AIR INSTALLATION COMPATIBLE USE ZONE STUDY
VOLK FIELD AIR NATIONAL GUARD BASE

WISCONSIN AIR NATIONAL GUARD COMBAT READINESS TRAINING CENTER CAMP DOUGLAS, WISCONSIN

May 2008
## Aircraft Key

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TO: Area Governments

SUBJECT: Air Installation Compatible Use Zone (AICUZ) Study

This Air Installation Compatible Use Zone (AICUZ) Study for Volk Field Air National Guard Base (ANGB), dated May 2008, is an update of the original AICUZ Study dated June 2001. The update was initiated because of changes in the number of aircraft operations and aircraft fleet mix and is a reevaluation of aircraft noise and accident potential related to Air Force flying operations. It is designed to aid in the development of local planning mechanisms which will protect public safety and health as well as preserve the operational capabilities of Volk Field ANGB.

The enclosed report contains a summary description of the affected area around the base. The report outlines the location of runway clear zones, aircraft accident potential zones, noise contours, height restrictions, runway airspace imaginary surfaces, and recommends compatible land use for areas in the vicinity of the base. It is our hope that this information will be incorporated into your community plans, zoning ordinances, subdivision regulations, building codes, and other related documents.

The basic objective of the AICUZ program is to achieve compatible uses of public and private lands in the vicinity of military airfields by controlling incompatible development through local actions. This update provides noise contours based upon the Day-Night Average A-Weighted Sound Level (DNL) metric used by the Air Force. This report provides the information necessary to maximize beneficial use of the land surrounding Volk Field ANGB while minimizing the potential for degradation of the health and safety of the affected public.

We greatly value the positive relationship Volk Field ANGB has experienced with its neighbors over the years. As a partner in the process, we have attempted to minimize noise disturbances through such actions as minimizing night flying and avoiding flights over heavily populated areas. We solicit your cooperation in implementing the recommendations and guidelines presented in this AICUZ Study.

[Signature]

GUNTHER H. NEUMANN, Col, WI ANG
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100 Independence Drive
Camp Douglas, WI 54618-5001
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<td>128&lt;sup&gt;th&lt;/sup&gt; Air Control Squadron</td>
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<td>Air Combat Training System</td>
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<td>AFCEE</td>
<td>Air Force Center for Engineering and the Environment</td>
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<td>Integrated Noise Model</td>
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<tr>
<td>JCS</td>
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<tr>
<td>LANTIRN</td>
<td>Low Altitude Navigation and Targeting Infrared for Night</td>
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<td>MSL</td>
<td>mean sea level</td>
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Volk Field Air National Guard Base, Camp Douglas, WI
AICUZ Study – May 2008
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<td>NGB</td>
<td>National Guard Bureau</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NLR</td>
<td>Noise Level Reduction</td>
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<td>NM</td>
<td>Nautical Miles</td>
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<tr>
<td>NVG</td>
<td>Night Vision Goggles</td>
</tr>
<tr>
<td>ORE/ORI</td>
<td>Operational Readiness Exercise/Operational Readiness Inspection</td>
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<tr>
<td>SFO</td>
<td>simulated flame out</td>
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<tr>
<td>SLUCM</td>
<td>Standard Land Use Coding Manual</td>
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<tr>
<td>TACAN</td>
<td>Tactical Air Navigation</td>
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<td>United Facilities Criteria</td>
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<td>Visual Flight Rules</td>
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<td>VHF</td>
<td>Very High Frequency</td>
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<td>VORTAC</td>
<td>VHF Omnidirectional Range/Tactical Aircraft Control</td>
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SECTION 1
PURPOSE AND NEED

1.1 INTRODUCTION

This study is an update of the 2001 Volk Field Air National Guard Base (ANGB) Air Installation Compatible Use Zone (AICUZ) Study. The update presents and documents the changes to the AICUZ for the period of 2001 to 2008 and completes the requirement for Volk Field ANGB to comply with Department of Defense Instruction (DoDI) 4165.57 and Air Force Instruction (AFI) 32-7063 (Air Installations Compatible Use Zones and Air Installation Compatible Use Zone Program, respectively). This AICUZ update reaffirms Air Force policy of promoting public health, safety, and general welfare in areas surrounding Volk Field ANGB. This study presents changes in flight operations since the last study, and provides current noise contours and compatible use guidelines for land areas surrounding the base. It is intended this information will assist the local communities, and serve as a tool for future planning and zoning activities.

AICUZ studies describe three major types of constraints that affect, or result from aircraft operations: accident potential, noise exposure, and structure height (including runway airspace imaginary surfaces). Differences between the 2001 Volk Field ANGB AICUZ Study and this update are attributable to changes in noise exposure specifically driven by:

- Changes in the number of flight operations;
- Changes to the aircraft fleet mix;
- Change in the number of operating days;
- Addition, elimination, or alteration of flight tracks for mission purposes;
- Technical improvements to the NOISEMAP noise model program; and
- Incorporation of additional aircraft into acoustical database.

1.2 PURPOSE AND NEED

The purpose of the AICUZ program is to promote compatible land development in areas subject to aircraft noise and accident potential. The Air Force provides
the AICUZ Study to local communities to assist them in preparing their local land use plans.

Airspace obstructions, construction in the APZs, residential development, and the construction of other noise-sensitive uses near the base are of great concern to Volk Field ANGB. The Air Force is very interested in minimizing increases in incompatible usage and in encouraging voluntary conversion of incompatible usage to compatible usage. The base evaluates the impact aircraft operations have on surrounding properties and the effect new development or changes in land use might have on Volk Field ANGB operational capabilities.

In addition to working with local governing entities and planning professionals, the Volk Field ANGB Public Affairs Office works to address complaints and concerns expressed by off-airfield neighbors.

Volk Field ANGB conducts active outreach to the community by meeting with various community groups and speaking with individuals as needed. The Volk Field ANGB Civil Engineer and Public Affairs Offices work together providing public meetings and informational workshops to disseminate information about base operations, forecasts, plans, and mitigation strategies.

As the North Central Wisconsin Regional Planning Commission, Town of Orange, Village of Camp Douglas, and Juneau County prepare and modify their land use development plans, recommendations from this updated AICUZ study – namely those addressing accident potential and aircraft noise – should be considered in their planning processes to prevent land use and/or zoning incompatibility that may compromise Volk Field ANGB ability to fulfill its mission requirements.

Air Force AICUZ land use guidelines reflect land use recommendations for air field safety zones (i.e., clear zones [CZs], accident potential zones [APZs] I and II), four noise zones, and structure height (including obstacle-free runway airspace imaginary surfaces). These guidelines have been established on the basis of studies prepared and sponsored by several Federal agencies, including the Department of Housing and Urban Development (HUD), Environmental Protection Agency (EPA), Federal Aviation Administration (FAA), Air Force, and
state and local agencies. The guidelines recommend land uses which are compatible with airfield operations while allowing maximum beneficial use of adjacent properties. The Air Force has no desire to recommend land use regulations which render property economically useless. It does, however, have an obligation to the inhabitants of the Volk Field ANGB environs and to the citizens of the United States to identify ways to protect the public in adjacent areas, as well as the public investment in the base itself.

As a critical component of this effort, the AICUZ program uses the latest technology to define noise levels in areas near Air Force bases. An analysis of Volk Field ANGB’s flying operations was performed, including types of aircraft, flight patterns utilized, variations in altitude, power settings, number of operations, and hours of operations. This information was used to develop the noise contours contained in this study. The Department of Defense (DoD) NOISEMAP methodology and the Day-Night Average A-Weighted Sound Level (DNL) metric were used to define the noise zones for Volk Field ANGB.

1.2.1 AICUZ Study Organization

Information within this study is organized in a manner to present a description of the base, airfield criteria and restrictions, land use guidelines, land use analysis, study implementation, and references. Section headings presented within this study include the following:

- Section 1, Purpose and Need
- Section 2, Installation Description
- Section 3, Basis for Land Use Compatibility/Incompatibility
- Section 4, Land Use Compatibility Guidelines
- Section 5, Land Use Analysis
- Section 6, Implementation
- Section 7, References

1.3 Process and Procedure

Preparation and presentation of this update to Volk Field ANGB’s AICUZ Study is part of the continuing Air Force participation in the local planning process. It is recognized that, as local communities prepare land use plans and zoning ordinances, the Air Force has the responsibility of providing input on its activities relating to the community. This study is presented in the spirit of
mutual cooperation and assistance by Volk Field ANGB to aid in the local land use planning process. This study updates information on base flying activities since 2001 to assist in the planning process. Since 2001, the only key identified AICUZ program constraint that has changed at Volk Field ANGB is noise exposure resulting from changes in aircraft operations; neither accident potential zone boundaries nor structure height restrictions – or infringements – have changed. Noise contours portrayed on the AICUZ maps in this study are based on current mission plans.

Data collection was conducted at Volk Field ANGB in June 2007. Aircraft operational and maintenance data were obtained to derive average daily operations by runway and type of aircraft. This data was supplemented by flight track information (i.e., “where we fly”), flight profile information (i.e., “how we fly”), and ground run-up information (i.e., “how we test engines”). After verification for accuracy, data were input into the NOISEMAP 7.3 program to produce DNL contours. Contours were plotted on an area map and overlaid with designated CZ and APZ areas. Appendix A contains detailed information on the development of the AICUZ program.

1.3.1 Noise Exposure Model

The Air Force developed the NOISEMAP computer program to describe noise impacts created by aircraft operations. NOISEMAP is one of two EPA-approved computer programs; the other is the Integrated Noise Model (INM) used by the FAA for noise modeling and analysis at civil airports.

NOISEMAP is a suite of computer programs and components developed by the Air Force to predict noise exposure in the vicinity of an airfield due to aircraft flight, maintenance, and ground run-up operations. The components of NOISEMAP are:

- **BASEOPS** is the input module for NOISEMAP and is used to enter detailed aircraft flight track and profile and ground maintenance operational data.
- **NOISEFILE** is a comprehensive database of measured military and civil aircraft noise data. Aircraft operational information is matched with the noise measurements in the NOISEFILE after the detailed aircraft flight
and ground maintenance operational data has been entered into BASEOPS.

- **NMAP** is the computational module in NOISEMAP. NMAP takes BASEOPS input and uses the NOISEFILE database to calculate the noise levels caused by aircraft events at specified grid points in the airbase vicinity. The output of NMAP is a series of georeferenced data points, specific grid point locations, and corresponding noise levels.

- **NMPLOT** is the program for viewing and editing the sets of georeferenced data points. Using the NMAP grid output, NMPLOT produces noise contours that can be viewed and exported in a format compatible with mapping programs used to analyze noise impacts.
SECTION 2
INSTALLATION DESCRIPTION

2.1 INTRODUCTION

Volk Field ANGB was established in 1954 and covers 2,336 acres or about 3.6 square miles. Volk Field ANGB is located approximately 75 miles north of Madison, Wisconsin, and 55 miles east of La Crosse, Wisconsin, along Interstate 90/94 (Figure 2-1). The primary landing strip is 9,000 feet long (with an additional 1,000 feet of overruns at each end of the runway) and 150 feet in width. The runway can accommodate all U.S. military aircraft and has both precision and non-precision navigational approaches along with a tower and radar approach control. There are about 40 acres of aircraft parking available.

2.2 MISSION

Volk Field ANGB was established and funded by the National Guard Bureau (NGB) in Washington, D.C., and is directly under the command of The Adjutant General of Wisconsin. The Wisconsin Air National Guard (ANG) Combat Readiness Training Center (CRTC) operates Volk Field ANGB with a mission of providing a year-round training environment for National Guard units to enhance their combat readiness. The Wisconsin ANG CRTC at Volk Field ANGB is the only ANG CRTC in the Nation which allows around-the-clock training. On a daily basis the facility is used by units from an 11 state area in the Midwest. Annually units from around the Nation use this base and the nearby Hardwood Bombing Range to enhance their combat abilities. The CRTC allows training to be done which cannot be accomplished at the units’ home stations. The facilities approximate a Forward Operating Location (FOL), and provide a realistic setting for the conduct of unit Operational Readiness Exercises and Inspections (ORE/ORI). Additionally, the CRTC manages the operations and scheduling of assigned ranges and airspace training areas.

Units from across the Nation utilize Volk Field ANGB. In 2007, 209 units trained at this facility, of these 79 were ANG Units. The rest included Air Force, Army and Navy Units, as well as non-DoD entities. The Wisconsin ANG CRTC enhances the units’ capabilities providing command, control, communications,
No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

Data Source: Volk Field ANGB 2007B; ESRI Streetmap USA
Geographic Reference: NAD 1983 Wisconsin Stateplane South

Legend
- Township of Orange
- County Trunk Highways
- Runway
- County Line
- Volk Field ANGB Boundary

Volk Field ANGB Camp Douglas, WI
Air Installation Compatible Use Zone Vicinity Map

FIGURE
2-1
computer, and intelligence support during inspections, exercises, and annual training at Volk Field ANGB.

Volk Field ANGB is also home to the 128th Air Control Squadron (128 ACS). The 128 ACS is tasked on a daily basis to support the flying activities scheduled at the ANGB. Also, the 128 ACS is a worldwide deployable Ground Control Intercept (GCI) unit and often deploys to support counter-narcotics operations and Joint Chiefs of Staff (JCS) operations and exercises. The ANGB Air Traffic Control (ATC) complex provides both visual and instrument flight rule services. The approach control services extend from Volk Field ANGB to eight civilian airports in the area.

The Federal mission of the 128 ACS is to maintain and operate a transportable extension of the Theater Air Control System. In this role the unit provides:

- The air picture via datalinks from multiple sensors to the theater commander,
- Radar control for offensive and defensive air operations,
- Early warning, detection and tracking of surveillance data, and
- Personnel training and equipment maintenance to a state of readiness for worldwide deployment.

The 128 ACS’s state mission is to provide the Governor of Wisconsin the capability for a highly mobile command, control, computer, communications, and intelligence element, capable of supporting any contingency including natural disaster and civil unrest response. On a daily basis the 128 ACS provides airspace management to ANG and Reserve aircrews from seven surrounding states.

The Air Combat Training System (ACTS) at Volk Field ANGB is one of only 21 such facilities worldwide. The ACTS is the most powerful state-of-the-art training aid for combat aircrews. It is a computerized three-dimensional tracking and recording system. The ACTS provides enhanced safety for aircrews training in aerial combat, air-to-ground weapons delivery, surface-to-air defenses, and

Volk Field ANGB is the Aerial Port of Embarkation/Debarkation (APOE/D) for Fort McCoy, given its close proximity to Fort McCoy, also supporting the return and subsequent demobilization of troops. Fort McCoy serves as one of 15 Power Projection Platforms in the nation and troops are brought to Volk Field ANGB via bus and then deployed worldwide. Numerous troops have been deployed to Iraq and Afghanistan through the facilities. In 2007, 18,400 passengers and 5.8 million pounds of cargo passed through Volk Field ANGB.

Volk Field ANGB is critical to non-defense activities as well. The base provides training to area law enforcement and other protective services in the area. The Northeast Counter-drug Training Center has a remote campus on base. There is also a new emphasis on Homeland Security at the base for local law enforcement training. The fire training center is often used by local firefighters, and occasionally Western Wisconsin Technical College will use the facility for firefighter training. There are also mutual aid agreements for fire protection with the Village of Camp Douglas and with Juneau County for HAZMAT.

2.3 ECONOMIC IMPACT

Volk Field ANGB is located in Juneau County adjacent to the Village of Camp Douglas (refer to Figure 2-1). Volk Field ANGB is the top employer for the Village of Camp Douglas. Military and civilian personnel assigned to the base make a significant economic contribution to Camp Douglas due to the large Federal payroll and high volume of local purchases.

Total Volk Field ANGB employment is 399 personnel of which 227 are military personnel and 172 are civilian employees. The total gross payroll disbursed to employees at Volk Field ANGB in fiscal year (FY) 2006 was approximately $10.6 million (Table 2-1). Of this amount, $4.3 million in appropriated funds was paid to civil service employees while military personnel received appropriated funds totaling $6.3 million. The estimated number and dollar value of indirect jobs created from Volk Field ANGB totaled 136 and $4.3 million, respectively. Actual
Table 2-1. Volk Field ANGB Expenditures

<table>
<thead>
<tr>
<th>Classification</th>
<th>Personnel</th>
<th>Total Amount (million dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Employment Payroll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Military</td>
<td>227</td>
<td>6.3</td>
</tr>
<tr>
<td>Civilian</td>
<td>172</td>
<td>4.3</td>
</tr>
<tr>
<td>Total</td>
<td>399</td>
<td>10.6</td>
</tr>
<tr>
<td>Indirect Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civilian</td>
<td>136</td>
<td>4.3</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
<td>4.3</td>
</tr>
<tr>
<td>Expenditures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td>3.7</td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td>Materials, Equipment, and Supplies</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7.1</td>
</tr>
<tr>
<td>Total Economic Effect</td>
<td></td>
<td>22.0</td>
</tr>
</tbody>
</table>

Annual expenditures totaled approximately $22 million. Of this amount, $3.7 million was paid for construction costs. Services paid $0.9 million, and materials, equipment, and supplies procurement totaled $2.5 million. Table 2-1 shows the estimated local direct and indirect total economic effect associated with Volk Field ANGB in 2006 (the most recent year for which these data are available). As tenant units on base add personnel and expand, this figure will increase.

2.4 Aircraft Activity

To describe the relationship between aircraft operations and land use at and around the airfield, it is necessary to fully evaluate the exact nature of flying activities. The June 2007 data collection regarding aircraft operations at Volk Field ANGB included where aircraft fly, how high they fly, how many times they fly over a given area, and the time of day they operate. Section 2.4.1 discusses aircraft operations at Volk Field ANGB. Section 2.4.2 discusses runway utilization for all operations. Section 2.4.3 describes aircraft maintenance activity, and Section 2.4.4 presents climatological data.
2.4.1 Aircraft Operations

Approximately, 9,000 annual aircraft operations occur at Volk Field ANGB based on aircraft operations data validated in June 2007. An aircraft operation is defined as one takeoff/departure, one approach/landing, or half a closed pattern. A closed pattern consists of two portions: a takeoff/departure and an approach/landing (i.e., two operations). A sortie is a single military aircraft flight from the initial takeoff through the termination landing. The minimum number of aircraft operations for one sortie is two operations, one takeoff (departure) and one landing (approach). Over the last five years, annual aircraft operators at Volk Field ANGB have averaged close to 9,000 operations annually with a high of 12,455 operations in 2003 and a low of 6,766 operating in 2006. The variation in annual aircraft operations is based on ANG deployments overseas and the fact that Volk Field ANGB is a training center without an assigned flying unit.

Table 2-2 summarizes the projected “average busy day” aircraft operations for Volk Field ANGB based on information provided by base staff, flying units, and air traffic control personnel. Aircraft types operating at the base consist primarily of military aircraft. Given that Volk Field ANGB does not have any based aircraft, aircraft operations at the base result from numerous types of transient military and civilian aircraft activity. The table reflects a total of about 30 average busy-day aircraft operations based on collected operations data. Approximately 2.0 percent of the total daily operations occur at night (defined as occurring from 10:00 PM to 7:00 AM).

Table 2-2. Volk Field ANGB Daily Aircraft Operations

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700-2200</td>
<td></td>
</tr>
<tr>
<td>2200-0700</td>
<td></td>
</tr>
<tr>
<td>Daily Operations</td>
<td>29.78</td>
</tr>
</tbody>
</table>

Although the number of military and civil aircraft operations at a base usually varies from day to day, NOISEMAP requires input of the specific numbers of daily flight and aircraft maintenance engine runup operations. The Air Force does not follow the FAA’s use of the “average annual day” in which annual operations are averaged over an entire 365-day year. Neither does the Air Force use the “worst-case day” since it typically does not represent typical noise.
exposure. Instead, the Air Force uses the “average busy-day” concept in which annual operations for an aircraft type are averaged over the number of flying days per year by that aircraft type. Non-flying days (e.g., weekends or holidays) are not used in computing the “average busy-day” operations. Flying activity at Volk Field ANGB occurs 300 days per year.

Under the current ANG and NG leadership, the CRTCs are recognized as vital ANG and national training assets. Fighter use will decline in the future given that F-16s, A-10s, and/or F-15s will be replaced by either F-22s or F-35s; however, “heavy” (i.e., cargo) ANG aircraft would most likely hold steadier in the long-term. According to the Air Force Roadmap, locally, the 114 FW, 115 FW, 132 FW, and 148 FW are anticipated to receive F-35s. The majority of deployed business to Volk Field ANGB is from Active Duty, Guard, and Reserve AMC-gained units.

2.4.2 Runway Utilization

Runway 09/27 is oriented 090°–270° magnetic and is 150 feet wide and 9,000 feet long. The overruns at the ends of each runway are 1,000 feet long and 150 feet wide. The airfield elevation is 912 feet above mean sea level (MSL).

Other airports and military airfields within the area surrounding the base influence Volk Field ANGB aircraft arrival and departure flight tracks. The Mauston-New Lisbon Union Airport is 8 nautical miles to the southeast and Necedah Airport is 9 nautical miles to the northeast.

Aircraft operating at Volk Field ANGB use the following flight patterns:

- Departures in all directions;
- Arrivals from all directions;
- Radar and visual closed patterns predominately to the north of the airfield; and,
- Overhead and rectangular closed patterns for all aircraft are flown at 1,500 feet above ground level (AGL).
Flight patterns specific to Volk Field ANGB result from several considerations, including:

- Takeoff patterns routed to avoid noise-sensitive areas as much as possible;
- Arrivals and departures routed to avoid restricted airspace;
- Criteria governing speed, rate of climb, and turning radius for each type of aircraft;
- Efforts to control and schedule missions to keep noise levels low, especially at night; and
- Coordination with the FAA to minimize conflict with civil aircraft operations.

Arrivals and departures on Runway 09 and 27 is approximately 5.0 and 95.0 percent, respectively, with closed patterns almost exclusively taking place on Runway 27 (Table 2-3).

**Table 2-3. Volk Field ANGB Average Daily Runway Utilization**

<table>
<thead>
<tr>
<th>Runway 27</th>
<th>Runway 09</th>
</tr>
</thead>
<tbody>
<tr>
<td>0700-2200*</td>
<td>2200-0700*</td>
</tr>
<tr>
<td>Daily Operations</td>
<td>29.1</td>
</tr>
</tbody>
</table>

Note: * denotes military time

### 2.4.3 Airfield and Airspace

Airfield planning considers three primary aircraft operational/land use determinants: (1) accident potential to land users, (2) aircraft noise, and (3) hazards to operations from land uses (e.g., height obstructions). Each of these concerns is addressed in conjunction with mission requirements and safe aircraft operations to determine the optimum flight track for each aircraft type; tracks depicted in Figures 2-2, 2-3, and 2-4 are the result of such planning. These flight tracks have been configured to implement practicable mitigation measures to reduce noise impacts to the local community while maintaining flight safety standards. Flight track configuration results from the following considerations:

- takeoff patterns routed to avoid heavily populated areas when possible;
FIGURE 2-2

Volk Field ANGB
Air Installation Compatible Use Zone
Arrival Flight Tracks

No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

Legend
- Arrival Flight Tracks
- Runway
- Township of Orange
- County Trunk Highways
- County Line
- Volk Field ANGB Boundary

Data Source: Volk Field ANGB 2007B; ESRI Streetmap USA
Geographic Reference: NAD 1983 Wisconsin Stateplane South

N 0 1 2 Miles

Camp Douglas

Volk Field ANGB

Prepared by AMEC Earth & Environmental, Inc. Tempe, Arizona
Volk Field ANGB
Air Installation Compatible Use Zone
Departure Flight Tracks
• Air Force criteria governing the aircraft speed, rate of climb, and turning radius;
• efforts to control and schedule missions to keep noise levels low, especially at night; and
• coordination with FAA to minimize conflict with civilian aircraft operations.

Most procedures governing aircraft operations and airspace use distinguish between two types of flight rules — *visual* and *instrument* — which dictate how and where a pilot can operate. Pilot qualifications/certifications and the type of flight aviation generally dictate which rules must be used. For instance, general aviation pilots who possess only a private license and fly light aircraft normally operate under Visual Flight Rules (VFR).

VFR do not require ATC clearances and generally allow pilots to fly unrestricted under 18,000 feet MSL using visual references such as towns, highways, and railroads as a means of navigation. VFR rely on “see-and-avoid” flight which requires pilots to be visually alert for and to maintain safe distances from other obstacles (e.g., populated areas, clouds). Most other air traffic, including air passenger carriers, business aircraft, and military aircraft, operate under Instrument Flight Rules (IFR), which require pilots to be trained and certified in instrument navigational procedures and ATC clearance requirements that provide separation between all aircraft operating under IFR. The respective procedures established under VFR and IFR for flight operations and airspace use help segregate aircraft operating under each set of rules.

Federal Aviation Regulations (FAR) ensure that the nation’s busiest airports are surrounded by controlled airspace. Controlled airspace is a generic term for five different classifications of airspace and defined dimensions within which ATC services are provided (Figure 2-5).

**Class A Airspace.** Class A airspace includes operating altitudes above 18,000 feet MSL. Formerly referred to as Positive Control Areas, Class A airspace is dominated by commercial and military aircraft utilizing jet routes between 18,000 and 45,000 feet MSL.
Federal Aviation Administration Controlled Airspace Classifications

Class A

Class B

Class C

Class D

Class E

Class F

Class G

18,000 MSL

14,500 MSL

AGL – above ground level
MSL – above mean sea level

Note: Altitudes not to scale.

**Section 2**

**Class B Airspace.** Class B airspace comprises contiguous cylinders of controlled airspace, which can extend from ground level up to 14,500 feet MSL. The radii of the cylinders increase incrementally with the shortest radius located closest to the airfield complex and the longest radius located up to 30 nautical miles from the airfield at altitudes between 8,000 and 14,500 feet MSL. This increasing radius with increasing altitude gives the airspace structure the shape of an upside down wedding cake. This shape roughly corresponds to the paths of aircraft approaching and departing from the airport. Prior to operating in Class B airspace, pilots must contact controlling authorities and receive clearance to enter the airspace. Aircraft operating within Class B airspace must be equipped with specialized electronics which allow air traffic controllers to accurately track aircraft speed, altitude, and position. Class B airspace is typically associated with major airports.

**Class C Airspace.** Within Class C airspace, aircraft are required to maintain two-way radio communication with local ATC entities. Class C airspace areas were designed and implemented to provide additional ATC into and out of primary airports where aircraft operations are periodically at high-density levels. Class C airspace starts at the surface and extends to 4,000 feet AGL.

**Class D Airspace.** Class D airspace generally encompasses a 5.2-statute-mile radius of an airport equipped with ATC facilities, extending from the ground to 2,500 feet AGL. All aircraft operating within Class D airspace must maintain two-way radio communication with, and have permission from, the ATC facility at the airport in order to enter the airspace. Volk Field ANGB operates Class D airspace from the surface up to 3,400 feet AGL. The specific altitudes for the Class D airspace associated with Volk Field ANGB are shown in Figure 2-6.

**Class E Airspace.** Class E airspace can be described as general controlled airspace and includes designated federal airways, portions of the jet route system, and area low routes. Federal airways have a width of 4 statute miles on either side of the airway centerline and occur between 700 feet AGL and 18,000 feet MSL but may have a floor located at ground level at non-towered airfields. These airways frequently intersect approach and departure paths of both military and civilian airfields.
Local Airspace. Volk Field ANGB has its own ATC personnel to provide flight tracking and aircraft separation services for IFR and VFR aircraft in the vicinity of Volk Field ANGB. In certain situations, aircraft separation requirements may necessitate different routing than the flight tracks shown in Figures 2-2, 2-3, and 2-4.

2.4.4 Aircraft Runup Operations

To the maximum extent possible, aircraft engine runup locations have been established in areas to minimize noise for people in the surrounding communities, as well as for those on base (Figure 2-7). Given that Volk Field ANGB does not have any based aircraft or based maintenance personnel, typical aircraft engine runup operations associated with ORE/ORI activities only occurs during pre- and post-flight on the aircraft parking apron and arm/de-arm locations. Average busy-day aircraft runup operations were calculated similarly to flight operations described in Section 2.4.1. Approximately 10.0 percent of aircraft runup operations at Volk Field ANGB occur during nighttime (10:00 PM to 7:00 AM).

2.4.5 Climatological Data

Weather conditions, measured by temperature and relative humidity, are an important factor in the propagation of noise. Temperature and relative humidity affect sound absorption. Climatological data for Volk Field ANGB was provided by Volk Field ANGB personnel and Air Force Combat Climatology Center (26 June 2007). The average temperature and humidity for each month of the year are input into BASEOPS, which then calculates the sound absorption coefficient for each month. Ranking the twelve monthly sound absorption coefficients from smallest to largest, BASEOPS chooses the sixth smallest sound absorption coefficient to represent the typical weather conditions at the base. The month with the sixth smallest sound absorption coefficient for Volk Field ANGB is June, the month with an average monthly temperature of 70 degrees Fahrenheit and 53 percent relative humidity (Table 2-4).
Table 2-4. Volk Field ANGB Average Monthly Climatological Data

<table>
<thead>
<tr>
<th>Source</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Temperature (F)</td>
<td>18</td>
<td>22</td>
<td>34</td>
<td>49</td>
<td>61</td>
<td>70</td>
<td>75</td>
<td>72</td>
<td>63</td>
<td>52</td>
<td>38</td>
<td>24</td>
<td>49</td>
</tr>
<tr>
<td>Relative Humidity (%)</td>
<td>66</td>
<td>59</td>
<td>54</td>
<td>47</td>
<td>47</td>
<td>53</td>
<td>52</td>
<td>55</td>
<td>56</td>
<td>56</td>
<td>62</td>
<td>68</td>
<td>56</td>
</tr>
<tr>
<td>Barometric Pressure (in Hg)</td>
<td>29.03</td>
<td>29.07</td>
<td>29.00</td>
<td>28.96</td>
<td>28.96</td>
<td>28.96</td>
<td>29.01</td>
<td>29.05</td>
<td>29.05</td>
<td>29.03</td>
<td>29.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (F) = Fahrenheit  
(%) = Percent  
(in Hg) = inches of Mercury
3.1 INTRODUCTION

The DoD developed the AICUZ program for military airfields in 1973. Using this program, the DoD works to protect aircraft operational capabilities at its installations and to assist local government officials in protecting and promoting public health, safety, and quality of life. The primary goal of the AICUZ program is to promote compatible land use and development around military airfields by providing information on accident potential, aircraft noise exposure, height restrictions (including obstacle-free runway airspace imaginary surfaces), and local considerations.

3.2 CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

Areas around airports are exposed to the possibility of aircraft accidents even with well maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, past history makes clear that accidents may occur.

The risk of people on the ground being injured or killed by aircraft accidents is remote. However, an aircraft accident is a high-consequence event and, when a crash does occur, the result is often catastrophic. Because of this, the Air Force does not attempt to base its safety standards on accident probabilities. Instead it approaches this safety issue from a land use-planning perspective. Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public’s exposure to safety hazards.

The AICUZ program includes three safety zones in the airfield environment: the CZ, APZ I, and APZ II. These zones were developed from statistical analysis of more than 800 major Air Force accidents that occurred within 10 miles of an Air Force installation between 1968 and 1995. DoD analysis has determined that the areas immediately beyond the ends of the runways and along the approach and departure flight paths have the highest potential for aircraft accidents. Figure B-3 in Appendix B summarizes the location of these accidents.
3.2.1 Clear Zones

The CZ has the highest accident potential of the three zones, as 27 percent of accidents studied occurred in this area. Due to the relatively high accident potential, the Air Force adopted a policy of acquiring real estate interests in the CZ through purchase or easement when feasible.

Accident potential on or adjacent to the runway or within the CZ is so high that the necessary land use restrictions would prohibit reasonable economic use of land. As stated previously, it is Air Force policy to request that Congress authorize and appropriate funds to purchase the real property interests in this area to prevent incompatible land uses.

3.2.2 Accident Potential Zones

APZ I is an area that possesses somewhat less accident potential than the CZ, with 10 percent of the accidents studied occurring in this zone. APZ II has less accident potential than APZ I, with 6 percent of the accidents studied occurring in this zone. While the potential for aircraft accidents in APZs I and II does not warrant land acquisition by the Air Force, land-use planning and controls are strongly encouraged in these areas for the protection of the public.

3.2.2.1 Accident Potential Zone I

APZ I is less critical than the CZ, but still possesses a significant risk factor. This 3,000 foot by 5,000 foot area has land use compatibility guidelines that are sufficiently flexible to allow reasonable economic use of the land, such as industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agriculture. However, uses that concentrate people in small areas are not acceptable.

3.2.2.2 Accident Potential Zone II

APZ II is less critical than APZ I, but still possesses potential for accidents. APZ II, also 3,000 feet wide, is 7,000 feet long extending to 15,000 feet from the runway threshold. Acceptable uses include those of APZ I, as well as low-density single-
family residential and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High density functions such as multi-story buildings, places of assembly (e.g., theaters, churches, schools, restaurants, etc.), and high density office uses are not considered appropriate. High people densities should be limited to the maximum extent possible in APZ II. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in APZ II is one dwelling per acre. For most nonresidential usage, buildings should be limited to one story and lot coverage should not exceed 20 percent.

Figure 3-1 depicts the CZs and APZs for Runway 09/27 at Volk Field ANGB. At each end of Runway 09/27, Volk Field ANGB has a CZ that encompasses an area 3,000 feet wide by 3,000 feet long, an APZ I that is 3,000 feet wide by 5,000 feet long, and an APZ II that is 3,000 feet wide by 7,000 feet long. Currently, land use incompatibilities exist within the Runway 27 CZ and APZ I and within the Runway 09 APZ I. Land use incompatibilities are discussed in detail within Section 5.5.1 of this Study. Additional general information on APZs and CZs is contained in Appendix B of this report.

3.3 Noise

The second development constraint involves noise zones and different sounds have different frequency content. When describing sound and its effect on a human population, A-weighted decibels (dBA) are typically used to account for the response of the human ear. The term “A-weighted” refers to a filtering of the sound signal to emphasize frequencies in the middle of the audible spectrum and to de-emphasize low and high frequencies in a manner corresponding to the way the human ear perceives sound. This filtering network has been established by the American National Standards Institute. The A-weighted noise level has been found to correlate well with people’s judgments of the noisiness of different sounds and has been in use for many years as a measure of community noise.
Volk Field ANGB
Air Installation Compatible Use Zone
Clear Zones and Accident Potential Zones

Legend
- Clear Zone
- Accident Potential Zone I
- Accident Potential Zone II
- Runway
- County Line
- Volk Field ANGB Boundary
- Castle Rock Wayside
- Church
- School
- County Trunk Highways
- Township of Orange

Data Source: Volk Field ANGB 2007B; ESRI Streetmap USA
Geographic Reference: NAD 1983 Wisconsin Stateplane South

No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document", in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.

FIGURE 3-1
3.3.1 Noise Zones

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise (FICUN) published guidelines relating DNL to compatible land uses. In 1992, the Federal Interagency Committee on Noise (FICON) further examined airport noise analysis issues and refined the guidelines. Both committees were composed of representatives from DoD, FAA, HUD, EPA, and VA. Since the issuance of these guidelines, Federal agencies have adopted the guidelines for their noise analyses.

Following the lead of the committee, DoD and Air Force adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. Using a DNL of 65 as a starting level for assessing noise impacts, four noise zones (65-69 DNL, 70-74 DNL, 75-79 DNL, and 80 and greater DNL) in 5 DNL increments have been established based on the impact of noise levels to land use. As the noise level increases from one noise zone to the next, compatibility of sensitive land use (e.g., residences, hospitals, schools, etc.) decreases. For example, single-family residences are compatible within the 65-69 DNL noise zone when Noise Level Reduction (NLR) measures are incorporated during construction; however, single-family residences are not compatible within the 80 DNL and greater noise zone, regardless of NLR measures.

The Air Force NOISEMAP 7.3 computer program produces contours showing noise levels generated by aircraft operations based on average busy-day aircraft operations data collected in 2007 and described in Section 2.3.1. The AICUZ report contains noise contours plotted in increments of 5 decibels (dB), ranging from DNL 65 to 80. Figure 3-2 shows noise contours based on current operations at Volk Field ANGB. Additional information on noise methodology is contained in Appendix C of this report.

Table 3-1 shows the off-installation noise exposure within the 65 DNL and greater noise exposure area for aircraft operations at Volk Field ANGB in terms of acreage and estimated population. The population data used in preparing this estimate was obtained from the United States Census Bureau 2000 census.
FIGURE 3-2

Volk Field ANGB
Air Installation Compatible Use Zone
2008 Noise Contours

Legend
- 2008 Noise Contours
- Castle Rock Wayside
- Church
- School
- Runway
- Township of Orange
- County Trunk Highways
- County Line
- Volk Field ANGB Boundary

*DNL- Average Day/Night Level
Data Source: Volk Field ANGB 2007B;
ESRI Streetmap USA
Geographic Reference:
NAD 1983 Wisconsin Stateplane South

No warranty is made by the State/Territory/National Guard Bureau as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data. This map is a "living document," in that it is intended to change as new data become available and is incorporated into the Enterprise GIS database.
Table 3-1. 2008 Area and Population within DNL 65 dB and Greater Noise Exposure Area (Off-Base)

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Acreage</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>286.1</td>
<td>10.0</td>
</tr>
<tr>
<td>70-74</td>
<td>28.9</td>
<td>0.0</td>
</tr>
<tr>
<td>75-79</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>80+</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>315.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

To estimate affected population, it was assumed that population was equally distributed within a census tract area. Using this assumption, the total acreage and population in each census tract surrounding Volk Field ANGB was collected and assessed. Using the noise contour information, the number of acres of land in each noise zone was divided by the number of acres of land in each census tract to determine what portion of the census tract was contained within each noise zone. Within Juneau County, “average residence size” is 2.5 persons per residence. The population total in each block-group was then multiplied by this ratio to estimate population exposed to aircraft noise at and above 65 DNL.

As shown in Table 3-1, a total of 315.05 acres and 10 people are expected to be in the off-installation area within the 65 DNL and greater noise exposure areas all of whom are anticipated to be within the DNL 65–69 DNL noise zone extending to the west of the base. This area is estimated to contain 286 acres in off-base land area (90.8 percent of the total) and an estimated population of 10 persons based on the calculated population densities for the area.

Noise contours presented in this study differ in both shape and extent of coverage when compared to the noise contours generated for the 2001 AICUZ Study. Figure 3-3 depicts the 2001 AICUZ Study contours and 2008 contours. The overall exposure for this 2008 update AICUZ Study is approximately 247 acres less than that determined from the 2001 AICUZ Study. Table 3-2 lists the total noise exposure for the four noise zones in each study. The decrease in noise exposure since the 2001 AICUZ Study is attributed to the decrease in the number of aircraft operations.
Volk Field ANGB
Air Installation Compatible Use Zone
2001 and 2008 Noise Contours
Table 3-2. Comparison between 2001 and 2008 AICUZ Study Noise Zone Exposure

<table>
<thead>
<tr>
<th>Noise Level</th>
<th>Year 2001 (Acres)</th>
<th>Year 2008 (Acres)</th>
<th>Percent (%)</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>472.4</td>
<td>286.1</td>
<td>-39.4</td>
<td>-186.3</td>
</tr>
<tr>
<td>70-74</td>
<td>87.9</td>
<td>28.9</td>
<td>-67.1</td>
<td>-59.0</td>
</tr>
<tr>
<td>75-79</td>
<td>1.5</td>
<td>0.0</td>
<td>-155.0</td>
<td>-1.5</td>
</tr>
<tr>
<td>80+</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>561.8</td>
<td>315.0</td>
<td>-43.9</td>
<td>-246.8</td>
</tr>
</tbody>
</table>

3.4 Height Restrictions and Runway Airspace Imaginary Surfaces

3.4.1 Height Restriction

FAA and DoD have identified height restrictions to prevent man-made structures from being built in the flight path of or otherwise obstruct aircraft using airports (see Height and Obstructions Criteria in Appendix D). DoD obstruction criteria in Unified Facilities Criteria (UFC) 3-260-01 are based on those contained in FAR Part 77, Objects Affecting Navigable Airspace, Subpart C. As aircraft approach and depart from airports, the building height restriction exists along a diagonal line that gets farther from the ground as distance from the airport increases. The height and obstructions criteria reflect that and allow taller structures as distance from the airport increases.

Restrictions exist in a three-mile radius around Volk Field ANGB where height limitations can be imposed on buildings to ensure that they do not pose a danger to aviation. Any development which meets certain criteria, mostly related to height or transmitting radio frequencies, which could have an effect on the operation of the airfield must submit an application to the Air Force and FAA. There are also restrictions placed in state law. The basic trigger for review is a structure of a certain height above average grade – 200 feet in Federal law, and 150 feet in state law – that requires some form of permit. Any zoning changes, within the three-mile limit around the airfield, must be reviewed by airfield authorities and subsequent changes must be approved by a two-thirds majority of the governing body (Town of Orange 2006).
3.4.2 Runway Airspace Imaginary Surfaces

Runway airspace imaginary surfaces, in graphical form, are the result of the application of obstruction height criteria to Volk Field ANGB. Imaginary surfaces are surfaces in space around airfields in relation to runways. The surfaces are designed to define the obstacle-free airspace at and around the airfield. Obstructions to air navigation are considered to be:

- Natural objects or man-made structures that protrude above the planes or imaginary surfaces, and/or;
- Man-made objects that extend more than 200 feet AGL at the site of the structure.

Refer to UFC 3-260-01, Airfield and Heliport Planning and Design, for a more complete description of runway airspace imaginary surfaces for Class B runways. Figure 3-4 depicts the runway airspace imaginary surfaces for the Volk Field ANGB Class B runways. The following paragraphs contain definitions of the obstacle-free runway airspace imaginary surfaces for Air Force class B runways:

**Primary Surface**—An imaginary surface symmetrically centered on the runway, extending 200 feet beyond each runway end that defines the limits of the obstruction clearance requirements in the vicinity of the landing area. The width of the primary surface is 2,000 feet, or 1,000 feet on each side of the runway centerline.

**Approach-Departure Clearance Surface**—This imaginary surface is symmetrically centered on the extended runway centerline, beginning as an inclined plane (glide angle) 200 feet beyond each end of the primary surface, and extending for 50,000 feet. The slope of the approach-departure clearance surface is 50:1 until it reaches an elevation of 500 feet above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 feet from the starting point. The width of this surface at the runway end is 2,000 feet, flaring uniformly to a width of 16,000 feet at the end point.
Volk Field ANGB
Air Installation Compatible Use Zone
Runway Airspace Imaginary Surfaces

Legend
- Airfield Imaginary Surface
- Castle Rock Wayside
- Church
- School
- Runway
- Township of Orange
- County Trunk Highways
- County Line
- Volk Field ANGB Boundary

Data Source: Department of Defense; ESRI Streetmap USA
Geographic Reference: NAD 1983 Wisconsin Stateplane South

0 6,000 12,000 Feet

A. Primary Surface  E. Inner Horizontal Surface
B. Clear Zone Surface  F. Conical Surface
C. Approach/Departure  G. Outer Horizontal Surface
   Clearance Surface (Glide Angle)  H. Transitional Surface
D. Approach/Departure  
   Clearance Surface (Horizontal)

FIGURE
3-4
**Inner Horizontal Surface**—This imaginary surface is an oval plane at a height of 150 feet above the established airfield elevation. The inner boundary intersects with the approach-departure clearance surface and the transitional surface. The outer boundary is formed by scribing arcs with a radius of 7,500 feet from the centerline of each runway end and interconnecting these arcs with tangents.

**Conical Surface**—This is an inclined imaginary surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation. The slope of the conical surface is 20:1. The conical surface connects the inner and outer horizontal surfaces.

**Outer Horizontal Surface**—This imaginary surface is located 500 feet above the established airfield elevation and extends outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.

**Transitional Surface**—This imaginary surface extends outward and upward at right angles to the runway centerline and extended runway centerline at a slope of 7:1. The transitional surface connects the primary and the approach-departure clearance surfaces to the inner horizontal, the conical, and the outer horizontal surfaces.

Currently, runway airspace imaginary surfaces for the Volk Field ANGB Class B runways are obstacle-free and comply with UFC 3-260-01, *Airfield and Heliport Planning and Design*.

### 3.5 **Restricted and/or Prohibited Land Uses**

Other existing factors that could be hazardous to aircraft operations include any airborne substance or light emission that would impair visibility, electrical emissions that would interfere with an aircraft’s electronic equipment, bird attractants (e.g. standing water, etc.), or any free-standing structure located in close proximity to an airfield.
The land areas outlined by these criteria should be regulated to prevent uses that might otherwise be hazardous to aircraft operations. The following uses should be restricted and/or prohibited:

- Releases into the air of any substance that would impair visibility or otherwise interfere with the operation of aircraft (e.g., steam, dust, or smoke);
- Light emissions, either direct or indirect (reflective), that would interfere with pilot vision;
- Electrical emissions that would interfere with aircraft communications systems or navigational equipment;
- Uses that would attract birds or waterfowl, including but not limited to, operation of sanitary landfills, waste transfer facilities, maintenance of feeding stations, sand and gravel dredging operations, storm water retention ponds, created wetland areas, or the growing of certain vegetation (FAA Advisory Circular [AC] 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*) (Appendix E); and
- Structures within 10 feet of aircraft approach-departure and/or transitional surfaces.

Currently, the Town of Orange, the Village of Camp Douglas, and Juneau County have no local regulations addressing restricted or prohibited land uses at airports or more specifically, in the vicinity of Volk Field ANGB. However, if new local regulations regarding prohibited or restricted land use are incorporated into local agency development guidelines with respect to aircraft operations and specifically Volk Field ANGB, those guidelines would be incorporated into future Volk Field ANGB AICUZ studies.
SECTION 4
LAND USE COMPATIBILITY GUIDELINES

4.1 INTRODUCTION

The DoD developed the AICUZ program for military airfields to protect aircraft operational capabilities at its installations and to assist local government officials in protecting and promoting the public health, safety, and quality of life (DoDI 4165.57). The goal of the AICUZ program is to promote compatible land-use development around military airfields by providing information on aircraft noise exposure and accident potential and working collaboratively with local agencies.

AICUZ reports describe three basic types of constraints that affect, or result from, flight operations:

- The first constraint involves CZs and APZs based on statistical analysis of past DoD aircraft accidents. DoD analysis has determined that areas immediately beyond the ends of runways and along the approach and departure flight paths have greater potential for aircraft accidents.

- The second constraint involves noise zones based on the DNL metric and the DoD NOISEMAP methodology. Using the NOISEMAP program, which is similar to FAA’s INM, the Air Force produces noise contours showing the noise levels generated by aircraft operations. The AICUZ report contains noise contours plotted in 5 dB increments, ranging from 65 to 80+ DNL.

- The third constraint involves identifying height restrictions, which includes runway airspace imaginary surfaces, to prevent man-made structures from being built in the flight path of or otherwise obstruct aircraft using airports (see Section 4.2).
4.2 LAND USE COMPATIBILITY

Each AICUZ Study contains land-use guidelines. Table 4-1 identifies land uses and possible noise exposure and accident potential combinations for Volk Field

Table 4-1. Noise Levels and Accident Potential Zones Land Use Guidelines

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Accident Potential Zones</th>
<th>Noise Zones (DNL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CZ</td>
<td>APZ I</td>
</tr>
<tr>
<td>Agricultural</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Commercial</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Industrial</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Public</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Recreation</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Residential</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Roads</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Schools &amp; Churches</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Utilities</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Vacant</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Water</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

Notes: • = Compatible; • = Potentially Incompatible; • = Incompatible
Compatible- Land use is compatible with military operations.
Potentially Incompatible- Land use is generally compatible with military operations provide certain provisions are incorporated.
Incompatible- Land use is not compatible with military operations

ANGB. These noise guidelines are essentially the same as those published by the Federal Interagency Committee on Urban Noise in the June 1980 publication, Guidelines for Considering Noise in Land-Use Planning and Control and the U.S. Department of Transportation (DOT) publication, Standard Land Use Coding Manual (SLUCM) (Appendix A, Table A-1).
SECTION 5
LAND USE ANALYSIS

5.1 INTRODUCTION

Land use planning and control is a *dynamic*, rather than a *static* process. The specific characteristics of land use determinants will always reflect, to some degree, the changing conditions of the economic, social, and physical environment of a community, as well as changing public concern. The planning process accommodates this fluidity in which decisions are normally not based on boundary lines, but rather on more generalized area designations.

Counties within the State of Wisconsin are currently participating in the Wisconsin Land Information Program that facilitates the development of land information systems and modernization of land records within the state. The Wisconsin Land Information Board establishes guidelines and acts as statutory authority in a statewide effort to modernize land information data.

Volk Field ANGB and the adjoining Wisconsin National Guard Facility, Camp Williams, are adjacent to the Village of Camp Douglas within the Town of Orange and are located in a very rural area of Juneau County. The Village of Camp Douglas has a population of less than 600 and has only grown by 10 people over the last 20 years. The base is completely located within the Town of Orange, which has a population of 549 and is considered rural.

Improvements in computer technology have enabled the Air Force to more precisely display its flight tracks and noise contours for land use planning purposes. These technical improvements reveal the extent of the Volk Field ANGB region of influence into the counties and surrounding nearby towns.

5.2 EXISTING LAND USE

5.2.1 Juneau County

Existing land use within Juneau County (Figure 5-1) is currently based on land use designations developed by the North Central Wisconsin Regional Planning
FIGURE 5-1

Volk Field ANGB
Air Installation Compatible Use Zone Area Land Use Designations
Commission and are used for the purpose of this Study. Existing land use presented in the figures within this section are generalized into one of the following eight categories developed by the North Central Wisconsin Regional Planning Commission:

- **Residential**: This category includes all types of residential activity, such as single- and multi-family residences and mobile homes, at a density greater than one dwelling unit per acre.
- **Commercial**: This category includes offices, retail, restaurants, and other types of commercial establishments.
- **Industrial**: This category includes manufacturing, warehousing, and other similar uses.
- **Outdoor Recreation**: This category includes land areas designated for recreational activity including parks, wilderness areas and reservations, conservation areas, and areas designated for trails, hikes, camping, etc.
- **Government**: This category includes Volk Field ANGB and the adjoining Wisconsin National Guard Facility, Camp Williams.
- **Open Grassland/Low Density**: This category includes undeveloped land areas, grazing lands and areas with residential activity at densities less than or equal to one dwelling unit per acre.
- **Agriculture/Low Density**: This category includes agricultural areas and areas with residential activity at densities less than or equal to one dwelling unit per acre.
- **Woodlands/Low Density**: This category includes undeveloped woodland areas and areas with residential activity at densities less than or equal to one dwelling unit per acre.
- **Water**: This category includes surface water resources that could be lakes, rivers, streams, or wetlands. These areas are inhabitable.
- **Cranberry Bog**: This category includes cranberry bogs and areas designated for cranberry harvesting activities. It should be noted that at certain locations single-family residences are located between cranberry beds.
5.2.1.1 Town of Orange

The majority of the Town of Orange is devoted to agricultural uses with scattered woodlands. There is an excellent working relationship between the Village of Camp Douglas, the Town of Orange, and Volk Field ANGB. For example, the town has approached the base to have a representative from the base serve on its Land Use Committee. The Town of Orange submitted a resolution on 21 September 2004 in support of maintaining Volk Field ANGB as an active base and a value to the community. The Town of Orange’s Comprehensive Plan had designated the following land use classifications (Town of Orange 2006; Mississippi River Regional Planning Commission 2004; North Central Wisconsin Regional Planning Commission 2008):

- **Residential**: areas recommended for residential development typically consisting of smaller lot sizes;
- **Rural Residential**: areas that are recommended for less dense residential development, consisting of larger minimum lot sizes than the residential category and will also allow a mixture of residential uses, and provide a good transition from more dense development to the rural countryside;
- **Commercial**: areas recommended for commercial development, as well as existing commercial establishments located throughout the town;
- **Industrial**: areas recommended for industrial development, as well as existing industrial areas located throughout the town;
- **Governmental/Public/Institutional**: identifies existing or planned governmental/public/institutional facilities within the town, including recreational facilities;
- **Agricultural Areas**: areas to be preserved for the purpose of general crop farming or the raising of livestock; forestry areas: areas of large woodlands within the town;
- **Transportation Corridors**: the existing road network along with the recommendations for improved and safe traffic movement in the town, including airports and rail facilities, and;
- **Preservation & Open Space**: contains sensitive environmental areas, such as 100-year floodplains as defined by the Federal Emergency Management Agency, Wisconsin Department of Natural Resources wetlands, steep slopes of 12 percent or greater, open water, and could include endangered species habitat or other significant features or areas.
5.2.1.2 Village Camp Douglas

The Village of Camp Douglas is currently developing a comprehensive plan (North Central Wisconsin Regional Planning Commission 2007). Given that the Village of Camp Douglas is located within the boundaries to the Town of Orange, it is probable that land use classifications and descriptions described for the Town of Orange would be similar to those adopted by the Village of Camp Douglas. Subsequent Volk Field ANGB AICUZ studies should include Village of Camp Douglas comprehensive plan information and adopted land use categories.

5.3 CURRENT ZONING

Zoning refers to the division of a municipality into districts and establishment of regulations to govern the use, placement, and size of lots and structures. The exact zoning designation of any parcel of land should be determined through consultation with local planning agencies.

5.3.1 Juneau County

Zoning on a community level has not yet been established in the rural areas of Juneau County, although there are lot size restrictions and building regulations in place. Juneau County does not currently have general zoning; Juneau County does have zoning policies associated with wetlands and shoreline areas. The County’s shoreland zoning regulations apply only to areas within 300 feet of a stream or river, and within 1,000 feet of a pond or lake. The county also takes part in the 1977 Farmland Preservation Program that includes tax relief for farmers who enroll in the program and incentives for local municipalities for local land use and conservation planning (University of Wisconsin 2000). The program is voluntary for farmland owners, but does not prevent the sale of farmland for development. Even though Juneau County has no general zoning, it is still useful to look at surrounding land use classifications as guidelines which are similar to criteria generally embodied in zoning ordinances in order to determine compatible development (Town of Orange 2006).
5.3.1.1 Town of Orange

Currently, the Town of Orange does not have general zoning, either with Juneau County or on its own. Land use classifications within the Town of Orange are not zoning districts and do not have the authority of zoning; however, the preferred land use map and classifications are intended for use as a guidelines when making land use decisions. The Town of Orange has other tools that could be used to implement restrictions on incompatible land use development and include: purchase of land, easements or development rights; subdivision ordinance; mobile/manufactured home restrictions; nuisance regulations; design review for commercial and industrial developments, infrastructure improvements (sewer and water, utilities), road construction and maintenance, and public services (Town of Orange 2006).

5.3.1.2 Village Camp Douglas

Located within the center of the Town of Orange, the Village of Camp Douglas has no general zoning but the authority to provide extraterritorial review of subdivision requests in the town within 1.5 miles of its corporate limits. There is also the potential for extraterritorial zoning to be implemented within this area. To do this, however, requires a lengthy three-step process including:

- creating a joint committee consisting of representatives from the Village and the Town;
- preparing a proposed plan and regulations for the extraterritorial area and submitting it to the Village, which may adopt it as proposed or resubmit the proposal to the joint committee for changes;
- receiving a favorable majority vote from the joint committee on the proposed regulations before the Village can adopt them.

At this time the Village has not expressed any intention to implement extraterritorial zoning authority (Town of Orange 2006).
5.4 FUTURE LAND USE

The Future Land Use Plan for the Town of Orange and Volk Field ANGB areas, as indicated within the Town of Orange Comprehensive Plan, has identified approximately 5,459 acres of land for Agriculture, 6,772 acres of land for Forestry, 3,869 acres of land for Preservation & Open Space, 2,225 acres of land for Government/Public/Institutional development (including Volk Field ANGB), 424 acres in Residential and 1,714 acres for Rural Residential development, and 109 acres in Commercial use (Town of Orange 2006).

Most existing agricultural land is expected to stay in that use, including the cranberry bog at U.S. Route 12 and Belcher Road. Residential clusters are seen along North 6th Avenue near the intersection with County Trunk Highway (CTH) C, West 24th Street and West North Road; along CTH H; and along West 25th Street. Rural residential development is expected to grow around the residential cluster along CTH C and CTH H, and along CTH M near West 30th Street and West Hancock Road, and around the historic settlement of Lone Rock. Other rural residential areas are expected along West Jensen Road, North Keichinger Road, and West 34th Street. Rural residential is expected to stretch along U.S. Route 12 east of Camp Douglas. The wayside rest at Castle Rock and the site of the Old Orange Mill School is shown in governmental/institutional use (Town of Orange 2006).

The most significant change in land use is envisioned for the area west of the Village of Camp Douglas, both along U.S. Route 12 and CTH C, and in the area of West Nelson Valley Road. Here, current commercial and industrial uses exist (namely an auto salvage yard and a local excavating company) and are expected to be redeveloped but will remain as commercial use. This area should be sufficient to accommodate any future commercial demand. Although only 425 acres are set aside for residential use in the Future Land Use Plan, the 2,138 acres of land envisioned for residential and rural residential development more than meets the projected need for residential land through the planning period. The Town of Orange does not see any additional need for land dedicated to industrial or commercial uses in the future, beyond the redevelopment of existing commercial operations (Town of Orange 2006).
5.5 INCOMPATIBLE LAND USES

Most of the land surrounding Volk Field ANGB is currently considered rural with agricultural and open space land uses. For a land use area to be considered compatible, it must meet criteria for its category for accident potential and noise as shown in Table 4-1 and not violate height restrictions or runway airspace imaginary surfaces criteria.

5.5.1 Clear Zones and Accident Potential Zones

Figure 5-2 and Table 5-1 shows existing land use within the vicinity of Volk Field ANGB and CZs and APZs associated with Volk Field ANGB runways.

Table 5-1. Volk Field ANGB Clear Zones, Accident Potential Zones, and Land Use (Acres)

<table>
<thead>
<tr>
<th>Category</th>
<th>Runway 09 (West)</th>
<th></th>
<th></th>
<th>Runway 27 (East)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clear Zone</td>
<td>APZ I</td>
<td>APZ II</td>
<td>Clear Zone</td>
<td>APZ I</td>
<td>APZ II</td>
</tr>
<tr>
<td>Residential</td>
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<td>8.7</td>
<td>5.2</td>
<td>1.7</td>
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<td>Commercial</td>
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<td>0.0</td>
<td>3.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>Industrial</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Government (Volk Field ANGB)</td>
<td>120.8</td>
<td>0.0</td>
<td>0.0</td>
<td>165.6</td>
<td>32.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Recreational</td>
<td>0.0</td>
<td>21.5</td>
<td>1.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Open Grassland Low Density</td>
<td>1.6</td>
<td>65.5</td>
<td>10.0</td>
<td>10.2</td>
<td>11.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Agricultural Low Density</td>
<td>74.7</td>
<td>168.2</td>
<td>178.3</td>
<td>0.0</td>
<td>194.7</td>
<td>179.1</td>
</tr>
<tr>
<td>Woodlands Low Density</td>
<td>9.5</td>
<td>75.2</td>
<td>277.4</td>
<td>29.1</td>
<td>74.7</td>
<td>303.0</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.0</td>
<td>5.3</td>
<td>7.0</td>
<td>0.0</td>
<td>4.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td><strong>206.6</strong></td>
<td><strong>344.4</strong></td>
<td><strong>482.1</strong></td>
<td><strong>206.6</strong></td>
<td><strong>344.4</strong></td>
<td><strong>482.1</strong></td>
</tr>
</tbody>
</table>

5.5.1.1 Runway 09 Clear Zones and Accident Potential Zones

Volk Field ANGB does not have sole ownership of the CZs. Perpetual easements do exist within some of these areas. The southwest corner (1.89 acres) and
northern section (18.87 acres) of the western CZ are not under easement or owned by Volk Field ANGB. Further, land use within this CZ is not compatible with UFC 3-260-01 criteria; however, Volk Field ANGB has obtained the necessary Air Force Airfield waiver.

Residences also exist in the west APZ I within areas primarily used for agriculture. Under SLUCM Section 70, residential units are not recommended in APZ I. These incompatibilities were previously identified in the 1993 and 2001 AICUZ Studies.

Located in the western APZ II is Mill Bluff State Park. Under SLUCM, Section 70, certain recreational activities are compatible but with conditions within APZ II (e.g., meeting areas are of low intensity). Commercial and residential land use also exists within APZ II; further, according to SLUCM guidelines, these two land use designations within APZ II are considered compatible with conditions.

5.5.1.2 Runway 27 Clear Zones and Accident Potential Zones

As noted in the 1993 and 2001 Volk Field ANGB AICUZ studies, incompatible land use currently exists within the eastern CZ with three residences located within the northwest corner of the CZ. Volk Field does not have sole ownership of this CZ. Perpetual easements do exist within some of these areas; however, the northwest, northeast, and southeast corners of the eastern CZ are not under easement or owned by Volk Field ANGB.

Additional incompatible developments currently exist east of Volk Field ANGB in APZ I where several residential structures and Lone Rock Church are located near the intersection of 20th and 34th Streets. Residences also exist in the east APZ I within in areas primarily used for agriculture. Under SLUCM Section 70, residential units are not recommended in APZ I. These incompatibilities were previously identified in the 1993 and 2001 AICUZ studies. All designated land use within eastern APZ II is considered compatible.
5.5.2 Noise Zones

Figure 5-3 and Table 5-2 shows existing land use and noise contours resulting from Volk Field ANGB aircraft operations. The DoD and other Federal agencies use DNL 65 as a land use planning threshold. Additional details of the methodologies used to produce the noise contours are presented in Appendix A.

Table 5-2. Volk Field ANGB Noise Exposure and Land Use Off-base (Acres)

<table>
<thead>
<tr>
<th>Category</th>
<th>Acreage within Noise Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>65-69</td>
</tr>
<tr>
<td>Residential</td>
<td>4.1</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.0</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.0</td>
</tr>
<tr>
<td>Government (State of Wisconsin)</td>
<td>1.4</td>
</tr>
<tr>
<td>Recreational</td>
<td>0.0</td>
</tr>
<tr>
<td>Open Grassland Low Density</td>
<td>70.3</td>
</tr>
<tr>
<td>Agricultural Low Density</td>
<td>148.1</td>
</tr>
<tr>
<td>Woodlands Low Density</td>
<td>59.7</td>
</tr>
<tr>
<td>Transportation</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>286.1</td>
</tr>
</tbody>
</table>

No incompatibilities exist around the Volk Field ANGB airfield as a result of noise exposure. High noise levels are generally confined to areas within the base boundary and areas adjacent to the airfield complex. Four residences currently exist within the 65-to-69 DNL contour located near the north east section of Volk Field ANGB boundary. Residential land use within the 65-to-69 DNL contour is compatible with Noise Compatibility Guidelines if Noise Level Reduction measures have been incorporated to residential construction. However, measures to achieve an overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted. Although local conditions may require residential use, it is discouraged in DNL 65-to-69 dB. An evaluation should be conducted prior to approvals, indicating a demonstrated
Legend

- Agriculture
- Commercial
- Cranberry Bog
- Governmental (Volk Field ANGB)
- Industrial
- Open Grassland
- Outdoor Recreation
- Residential
- Transportation
- Water
- Woodlands

*DNL- Average Day/Night Level

Data Source: North Central Wisconsin Regional Planning Commission 2003; Volk Field ANGB 2007B; ESRI Streetmap USA
Geographic Reference: NAD 1983 Wisconsin Stateplane South

Volk Field ANGB
Air Installation Compatible Use Zone
Noise Contours and Area Land Use Designations

FIGURE 5-3
community need for residential use would not be met if development were prohibited in these zones, and there are no viable alternative locations.

5.5.3 Height Restrictions and Runway Airspace Imaginary Surfaces

Currently, all height restrictions and runway airspace imaginary surfaces associated with Volk Field ANGB airfield comply with Air Force obstruction criteria in Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*. No incompatible objects or structures exceed the given criteria that would result in land use incompatibility.

5.5.4 Land Use Incompatibility

The compatibility guidelines shown in Table 4-1 were combined with the existing land use data presented on Figure 5-1 to determine land use compatibility associated with clear zones, accident potential zones, and noise contours at Volk Field ANGB (Figure 5-4). Height restriction criteria and runway airspace imaginary surface figures are not combined with land use given that height restrictions criteria has not been exceeded or the runway airspace imaginary surfaces compromised. Also for the purpose of this study, land use is restricted to ground cover.

Land use areas to the east of Volk Field ANGB are incompatible with base operations, while land use areas to both the east and west are compatible with base operations but only under specific conditions (e.g., NLR measures incorporated into construction, etc.).

5.5.5 Zoning

As mentioned in Section 5.3, Zoning, no zoning currently exists within Juneau County, the Town of Orange, or the Village of Camp Douglas; however, land use classifications within Juneau County, the Town of Orange, and Village of Camp Douglas are intended for use as a guide when making land use decisions.
Regarding Volk Field ANGB, restrictions exist in a 3-mile radius around Volk Field ANGB where height limitations can be imposed on buildings to ensure that they do not pose a danger to aviation. Any development which meets certain criteria, mostly related to height or transmitting radio frequencies, which could have an effect on the operation of the airfield must submit an application to the Air Force and FAA. There are also restrictions placed in state law. The basic trigger for review is a structure of a certain height above average grade – 200 feet in Federal law and 150 feet in state law – that requires some form of permit. Any development, within the 3-mile radius around the airfield, must be reviewed by airfield authorities and subsequent changes must be approved by a two-thirds majority of the governing body (Town of Orange 2006). Essentially, development permits within 3 miles of Volk Field ANGB have restrictions and these restrictions act as zoning regulations around Volk Field ANGB.

5.5.6 Planning Considerations

DoD analysis has determined that the areas immediately beyond the ends of the runways and along the approach and departure flight paths have the highest potential for aircraft accidents. Volk Field ANGB CZs and APZs will remain as located regardless of a significant operational change and would not be a reason for the AICUZ to be amended.

AICUZ noise contours describe the noise characteristics of a specific operational environment and, as such, will change if a significant operational change is made. Should a new mission be established at Volk Field ANGB, adding a larger number of aircraft or different aircraft types, the AICUZ would be amended.

Height restriction and obstacle-free runway airspace imaginary surfaces associated with Volk Field ANGB will remain as located regardless of a significant operational change and would not cause the AICUZ to be amended.

Volk Field ANGB has provided CZ, APZ, noise contour, height restriction, and obstacle-free runway airspace imaginary surfaces information in this study that reflects the most current and accurate depiction of aircraft activities. It is highly
recommended that Juneau County, the Town of Orange, and the Village of Camp Douglas establish long-term zoning ordinances around Volk Field ANGB.
SECTION 6
IMPLEMENTATION

6.1 INTRODUCTION

The implementation of the AICUZ Study must be a joint effort between the Air Force and the adjacent communities. The Air Force’s role is to minimize the impact on the local communities by Volk Field ANGB operations. The role of the communities is to ensure that development in the environs is compatible with accepted planning and development principles and practices.

6.2 AIR FORCE RESPONSIBILITIES

In general, the Air Force perceives its AICUZ responsibilities as encompassing the areas of flying safety, noise abatement, and participation in the land use planning process.

Well maintained aircraft and well trained aircrews do much to assure that aircraft accidents are avoided. Despite the best training of aircrews and maintenance of aircraft, however, history makes it clear that accidents do occur. It is imperative that flights be routed over sparsely populated areas as much as possible to reduce the exposure of lives and property to a potential accident.

By Air Force regulation (AFI 32-7063), commanders are required to periodically review existing traffic patterns, instrument approaches, weather minima, and operating practices, and evaluate these factors in relationship to populated areas and other local situations. This requirement is a direct result and expression of Air Force policy that all AICUZ studies must include an analysis of flying and flying related activities designed to reduce and control the effects of such operations on surrounding land areas. Noise is generated from aircraft both in the air and on the ground. In an effort to reduce the noise effects of Volk Field ANGB operations on surrounding communities, the base restricts nighttime flying activities and has routed flight tracks to avoid populated areas. Practice takeoffs/landings and instrument approaches are conducted at times when individuals are normally awake. These activities are not scheduled between 10:00 PM and 7:00 AM. During this time, only mission essential aircraft arrivals
and departures are conducted. Whenever possible, traffic patterns are all located away from population centers, both on and off-base. Base maintenance run-up activities are not performed between 10:00 PM and 7:00 AM, except for high priority mission requirements.

The preparation and presentation of this Volk Field ANGB AICUZ Study is one phase of the continuing Air Force participation in the local planning process. It is recognized that as the local community updates its land use plans, the Air Force must be ready to provide additional inputs.

It is also recognized that the AICUZ program will be an ongoing activity even after compatible development plans are adopted and implemented. Base personnel are prepared to participate in the continuing discussion of zoning and other land use matters as they may affect, or may be affected by, Volk Field ANGB. Base personnel will also be available to provide information, criteria and guidelines to state, regional, and local planning bodies, civic associations, and similar groups.

6.3 LOCAL COMMUNITY RESPONSIBILITIES

Area residents and the personnel at Volk Field ANGB have a long history of working together for mutual benefit. We feel that adoption of the following recommendations will strengthen this relationship, increase the health and safety of the public, and help protect the integrity of the base’s flying mission:

- Incorporate AICUZ policies and guidelines into the comprehensive plans of North Central Wisconsin Regional Planning Commission, Juneau County, the Town of Orange, and the Village Camp Douglas. Use overlay maps of the AICUZ noise contours with the CZs and APZs and Air Force Land Use Compatibility Guidelines to evaluate existing and future land use proposals.

- Modify existing zoning ordinances and subdivision regulations to support the compatible land uses outlined in this study.

- Implement height and obstruction ordinances which reflect current Air Force requirements.
• Modify building codes to ensure that new construction within the AICUZ area has the recommended noise level reductions incorporated into its design and construction.

• Continue to inform Volk Field ANGB of planning and zoning actions that have the potential of affecting base operations. Develop a working group representing city, county, and base personnel to meet at least quarterly to discuss AICUZ-related concerns and development proposals that could affect or be affected by airfield operations.
SECTION 7
REFERENCES


DoD. 2006. United Facilities Criteria (UFC) 3-260-01 Airfield and Heliport Planning and Design. 19 May.


Volk Field ANGB. 2001. Air Installation Compatible Use Zone Study, Volk Field ANGB. June.
Volk Field ANGB. 2007a. Personal communication with the following Volk Field ANGB personnel: LTC Brendan Smith, Director of Operations; Capt. Bart Van Roo, Range Training Officer; SMSgt Gregory Cullen, Airfield Manager; and MSgt Wayne Reynolds, Air Traffic Manager.


APPENDIX A
AICUZ PROGRAM
APPENDIX A
THE AICUZ CONCEPT, PROGRAM, METHODOLOGY, AND POLICIES

A.1 INTRODUCTION

The Department of Defense (DoD) developed the Air Installation Compatible Use Zone (AICUZ) program for military airfields. Using this program, DoD works to protect aircraft operational capabilities at its installations and to assist local government officials in protecting and promoting public health, safety, and quality of life. The program goal is to promote compatible land use development around military airfields by providing information on aircraft noise exposure and accident potential.

AICUZ reports describe three basic types of constraints that affect, or result from, flight operations. The first constraint involves areas the Federal Aviation Administration (FAA) and DoD have identified for height restrictions (see Height and Obstructions Criteria in Appendix D). United States Air Force (USAF) obstruction criteria are based on those contained in Federal Aviation Regulation Part 77, Subpart C.

The second constraint involves accident potential zones (APZs) based on statistical analysis of past DoD aircraft accidents. DoD analysis has determined that the areas immediately beyond the ends of runways and along the approach and departure flight paths have relatively significant potential for aircraft accidents. Based on this analysis, DoD developed three zones that have high relative potential for accidents. The clear zone (CZ), the area closest to the runway end, is the most hazardous. The overall risk is so high that DoD generally acquires the land through purchase or easement to prevent development. APZ I is an area beyond the CZ that possesses a significant potential for accidents. APZ II is an area beyond APZ I having lesser, but still significant, potential for accidents. While aircraft accident potential in APZs I and II does not warrant acquisition by the USAF, it strongly encourages local communities to use land use planning and controls in these areas to protect the public.
The third constraint involves noise zones (NZs), depictions of which are generated by the computerized Day-Night Average A-Weighted Sound Level (DNL) and DoD NOISEMAP methodologies. Using the USAF NOISEMAP 7.0 computer program, similar to FAA's Integrated Noise Model but specific to military aircraft, DoD produces noise contours showing the noise levels generated by current aircraft operations. The AICUZ report contains noise contours plotted in increments of 5 decibels (dB), ranging from DNL 65 to DNL 85. Additional information on noise methodology is contained in Noise Appendix C of this report.

A.2 CONCEPT

Federal legislation, national sentiment, and other external forces, which directly affect the USAF mission have served to greatly increase the USAF role in environmental and planning issues. Problems of airfield encroachment from incompatible land uses surrounding installations, as well as air and water pollution and socioeconomic impact, require continued and intensified USAF involvement. The nature of these problems dictates direct USAF participation in comprehensive community and land use planning. Effective, coordinated planning that bridges the gap between the federal government and the community requires the establishment of good working relationships with local citizens, local planning officials, and state and federal officials. This depends upon creating an atmosphere of mutual trust and helpfulness.

The AICUZ concept has been developed in an effort to:

- Protect local citizens from the noise exposure and accident potential associated with flying activities; and
- Prevent degradation of the Air Force’s capability to achieve its mission by promoting compatible land use planning.

The land use guidelines in this document are a composite of a number of other land use compatibility studies that have been refined to fit the Volk Field Air National Guard Base aviation environment.
A.3 Program

Installation commanders establish and maintain active programs to achieve the maximum feasible land use compatibility between air installations and neighboring communities. The program requires that all appropriate government bodies and citizens be fully informed whenever AICUZ or other planning matters affecting the installation are under consideration. This includes continuous programs designed to:

- Provide information, criteria, and guidelines to federal, state, regional, and local planning bodies, civic associations, and similar groups;
- Inform such groups of the requirements of the flying activity, noise exposure, aircraft accident potential, and AICUZ plans;
- Describe the noise reduction measures that are being used; and
- Ensure that all reasonable, economical, and practical measures are taken to reduce or control the impact of noise-producing activities. These measures include such considerations as proper location of engine test facilities, provision of sound suppressors where necessary, and adjustment of flight patterns and/or techniques to minimize the noise impact on populated areas. This must be done without jeopardizing safety or operational effectiveness.

A.4 Methodology

The AICUZ consists of land areas upon which certain land uses may obstruct the airspace or otherwise be hazardous to aircraft operations and land areas which are exposed to the health, safety, or welfare hazards of aircraft operations. The AICUZ includes:

- APZs and CZs which have been developed based on past USAF aircraft accidents and installation operational data (Appendix B);
- NZs depicted using the NOISEMAP generated DNL metric; and
- Areas designated by the FAA and the USAF for purposes of height limitations in the approach and departure zones of the base (Appendix E).
The APZs, CZs, and NZs are the basic building blocks for land use planning with AICUZ data. Compatible land uses are specified for these zones in Sections A.6 Accident Potential, A.7 Noise Zones, and A.8 Basic Land Use Compatibility.

A.5 AICUZ LAND USE DEVELOPMENT POLICIES

The basis for any effective land use control system is the development of, and subsequent adherence to, policies which serve as the standard by which all land use planning and control actions are evaluated. Volk Field ANGB recommends the following policies be considered for incorporation into the comprehensive plans of agencies in the vicinity of the base.

A.5.1 Policy 1. In order to promote the public health, safety, peace, comfort, convenience, and general welfare of the inhabitants of airfield environs, it is necessary to:

- Guide, control, and regulate future growth and development;
- Promote orderly and appropriate use of land;
- Protect the character and stability of existing land uses;
- Prevent the destruction or impairment of the airfield and the public investment therein;
- Enhance the quality of living in the areas affected; and
- Protect the general economic welfare by restricting incompatible land use.

A.5.2 Policy 2. In furtherance of Policy 1, it is appropriate to:

- Establish guidelines of land use compatibility;
- Restrict or prohibit incompatible land use;
- Prevent establishment of any land use which would unreasonably endanger aircraft operations and the continued use of the airfield;
- Incorporate the AICUZ concept into community land use plans, modifying them when necessary; and
- Adopt appropriate ordinances to implement airfield environs land use plans.
A.5.3 Policy 3. Within the boundaries of the AICUZ, certain land uses are inherently incompatible. The following land uses are not in the public interest and must be restricted or prohibited:

- Uses that release into the air any substance, such as steam, dust, or smoke, which would impair visibility or otherwise interfere with the operation of aircraft;
- Uses that produce light emissions, either direct or indirect (reflective), which would interfere with pilot vision;
- Uses that produce electrical emissions which would interfere with aircraft communication systems or navigation equipment;
- Uses that attract birds or waterfowl, such as operation of sanitary landfills, maintenance or feeding stations, or growth of certain vegetation; and
- Uses that provide for structures within 10 feet of aircraft approach-departure and/or transitional surfaces.

A.5.4 Policy 4. Certain noise levels of varying duration and frequency create hazards to both physical and mental health. A limited, though definite, danger to life exists in certain areas adjacent to airfields. Where these conditions are sufficiently severe, it is not consistent with public health, safety, and welfare to allow the following land uses:

- Residential;
- Retail business;
- Office buildings;
- Public buildings (schools, churches, etc.); and
- Recreation buildings and structures.

A.5.5 Policy 5. Land areas below takeoff and final approach flight paths are exposed to significant danger of aircraft accidents. The density of development and intensity of use must be limited in such areas.

A.5.6 Policy 6. Different land uses have different sensitivities to noise. Standards of land use acceptability should be adopted, based on these noise sensitivities. In addition, a system of Noise Level Reduction (NLR) guidelines for new construction should be implemented to permit certain uses where they would otherwise be prohibited.
A.5.7 Policy 7. Land use planning and zoning in the airfield environs cannot be based solely on aircraft-generated effects. Allocation of land used within the AICUZ should be further refined by consideration of:

- Physiographic factors;
- Climate and hydrology;
- Vegetation;
- Surface geology;
- Soil characteristics;
- Intrinsic land use capabilities and constraints;
- Existing land use;
- Land ownership patterns and values;
- Economic and social demands;
- Cost and availability of public utilities, transportation, and community facilities; and
- Other noise sources.

A.6 ACCIDENTAL POTENTIAL

Land use guidelines in the airfield vicinity are based on a hazard index system which compares the relationship of accident occurrence for five areas:

- On or adjacent to the runway;
- Within the CZ;
- In APZ I;
- In APZ II; and
- In all other areas within a 10 nautical mile radius of the runway.

Accident potential on or adjacent to the runway or within the CZ is so high that few uses are acceptable. The risk outside APZ I and APZ II, but within the 10 nautical mile radius area, is significant, but is acceptable if sound planning practices are followed.

Land use guidelines for APZs I and II have been developed. The main objective has been to restrict all people-intensive uses because there is greater risk in these areas. The basic guidelines aim to prevent uses that:
• Have high residential density characteristics;
• Have high labor intensity;
• Involve above-ground explosive, fire, toxic, corrosive, or other hazardous characteristics;
• Promote population concentrations;
• Involve utilities and services required for area-wide populations, where disruption would have an adverse impact (e.g., telephone, gas, etc.);
• Concentrate people who are unable to respond to emergency situations (e.g., such as children, elderly, handicapped, etc.) and/or
• Pose hazards to aircraft operations.

There is no question that these guidelines are relative. Ideally, there should be no people-intensive uses in either of the APZs. However, free market and private property systems prevent this where there is land development demand. To go beyond these guidelines, however, substantially increases risk by placing more people in areas where there may ultimately be an aircraft accident.

A.7 NOISE ZONES

Nearly all studies analyzing aircraft noise and residential compatibility recommend no residential uses in noise zones above DNL 75 dB. Usually, no restrictions are recommended below noise zone DNL 65 dB. Between DNL 65-74 dB there is currently no consensus. These areas may not qualify for Federal mortgage insurance in residential categories according to United States (US) Department of Housing and Urban Development (HUD) Regulation 24 Code of Federal Regulations § 51B. In many cases, HUD approval requires noise attenuation measures, the Regional Administrator’s concurrence, and an Environmental Impact Statement. The Department of Veterans Affairs also has airfield noise and accident restrictions which apply to their home loan guarantee program. Air Force land use recommendations also state that whenever possible residential land use should be located below DNL 65 dB.

Most industrial/manufacturing uses are compatible in the airfield environs. Exceptions are uses such as research or scientific activities which require lower
noise levels. Noise attenuation measures are recommended for portions of buildings devoted to office use, receiving the public, or where there is a requirement for low background noise levels.

*Transportation, communications, and utility* categories have higher noise level compatibility because they generally are not people-intensive. When people use land for these purposes, the use is generally very short in duration. However, when buildings are required for these uses, additional evaluation is warranted.

The *commercial/retail trade and personal and business services* categories are compatible without restriction up to DNL 70 dB. However, they are generally incompatible above DNL 80 dB. Between DNLs 70-80 dB, noise level reduction measures should be included in the design and construction of buildings.

The nature of most uses in the *public and quasi-public services* category requires a quieter environment, and attempts should be made to locate these uses below DNL 65 dB (an USAF land use recommendation), or else provide adequate noise level reduction.

Although *recreational* use has often been recommended as compatible with high noise levels, recent research has resulted in a more conservative view. Above DNL 75 dB, noise becomes a factor which limits the ability to enjoy such uses. Where the requirement to hear is a function of the use (i.e., music shell, etc.), compatibility is limited. Buildings associated with golf courses and similar uses should be noise attenuated.

*Forestry activities, livestock farming*, uses in the *resources production, extraction, and open space* categories are compatible almost without restrictions within all NZs.

**A.8 Basic Land Use Compatibility**

Each runway end at Volk Field ANGB has a 3,000 foot by 3,000 foot CZ and two APZs (AICUZ Study, Section 3.2). Accident potential on or adjacent to the runway or within the CZ is so high that the necessary land use restrictions would prohibit reasonable economic use of land. As stated previously, it is USAF policy to request Congress to authorize and appropriate funds for acquisition of the
necessary real property interests in CZs to prevent incompatible land uses. At Volk Field ANGB, CZ areas extend off base and land use control over these areas should be achieved either fee simple or through restrictive easements.

APZ I is less critical than the CZ, but still possesses a significant risk factor. This 3,000 foot by 5,000 foot area has land use compatibility guidelines which are sufficiently flexible to allow reasonable economic use of the land, such as industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agriculture. However, uses that concentrate people in small areas are not recommended.

APZ II is less critical than APZ I, but still possesses potential for accidents. APZ II, is 3,000 feet wide by 7,000 feet long, extending to 15,000 feet from the runway threshold when added to the CZ and APZ I. Acceptable uses in APZ II include those of APZ I, as well as low density single family residential and personal and business services and commercial/retail trade uses of low intensity or scale of operation. High density functions such as multistory buildings, places of assembly (e.g., theaters, churches, schools, restaurants, etc.), and high density office uses are not considered appropriate.

High densities of people should be limited to the maximum extent possible. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in APZ II is one dwelling per acre. For most nonresidential usage, buildings should be limited to one story and the lot coverage should not exceed 20 percent.

Research on aircraft accident potential, noise, and land use compatibility is ongoing at a number of federal and other agencies. The guidelines in this document and all other compatibility guidelines must not be considered inflexible standards. They are the framework within which land use compatibility questions can be addressed and resolved. In each case, full consideration must be given to local conditions such as:

- Previous community experience with aircraft accidents and noise;
- Local building construction and development practices;
• Existing noise environment due to other urban or transportation noise sources;
• Time period of aircraft operations and land use activities;
• Specific site analysis; and
• Noise buffers or concentrators, including topography.

These basic guidelines cannot resolve all land use compatibility questions, but they do offer a reasonable framework within which to work.

Each AICUZ report contains land use guidelines. Table A-1 lists all combinations of noise exposure and accident potential at Volk Field ANGB, showing land uses that are compatible or incompatible with each. Noise guidelines are essentially the same as those published by the Federal Interagency Committee on Urban Noise in the June 1980 publication *Guidelines for Considering Noise in Land Use Planning and Control*. The US Department of Transportation, Federal Highway Administration publication, *Standard Land Use Coding Manual (SLUCM)* has been used for identifying and coding land use activities.

**A.9 PARTICIPATION IN THE PLANNING PROCESS**

As local communities prepare their land use plans, the Air National Guard must be ready to provide additional inputs. The Base Civil Engineer has been designated as the official liaison with the local community on all planning matters. This office is prepared to participate in the continuing discussion of zoning and other land use matters as they may affect, or be affected by, Volk Field ANGB.
### Table A-1. Land Use Compatibility

<table>
<thead>
<tr>
<th>SLUCM NO.</th>
<th>NAME</th>
<th>LAND USE</th>
<th>ACCIDENT POTENTIAL ZONES</th>
<th>NOISE ZONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Household units</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.11</td>
<td>Single units; detached</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>11.12</td>
<td>Single units; semidetached</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>11.13</td>
<td>Single units; attached row</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11.21</td>
<td>Two units; side-by-side</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>11.22</td>
<td>Two units; one above the</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>11.31</td>
<td>Apartments; walk up</td>
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<td></td>
</tr>
<tr>
<td>11.32</td>
<td>Apartments; elevator</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Group quarters</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Residential hotels</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Mobile home parks or courts</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Transient lodgings</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>Other residential</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Manufacturing</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Food &amp; kindred products; manufacturing</td>
<td></td>
<td>N</td>
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<td>22</td>
<td>Textile mill products; manufacturing</td>
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<td></td>
</tr>
<tr>
<td>23</td>
<td>Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing</td>
<td></td>
<td>N</td>
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</tr>
<tr>
<td>24</td>
<td>Lumber and wood products (except furniture); manufacturing</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Furniture and fixtures; manufacturing</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Paper &amp; allied products; manufacturing</td>
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<td>N</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Printing, publishing, and allied industries</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Chemicals and allied products; manufacturing</td>
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<td>29</td>
<td>Petroleum refining and related industries</td>
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<td>N</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Manufacturing</td>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Rubber and misc. plastic products, manufacturing</td>
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</tr>
<tr>
<td>32</td>
<td>Stone, clay and glass products manufacturing</td>
<td></td>
<td>N</td>
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<tr>
<td>33</td>
<td>Primary metal industries</td>
<td></td>
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<tr>
<td>34</td>
<td>Fabricated metal products; manufacturing</td>
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<table>
<thead>
<tr>
<th></th>
<th>CLEAR ZONE</th>
<th>APZ I</th>
<th>APZ II</th>
<th>65-69 dB</th>
<th>70-74 dB</th>
<th>75-79 dB</th>
<th>80+ dB</th>
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<tr>
<td>10</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>11</td>
<td>Household units</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.11</td>
<td>Single units; detached</td>
<td></td>
<td>Y</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
<td>N</td>
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<tr>
<td>11.12</td>
<td>Single units; semidetached</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
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<td>N</td>
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<tr>
<td>11.13</td>
<td>Single units; attached row</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
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<tr>
<td>11.21</td>
<td>Two units; side-by-side</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
<td>N</td>
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<tr>
<td>11.22</td>
<td>Two units; one above the other</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
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<td>N</td>
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<tr>
<td>11.31</td>
<td>Apartments; walk up</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
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<td>N</td>
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<tr>
<td>11.32</td>
<td>Apartments; elevator</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
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<td>N</td>
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<tr>
<td>12</td>
<td>Group quarters</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
<td>N</td>
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<tr>
<td>13</td>
<td>Residential hotels</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>14</td>
<td>Mobile home parks or courts</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
<td>N</td>
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<td>15</td>
<td>Transient lodgings</td>
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<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>C&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
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<tr>
<td>16</td>
<td>Other residential</td>
<td></td>
<td>N</td>
<td>A&lt;sup&gt;11&lt;/sup&gt;</td>
<td>B&lt;sup&gt;11&lt;/sup&gt;</td>
<td>N</td>
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<td></td>
<td>N</td>
<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>21</td>
<td>Food &amp; kindred products; manufacturing</td>
<td></td>
<td>N</td>
<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>22</td>
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<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing</td>
<td></td>
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<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Paper &amp; allied products; manufacturing</td>
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<td>Y&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sup&gt;&lt;/sup&gt;</td>
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<td>27</td>
<td>Printing, publishing, and allied industries</td>
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<td>N</td>
<td>Y&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sup&gt;&lt;/sup&gt;</td>
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<td>28</td>
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<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Petroleum refining and related industries</td>
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<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Rubber and misc. plastic products, manufacturing</td>
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<td>N</td>
<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>32</td>
<td>Stone, clay and glass products manufacturing</td>
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<td>N</td>
<td>N&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Y</td>
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<td>Y&lt;sup&gt;Y&lt;sub&gt;13&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Primary metal industries</td>
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<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>Fabricated metal products; manufacturing</td>
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<td>Y&lt;sup&gt;Y&lt;sub&gt;12&lt;/sub&gt;&lt;/sup&gt;</td>
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<td>CLEAR ZONE</td>
<td>APZ I</td>
<td>APZ II</td>
<td>65-69 dB</td>
<td>70-74 dB</td>
<td>75-79 dB</td>
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<td>Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks manufacturing</td>
<td>N N N²</td>
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<td>A</td>
<td>B N</td>
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<td>Miscellaneous manufacturing</td>
<td>N Y² Y²</td>
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<td>Y¹²</td>
<td>Y¹³</td>
<td>Y¹⁴</td>
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<td>Transportation, communications and utilities</td>
<td>N³ Y⁴ Y</td>
<td>Y</td>
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<td>Y¹³</td>
<td>Y¹⁴</td>
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<tr>
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<td>Railroad, rapid rail transit and street railroad transportation</td>
<td>N³ Y³ Y</td>
<td>Y</td>
<td>Y¹²</td>
<td>Y¹³</td>
<td>Y¹⁴</td>
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<td>Motor vehicle transportation</td>
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<td>Y</td>
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<td>Aircraft transportation</td>
<td>N³ Y⁴ Y</td>
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<td>Y¹²</td>
<td>Y¹³</td>
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<td>Marine craft transportation</td>
<td>N³ Y⁴ Y</td>
<td>Y</td>
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<td>Y¹³</td>
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<td>N³ Y³ Y</td>
<td>Y</td>
<td>Y¹²</td>
<td>Y¹³</td>
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<td>Automobile parking</td>
<td>N³ Y⁴ Y</td>
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<td>Y¹²</td>
<td>Y¹³</td>
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<td>N³ Y⁴ Y</td>
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<td>Y¹³</td>
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<td>Utilities</td>
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<td>Y¹³</td>
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<td>Wholesale trade</td>
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<td>Y¹³</td>
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<td>Retail trade-building materials, hardware and farm equipment</td>
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<td>Y¹³</td>
<td>Y¹⁴</td>
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<td>53</td>
<td>Retail trade-general merchandise</td>
<td>N N² Y²</td>
<td>Y</td>
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<td>B N</td>
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<td>54</td>
<td>Retail trade-food</td>
<td>N N² Y²</td>
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<td>A</td>
<td>B N</td>
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<tr>
<td>55</td>
<td>Retail trade-automotive, marine craft, aircraft and accessories</td>
<td>N Y² Y²</td>
<td>Y</td>
<td>A</td>
<td>B N</td>
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<td>56</td>
<td>Retail trade-apparel and accessories</td>
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<td>B N</td>
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<td>Retail trade-furniture, home furnishings and equipment</td>
<td>N N² Y²</td>
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<td>A</td>
<td>B N</td>
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<td>58</td>
<td>Retail trade-eating and drinking establishments</td>
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<td>B N</td>
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<td>59</td>
<td>Other retail trade</td>
<td>N N² Y²</td>
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<td>B N</td>
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<td>Services</td>
<td>N N Y⁶</td>
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<td>B N</td>
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<td>61</td>
<td>Finance, insurance and real estate services</td>
<td>N N Y⁶</td>
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<td>A</td>
<td>B N</td>
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<td>Personal services</td>
<td>N Y⁷ Y⁷</td>
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<td>Cemeteries</td>
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<td>Y</td>
<td>Y¹²</td>
<td>Y¹³</td>
<td>Y¹⁴,2¹</td>
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<td>Business services</td>
<td>N Y⁸ Y⁸</td>
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<td>A</td>
<td>B N</td>
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<td>Repair services</td>
<td>N Y² Y²</td>
<td>Y</td>
<td>Y¹²</td>
<td>Y¹³</td>
<td>Y¹⁴</td>
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<td>65</td>
<td>Professional services</td>
<td>N N Y⁶</td>
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<td>A</td>
<td>B N</td>
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Table A-1. Land Use Compatibility (continued)

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<td>LAND USE</td>
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<td>Hospitals, nursing homes</td>
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<td>66</td>
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<td>Contract construction services</td>
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<td>67</td>
<td>Governmental services</td>
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<td>68</td>
<td>Educational services</td>
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<td>Other medical facilities</td>
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<td>Contract construction services</td>
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<td>69</td>
<td>Miscellaneous services</td>
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<td>N</td>
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<td>Cultural, entertainment and recreational</td>
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<td>Cultural activities (including churches)</td>
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<td>Nature exhibits</td>
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<td>Public assembly</td>
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<td>Auditoriums, concert halls</td>
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<td>Outdoor music shell, amphitheaters</td>
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<td>Outdoor sports arenas, spectator sports</td>
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<td>73</td>
<td>Amusements</td>
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<td>Recreational activities (including golf courses, riding stables, water recreation)</td>
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<td>75</td>
<td>Resorts and group camps</td>
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<td>76</td>
<td>Parks</td>
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<td>Y*</td>
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<td>Other cultural, entertainment and recreation</td>
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<td>Resources production and extraction</td>
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<td>Livestock farming and animal breeding</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>82</td>
<td>Agricultural related activities</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>83</td>
<td>Forestry activities and related services</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>84</td>
<td>Fishing activities and related services</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>85</td>
<td>Mining activities and related services</td>
<td>N</td>
<td>Y*</td>
</tr>
<tr>
<td>89</td>
<td>Other resources production and extraction</td>
<td>N</td>
<td>Y*</td>
</tr>
</tbody>
</table>
LEGEND

Y - (Yes) - Land uses and related structures are compatible without restriction.
N - (No) - Land use and related structures are not compatible and should be prohibited.
Yx - (yes with restrictions) - Land use and related structures generally compatible; see notes indicated by the superscript.
Nx - (no with exceptions) - See notes indicated by the superscript.
NLR - NLR (outdoor to indoor) to be achieved through incorporation of noise attenuation measures into the design and construction of the structures.
A, B, or C - Land use and related structures generally compatible; measures to achieve NLR for A (DNL / 65-69), B (DNL / 70-74), C (DNL / 75-79), need to be incorporated into the design and construction of structures.
A*, B*, and C* - Land use generally compatible with NLR. However, measures to achieve an overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted. See appropriate footnotes.
* - The designation of these uses as 'compatible' in this zone reflects individual federal agencies' and program considerations of general cost and feasibility factors, as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

NOTES

1. Suggested maximum density of 1-2 dwelling units per acre, possibly increased under a Planned Unit Development where maximum lot coverage is less than 20 percent.
2. Within each land use category, uses exist where further deliberating by local authorities may be needed due to the variation of densities in people and structures. Shopping malls and shopping centers are considered incompatible use in any accident potential zone (CZ, APZ I, or APZ II).
3. The placement of structures, buildings, or aboveground utility lines in the clear zone is subject to severe restrictions. In a majority of the clear zones, these items are prohibited. See AFI 32-7060 and AFJM 32-8008 for specific guidance.
4. No passenger terminals and no major aboveground transmission lines in APZ I.
5. Factors to be considered: labor intensity, structural coverage, explosive characteristics, and air pollution.
6. Low-intensity office uses only. Meeting places, auditoriums, etc. are not recommended.
7. Excludes chapels.
8. Facilities must be low intensity.
9. Clubhouse not recommended.
10. Areas for gatherings of people are not recommended.
11. Although local conditions may require residential use, it is discouraged in DNL 65-69 dB and strongly discouraged in DNL 70-74 dB. The absence of viable alternative development options should be determined and an evaluation indicating a demonstrated community need for residential use would not be met if development were prohibited in these zones should be conducted prior to approvals.
b) Where the community determines the residential uses must be allowed, measures to achieve outdoor to indoor NLR for DNL 65-69 dB and DNL 70-74 dB should be incorporated into building codes and considered in individual approvals.

c) NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, and design and use of berms and barriers can help mitigate outdoor exposure, particularly from near ground level sources. Measures that reduce outdoor noise should be used whenever practical in preference to measures which only protect interior spaces.

12. Measures to achieve the same NLR as required for facilities in DNL 65-69 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

13. Measures to achieve the same NLR as required for facilities in DNL 70-74 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

14. Measures to achieve the same NLR as required for facilities in DNL 75-79 dB range must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

15. If noise sensitive, use indicated NLR; if not, the use is compatible.

16. No buildings.

17. Land use is compatible provided special sound reinforcement systems are installed.

18. Residential buildings require the same NLR as required for facilities in DNL 65-69 dB range.

19. Residential buildings require the same NLR as required for facilities in DNL 70-74 dB range.

20. Residential buildings are not permitted.

21. Land use is not recommended. If the community decides the use is necessary, personnel should wear hearing protection devices.
APPENDIX B
CLEAR ZONES AND ACCIDENT POTENTIAL ZONES
APPENDIX B
CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

B.1 GUIDELINES FOR ACCIDENT POTENTIAL

Urban areas around airports are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, history makes it clear that accidents are going to occur.

When the Air Installation Compatible Use Zone Program began there were no current comprehensive studies on accident potential. In support of the program, the United States Air Force (USAF) completed a study of USAF accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 percent of the accidents occurred on or adjacent to the runway (1,000 feet to each side of the runway centerline) and in a corridor 3,000 feet wide (1,500 feet on either side of the runway centerline), extending from the runway threshold along the extended runway centerline for a distance of 15,000 feet.

Three zones were established based on crash patterns: The clear zone (CZ), accident potential zone (APZ) I, and APZ II. Each of these is 3,000 feet wide, including 1,500 feet to either side of the runway centerline. The CZ starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The USAF has adopted a policy of acquiring property rights to areas designated as CZs because of the high accident potential. APZ I extends from the CZ an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet to include an area of further reduced although still significant, accident potential.

The USAF’s research work in accident potential was the first significant effort in this subject area since 1952 when the President’s Airport Commission published “The Airport and Its Neighbors,” better known as the “Doolittle Report.” The recommendations of this earlier report were influential in the formulation of the APZ concept.
B.2 ACCIDENT POTENTIAL ANALYSIS

The risk to people on the ground of being killed or injured by aircraft accidents is small. Military aircraft accidents differ from commercial air carrier and general aviation accidents because of the variety of aircraft used, the type of missions, and the number of training flights. In 1973, the USAF performed a service-wide aircraft accident hazard study in order to identify land near airfields with significant accident potential. Accidents studied occurred within 10 nautical miles of airfields and were airfield-related in-flight mishaps.

The study reviewed the 369 major USAF accidents during 1968-1972, and found 61 percent of the accidents were related to landing operations and 39 percent were takeoff related. It also found that 70 percent occurred in daylight, and fighter and/or training aircraft accounted for 80 percent of the accidents.

Since the purpose of the study was to identify accident hazards, the study plotted each of the 369 accidents in relation to the airfield. This plotting found the accidents clustered along the runway and its extended centerline. To further refine this clustering, a tabulation was prepared which described the cumulative frequency of accidents as a function of distance from the runway centerline along the extended centerline. This analysis was done for areas with widths of 2,000, 3,000, and 4,000 total feet (Table B-1).
Table B-1. Accident Location Analysis

<table>
<thead>
<tr>
<th>Length From both Ends of Runway (feet)</th>
<th>Width of Runway Extension (feet)</th>
<th>Percent of Accidents</th>
<th>Cumulative percent of accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,000</td>
<td>3,000</td>
<td>4,000</td>
</tr>
<tr>
<td>On or adjacent to runway (1,000 feet to each side of runway centerline)</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>0 to 3,000</td>
<td>35</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>3,000 to 8,000</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>8,000 to 15,000</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>0 to 3,000</td>
<td>58</td>
<td>62</td>
<td>62</td>
</tr>
<tr>
<td>3,000 to 8,000</td>
<td>66</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>8,000 to 15,000</td>
<td>71</td>
<td>75</td>
<td>77</td>
</tr>
</tbody>
</table>

Figure B-1 indicates that the cumulative number of accidents rises rapidly from the end of the runway to 3,000 feet, rises more gradually to 8,000 feet, then continues at about the same rate of increase to 15,000 feet, where it levels off rapidly. The location analysis also indicates that the optimum width of the safety zones, designed to include the maximum percentage of accidents in the smallest area, is 3,000 feet.

Figure B-1. Distribution of USAF Aircraft Accidents (369 Accidents, 1968-1972)

![Figure B-1](image)

Using the optimum runway extension width (3,000 feet), and the cumulative distribution of accidents from the end of the runway, zones were established...
which minimized the land area included and maximized the percentage of accidents included. The zone dimensions and accidents statistics for the 1968-1972 study are shown in Figure B-2.

**Figure B-2. USAF Aircraft Accident Data (369 Accidents, 1968-1972)**

<table>
<thead>
<tr>
<th>Runway</th>
<th>CZ</th>
<th>APZ I</th>
<th>APZ II</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000'</td>
<td>144 Accidents (39.0%)</td>
<td>29 Accidents (7.9%)</td>
<td>18 Accidents (4.9%)</td>
</tr>
<tr>
<td>5,000'</td>
<td>84 Accidents (22.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7,000'</td>
<td>Other Accidents within 10 Nautical Miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,000'</td>
<td>94 Accidents – 25.4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The original study has been updated to include accidents through September 1995. The updated study now includes 838 accidents during the 1968-1995 period. Using the optimum runway extension width of 3,000 feet, the accident statistics of the updated study are shown in Figure B-3.

**Figure B-3. USAF Aircraft Accident Data (838 Accidents 1968-1995)**

<table>
<thead>
<tr>
<th>Runway</th>
<th>CZ</th>
<th>APZ I</th>
<th>APZ II</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000'</td>
<td>230 Accidents (27.4%)</td>
<td>85 Accidents (10.1%)</td>
<td>47 Accidents (5.6%)</td>
</tr>
<tr>
<td>5,000'</td>
<td>209 Accidents (24.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7,000'</td>
<td>Other Accidents within 10 Nautical Miles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,000'</td>
<td>267 Accidents – 31.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using the designated zones and accident data, it is possible to calculate a ratio of percentage of accidents to area. These ratios indicate the CZ, with the smallest area and the highest number of accidents, has the highest ratio, followed by the runway itself, APZ I, and then APZ II (Table B-2).
Table B-2. Accident-to-Area Ratio

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of Accidents</th>
<th>Accidents per Acre</th>
<th>% Total Area</th>
<th>% Total Accidents</th>
<th>Ratio: Accidents to Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runway Area(^4)</td>
<td>487</td>
<td>209</td>
<td>1 per 2.3</td>
<td>0.183</td>
<td>24.9</td>
</tr>
<tr>
<td>CZ (^1)</td>
<td>413</td>
<td>230</td>
<td>1 per 1.8</td>
<td>0.155</td>
<td>27.4</td>
</tr>
<tr>
<td>APZ I (^2)</td>
<td>689</td>
<td>85</td>
<td>1 per 8.1</td>
<td>0.258</td>
<td>10.1</td>
</tr>
<tr>
<td>APZ II (^2)</td>
<td>964</td>
<td>47</td>
<td>1 per 20.5</td>
<td>0.362</td>
<td>5.6</td>
</tr>
<tr>
<td>Other (^2)</td>
<td>264,053</td>
<td>267</td>
<td>1 per 989.</td>
<td>99.042</td>
<td>31.9</td>
</tr>
</tbody>
</table>

\(^1\) Area includes land within 10 nautical miles of runway (266,606 acres).
\(^2\) Total number of accidents is 838 (through 1995).
\(^3\) Percent total accidents divided by percent total area.
\(^4\) Runway dimension is 2,000’ X 10,600’.

B.3 Definable Debris Impact Areas

The USAF also determined which accidents had definable debris impact areas, and in what phase of flight the accident occurred. Overall, 75 percent of the accidents had definable debris impact areas, although they varied in size by type of accident.

The USAF study used weighted averages of impact areas, for accidents occurring only in the approach and departure phase, to determine the following average impact areas: the overall average impact area is 5.06 acres, the fighter, trainer, and misc. aircraft is 2.73 acres, and the heavy bomber and tanker aircraft is 8.73 acres.

B.4 Findings

- Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public’s exposure to safety hazards.
- USAF accident studies have found that aircraft accidents near USAF installations occurred in the following patterns:
  - 61% were related to landing operations.
  - 39% were related to takeoff operations.
  - 70% occurred in daylight.
♦ 80% were related to fighter and training aircraft operations.

♦ 27% occurred on the runway or within an area extending 1,000 feet out from each side of the runway.

♦ 29% occurred in an area extending from the end of the runway to 3,000 feet along the extended centerline and 3,000 feet wide, centered on the extended centerline.

♦ 13% occurred in an area between 3,000 and 15,000 feet along the extended runway centerline and 3,000 feet wide, centered on the extended centerline.

• USAF aircraft accident statistics found 75 percent of aircraft accidents resulted in definable impact areas. The size of the impact areas were:
  ♦ 5.1 acres overall average.
  ♦ 2.7 acres for fighters and trainers.
  ♦ 8.7 acres for heavy bombers and tankers.
APPENDIX C
NOISE
APPENDIX C
NOISE

C.1 GENERAL

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in a rural surrounding, where noise from interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

Sound is a physical phenomenon consisting of minute vibrations, which travel through a medium such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., aircraft noise) depends largely on the listener’s current activity, past experience, and attitude toward the source of that sound. It is often true that one person’s music is another person’s noise.

The measurement and human perception of sound involves two basic physical characteristics – intensity and frequency. Intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The higher the sound’s pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.

The loudest sounds which can be detected comfortably by the human ear, have intensities that are 1 trillion times higher than those of sound that can not be detected by humans. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.
A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above about 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Because of the logarithmic nature of the dB unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound’s intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

\[ 60 \text{ dB} + 60 \text{ dB} = 63 \text{ dB}, \text{ and} \]
\[ 80 \text{ dB} + 80 \text{ dB} = 83 \text{ dB}. \]

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

\[ 60.0 \text{ dB} + 70.0 \text{ dB} = 70.4 \text{ dB}. \]

Because the addition of sound levels behaves differently than that of ordinary numbers, such an addition is often referred to as “dB addition” or “energy addition.” The latter term arises from the fact that what we are really doing when we add dB values is first converting each dB value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its dB equivalent.

An important facet of dB addition arises later when the concept of time-average sound levels is introduced to explain Day-Night Average A-Weighted Sound Level (DNL). Because of the logarithmic units, the time-average sound levels are dominated by the louder levels, which occur during the averaging period. As a simple example, consider a sound level, which is 100 dB and lasts for 30-seconds, followed by a sound level of 50 dB which also lasts for 30-seconds. The time-average sound level over the total 60- second period is 97 dB, not 75 dB.
Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the preferred scientific unit for cps. The normal human ear can detect sounds over a wide range of frequencies. However, not all frequencies in this range are heard equally well by the human ear which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. In measuring community noise, this frequency dependence is taken into account by adjusting the very high and low frequencies to approximate the human ear’s lower sensitivity to those frequencies. This is called “A-weighting” and is commonly used in measurements of community environmental noise.

Sound levels measured using A-weighting are referred to as A-weighted sound levels while sound levels measured without any frequency weighting are referred to as sound levels. However, since most environmental impact analysis documents deal only with A-weighted sound levels, the adjective “A-weighted” is often omitted, and A-weighted sound levels are referred to simply as sound levels. In some instances the author will indicate that the levels have been A-weighted by using the abbreviation dB or dBA, for decibel. As long as the use of A-weighting is understood to be used, there is no difference implied by the terms “sound level” and “A-weighted sound level” or by the units dB and dBA. In this document all sound levels are A-weighted sound levels and the adjective “A-weighted” has been omitted.

Sound levels do not represent instantaneous measurements but rather averages over short periods of time. Two measurement time periods are most common – one second and one-eighth of a second. A measured sound level averaged over one second is called a slow response sound level; one averaged over one-eighth of a second is called a fast response sound level. Most environmental noise studies use slow response measurements, and the adjective “slow response” is usually omitted. It is easy to understand why the proper descriptor “slow response A-weighted sound level” is usually shortened to “sound level” in environmental impact analysis documents.

C.2 Noise Metrics

A “metric” is defined as something “of, involving, or used in measurement.” As used in environmental noise analyses, a metric refers to the unit or quantity,
which quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics as individual researchers have attempted to understand and represent the effects of noise. As a result, past literature describing environmental noise abatement has included many different metrics.

Recently, however, various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents, and both the Department of Defense and the Federal Aviation Administration (FAA) have specified those which should be used for federal aviation noise assessments. These metrics are as follows.

**C.2.1 Maximum Sound Level**

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level (ALM) or maximum sound level, for short.

**C.2.2 Sound Exposure Level**

Individual time-varying noise events have two main characteristics - a sound level which changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (SEL) combines both of these characteristics into a single metric.

SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy, as did the actual time-varying noise event. Since aircraft overflights usually last longer than one second, the SEL of an overflight is usually greater than the ALM of the overflight.
Note that SEL is a composite metric, which represents both the intensity of a sound level and its duration. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that SEL measures this impact much more reliably than just the A-weighted sound level.

Because the SEL and the ALM are both A-weighted sound levels expressed in dBs, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

**C.2.3 Day-Night Average A-Weighted Sound Level**

Time-averaged sound levels are measurements of sound levels, which are averaged over a specified length of time. These levels provide a measure of the average sound energy during the measurement period.

For the evaluation of community noise effects, and particularly aircraft noise effects, DNL is used. DNL averages aircraft sound levels at a location over a complete 24-hour period, with a 10 dB adjustment added to those noise events which take place between 10:00 p.m. and 7:00 a.m. (local time). This 10 dB “penalty” represents the added intrusiveness of sounds which occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours.

DNL provides a single measure of overall noise impact, but does not provide specific information on the number of noise events or the individual sound levels, which occur during the day. For example, a DNL of 65 dB could result from a few very noisy events, or many quieter events during the 24-hour period.

As noted earlier for SEL, DNL does not represent the sound level heard at any particular time, but rather represents the total sound exposure. Scientific studies and social surveys, which have been conducted to determine community annoyance to all types of environmental noise, have found DNL to be the best measure of that annoyance. Its use is endorsed by the following scientific communities: American National Standards Institute (1980, 1998); United States
Attitudinal surveys about aircraft noise have been conducted in different countries to find the percentages of groups of people who express various degrees of annoyance when exposed to different levels of DNL. The results of these surveys are remarkably consistent. Synthesis of Social Surveys of Noise Annoyance (Schultz 1978) was published in 1978. A more recent study has reaffirmed the results found in the 1978 study (Fidell et al 1991). In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. Nevertheless, the findings of these and other studies substantiate that community annoyance to aircraft noise is represented quite reliably using DNL.

This relation between community annoyance and time-average sound level also has been confirmed for infrequent aircraft noise events. Community Reactions to Helicopter Noise (Acoust 1991) reported the reactions of individuals in a community to daily helicopter overflights correlated quite well with the daily time-average sound levels over this range of numbers of daily noise events.

The use of DNL has been criticized recently as not accurately representing community annoyance and land-use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the basis for the measurement or calculation of DNL. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to “meaningless” time-average sound levels.

In fact, a time-average noise metric, such as DNL, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the dB unit causes the noise levels of the loudest events to control the 24-hour average.
As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23-hours, 59-minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.5 dB. Assume, as a second example that ten such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23-hours and 55-minutes of the day. The DNL for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-averaged sound metric such as DNL.

C.3 Noise Effects

C.3.1 Hearing Loss

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of (Equivalent Continuous Sound Pressure Level \(L_{EQ}\)) 90 dB over an 8-hour period, or \(L_{EQ}\) 85 dB averaged over a 16-hour period. Even the most protective criterion suggests a time-averaged sound level of DNL 70 dB over a 24-hour period. Since it is unlikely that airport neighbors will remain outside their homes 24-hours per day for extended periods of time, and there is little possibility of hearing loss below a DNL of 75 dB, this protection level is extremely conservative.

C.3.2 Nonauditory Health Effects

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor have never been found to occur at levels below those which protect against noise-induced hearing loss (described in Section C.3.1). Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institute...

The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dB for complete protection against hearing loss for an eight-hour day). At the recent (1988) International Congress on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place. (Von Gierke 1990; parenthetical wording added for clarification.)

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous at best, and often contradictory. In addition, even those studies which purport to find such health effects use time-averaged noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles (UCLA) researchers apparently found a relationship between aircraft noise levels under the approach path to Los Angeles International Airport (LAX) and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the “noise-exposed” population (Meacham et al 1979). Nevertheless, three other UCLA professors analyzed those same data and found no relation between noise exposure and mortality rates (Frericks et al 1980).

As a second example, two other UCLA researchers used this same population near LAX to show a higher rate of birth defects in 1970-1972 when compared
with a control group residing away from the airport (Jones et al 1978). Based on this report, a separate group at the United States (US) Center for Disease Control performed a more thorough study of populations near Atlanta’s Hartsfield International Airport for 1970-1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds et al 1979).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.

C.3.3 Annoyance

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by USEPA as any negative subjective reaction on the part of an individual or group (USEPA 1972). As noted in the discussion of DNL (Section C.2.3) community annoyance is best measured by that metric.

It is often suggested that a lower DNL, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for airport environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a DNL of 65 dB:

1. Provides a valid basis for comparing and assessing community noise effects;
2. Represents a noise exposure level which is normally dominated by aircraft noise and not other community or nearby highway noise sources; and
3. Reflects the FAA’s threshold for grant-in-aid funding of airport noise mitigation projects.

The US Department of Housing and Urban Development also established a DNL standard of 65 dB for eligibility for federally guaranteed home loans.

C.3.4 Speech Interference

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities
such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that “whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication” (FICON 1992). A steady A-weighted background sound level of 60 dB will produce 93 percent intelligibility; that of 70 dB will produce 66 percent intelligibility; and that of 75 dB will produce 2 percent intelligibility (Figure C-1 in USEPA 1972).

C.3.5 Sleep Interference

Sleep interference may be measured in either of two ways. “Arousal” represents actual awakening from sleep, while a change in “sleep stage” represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat louder noise level than does a change in sleep stage.

A recent analysis sponsored by the US Air Force summarized 21 published studies concerning the effects of noise on sleep (Pearsons et al 1989). The analysis concluded that a lack of reliable studies in homes, combined with large differences among the results from the various laboratory studies and the limited in-home studies, did not permit development of an acceptable accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced in the home. None of the laboratory studies was of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions.

Nevertheless, some guidance is available in judging sleep interference. The USEPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference (USEPA 1972). Since typical dwelling units provide a sound level reduction of 20 dB, an outdoor noise level of DNL 65 dB would cause minimal interference with sleep.
The FICON (FICON 1992) reviewed the sleep disturbance issue and presented an Air Force-developed sleep disturbance dose-response prediction curve, based on data from Analyses of the Predictability of Noise-Induced Sleep Disturbance (Pearsons et al 1989), as an interim tool for analysis of potential sleep disturbance. This interim curve shows that for an indoor SEL of 65 dB, approximately 15 percent or less of those exposed would be awakened.

C.3.6 Noise Effects on Domestic Animals and Wildlife

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions. Secondary effects may include nonauditory effects similar to those exhibited by humans – stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

There are many scientific studies available regarding the effects of noise on wildlife and some anecdotal reports of wildlife “flight due to noise”. Few of these studies or reports include any reliable measures of the actual noise levels involved.

In the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research council has proposed that protective noise criteria for animals be taken to be the same as for humans (National Academy of Sciences 1977).

C.3.7 Effects of Noise-Induced Vibration on Structures and Humans

The sound from aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some of the energy lost in the
airspace. This surface then radiates sound into the dwelling interior. Vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressure impinging on the structure is normally sufficient to determine the possibility of damage. In general, sound levels above 130 dB (peak sound pressure for window breakage) may be of more concern than other frequencies. Conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Von Gierke et al 1991).

In terms of average acceleration of wall or ceiling vibration, the thresholds for structural damage (International Organization for Standardization [ISO] 1989) are:

- 0.5 m/s/s – threshold of risk of damage to sensitive structures (i.e. ancient monuments); and
- 1.0 m/s/s/ - threshold of risk of damage to normal dwellings (i.e. houses with plaster ceilings and walls).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or “rattle”, of objects within the dwelling – hanging pictures, dishes, plaques, and bric-a-brac. Loose windowpanes may also vibrate noticeably when exposed to high levels of noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally compatible with residential land use. Thus, noise levels compatible for residential land use, i.e. below DNL 65 dB, would not cause significant secondary noise-induced vibrations.

In the assessment of vibrations on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

- Type of excitation: steady state, intermittent, or impulsive vibration;
• Frequency of the excitation. ISO 2631-2 (ISO 1989) recommends a frequency range of 1 to 80 Hz be used for assessing the effect of vibration on humans;
• Orientation of the body with respect to the vibration;
• The use of the occupied space; and
• Time of day.

C.3.8 Noise Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

C.3.9 Noise Effects on Historical and Archaeological Sites

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may effect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde aircraft at Dulles (Wesler 1977). There was a special concern for the building’s windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning.

As noted above for the noise effects of noise-induced vibrations on normal structures, assessments of noise exposure levels for normally compatible land
uses should also assist in protecting historic and archaeological sites from structural damage caused by aircraft noise.
APPENDIX D
HEIGHT AND OBSTRUCTIONS CRITERIA
APPENDIX D
HEIGHT AND OBSTRACTIONS CRITERIA

D.1 HEIGHT AND OBSTRACTIONS CRITERIA

D.1.1 General

This section establishes criteria for determining whether an object or structure is an obstruction to air navigation. Obstructions to air navigation are considered to be:

- natural objects or man-made structures that protrude above the planes or surfaces as defined in the following paragraphs; and/or;
- man-made objects that extend more than 500 feet above the ground at the site of the structure.

D.1.2 Explanation of Terms

The following will apply:

- Controlling Elevation. Whenever surfaces or planes within the obstruction criteria overlap, the controlling (or governing) elevation becomes that of the lowest surface or plane.
- Runway Length. Runway 09/27 at Volk Field Air National Guard Base (ANGB) is 9,000 feet long and 150 feet wide, and was designed and built for sustained aircraft landings and takeoffs.
- Established Airfield Elevation. The established elevation in feet above mean sea level for Volk Field ANGB is 912 feet.
- Dimensions. All dimensions are measured horizontally unless otherwise noted.

For a more complete description of airspace and control surfaces for Class A and Class B runways, refer to Federal Aviation Regulation (FAR) Part 77, Subpart C, or UFC 3-260-01.

D.1.3 Planes and Surfaces

Definitions are as follows:
Primary Surface
- this surface defines the limits of the obstruction clearance requirements in the immediate vicinity of the landing area;
- comprises surfaces of the runway, runway shoulders, and lateral safety zones and extends 200 feet beyond the runway end; and
- for a single class "B" runway, is 2,000 feet wide, or 1,000 feet on each side of the runway centerline.

Clear Zone (CZ) Surface
- this surface defines the limits of the obstruction clearance requirements in the vicinity contiguous to the end of the primary surface; and
- for a single runway end, measures 3,000 feet by 3,000 feet.

Approach-Departure Clearance Surface
- this surface is symmetrical from the extended runway centerline, it begins as an inclined plane (glide angle) 200 feet beyond each runway end, and extends for 50,000 feet; it begins with the centerline elevation of the runway end;
- the slope of the approach-departure clearance surface is 50:1 along the extended runway (glide angle) centerline until it reaches an elevation of 500 feet above the established airfield elevation;
- it then continues horizontally at this elevation to a point 50,000 feet from the start of the glide angle; and
- the width of this surface at the runway end is 2,000 feet; it flares uniformly, and the width at 50,000 feet is 16,000 feet.

Inner Horizontal Surface
- this surface is a plane, oval in shape at a height of 150 feet above the established airfield elevation; and
- is constructed by scribing an arc with a radius of 7,500 feet above the centerline at the end of the runway and interconnecting these arcs with tangents.

Conical Surface
- this is an inclined surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation; and
- the slope of the conical surface is 20:1.

Outer Horizontal Surface
- this surface is a plane located 500 feet above the established airfield elevation; and
• it extends for a horizontal distance of 30,000 feet from the outer periphery of the conical surface.

**Transitional Surfaces**
• these surfaces connect the primary surfaces, CZ surfaces, and approach/departure clearance surfaces to the outer horizontal surface, conical surface, other horizontal surface, or other transitional surfaces;
• the slope of the transitional surface is 7:1 outward and upward at right angles to the runway centerline;
• to determine the elevation for the beginning of the transitional surface slope at any point along the lateral boundary of the primary surface, including the CZ, draw a line from this point to the runway centerline;
• this line will be at right angles to the runway axis; and
• the elevation at the runway centerline is the elevation for the beginning of the 7:1 slope.

The land areas outlined by these criteria should be regulated to prevent uses which might otherwise be hazardous to aircraft operations. The following uses should be restricted and/or prohibited:

• uses which release any substance into the air which would impair visibility or otherwise interfere with the operation of aircraft (i.e., steam, dust, or smoke);
• produce light emissions, either direct or indirect (reflective), which would interfere with pilot vision;
• produce electrical emissions which would interfere with aircraft communications systems or navigational equipment;
• would attract birds or waterfowl, including but not limited to, operation of sanitary landfills, maintenance of feeding stations, sand and gravel dredging operations, storm water retention ponds, created wetland areas, or the growing of certain vegetation; and
• uses that provide for structures within 10 feet of aircraft approach/departure and/or transitional surfaces.

**D.2 HEIGHT RESTRICTIONS**

Village/Town/County agencies involved with approvals of permits for construction should require developers to submit calculations which show that projects meet the height restriction criteria of FAR Part 77 as described, in part, by the information contained in this Section.
Volk Field ANGB, Wisconsin

Airfield Coordinates
- **Airfield Elevation:** 912
- **Navigational Aid:** TACAN  
  43 Degrees 56 Minutes 34.38 Seconds North Latitude  
  90 Degrees 15 Minutes 32.47 Seconds West Longitude
- **Runway Coordinates:** 09  
  **Start:**  43 Degrees 56 Minutes 20.49 Seconds North Latitude  
  90 Degrees 16 Minutes 12.87 Seconds West Longitude
- **Runway Coordinates:** 27  
  **Start:**  43 Degrees 56 Minutes 22.02 Seconds North Latitude  
  90 Degrees 14 Minutes 9.9 Seconds West Longitude
APPENDIX E
HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS
1. **PURPOSE.** This Advisory Circular (AC) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. **APPLICABILITY.** The Federal Aviation Administration (FAA) recommends that public-use airport operators implement the standards and practices contained in this AC. The holders of Airport Operating Certificates issued under Title 14, Code of Federal Regulations (CFR), Part 139, Certification of Airports, Subpart D (Part 139), 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.


4. **PRINCIPAL CHANGES.** This AC contains the following major changes, which are marked with vertical bars in the margin:
   a. Technical changes to paragraph references.
   b. Wording on storm water detention ponds.
   c. Deleted paragraph 4-3.b, *Additional Coordination*.

5. **BACKGROUND.** Information about the risks posed to aircraft by certain wildlife species has increased a great deal in recent years. Improved reporting, studies, documentation, and statistics clearly show that aircraft collisions with birds and other wildlife are a serious economic and public safety problem. While many species of wildlife can pose a threat to aircraft safety, they are not equally hazardous. Table 1
ranks the wildlife groups commonly involved in damaging strikes in the United States according to their relative hazard to aircraft. The ranking is based on the 47,212 records in the FAA National Wildlife Strike Database for the years 1990 through 2003. These hazard rankings, in conjunction with site-specific Wildlife Hazards Assessments (WHA), will help airport operators determine the relative abundance and use patterns of wildlife species and help focus hazardous wildlife management efforts on those species most likely to cause problems at an airport.

Most public-use airports have large tracts of open, undeveloped land that provide added margins of safety and noise mitigation. These areas can also present potential hazards to aviation if they encourage wildlife to enter an airport's approach or departure airspace or air operations area (AOA). Constructed or natural areas—such as poorly drained locations, detention/retention ponds, roosting habitats on buildings, landscaping, odor-causing rotting organic matter (putrescible waste) disposal operations, wastewater treatment plants, agricultural or aquaculture activities, surface mining, or wetlands—can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape. Even small facilities, such as fast food restaurants, taxicab staging areas, rental car facilities, aircraft viewing areas, and public parks, can produce substantial attractions for hazardous wildlife.

During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives worldwide, as well as billions of dollars in aircraft damage. Hazardous wildlife attractants on and near airports can jeopardize future airport expansion, making proper community land-use planning essential. This AC provides airport operators and those parties with whom they cooperate with the guidance they need to assess and address potentially hazardous wildlife attractants when locating new facilities and implementing certain land-use practices on or near public-use airports.

6. MEMORANDUM OF AGREEMENT BETWEEN FEDERAL RESOURCE AGENCIES. The FAA, the U.S. Air Force, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture - Wildlife Services signed a Memorandum of Agreement (MOA) in July 2003 to acknowledge their respective missions in protecting aviation from wildlife hazards. Through the MOA, the agencies established procedures necessary to coordinate their missions to address more effectively existing and future environmental conditions contributing to collisions between wildlife and aircraft (wildlife strikes) throughout the United States. These efforts are intended to minimize wildlife risks to aviation and human safety while protecting the Nation's valuable environmental resources.

DAVID L. BENNETT
Director, Office of Airport Safety and Standards
Table 1. Ranking of 25 species groups as to relative hazard to aircraft (1=most hazardous) based on three criteria (damage, major damage, and effect-on-flight), a composite ranking based on all three rankings, and a relative hazard score. Data were derived from the FAA National Wildlife Strike Database, January 1990–April 2003.\(^1\)

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1 Excerpted from the Special Report for the FAA, “Ranking the Hazard Level of Wildlife Species to Civil Aviation in the USA: Update #1, July 2, 2003”. Refer to this report for additional explanations of criteria and method of ranking.
2 Relative rank of each species group was compared with every other group for the three variables, placing the species group with the greatest hazard rank for ≥ 2 of the 3 variables above the next highest ranked group, then proceeding down the list.
3 Percentage values, from Tables 3 and 4 in Footnote 1 of the Special Report, for the three criteria were summed and scaled down from 100, with 100 as the score for the species group with the maximum summed values and the greatest potential hazard to aircraft.
4 Aircraft incurred at least some damage (destroyed, substantial, minor, or unknown) from strike.
5 Aircraft incurred damage or structural failure, which adversely affected the structure strength, performance, or flight characteristics, and which would normally require major repair or replacement of the affected component, or the damage sustained makes it inadvisable to restore aircraft to airworthy condition.
6 Aborted takeoff, engine shutdown, precautionary landing, or other.
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SECTION 1.

GENERAL SEPARATION CRITERIA FOR HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. INTRODUCTION. When considering proposed land uses, airport operators, local planners, and developers must take into account whether the proposed land uses, including new development projects, will increase wildlife hazards. Land-use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife strikes.

The FAA recommends the minimum separation criteria outlined below for land-use practices that attract hazardous wildlife to the vicinity of airports. Please note that FAA criteria include land uses that cause movement of hazardous wildlife onto, into, or across the airport’s approach or departure airspace or air operations area (AOA). (See the discussion of the synergistic effects of surrounding land uses in Section 2-8 of this AC.)

The basis for the separation criteria contained in this section can be found in existing FAA regulations. The separation distances are based on (1) flight patterns of piston-powered aircraft and turbine-powered aircraft, (2) the altitude at which most strikes happen (78 percent occur under 1,000 feet and 90 percent occur under 3,000 feet above ground level), and (3) National Transportation Safety Board (NTSB) recommendations.

1-2. AIRPORTS SERVING PISTON-POWERED AIRCRAFT. Airports that do not sell Jet-A fuel normally serve piston-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 5,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport’s AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance measured from the nearest aircraft operations areas.

1-3. AIRPORTS SERVING TURBINE-POWERED AIRCRAFT. Airports selling Jet-A fuel normally serve turbine-powered aircraft. Notwithstanding more stringent requirements for specific land uses, the FAA recommends a separation distance of 10,000 feet at these airports for any of the hazardous wildlife attractants mentioned in Section 2 or for new airport development projects meant to accommodate aircraft movement. This distance is to be maintained between an airport’s AOA and the hazardous wildlife attractant. Figure 1 depicts this separation distance from the nearest aircraft movement areas.

1-4. PROTECTION OF APPROACH, DEPARTURE, AND CIRCLING AIRSPACE. For all airports, the FAA recommends a distance of 5 statute miles between the farthest edge 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.
Figure 1. Separation distances within which hazardous wildlife attractants should be avoided, eliminated, or mitigated.

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.
SECTION 2.

LAND-USE PRACTICES ON OR NEAR AIRPORTS THAT POTENTIALLY ATTRACT HAZARDOUS WILDLIFE.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment vary considerably, depending on several factors, including land-use practices on or near the airport. This section discusses land-use practices having the potential to attract hazardous wildlife and threaten aviation safety. In addition to the specific considerations outlined below, airport operators should refer to *Wildlife Hazard Management at Airports*, prepared by FAA and U.S. Department of Agriculture (USDA) staff. (This manual is available in English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA’s wildlife hazard mitigation web site: [http://wildlife-mitigation.tc.FAA.gov](http://wildlife-mitigation.tc.FAA.gov).) And, *Prevention and Control of Wildlife Damage*, compiled by the University of Nebraska Cooperative Extension Division. (This manual is available online in a periodically updated version at: [ianrwww.unl.edu/wildlife/solutions/handbook/](http://ianrwww.unl.edu/wildlife/solutions/handbook/).

2-2. WASTE DISPOSAL OPERATIONS. Municipal solid waste landfills (MSWLF) are known to attract large numbers of hazardous wildlife, particularly birds. Because of this, these operations, when located within the separations identified in the siting criteria in Sections 1-2 through 1-4, are considered incompatible with safe airport operations.

a. Siting for new municipal solid waste landfills subject to AIR 21. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) (AIR 21) prohibits the construction or establishment of a new MSWLF within 6 statute miles of certain public-use airports. Before these prohibitions apply, both the airport and the landfill must meet the very specific conditions described below. These restrictions do not apply to airports or landfills located within the state of Alaska.

The airport must (1) have received a Federal grant(s) under 49 U.S.C. § 47101, et. seq.; (2) be under control of a public agency; (3) serve some scheduled air carrier operations conducted in aircraft with less than 60 seats; and (4) have total annual enplanements consisting of at least 51 percent of scheduled air carrier enplanements conducted in aircraft with less than 60 passenger seats.

The proposed MSWLF must (1) be within 6 miles of the airport, as measured from airport property line to MSWLF property line, and (2) have started construction or establishment on or after April 5, 2001. Public Law 106-181 only limits the construction or establishment of some new MSWLF. It does not limit the expansion, either vertical or horizontal, of existing landfills.

NOTE: Consult the most recent version of AC 150/5200-34, *Construction or Establishment of Landfills Near Public Airports*, for a more detailed discussion of these restrictions.
b. **Siting for new MSWLF not subject to AIR 21.** If an airport and MSWLF do not meet the restrictions of Public Law 106-181, the FAA recommends against locating MSWLF within the separation distances identified in Sections 1-2 through 1-4. The separation distances should be measured from the closest point of the airport’s AOA to the closest planned MSWLF cell.

c. **Considerations for existing waste disposal facilities within the limits of separation criteria.** The FAA recommends against airport development projects that would increase the number of aircraft operations or accommodate larger or faster aircraft near MSWLF operations located within the separations identified in Sections 1-2 through 1-4. In addition, in accordance with 40 CFR 258.10, owners or operators of existing MSWLF units that are located within the separations listed in Sections 1-2 through 1-4 must demonstrate that the unit is designed and operated so it does not pose a bird hazard to aircraft. (See Section 4-2(b) of this AC for a discussion of this demonstration requirement.)

d. **Enclosed trash transfer stations.** Enclosed waste-handling facilities that receive garbage behind closed doors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles generally are compatible with safe airport operations, provided they are not located on airport property or within the Runway Protection Zone (RPZ). These facilities should not handle or store putrescible waste outside or in a partially enclosed structure accessible to hazardous wildlife. Trash transfer facilities that are open on one or more sides; that store uncovered quantities of municipal solid waste outside, even if only for a short time; that use semi-trailers that leak or have trash clinging to the outside; or that do not control odors by ventilation and filtration systems (odor masking is not acceptable) do not meet the FAA’s definition of fully enclosed trash transfer stations. The FAA considers these facilities incompatible with safe airport operations if they are located closer than the separation distances specified in Sections 1-2 through 1-4.

e. **Composting operations on or near airport property.** Composting operations that accept only yard waste (e.g., leaves, lawn clippings, or branches) generally do not attract hazardous wildlife. Sewage sludge, woodchips, and similar material are not municipal solid wastes and may be used as compost bulking agents. The compost, however, must never include food or other municipal solid waste. Composting operations should not be located on airport property. Off-airport property composting operations should be located no closer than the greater of the following distances: 1,200 feet from any AOA or the distance called for by airport design requirements (see AC 150/5300-13, Airport Design). This spacing should prevent material, personnel, or equipment from penetrating any Object Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway. Airport operators should monitor composting operations located in proximity to the airport to ensure that steam or thermal rise does not adversely affect air traffic. On-airport disposal of compost by-products should not be conducted for the reasons stated in 2-3f.
f. **Underwater waste discharges.** The FAA recommends against the underwater discharge of any food waste (e.g., fish processing offal) within the separations identified in Sections 1-2 through 1-4 because it could attract scavenging hazardous wildlife.

g. **Recycling centers.** Recycling centers that accept previously sorted non-food items, such as glass, newspaper, cardboard, or aluminum, are, in most cases, not attractive to hazardous wildlife and are acceptable.

h. **Construction and demolition (C&D) debris facilities.** C&D landfills do not generally attract hazardous wildlife and are acceptable if maintained in an orderly manner, admit no putrescible waste, and are not co-located with other waste disposal operations. However, C&D landfills have similar visual and operational characteristics to putrescible waste disposal sites. When co-located with putrescible waste disposal operations, C&D landfills are more likely to attract hazardous wildlife because of the similarities between these disposal facilities. Therefore, a C&D landfill co-located with another waste disposal operation should be located outside of the separations identified in Sections 1-2 through 1-4.

i. **Fly ash disposal.** The incinerated residue from resource recovery power/heat-generating facilities that are fired by municipal solid waste, coal, or wood is generally not a wildlife attractant because it no longer contains putrescible matter. Landfills accepting only fly ash are generally not considered to be wildlife attractants and are acceptable as long as they are maintained in an orderly manner, admit no putrescible waste of any kind, and are not co-located with other disposal operations that attract hazardous wildlife.

Since varying degrees of waste consumption are associated with general incineration (not resource recovery power/heat-generating facilities), the FAA considers the ash from general incinerators a regular waste disposal by-product and, therefore, a hazardous wildlife attractant if disposed of within the separation criteria outlined in Sections 1-2 through 1-4.

### 2-3. WATER MANAGEMENT FACILITIES

Drinking water intake and treatment facilities, storm water and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of storm water management facilities on or near all public-use airports to ensure a safe airport environment.

a. **Existing storm water management facilities.** On-airport storm water management facilities allow the quick removal of surface water, including discharges related to aircraft deicing, from impervious surfaces, such as pavement and terminal/hangar building roofs. Existing on-airport detention ponds collect storm water, protect water quality, and control runoff. Because they slowly release water
after storms, they create standing bodies of water that can attract hazardous wildlife. Where the airport has developed a Wildlife Hazard Management Plan (WHMP) in accordance with Part 139, the FAA requires immediate correction of any wildlife hazards arising from existing storm water facilities located on or near airports, using appropriate wildlife hazard mitigation techniques. Airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

Where possible, airport operators should modify storm water detention ponds to allow a maximum 48-hour detention period for the design storm. The FAA recommends that airport operators avoid or remove retention ponds and detention ponds featuring dead storage to eliminate standing water. Detention basins should remain totally dry between rainfalls. Where constant flow of water is anticipated through the basin, or where any portion of the basin bottom may remain wet, the detention facility should include a concrete or paved pad and/or ditch/swale in the bottom to prevent vegetation that may provide nesting habitat.

When it is not possible to drain a large detention pond completely, airport operators may use physical barriers, such as bird balls, wires grids, pillows, or netting, to deter birds and other hazardous wildlife. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office.

The FAA recommends that airport operators encourage off-airport storm water treatment facility operators to incorporate appropriate wildlife hazard mitigation techniques into storm water treatment facility operating practices when their facility is located within the separation criteria specified in Sections 1-2 through 1-4.

b. New storm water management facilities. The FAA strongly recommends that off-airport storm water management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. Stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48–hour detention period after the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, rip-rap lined, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport’s AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages
the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

c. **Existing wastewater treatment facilities.** The FAA strongly recommends that airport operators immediately correct any wildlife hazards arising from existing wastewater treatment facilities located on or near the airport. Where required, a WHMMP developed in accordance with Part 139 will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should encourage wastewater treatment facility operators to incorporate measures, developed in consultation with a wildlife damage management biologist, to minimize hazardous wildlife attractants. Airport operators should also encourage those wastewater treatment facility operators to incorporate these mitigation techniques into their standard operating practices. In addition, airport operators should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

d. **New wastewater treatment facilities.** The FAA strongly recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in Sections 1-2 through 1-4. Appendix 1 defines wastewater treatment facility as “any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes.” The definition includes any pretreatment involving the reduction of the amount of pollutants or the elimination of pollutants prior to introducing such pollutants into a publicly owned treatment works (wastewater treatment facility). During the site-location analysis for wastewater treatment facilities, developers should consider the potential to attract hazardous wildlife if an airport is in the vicinity of the proposed site, and airport operators should voice their opposition to such facilities if they are in proximity to the airport.

e. **Artificial marshes.** In warmer climates, wastewater treatment facilities sometimes employ artificial marshes and use submersed and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. The FAA strongly recommends against establishing artificial marshes within the separations identified in Sections 1-2 through 1-4.

f. **Wastewater discharge and sludge disposal.** The FAA recommends against the discharge of wastewater or sludge on airport property because it may improve soil moisture and quality on unpaved areas and lead to improved turf growth that can be an attractive food source for many species of animals. Also, the turf requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw, both of which can attract hazardous wildlife. In addition, the improved turf may attract grazing wildlife, such as deer and geese. Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.
2-4. **WETLANDS.** Wetlands provide a variety of functions and can be regulated by local, state, and Federal laws. Normally, wetlands are attractive to many types of wildlife, including many which rank high on the list of hazardous wildlife species (Table 1).

**NOTE:** If questions exist as to whether an area qualifies as a wetland, contact the local division of the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, or a wetland consultant qualified to delineate wetlands.

a. **Existing wetlands on or near airport property.** If wetlands are located on or near airport property, airport operators should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations. At public-use airports, the FAA recommends immediately correcting, in cooperation with local, state, and Federal regulatory agencies, any wildlife hazards arising from existing wetlands located on or near airports. Where required, a WHMP will outline appropriate wildlife hazard mitigation techniques. Accordingly, airport operators should develop measures to minimize hazardous wildlife attraction in consultation with a wildlife damage management biologist.

b. **New airport development.** Whenever possible, the FAA recommends locating new airports using the separations from wetlands identified in Sections 1-2 through 1-4. Where alternative sites are not practicable, or when airport operators are expanding an existing airport into or near wetlands, a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, and the state wildlife management agency should evaluate the wildlife hazards and prepare a WHMP that indicates methods of minimizing the hazards.

c. **Mitigation for wetland impacts from airport projects.** Wetland mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects or projects required to correct wildlife hazards from wetlands. Wetland mitigation must be designed so it does not create a wildlife hazard. The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4.

(1) **Onsite mitigation of wetland functions.** The FAA may consider exceptions to locating mitigation activities outside the separations identified in Sections 1-2 through 1-4 if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge, which cannot be replicated when moved to a different location. Using existing airport property is sometimes the only feasible way to achieve the mitigation ratios mandated in regulatory orders and/or settlement agreements with the resource agencies. Conservation easements are an additional means of providing mitigation for project impacts. Typically the airport operator continues to own the property, and an easement is created stipulating that the property will be maintained as habitat for state or Federally listed species.
Mitigation must not inhibit the airport operator’s ability to effectively control hazardous wildlife on or near the mitigation site or effectively maintain other aspects of safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife must be avoided. The FAA will review any onsite mitigation proposals to determine compatibility with safe airport operations. A wildlife damage management biologist should evaluate any wetland mitigation projects that are needed to protect unique wetland functions and that must be located in the separation criteria in Sections 1-2 through 1-4 before the mitigation is implemented. A WHMP should be developed to reduce the wildlife hazards.

(2) **Offsite mitigation of wetland functions.** The FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in Sections 1-2 through 1-4 unless they provide unique functions that must remain onsite (see 2-4c(1)). Agencies that regulate impacts to or around wetlands recognize that it may be necessary to split wetland functions in mitigation schemes. Therefore, regulatory agencies may, under certain circumstances, allow portions of mitigation to take place in different locations.

(3) **Mitigation banking.** Wetland mitigation banking is the creation or restoration of wetlands in order to provide mitigation credits that can be used to offset permitted wetland losses. Mitigation banking benefits wetland resources by providing advance replacement for permitted wetland losses; consolidating small projects into larger, better-designed and managed units; and encouraging integration of wetland mitigation projects with watershed planning. This last benefit is most helpful for airport projects, as wetland impacts mitigated outside of the separations identified in Sections 1-2 through 1-4 can still be located within the same watershed. Wetland mitigation banks meeting the separation criteria offer an ecologically sound approach to mitigation in these situations. Airport operators should work with local watershed management agencies or organizations to develop mitigation banking for wetland impacts on airport property.

2-5. **DREDGE SPOIL CONTAINMENT AREAS.** The FAA recommends against locating dredge spoil containment areas (also known as Confined Disposal Facilities) within the separations identified in Sections 1-2 through 1-4 if the containment area or the spoils contain material that would attract hazardous wildlife.

2-6. **AGRICULTURAL ACTIVITIES.** Because most, if not all, agricultural crops can attract hazardous wildlife during some phase of production, the FAA recommends against the used of airport property for agricultural production, including hay crops, within the separations identified in Sections 1-2 through 1-4. If the airport has no financial alternative to agricultural crops to produce income necessary to maintain the viability of the airport, then the airport shall follow the crop distance guidelines listed in the table titled "Minimum Distances between Certain Airport Features and Any On-Airport Agricultural Crops" found in AC 150/5300-13, *Airport Design*, Appendix 17. The cost of wildlife control and potential accidents should be weighed against the income produced by the on-airport crops when deciding whether to allow crops on the airport.
a. **Livestock production.** Confined livestock operations (i.e., feedlots, dairy operations, hog or chicken production facilities, or egg laying operations) often attract flocking birds, such as starlings, that pose a hazard to aviation. Therefore, The FAA recommends against such facilities within the separations identified in Sections 1-2 through 1-4. Any livestock operation within these separations should have a program developed to reduce the attractiveness of the site to species that are hazardous to aviation safety. Free-ranging livestock must not be grazed on airport property because the animals may wander onto the AOA. Furthermore, livestock feed, water, and manure may attract birds.

b. **Aquaculture.** Aquaculture activities (i.e. catfish or trout production) conducted outside of fully enclosed buildings are inherently attractive to a wide variety of birds. Existing aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4 must have a program developed to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should also oppose the establishment of new aquaculture facilities/activities within the separations listed in Sections 1-2 through 1-4.

c. **Alternative uses of agricultural land.** Some airports are surrounded by vast areas of farmed land within the distances specified in Sections 1-2 through 1-4. Seasonal uses of agricultural land for activities such as hunting can create a hazardous wildlife situation. In some areas, farmers will rent their land for hunting purposes. Rice farmers, for example, flood their land during waterfowl hunting season and obtain additional revenue by renting out duck blinds. The duck hunters then use decoys and call in hundreds, if not thousands, of birds, creating a tremendous threat to aircraft safety. A wildlife damage management biologist should review, in coordination with local farmers and producers, these types of seasonal land uses and incorporate them into the WHMP.

2-7. **GOLF COURSES, LANDSCAPING AND OTHER LAND-USE CONSIDERATIONS.**

a. **Golf courses.** The large grassy areas and open water found on most golf courses are attractive to hazardous wildlife, particularly Canada geese and some species of gulls. These species can pose a threat to aviation safety. The FAA recommends against construction of new golf courses within the separations identified in Sections 1-2 through 1-4. Existing golf courses located within these separations must develop a program to reduce the attractiveness of the sites to species that are hazardous to aviation safety. Airport operators should ensure these golf courses are monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be immediately implemented.

b. **Landscaping and landscape maintenance.** Depending on its geographic location, landscaping can attract hazardous wildlife. The FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. A wildlife damage management biologist should review all landscaping plans. Airport operators should also monitor all landscaped areas on a continuing basis for the presence of hazardous wildlife. If
hazardous wildlife is detected, corrective actions should be immediately implemented.

Turf grass areas can be highly attractive to a variety of hazardous wildlife species. Research conducted by the USDA Wildlife Services’ National Wildlife Research Center has shown that no one grass management regime will deter all species of hazardous wildlife in all situations. In cooperation with wildlife damage management biologist, airport operators should develop airport turf grass management plans on a prescription basis, depending on the airport’s geographic locations and the type of hazardous wildlife likely to frequent the airport.

Airport operators should ensure that plant varieties attractive to hazardous wildlife are not used on the airport. Disturbed areas or areas in need of re-vegetating should not be planted with seed mixtures containing millet or any other large-seed producing grass. For airport property already planted with seed mixtures containing millet, rye grass, or other large-seed producing grasses, the FAA recommends disking, plowing, or another suitable agricultural practice to prevent plant maturation and seed head production. Plantings should follow the specific recommendations for grass management and seed and plant selection made by the State University Cooperative Extension Service, the local office of Wildlife Services, or a qualified wildlife damage management biologist. Airport operators should also consider developing and implementing a preferred/prohibited plant species list, reviewed by a wildlife damage management biologist, which has been designed for the geographic location to reduce the attractiveness to hazardous wildlife for landscaping airport property.

c. **Airports surrounded by wildlife habitat.** The FAA recommends that operators of airports surrounded by woodlands, water, or wetlands refer to Section 2.4 of this AC. Operators of such airports should provide for a Wildlife Hazard Assessment (WHA) conducted by a wildlife damage management biologist. This WHA is the first step in preparing a WHMP, where required.

d. **Other hazardous wildlife attractants.** Other specific land uses or activities (e.g., sport or commercial fishing, shellfish harvesting, etc.), perhaps unique to certain regions of the country, have the potential to attract hazardous wildlife. Regardless of the source of the attraction, when hazardous wildlife is noted on a public-use airport, airport operators must take prompt remedial action(s) to protect aviation safety.

**2-8. SYNERGISTIC EFFECTS OF SURROUNDING LAND USES.** There may be circumstances where two (or more) different land uses that would not, by themselves, be considered hazardous wildlife attractants or that are located outside of the separations identified in Sections 1-2 through 1-4 that are in such an alignment with the airport as to create a wildlife corridor directly through the airport and/or surrounding airspace. An example of this situation may involve a lake located outside of the separation criteria on the east side of an airport and a large hayfield on the west side of an airport, land uses that together could create a flyway for Canada geese directly across the airspace of the airport. There are numerous examples of such situations;
therefore, airport operators and the wildlife damage management biologist must consider the entire surrounding landscape and community when developing the WHMP.
SECTION 3.

PROCEDURES FOR WILDLIFE HAZARD MANAGEMENT BY OPERATORS OF PUBLIC-USE AIRPORTS.

3.1. INTRODUCTION. In recognition of the increased risk of serious aircraft damage or the loss of human life that can result from a wildlife strike, the FAA may require the development of a Wildlife Hazard Management Plan (WHMP) when specific triggering events occur on or near the airport. Part 139.337 discusses the specific events that trigger a Wildlife Hazard Assessment (WHA) and the specific issues that a WHMP must address for FAA approval and inclusion in an Airport Certification Manual.

3.2. COORDINATION WITH USDA WILDLIFE SERVICES OR OTHER QUALIFIED WILDLIFE DAMAGE MANAGEMENT BIOLOGISTS. The FAA will use the Wildlife Hazard Assessment (WHA) conducted in accordance with Part 139 to determine if the airport needs a WHMP. Therefore, persons having the education, training, and expertise necessary to assess wildlife hazards must conduct the WHA. The airport operator may look to Wildlife Services or to qualified private consultants to conduct the WHA. When the services of a wildlife damage management biologist are required, the FAA recommends that land-use developers or airport operators contact a consultant specializing in wildlife damage management or the appropriate state director of Wildlife Services.

NOTE: Telephone numbers for the respective USDA Wildlife Services state offices can be obtained by contacting USDA Wildlife Services Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD, 20737-1234, Telephone (301) 734-7921, Fax (301) 734-5157.

3-3. WILDLIFE HAZARD MANAGEMENT AT AIRPORTS: A MANUAL FOR AIRPORT PERSONNEL. This manual, prepared by FAA and USDA Wildlife Services staff, contains a compilation of information to assist airport personnel in the development, implementation, and evaluation of WHMPs at airports. The manual includes specific information on the nature of wildlife strikes, legal authority, regulations, wildlife management techniques, WHAs, WHMPs, and sources of help and information. The manual is available in three languages: English, Spanish, and French. It can be viewed and downloaded free of charge from the FAA’s wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov/. This manual only provides a starting point for addressing wildlife hazard issues at airports. Hazardous wildlife management is a complex discipline and conditions vary widely across the United States. Therefore, qualified wildlife damage management biologists must direct the development of a WHMP and the implementation of management actions by airport personnel.

There are many other resources complementary to this manual for use in developing and implementing WHMPs. Several are listed in the manual's bibliography.

3-4. WILDLIFE HAZARD ASSESSMENTS, TITLE 14, CODE OF FEDERAL REGULATIONS, PART 139. Part 139.337(b) requires airport operators to conduct a Wildlife Hazard Assessment (WHA) when certain events occur on or near the airport.
Part 139.337 (c) provides specific guidance as to what facts must be addressed in a WHA.

3-5. WILDLIFE HAZARD MANAGEMENT PLAN (WHMP). The FAA will consider the results of the WHA, along with the aeronautical activity at the airport and the views of the airport operator and airport users, in determining whether a formal WHMP is needed, in accordance with Part 139.337. If the FAA determines that a WHMP is needed, the airport operator must formulate and implement a WHMP, using the WHA as the basis for the plan.

The goal of an airport’s Wildlife Hazard Management Plan is to minimize the risk to aviation safety, airport structures or equipment, or human health posed by populations of hazardous wildlife on and around the airport.

The WHMP must identify hazardous wildlife attractants on or near the airport and the appropriate wildlife damage management techniques to minimize the wildlife hazard. It must also prioritize the management measures.

3-6. LOCAL COORDINATION. The establishment of a Wildlife Hazards Working Group (WHWG) will facilitate the communication, cooperation, and coordination of the airport and its surrounding community necessary to ensure the effectiveness of the WHMP. The cooperation of the airport community is also necessary when new projects are considered. Whether on or off the airport, the input from all involved parties must be considered when a potentially hazardous wildlife attractant is being proposed. Airport operators should also incorporate public education activities with the local coordination efforts because some activities in the vicinity of your airport, while harmless under normal leisure conditions, can attract wildlife and present a danger to aircraft. For example, if public trails are planned near wetlands or in parks adjoining airport property, the public should know that feeding birds and other wildlife in the area may pose a risk to aircraft.

Airport operators should work with local and regional planning and zoning boards so as to be aware of proposed land-use changes, or modification of existing land uses, that could create hazardous wildlife attractants within the separations identified in Sections 1-2 through 1-4. Pay particular attention to proposed land uses involving creation or expansion of waste water treatment facilities, development of wetland mitigation sites, or development or expansion of dredge spoil containment areas. At the very least, airport operators must ensure they are on the notification list of the local planning board or equivalent review entity for all communities located within 5 miles of the airport, so they will receive notification of any proposed project and have the opportunity to review it for attractiveness to hazardous wildlife.

3-7 COORDINATION/NOTIFICATION OF AIRMEN OF WILDLIFE HAZARDS. If an existing land-use practice creates a wildlife hazard and the land-use practice or wildlife hazard cannot be immediately eliminated, airport operators must issue a Notice to Airmen (NOTAM) and encourage the land–owner or manager to take steps to control the wildlife hazard and minimize further attraction.
SECTION 4.

FAA NOTIFICATION AND REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS

4-1. FAA REVIEW OF PROPOSED LAND-USE PRACTICE CHANGES IN THE VICINITY OF PUBLIC-USE AIRPORTS.

a. The FAA discourages the development of waste disposal and other facilities, discussed in Section 2, located within the 5,000/10,000-foot criteria specified in Sections 1-2 through 1-4.

b. For projects that are located outside the 5,000/10,000-foot criteria but within 5 statute miles of the airport’s AOA, the FAA may review development plans, proposed land-use changes, operational changes, or wetland mitigation plans to determine if such changes present potential wildlife hazards to aircraft operations. The FAA considers sensitive airport areas as those that lie under or next to approach or departure airspace. This brief examination should indicate if further investigation is warranted.

c. Where a wildlife damage management biologist has conducted a further study to evaluate a site’s compatibility with airport operations, the FAA may use the study results to make a determination.

4-2. WASTE MANAGEMENT FACILITIES.

a. Notification of new/expanded project proposal. Section 503 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (Public Law 106-181) limits the construction or establishment of new MSWLF within 6 statute miles of certain public-use airports, when both the airport and the landfill meet very specific conditions. See Section 2-2 of this AC and AC 150/5200-34 for a more detailed discussion of these restrictions.

The Environmental Protection Agency (EPA) requires any MSWLF operator proposing a new or expanded waste disposal operation within 5 statute miles of a runway end to notify the appropriate FAA Regional Airports Division Office and the airport operator of the proposal (40 CFR 258, Criteria for Municipal Solid Waste Landfills, Section 258.10, Airport Safety). The EPA also requires owners or operators of new MSWLF units, or lateral expansions of existing MSWLF units, that are located within 10,000 feet of any airport runway end used by turbojet aircraft, or within 5,000 feet of any airport runway end used only by piston-type aircraft, to demonstrate successfully that such units are not hazards to aircraft. (See 4-2.b below.)

When new or expanded MSWLF are being proposed near airports, MSWLF operators must notify the airport operator and the FAA of the proposal as early as possible pursuant to 40 CFR 258.
b. Waste handling facilities within separations identified in Sections 1-2 through 1-4. To claim successfully that a waste-handling facility sited within the separations identified in Sections 1-2 through 1-4 does not attract hazardous wildlife and does not threaten aviation, the developer must establish convincingly that the facility will not handle putrescible material other than that as outlined in 2-2.d. The FAA strongly recommends against any facility other than that as outlined in 2-2.d (enclosed transfer stations). The FAA will use this information to determine if the facility will be a hazard to aviation.

c. Putrescible-Waste Facilities. In their effort to satisfy the EPA requirement, some putrescible-waste facility proponents may offer to undertake experimental measures to demonstrate that their proposed facility will not be a hazard to aircraft. To date, no such facility has been able to demonstrate an ability to reduce and sustain hazardous wildlife to levels that existed before the putrescible-waste landfill began operating. For this reason, demonstrations of experimental wildlife control measures may not be conducted within the separation identified in Sections 1-2 through 1-4.

4-3. OTHER LAND-USE PRACTICE CHANGES. As a matter of policy, the FAA encourages operators of public-use airports who become aware of proposed land use practice changes that may attract hazardous wildlife within 5 statute miles of their airports to promptly notify the FAA. The FAA also encourages proponents of such land use changes to notify the FAA as early in the planning process as possible. Advanced notice affords the FAA an opportunity (1) to evaluate the effect of a particular land-use change on aviation safety and (2) to support efforts by the airport sponsor to restrict the use of land next to or near the airport to uses that are compatible with the airport.

The airport operator, project proponent, or land-use operator may use FAA Form 7460-1, Notice of Proposed Construction or Alteration, or other suitable documents similar to FAA Form 7460-1 to notify the appropriate FAA Regional Airports Division Office. Project proponents can contact the appropriate FAA Regional Airports Division Office for assistance with the notification process.

It is helpful if the notification includes a 15-minute quadrangle map of the area identifying the location of the proposed activity. The land-use operator or project proponent should also forward specific details of the proposed land-use change or operational change or expansion. In the case of solid waste landfills, the information should include the type of waste to be handled, how the waste will be processed, and final disposal methods.

a. Airports that have received Federal grant-in-aid assistance. Airports that have received Federal grant-in-aid assistance are required by their grant assurances to take appropriate actions to restrict the use of land next to or near the airport to uses that are compatible with normal airport operations. The FAA recommends that airport operators to the extent practicable oppose off-airport land-use changes or practices within the separations identified in Sections 1-2 through 1-4 that may attract hazardous wildlife. Failure to do so may lead to noncompliance with applicable grant assurances. The FAA will not approve the placement of airport
development projects pertaining to aircraft movement in the vicinity of hazardous wildlife attractants without appropriate mitigating measures. Increasing the intensity of wildlife control efforts is not a substitute for eliminating or reducing a proposed wildlife hazard. Airport operators should identify hazardous wildlife attractants and any associated wildlife hazards during any planning process for new airport development projects.
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APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. GENERAL. This appendix provides definitions of terms used throughout this AC.

1. Air operations area. Any area of an airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved areas or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiways, or apron.

2. Airport operator. The operator (private or public) or sponsor of a public-use airport.

3. Approach or departure airspace. The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

4. Bird balls. High-density plastic floating balls that can be used to cover ponds and prevent birds from using the sites.


6. Construct a new MSWLF. To begin to excavate, grade land, or raise structures to prepare a municipal solid waste landfill as permitted by the appropriate regulatory or permitting agency.

7. Detention ponds. Storm water management ponds that hold storm water for short periods of time, a few hours to a few days.

8. Establish a new MSWLF. When the first load of putrescible waste is received on-site for placement in a prepared municipal solid waste landfill.

9. Fly ash. The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.


11. Hazardous wildlife. Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard.

12. Municipal Solid Waste Landfill (MSWLF). A publicly or privately owned discrete area of land or an excavation that receives household waste and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under 40 CFR § 257.2. An MSWLF may receive
other types wastes, such as commercial solid waste, non-hazardous sludge, small-quantity generator waste, and industrial solid waste, as defined under 40 CFR § 258.2. An MSWLF can consist of either a stand alone unit or several cells that receive household waste.

13. **New MSWLF.** A municipal solid waste landfill that was established or constructed after April 5, 2001.

14. **Piston-powered aircraft.** Fixed-wing aircraft powered by piston engines.

15. **Piston-use airport.** Any airport that does not sell Jet-A fuel for fixed-wing turbine-powered aircraft, and primarily serves fixed-wing, piston-powered aircraft. Incidental use of the airport by turbine-powered, fixed-wing aircraft would not affect this designation. However, such aircraft should not be based at the airport.

16. **Public agency.** A State or political subdivision of a State, a tax-supported organization, or an Indian tribe or pueblo (49 U.S.C. § 47102(19)).

17. **Public airport.** An airport used or intended to be used for public purposes that is under the control of a public agency; and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft is publicly owned (49 U.S.C. § 47102(20)).

18. **Public-use airport.** An airport used or intended to be used for public purposes, and of which the area used or intended to be used for landing, taking off, or surface maneuvering of aircraft may be under the control of a public agency or privately owned and used for public purposes (49 U.S.C. § 47102(21)).

19. **Putrescible waste.** Solid waste that contains organic matter capable of being decomposed by micro-organisms and of such a character and proportion as to be capable of attracting or providing food for birds (40 CFR §257.3-8).

20. **Putrescible-waste disposal operation.** Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

21. **Retention ponds.** Storm water management ponds that hold water for several months.

22. **Runway protection zone (RPZ).** An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the airport design, aircraft, type of operation, and visibility minimum.

23. **Scheduled air carrier operation.** Any common carriage passenger-carrying operation for compensation or hire conducted by an air carrier or commercial
operator for which the air carrier, commercial operator, or their representative offers in advance the departure location, departure time, and arrival location. It does not include any operation that is conducted as a supplemental operation under 14 CFR Part 119 or as a public charter operation under 14 CFR Part 380 (14 CFR § 119.3).

24. **Sewage sludge.** Any solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and a material derived from sewage sludge. Sewage does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works. (40 CFR 257.2)

25. **Sludge.** Any solid, semi-solid, or liquid waste generated from a municipal, commercial or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility or any other such waste having similar characteristics and effect. (40 CFR 257.2)

26. **Solid waste.** Any garbage, refuse, sludge, from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded material, including, solid liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or by product material as defined by the Atomic Energy Act of 1954, as amended, (68 Stat. 923). (40 CFR 257.2)

27. **Turbine-powered aircraft.** Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft rotary-wing aircraft.

28. **Turbine-use airport.** Any airport that sells Jet-A fuel for fixed-wing turbine-powered aircraft.

29. **Wastewater treatment facility.** Any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1987 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. (See 40 CFR Section 403.3 (q), (r), & (s)).
30. **Wildlife.** Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring thereof (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, wildlife includes feral animals and domestic animals out of the control of their owners (14 CFR Part 139, Certification of Airports).

31. **Wildlife attractants.** Any human-made structure, land-use practice, or human-made or natural geographic feature that can attract or sustain hazardous wildlife within the landing or departure airspace or the airport’s AOA. These attractants can include architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquaculture activities, surface mining, or wetlands.

32. **Wildlife hazard.** A potential for a damaging aircraft collision with wildlife on or near an airport.

33. **Wildlife strike.** A wildlife strike is deemed to have occurred when:
   
   a. A pilot reports striking 1 or more birds or other wildlife;
   
   b. Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;
   
   c. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
   
   d. Bird or other wildlife remains, whether in whole or in part, are found within 200 feet of a runway centerline, unless another reason for the animal's death is identified;
   
   e. The animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, aircraft left pavement area to avoid collision with animal) (Transport Canada, Airports Group, *Wildlife Control Procedures Manual*, Technical Publication 11500E, 1994).

2. RESERVED.