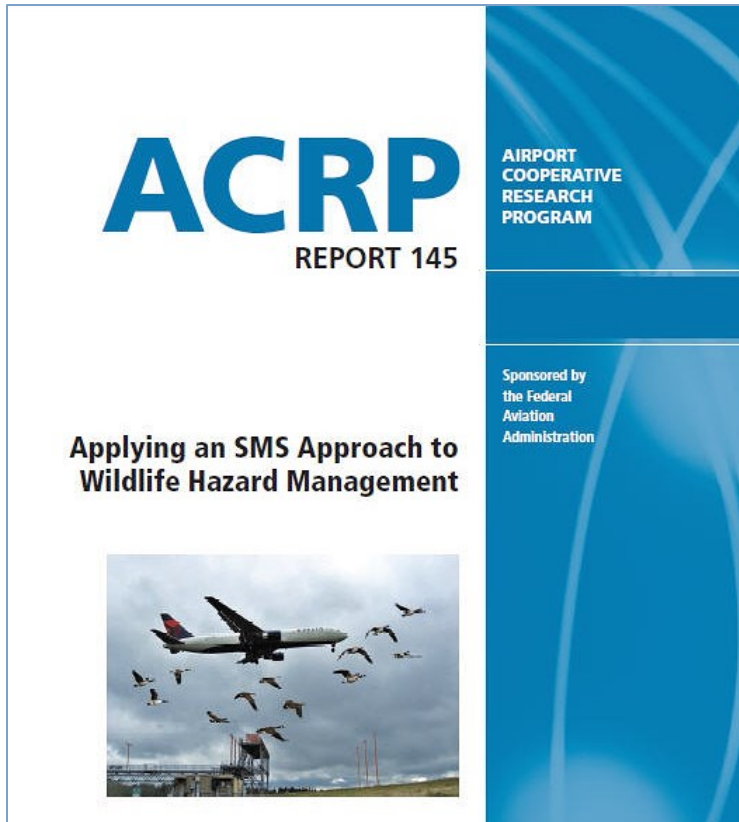
Applying an SMS Approach to Wildlife Hazard Management



ACRP

**AIRPORT
COOPERATIVE
RESEARCH
PROGRAM**

ACRP 145 Authors



Russell P. DeFusco, PhD
BASH Incorporated
Colorado Springs, CO

Edward T. Unangst, Jr., PhD
TEWS Incorporated
Colorado Springs, CO

Timothy R. Cooley, PhD
DynamX Consulting
Castle Rock, CO

Joanne M. Landry, MBA
Landry Consultants LLC
Seattle, WA

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Project Objectives

Address integration of wildlife management programs into airport Safety Management Systems (SMS)

Develop a quantitative wildlife risk tool that includes:

- Wildlife hazard
- Airport operations by airport and aircraft class
- Habitat on and off airport by varying distances
- Current wildlife control practices on and off airport
- Future wildlife control practices on and off airport



SMS and Wildlife Management Programs

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

“Perfect fit”

Continuous data collection, monitoring,
feedback, and improvement

AC 150/5200-37A



Safety Management System (SMS)



ACRP

**AIRPORT
COOPERATIVE
RESEARCH
PROGRAM**

SMS Components

Safety Assessment (SA)

The risk assessment conducted by Subject Matter Expert (Experts).

Safety Risk Management (SRM)

The process / program of identifying hazards, analyzing and assessing the risks, mitigating the risks, monitoring, and feedback for improvement.

Safety Management System (SMS)

The overall system of processes, procedures, policies, etc.



SMS Risk Mitigation

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Describe System

Identify all related systems and include operational, procedural, organizational, and environmental factors, as well as physical characteristics.

Identify Hazards

Identify any condition or situation that could create adverse safety consequences for the airport, users, and surrounding community. Include operational, personnel, organizational, and environmental factors.

Analyze Risks

For each hazard, identify the worst case outcomes that are reasonable or credible within the operational lifetime of the system. Determine consequences likelihood and initial risk level.

Assess Risks

Severity and likelihood are used to determine associated risk using a predictive risk matrix.

Mitigate Risks

Identify actions, controls or other measures to reduce the likelihood of consequences associated with a hazard. Reduce the predicted risk level to moderate or low.

Hazard vs. Risk

Terms often confused—sometimes used interchangeably or defined via a combination of variables

Hazard—a condition in the environment that is a potential source of “harm”

- Magnitude of a hazard is often referred to as “**severity**” in safety literature/SMS

Risk—probability of harm if exposed to a hazard

- Probability of exposure is often referred to as “**likelihood**” in safety literature/SMS
- Actual “**RISK**” is a combination of hazard/severity and exposure/likelihood



WHaMRAT

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

WHaMRAT—Wildlife Hazard Management Risk Assessment Tool

- Just one of the tools in the SMS toolbox

EZ vs. Advanced Versions

- Discrimination within wildlife guilds defines difference
- Guild-level discrimination in EZ Version
- Species-level discrimination within guilds in Advanced Version

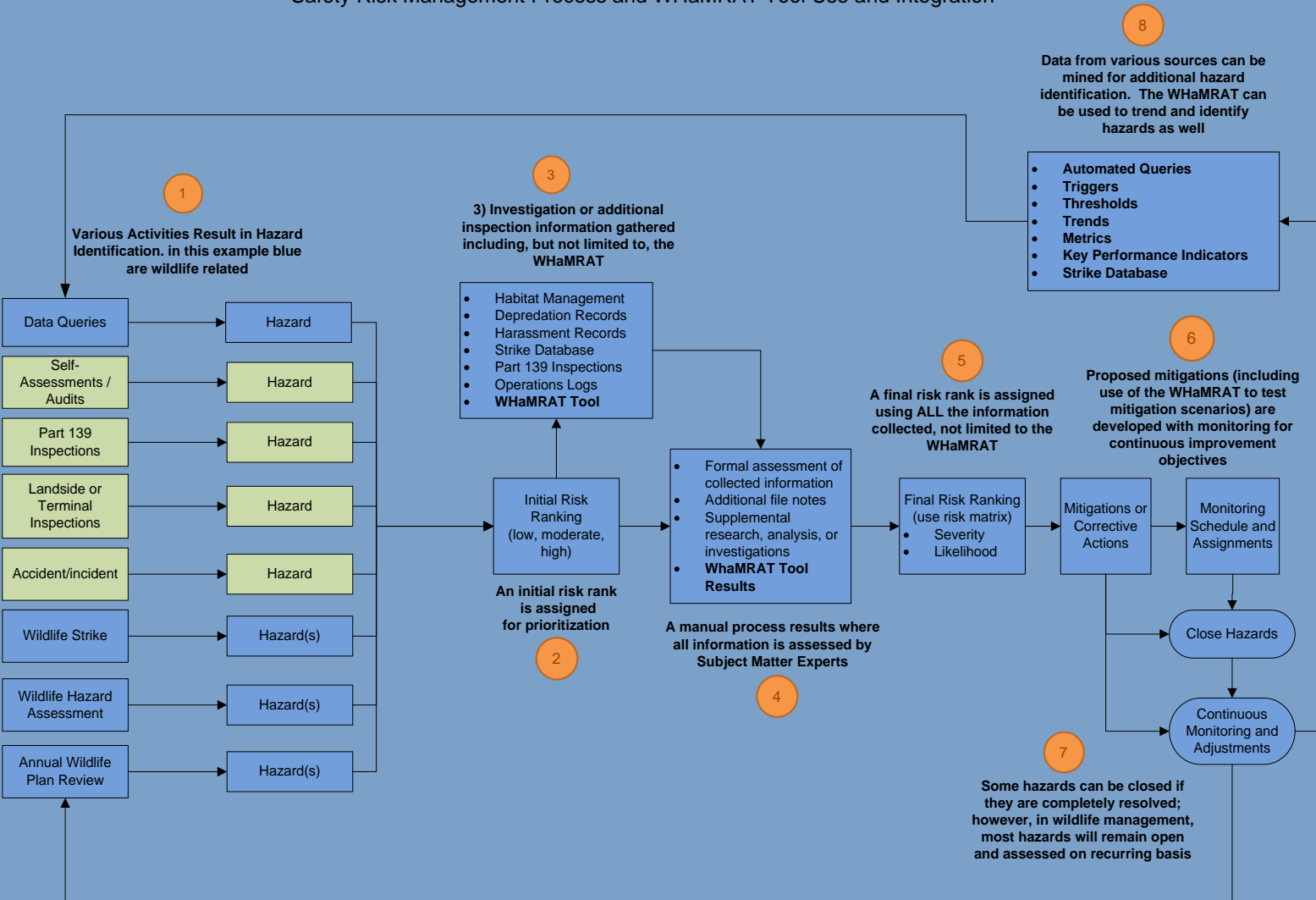


SMS Process and WHaMRAT Integration

ACRP

AIRPORT COOPERATIVE RESEARCH PROGRAM

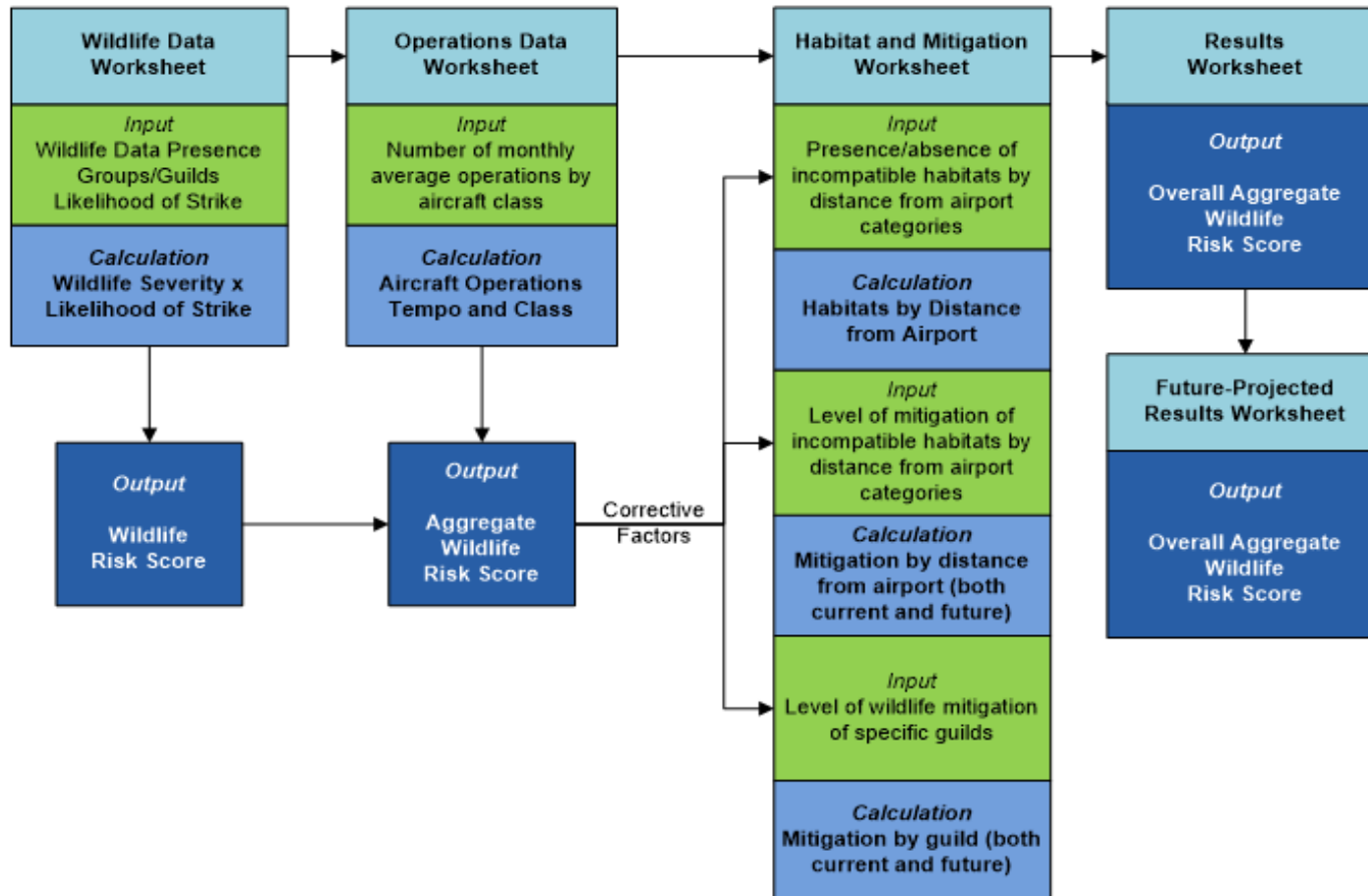
Safety Risk Management Process and WHaMRAT Tool Use and Integration



WHaMRAT Process

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

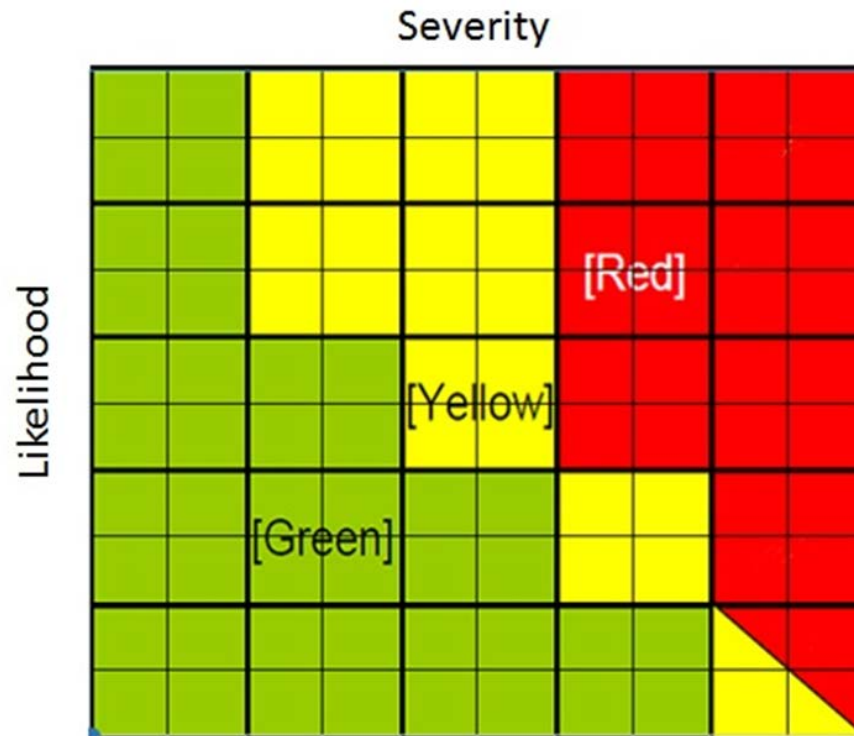


Wildlife Hazard Risk Matrix

Likelihood vs. Severity

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



FAA Order
8040.4A

Avian Guilds

ACRP

**AIRPORT
COOPERATIVE
RESEARCH
PROGRAM**

1. Waterbirds
2. Seabirds
3. Pelicans/Cormorants
4. Waders
5. Waterfowl
6. Raptors/Vultures/Owls
7. Upland Game Birds
8. Cranes
9. Shorebirds
10. Gulls/Terns
11. Pigeons/Doves
12. Parrots
13. Aerial Foragers
14. Woodland Birds
15. Corvids
16. Grassland Birds
17. Blackbirds/Starlings
18. Miscellaneous



Avian Guild Severity—EZ WHaMRAT

ACRP

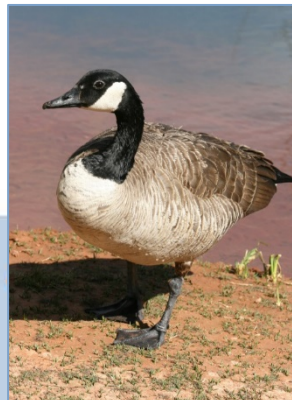
AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Guilds	Severity
Waterbirds	2
Seabirds	2
Pelicans/Cormorants	4
Waders	2
If flocks ≥ 5	5
Waterfowl	3
If flocks < 5	4
If flocks ≥ 5	5
Raptors/Vultures/Owls	2
Upland Game Birds	2
If Turkeys	5
Cranes	5
Shorebirds	1
If flocks < 15	4
If flocks ≥ 15	5
Gulls/Terns	2
If flocks < 10	4
If flocks ≥ 10	5
Pigeons/Doves	1
If flocks < 20	4
If flocks ≥ 20	5
Parrots	1
Aerial Foragers	1
Woodland Birds	1
Corvids	2
If flocks < 10	4
If flocks ≥ 10	5
Grassland Birds	1
Blackbirds/Starlings	1
If flocks < 100	4
If flocks ≥ 100	5
Miscellaneous	1
Criteria for Score	Severity
Less than 300g	1
300–999g	2
1000–1999g	3
2000–3999g	4
Greater than 4000g	5

Hazard level is based strictly on body mass

Body mass varies significantly within guilds

Each guild has a singular severity value based on average body mass within guild. Increased severity levels to account for flocking behavior



Non-Avian Guilds Mammals

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

- 1) **Rodents** – Beavers, Squirrels, Rats, Mice, Ground Squirrels, Shrews, Prairie Dogs, Marmots, Chipmunks, Pocket Gophers, Voles, Lemmings
- 2) **Lagomorphs** – Rabbits, Hares, Pikas
- 3) **Bats** – Bats
- 4) **Mesomammals** – Opossums, Armadillos, Weasels, Minks, Martins, Wolverines, Badgers, Otters, Skunks, Raccoons
- 5) **Canids** – Coyotes, Wolves, Foxes, Domestic Dogs
- 6) **Felids** – Bobcats, Lynxes, Mountain Lions, Feral Cats
- 7) **Hooved** – Horses, Hogs/Pigs, Deer, Elk, Moose, Caribou, Antelope, Sheep
- 8) **Bears** – Bears



Non-Avian Guilds

Reptiles and Amphibians



- 1) **Alligators/Crocodiles** – Alligators, Crocodiles
- 2) **Turtles** – Turtles, Tortoises
- 3) **Iguanas** – Iguanas
- 4) **Lizards/Snakes** – Smaller Lizards and Most Snakes



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Non-Avian Guild Severity—EZ WHaMRAT

ACRP

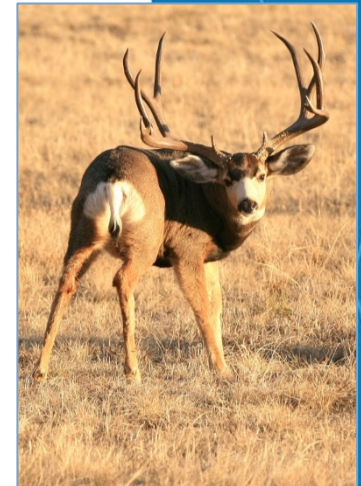
AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Guilds	Severity
Rodents	2
Lagomorphs	4
Bats	1
Mesomammals	4
Canids	5
Felids	5
Hooved	5
Bears	5
Turtles	2
Iguanas	2
Lizards/Snakes	2
Crocodiles/Alligators	5
Criteria for Score	Severity
0-99g	1
100-599g	2
600-1999g	3
2000-9999g	4
Greater than 10000g	5

Hazard is based strictly on body mass

Body mass varies significantly within guilds

Each guild has a singular severity value with increasing value as average body mass (within guild) increases.



Likelihood Scoring

(Value based on relative abundance of wildlife observations for a particular guild)

- 1) **Species not present at all:** likelihood score of “0” or cell left blank.
- 2) **Rare:** likelihood score of “1”.
- 3) **Uncommon:** likelihood score of “2”.
- 4) **Fairly Common:** likelihood score of “3”.
- 5) **Common:** likelihood score of “4”.
- 6) **Abundant:** likelihood score of “5”.



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

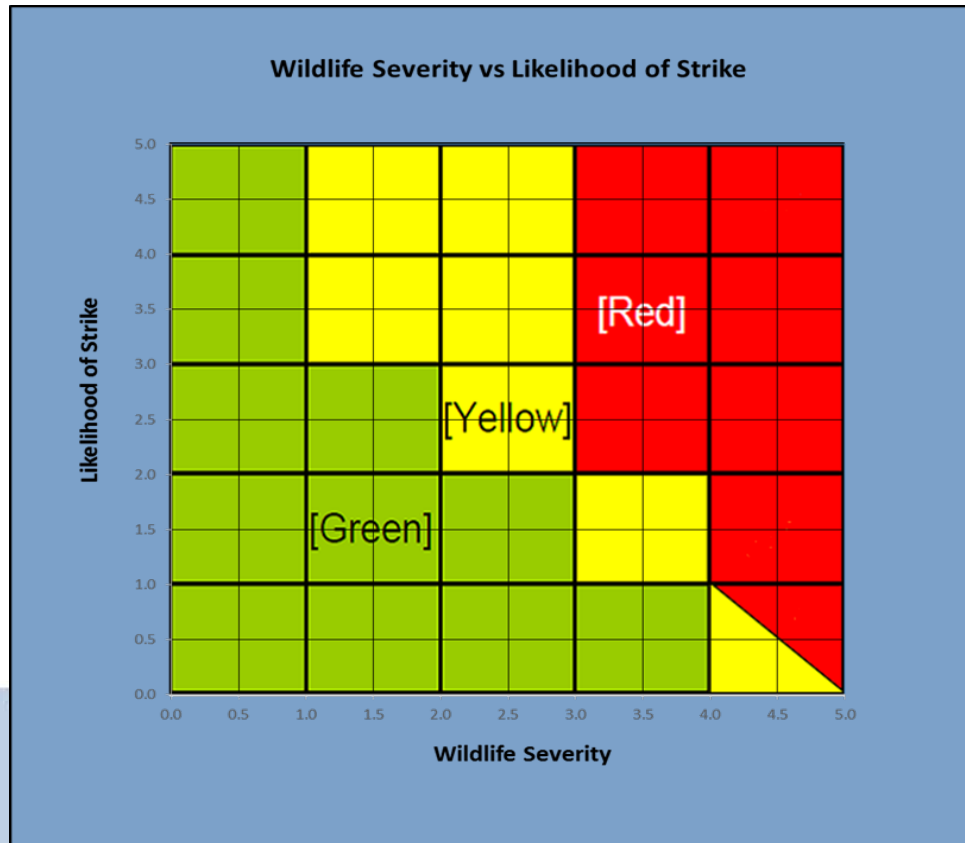
Wildlife Risk Value

ACRP

Function of Wildlife Severity and Likelihood of Strike by Guild

Results in a “cloud” of points that the model resolves into a singular objective risk value

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



Operations Risk Value

Aircraft Type

- Susceptibility to damage varies

Operations Tempo

- Segregated by movements of each aircraft type

Aircraft susceptibility to wildlife strike damage by category derived from FAA Wildlife Strike Database



NPIAS Aircraft Designations

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

- 1) Commercial
- 2) Air Taxi
- 3) General Aviation
- 4) Military
- 5) Rotary

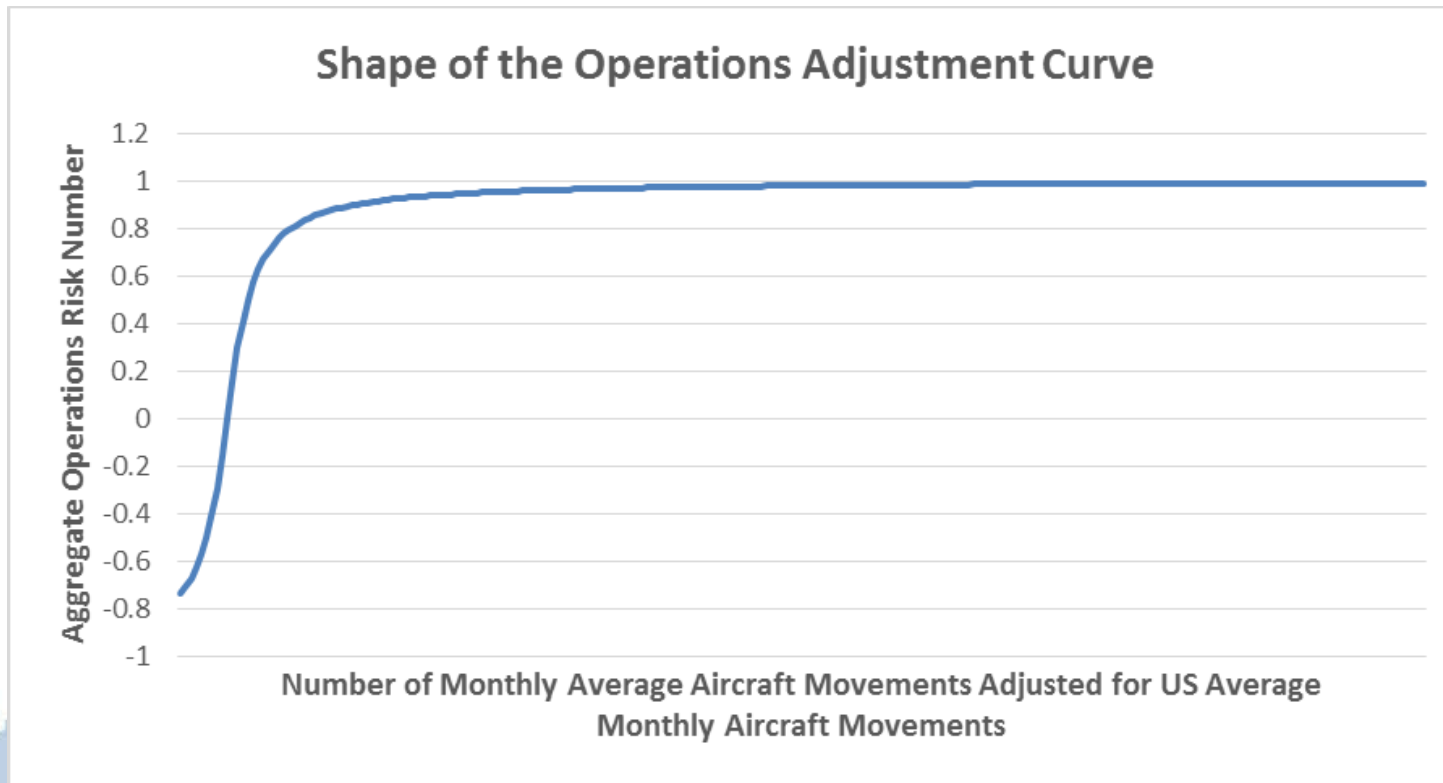


Effect of Aircraft Operations

(Operations risk value increases non-linearly as operations increase and plateaus as operations reach high values)

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



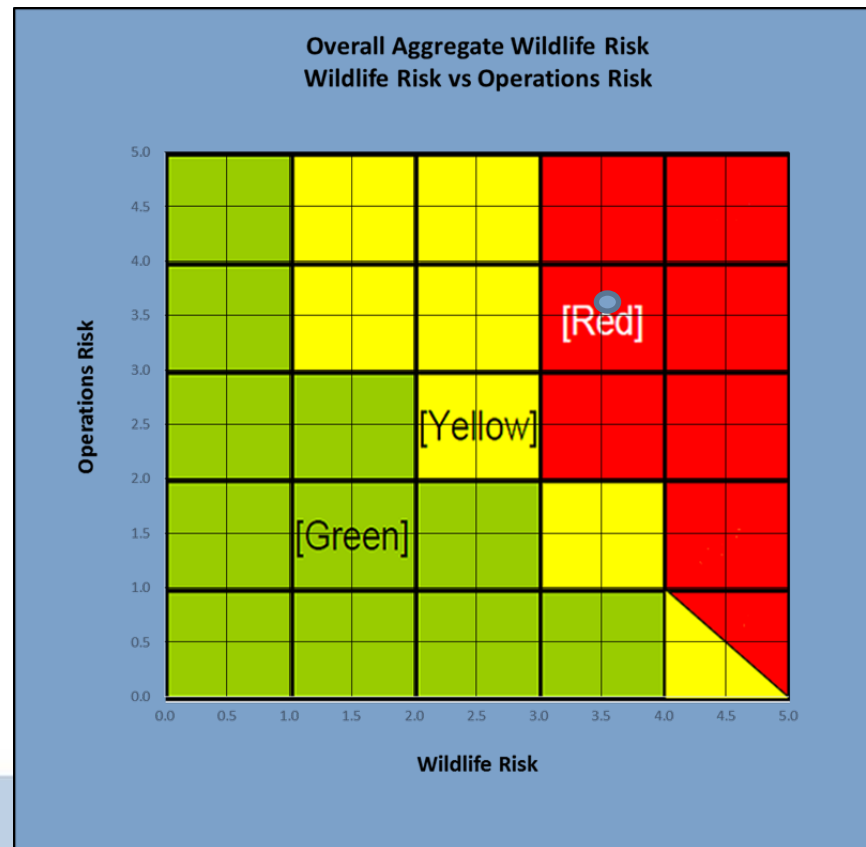
Aggregate Wildlife Risk

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Function of Wildlife Risk and Operations Risk

Results in a “cloud” of
points by aircraft class
that the model resolves
into a singular objective
risk value



Habitat On and Off Airport

Specific incompatible habitats within WHaMRAT include:

- 1) Solid waste open landfill.
- 2) Enclosed trash transfer.
- 3) Composting operations.
- 4) Underwater waste discharge.
- 5) Stormwater collection.
- 6) Wastewater treatment facility.
- 7) Artificial marsh.
- 8) Natural wetlands.

AC 150/5200-33B



- 9) Agricultural crops.
- 10) Livestock production.
- 11) Aquaculture.
- 12) Golf courses.
- 13) Woodlands/forests.
- 14) Landscaping.
- 15) Synergistic effects of authorized uses.
- 16) User-defined #1.
- 17) User-defined #2.
- 18) User-defined #3.

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Habitat Location Criteria

- 1) Airport property within perimeter fence.
- 2) Outside perimeter fence within 10,000-foot or 5,000-foot separation distances.
- 3) Greater than 10,000-foot or 5,000-foot separation, within 5-miles, and in the traffic pattern.
- 4) Greater than 10,000-foot or 5,000-foot separation, within 5-miles, and not in the traffic pattern.
- 5) Greater than 5-miles but wildlife movement potential across airport.

AC 150/5200-33B



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Effect of Habitat by Distance

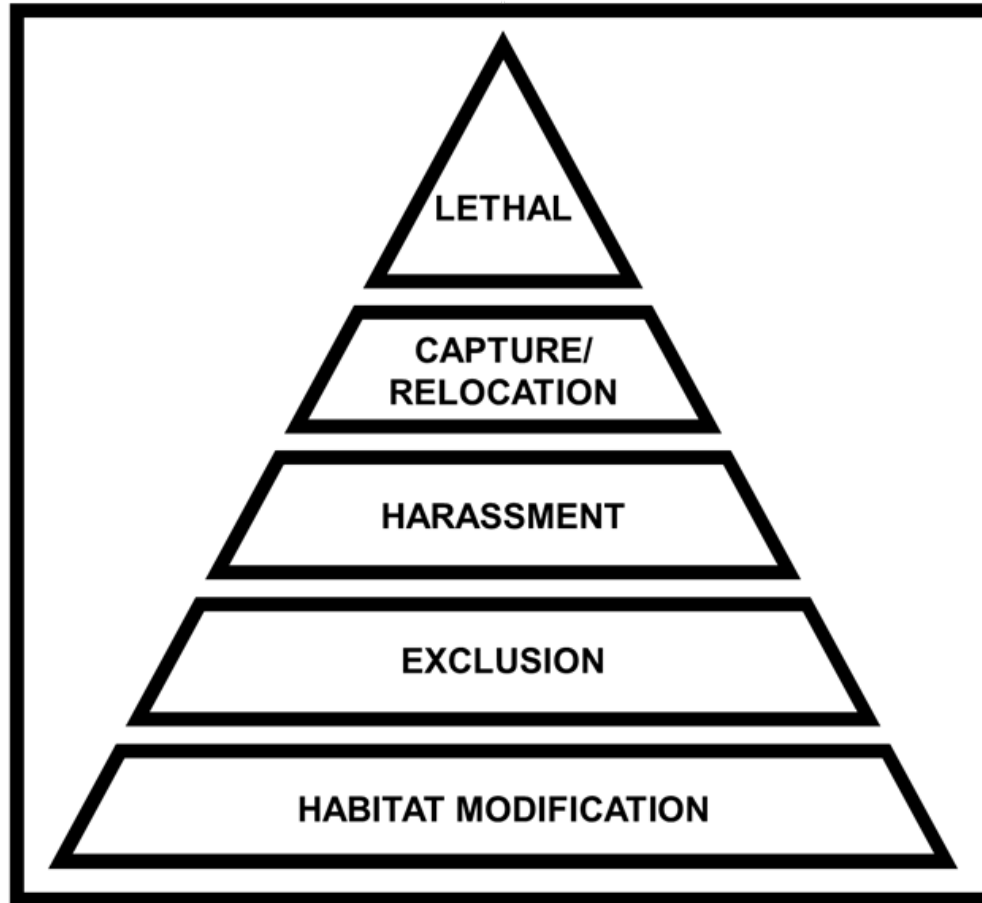
Distance	Points
Airport Property Within Perimeter Fence	10
Outside Perimeter Fence within 10,000-foot or 5,000-foot separation	7
> 10,000 or 5,000-foot separation, within 5 miles, and in traffic pattern	4
> 10,000 or 5,000-foot separation, within 5 miles, not in traffic patterns	2
> 5 miles but wildlife movement potential across airport	1

Closer proximity to airport AOA yields greatest value

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Wildlife Management and Control Hierarchy



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

EZ WHaMRAT—Wildlife Risk

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Step 1: Wildlife Data
NEXT (click here)
Step 2: Operations

Step 3: Habitat & Mitigation

Results

EZ Wildlife Hazard Management Risk Assessment Tool (WHaMRAT)

BIRDS

Group/Guild (Defined in User Guide)	Wildlife Severity (1-5)	Likelihood of Strike (1-5)
Waterbirds	2	
Seabirds	2	
Pelicans	4	
Waders [Solitary]	2	
Waders [Flocked or near roosts]	5	
Waterfowl [Solitary]	3	
Waterfowl [Flocks, 5 or less than birds]	4	
Waterfowl [Any Geese/Swans or Flocks greater than 5]	5	
Raptors	2	
Upland Game Birds [Solitary, non-Turkeys]	2	
Upland Game Birds [Primarily Turkeys]	5	
Cranes	5	
Shorebirds [Solitary]	1	
Shorebirds [Flocks, 15 or less birds]	4	
Shorebirds [Flocks, greater than 15 birds]	5	
Gulls/Terns [Solitary]	2	
Gulls/Terns [Flocks, 20 or less birds]	4	
Gulls/Terns [Flocks, greater than 20 birds]	5	
Pigeons/Doves [Solitary]	1	
Pigeons/Doves [Flocks, 50 or more birds]	5	

MAMMALS

Group (Defined in User Guide)	Wildlife Severity (1-5)	Likelihood of Strike (1-5)
Rodents	2	
Lagomorphs	4	
Bats	1	
Mesomammals	4	
Canids [inc feral dogs]	5	
Felids [inc feral cats]	5	
Hooved	5	
Bears	5	

REPTILES

Group (Defined in User Guide)	Wildlife Severity (1-5)	Likelihood of Strike (1-5)
Turtles	2	
Iguanas	2	
Lizards/Snakes	2	
Crocodiles	5	

Back to Introduction

Introduction
Wildlife Data
Operations
Habitat-Mitigation
Results
Future-Projected Results
Calculations
Calculations-Projected

EZ WHaMRAT—Aircraft Operations Risk

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Microsoft Excel interface showing the EZ WHaMRAT spreadsheet.

Navigation:

- Step 1: Wildlife Data (with BACK button)
- Step 2: Operations (with NEXT button)
- Step 3: Habitat & Mitigation
- Results

Current Operations Table:

Aircraft Type	Monthly Average Movements	Weighting (0 - 1.0) Must Sum to 1.0
Commercial		0.125
Air Taxi		0.250
General Aviation		0.250
Military		0.125
Rotary		0.250

Future Operations Table:

Aircraft Type	Monthly Average Movements - Projected	Weighting (0 - 1.0) Must Sum to 1.0
Commercial		0.125
Air Taxi		0.250
General Aviation		0.250
Military		0.125
Rotary		0.250

[Back to Introduction](#)

EZ WHaMRAT—Habitat and Mitigation Factors

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Step 1: Wildlife Data			Step 2: Operations		← BACK (click here)		Step 3: Habitat - Mitigation		NEXT (click here) →		Results	
2													
3	Current Habitat Situation												
4	Place an "X" in the appropriate boxes if you have the habitat within the designated distances												
5													
6	Habitat Type	Airport Property Within Perimeter Fence	Outside Perimeter Fence within 10,000-foot or 5,000-foot separation	> 10,000 or 5,000-foot separation, within 5-miles, and in traffic pattern	>10,000 or 5,000-foot separation, within 5-miles, not in traffic patterns	> 5-miles but wildlife movement potential across airport							
7	Solid Waste Open Landfill												
8	Enclosed Trash Transfer												
9	Composting Operations												
10	Underwater Waste Discharge												
11	Stormwater Collection												
12	Wastewater treatment facility												
13	Artificial Marsh												
14	Natural Wetlands												
15	Agriculture Crops												
16	Livestock Production												
17	Aquaculture												
18	Golf Courses												
19	Woodlands/Forests												
20	Landscaping												
21	Synergistic Effect of Authorized uses												
22	User Defined #1												
23	User Defined #2												
24	User Defined #3												
25													
26	Current Habitat Mitigation Level												
27	Place a 1, 2, 3 for your current mitigation level for each Habitat in each area. 1 = Low, 2 = Moderate, 3 = High. If no mitigation, leave the box blank												

[Back to Introduction](#)

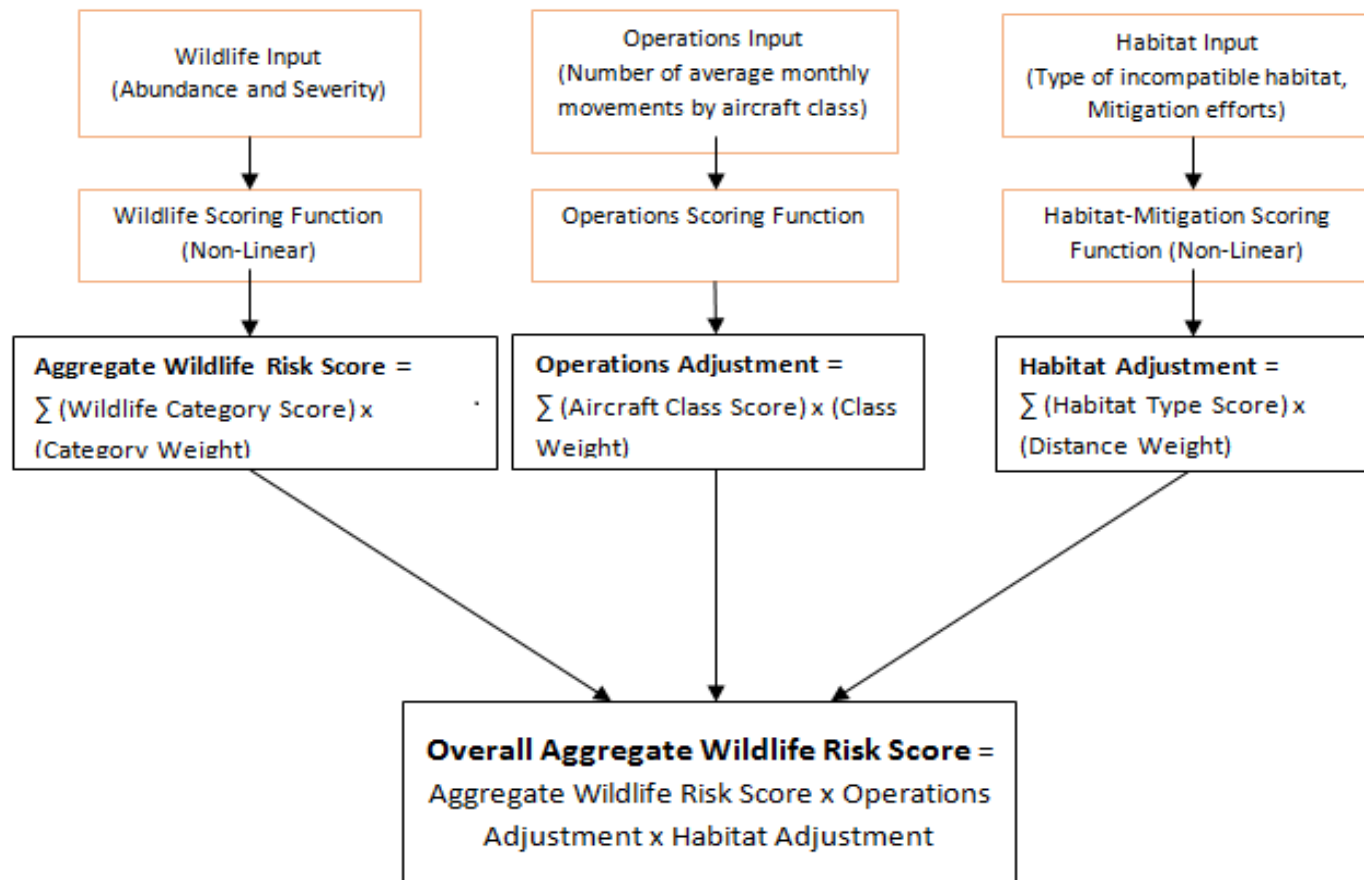
Current Habitat Multiplier with no mitigation	0.5000
---	--------

Current Habitat Multiplier with mitigation	0.5000
--	--------

Future Habitat Multiplier with planned mitigation	0.5000
---	--------

Overall Aggregate Wildlife Risk Score

(Resultant value based on wildlife risk, operations risk, and habitat-mitigation adjustments)



EZ WHaMRAT—Results

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Step 1: Wildlife Data

Step 2: Operations

Step 3: Habitat & Mitigation

BACK (click here)

Results

NEXT (click here)

Projected RESULTS

Results

Risk Scores (0-5 Scale)

Avian Risk Score 1.28

Mammal Risk Score 0.73

Reptile Risk Score 0.11

Risk Score Override No

Aggregate Wildlife Risk Score 2.12

Wildlife Rating High Risk

Habitat Adjustment - Mitigated 1.1793

Aggregate Wildlife Risk Score
Adjusted for Habitat 2.5034

Operations Adjustment 1.3054

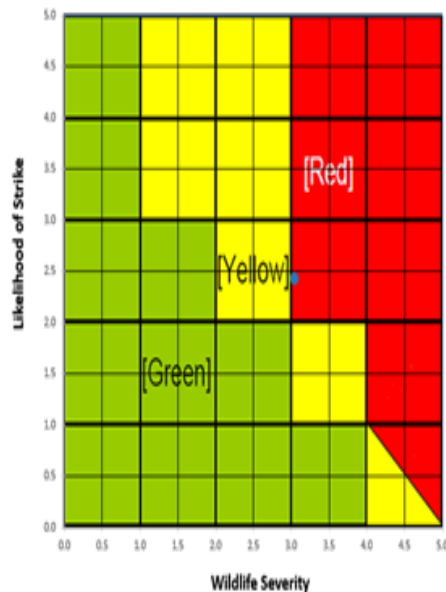
Overall Aggregate of Wildlife Risk
Score 3.268

Final Rating Moderate Risk

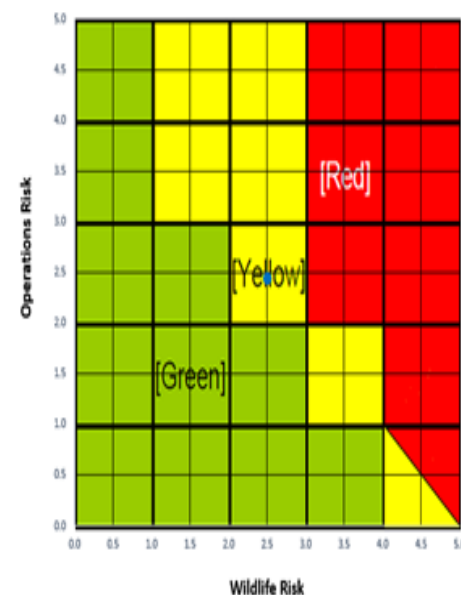
Overall Risk Score



Wildlife Severity vs Likelihood of Strike



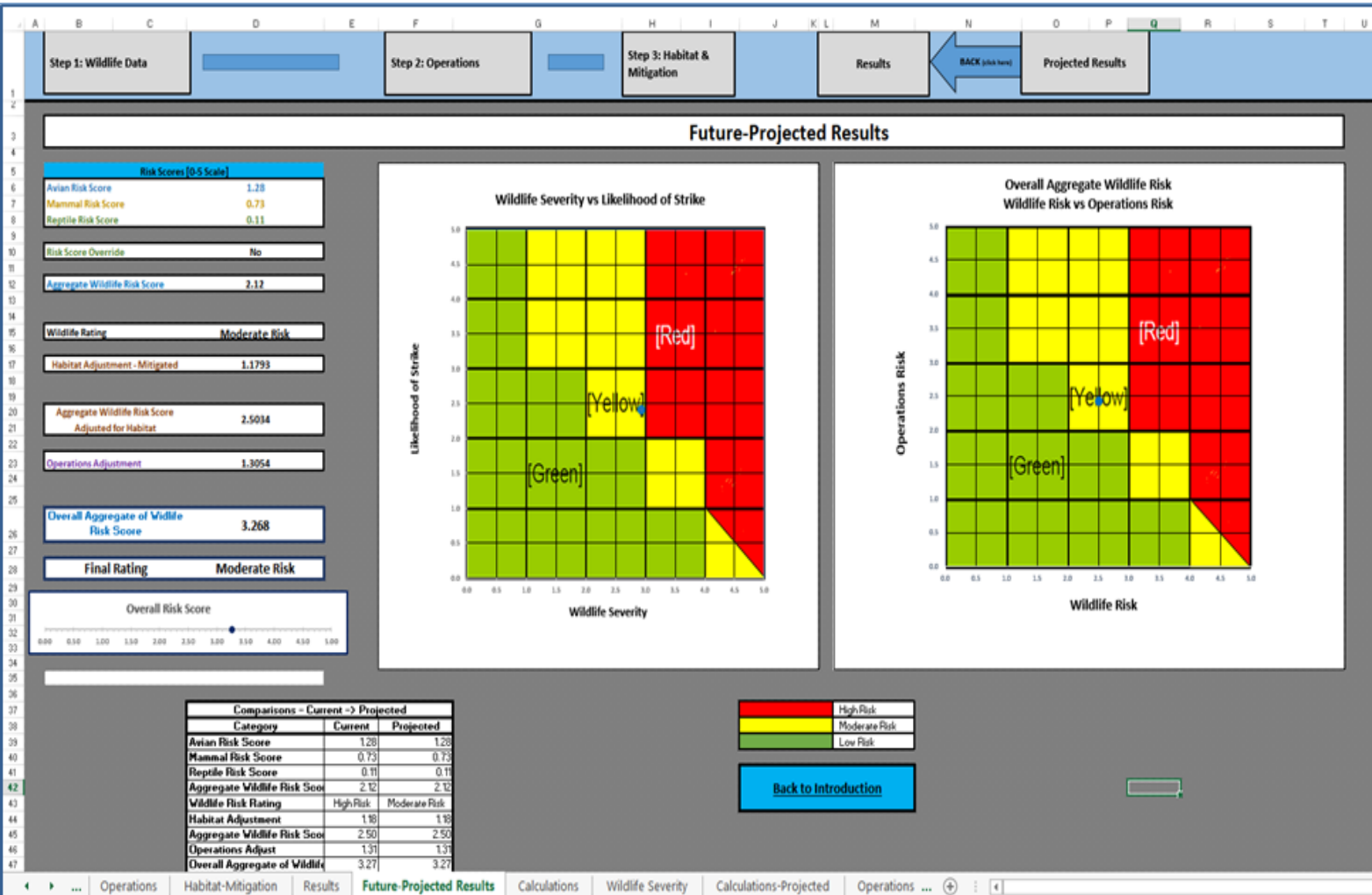
Overall Aggregate Wildlife Risk
Wildlife Risk vs Operations Risk



EZ WHaMRAT—Future-Projected Results

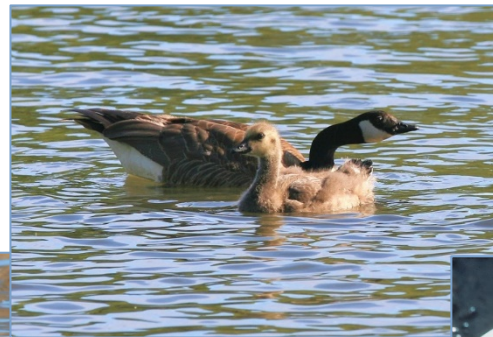
ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



Advanced WHaMRAT

Differs from EZ WHaMRAT by allowing wildlife severity to be determined by specific species within guilds and their associated differences in body mass



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Avian Guild Severity—Advanced WHaMRAT

Guild	Severity
Pelicans/Cormorants	
Pelicans 1000-1999g	3
Pelicans 2000-3999g	4
Pelicans > 4000g	5
Waders	
If flocks ≥ 5	5
Waders < 300g	1
Waders 300-999g	2
Waders 1000-1999g	3
Waders 2000-3999g	4
Waterfowl	
If flocks < 5	4
If flocks ≥ 5	5
Waterfowl 300-999g	2
Waterfowl 1000-1999g	3
Waterfowl 2000-3999g	4
Waterfowl > 4000g	5
Raptors/Vultures/Owls	
Raptors < 300g	1
Raptors 300-999g	2
Raptors 1000-1999g	3
Raptors 2000-3999g	4
Raptors > 4000g	5
Upland Game Birds	
Upland Game Birds < 300g	1
Upland Game Birds 300-999g	2
Upland Game Birds 1000-1999g	3
Upland Game Birds 2000-3999g	4
Upland Game Birds > 4000g	5
Cranes	5
Shorebirds	
If flocks < 20	4
If flocks ≥ 20	5
Shorebirds < 300g	1
Shorebirds 300-999g	2

Guilds subdivided into body mass classes with associated increase in hazard/severity as body mass increases



ACRP

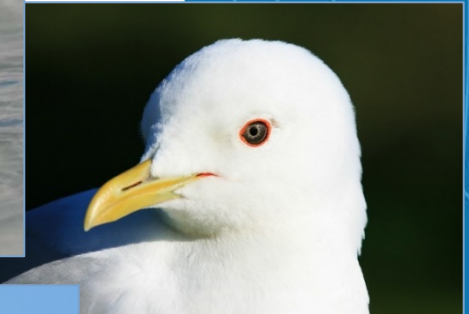
AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Avian Species by Guild with Varied Body Mass

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Waterbirds			
Common Name	Scientific Name	Guild (Mass)	Severity
Least Grebe	<i>Tachybaptus dominicus</i>	Waterbirds <300g	1
Yellow Rail	<i>Coturnicops noveboracensis</i>	Waterbirds <300g	1
Black Rail	<i>Laterallus jamaicensis</i>	Waterbirds <300g	1
Corn Crake	<i>Crex crex</i>	Waterbirds <300g	1
Ridgway's Rail	<i>Rallus obsoletus</i>	Waterbirds <300g	1
Clapper Rail	<i>Rallus crepitans</i>	Waterbirds <300g	1
King Rail	<i>Rallus elegans</i>	Waterbirds <300g	1
Virginia Rail	<i>Rallus limicola</i>	Waterbirds <300g	1
Rufous-necked Wood-Rail	<i>Aramides axillaris</i>	Waterbirds <300g	1
Gray-necked Wood-Rail	<i>Aramides cajaneus</i>	Waterbirds <300g	1
Sora	<i>Porzana carolina</i>	Waterbirds <300g	1
Paint-billed Crake	<i>Neocrex erythrops</i>	Waterbirds <300g	1
Spotted Rail	<i>Pardirallus maculatus</i>	Waterbirds <300g	1
Purple Swamphen	<i>Porphyrio porphyrio</i>	Waterbirds <300g	1
Purple Gallinule	<i>Porphyrio martinicus</i>	Waterbirds <300g	1
Azure Gallinule	<i>Porphyrio flavirostris</i>	Waterbirds <300g	1
Common Gallinule	<i>Gallinula galeata</i>	Waterbirds <300g	1
Sungrebe	<i>Heliornis fulica</i>	Waterbirds <300g	1
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Waterbirds 300-999g	2
Horned Grebe	<i>Podiceps auritus</i>	Waterbirds 300-999g	2
Eared Grebe	<i>Podiceps nigricollis</i>	Waterbirds 300-999g	2
Common Moorhen	<i>Gallinula chloropus</i>	Waterbirds 300-999g	2
Eurasian Coot	<i>Fulica atra</i>	Waterbirds 300-999g	2
Hawaiian Coot	<i>Fulica alai</i>	Waterbirds 300-999g	2
American Coot	<i>Fulica americana</i>	Waterbirds 300-999g	2
Red-throated Loon	<i>Gavia stellata</i>	Waterbirds 1000-1999g	3
Arctic Loon	<i>Gavia arctica</i>	Waterbirds 1000-1999g	3
Pacific Loon	<i>Gavia pacifica</i>	Waterbirds 1000-1999g	3
Red-necked Grebe	<i>Podiceps grisegena</i>	Waterbirds 1000-1999g	3
Western Grebe	<i>Aechmophorus occidentalis</i>	Waterbirds 1000-1999g	3
Clark's Grebe	<i>Aechmophorus clarkii</i>	Waterbirds 1000-1999g	3



Non-Avian Guild Severity—Advanced WHaMRAT

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Guilds subdivided by body mass classes with associated increase in hazard/severity as body mass increases

Guild	Severity
Rodents	
Rodents < 100g	1
Rodents 100-599g	2
Rodents 600-1999g	3
Rodents 2000-9999g	4
Rodents > 10000g	5
Lagomorphs	
Lagomorphs 100-599g	2
Lagomorphs 2000-9999g	4
Bats	
Bats < 100g	1
Bats 100-599g	2
Mesomammals	
Mesomammals 100-599g	2
Mesomammals 600-1999g	3
Mesomammals 2000-9999g	4
Mesomammals > 10000g	5
Canids	
Canids 2000-9999g	4
Canids > 10000g	5
Felids	
Felids 600-1999g	3
Felids > 10000g	5
Hooved	
Hooved > 10000g	5
Bears	
Bears > 10000g	5



Mammalian Species within a Guild with Varied Body Mass

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Mesomammals (Continued)			
Common Name	Scientific Name	Guild (Mass)	Severity
Fisher	<i>Martes pennanti</i>	Mesomammals 2000-9999g	4
American marten	<i>Martes americana</i>	Mesomammals >10000g	5
Wolverine	<i>Gulo gulo</i>	Mesomammals >10000g	5
American badger	<i>Taxidea taxus</i>	Mesomammals >10000g	5
Northern river otter	<i>Lontra canadensis</i>	Mesomammals >10000g	5
Canids			
Common Name	Scientific Name	Guild (Mass)	Severity
Domestic/Feral Dog	<i>Canis familiaris</i>	Canids 2000-9999g	4
Arctic fox	<i>Alopex lagopus</i>	Canids 2000-9999g	4
Swift fox	<i>Vulpes velox</i>	Canids 2000-9999g	4
Kit fox	<i>Vulpes macrotis</i>	Canids 2000-9999g	4
Red fox	<i>Vulpes vulpes</i>	Canids 2000-9999g	4
Gray fox	<i>Urocyon cinereoargenteus</i>	Canids 2000-9999g	4
Island gray fox	<i>Urocyon littoralis</i>	Canids 2000-9999g	4
Coyote	<i>Canis latrans</i>	Canids >10000g	5
Gray wolf	<i>Canis lupus</i>	Canids >10000g	5
Eastern timber wolf	<i>Canis lycaon</i>	Canids >10000g	5
Red Wolf	<i>Canis rufus</i>	Canids >10000g	5
Felids			
Common Name	Scientific Name	Guild (Mass)	Severity
Domestic/Feral Cat	<i>Felis catus</i>	Felids 600-1999g	3
Cougar	<i>Puma concolor</i>	Felids >10000g	5
Ocelot	<i>Leopardus pardalis</i>	Felids >10000g	5
Jaguarundi	<i>Herpailurus yagouaroundi</i>	Felids >10000g	5
Bobcat	<i>Lynx rufus</i>	Felids >10000g	5
Canada lynx	<i>Lynx canadensis</i>	Felids >10000g	5
Jaguar	<i>Panthera onca</i>	Felids >10000g	5
Hooved			
Common Name	Scientific Name	Guild (Mass)	Severity
Wild boar	<i>Sus scrofa</i>	Hooved >10000g	5
Collared peccary	<i>Tayassu tajacu</i>	Hooved >10000g	5
Elk	<i>Cervus elaphus</i>	Hooved >10000g	5
Sika deer	<i>Cervus nippon</i>	Hooved >10000g	5
Sambar deer	<i>Cervus unicolor</i>	Hooved >10000g	5
Axis deer	<i>Axis axis</i>	Hooved >10000g	5
Fallow deer	<i>Dama dama</i>	Hooved >10000g	5

Advanced WHaMRAT—Wildlife Risk

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Step 1: Wildlife Data **NEXT (click here)** Step 2: Operations Data Step 3: Habitat & Mitigation Results

BIRDS			MAMMALS			REPTILES		
Group/Guild (Defined in User Guide)	Standard Severity (1-5)	Likelihood (1-5)	Group (Defined in User Guide)	Standard Severity (1-5)	Likelihood (1-5)	Group (Defined in User Guide)	Standard Severity (1-5)	Likelihood (1-5)
Waterbird1 - less than 300g	1		Rodent1 - less than 100g	1		Turtle2	2	1
Waterbird2 - between 300-999g	2	3	Rodent2 - between 100-599g	2		Iguanas2	2	
Waterbird3 - between 1000-1999g	3	2	Rodent3 - between 600-1999g	3	3	Lizards/Snakes2	2	1
Waterbird4 - between 2000-3999g	4		Rodent4 - between 2000-9999g	4		Crocks	5	
Waterbird5 - greater than 4000g	5		Rodent5 - greater than 10,000g	5				
Seabird1 - less than 300g	1	2	Lagomorph2 - between 100-599g	2				
Seabird2 - between 300-999g	2	2	Lagomorph4 - between 2000-9999g	4	2			
Seabird3 - between 1000-1999g	3		Bat1 - less than 100g	1				
Seabird4 - greater than 2000g	4		Bat2 - between 100-599g	2				
Pelican3 - between 1000-1999g	3		MES2 - between 100-599g	2				
Pelican4 - between 2000-3999g	4	1	MES3 - between 600-1999g	3				
Pelican5 - greater than 4000g	5		MES4 - between 2000-9999g	4				
Wader1 - less than 300g	1		MES5 - greater than 10000g	5				
Wader2 - between 300-999g	2		Canid4 - less than 10000g or Domestic/feral dog	4				
Wader3 - between 1000-1999g	3	2	Canid5 - greater than 10000g	5				

[Back to Introduction](#)

Introduction **Advanced Wildlife** Operations Habitat-Mitigation Results Future-Projected Results Calculations

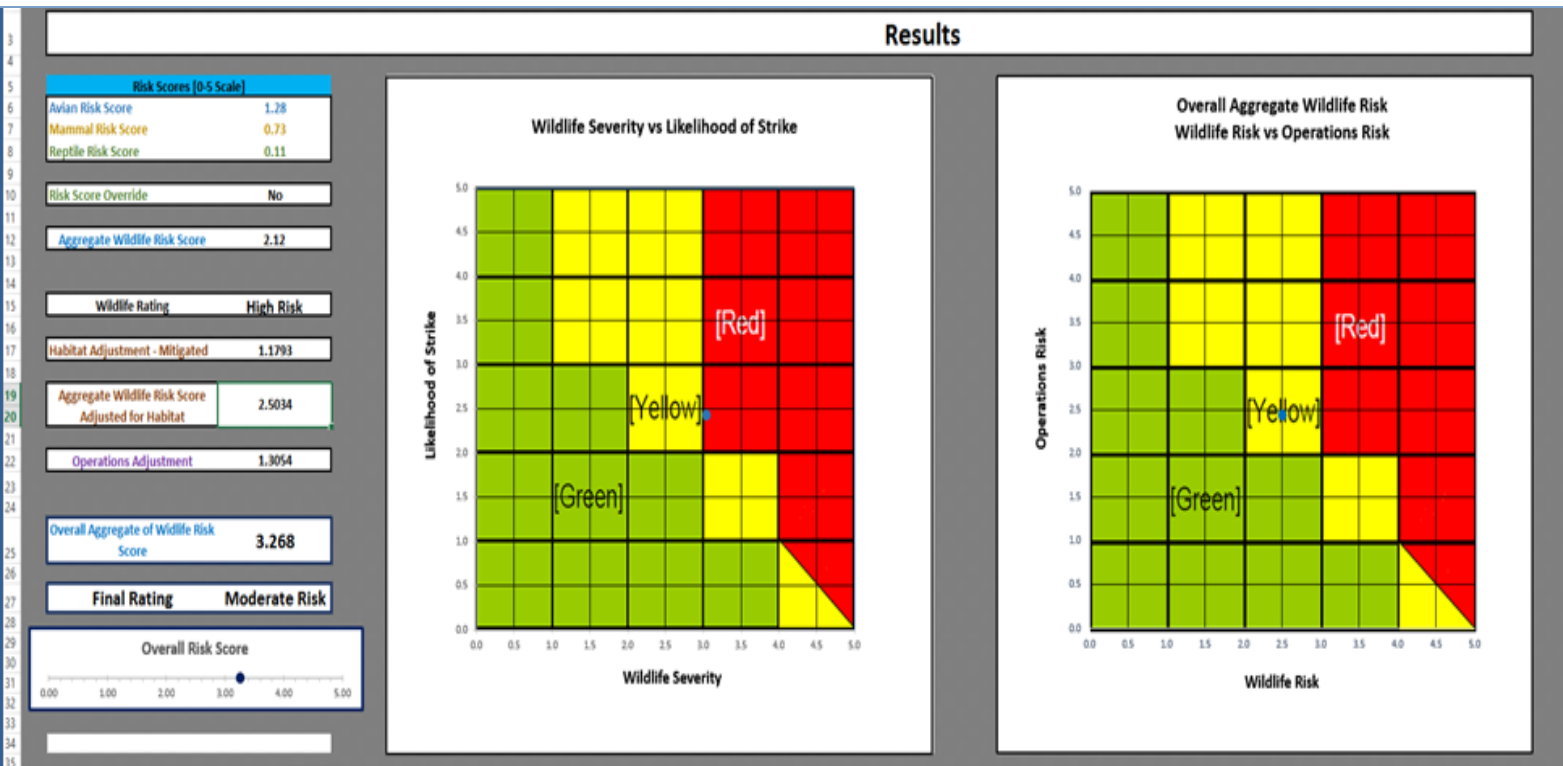
WHaMRAT Summary

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Results of the WHaMRAT models are objective scores used as baselines for airports to monitor continuous improvements within their SMS programs

WHaMRAT is but one tool in the box to be used as part of airports' SMS programs



Conclusion

Wildlife management programs are a “perfect fit” within airport SMS programs

ACRP 145 is “on the shelf” and awaiting your use!

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM



For additional information:

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

ACRP Report 145: Applying an SMS Approach to Wildlife Hazard Management

birdmanruss@aol.com

etunangst@msn.com

joanne@landryconsultants.com

ACRP

REPORT 145

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Sponsored by
the Federal
Aviation
Administration

Applying an SMS Approach to
Wildlife Hazard Management

