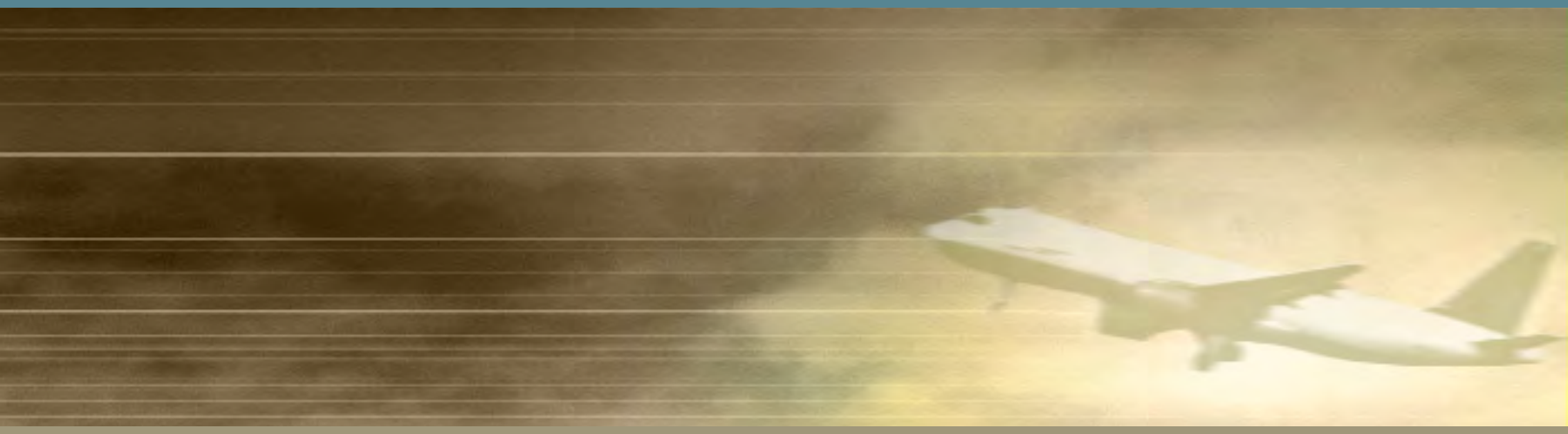
Rapid City Regional Airport

Airport Master Plan
Land Use Compatibility Plan

October 2010



Kadrmas Lee & Jackson
Engineers Surveyors Planners

Rapid City Regional Airport Master Plan

Land Use Compatibility Plan

Prepared for the

Rapid City Regional Airport

Prepared by

Kadrmas, Lee & Jackson

This planning document has been prepared for the Rapid City Regional Airport on behalf of the City of Rapid City and adheres to Federal Aviation Administration (FAA) Advisory Circulars and state and local laws as of October 2010.

Recommendations for this document only identify the preliminary location of safety compatibility zones based on preliminary planning sources and information (U.S. quadrangle maps and aerial photographs). Information and decisions within this document are completed as a collaborative effort of the City of Rapid City, the City of Box Elder, Pennington County, Meade County, the Airport, and others as outlined at the beginning of this document.

The preparation of this document was financed in part through local Passenger Facility Charges (PFC 5-6). The information and reference materials contained herein are intended to be read as a complete document and are for planning purposes only.

Planning Participation List

Company	First Name	Last Name	Title	Project Role
Consultant				
Kadrmas Lee & Jackson	Mike	Mahoney	Project Manager	Drafting Land Use Compatibility Plan & QA/QC
Kadrmas Lee & Jackson	Rick	Ennen	Planner	QA/QC
Kadrmas Lee & Jackson	Jen	Einrem	Planning Engineer	Planning Engineer and QA/QC
Kadrmas Lee & Jackson	Rod	Senn	Planning Engineer	QA/QC
Kadrmas Lee & Jackson	Julie	Hempel	Administrative Assistant I	Formatting, Graphic Design, and QA/QC
Kadrmas Lee & Jackson	Al	Schafer	Planning Technician	CAD and GIS Drafting
Kadrmas Lee & Jackson	Matt	Nisbet	Planner	Drafting Land Use Compatibility Plan
Kadrmas Lee & Jackson	Alexis	Morlok	Planning Engineer	QA/QC
Kadrmas Lee & Jackson	Mason	Short	Planner	QA/QC
Kadrmas Lee & Jackson	Dave	Lepine	Planning Engineer	QA/QC
Airport Management				
Rapid City Regional Airport	Cameron	Humphres	Executive Director	Solicitation for Comments and Review
Rapid City Regional Airport	Jennifer	Eckman	Finance and Administration Manager	Solicitation for Comments and Review
Regional Counties and Municipalities				
City of Rapid City	Marcia	Elkins	Growth Management Department Director	Solicitation for Comments and Review
City of Rapid City	Patsy	Horton	Transportation Planning Coordinator	Solicitation for Comments and Review
Pennington County	Dan	Jennissen	Planning Director	Solicitation for Comments and Review
Pennington County	Lysann	Zeller	Planner III	Planning Meeting Attendee
City of Box Elder	Mike	McMahon	Planning and Zoning Coordinator	Solicitation for Comments and Review
Meade County	Bill	Rich	Meade County Planning, Engineering & GIS	Solicitation for Comments and Review

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ACRONYM LIST

AC Advisory Circular
AIP Airport Improvement Program
ALP Airport Layout Plan
AOA Air Operations Area
ATC Air Traffic Control

CFR Code of Federal Regulations

DASR Digital Airport Surveillance Radar
dB Decibel
DNE Does Not Exceed
DNH Determination of No Hazard to Air Navigation
DNL Day-Night Average Sound Level
DOD Department of Defense
DOH Determination of Hazard

EBO Exceeds But Okay
EMI Electromagnetic Interference

FAA Federal Aviation Administration
FAR Federal Aviation Regulations

GA General Aviation

IFR Instrument Flight Rules
INM Integrated Noise Model

NNR No Notice is Required
NPH Notice of Presumed Hazard
NTSB National Transportation Safety Board

RCMC Rapid City Municipal Code
RCRA Rapid City Regional Airport
RPZ Runway Protection Zone
RS&H Reynolds, Smith, and Hills, Inc.

SDAC South Dakota Aeronautics Commission

TAF Terminal Area Forecasts

VFR Visual Flight Rules

Chapter 1. Introduction

Plan Purpose

The purpose of this plan is to identify existing and potential hazards and incompatible uses of lands surrounding Rapid City Regional Airport (RCRA) and to recommend reasonable actions to eliminate, mitigate, or prevent hazards and incompatible land uses.

RCRA is owned and operated by the City of Rapid City. The Airport is part of Rapid City, but is surrounded by unincorporated parcels in Pennington County. The Box Elder city limits lie less than a mile north of the Airport property line and Meade County is located approximately 5 miles north of the Airport property line. Consequently, this plan will address lands that are within the planning jurisdiction of the following local governments:

- Rapid City
- Box Elder
- Pennington County
- Meade County

Appendix A contains a jurisdiction map for areas surrounding RCRA.

When airport sponsors accept funds from FAA-administered airport financial assistance programs, they must agree to certain obligations (or assurances). Incorporating this plan into local zoning and land use planning will help RCRA and the City of Rapid City fulfill their contractual obligations to prevent and remove airport hazards and incompatible land uses. **Appendix B** contains FAA Sponsor Assurances, Paragraphs 20 and 21.

South Dakota Codified Law 50-10 enables governmental jurisdictions to create zoning and other controls for purposes of achieving and maintaining airport land use compatibility. Section 50-10-2 declares that an airport hazard endangers the lives and property of users of the airport and of occupants of land in its vicinity or destroys or impairs the utility of the airport. The section states the creation or establishment of an airport hazard is a public nuisance and an injury to the communities and that it is therefore necessary that the creation of airport hazards be prevented. **Appendix C** contains South Dakota Codified Law 50-10, Airport Zoning.

The 2008 RCRA Master Plan Update written by Reynolds, Smith, and Hills, Inc. (RS&H)[1] recommended the additional study of potential hazards and land use compatibility issues for the lands surrounding the airport. This Land Use Compatibility Plan has been prepared by Kadrmas, Lee & Jackson as Phase 2 of the RCRA Master Plan Update to address those issues. The 20-year outlook of the 2008 Master Plan in terms of aviation demand and airport development was used to develop the criteria contained in this Land Use Compatibility Plan for long-term application. Existing city and county planning documents were also considered in the development of this Land Use Compatibility Plan in order to help bring about a mutually compatible plan for RCRA and local governments.

[1] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Airport Compatibility and Hazard Issues

Four types of airport compatibility and hazard issues need be considered in order to achieve land use compatibility:

- Airspace
- Safety
- Wildlife Attractants
- Noise

A brief and general description of each of these issues is provided below based primarily on criteria developed by FAA. Each issue is explained in terms of the basic objective to be met, the measurement of risk, and criteria that can be used to establish land use compatibility policies. Chapter 2 contains the specific assessment of RCRA in light of the land use compatibility issues and Chapter 3 provides recommendations to improve land use compatibility in areas surrounding RCRA.

Airspace

The airspace objective is to avoid any development that increases risks of aircraft accidents or measurably reduces the operational utility of airports. Types of development that may impair airports from meeting this objective include tall structures, such as radio towers and wind turbines, and visual or electronic interference such as bright lights near runways or airborne emissions from industrial plants. The risk of accidents involving airspace obstructions can be lowered through the efforts of the FAA to evaluate and manage airspace and through the communities' control over the creation of obstructing structures.

The definition of airspace requirements is primarily accomplished through standards established in Title 14 of the Code of Federal Regulations (CFR). More specifically, 14 CFR Part 77 – Objects Affecting Navigable Airspace.

The standards established in Part 77 relate to the size of the largest aircraft using the runway, the approach type, and the minimum visibility under which the runway can still be used by aircraft.

Part 77.13 states that any person/organization who intends to sponsor any of the following construction or alterations must notify the Administrator of the FAA:

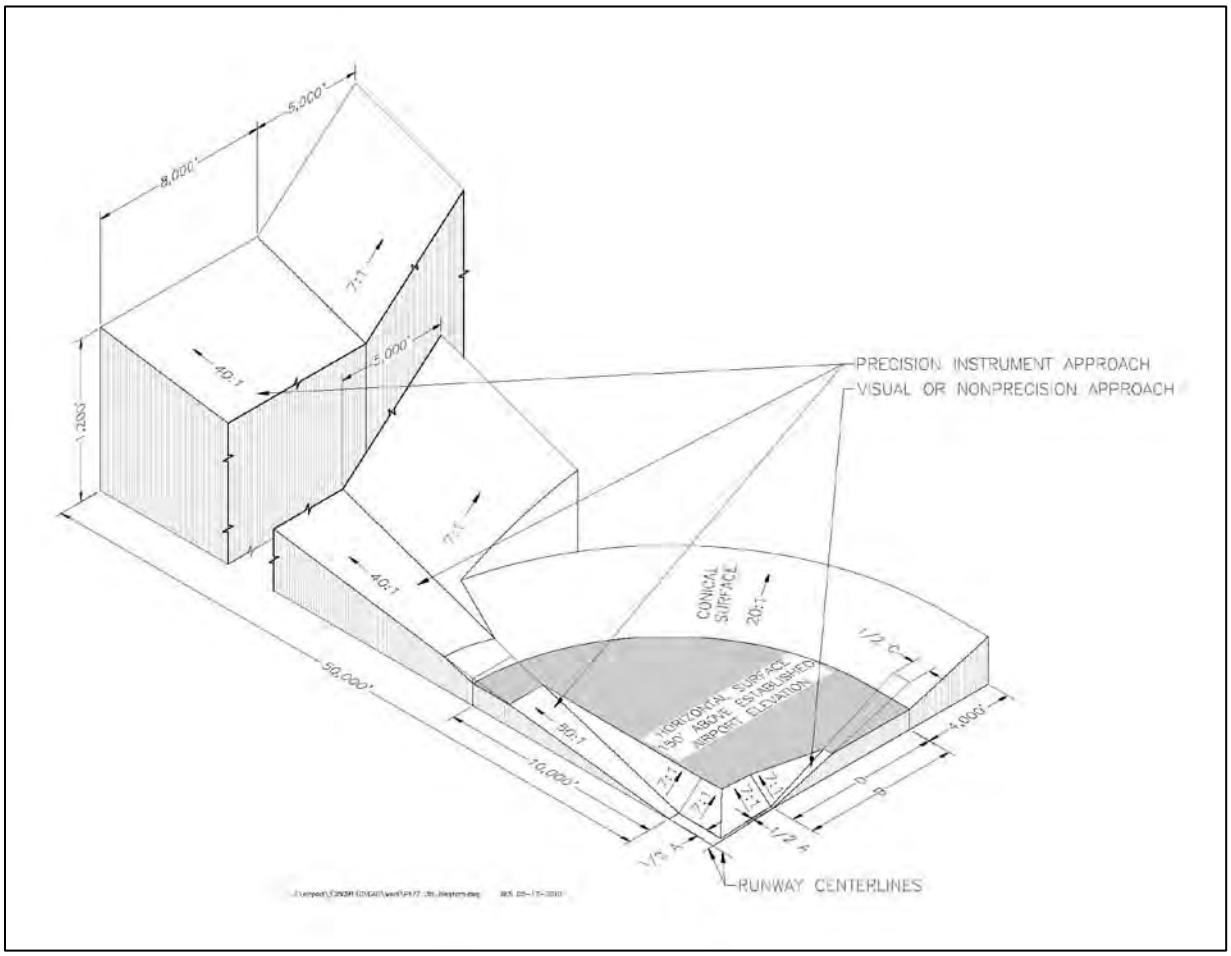
- Any construction or alteration exceeding 200 feet above ground level
- Any construction or alteration within 20,000 feet of a public use or military airport, which exceeds a 100:1 surface from any point on the runway of each airport with at least one runway more than 3,200 feet
- When requested by the FAA

- Any construction or alteration located on a public use airport or heliport regardless of height or location.

Proponents of structures proposed near airports may be required to file FAA Form 7460-1 with the FAA for evaluation and FAA Form 7460-2 when construction is completed. Both of these forms can now be filed electronically through the FAA website at http://oeaaa.faa.gov.

Part 77 standards appear in the form of three dimensional surfaces as illustrated on **Exhibit 1: Part 77 Standards**.

Exhibit 1: Part 77 Standards



In analyzing 7460-1 forms, the FAA considers several types of airspace impacts: (1) imaginary surface penetration, (2) operational impacts, and (3) electromagnetic interference.

Imaginary Surfaces – If a Part 77 imaginary surface would be penetrated by a constructed object, the FAA then performs an extended study to determine whether the object poses an operational problem for the relevant airport. If the penetration does not pose an operational impact, it may be determined not to be a hazard.

Operational Impacts – The dozens of daily flights arriving and departing airports like RCRA are possible because of complex protocols known as Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). Operational impacts are those that affect VFR and IFR operations. Examples of measurable operational impacts include increasing the minimum flight altitude in a specific area, increasing the minimum climb gradient for airport departure, diverting air traffic away from an obstacle, or increasing the minimum descent altitude at the obstacle location for airport arrivals.

Electromagnetic Interference –Electromagnetic Interference (EMI) is any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics and electrical equipment like Digital Airport Surveillance Radar (DASR) used by Air Traffic Control (ATC) or air defense radar. One source of EMI that is becoming more prevalent, especially in the Great Plains states, is wind turbines. Wind turbines can create clutter interference with the sensitive radars used by the FAA, DOD, and other agencies. Aircraft can be temporarily lost, misidentified, shadowed by the radar signature of wind turbines. ATC radar interference is generally limited to wind turbines that are within line of sight of the radar. A 2006 Department of Defense (DOD) report titled "*The Effect of Windmill Farms on Military Readiness"* identifies issues with air defense radar. DOD's report concludes that the only way to prevent signal degradation of air defense radar is to keep wind turbines out of the radar's line of sight.[2]

Airspace Analysis and Regulations

For projects filed with the FAA through Form 7460-1, an initial aeronautical study is undertaken within the appropriate FAA office, which will issue one of the determinations detailed below. The determinations are direct excerpts from Chapter 7 of FAA Order JO 7400.2G Procedures for Handling Airspace Matters.

> ". . . Determinations shall be issued as follows:
>
> a. *Issue a 'Does Not Exceed' (automated DNE letter) determination if the structure does not exceed obstruction standards, does not have substantial adverse physical or electromagnetic interference effect upon navigable airspace or air navigation facilities, and would not be a hazard to air navigation.*
>
> *NOTE: A determination indicating that No Notice is Required (NNR) is no longer authorized.*
>
> b. *Issue an 'Exceeds But Okay' (automated EBO letter) determination if the structure exceeds obstruction standards, but does not result in a substantial adverse effect, circularization was not necessary, and meets one of the following conditions:*
>
> 1. *The structure is temporary;*
> 2. *The structure is existing; or*
> 3. *The structure involves an alteration with no physical increase in height or change of location such as a proposed decrease in height or proposed side mount.*

2 Source: The Effect of Windmill Farms on Military Readiness, Report to the Congressional Defense Committees. Department of Defense, 2006.

NOTE: The significant difference between an EBO determination and a 'Determination of No Hazard to Air Navigation' (DNH) is that the EBO determination does not allow for petition rights.

c. *Issue a 'Notice of Presumed Hazard' (automated NPH letter) if the structure exceeds obstruction standards and/or has an adverse effect upon navigable airspace or air navigation facilities and resolution or further study is necessary to fully determine the extent of the adverse effect. The NPH facilitates negotiation and is useful in preserving navigable airspace. Normally the FAA should not automatically initiate further study (including circularization) without a request to do so by the sponsor. The intent of the NPH is to inform the sponsor of the initial findings and to attempt resolution. If the sponsor fails to contact the FAA after receiving the notice, terminate the case. No further action by the FAA is required unless the sponsor re-files. If negotiation is successful, and resolution is achieved, or further study is completed, an appropriate subsequent determination should be issued.*

d. *Issue a 'Determination of No Hazard' (DNH) if the structure exceeds obstruction standards but does not result in a substantial adverse effect.*

e. *Issue a 'Determination of Hazard' (DOH) if the structure would have or has a substantial adverse effect; negotiations with the sponsor have been unsuccessful in eliminating the substantial adverse effect; and the affected aeronautical operations and/or procedures cannot be adjusted to accommodate the structure without resulting in a substantial adverse effect. The obstruction evaluation may or may not have been circularized. [3]"*

It is important to acknowledge that the FAA's role is limited to evaluating the aeronautical effects of proposed structures; the FAA has no legal authority to stop the construction of any proposed structure. It is the responsibility of local governments with jurisdiction to plan and control development. Notwithstanding, the FAA does not relieve airport sponsors of their contractual obligation to prevent and remove hazards to air navigation.

In addition to federal requirements, the State of South Dakota has height requirements set forth in South Dakota Codified Laws § 50-9-1 and § 50-9-7. The laws require that an Aeronautical Hazard Application be filed with the South Dakota Aeronautics Commission (SDAC) in certain circumstances. The laws are paraphrased below:

- § 50-9-1 No person, firm, corporation, limited liability company, or association may erect anywhere in this state a building, structure, or tower of any kind over two hundred feet in height above the terrain, without first filing with the SDAC a notice and application showing the location and dimensions of the building, structure, or tower, and procuring a permit approving the location from the SDAC.

- § 50-9-7 Before any person or entity may construct or alter any structure within two miles from the nearest boundary of any public airport at a height that exceeds a 50:1 slope from the nearest boundary of the airport, they shall first file an application with and obtain the approval of the SDAC to enter upon and complete such construction or alteration.

A copy of South Dakota Codified Laws § 50-9-1 and § 50-9-7 can be found in **Appendix C**.

[3] *Source: Chapter 7 of FAA Order JO 7400.2G Procedures for Handling Airspace Matters.*

Safety

The safety objective is to minimize risks to persons on the ground and aircraft occupants that may be associated with aircraft accidents. Assessing the risks of aircraft accidents and creating policies to address those risks is challenging, because aircraft accidents are rare and the specific circumstances of an accident are nearly impossible to predict.

National Transportation Safety Board (NTSB) data gathered between 1990 and 2000 indicate that approximately 95 percent of all aircraft accidents happen either on or near airports. This data also shows that most aircraft accidents occur during the approach or departure phases of flight. Approach accidents for multiengine aircraft, including jets, typically occur within 500 feet of both sides of the runway centerline and within 2,200 feet from the runway threshold. Departure accidents are usually widely scattered in the vicinity of the runway.

Communities typically use FAA airport design standards and safety compatibility guidelines developed by state aeronautical agencies to formulate safety policies. A good source for safety compatibility guidelines is the California Airport Land Use Planning Handbook. The guidelines in that document have been used as the foundation for the land use compatibility planning at many communities in the western states and several state aeronautical agencies have adapted it for use in developing their own airport land use planning handbooks. The method used in these handbooks involves the creation of as many as six safety compatibility zones that encompass airport owned property and lands surrounding the airport. Each safety compatibility zone is assigned compatible development criteria involving acceptable and prohibited land uses and acceptable maximum development densities. The development criteria for each safety zone are directly related to noise levels and the risk of aircraft accidents within that zone.

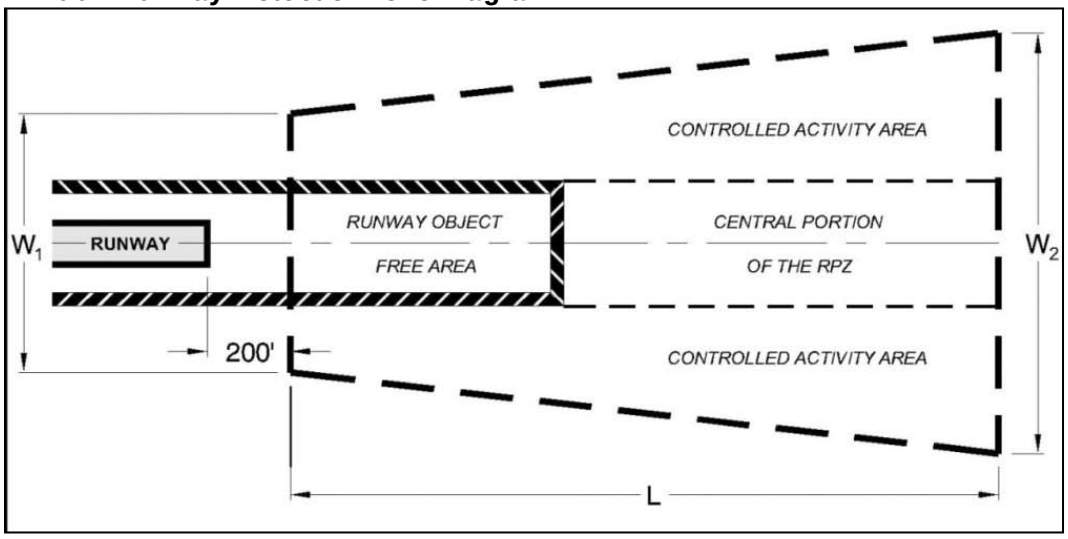
FAA airport design standards, as contained in Advisory Circular (AC) 150/5300-13, define the dimensions and provide land use policy for Runway Protection Zones (RPZ). RPZs form the inner approach area near the runway threshold. According to the FAA, the property the RPZs encompass should be controlled by the airport sponsor, so that no residences or places of public assembly exist in RPZs. Places of public assembly include churches, hospitals, schools, office buildings, shopping malls, and other uses with similar concentrations of people. FAA recommends that airport sponsors acquire all the land within RPZs. **Table 1: Dimensional Requirements for Runway Protection Zones** provides the RPZ dimensions associated with different runway design standards. **Exhibit 2: Runway Protection Zone Diagram** provides a graphic of the RPZ dimensions.

Table 1: Dimensional Requirements for Runway Protection Zones

Approach Visibility Minimums[1]	Facilities Expected to Serve	Dimensions			
		Length L feet (meters)	Inner Width W_1 feet (meters)	Outer Width W_2 feet (meters)	RPZ acres
Visual and not lower than 1 mile (1,600 m)	Small aircraft exclusively	1,000 (300)	250 (75)	450 (135)	8.035
	Aircraft Approach Categories A & B	1,000 (300)	500 (150)	700 (210)	13.770
	Aircraft Approach Categories C & D	1,700 (510)	500 (150)	1,010 (303)	29.465
Not lower than ¾-mile (1.200 m)	All aircraft	1,700 (510)	1,000 (300)	1,510 (453)	48.978
Lower than ¾-mile (1,200 m)	All aircraft	2,500 (750)	1,000 (300)	1,750 (525)	78.914

[1] The RPZ dimensional standards are for the runway end with the specified approach visibility minimums. The departure RPZ dimensional standards are equal to or less than the approach RPZ dimensional standards. When an RPZ begins other than 200 feet (60m) beyond the runway end, separate approach and departure RPZs should be provided. Refer to Appendix 14 for approach and departure RPZs.
Source: FAA AC 150/5300-13 Change 15, Airport Design Standards

Exhibit 2: Runway Protection Zone Diagram[4]



[4] *Source: FAA AC 150/5300-13*

Runway Protection Zones (RPZ) at RCRA – The RPZs for both ends of Runway 5-23 begin 200 feet beyond the runway ends, have an inner width (W1) of 250 feet, a length of 1,000 feet, and an outer width (W2) of 450 feet.

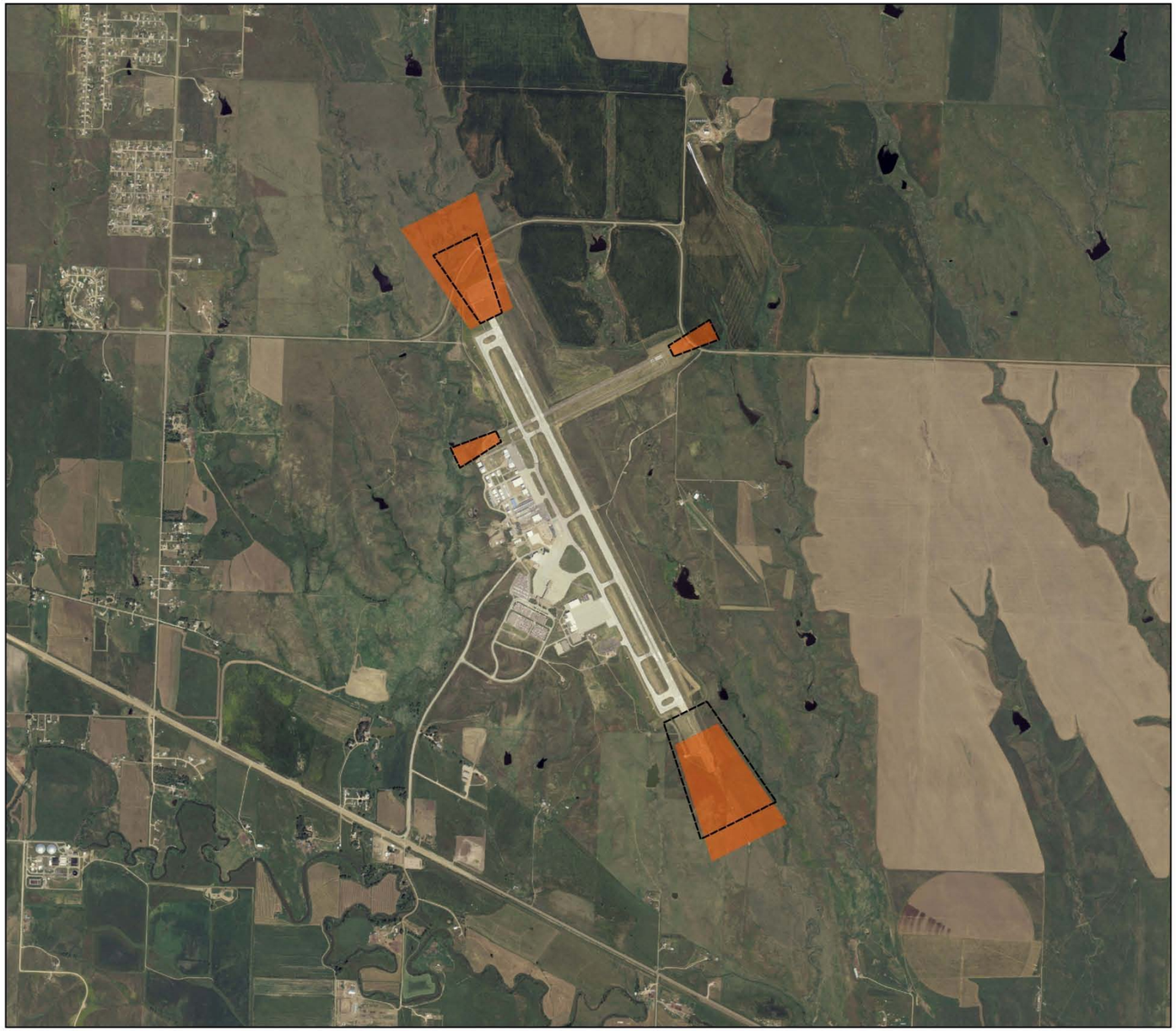
The existing RPZ for Runway 14 begins 200 feet beyond the runway end, has an inner width of 500 feet, a length of 1,700 feet, and an outer width of 1,010 feet. However, the 2008 RCRA Master Plan Update[5] proposes adding a precision approach to Runway 14, which requires the future RPZ to have an inner width of 1,000 feet, a length of 2,500 feet, and an outer width of 1,750 feet. The future RPZ proposed for Runway 14 was utilized for this Land Use Compatibility Plan.

The existing and future RPZ for Runway 32 begins 200 feet beyond the runway end, has an inner width of 1,000 feet, a length of 2,500 feet, and an outer width of 1,750 feet. For the purposes of this Land Use Compatibility Plan, the future end of Runway 32 depicted in the 2008 RCRA Master Plan Update, which shows a 500-foot runway extension, was utilized.

Rapid City Regional Airport's existing RPZs and the proposed RPZs utilized for land use planning purposes are shown on **Exhibit 3: RCRA Runway Protection Zones**.

[5] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Exhibit 3: RCRA Runway Protection Zones



Rapid City Regional Airport
Rapid City, South Dakota

Runway Protection Zones
Overlaid on Aerial Photo

Legend
- Existing Runway Protection Zone
- Proposed Runway Protection Zone

N

0 1,000 2,000 4,000 Feet

FOR PLANNING PURPOSES ONLY

Kadrmas Lee & Jackson
Engineers Surveyors Planners

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Wildlife Attractants

The wildlife objective is to minimize risks associated with wildlife activities, particularly birds, in the vicinity of an airport. Minimizing wildlife risks helps reduce aircraft damage costs and increases safety for aircraft occupants and persons on the ground. FAA statistics indicate that the number of aircraft bird strikes reported in the U.S. quadrupled from 1990 to 2007, rising from 1,738 per year to 7,286. Additionally, over 5,000 bird strikes were reported by the U.S. Air Force in 2007. At least 219 people have been killed world-wide as a result of bird strikes since 1988 and the cost to USA civil aviation is estimated at over $600 million per year. Approximately 80 percent of all bird strikes occur while aircraft are operating at altitudes less than 1,000 feet above ground level, which is typical for aircraft operating within an airport traffic pattern.

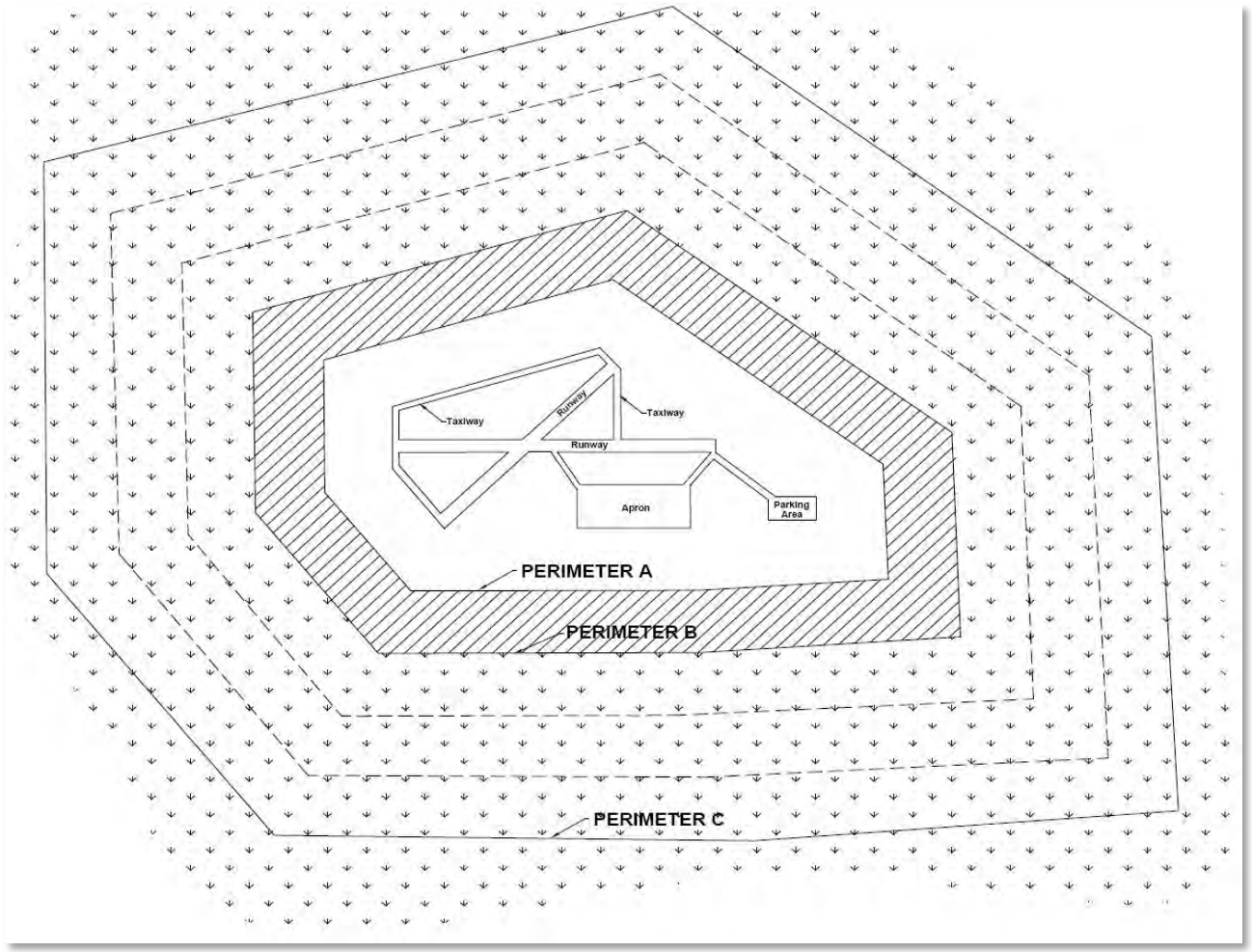
FAA AC 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports, recommends the wildlife attractants be located at least 10,000 feet away from the Air Operations Area (AOA) for turbine-powered aircraft. A copy of FAA AC 150/5200-33B is located in **Appendix D**. For all airports, the FAA recommends a distance of 5 statute miles between the furthest edges of the airport's AOA and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace. **Table 2: Hazardous Wildlife Attractants On or Near Airports** lists examples of items not recommended within 10,000 feet and 5 miles of the AOA.

Exhibit 4: Wildlife Hazard Separation Distances provides an example illustration of recommended separation distances for wildlife attractants.

Table 2: Hazardous Wildlife Attractants On or Near Airports

Land Use Guidance as Related to Wildlife Attractants
Typically not recommended within 10,000 feet of airports using turbine-powered aircraft:
1. New landfills (prohibited within 6 statute miles of airports)
2. Underwater waste discharges
3. Storm water management facilities (unless modified/designed so as to minimize attractiveness to wildlife)
4. Wastewater treatment facilities
5. Artificial marshes, stock ponds, and recreational lakes
6. Wastewater discharge and sludge disposal
7. Wetlands that attract wildlife
8. Dredge spoil containment areas (if they contain materials that would attract wildlife)
9. Agricultural crops (may be grown within 10,000 feet - follow separation distances in "Minimum Distances Between Certain Airport Features and Any On Airport Agricultural Crops")
10. Confined livestock operations (feedlots, dairy operations, hog/chicken production facilities, etc)
11. Aquaculture (unless they can show it does not pose a bird hazard)
12. Golf courses (allowed if they develop a program to reduce wildlife attractiveness)
Typically not recommended within 5 mile radius of airport:
1. Any items listed above if they would cause wildlife movement across approach/departure surface
2. New wastewater treatment facilities
3. New golf courses
4. New Landfills
Typically compatible with airports:
1. Enclosed trash transfer stations
2. Composting operations (yard waste; does not include food/municipal solid waste)
3. Recycling centers
4. Construction and demolition debris facilities
5. Fly ash disposal
Source: FAA AC 150/5200-33B

Exhibit 4: Wildlife Hazard Separation Distances[6]



PERIMETER A: For airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area.

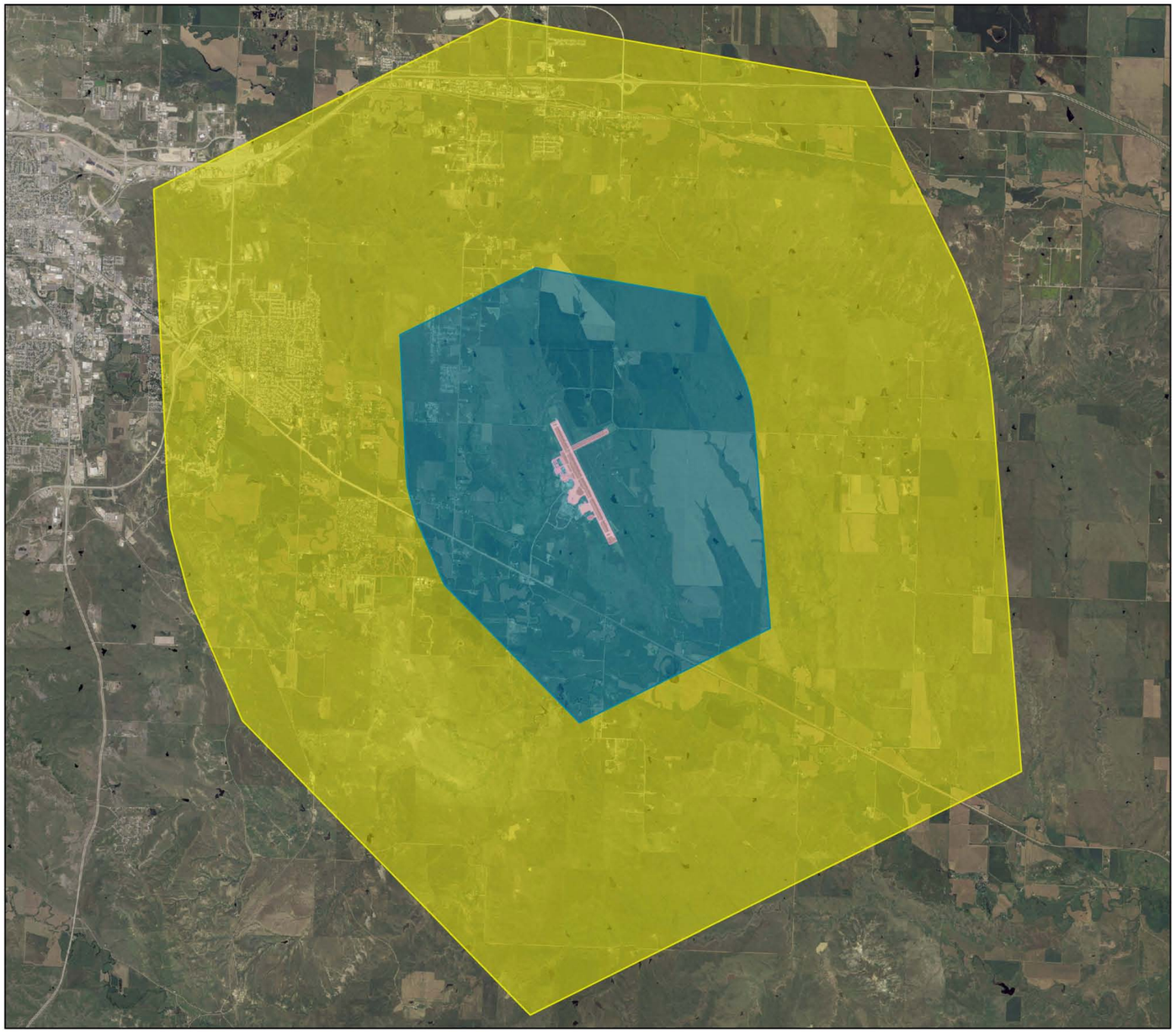
PERIMETER B: For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area.

PERIMETER C: 5-mile range to protect approach, departure and circling airspace.

Exhibit 5: Wildlife Attractant Zones displays the recommended 10,000 foot and 5-mile separation zones at RCRA.

[6] *Source: FAA AC 150/5200-33B*

Exhibit 5: Wildlife Attractant Zones



Rapid City Regional Airport
Rapid City, South Dakota

Wildlife Attractant Zones
Overlaid on Aerial Photo

Legend
- Aircraft Operations Area
- Wildlife Critical Zone (10,000 feet)
- Wildlife General Zone (5 miles)

N

Miles
0 0.625 1.25 2.5

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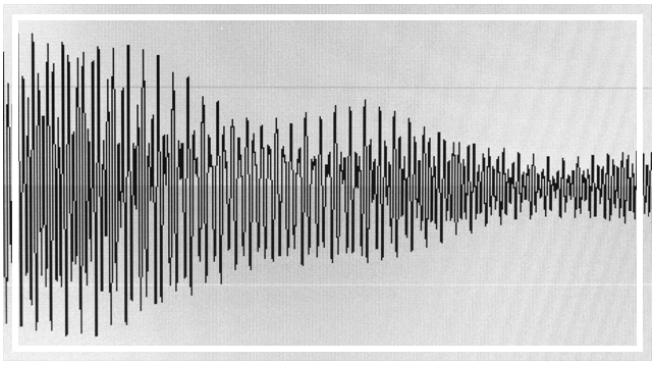
The FAA recommends that public-use airport sponsors implement the standards and practices contained in AC 150/5200-33B, Hazardous Wildlife Attractants On or Near Airports. Holders of Airport Operating Certificates issued under Title 14 CFR Part 139 Subpart D, Certification of Airports, may use the standards, practices, and recommendations contained in this AC to comply with the wildlife hazard management requirements of Part 139. Airports that have received federal grant-in-aid assistance must use these standards. The FAA also recommends the guidance in this AC for land-use planners, operators of non-certificated airports, and developers of projects, facilities, and activities on or near airports.

RCRA services commercial airline operations under the authority of an Airport Operating Certificate issued under Part 139 which requires RCRA to comply with wildlife hazard management requirements of Part 139. Compliance would normally be satisfied through implementation of the standards and practices contained in AC 150/5200-33B.

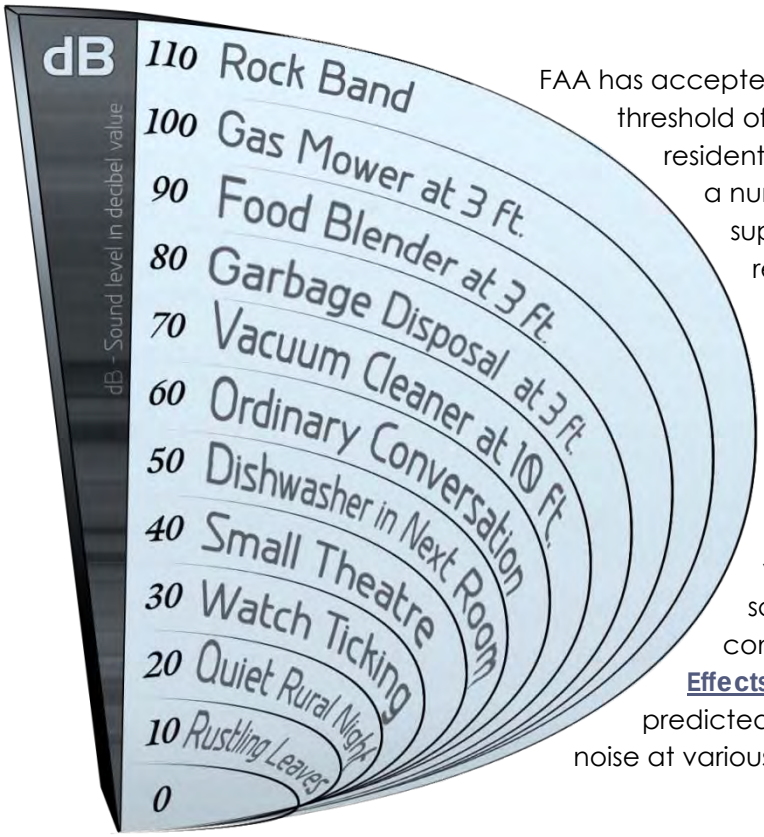
Noise

The noise objective is to minimize the number of people exposed to high levels of aircraft noise capable of disrupting noise-sensitive activities. Noise emitted from aircraft can affect the well-being of persons living or working near an airport. While there are several effects of aircraft noise upon people, the most common is annoyance. Annoyance can be defined as the overall adverse reaction of people to noise. Other effects of aircraft noise include sleep disturbance and speech interference.



Noise analysis for airports is typically conducted using Integrated Noise Model (INM) software. The noise measurement recommended by FAA for use in the analysis of aircraft noise is the Day-Night Average Sound Level (DNL). The DNL is defined as the average annual weighted sound level produced by aircraft at a location during a 24-hour period. An additional 10 decibel (dB) weight is applied to aircraft noise occurring between 10 p.m. and 7 a.m., when aircraft noise is more likely to create an annoyance. The FAA has determined that a significant noise impact would occur if a detailed noise analysis indicates an action would result in an increase of 1.5 dBs or greater within the 65 dB DNL contour over a noise sensitive area. **Exhibit 6: Common Sounds and Their Associated Decibel Levels** provides examples of many common sounds and graphs their associated dB levels.

Exhibit 6: Common Sounds and Their Associated Decibel Levels



FAA has accepted a maximum of 65 dB DNL as the threshold of concern for noise impacts over residential areas. However, there have been a number of instances where FAA has supported local policies to restrict new residential development to not exceed 60 dB DNL, particularly in rural or less developed areas that are not already subjected to high levels of urban noise, e.g., vehicle traffic or industrial activity. Note that local noise policies commonly define separate thresholds for various types of land uses, e.g., schools, hospitals, industrial complexes, etc.) **Table 3: Community Effects and Reactions to Noise** provides predicted community effects and reactions to noise at various DNL thresholds.

Table 3: Community Effects and Reactions to Noise

Day-Night Average Sound Level (Decibels)	Effects [1]			
	Hearing Loss (Qualitative Description)	Annoyance [2] (Percentage of Population Highly Annoyed)[3]	Average Community Reaction [4]	General Community Attitude Toward Area
≥75	May begin to occur	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will not likely occur	22%	Severe	Noise is one of the most important aspects of the community environment.
65	Will not occur	12%	Significant	Noise is one of the most important aspects of the community environment.
60	Will not occur	7%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
≤55	Will not occur	3%		Noise considered no more important than various other environmental factors.

1. All data is drawn from National Academy of Science 1977 report Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation of Environmental Impact of Noise.

2. A summary measure of the general adverse reaction of people to living in noisy environments that cause speech interference; sleep disturbance; desire for tranquil environment; and the inability to use the telephone, radio, or television satisfactorily.

3. The percentage of people reporting annoyance to lesser extents is higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time. USAF Update with 400 points (Finegold et al. 1992)

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

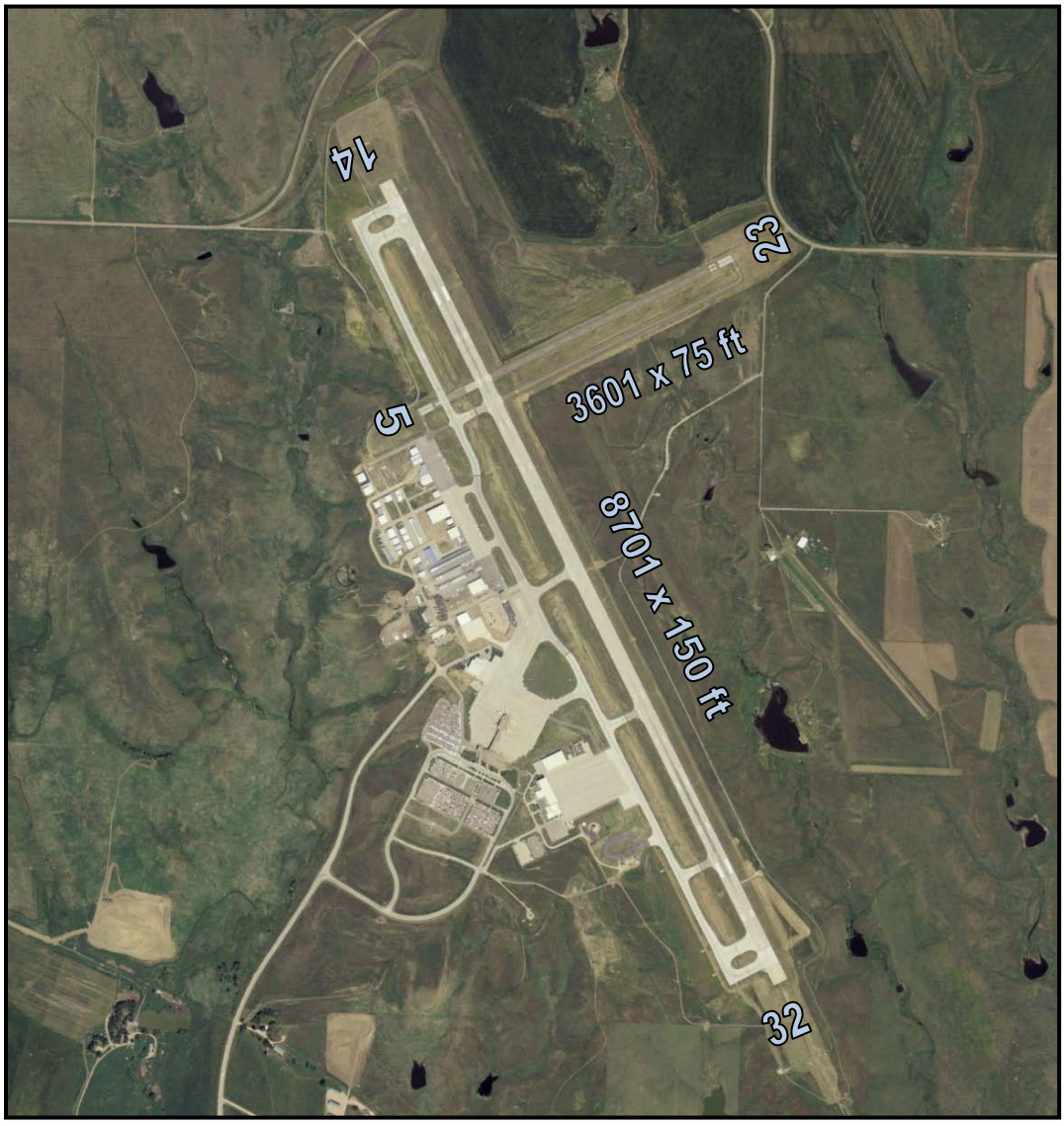
NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been conclusively demonstrated. (Thompson 1981; Thompson et al. 1989; CHABA 1981; CHABA 1982; Hattis et al. 1980; and U.S. EPA 1981.

Chapter 2. Airport Conditions

Existing Conditions

The existing layout of the facilities at Rapid City Regional Airport is shown on **Exhibit 7: RCRA Layout**. All operations conducted by commercial airlines and large jet aircraft use Runway 14-32 due to its 8701-foot length and instrument approach capabilities. Runway 5-23 is used by smaller aircraft. The 2008 RCRA Master Plan Update[7] shows a proposed 500-foot extension of Runway 14-32 to the south, resulting in an ultimate runway length of 9,200 feet. For planning purposes, the 500-foot extension to Runway 14-32 was incorporated into this Land Use Compatibility Plan.

Exhibit 7: Existing RCRA Layout



[7] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Airport Operations

RCRA currently receives scheduled passenger service from Delta Airlines (including service from their affiliates Northwest, Skywest/Delta Connection, Compass, Mesaba, and Pinnacle) to Minneapolis and Salt Lake City, United Airlines (including their affiliates Skywest/United Express, Mesa Airlines and ExpressJet) to Denver and Chicago, American Airlines via their affillliate American Eagle to Chicago and Dallas/ Ft. Worth and Allegiant Airlines to Las Vegas and Phoenix.

RCRA is currently served daily by several different regional jets through Delta, United, and American. Allegiant provides service three times each week and utilizes a MD 83. The current service fleet consists of the following aircraft types:

- Embraer ERJ 140 (44 seats)
- Embraer ERJ 145 (50 seats)
- Bombardier CRJ 100/200 (50 seats)
- Bombardier CRJ 700 (70 seats)
- Bombardier CRJ 900 (76 seats)
- McDonnell-Douglas MD-83 (150 seats)

Historically, RCRA has been served by several different airline aircraft types, varying by demand and time of year. Because the type of aircraft an airline utilizes can change overnight, it is anticipated that the following common airline aircraft types could return to service at RCRA, since they have operated at the Airport in the past and are still in the fleet of airlines currently operating at RCRA:

- Boeing 737-300 (126 Seats)
- McDonnell-Douglas DC9-30, 40, and 50 (100 to 125 Seats)
- Airbus A319/A320 (124/148 seats)
- Bombardier Dash 8-200 and Q400 (37 to 70 seats)

For the past 20 years, the number of airline operations at RCRA has fluctuated between 15,000 and 18,000 operations, with the last 5 years showing moderate declines as airlines moved aggressively to balance demand and capacity. The FAA Terminal Area Forecast (TAF) reports the last full year of data as 2008 with 15,570 commercial service operations. For the foreseeable future, commercial service operations will likely remain within the historical range;

for 2025, the 2008 RCRA Master Plan Update[8] forecasts 16,834 commercial service operations and the FAA TAF forecasts 17,926 operations.

The 2008 RCRA Master Plan Update forecasts the number of General Aviation (GA) aircraft based at RCRA to increase from 117 in 2005 to 173 in 2025. GA operations have declined from 70,000 in 1980 to 25,000 in 2008. The 2008 RCRA Master Plan Update concludes that the anticipated increase in based aircraft will provide a steady increase in GA operations up to 46,900 in 2025. However, the TAF indicates that GA operations will remain relatively flat and will still be approximately 26,800 in 2025.

Military aircraft operate at RCRA. These operations involve rotary wing and fixed wing aircraft used for training and transport activities. Those operations currently total about 2,600 annually and are forecasted to increase slightly to about 3,000 annual operations.

A summary of the aviation forecasts from the 2008 RCRA Master Plan Update is provided in **Table 4: Forecasts Summary**. A copy of the 2009 FAA TAF report is located in **Appendix D**.

[8] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Table 4: Forecasts Summary

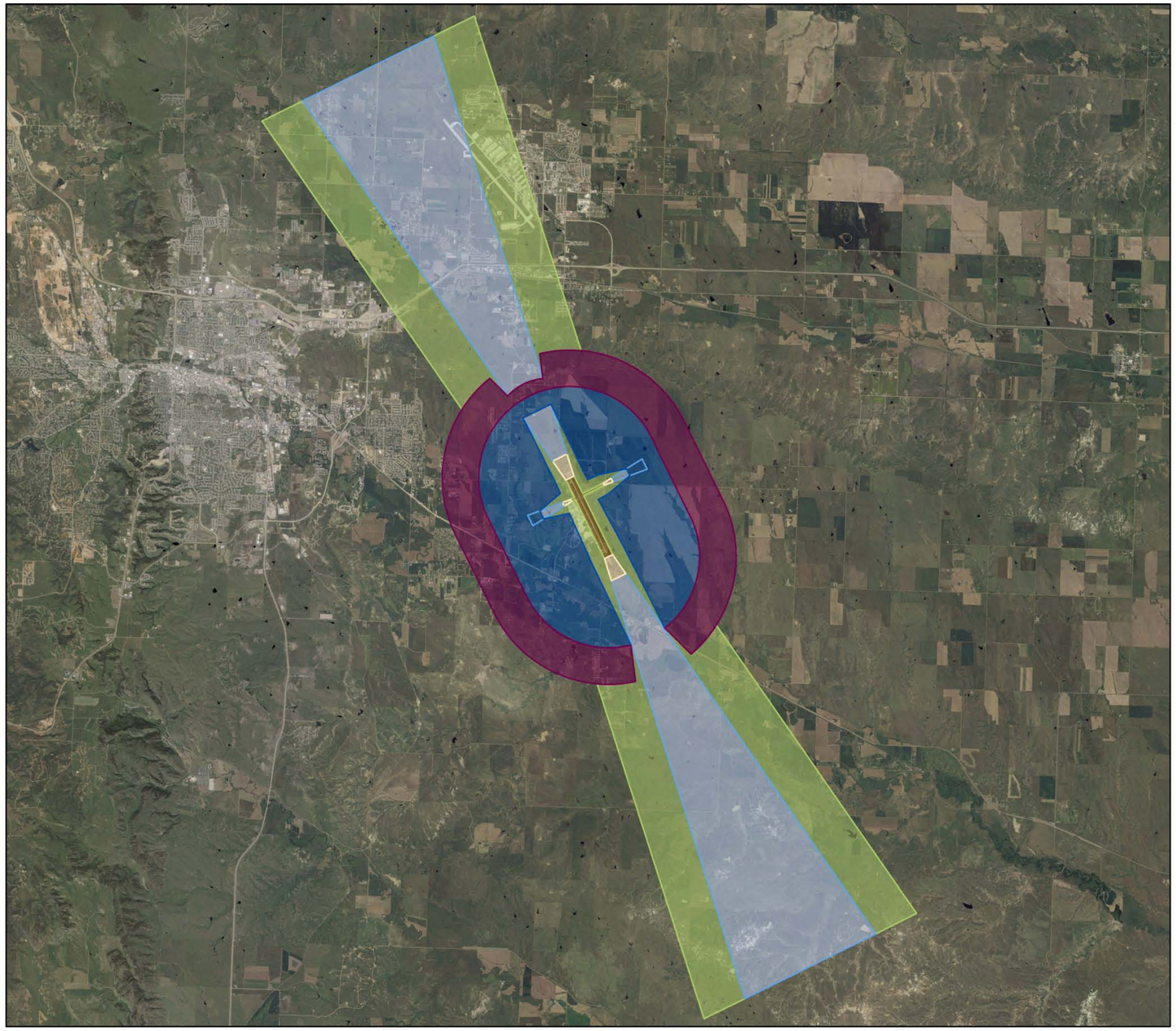
	2005	2010	2015	2025
Enplanements				
Airline Enplanements	252,109	284,414	320,594	407,743
Based Aircraft				
Total Based Aircraft	**117**	**129**	**144**	**173**
Local Operations				
General Aviation	11,129	11,996	12,907	14,943
Military	1,748	1,748	1,748	1,748
Total Local Operations	**12,877**	**13,744**	**14,655**	**16,691**
Itinerant Operations				
General Aviation	21,985	24,826	27,749	31,957
Commuter	12,336	12,474	12,613	12,895
Military	2,885	2,885	2,885	2,885
Airline	3,144	3,326	3,519	3,939
Total Itinerant Operations	**40,350**	**43,511**	**46,766**	**51,676**
Total Operations	**53,227**	**57,255**	**61,421**	**68,367**

Source: Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008

Airspace Structure

FAR Part 77 airspace surfaces with the proposed 500-foot extension of Runway 14-32 are shown in **Exhibit 8: RCRA Part 77 Airspace Surfaces**. Additional exhibits located in **Appendix D** detail RCRA's Part 77 surfaces along with height contours for the Part 77 surfaces and terrain surrounding RCRA.

Exhibit 8: RCRA Part 77 Airspace Surfaces



Rapid City Regional Airport
Rapid City, South Dakota

Proposed Part 77 Airspace
Overlaid on Aerial Photo

Legend

Proposed Part 77 Airspace

- APPROACH SURFACE
- CONICAL SURFACE
- HORIZONTAL SURFACE
- TRANSITIONAL SURFACE
- RUNWAY PROTECTION ZONE
- PRIMARY SURFACE

N

0 1 2 4 Miles

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Existing Airspace Zoning and Jurisdiction

The following describes the existing zoning for the airspace areas around the Airport and within each of the jurisdictions that are under the airspace.

Existing Rapid City Airspace Zoning

The City of Rapid City added Chapter 17.58 - Airport Zoning District to the Rapid City Municipal Code (RCMC) effective November 11, 2005. The Chapter establishes zoning authority over the Airport Zoning District, which encompasses the RCRA property. In Chapter 17.58, an Airport Encroachment Area and Height Regulations section are established in reference to Part 77.25, but do not adequately define the restrictions. In addition, the terminology used in RCMC Chapter 17.58 and Part 77.25 do not exactly match. The zones and height restrictions referred to in RCMC Chapter 17.58 are defined by the imaginary surfaces in Part 77.25, as shown in the chart below.

Rapid City Municipal Code Chapter 17.58	14 CFR Part 77.25
Runway Area Zones	Primary Surface
Approach Departure Zones	Approach Surface
Transition Zones	Transitional Surface
Horizontal Zone	Horizontal Surface
Conical Zone	Conical Surface

The language of RCMC Chapter 17.58 can be found in **Appendix E**.

Existing Pennington County Airspace Zoning

Pennington County has zoning authority over the area surrounding and abutting the Airport property. Airspace protection is provided for RCRA in Section 301 of the Pennington County Zoning Ordinance. Section 301 – Airport Height and Hazard Zoning is located in **Appendix E**. Section 301 establishes zones and height limitations consistent with FAR Part 77.25; exempts existing non-conforming uses; establishes a variance approval process; and allows appeals to the Board of Adjustment, followed by judicial review.

There are concerns with the existing language of Section 301:

1. Subsection D.10 states:

   "Nothing in this Ordinance shall be construed as prohibiting the construction or maintenance of any structure, or growth of any tree, to a height up to fifty (50) feet above the surface of the land."

   Due to local topography, especially north of RCRA, it is possible that a structure less than 50 feet tall could present a hazard to air navigation to the RCRA users. Also, this subsection appears to contradict the language in subsection G.1.

2. Although Section 301 requires a County Permit for uses in the defined zones (except structures and trees less than 50 feet high that wouldn't extend above zone height limits), it does not mention the federal requirement to file FAA Form 7460-1 before construction, if the construction meets certain criteria outlined in Part 77[9],. Procedurally, the County may require an applicant to file FAA Form 7460-1 and receive a response from the FAA before the County issues a permit, but including that requirement in the Ordinance would strengthen the County's position and avoid applicant consternation and misunderstanding of the process.

3. Subsection C refers to a Rapid City Airport Zoning Map consisting of two sheets dated October 15, 2003. That map should be updated to incorporate the Part 77 surfaces detailed in the most recent ALP. The Part 77 surface maps located in **Appendix D** could be utilized for that purpose.

4. Subsection D.7 and D.8 incorrectly apply an airport elevation of 100 feet above mean sea level.

Existing Box Elder and Meade County Airspace Zoning

At this time, the City of Box Elder and Meade County have not adopted airspace zoning. However, they are currently working with the Ellsworth Air Force Base task force to protect the airspace serving the airbase.

Residential Density Zoning

The area northwest of the Airport is developing as residential space. Appropriate zoning for density, population, height, and noise impacts must be maintained in this area. The area east of the airport may eventually develop as residential and appropriate densities should be zoned for this area.

---

[9] *Persons failing to comply with the provisions of Part 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended and pursuant to 49 U.S.C. Section 46301(a).*

Examples of times when a structure proponent is required to file Notice of Construction (Form 7460-1)

- *Structures Exceeding 200 feet above ground level*
- *Structures Within 20,000 ft of public/military airport, that exceed 100:1 surface from any point on the runway*
- *Everything located on an airport*

Wind Turbine Restrictions

Rapid City and Box Elder have enacted ordinances that place restrictions on wind turbines, or "wind energy conversion systems" as they are referred to in RCMC Chapter 17.50.215 and "wind energy systems" as they are referred to in City of Box Elder Ordinance #478. Both ordinances are located in **Appendix F** . Among other restrictions, the ordinances detail height and setback requirements, and mandate that interference with electromagnetic devices be mitigated. RCMC Chapter 17.50.215 also prohibits the commercial sale of power. The ordinance reads:

"B. Commercial sale of power prohibited. Any wind energy conversion system shall be used only for the purpose of generating power for the property on which the wind energy conversion system is located, or for the purpose of transmitting power to the electrical grid of an electric utility company through an approved interconnection."

Pennington County has placed restrictions on wind turbines by designating them a conditional use. It is up to the Pennington County Planning Commission to determine whether or not a conditional use such as a wind turbine should be allowed.

Meade County has enacted an ordinance which requires sponsors of "Wind Generator Facilities" to file a permit application. The restrictions on the facilities depend on whether they are "commercial", "rural", or "small residential". A copy of the ordinance, Wind Generator Ordinance 32, can be found in **Appendix F**.

The existing restrictions on wind turbine development may not provide sufficient protections for the airspace surrounding RCRA. Therefore, recommendations for improving airspace protection through wind turbine development restrictions are detailed in Chapter 3 of this study.

Safety

The City of Rapid City has annexed the Airport property encompassed by RCRA and designated it the 'Airport Zoning District'. RCMC Chapter 17.58 currently provides land use restrictions for the district. The land use restrictions include permitted uses, conditional uses, and other use regulations. RCMC Chapter 17.58 can be found in **Appendix E**.

Outside of height restrictions, Pennington County ordinances provide few land use restrictions that specifically protect RCRA. The City of Box Elder and Meade County provide no land use restrictions which specifically protect RCRA.

It is recommended that additional land use restrictions be implemented for the area surrounding Rapid City Regional Airport. Proposed land use restrictions for the area surrounding RCRA are detailed in the subsequent chapter.

Wildlife

Wildlife, particularly birds, is of concern for aircraft operating within the central migration flyway in which RCRA is located. Activity by migrating birds is especially intense during spring and fall migration periods and extra vigilance to monitor bird numbers and movements is required of pilots, the RCRA FAA Air Traffic Control (ATC) Tower, and approach/departure radar operators located at Ellsworth Air Force Base.

RCRA is operated according to the requirements of a 2003 Wildlife Hazard Management Plan. This plan was prepared using data on actual wildlife activity recorded in a Wildlife Hazard Assessment prepared by the USDA Wildlife Services. It is important to note that the Wildlife Hazard Assessment and Wildlife Hazard Management Plan focused on wildlife activity within RCRA property, whereas land use compatibility, the subject of the present effort, deals primarily with land surrounding the Airport. Where land use compatibility is addressed in the Wildlife Hazard Management Plan, the action specified is that the Airport Director would be vigilant of development proposals that may cause the attraction of wildlife activity near the Airport.

Table 2: Hazardous Wildlife Attractants On or Near Airports from Chapter 1 lists the types of facilities and activities that are not considered compatible with airport operations because they typically attract wildlife of concern to aircraft safety.

On Airport Potential Wildlife Attractants

The 2003 RCRA Wildlife Hazard Management Plan details some potential wildlife attractants located on the airfield and provides methods to remove or mitigate those hazards. Some examples of potential wildlife attractants located on RCRA's airfield include a natural spring, two small marsh areas, and several drainage ditches adjacent to runways and taxiways.

Off Airport Potential Wildlife Attractants

There are existing facilities and activities near RCRA that may be considered incompatible with airport operations; wetlands and agricultural crops that could attract wildlife currently exist within 10,000 feet of the Airport.

Some land uses noticed or proposed near the Airport that are typically identified as a wildlife hazard include:

- Wetlands and stock ponds around Airport property
- Drainage area for Rapid Creek south of the Airport (approximately 5,700 feet from Runway 32)
- Waste water treatment plant (approximately 12,700 feet from Runway 32)

- Potential golf course and housing development along Rapid Creek south of the Airport
- Planting of corn and other incompatible row crops next to Airport property

A determination as to whether or not a land use is a hazard will need to be made through a wildlife study conducted by a qualified wildlife hazard biologist. The wildlife study would outline what mitigation efforts are recommended.

Noise

The 2008 RCRA Master Plan Update[10] included an aircraft noise analysis to identify the existing and projected future noise exposure levels in the airport vicinity. Noise contours were prepared for the years 2005 and 2025. **Appendix G** contains the 2005 and 2025 noise contour maps developed by RS&H.

As shown on the maps, the total area included within the noise contours is expected to stay relatively stable over time. Even though aircraft operations are expected to increase, the introduction of quieter, more technologically advanced aircraft that replace older aircraft now in use will result in noise impacts remaining constant or decreasing. In both cases, the 65 decibel (dB) Day-Night Average Sound Level (DNL) contour remains on existing RCRA property or property over which the airport has an easement. RCRA can ensure that development which would be incompatible with noise levels will not occur.

[10] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Chapter 3. Compatibility Guidelines

Introduction

This chapter contains guidelines Rapid City, Pennington County, Meade County, and Box Elder may use to establish additional policies governing the planning and development of lands surrounding Rapid City Regional Airport (RCRA). The approach used in this effort is to identify a best scenario for airport land use compatibility and then balance that best scenario with existing and planned land uses surrounding the Airport. A comparison of existing zoning ordinances and recommended changes to those ordinances is also presented. **Appendix I** details recommendations specific to each planning jurisdiction.

Airport sponsors can take a number of proactive steps to facilitate airport land use compatibility. Below are some suggestions:

- Ensure land use restrictions for all surrounding jurisdictions are in place and reflect the Airport's current and future operational levels.
- Assist surrounding jurisdictions in understanding how the Airport operates, the Airport's flight patterns and the type of aircraft operating at the Airport. Also assist surrounding jurisdictions in understanding how the Airport benefits the local economy and the community's health, welfare, and safety.
- Maintain awareness of land use actions proposed by the adjacent counties and municipalities.
- Stay apprised of the existing zoning or land use, how it is being enforced, and changing Airport operations and associated needs and impacts on areas adjacent to the Airport.
- Assist local jurisdictions in understanding Part 77 notification requirements and the special needs for protecting the safety and efficiency of aircraft operations.
- Provide copies of the Airport Layout Plan (ALP) to the local planning and zoning authorities.
- Attend planning meetings on land use decisions in the vicinity of the Airport.
- Invite local government officials and planners to be part of airport advisory committee meetings to keep them informed of the airport's plans and needs.

Zoning Implementation

Due to the number of planning entities affected by the proposed zoning for RCRA, it was determined the best method to implement comprehensive zoning was for Rapid City, Box Elder, Pennington County, and Meade County to separately enact zoning for their respective jurisdictions. In order to eliminate confusion, it is highly recommended that RCRA specific ordinances implemented in the cities and counties be the same or as similar as possible.

Land Use Compatibility Categories

The land use compatibility issues introduced in this report are treated as separate categories with individual policy recommendations for each issue. The land use compatibility categories for which criteria have been developed are airspace, safety, and wildlife attractants. The issue of noise is not addressed, because the current and projected noise contours show the 65 decibel (dB) Day-Night Average Sound Level (DNL) contour staying on RCRA controlled property.

The pace and nature of development in the areas bordering RCRA make an individualized approach to each land use compatibility issue appropriate. Rapid City, Box Elder, Pennington County, and Meade County have adopted zoning ordinances that at least partially satisfy land use compatibility concerns, so an individualized approach allows a more specific analysis of the suitability of existing zoning.

Airspace Category

Airspace definition is established through Part 77 as explained earlier in this document and there is no need to improve upon the current arrangement of airspace surfaces as shown in the ALP. See **Exhibit 8: RCRA Part 77 Airspace Surfaces** for RCRA's airspace surfaces.

Responsibility for planning and controlling the placement of tall structures that could obstruct RCRA's airspace is shared by Rapid City, Box Elder, Pennington County, and Meade County; however, the City of Rapid City has a higher level of responsibility through sponsor assurances on federal grants the city has received for airport improvements. Noncompliance with sponsor assurances could result in demands for repayment of grants, revocation of the FAA Airport Operating Certificate required by FAR Part 139 for commercial airline service, or a significant diminishment of the Airport's capability to serve all aircraft operations resulting from the obstruction of airspace caused by construction of a tall structure.

Each of the jurisdictions around the Airport play a vital role in controlling airspace, but not all have formally adopted zoning that specifically protects airspace required for the safe and effective operation of RCRA.

Pennington County has adopted zoning that specifically protects airspace through Section 301 – Airport Height and Hazard Zoning. However, changes should be made to the existing ordinance to better protect RCRA. The recommended changes were discussed in **Chapter 2** and are also detailed in **Appendix I**.

It is recommended that Rapid City, Box Elder, and Meade County adopt zoning that protects RCRA airspace. Pennington County's Section 301, along with the changes recommended to Section 301, could be utilized to draft zoning that protects RCRA airspace.

Wind Turbine Restrictions

It is recommended that Rapid City, Box Elder, Pennington County, and Meade County restrict commercial wind turbine development near RCRA. Rapid City Municipal Code (RCMC) Chapter 17.50.215 provides a good example of appropriate restrictions on commercial wind development.

It is also recommended that proponents of non-commercial wind energy systems who are required to file a Notice of Proposed Construction or Alteration (Form 7460-1) with the FAA be required to present the FAA determination to the appropriate jurisdiction's planning department for approval before they begin construction.

Safety Category

A safety compatibility zone map was developed for RCRA that includes five compatibility zones.

- Zone 1: Runway Protection Zone
- Zone 2: Inner Approach/Departure
- Zone 3: Circling Traffic Patterns
- Zone 4: Precision Flight Corridor
- Zone 5: Aviation Hazards

Each safety compatibility zone is assigned development criteria involving acceptable and prohibited land uses. **Exhibit 9: Safety Compatibility Zones** provides an illustration of the safety compatibility zones and **Table 5: Safety Compatibility Zone Criteria** outlines the development criteria for each zone.

Each safety compatibility zone and its criteria approximately relate to the degree of risk of aircraft accidents within each zone. As compared to the California Airport Land Use Planning Handbook, the proposed safety compatibility map for RCRA uses fewer zones. This change reflects the actual development character of the area surrounding RCRA. A description of each of the RCRA safety compatibility zones is detailed in the following paragraphs.

Zone 1 – Runway Protection Zone

This zone consists of the Runway Protection Zone (RPZ) located within the inner approach area at each runway end. The total area, shape, and development criteria used for Zone 1 comply with the RPZ design standards in FAA Advisory Circular (AC) 150/5300-13 and are consistent with the ultimate RPZs shown on the Draft Airport Layout Plan (ALP) for RCRA located in the 2008 RCRA Master Plan Update[11].

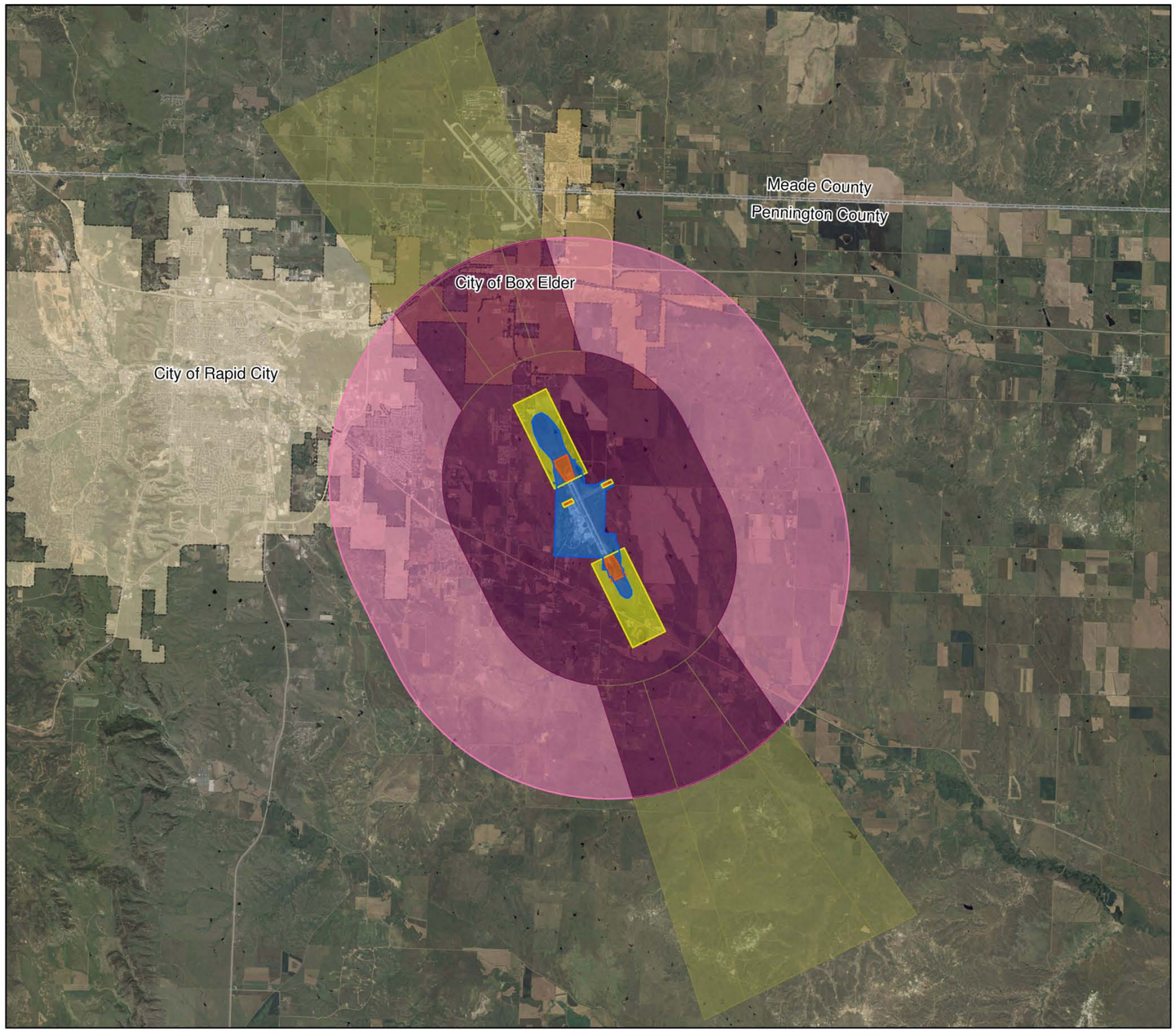
Zone 1 prohibits all development that is not necessary for aeronautical purposes. As with Zones 2 through 5, hazards to flight, which include physical, visual, and electronic forms of interference with the safety of aircraft operations, are prohibited within Zone 1.

All land within this zone should be owned by the Airport in order to provide the level of control commensurate with the high level of accident risk the area is subject to. The high level of aircraft noise experienced in this area also makes most forms of development incompatible. When airport ownership is not possible, avigation easements should be secured. Avigation easements convey rights of aircraft over-flight, creation of noise and vibrations, limitations on the heights of structures and trees, and prohibit uses that involve congregations of people.

RCRA has protected the majority of Zone 1 by acquiring all of the property included in the existing RPZ for all four runway ends. RCRA currently owns the majority of the future RPZ for an ultimate 500 foot extension Runway 14-32 to the south; a small amount of property needs to be acquired to fully protect the RPZ if the Runway 32 End is lengthened 500 feet. The property to be acquired is shown on the 2008 RCRA Master Plan Update[12] Airport Property Map. A copy of the Airport Property Map is located in **Appendix D**.

[11] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*
[12] *Rapid City Regional Airport Master Plan Update. Reynolds, Smith, and Hills, Inc., 2008*

Exhibit 9: Safety Compatibility Zones



Rapid City Regional Airport
Rapid City, South Dakota

Safety Compatibility Zones

Legend

Proposed Airport Land Use Zoning

- ZONE 0 = Airport Property
- ZONE 1 = Runway Protection Zone
- ZONE 2 = Inner Approach/Departure
- ZONE 3 = Circling Traffic Patterns
- ZONE 4 = Precision Flight Corridor
- ZONE 5 = Aviation Hazards
- Rapid City Jurisdiction
- Box Elder Jurisdiction
- County Lines

N

0 1 2 4 Miles

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Table 5: Safety Compatibility Zone Criteria

Safety Zone		Maximum People Per Acre		Additional Criteria	
		Average	Single Acre	Unacceptable Uses	Other Development Conditions
1	Runway Protection Zone	Not Applicable	Not Applicable	▸ All structures except ones with location set by aeronautical function ▸ Assemblages of people ▸ Storage of hazardous materials ▸ Hazards to flight	▸ Airport should acquire fee ownership of land within RPZs or acquire adequate land use control through avigation easements
2	Inner Approach/ Departure Zone	25	50	▸ Children's schools, child care centers, libraries, hospitals, and nursing homes ▸ Above ground bulk storage of hazardous materials ▸ Highly noise-sensitive outdoor nonresidential uses ▸ "Hazardous Wildlife Attractants" as defined in FAA AC 150/5200-33B ▸ Commercial Wind Energy Systems ▸ Hazards to flight	▸ Locate structures maximum distance from extended runway centerline ▸ Critical community infrastructure facilities generally unacceptable ▸ Maximum of one dwelling unit per 10 acres ▸ Minimum lot size of 10 acres
3	Circling Traffic Pattern Protection Zone	150	450	▸ Highly noise-sensitive nonresidential uses ▸ "Hazardous Wildlife Attractants" as defined in FAA AC 150/5200-33B ▸ Commercial Wind Energy Systems ▸ Hazards to flight	▸ Children's schools, hospitals, nursing homes, and similar uses should be avoided ▸ Major spectator-oriented facilities, amphitheaters, concert halls generally unacceptable
4	Precision Flight Corridor Zone	No Restriction		▸ Commercial Wind Energy Systems ▸ Hazards to flight	▸ Major spectator-oriented facilities, amphitheaters, concert halls generally unacceptable
5	Aviation Hazards Zone	No Restriction		▸ "Hazardous Wildlife Attractants" as defined in FAA AC 150/5200-33B ▸ Commercial Wind Energy Systems ▸ Hazards to flight	

Zone 2 – Inner Approach & Departure Zone

This zone includes the portion of the inner, final approach located immediately outside of the RPZs (Zone 1). Zone 2 is the area normally residing outside of airport property that is exposed to the highest noise levels and greatest risk of an aircraft accident. Aircraft in this zone operate at very low altitudes and during takeoffs, under full thrust power. This combination of aircraft operation factors creates the moderate levels of noise and increased risk of accidents. The distance this zone extends away from the runway end is greatest for primary Runway 14-32, which serves most of the aircraft operations and all large aircraft. Crosswind Runway 5-23 is a secondary runway with fewer aircraft operations and the length of Zone 2 on this runway was substantially reduced.

Zone 2 extends from the ends of primary Runway 14-32 an approximate distance of 10,200 feet (1/5 the length of the FAR Part 77 approach surface) and at a width of 4000 feet. Zone 2 extends from the ends of crosswind Runway 5-23 an approximate distance of 1,200 feet (1/5 the length of the FAR Part 77 approach surface) and at a width of 450 feet.

It is recommended that Zone 2 have a minimum lot size requirement of ten acres. This is consistent with density requirements currently in place. Additionally, it is recommended that land within Zone 2 remain designated as "agricultural". Schools, hospitals, churches, and similar uses are not acceptable uses. Above ground storage of fuel or other hazardous materials should be avoided.

It is also recommended that Zone 2 have population density restrictions. The population density of any use in Zone 2 should not exceed an average of 25 persons per gross acre, and a maximum of 50 persons per single acre, at any time. Density calculations shall include all people (e.g., employees, customers/visitors, etc.) who may be on the property at any single point in time, whether indoors or outside.

No commercial wind turbine development or hazards to flight should be allowed in Zone 2. It is also recommended that restrictions be placed on applicable "Hazardous Wildlife Attractants" detailed in **Table 2: Hazardous Wildlife Attractants On or Near Airports**.

Zone 3 – Circling Traffic Pattern Protection Zone

This zone is representative of the traffic pattern flown by aircraft that use RCRA. Zone 3 approximately extends to the perimeter of the Part 77 conical surface to ensure the zone encompasses the aircraft traffic pattern. The approximate dimensions of Zone 3 would be established by swinging arcs of 14,000 feet from the center of each end of the Part 77 primary surfaces of Runway 14-32 (the end of the primary surface extends 200 feet beyond the runway end) and connecting the adjacent arcs by drawing lines tangent to these arcs. Zone 3 also includes the outer portion of RCRA's Part 77 approach and transitional surfaces for Runway 14-32 within five miles of the Airport.

Zone 3 is subject to moderate levels of noise occurring during individual events as an airplane flies overhead. The risk of an accident is also lower within this zone.

It is recommended that Zone 3 have population density restrictions. The population density of any use in Zone 3 should not exceed an average of 150 persons per gross acre, and a maximum 450 persons per single acre, at any time. Density calculations shall include all people (e.g., employees, customers/visitors, etc.) who may be on the property at any single point in time, whether indoors or outside. Major spectator oriented facilities should be avoided due to the concentrations of people they produce and exposure to aircraft noise interference.

No commercial wind turbine development or hazards to flight should be allowed in Zone 3. It is also recommended that restrictions be placed on applicable "Hazardous Wildlife Attractants" detailed in **Table 2: Hazardous Wildlife Attractants On or Near Airports**.

Zone 4 – Precision Flight Corridor Zone

This zone roughly encompasses the area not covered by Zone 2 and Zone 3 that is under the outer portion of RCRA's Part 77 approach and transitional surfaces for Runway 14-32. Zone 4 extends approximately 50,000 feet beyond the ends of Runway 14-32's FAR Part 77 primary surface (the end of the Part 77 primary surface extends 200 feet beyond the runway end). The width of Zone 4 is approximately 26,000 feet wide at its outer limits and narrows as it approaches the end of Zone 3.

Development in this area is exposed to lower levels of aircraft noise and lower risk of aircraft accidents. No commercial wind turbine development or hazards to flight should be allowed in Zone 4.

Zone 5 – Aviation Hazards Zones

Zone 5 encompasses a 5-mile area surrounding RCRA. This zone is representative of the FAA recommended distance between airports and hazardous wildlife attractants that could cause hazardous wildlife movement into or across the approach or departure surfaces. For ease of implementation, the perimeter of the zone is constructed by swinging arcs of five statute miles from the center of each end of Runway 14-32 and connecting the adjacent arcs by lines tangent to those arcs.

It is recommended that restrictions be placed on applicable "Hazardous Wildlife Attractants" detailed in **Table 2: Hazardous Wildlife Attractants On or Near Airports**. It is also recommended that no commercial wind turbine development or hazards to flight be allowed in Zone 5.

Supporting Material

Appendix H contains exhibits of the safety compatibility zones overlaid on the following:

- Existing zoning map developed using RapidMap, the Rapid City - Pennington County Internet Mapping Site
- Airport Neighborhood Area Future Land Use Map
- Pennington County's Future Land Use Map.

For reference purposes, **Appendix H** also contains the above-mentioned maps without the compatibility zone overlay along with the Airport Neighborhood Area Future Land Plan, and Pennington County Zoning Ordinance, Sections 205 – 213. Pennington County Zoning Ordinance Sections 205 – 213 details the county's zoning district provisions.

Wildlife Attractants

RCRA intends to update the Airport's Wildlife Hazard Management Plan in the near future. The updated Plan will detail potential wildlife attractants located on the airfield and provide methods to remove or mitigate those hazards.

The safety compatibility zones discussed above include wildlife attractant restrictions for areas within five miles of the Airport. The best method of implementing the land use compatibility recommendations related to wildlife attractants will be determined by Rapid City, Box Elder, and Pennington County.

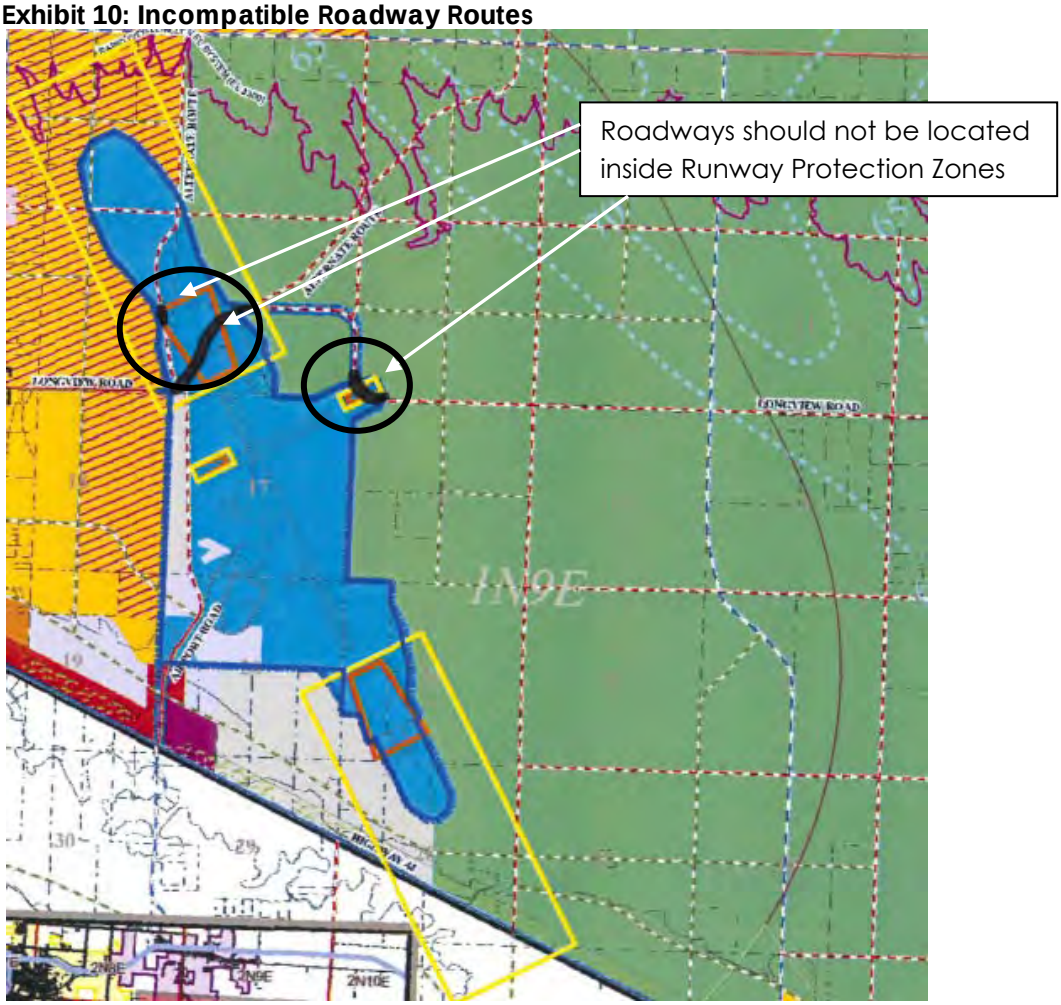
Other Areas of Concern

Proposed Road Construction

The 2005 Airport Neighborhood Future Land Use Plan located in **Appendix H** shows road development alternatives on existing Airport property, near critical areas, such as RPZs and Zone 2, which may lead to unwanted development of land surrounding the Airport. RCRA should be vigilant in protecting the interests of the Airport and opposing development which could lead to incompatible land uses.

Exhibit 10: Incompatible Roadway Routes displays a portion of Rapid City's Airport Neighborhood Future Land Use Zoning Map; blacked out routes are strongly recommended not to be considered for construction due to the above concerns. Existing roadways in RCRA's RPZs should be relocated outside the RPZ if possible.

Exhibit 10: Incompatible Roadway Routes



Compatibility Zone Implementation Issues

The compatibility zones detailed in this plan may be difficult to implement since they are based on stated distances from airport surfaces or runway ends. Therefore, it was decided to make adjustments to the zones by basing zone boundaries on 10-acre squares that follow section line boundaries. This change makes zone boundaries easier to define and enforce. Because the 10-acre squares followed section line boundaries, they could be considered a quarter-quarter-quarter section. If less than 25 percent of a 10-acre square was within a certain zone, the 10-acre square was not considered part of that zone. **Appendix J** contains an exhibit of the proposed safety compatibility zones based on this method. The various zoning jurisdiction lines were also included on the exhibit.

Conclusion

The implementation of the recommended measures in this Land Use Compatibility Plan will help RCRA achieve the stated objectives of land use compatibility for the issues of airspace, safety, wildlife attractants, and noise. Implementation will also assist RCRA in compliance with applicable FAA and State requirements for airport land use compatibility. Additional work on the part of RCRA, in cooperation with Rapid City, Box Elder, Pennington County, and Meade County, will be required to arrive at the best methods of transforming these recommendations into active land use policies. Adjustments to some of the zone boundaries and development criteria may be necessary to arrive at the best solution. Further, land use is a dynamic process and periodic updates to map boundaries, development criteria, and overall policies will be necessary.