



Luke AFB Arizona

Air Installation Compatible Use Zone Study



November 2003

COVER SHEET

- Agency:** U.S. Air Force
- Action:** Changes in flight operations at Luke Air Force Base, Arizona.
- Contacts:** Mr. Cisco Pardieu, 56 CES/CECB, Base Community Planner
13970 West Lightning Street,
Luke Air Force Base, Arizona 85309-1149
Telephone 623-856-4736
- Ms. Mary Jo May, 56 FW/PA, Chief of Community Relations
Luke AFB Public Affairs Office
14185 W. Falcon St
Luke Air Force Base, Arizona 85309-1149
Telephone (623) 856-5853
- Designation:** Final, Air Installation Compatible Use Zone (AICUZ) Study
- Abstract:** This AICUZ Study has been prepared in accordance with U.S. Air Force requirements as a result of changes in flight operations at Luke AFB, located in Maricopa County, Arizona.
- The Study addresses safety, noise, and land use issues that must be addressed by the communities surrounding Luke AFB.



Luke AFB Arizona

Air Installation Compatible Use Zone Study

Volume I



November 2003

TABLE OF CONTENTS

Table of Contents, Volume I	i
Table of Contents, Volume II: Appendices	ii
List of Figures	iii
List of Tables	iii
Acronyms and Abbreviations	v

VOLUME I

1. PURPOSE AND NEED	1-1
1.1. Introduction.....	1-1
1.2. Purpose and Need	1-1
1.3. Process and Procedure	1-2
1.4. Land Use Analysis Methodology.....	1-2
1.5. Organization of the Document.....	1-3
2. INSTALLATION DESCRIPTION.....	2-1
2.1. Mission.....	2-1
2.2. Location	2-1
2.3. Economic Impact	2-1
2.4. Flying Activity	2-4
3. LAND USE COMPATIBILITY GUIDELINES	3-1
3.1. Introduction.....	3-1
3.2. The AICUZ Program	3-1
3.3. Noise-Based Constraints on Land Use.....	3-4
3.1.1. Arizona Regulations	3-4
3.1.2. Federal Interagency Committee on Urban Noise Guidelines	3-7
3.4. Land Use Compatibility	3-8
3.5. Participation in the Planning Process.....	3-16
4. LAND USE ANALYSIS.....	4-1
4.1. Introduction.....	4-1
4.2. Land Use Categories	4-1
4.3. Existing Land Use.....	4-2
4.4. Current Zoning.....	4-4
4.5. Future Land Use.....	4-6
4.6. Incompatible Land Uses.....	4-8
4.6.1. Accident Potential Zones.....	4-8
4.6.2. Noise Zones	4-10
4.7. Planning Considerations	4-10
5. IMPLEMENTATION	5-1
5.1. Air Force Responsibilities.....	5-1
5.2. Local Community Responsibilities.....	5-2
6. LIST OF PREPARERS	6-1

VOLUME II: APPENDICES

Appendix A. The AICUZ Concept, Program, Methodology, and Policies A-1

- A.1. Concept.....A-1
- A.2. Program.....A-1
- A.3. Methodology.....A-2
- A.4. AICUZ Land Use Development Policies.....A-2
 - A.4.1. Policy 1A-2
 - A.4.2. Policy 2A-3
 - A.4.3. Policy 3A-3
 - A.4.4. Policy 4A-3
 - A.4.5. Policy 5A-3
 - A.4.6. Policy 6A-4
 - A.4.7. Policy 7A-4
- A.5. Basic Land Use Compatibility.....A-5
- A.6. Accident Potential.....A-5
- A.7. Noise.....A-6

Appendix B. Accident Potential Zones B-1

- B.1. Guidelines For Accident PotentialB-1
- B.2. Accident Potential Analysis.....B-1
- B.3. Definable Debris Impact Areas.....B-4
- B.4. FindingsB-4

Appendix C. Description of the Noise Environment C-1

- C.1. Noise Environment DescriptorC-1
- C.2. Noise Event Descriptor.....C-1
- C.3. Noise Contour ProductionC-2
- C.4. Technical Information.....C-3

Appendix D. Height and Obstructions Criteria D-1

- D.1. Height And Obstructions CriteriaD-1
 - D.1.1. General.....D-1
 - D.1.2. Explanation of Terms.....D-1
 - D.1.3. Planes and Surfaces.....D-1
- D.2. Height RestrictionsD-2

Appendix E. Noise Level Reduction GuidelinesE-1

LIST OF FIGURES

Figure 2-1. Location and Vicinity of Luke AFB, Arizona.....	2-2
Figure 2-2. Luke AFB and Surrounding Communities.....	2-5
Figure 2-3. Luke AFB Flight Tracks	2-6
Figure 3-1. Luke AFB Runways and Safety Zones	3-2
Figure 3-2. Luke AFB Noise Contours and Safety Zones	3-5
Figure 3-3. Current Land Use with Operational and JLUS Contours.....	3-6
Figure 4-1. Current Zoning with Operational and JLUS Contours.....	4-7
Figure 4-2. Projected Future Land Use with Operational and JLUS Contours.....	4-8
Figure B-1. Distribution of Air Force Aircraft Accidents	B-3
Figure B-2. Air Force Accident Data (1968-1972).....	B-3
Figure B-3. Air Force Accident Data[Updated] (1968-1995)	B-3
Figure C-1. Day-Night Average A-Weighted Sound Level	C-1
Figure C-2. Sound Exposure Level	C-2
Figure D-1. Airspace Control Surface Plan	D-3

LIST OF TABLES

Table 2-1. Luke AFB Direct Non-Payroll Expenditures, Fiscal Year 2001	2-4
Table 3-1. Summary Comparison of Arizona Requirements and Federal Guidelines.....	3-8
Table 3-2. Arizona Land Use Compatibility Requirements, According to Arizona Revised Statute 28-8481	3-9
Table 3-3. Federal Land Use Compatibility Guidelines	3-12
Table B-1. Hazard Potential Location Analysis	B-2
Table B-2. Accident to Area Ratio: Ratio of Percentage of Accidents to Percentage of Area (Air Force Accident Data 1968-1995).....	B-4
Table D-1. Coordinates and Elevations, Luke AFB, Arizona	D-3

This page intentionally left blank.

ACRONYMS AND ABBREVIATIONS

56 FW	56 th Fighter Wing
56 FW/PA	56 th Fighter Wing/Public Affairs Office
56 CES/CECB	56 th Fighter Wing/Civil Engineer Squadron, Community Planner
944 FW	944 th Fighter Wing
AETC	Air Education and Training Command
AFB	Air Force Base
AFI	Air Force Instruction
AFM	Air Force Manual
Ag	agricultural land-use category
AICUZ	Air Installation Compatible Use Zone
APZ	accident potential zone
A.R.S.	Arizona Revised Statutes
AZ	Arizona
BCE	Base Civil Engineer
BMGR	Barry M. Goldwater Range
C	commercial land-use category
CZ	clear zone
dB	decibel
dBA	“A-weighted” decibel
DNL	day-night average sound level (see also L_{dn})
EA	Environmental Assessment
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FHWA	Federal Highway Administration
FICUN	Federal Interagency Committee on Urban Noise
ft	feet
FW	fighter wing
FY	Fiscal Year
I	industrial land-use category
JLUS	Joint Land Use Study

L _{dn}	average sound level
L _{eq}	equivalent sound level
LR	low density residential land-use category
MAG	Maricopa [County] Association of Governments
metro	metropolitan
mph	miles per hour
MSA	metropolitan statistical area
MSL	mean sea level
MTR	military training routes
NLR	noise level reduction
NM	nautical miles
O	open space land-use category
P	public land-use category
R	residential land use category
Rec	recreational land-use category
ROI	region of influence
SEL	Sound Exposure Level
TGO	touch-and-go
USAF	United States Air Force
USC/U.S.C.	<i>United States Code</i>
UFC	Unified Facilities Criteria

SECTION 1. PURPOSE AND NEED

1.1. Introduction

This study is an update of the Luke AFB 1995 *Air Installation Compatible Use Zone (AICUZ) Study*, which was corrected and re-issued in 1997. The current update presents and documents the changes to the AICUZ for the period 1996 to 2003 and beyond. It reaffirms the Air Force policy of promoting public health, safety, and general welfare in areas surrounding Luke AFB. The report presents changes in flight operations since the last study and provides noise contours and compatible use guidelines for land areas surrounding the base. This information will assist local communities and serve as a tool for future planning and zoning activities to help protect the general health, safety, and welfare of people within these communities.

The changes in the AICUZ are attributed to:

- A change in the predominant direction of departure, with the predominant departure direction to the southwest.
- A shift of some flights to nighttime, which will result in a small increase in flights occurring after 10:00 p.m.
- Technical improvements to the NOISEMAP program.
- Changes in Arizona land use regulations.

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. Community cooperation regarding recommendations made in earlier AICUZ studies has been outstanding. As Maricopa County and nearby cities prepare and modify their land use development plans, recommendations from this updated AICUZ study should be included in the planning process to prevent incompatibility that may compromise Luke AFB's ability to fulfill its mission requirements, which will continue to change in response to world events. Accident potential and aircraft noise should remain major considerations in the planning processes of the surrounding communities.

Air Force AICUZ guidelines reflect land use recommendations for clear zones, accident potential zones I and II, and four noise zones. 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, the Environmental Protection Agency, and the Air Force, as well as state and local agencies. The guidelines recommend land uses that are compatible with airfield operations while allowing maximum beneficial use of adjacent properties. The Air Force has no desire to recommend land use regulations that render property economically useless. It does, however, have an obligation to the inhabitants of the Luke AFB environs and to the citizens of the United States to point out ways to protect the people in adjacent areas as well as the public investment in the installation itself.

In Arizona, noise-based constraints on land use are regulated by Arizona state law and local zoning ordinances. The Arizona Revised Statutes (A.R.S.) were amended in July 2001 to include provisions for regulating the effects of noise generated by aircraft in the vicinity of a military airport. These regulations are based on noise guidelines defined by the Federal Interagency Committee on Urban Noise (FICUN) for considering noise in land use planning, but include special considerations for land use within a territory in the vicinity of a military airport. Section 3 provides a summary of the Arizona regulations and FICUN Guidelines, along with specific land use constraints.

1.3. Process and Procedure

The AICUZ program uses the latest technology to define noise levels in areas near Air Force installations. An analysis of current and expected flying operations was performed to develop the noise contours contained in this study. 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 Luke AFB. Aircraft flying data were collected in May-July, 2001, and land use and zoning data were collected in May-December, 2001.

The Air Force NOISEMAP program uses data on aircraft operations (types of aircraft, engine settings, flight tracks (where the aircraft fly), flight profile information (how they fly), timing and direction of flights, and numbers of operations) and maintenance (ground runup information and other details). Specified locations are also entered into NOISEMAP to determine noise level information at those locations. NOISEMAP converts the data to DNL noise contours, which were plotted on area maps and overlain with clear zones and accident potential zones.

Preparation and presentation of this update to Luke AFB'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 to provide information on its activities relating to the community. This study is presented in the spirit of mutual cooperation and assistance by Luke AFB to aid in the local land use planning process. This study updates information on base flying activities since 1997, and provides noise contours and AICUZ maps based on the proposed action that was found to have no significant impact in the June 2002 *Environmental Assessment on Proposed Changes in Flight Operations at Luke AFB, AZ*. References within the document to "current contours" refer to the contours associated with the EA's proposed action, one component of which was that 70 to 94 percent of aircraft operations would be to the southwest. This action has now been implemented.

1.4. Land Use Analysis Methodology

A current land use map was developed from aerial photographs taken December 17, 2000, (obtained from the Maricopa County Assessors Office website), and land use documents from local communities. Land use classifications (see Section 4.1) were derived from guidelines in the Air Force Handbook 32-7084 (*AICUZ Program Manager's Guide*) and the *Standard Land Use Coding Manual* (SLUCM), developed by the U.S. Department of

Transportation. A zoning map was compiled using current zoning maps and other available information from Maricopa County, Glendale, Peoria, Surprise, El Mirage, Youngtown, Litchfield Park, Goodyear, Avondale, and Buckeye. Future land use was projected using information from Maricopa County (primarily the 2001 *White Tank and Grand Avenue Plan*), and land use plans from Glendale, Peoria, Surprise, El Mirage, and Goodyear.

The NOISEMAP contours were overlain on maps showing current land use, zoning classifications, and projected future land use to assess potential areas of infringement on noise zones and other areas of land use incompatibility.

The flight operations described in this AICUZ Study were assessed as the proposed action in the June 2002 EA. The directional component of the proposed action involved 70 to 94 percent of arrivals from and departures to the southwest. Sets of contours were developed for the upper and lower “boundaries” of the action: one contour represents 94 percent of operations to the southwest; the other contour represents 70 percent of operations to the southwest. In the environmental analysis, both sets of contours were mapped to show the total land area within which impacts could occur. In the discussion within this AICUZ Study, impacts to the total area are discussed using the two sets of contours.

1.5. Organization of the Document

Volume I of this AICUZ Study includes the purpose and need for the study, found in Chapter 1. A description of the installation is provided in Chapter 2. Land use compatibility guidelines are discussed in Chapter 3, while Chapter 4 contains an analysis of land use. Implementation of the AICUZ Study is discussed in Chapter 5.

Volume II contains specialized appendices, as follows:

- Appendix A, *The AICUZ Concept, Program, Methodology, and Policies*, contains detailed information on the development of the AICUZ program.
- Appendix B, *Accident Potential Zones*, describes the safety zones surrounding the airfield.
- Appendix C, *Description of the Noise Environment*, explains the descriptors used to evaluate noise impacts.
- Appendix D, *Height and Obstructions Criteria*, describes the height constraints for structures near the airfield.
- Appendix E, *Noise Level Reduction Guidelines*, refers the reader to other noise publications.

This page intentionally left blank.

SECTION 2. INSTALLATION DESCRIPTION

2.1. Mission

Luke AFB is the largest fighter training base in the free world. As host unit at Luke AFB, the mission of the 56th Fighter Wing (56 FW) is to train the world's finest F-16 pilots and crew chiefs while providing agile combat support for aerospace expeditionary forces. The 56 FW serves as the hub of the Air Education and Training Command's Operation Training Development Program for fighter aircraft and is responsible for all fighter pilot and other aircrew training at Luke AFB. The wing graduates over 730 aircrew members and 1,000 maintainers each year.

The installation's importance to the United States military mission is exemplified by its assets. There are more than 200 aircraft based at Luke AFB; all are F-16 Fighters. The 56 FW contains eight flying training squadrons, while the average Air Force wing contains three squadrons. The Barry M. Goldwater Range (BMGR), located southwest of the base, is of primary importance to the mission of Luke AFB. This vast 2.7 million-acre tract of desert contains eight bombing and gunnery ranges used by all branches of the military for air-to-air and air-to-surface tactical training.

2.2. Location

Luke AFB is located on 4,200 acres in Glendale (Maricopa County), AZ, in the western portion of the Phoenix metropolitan ("metro") area.¹ The Phoenix metro area lies in a physiographic basin known locally as the "Valley of the Sun," and the area surrounding Luke AFB is known as the West Valley. The impact area for this study is defined as the portion of the West Valley that includes the nine municipalities of Glendale, Peoria, Surprise, El Mirage, Youngtown, Litchfield Park, Goodyear, Avondale, and Buckeye, and the unincorporated portions of Maricopa County that lie between these incorporated areas and under the noise contours. Figure 2-1 shows the location of Luke AFB.

2.3. Economic Impact

The Phoenix metro area contains a diverse economy fueled by a variety of sources, and has experienced considerable growth over the past several decades. Maricopa County experienced more than a 16-fold population increase between 1940, just before Luke Field was established, and 2000. The region's pleasant climate, modern services, and economic opportunities enticed more than 950,000 people to move into the Valley of the Sun during the 1990s.

¹ The Phoenix-Mesa Metropolitan Statistical Area (MSA) includes Maricopa County as well as Pinal County, which is to the southeast. Pinal County is not included as part of the region of influence for this analysis.

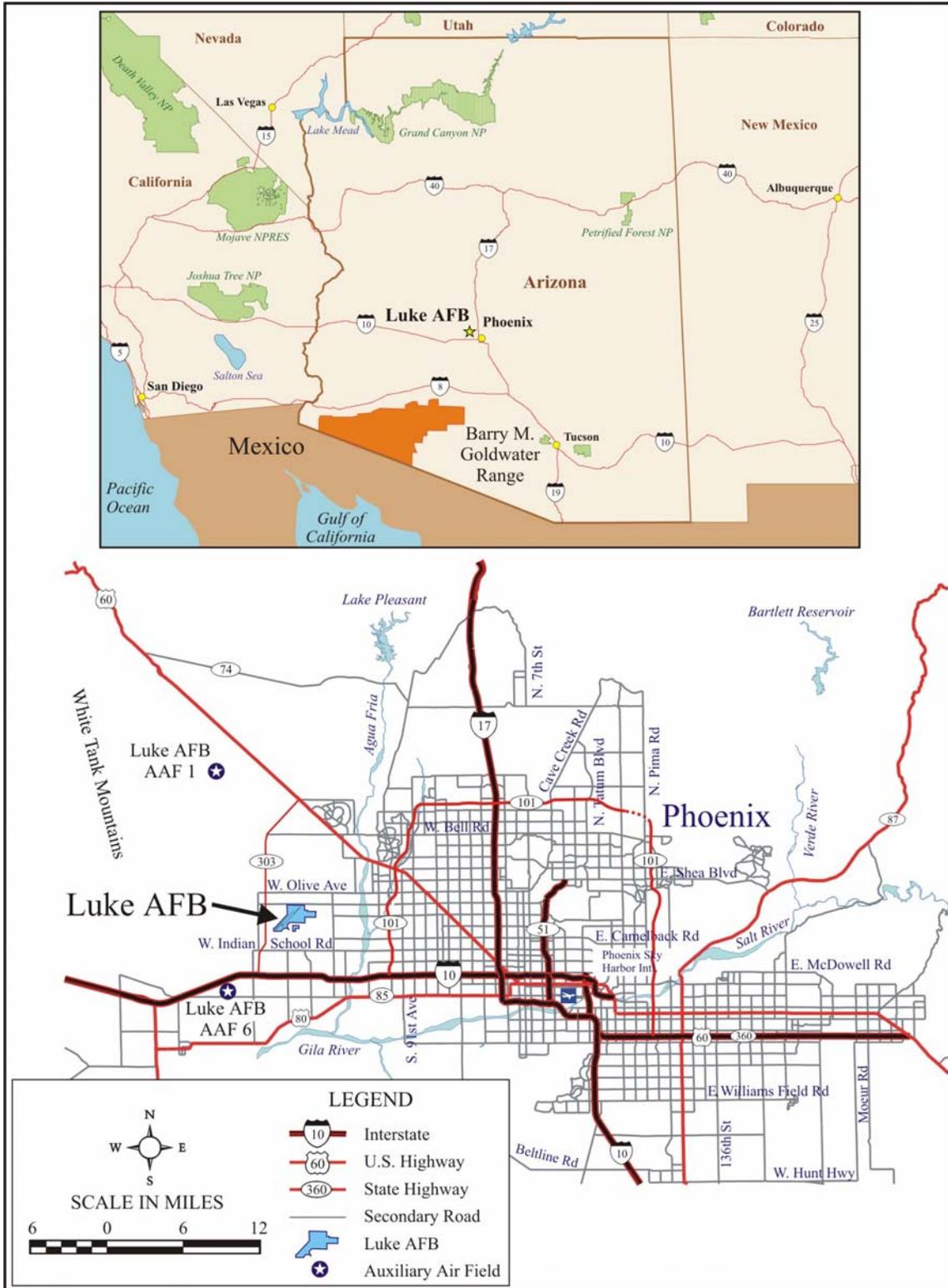


Figure 2-1. Location and Vicinity of Luke AFB, Arizona

Phoenix, the state capital, is served by an established and expanding transportation network that includes two interstate highways, and a city transit system. Phoenix's Sky Harbor International Airport, an ultramodern and rapidly growing facility, was the 5th busiest airport (for aircraft movements) in the world in 2002 (ACI, 2003). Amtrak serves the Phoenix metro area with a station at Maricopa, approximately 30 miles to the south.

Major employment sectors within the Phoenix area include government, services, industrial, health care, and manufacturing. Additionally, the Phoenix area is attractive to retirees, as noted by the success of retirement communities such as Sun City and Sun City West, located north and northeast of Luke AFB. Similar communities are developing in the West Valley and throughout the Phoenix metro area as the number of U.S. retirees continues to increase.

The West Valley has changed dramatically since 1941, when Luke Field was established in a sparsely settled area west of the city of Phoenix. In the 1940 Census, only two of the nine towns were incorporated (Glendale and Buckeye), and their combined population of 6,160 made up only 3 percent of the county's total population. In 2000, the West Valley was still less densely settled than some eastern portions of the metro area, but the nine towns had a population of nearly 434,000 and made up 14 percent of the County's population. Growth rates during the 1990s varied among the West Valley communities, ranging from lows of 15 and 18 percent increases for Litchfield Park and Youngstown, to more than 200 and 300 percent for Goodyear and Surprise, respectively.

The Luke AFB presence and mission has provided a reliable and expanding economic stimulus to the area and region. Its importance became even more apparent with the closure of Williams AFB in 1993, which left Luke AFB as the Phoenix area's sole military installation. To support its mission of training the world's finest fighter aircraft pilots and support personnel, Luke AFB expends considerable amounts on personnel, construction, and support contracts. As of June 2002, Luke AFB employed approximately 5,500 military personnel, 1,060 federal civilian personnel, and 1,050 other civilians (Luke AFB, 2002). The Maguire Company's *Economic Impact of Arizona's Principal Military Operations* (2002) estimated that payroll expenditures for Fiscal Year (FY) 2000 totaled nearly \$359 million for military and civilian personnel.

Military retirees tend to prefer settling near a military installation, where they have access to on-base services. Retirees are also drawn to the Phoenix area because of its climate and other amenities. The Maguire study estimated that in FY 2000 there were approximately 22,000 military retirees in the local area, receiving retirement pay of almost \$419 million.

Expenditures by Luke AFB during FY 2001 for construction, contracts, and other types of payments exceeded \$416 million. Luke's direct expenditures are shown in Table 2-1.

Re-spending of the payroll, retirement benefits, and direct expenditures within the local economy amounts to a secondary economic impact to the community that is much greater than the actual expenditure. The presence of Luke AFB results in the creation of an estimated 9,300 jobs. A conservative estimate of Luke's overall economic impact within the base's economic impact region is \$1.4 billion, although the total impact may be somewhat higher.

Table 2-1. Luke AFB Direct Non-Payroll Expenditures, Fiscal Year 2001	
<i>Classification</i>	<i>Dollar Value (\$)</i>
Contracts and direct spending: maintenance and operations	\$16,377,313
Contracts: construction and building	\$25,693,556
Purchases	\$195,448,684
Utilities	\$7,694,911
Education Payments	\$3,034,641
Health Services	\$57,361,058
Commissary and Exchange Sales	\$110,725,075
Total	\$416,335,238
Source: The Maguire Company, 2002. <i>Economic Impact of Arizona's Principal Military Operations.</i>	

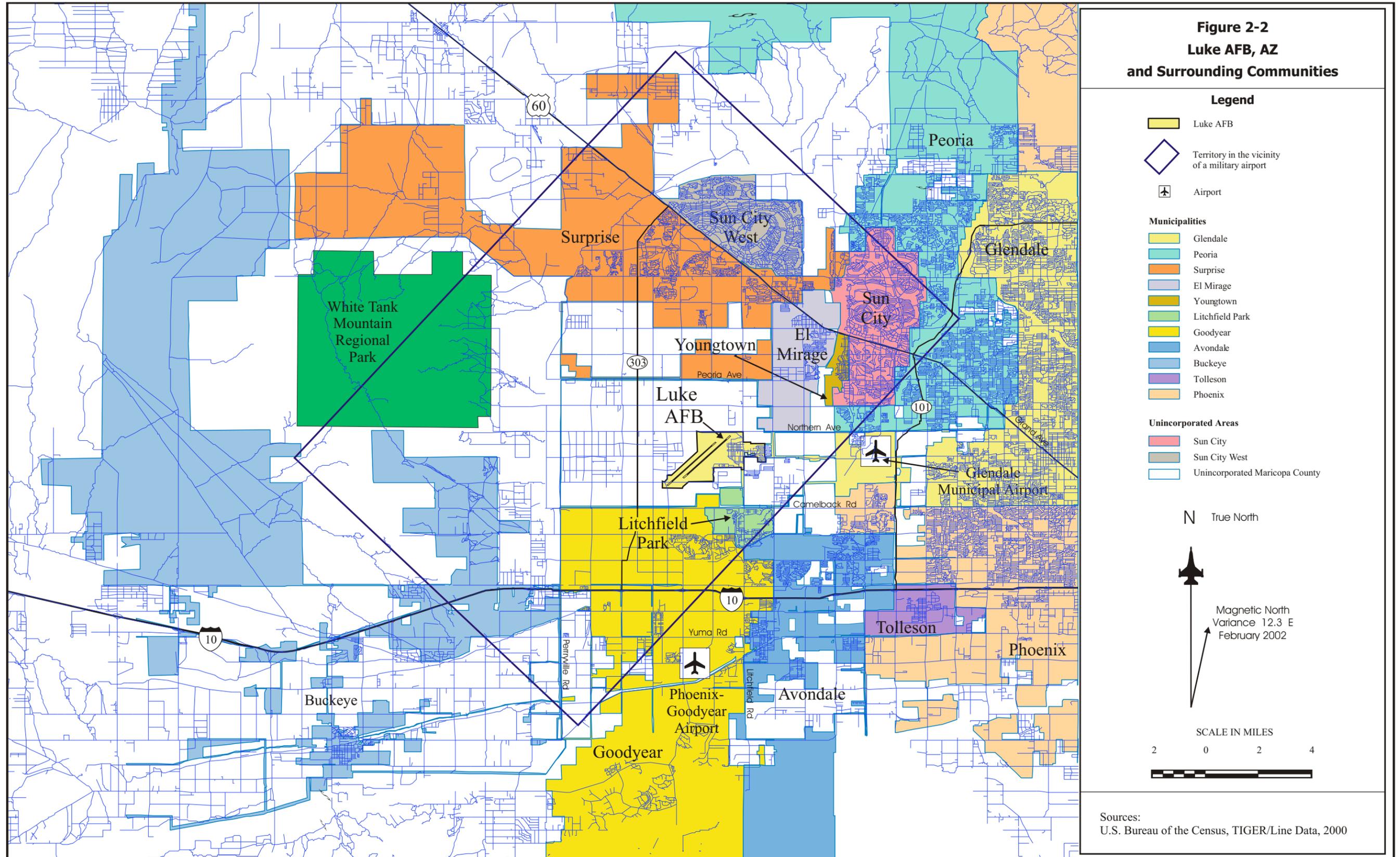
2.4. Flying Activity

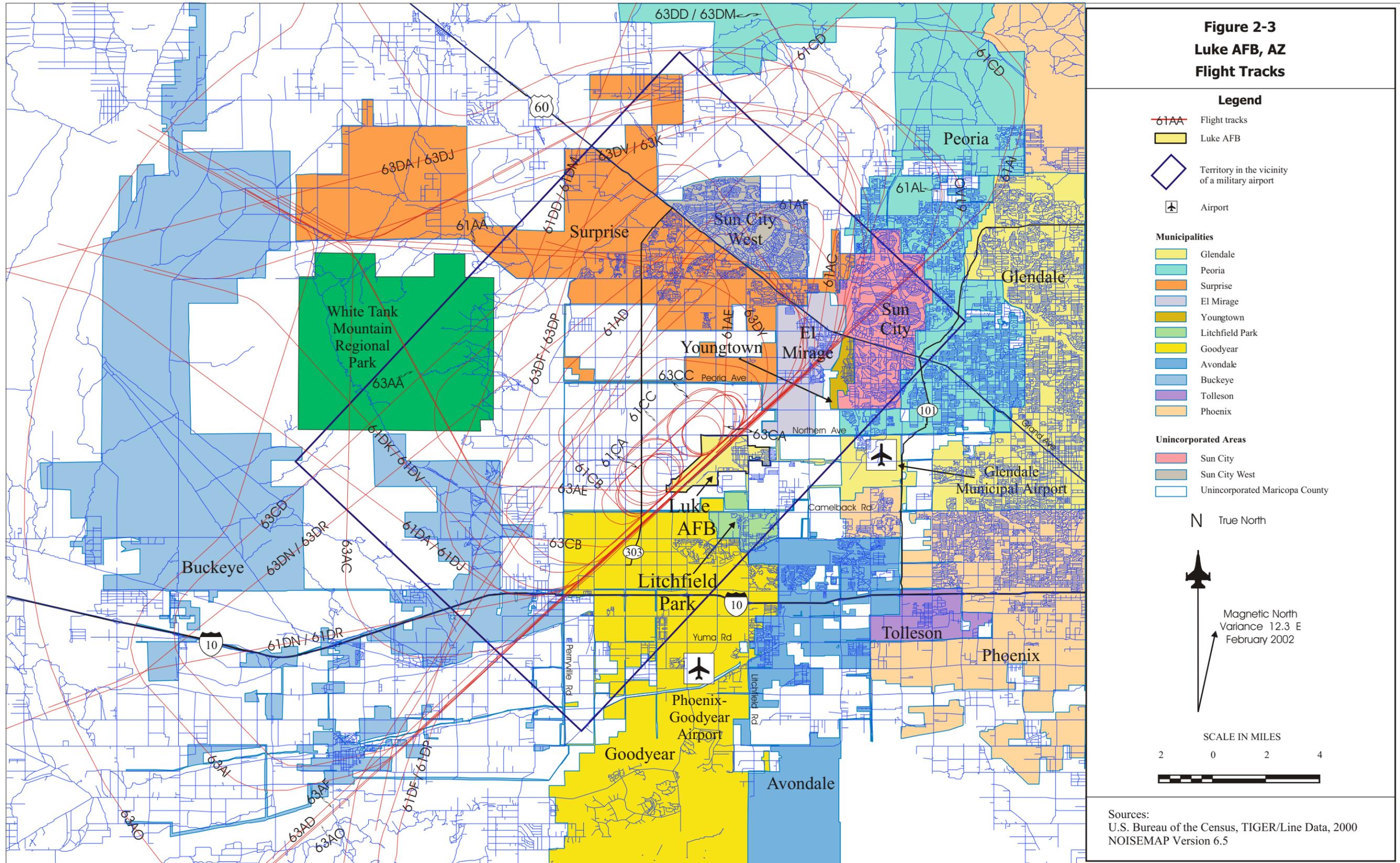
To describe the relationship between aircraft operations and land use, it is necessary to fully evaluate the exact nature of flying activities. An inventory has been made of the types of aircraft based at Luke AFB, where and how high those aircraft fly, how many times they fly over a given area, and when they operate. The F-16 Fighter (Fighting Falcon) is the principal aircraft operating at Luke AFB. As of 2001, Luke-based aircraft conducted an average of approximately 445 daily operations at the base. (An operation is defined as one departure, one approach, or half of a closed pattern. A closed pattern consists of both a departure portion and an approach portion—i.e. two operations.)

Luke-based aircraft account for 97 percent of flight operations at Luke's airfield. Transient or deployed aircraft conduct the remaining 3 percent of operations—an average of 12 per day. *Transient* aircraft temporarily use the Luke AFB airfield but are based elsewhere. Transient activities include using the airfield facilities while en route to another destination, transporting personnel or materiel to or from Luke AFB, and other purposes. *Deployed* aircraft (and support personnel) are temporarily assigned to Luke AFB from their home base to participate in training activities with Luke personnel and aircraft. For example, in FY 2001, approximately 60 fighter and trainer aircraft were deployed to Luke AFB for an average stay of 13 days. Most of these aircraft were F-15 fighters. Operations from deployed and transient aircraft have been included in the calculation of the Luke AFB noise contours.

Figure 2-2 is a closer view of Luke AFB and the surrounding communities in the West Valley, while Figure 2-3 illustrates the basic flight patterns used by Luke AFB:

- Straight-out departure.
- Departures-in approach.
- Departures to the west.
- Approaches from the west.
- Instrument flight rules (IFR) pattern.
- Visual flight rules (VFR) pattern.





Luke AFB flight patterns have been developed based on several considerations, including:

- Routing of departure patterns to avoid heavily populated areas as much as possible.
- Air Force criteria governing the 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.
- Coordination with the Federal Aviation Administration (FAA) to minimize conflicts with civilian aircraft operations.

To the maximum extent possible, engine runup locations have been established in areas that minimize noise for people on base, as well as for those in the surrounding communities. Normal base operations do not include late night engine runups, but heavy workloads or unforeseen contingencies sometimes require a limited number of these operations at night.

Airfield environs planning is concerned with the following primary aircraft operational/land use determinants, which are discussed in more detail later in this document:

- Accident potential to land users.
- Aircraft noise.
- Hazards to operations from land uses (e.g., height obstructions).

Each of these concerns is addressed in conjunction with mission requirements and safe aircraft operation to determine the optimum flight track for each aircraft type. The flight tracks depicted in Figure 2-3 are the result of such planning.

This page intentionally left blank.

SECTION 3. LAND USE COMPATIBILITY GUIDELINES

3.1. Introduction

For Air Force installations located in Arizona, noise-based constraints on land use are regulated by Arizona state law and local zoning ordinances, rather than AICUZ guidelines. A 1988 Joint Land Use Study (JLUS) for Luke AFB resulted in a set of noise contours that the Arizona Legislature codified into law in 1995 (A.R.S. Sec. 28-8462), thus stabilizing the area within which noise-based land use restrictions occur.

This chapter describes the Air Force's AICUZ program and its safety zones, summarizes the federal land use constraints, briefly discusses the Arizona regulations and land use categories, provides land use compatibility tables for both federal and Arizona criteria, and concludes with a brief discussion of Air Force participation in the local planning process.

3.2. The AICUZ Program

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

AICUZ Studies describe three basic types of constraints that affect, or result from, flight operations. The first constraint involves areas that the Federal Aviation Administration (FAA) and DoD have identified for height limitations (see Height and Obstruction Criteria in Volume II, Appendix D). Air Force obstruction criteria are based upon those contained in Federal Aviation Regulations Part 77 under Subpart C.

The second constraint involves noise zones, as calculated by the computerized Day-Night Average A-Weighted Sound Level (DNL) metric and the DoD NOISEMAP methodology. Using the NOISEMAP computer software, which is similar to FAA's Integrated Noise Model, the DoD produces contours showing the noise levels generated by current aircraft operations. The contours, plotted in increments of 5 decibels (dB), range from DNL 65 dB to DNL 85+ dB. Additional information on noise methodology is contained in Volume II, Appendix C of this report.

The third constraint involves accident potential zones (APZ) based on statistical analysis of past DoD aircraft accidents. This analysis has determined that the areas immediately beyond the ends of runways and along the approach and departure flight paths have significant potential for aircraft accidents. Based on this analysis, DoD developed three zones that have high relative potential for accidents. Figure 3-1 shows the Luke AFB runways and the three zones associated with each runway, along with an additional zone defined by Arizona regulations, the High Noise and Accident Potential Zone. The zones are described below.

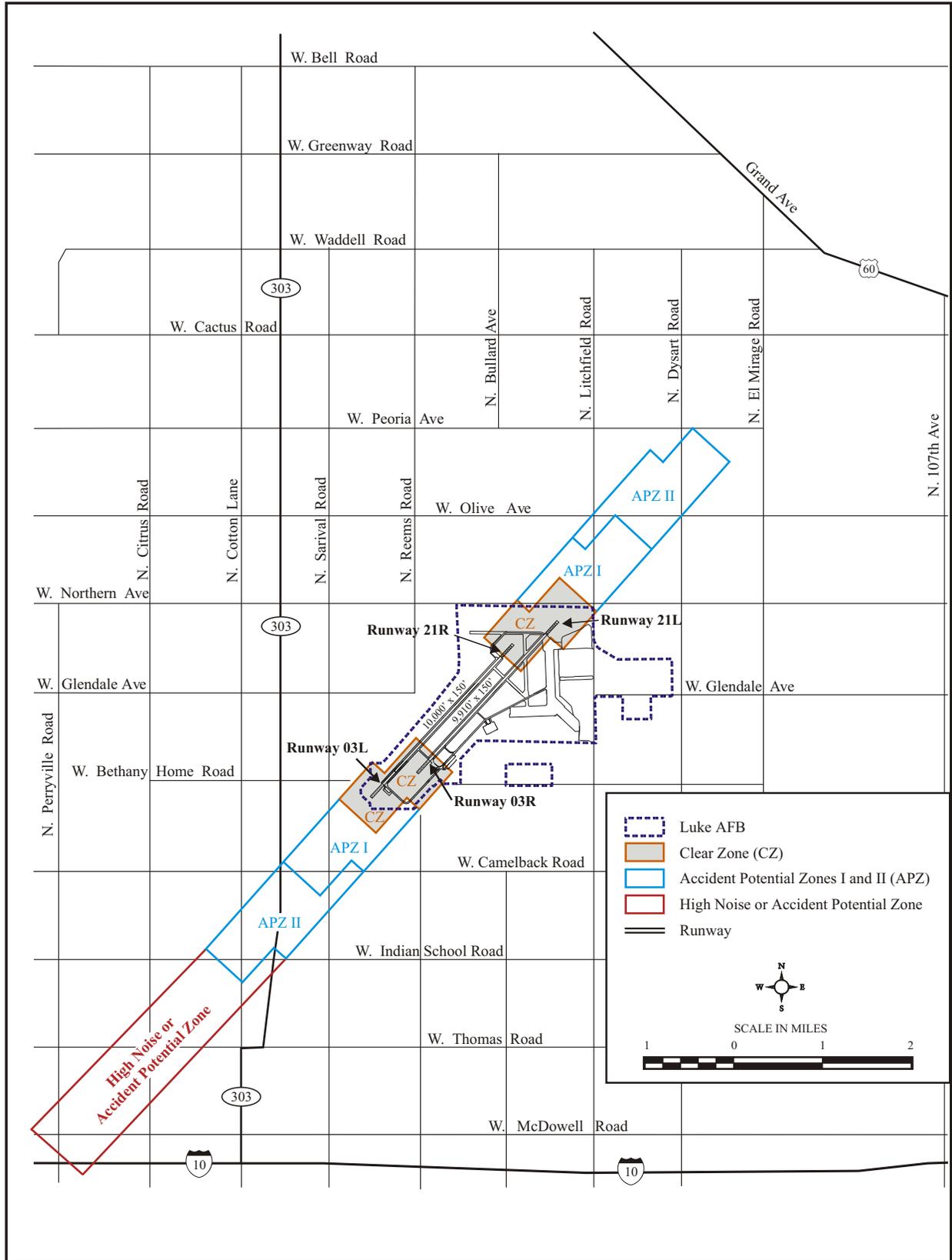


Figure 3-1. Luke AFB Runways and Safety Zones

- The **Clear Zone** at Luke AFB is 3,000 feet long and wide.

This zone, adjacent to either end of the runway, is the most hazardous. The overall risk is so high that DoD generally acquires this land through purchase or easement to prevent development. The dimensions of Clear Zones vary according to the type of aircraft assigned to the base. Clear Zones are to be gently graded in an area at least 1,000 feet wide along the center of the clear zone, and no aboveground structures or obstructions are allowed in this graded area. Land use is limited to open space or agricultural use without structures. Roadways are compatible within the non-graded portion of the Clear Zone, as long as they do not exceed height limit requirements. Existing structures that are not feasible to remove may be granted waivers in accordance with Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*. Flight support facilities such as navigation aids and weather instruments do not require a waiver if they sited in accordance with UFC3-260-01. Facilities constructed under previous standards should be documented as exemptions and programmed for replacement away from the airfield environment at the end of their normal life cycle, or when mission needs dictate earlier replacement.
- **Accident Potential Zone I (APZ I)** extends 5,000 feet beyond the Clear Zone at either end of the runway, and maintains a width of 3,000 feet.

APZ I possesses a significant potential for accidents. Land uses are generally restricted to agricultural use, limited types of manufacturing, wholesale commercial, and limited types of recreation.
- **Accident Potential Zone II (APZ II)** extends 7,000 feet beyond APZ I at either end of the runway, and maintains the 3,000-foot width.

APZ II is an area having measurable potential for accidents. While aircraft accident potential in APZs I and II does not warrant acquisition by the Air Force, land use planning and controls are strongly encouraged in these areas for the protection of the public, and land use must be limited to avoid high concentrations of populations or major obstructions from structures (see Appendix A). Land use constraints are less restrictive than for APZ I, but still exclude most residences. No new residences or expansions of existing residences are allowed under ARS Title 28 (the Federal guidelines suggest only low density developments—one to two dwellings per acre). No chemical manufacturing, hospitals, schools, restaurants, or places of assembly (such as churches or auditoriums) are permitted. Volume II, Appendix B, contains additional information on accident potential.
- The Arizona-defined **High Noise or Accident Potential Zone** extends 30,000 feet beyond the runway to the southwest and is 4,000 feet wide.

As defined by A.R.S. 28-8461, Section 8(a), this zone actually *includes* the Clear Zone and APZs I and II described above, but extends the zone at Luke AFB an additional 15,000 feet to the southwest, for a total distance of 30,000 feet in that direction. This zone is not found at the northeastern end of the runways. The width is defined such that it extends the APZ II width for *both* runways, and is therefore 4,000 feet wide rather than 3,000 feet, as shown in Figure 3-1.

3.3. Noise-based Constraints on Land Use

In 1979, the Federal Interagency Committee on Urban Noise (FICUN) was formed to develop Federal policy and guidance on noise. The committee included the USEPA, FAA, Federal Highway Administration, DoD, Department of Housing and Urban Development, and Department of Veterans Affairs. The designations contained in the FICUN land use compatibility table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities.

In Arizona, noise-based constraints on land use are regulated by Arizona state law and local zoning ordinances. The *Arizona Revised Statutes* (A.R.S.) were amended in July 2001 to include provisions for regulating the effects of noise generated by aircraft in the vicinity of a military airport. These regulations are based on noise guidelines defined by the FICUN for considering noise in land use planning, but include special considerations for land use within a territory in the vicinity of a military airport. The state regulations and FICUN Guidelines are summarized below.

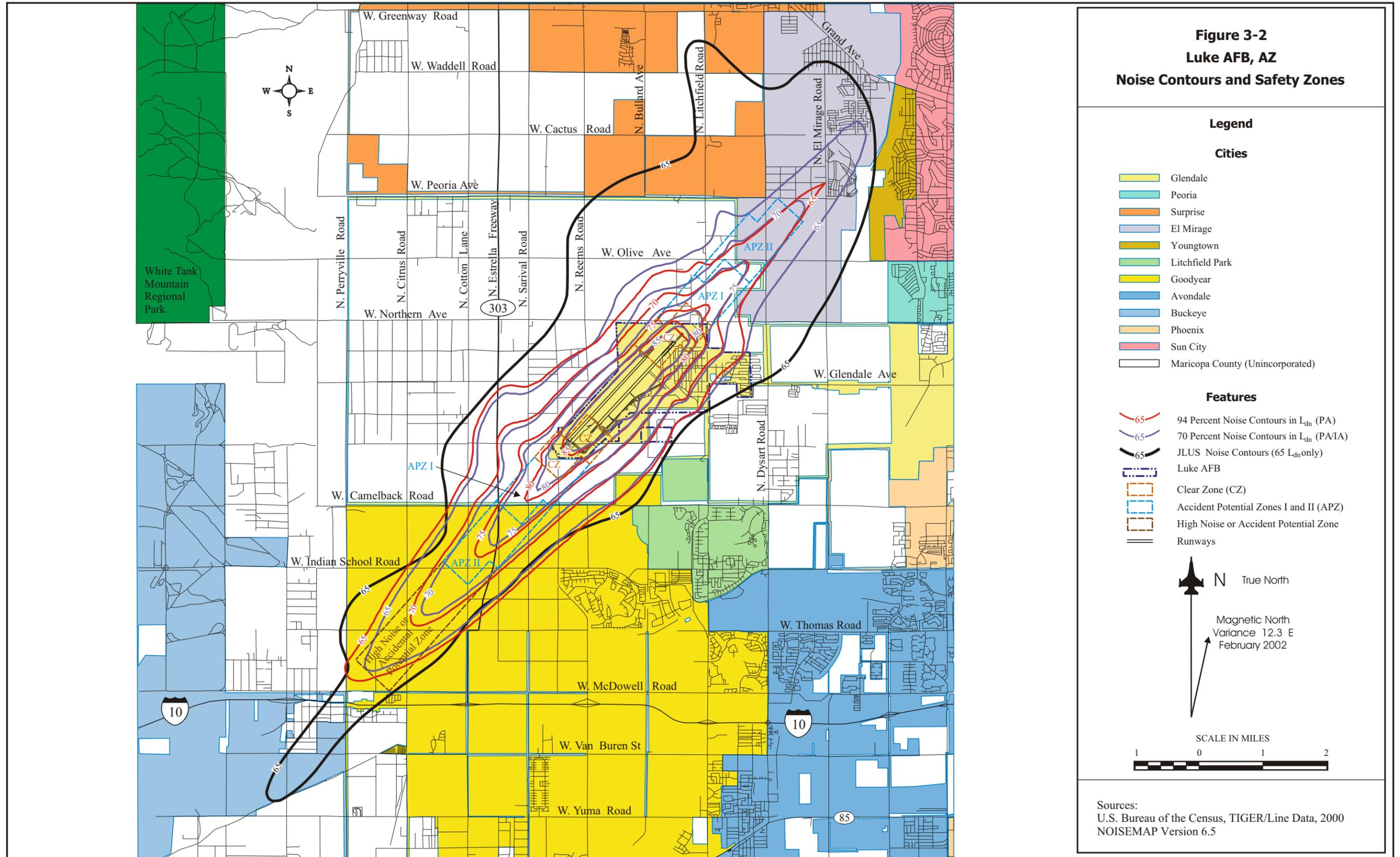
3.3.1. Arizona Regulations

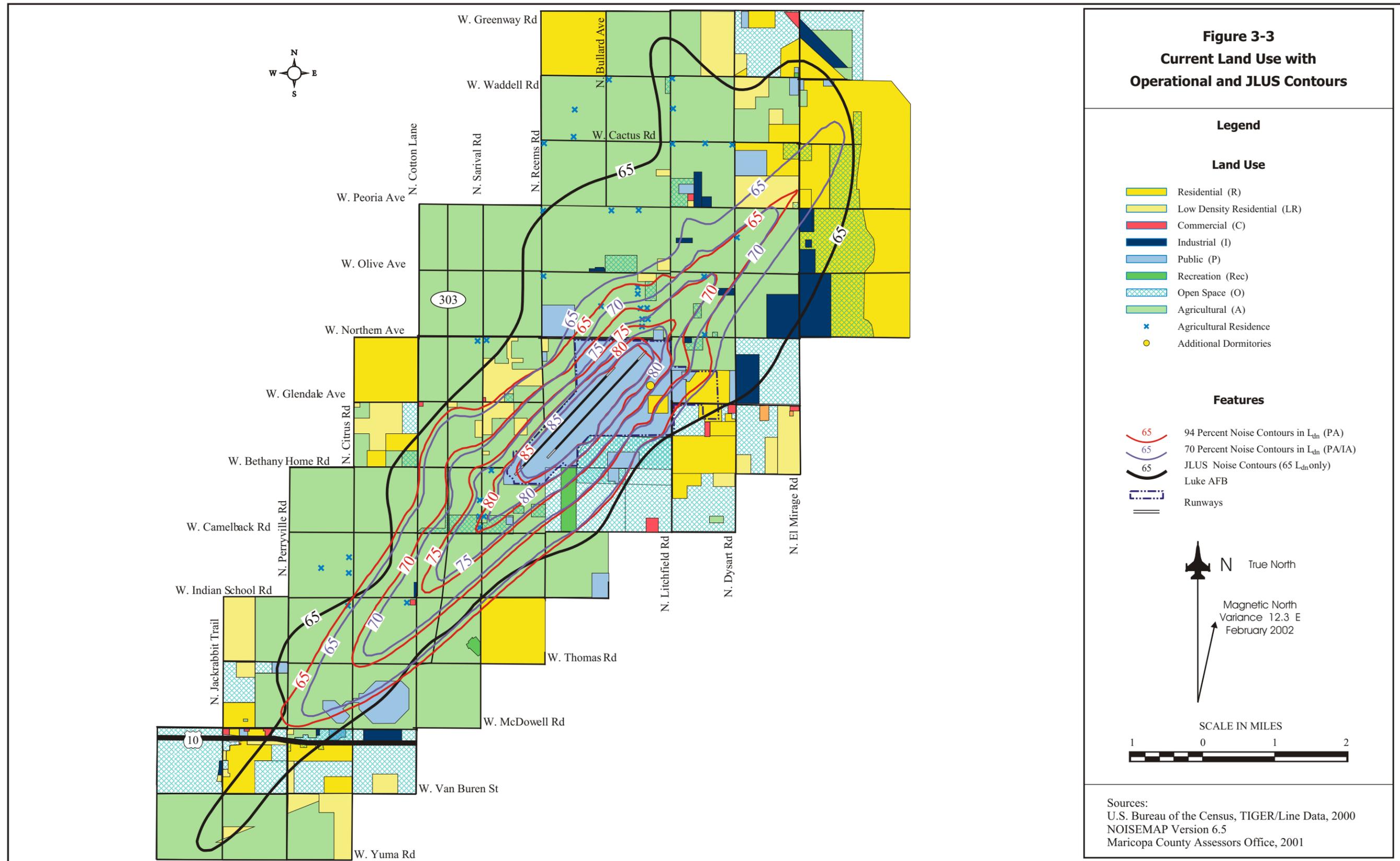
A.R.S. Sec. 28-8461 defines a “territory in the vicinity of military airports,” within which the law requires disclosure to property owners that they are within the territory of a military airport, and the noise attenuation required for structures within the 65-decibel (dB) noise contour applies to the entire area. In the case of Luke AFB, the territory is defined as 10 miles from the center of the runway to the north, west, and south, and 4 miles to the east (see Figure 2-2). Within this territory, land use restrictions apply only within the 65 dB contour established by the 1988 Joint Land Use Study. Figure 3-2 shows the Luke AFB noise contours (including the JLUS contour) and safety zones.

The JLUS contour was derived from a previous set of noise contours under which the predominant direction of operations was to the northeast, but it remains valid because the broader protection it affords would accommodate future mission changes at Luke AFB. Possible mission changes are unknown at this time, but it is reasonable to expect that these will occur as a result of changing geopolitical situations, advances in technology, and shifting priorities within the DoD and the Air Force. Figure 3-3 shows current land use in the vicinity of the noise contours, along with the 65 dB contours for the JLUS.

The land use provisions promulgated in A.R.S. Sec. 28-8481 include the following constraints, summarized below and detailed in Table 3-2:

- **Residential.** New residential structures or expansions of existing residential structures are banned within the 65 L_{dn} or greater contours, *except for*:
 - ♦ Single-family residential dwellings at a density of one dwelling per acre or less (permitted up to 79 L_{dn}), which are the subject of zoning approved on or before December 31, 2000, or
 - ♦ Single-family residential dwellings that are the primary residence for people engaged in agriculture (permitted up to 84 L_{dn}); these are referred to as agricultural residences.





- **Commercial.** New construction or expansion of existing structures are allowed for most commercial land uses up to 79 L_{dn} . Exceptions are wholesale trade, building materials, and repair establishments, which are allowed up to 84 L_{dn} .
- **Industrial.** New construction or expansion of existing structures are allowed for industrial land uses up to 84 L_{dn} . Noise reduction must be incorporated for noise-sensitive areas, such as offices.
- **Public/Quasi-Public.** Public, medical and health, nonprofit organizations, and other public uses are limited to 74 L_{dn} . Correction facilities and cemeteries are allowed up to 79 L_{dn} .
- **Recreational.** The restrictions on new land use for recreational uses vary between 74 and 79 L_{dn} , depending on the type of use.
- **Agricultural.** Agricultural land use is not restricted by noise levels.

A.R.S. Sec 28-8481 requires that political subdivisions with territory in the vicinity of a military airport shall do the following:

- Adopt land use plans and adopt and enforce zoning regulations to assure development compatible with the high noise and accident potential generated by military airport operations that have or may have an adverse effect on public health and safety.
- Incorporate sound attenuation standards into any building code in existence on or adopted after July 1, 2001 for all development on property on which the day-night average sound level is 65 dB or higher.

The A.R.S. Sec. 28-8483 requires that the state real estate department and political subdivisions with territory in the vicinity of a military airport shall request information from military airports in the state, including maps of military flight operations and a list of contact persons at each military airport who are knowledgeable about the impacts of military flight operations. This information shall be available to the public on request and shall be used to enforce the sound attenuation and public disclosure requirements of A.R.S. Sections 28-8481 and 28-8482. This AICUZ Study will assist state and local planners in their compliance with these state regulations.

3.3.2. Federal Interagency Committee on Urban Noise Guidelines

The FICUN guidelines consider areas with noise levels of 75 L_{dn} or greater as unacceptable living environments. Areas between 65-74 L_{dn} are considered “generally unacceptable” for noise-sensitive land uses such as residences, schools, hospitals, and public services. Houses located in areas between 65-74 L_{dn} may not qualify for federal mortgage insurance without additional costs associated with installing noise attenuation. In the outdoor noise environment, levels greater than 65 L_{dn} may be annoying to some people during communications. Generally, residential development is not recommended in areas experiencing noise levels of 65 dBA or greater. Although discouraged, residential development is compatible within the 65-69 dBA and 70-74 dBA contours, provided noise reduction levels of 25 dB and 30 dB, respectively, are achieved.

Commercial/retail businesses are a compatible land use without restrictions up to 69 dBA, and up to 79 dBA provided that noise reduction levels of 25-30 dB are achieved for public

areas. Industrial/manufacturing, transportation, and utility companies have a high noise level compatibility, and therefore can be located within the higher noise zones.

3.4. Land Use Compatibility

This AICUZ Study contains both Arizona land use requirements and federal land use guidelines. Table 3-1 summarizes the major differences between the two, while Table 3-2 shows land use compatibility in accordance with Arizona regulations (A.R.S. 28-8481) and Table 3-3 lists present federal land use compatibility guidance.

The federal noise guidelines are essentially the same as those published by FICUN in its June 1980 publication, *Guidelines for Considering Noise in Land Use Planning and Control*. The U.S. Department of Transportation publication, *Standard Land Use Coding Manual* (SLUCM), has been used for identifying and coding land use activities.¹

<i>Land Use</i>	<i>Arizona</i>	<i>FICUN*</i>
Residential	No residential at 65 DNL or above, except at a density of one dwelling per acre or less if the zoning for the development was approved by December 31, 2000. Allows agricultural residences up to 84 DNL with noise reduction in new or expanded units.	Allows all residential except mobile homes up to 74 DNL with noise level reduction. Allows agricultural residences up to 74 DNL with noise reduction, but agricultural residences are not allowed above 74 DNL
Transportation and Utilities	No utilities above 79 DNL, but allows other transportation, communication, and utilities (SLUCM 49) up to 84 DNL.	Utilities in 80+ DNL with noise reduction. Does not allow other transportation, communication, and utilities (SLUCM 49) above 79 DNL.
Cultural, Entertainment, and Recreational	Allows existing outdoor music shells or amphitheaters up to 79 DNL, but does not allow new ones or expansion of existing ones	Does not allow outdoor music shells or amphitheaters above 65 DNL.
Agricultural Activities	Does not allow agriculture in APZ I; in other zones, building constraints and/or noise reduction requirements apply.	Allows agriculture.
APZ I	Generally prohibits all activities in APZ I, except for a few activities in transportation, communications, utilities, and outdoor recreation.	Allows some activities related to manufacturing, trade, services, cultural and recreation, and resource production and extraction, with restrictions on the density of people allowed.
*FICUN = Federal Interagency Committee on Urban Noise		

¹ In 2001, the SLUCM was superseded by the Land-based Classification Standards (LBCS). The LBCS are based on an activity-oriented and functional approach rather than SLUCM's industrial category basis. However, Air Force Instruction (AFI) 32-7063, *Air Installation Compatible Use Zone Program*, and AFH 32-7084, *AICUZ Program Manager's Guide*, have not yet been revised in accordance with the LBCS. Therefore, this AICUZ Study uses the SLUCM classifications.

Table 3-2. Arizona Land Use Compatibility Requirements, According to Arizona Revised Statute 28-8481							
Land Use	Accident Potential Zones		Noise Zones				
	<i>APZ I</i>	<i>APZ II</i>	<i>65-69</i>	<i>70-74</i>	<i>75-79</i>	<i>80-84</i>	<i>85+</i>
Residential							
Residential uses other than the residential uses listed below	N	N	N ¹³	N ¹³	N ¹³	N ¹³	N
Single family residential that is the subject of zoning approved on or before December 31, 2000 that permits one dwelling unit per acre or less	N	N ¹³	Y ⁹	Y ¹⁰	Y ¹¹	N ¹³	N ¹³
Single family residential that is the primary residence for persons engaging in agricultural use and ancillary residential buildings incident to the primary agricultural use	N	N ¹³	Y ⁹	Y ¹⁰	Y ¹¹	Y ¹²	N ¹³
Transportation, communications, and utilities							
Railroad and rapid rail transit	N	Y ¹⁵	Y	Y ⁵	Y ⁶	Y ⁷	N
Highway and street right-of-way	Y	Y	Y	Y	Y	Y	Y
Motor vehicle parking	Y	Y ¹⁵	Y	Y	Y	Y	Y
Communications(Noise sensitive)	Y ¹⁵	Y ¹⁶	Y	Y ²	Y ³	N	N
Utilities	Y ¹⁵	Y ¹⁶	Y	Y	Y	N	N
Other transportation, communications, and utilities	Y ¹⁵	Y ¹⁶	Y	Y ⁵	Y ⁶	Y ⁷	Y ⁸
Commercial/retail trade							
Wholesale trade	N	Y	Y	Y ⁵	Y ⁶	Y ⁷	N
Building materials-retail							
General merchandise-retail	N	N	Y	Y ¹	Y ²	N	N
Food-retail	N	N	Y	Y ⁵	Y ⁶	N	N
Automotive and marine	N	N/Y ¹⁷	Y	Y ⁵	Y ⁶	N	N
Apparel and accessories-retail	N	N	Y	Y ⁵	Y ⁶	N	N
Eating and drinking places							
Furniture and home furnishings-retail	N	N/Y ¹⁷	Y	Y ⁵	Y ⁶	N	N
Other retail trade	N	N	Y	Y ⁵	Y ⁶	N	N
Personal and business services							
Finance, insurance and real estate	N	Y	Y	Y ⁵	Y ⁶	N	N
Personal services							
Business services	N	Y	Y	Y ⁵	Y ⁶	Y ⁷	N
Repair services							
Contract construction services	N	Y	Y	Y ⁵	Y ⁶	N	N
Indoor recreation services							
Other services							
Industrial/manufacturing							
Food and kindred products	N	Y ¹⁶	Y	Y ⁵	Y ⁶	Y ⁷	N
Textile mill products							
Apparel							
Lumber and wood products							
Furniture and fixtures							
Paper and allied products							
Printing and publishing	N	N	Y	Y ⁵	Y ⁶	Y ⁷	N
Chemicals and allied products							
Petroleum refining and related industries							

**Table 3-2.
Arizona Land Use Compatibility Requirements, According to Arizona Revised Statute 28-8481**

Land Use	Accident Potential Zones		Noise Zones				
	APZ I	APZ II	65-69	70-74	75-79	80-84	85+
Rubber and miscellaneous plastic	N	Y ¹⁶	Y	Y ⁵	Y ⁶	Y ⁷	N
Stone, clay and glass products							
Primary metal industries							
Fabricated metal products							
Professional, scientific and controlling instruments	N	N	Y	Y ¹	Y ²	N	N
Miscellaneous manufacturing	N	Y ¹⁶	Y	Y ⁵	Y ⁶	Y ⁷	N
Public and quasi-public services							
Government services	N	Y ¹⁶	Y ¹	Y ²	Y ²	N	N
Cultural activities, including churches	N	N	Y ¹	Y ²	N	N	N
Medical and other health services							
Cemeteries	N	Y	Y ⁵	Y ⁶	Y ⁷	N	N
Nonprofit organizations	N	Y	Y ¹	Y ²	N	N	N
Correctional facilities	N	Y	Y ¹	Y ²	Y ³	Y ⁴	N
Other public and quasi-public services	N	Y ¹⁶	Y ¹	Y ²	N	N	N
Outdoor recreation							
Playgrounds and neighborhood parks	Y ¹⁵	Y	Y	Y	N	N	N
Community and regional							
Nature exhibits	N	N	Y	N	N	N	N
Spectator sports, including arenas	N	N	Y ¹³	Y ¹³	N	N	N
Golf courses and riding stables	Y ¹⁵	Y	Y	Y ⁵	Y ⁶	N	N
Water based recreational areas	N	N	Y	Y ⁵	Y ⁶	N	N
Resort and group camps	N	N	Y ¹	Y ²	N	N	N
Auditoriums and concert halls	N	N	Y ⁶	Y ⁷	N	N	N
Outdoor amphitheaters and music shells	N	N	Y ¹³	Y ¹³	Y ¹³	N	N
Other outdoor recreation	N	N	Y	Y ¹³	Y ¹³	N	N
Resource production, extraction and open space							
Agriculture (except livestock)	N	Y ¹³	Y ⁹	Y ¹⁰	Y ¹³	Y ¹³	Y ¹³
Livestock farming and animal breeding							
Forestry activities							
Fishing activities and related services	N	Y	Y	Y	Y	Y	Y
Mining activities	N	Y ¹⁶	Y	Y	Y	Y	Y
Permanent open space	N	Y	Y	Y	Y	Y	Y
Water areas	N	N	Y	Y	N	N	N
LEGEND							
Y (Yes) - Land use and related structures compatible without restriction							
Y ^x (Yes with Restrictions) - Land use and related structures generally compatible; see notes							
N (No) - Land use and related structures are not compatible and should be prohibited							
Mfg - Manufacturing							
A, B, or C – Land use and related structures compatible; measures to achieve NLR of 25,30, or 35 must be incorporated into design and construction of structure							
<i>Note:</i> Where consecutive categories exhibit the same restrictions, rows have been combined to simplify the table.							
<i>Source:</i> Arizona Legislature website, 2003 (http://www.azleg.state.az.us/ars/28/08481.htm)							

**Table 3-2.
Arizona Land Use Compatibility Requirements, According to Arizona Revised Statute 28-8481**

1. Measures to achieve an outdoor to indoor noise reduction level of twenty-five decibels pursuant to section 28-8482 must be incorporated into the design and construction of all buildings and the political subdivision must make an express finding, as part of approval, that use of noise reduction level criteria will not alleviate outdoor noise.
2. Measures to achieve an outdoor to indoor noise reduction level of thirty decibels must be incorporated into the design and construction of all buildings and the political subdivision must make an express finding, as part of approval, that use of noise reduction level criteria will not alleviate outdoor noise.
3. Measures to achieve an outdoor to indoor noise reduction level of thirty-five decibels pursuant to section 28-8482 must be incorporated into the design and construction of all buildings.
4. Measures to achieve an outdoor to indoor noise reduction level of forty decibels pursuant to section 28-8482 must be incorporated into the design and construction of all buildings.
5. Measures to achieve an outdoor to indoor noise reduction level of twenty-five decibels must be incorporated into the design and construction of portions of buildings where the public is received, office areas, noise sensitive areas or where normal noise level is low.
6. Measures to achieve an outdoor to indoor noise reduction level of thirty decibels must be incorporated into the design and construction of portions of buildings where the public is received, office areas, noise sensitive areas or where normal noise level is low.
7. Measures to achieve an outdoor to indoor noise reduction level of thirty-five decibels must be incorporated into the design and construction of portions of buildings where the public is received, office areas, noise sensitive areas or where normal noise level is low.
8. Measures to achieve an outdoor to indoor noise reduction level of forty decibels must be incorporated into the design and construction of portions of buildings where the public is received, office areas, noise sensitive areas or where normal noise level is low.
9. Measures to achieve an outdoor to indoor noise reduction level of twenty-five decibels must be incorporated into the design and construction of new residential buildings or expansions of existing residential buildings.
10. Measures to achieve an outdoor to indoor noise reduction level of thirty decibels must be incorporated into the design and construction of new residential buildings or expansions of existing residential buildings.
11. Measures to achieve an outdoor to indoor noise reduction level of thirty-five decibels must be incorporated into the design and construction of new residential buildings or expansions of existing residential buildings.
12. Measures to achieve an outdoor to indoor noise reduction level of forty decibels must be incorporated into the design and construction of new residential buildings or expansions of existing residential buildings.
13. No new residential buildings or expansions of existing residential buildings are permitted.
14. Compatible if special sound reinforcement systems are installed.
15. No aboveground buildings or structures.
16. No new buildings or improvements or expansion of nonagriculture buildings or improvements for uses that result in the release of any substance into the air that would impair visibility or otherwise interfere with operating aircraft, such as any of the following:
 - a. Steam, dust and smoke.
 - b. Direct or indirect reflective Light emissions.
 - c. Electrical emissions that would interfere with aircraft and air force communications or navigational aid systems or aircraft navigational equipment.
 - d. The attraction of birds or waterfowl such as operation of sanitary landfills or maintenance of feeding stations.
 - e. Explosives facilities or similar activities.
17. If located in the extended portion of accident potential zone two in territory of a political subdivision described in section 28-8461, paragraph 8, subdivision (a).

Table 3-3. Federal Land Use Compatibility Guidelines								
SLUCM Land Use		Accident Potential Zones			Noise Zones			
No.	Name	CZ	APZ I	APZ II	65-69	70-74	75-79	80+
10	Residential							
11	Household units							
11.11	Single units detached	N	N	Y ¹	A ¹¹	B ¹¹	N	N
11.12	Single units; attached row	N	N	N	A ¹¹	B ¹¹	N	N
11.13	Single units; attached row							
11.21	Two units; side-by-side							
11.22	Two units; one above the other							
11.31	Apartments; walk up							
11.32	Apartments; elevator							
12	Group quarters							
13	Residential hotels							
14	Mobile home parks or courts	N	N	N	N	N	N	N
15	Transient lodgings	N	N	N	A ¹¹	B ¹¹	C ¹¹	N
16	Other residential	N	N	N ¹	A ¹¹	B ¹¹	N	N
20	Manufacturing							
21	Food & kindred products; mfg	N	N ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
22	Textile mill products; mfg							
23	Apparel and other finished products made from fabrics, leather, and similar materials; mfg	N	N	N ²	Y	Y ¹²	Y ¹³	Y ¹⁴
24	Lumber and wood products (except furniture)	N	Y ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
25	Furniture and fixtures; mfg	N	Y ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
26	Paper & allied products; mfg							
27	Printing, publishing, & allied industries							
28	Chemicals and allied products; mfg	N	N	N ²	Y	Y ¹²	Y ¹³	Y ¹⁴
29	Petroleum refining and related industries	N	N	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
30	Manufacturing							
31	Rubber & miscellaneous plastic products, mfg	N	N ²	N ²	Y	Y ¹²	Y ¹³	Y ¹⁴
32	Stone, clay and glass products mfg	N	N ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
33	Primary metal industries				Y	Y ¹²	Y ¹³	Y ¹⁴
34	Fabricated metal products mfg	N	N ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
35	Professional, scientific and controlling instruments; photographic and optical goods; watches and clocks mfg	N	N	N ²	Y	A	B	N
39	Miscellaneous manufacturing	N	Y ²	Y ²	Y	Y ¹²	Y ¹³	Y ¹⁴

Table 3-3. Federal Land Use Compatibility Guidelines								
SLUCM Land Use		Accident Potential Zones			Noise Zones			
No.	Name	CZ	APZ I	APZ II	65-69	70-74	75-79	80+
40 Transportation, communications, and utilities								
41	Railroad, rapid rail transit and street railroad transportation	N ³	Y ⁴	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
42	Motor vehicle transportation	N ³	Y	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
43	Aircraft transportation	N ³	Y ⁴	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
44	Marine craft transportation							
45	Highway & street right-of-way	N ³	Y	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
46	Automobile parking	N ³	Y ⁴	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
47	Communication	N ³	Y ⁴	Y	Y	A ¹⁵	B ¹⁵	N
48	Utilities	N ³	Y ⁴	Y	Y	Y	Y ¹²	Y ¹³
49	Other transportation communication and utilities	N ³	Y ⁴	Y	Y	A ¹⁵	B ¹⁵	N
50 Trade								
51	Wholesale trade	N	Y ²²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
52	Retail trade-building materials, hardware and farm equipment	N	Y ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
53	Retail trade-general merchandise	N	N ²	Y ²	Y	A	B	N
54	Retail trade-food							
55	Retail-automotive marine craft aircraft & accessories							
56	Retail trade-apparel & accessories							
57	Retail trade-furniture, home furnishings & equipment							
57	Retail trade-eating & drinking establishments	N	N	N ²	Y	A	B	N
59	Other retail trade	N	N ²	Y ²	Y	A	B	N
60 Services								
61	Finance, insurance and real estate services	N	N	Y ⁶	Y	A	B	N
62	Personal services							
62.4	Cemeteries	N	Y ⁷	Y ⁷	Y	Y ¹²	Y ¹³	Y ^{14,21}
63	Business services	N	Y ⁸	Y ⁸	Y	A	B	N
64	Repair services	N	Y ²	Y	Y	Y ¹²	Y ¹³	Y ¹⁴
65	Professional services	N	N	Y ⁶	Y	A	B	N
65.1	Hospitals, nursing homes	N	N	N	A*	B*	N	N
65.1	Other medical facilities	N	N	N	Y	A	B	N
66	Contract construction services	N	Y ⁶	Y	Y	A	B	N
67	Governmental services	N	N	Y ⁶	Y*	A*	B*	N
68	Educational services	N	N	N	A*	B*	N	N
69	Miscellaneous services	N	N ²	Y ²	Y	A	B	N
70 Cultural, entertainment & recreational								
71	Cultural activities (incl. churches)	N	N	N ²	A*	B*	N	N
71.2	Nature exhibits	N	Y ²	Y	Y*	N	N	N

**Table 3-3.
Federal Land Use Compatibility Guidelines**

SLUCM Land Use		Accident Potential Zones			Noise Zones			
No.	Name	CZ	APZ I	APZ II	65-69	70-74	75-79	80+
72	Public assembly	N	N	N	Y	N	N	N
72.1	Auditoriums, concert halls	N	N	N	A	B	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	N	N	N	Y ¹⁷	Y ¹⁷	N	N
73	Amusements	N	N	Y ⁸	Y	Y	N	N
74	Recreational activities (including golf courses, riding stables, and water recreation)	N	Y ^{8, 9, 10}	Y	Y*	A*	B*	N
75	Resorts and group camps	N	N	N	Y*	Y*	N	N
76	Parks	N	Y ⁸	Y ⁸	Y**	Y*	N	N
79	Other cultural, entertainment and recreation	N	Y ⁹	Y ⁹	Y*	Y*	N	N
80	Resource production and extraction							
81	Agriculture (except livestock)	Y	Y	Y	Y ¹⁸	Y ¹⁹	Y ²⁰	Y ^{20,21}
81.5	Livestock farming and animal							
81.7	Breeding	N	Y	Y	Y ¹⁸	Y ¹⁹	Y ²⁰	Y ^{20, 21}
82	Agricultural related activities	N	Y ⁵	Y	Y ¹⁸	Y ¹⁹	N	N
83	Forestry activities related services	N ⁵	Y	Y	Y ¹⁸	Y ¹⁹	Y ²⁰	Y ^{20, 21}
84	Fishing activities related services	N ⁵	Y ⁵	Y	Y	Y	Y	Y
85	Mining activities related services							
89	Other resource production and extraction	N	Y ⁵	Y	Y	Y	Y	Y
LEGEND								
SLUCM - <i>Standard Land Use Coding Manual</i> (U.S. Department of Transportation)								
Y (Yes) - Land use and related structures compatible without restriction								
Y ^x (Yes with Restrictions) - Land use and related structures generally compatible								
N (No) - Land use and related structures are not compatible and should be prohibited								
Mfg - Manufacturing								
NLR (Noise Level Reduction) - Noise level reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure								
A, B, or C - Land use and related structures compatible; measures to achieve NLR of 25,30, or 35 must be incorporated into design and construction of structure								
A*, B*, or C*, - Land use generally compatible with NLR; however, measures to achieve and overall noise level reduction do not necessarily solve noise difficulties and additional evaluation is warranted								
* The designation of these uses as “compatible” in this zone reflects individual Federal agencies, and program consideration 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.								
<i>Note:</i> Where consecutive SLUCM categories share the same restrictions, rows have been combined to simplify the table.								

**Table 3-3.
Federal Land Use Compatibility Guidelines**

NOTES

1. Suggested maximum density 1-2 dwelling units per acre, possibly increased under a Planned Unit Development (PUD) where maximum lot coverage is less than 20 percent.
2. Within each land use category uses exist where further definition may be needed due to the variation of densities in people and structures.
3. The placing of structures, buildings, or above-ground utility lines in the clear zone is subject to certain restrictions. In a majority of the clear zones, these items are prohibited. See AFR 19-9 for specific guidance.
4. No passenger terminals and no major above-ground transmission lines in APZ I.
5. Factors to be considered: labor intensity, structural coverage, explosive characteristics, air pollution.
6. Low-intensity office uses only. Meeting places, auditoriums, etc., not recommended.
7. Excludes chapels.
8. Facilities must be low intensity.
9. Clubhouse not recommended.
10. Small areas for people-gathering places are not recommended.
11.
 - a. Although local conditions may allow residential use, it is discouraged in DNL 65-70 and strongly discouraged in DNL 70-75. The absence of viable alternative development options should be determined and an evaluation indicating that 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 Noise Level Reduction (NLR) of at least 25 dB (DNL 65-70) and 30 dB (DNL 70-75) should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20 dB, thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels.
 - c. NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, design and use of berms and barriers can help mitigate outdoor exposure particularly from level sources. Measures that reduce noise at a site should be used whenever practical in preference to measures which only protect interior spaces.
12. Measures to achieve NLR of 25 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 NLR of 30 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 NLR of 35 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, use is compatible.
16. No buildings.
17. Land use compatible provided special sound reinforcement systems are installed.
18. Residential buildings require a NLR of 25.
19. Residential buildings require a NLR of 30.
20. Residential buildings not permitted.
21. Land use not recommended, but if the community decides use is necessary, hearing protection devices should be worn by personnel.

3.5. Participation In The Planning Process

As local communities prepare their land use plans, the Air Force must be ready to provide additional inputs. The Base Civil Engineer is 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 may be affected by, Luke AFB.

SECTION 4. LAND USE ANALYSIS

4.1. Introduction

Land use planning and control is a dynamic process. 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 concerns. The planning process accommodates this fluidity in that decisions are normally not based on boundary lines, but rather on more generalized area designations. NOISEMAP is a computer program developed by the Air Force to generate contours of noise levels produced by aircraft, while geographic information systems (GIS) are used by base planners and surrounding communities for land use planning purposes. These computer software programs enable Luke AFB to more precisely display its flight tracks and noise contours for land use planning purposes.

The recently implemented operational changes at Luke AFB reflect a range of operations, with 70 to 94 percent of flights originating to the southwest, resulting in a shift in noise exposure from the northeast to the southwest. Two sets of contours were produced for these recently implemented changes, one set for 94 percent of operations to the southwest and 6 percent to the northeast, and one set for 70 percent of operations to the southwest and 30 percent to the northeast. The 65 L_{dn} contour for the 94 percent set of contours extends from the intersection of Desert Cove Road and North El Mirage Road in the city of El Mirage to just north of the intersection of West McDowell Road and North Perryville Road near Goodyear. The 65 L_{dn} contour for the 70 percent set of contours extends from a point about ¾ mile east and ¼ mile north of the intersection of North El Mirage Road and West Cactus Road in El Mirage, to an area northeast of the intersection of West McDowell Road and North Perryville Road near Goodyear. Both sets of contours are displayed in Figures 3-2 and 3-3.

A discussion of Federal and State guidelines for community exposure to noise was provided in Section 3 and is the basis for determining potential incompatible land uses in the vicinity of Luke AFB. A.R.S. 28-8481 dictates land use constraints for APZs I and II and for the remaining High Noise and Accident Potential Zone (see Section 3.2). Additional federal guidance for compatibility within the safety zones is found in Table 3-3.

4.2. Land Use Categories

Current land use was primarily determined by aerial photographs taken December 17, 2000, obtained from the Maricopa County Assessors Office website, and land use maps from Surprise, El Mirage, Goodyear, Buckeye, and Maricopa County. Land use categories are derived from the *Standard Land Use Coding Manual* (developed by the U.S. Department of Transportation), and for the purposes of this study are as follows:

- **Residential.** Includes all types of residential activity, such as single and multi-family residences, at unit densities of greater than one per acre.
- **Low Density Residential.** Residential development equal to or less than one dwelling per acre. The property size generally ranges from one to four acres.

- **Commercial.** Wholesale or retail establishments including offices, retail establishments, restaurants, and hotels and motels.
- **Industrial.** Manufacturing, warehouses, and other similar uses.
- **Public/Quasi-Public.** Publicly owned lands and lands open to public access; including military reservations, prisons, public buildings, schools, churches, cemeteries, and hospitals.
- **Recreational.** Land designated for recreational activity, including parks, golf courses, and wildlife and nature areas.
- **Open.** Undeveloped land.
- **Agricultural and Resource Extraction** Land used for agricultural production including cropland, grazing lands, and livestock production. This land use includes single-family residences located within an agricultural parcel, where the residence is the primary residence for persons engaging in agricultural production. Resource extraction includes such activities as mining or quarrying.

4.3. Existing Land Use

Luke AFB is located in the West Valley of the Phoenix metro area's "Valley of the Sun," and is immediately surrounded by undeveloped areas, agricultural land, and low intensity development. Luke AFB noise or accident potential zones impact lands that fall under the jurisdiction of Maricopa County, and the cities of Glendale, Surprise, El Mirage, Goodyear, Buckeye, and, to a lesser extent, Litchfield Park and Youngtown. Of these communities, Surprise, El Mirage, and unincorporated areas of Maricopa County contain the densest development within the AICUZ noise zones.

As discussed in Section 3.2, Clear Zones are an area with a high potential for aircraft accidents, and their land use is restricted. On base, there are several structures in the Clear Zones, but these are covered by waivers, or are exempt as deviations from the Clear Zone. Off base, there are two farm residences and associated buildings in the Clear Zone, north of Northern Avenue and West of Litchfield Road.

Extending out from the Clear Zone are APZs I and II. APZ I is located almost entirely off-base to both the north and south. Land use is primarily agricultural, with about four residences northeast of runway 21R and five residences southwest of runway 03L. The White Tanks Cemetery is located in the south APZ I about ¼ mile north of Camelback Road near Alsup Avenue. Land use in the APZ II north of Luke AFB is agricultural, with two residences located within its boundaries. Land use in the APZ II south of Luke AFB is also agricultural, with at least one residence. A small commercial area is located within this APZ at the southwest of West Indian School Road and North Cotton Lane.

As previously discussed, the recently implemented operational changes consist of a range of operations, from 70 to 94 percent to the southwest and 6 to 30 percent to the northeast. For purposes of discussion, these are referred to as the "94 percent southwest" and the "70 percent southwest." The extent of land area impacted by the 94 percent southwest is discussed first, followed by a discussion of the 70 percent Southwest.

The 94 percent southwest contours impact land areas of Goodyear and unincorporated Maricopa County. Towards the south of Luke AFB, the 65 L_{dn} noise contour for 94 percent southwest extends to the intersection of West McDowell Road and North Perryville Road (near Interstate 10). Impacted land areas are generally used for agricultural purposes. Structures impacted in agricultural areas include residences, both site-built and mobile homes, of extremely low density, and buildings for farm equipment and produce. A portion of the state correctional facility north of Interstate 10 is impacted by noise levels between 65 and 69 L_{dn} . Part of a planned area development southeast of North Sarival Road and West Indian School Road with moderately dense residential development (about four dwellings per acre) lies within the 65 L_{dn} contour. A small commercial area near North Cotton Lane and West Indian School Road is within the 70 L_{dn} contour. Three agricultural residences are within the 75 L_{dn} contour and three are within the 80 L_{dn} contour. The 85 and above L_{dn} contour is entirely within Luke AFB, in the flightline area.

The 70 percent southwest contours extend to about $\frac{1}{4}$ of a mile northeast of West McDowell Road and North Perryville Road and primarily impact agricultural land and associated residences. The northern edge of the state correctional facility is impacted by the 65 L_{dn} contour. A small commercial area near West Indian School Road and North Cotton Lane is within the 70 to 74 L_{dn} contour. Five residences in agricultural areas are within the 75 to 79 L_{dn} contour. One residence in an agricultural area is within the 80 to 84 L_{dn} contour. The 85 and above L_{dn} contour is entirely on-base in the flightline area.

To the west of the base, residential development increases, particularly along Sarival Avenue between Northern and Glendale Avenues and on the west side of Cotton Lane. Residences in this area include low density site-built and mobile homes. However, some areas contain residences, primarily mobile homes, that appear to exceed one dwelling unit per acre. The area of low density residential development east of North Sarival Road between West Glendale Avenue and West Northern Avenue lies within the 65 L_{dn} contour; the area west of Cotton Lane is just outside the 65 L_{dn} contour. The remaining land is used for agriculture. A church is located about $\frac{1}{4}$ of a mile outside the 65 L_{dn} contour. A small area of low density residential development about $\frac{1}{2}$ mile east of Sarival Road and from $\frac{1}{4}$ to $\frac{1}{2}$ mile south of Glendale Avenue is within the 70 to 79 L_{dn} noise contours.

Rural land uses continue to prevail immediately north and northeast of Luke AFB. The 65 L_{dn} contour for the 94 percent southwest extends to a low density residential area north of Peoria Avenue and west of El Mirage Road. Two churches near West Peoria Avenue and North El Mirage Road are just inside of the 65 L_{dn} contour. Another church is several hundred feet outside of this contour. A small area of industrial land use south of Olive Avenue and Dysart Road is partially within the 65 L_{dn} contour. Two public schools (Dysart High School and Dysart Middle School) are about $\frac{1}{2}$ mile outside the 65 L_{dn} contour. Agricultural land with about seven residences (including four small ranches north of Northern Avenue and west of Litchfield Road) comprises the balance of the area under the 65 L_{dn} contour. Agricultural land with two residences are within the 70 L_{dn} contour. One residence and surrounding agricultural land are within the 75 L_{dn} contour. The 80 and 85 L_{dn} contours are entirely on-base.

Under the 70 percent southwest set of contours, the 65 L_{dn} contour extends into a residential area in El Mirage north and east of El Mirage and Cactus Roads, and another residential area northeast of Peoria Avenue and El Mirage Road. A recreational vehicle community and an associated golf course east of El Mirage Road are also within the 65 L_{dn} contour. Most of a low density residential development (including three churches) north of Peoria Road between Dysart and El Mirage Roads is also under the 65 L_{dn} contour. Two small low density residential developments near Olive Avenue and Litchfield Road are also impacted. The balance of the land under the 65 L_{dn} contour is agricultural (with about four residences), with the exception of portions of two small industrial areas near Olive Avenue between Litchfield and Dysart Roads. The 70 L_{dn} contour primarily overlies agricultural land (with about 5 residences). Part of an industrial area near Dysart Road south of Olive Avenue is also impacted. The 75 L_{dn} contour affects agricultural land with about three residences. The 80 L_{dn} contour is mostly on the base, but impacts a small area of agricultural land north of Northern Avenue and west of Litchfield Road. The 85 L_{dn} contour is entirely on Luke AFB.

The Luke AFB Family Housing area east of Litchfield Road is partially within the 65 L_{dn} contour for both sets of contours. The base's dormitory areas west of Litchfield Road lie within the 65 and 70 L_{dn} contours and, to a small extent, the 75 L_{dn} contour. Other on-base areas, primarily industrial and flightline land uses, fall within higher noise levels.

4.4. Current Zoning

Soon after the release of Luke's original AICUZ Study in 1976, Maricopa County adopted the 1978 Military Airport Zoning Ordinance for the Unincorporated Area of Maricopa County. The stated purpose of this ordinance is to promote public health and safety in the vicinity of military airports and to minimize exposure to overflight hazards and high noise levels generated by military aircraft operations. It established three airport zoning districts titled Airport District (AD) I, II, and III. These zones address land uses within the Air Force-defined Clear Zone and APZs I and II, respectively. Residential uses are not permitted within any AD zoning district.

- **Airport District I** corresponds to a Clear Zone area 2,000 feet wide and 3,000 feet long to the southwest and northeast of the base. Agricultural uses, exclusive of buildings and structures, are the only uses allowed within this zone. It should be noted that the Clear Zone areas at Luke AFB now measure 3,000 feet by 3,000 feet, as required for Class B runways. As such, AD I should be expanded to include the Clear Zone area in its entirety.
- **Airport District II** corresponds with the 3,000 feet by 5,000 feet APZ I area.
- **Airport District III** corresponds with the 3,000 feet by 7,000 feet APZ II area.

In ADs II and III, limited low-intensity uses designed to minimize population concentrations are permitted. Airport District II zoning extends southwest from the Clear Zone to Camelback Road. The full extent of APZ II is not zoned as AD II; Goodyear has zoned a small portion of this area as agricultural. To the northeast of the base, AD I and II zoning does cover the extent of the Clear Zone and APZ I, respectively. Approximately the northeast one-half of APZ II has been zoned industrial by El Mirage.

Maricopa County Zoning Ordinances were amended January 9, 1992 to include the Westside Military Airbase Overlay Zoning District. This Zoning District is composed of four airbase zones, according to noise levels derived from the JLUS Study.

- **Airbase Zone 1** (80 L_{dn} and above) prohibits new residential developments and commercial uses. Industrial uses are limited to those having one employee per 3,500 square feet of lot area. Buildings supporting agricultural production are allowed, but all occupied buildings must have 40 dB noise reduction.
- **Airbase Zone 2** (75 to 79 L_{dn}) also prohibits residential development, but allows occupied buildings for industrial and agricultural uses. Occupied buildings must achieve noise reduction of 35 dB. Any commercial use would need to be approved as part of a plan of development.
- **Airbase Zone 3** (70 to 74 L_{dn}) allows low density residential development (less than 2.5 dwelling units per acre), but these developments are strongly discouraged. Community facilities, such as medical facilities, schools, auditoriums, and outdoor amphitheatres are prohibited. Other land uses are acceptable. A noise reduction of 30 dB is required for all occupied buildings.
- **Airbase Zone 4** (65 to 69 L_{dn}) allows residential development at a density of less than 3.5 dwelling units per acre, but these developments are strongly discouraged. Schools and hospitals are prohibited. Other land uses are acceptable, but a noise reduction of 25 dB must be achieved for all occupied buildings.

Arizona Revised Statute Title 28, Section 8481 (henceforth referred to as A.R.S. 28-8481), *Planning and Zoning, Military Airport Operation Compatibility*, was adopted in 2000 to assure development compatibility with the high noise and accident potential generated by military airport operations. These regulations are largely based on FICUN guidelines for noise compatibility, but differ in some respects. For example, the FICUN guidelines suggest that residential development in areas up to 74 L_{dn} is acceptable with noise reduction. A.R.S. 28-8481 prohibits any new construction of homes in areas of 65 L_{dn} or above, unless the plan was approved before December 31, 2000. An exception to this is primary residences for persons engaging in agricultural land use; new homes can be built in areas up to 84 L_{dn} if the required noise reduction is included. Details of other land use restrictions in accordance with A.R.S. 28-8481 are provided in Table 3-2.

Land areas to the west of Luke AFB are within the jurisdiction of Maricopa County. Airbase Zones 1, 2, 3, and 4 extend out to the 65 L_{dn} JLUS contour. Within Zones 3 and 4, there are several small areas (a total of approximately 20 acres) of mobile home residential. An area of industrial zoning extends from Cotton Lane ½ mile east and from Northern to Glendale Avenue. The southeast corner of Cotton Lane and Northern Avenue is zoned commercial, as is a small area around the intersection of Cotton Lane and Glendale Avenue. There is a special use overlay (zoning exemption) south of Northern Avenue just west of Sarival for a zoo. The remaining area is zoned R-43, allowing residential development at a density of up to one dwelling per acre.

Impacted land southwest of Luke AFB falls predominantly within the jurisdiction of the city of Goodyear and is zoned almost exclusively for agricultural purposes. Residential densities are restricted to one dwelling unit per ten acres.

Airport District 1 corresponds with the Clear Zone of Luke AFB. There is a small area of industrial zoning on the west side of Cotton Lane just north of Indian School Road. South of McDowell Road, between Perryville Road and Cotton Lane, there are areas of industrial, low density residential, and commercial zoning. These areas are just outside of the 65 L_{dn} contour. To the south of Luke AFB (within the jurisdiction of Goodyear), there is a large tract identified as a Planned Unit Development that is partially impacted by the 65-69 dB noise zone. Single family dwellings and a golf course are developing in this area and are generally compatible within this noise zone, especially with the incorporation of noise level reduction (NLR). Because the development plan for this area was approved before December 31, 2000, it is compatible with A.R.S. 28-8481. Also to the south of Luke AFB, just outside the 65 L_{dn} contour, an area of R-43 zoning extends to Camelback Road to the west of Litchfield Road. This area is under the jurisdiction of Litchfield Park and also contains a small tract of commercial land and a recently approved area for a public facility.

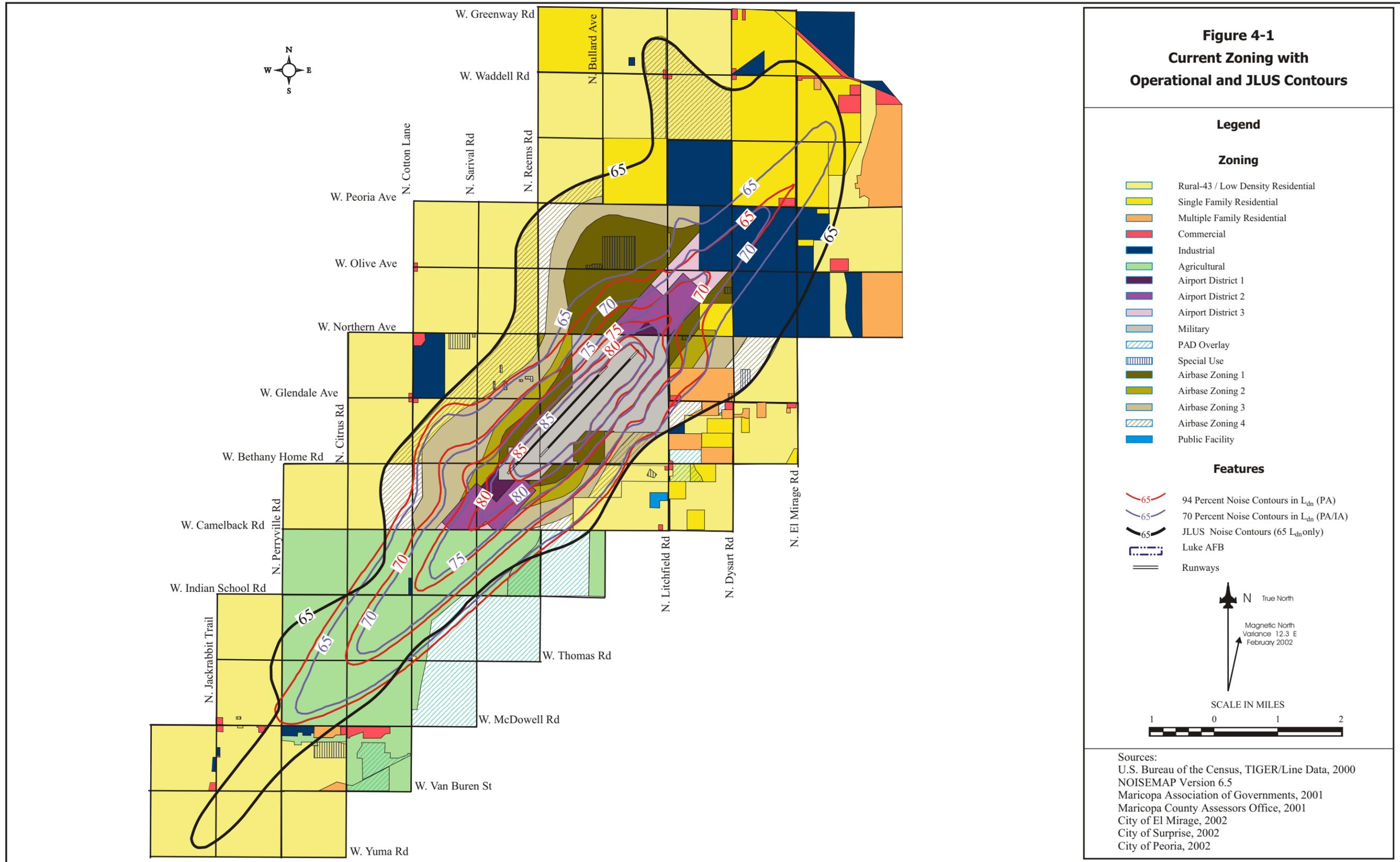
To the north of Luke AFB, Airbase Zone 1 extends nearly to Peoria Avenue, while Airbase Zones 3 and 4 extend out to the 65 L_{dn} JLUS contour. A special use overlay for industrial is located north of Olive Avenue from ½ to one mile west of Litchfield Road. North of Peoria Avenue, an area from Litchfield Road to Bullard Avenue extending to Cactus Avenue has been zoned residential by the city of Surprise. To the northeast of the base, much of the land within the jurisdiction of El Mirage has been zoned industrial. A ½ mile-square area to the northwest of Dysart Road and Northern Avenue has been zoned as single-family residential by El Mirage. This area is well within the JLUS contours as well as the 65 L_{dn} contour. Further northeast, north of Peoria Avenue and east of Dysart Road, the area is primarily zoned residential, with a few areas of commercial.

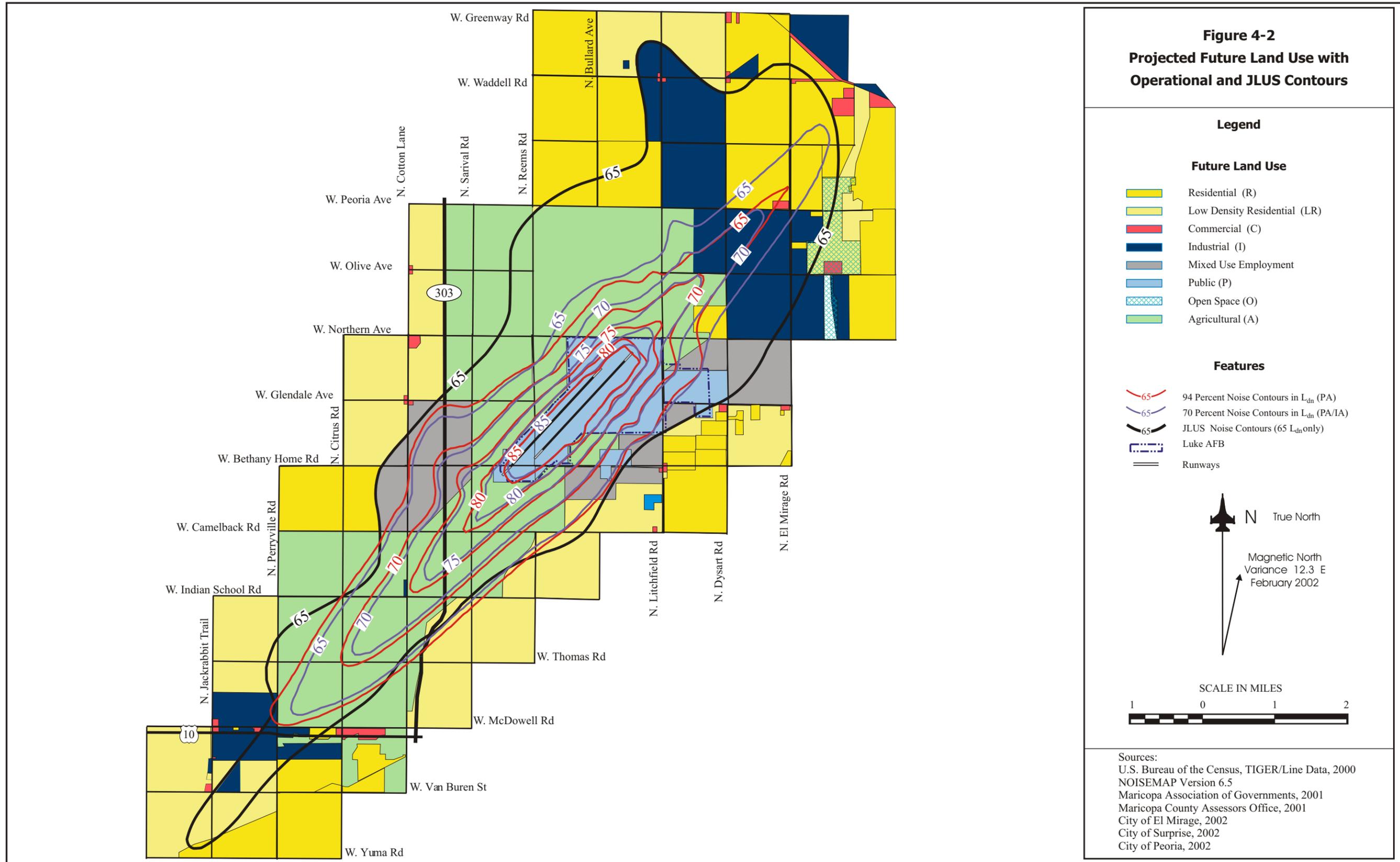
To the east of Luke AFB, the zoning is a mix of various intensities of residential and Airbase Zones 1, 2, 3, and 4. Two small commercial zones and an industrial area are located on the south side of Glendale Avenue east of Litchfield Road. Zoning in the vicinity of Luke AFB is illustrated in Figure 4-1.

4.5. Future Land Use

Jurisdictions affected by flight operations from Luke AFB came together as the Maricopa Association of Governments (MAG) to adopt, in 1991, the *Westside Military Airbase Area Land Use Plan*. This plan identified existing development and zoning within the Luke AFB noise and accident potential zones and encouraged future development patterns that were compatible with airfield operations. Under this plan, residences were strongly discouraged within areas impacted by the 65-74 dB contours. Figure 4-2 illustrates future land use in the vicinity of Luke AFB.

In 2000, A.R.S. 28-8481 was enacted to prohibit new residential development in areas of 65 L_{dn} or greater, unless the development plan was approved by December 31, 2000. Noise reduction is required for dwellings within the 65 L_{dn} contour. Residences for agricultural land use are exempted under this rule. Restrictions in various noise zones for other land uses were also promulgated in A.R.S. 28-8481.





The *White Tank and Grand Avenue Plan* was adopted by Maricopa County in 1999. It establishes a long-range land use plan for unincorporated areas of Maricopa County in the vicinity of Luke AFB. Future land use in incorporated areas of Surprise, El Mirage, Litchfield Park, Goodyear, and Buckeye are derived from their respective land use plans. Low density residential and agricultural uses are projected within much of the Luke AFB environs. Residential development is anticipated to occur to the north, northeast, southeast, and southwest of the base in areas of Surprise, El Mirage, Litchfield Park, and Goodyear (see Figure 4-2). Residential areas north of Peoria Avenue from Litchfield Road to Reems Road would encroach upon areas within the JLUS contour, potentially limiting future missions at Luke AFB. Conceptual land uses within El Mirage, Maricopa County, and Litchfield Park could increase the encroachment around Luke AFB. Vacant land areas impacted by the 65-74 dB noise zone have been identified within the El Mirage General Plan for residential uses of varying densities. However, these uses are not compatible with A.R.S. 28-8481. The northwest corner of an area northwest of Northern Ave and Dysart Road, where residential land use is planned, extends into APZ I and is within the 65 L_{dn} contour, and would therefore not be compatible.

Other vacant land within the same general area, identified for business and office park complexes, is impacted by the 65-74 dB noise zone. While these uses may be conditionally compatible with the incorporation of NLR, alternative uses that minimize population exposure should be considered. Similarly, areas impacted by AICUZ noise zones south of the base within Maricopa County are identified for industrial uses, mixed uses (consisting of major employment centers), residences, and recreation. The residential areas would extend into an area of 65 to 69 L_{dn} and would not be compatible with A.R.S. 28-8481. The compatibility of the mixed use area would depend upon the specific characteristics of a development plan.

A proposed mixed-use areas to the west of Sarival Avenue would be impacted by noise levels from 65-79 L_{dn} and would generally be compatible (this area is just outside APZs I and II). To remain compatible with the *Westside Military Airbase Area Land Use Plan*, NLR would be required for offices and other populated areas, and all development is subject to Plan of Development review and approval. Residential and industrial uses near Buckeye and Goodyear in the vicinity of Interstate 10 and Perryville Road are generally compatible with the JLUS contours and anticipated noise levels.

4.6. Incompatible Land Uses

Incompatible land uses under AICUZ are generally characterized in two ways: land uses within accident potential zones that exceed development or population density guidelines, and land uses that expose large numbers of residents to high levels of sound.

4.6.1. Accident Potential Zones

Incompatible land uses occur within the southern APZ I and within the northern Clear Zone and APZs I and II. According to Air Force guidelines, the clear zone area should be clear of all structures. On-base structures within the Clear Zones are addressed through a waivers program (see Section 3.2) under UFC3-260-01. These issues are being addressed by the base and are not discussed in detail here.

The northern clear zone contains one site-built home and a mobile home off-base. There are residential dwellings in both the north and south APZ I. Residential dwellings of any density are incompatible within APZ I. Residences that exceed one dwelling unit per acre are incompatible within APZ II. There are several residences within the APZ II, but these are residences in agricultural areas and are at densities of less than one dwelling per acre.

An area northwest of Cotton Lane and Indian School Road is currently zoned as industrial and lies in APZ II; development there would be compatible as long as it meets A.R.S. 28-8481 guidelines for potential emission of smoke and light.

4.6.2. Noise Zones

Noise generated from the F-16 aircraft operations at Luke AFB results in noise impacts to nearby lands. According to Arizona requirements and federal recommendations (see Tables 3-2 and 3-3), residences should not be sited within areas impacted by noise exceeding 75 dB, while residences within the 65-74 dB noise zones should contain NLR. Mobile homes, due to their inability to incorporate adequate NLR, are incompatible (according to FICUN guidelines) within any noise zone greater than DNL 65 dB. Several residences are located within the 75 to 79 and 80 to 84 L_{dn} contours northeast and southwest of the base. These dwellings are considered residences within agricultural lands and, as such, are acceptable under A.R.S. 28-8481, but are not recommended under federal guidelines.

An area of low density residential land use near Ocotillo Road / Maryland Avenue and Alsup Avenue / Reems Road lies within 75 to 79 L_{dn} and is thus incompatible with Federal guidelines. Under A.R.S. 28-8481, measures to achieve noise reduction of 35 dB are required for construction of new dwellings or modifications to existing dwellings in this area. Several mobile homes are located within the 75 to 79 L_{dn} noise zones beyond the runway ends and west of the airfield. Additionally, under the 70 percent southwest contours, the 65-69 dB noise zone impacts the recreational vehicle community along the Agua Fria wash.

4.7. Planning Considerations

AICUZ noise contours describe the noise characteristics of a specific operational environment and, as such, will change if a significant operational change is made. As discussed previously, the Arizona legislature codified the 1988 JLUS contours to stabilize the area within which noise-based land use constraints exist. This codification assists developers and residents by providing continuity in requirements. It also assists the Air Force by “protecting” Luke AFB from encroaching development that could limit its ability to adopt changes in its flying mission in response to world events or altered DoD needs.

The Air Force recommends that AICUZ data be utilized with all other planning data. Therefore, specific land use control decisions should not be based solely on AICUZ boundaries. With these considerations in mind, Luke AFB has revised the 1995/1997 AICUZ Study and has provided flight track, accident potential zone, and noise contour information in this Study that reflect the most accurate description of current aircraft activities.

SECTION 5. IMPLEMENTATION

The implementation of the AICUZ study must be a joint effort between the Air Force and the adjacent communities.¹ The Air Force's role is to minimize the impact on the local communities from Luke AFB operations. The role of the communities is to ensure that development in their environs is compatible with accepted planning and development principles and practices, and is consistent with Arizona regulations.

5.1. 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 ensure 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, commanders are required to periodically review existing traffic patterns, instrument approaches, weather minima², 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 plans 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. At Luke AFB, noise mitigation practices include routing flight tracks to avoid heavily populated areas, adjusting power settings and climb rates to minimize noise, and restricting nighttime engine maintenance and flight operations to a minimum.

The preparation and presentation of this Luke AFB AICUZ update 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, Luke AFB. Base personnel will also be available to provide information, criteria, and guidelines to state, regional, and local planning bodies, civic associations, and similar groups.

¹ In Arizona, state regulations override some of the AICUZ recommendations (see Section 3 for a discussion and comparison of Federal guidance and Arizona requirements). However, the AICUZ guidelines may be helpful in implementing the state requirements or in addressing areas not covered by the state regulations.

² Weather minima are the minimum ceiling and visibility conditions under which a particular pilot and aircraft can operate, based on pilot rating and type of aircraft.

5.2. LOCAL COMMUNITY RESPONSIBILITIES

The residents of the West Valley and the personnel of Luke AFB have a long history of working together for mutual benefit. 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:

- Consider incorporating AICUZ policies and guidelines into comprehensive plans in the nearby cities and Maricopa County. Use overlay maps of the 2002 AICUZ noise contours, in conjunction with Arizona requirements and Air Force Land Use Compatibility Guidelines, to evaluate existing and future land use proposals.
- Ensure that the land use policies and guidelines of the adopted *Westside Military Airbase Land Use Plan* are adhered to by the affected governments.
- Consider modifying existing zoning ordinances and subdivision regulations as necessary to support the compatible land use guidelines outlined in this study.
- Ensure that height and obstruction criteria as defined by Federal Aviation Regulation (FAR) Part 77 requirements are not compromised.
- Continue to enforce the requirements in A.R.S. 28-8481 pertaining to noise level reduction for new construction or modification of existing structures.
- Continue to inform Luke AFB of planning and zoning actions that have the potential to affect base operations. Informational efforts could involve the development of a working group representing city planners, county planners, and base planners. Such a group could meet at regular intervals (at least quarterly is suggested) to discuss AICUZ concerns and major development proposals that could affect airfield operations.

SECTION 6. LIST OF PREPARERS AND CONTRIBUTORS

This Air Installation Compatible Use Zone Study (and the accompanying Citizens Brochure) has been prepared by the Air Force Center for Environmental Excellence (AFCEE) and the 56th Civil Engineer Squadron (56 CES) at Luke AFB with contractual assistance from LABAT-ANDERSON INCORPORATED. The following personnel were involved in the preparation and review of this report:

Cris Brownlow, 56 CES/CECB, Community Planner, Luke AFB, AZ
B.A., 1992, Spanish, Arizona State University, Tempe, AZ
M.S., 1996, Planning, University of Arizona, Tucson, AZ
Years of Experience: 12

Dean P. Converse, LABAT-ANDERSON INCORPORATED, Environmental Analyst
B.S., 1998, Geography (Environmental Studies), University of Nebraska at Lincoln
Years of Experience: 5

Quinn Damgaard, LABAT-ANDERSON INCORPORATED, Environmental Analyst
B.A., 2000, Biology (Ecological Studies), Augustana College, Sioux Falls, SD
Years of Experience: 3

Carmen L. Hansen, LABAT-ANDERSON INCORPORATED, Executive Administrator
Years of Experience: 14

JoAnn M. Leonard, LABAT-ANDERSON INCORPORATED, Administrative Assistant
Years of Experience: 20

Robert L. Lopez, HQ AFCEE/ECA, Contracting Officer's Representative
B.S., 1976, Biology, Texas A&M University, Corpus Christi
M.S., 1998, Environmental Science, University of Texas at San Antonio
Years of Experience: 18

Mary Jo May, 56 FW/PA, Luke AFB Public Affairs Office, Chief of Community Relations
B.A., 1995, Business Management, University of Phoenix, Phoenix, AZ
Years of Experience: 29

Randall G. McCart, LABAT-ANDERSON INCORPORATED, Senior Environmental Analyst
B.S., 1981, Geography, University of Nebraska at Omaha
M.A., 1984, Geography, University of Nebraska at Omaha
B.S., 1987, Education, University of Nebraska at Omaha
Years of Experience: 15

Dorothy J. Miller, LABAT-ANDERSON INCORPORATED, Noise and AICUZ Consultant
B.Sc., 1947, Mathematics, Ohio State University, Columbus, OH
Years of Experience: 23

Joseph E. Milligan, LABAT-ANDERSON INCORPORATED, Director of Environmental Research, Senior Reviewer

B.S., 1963, Agriculture, Rutgers University, New Brunswick, NJ

M.S., 1975, Animal Science, Rutgers University

Ph.D., 1979, Nutrition/Physiology, Rutgers University

Years of Experience: 35

William K. Ohlmeyer, LABAT-ANDERSON INCORPORATED, Senior Environmental Analyst; Former Military Command Pilot and Currently Licensed Commercial Pilot with Instrument Rating

M.Arch., 1971, Construction Management, Texas A&M University, College Station

B.S., 1970, Architectural Construction, Texas A&M University, College Station

Years of Experience: 33

Sheri A. Rivera, LABAT-ANDERSON INCORPORATED, Senior Environmental Analyst

B.S., 1989, Geography, University of Nebraska at Omaha

M.S., 1995, Urban Studies, University of Nebraska at Omaha

Years of Experience: 15

C. Jefferson Rothrock, 56 CES/CEV, Chief of Integration and Analysis Element

B.A., 1984, Environmental Science, University of Virginia, Charlottesville

Years of Experience: 15

Larry L. Shane, LABAT-ANDERSON INCORPORATED, Environmental Consultant and Pilot (USAF, Retired)

B.S., 1961, Industrial Engineering, University of North Dakota, Grand Forks

M.S., 1975, Systems Management, University of Southern California, Los Angeles

Years of Experience: 42

Kristin L. Sutherlin, LABAT-ANDERSON INCORPORATED, Project Manager, Senior Environmental Analyst

B.A., 1986, Economics, Louisiana State University in Shreveport

M.A., 1988, Urban Studies (Planning), University of Maryland, College Park

Years of Experience: 17

Christopher R. Weber, LABAT-ANDERSON INCORPORATED, Environmental Analyst

B.S., 1998, Environmental Science, Creighton University, Omaha, NE

Years of Experience: 4



Luke AFB Arizona

Air Installation Compatible Use Zone Study

Volume II: Appendices



November 2003

TABLE OF CONTENTS — Volume II: Appendices

Appendix A The AICUZ Concept, Program, Methodology, and PoliciesA-1

- A.1. Concept..... A-1
- A.2. Program A-1
- A.3. Methodology A-2
- A.4. AICUZ Land Use Development Policies A-2
 - A.4.1. Policy 1..... A-2
 - A.4.2. Policy 2..... A-3
 - A.4.3. Policy 3..... A-3
 - A.4.4. Policy 4..... A-3
 - A.4.5. Policy 5..... A-3
 - A.4.6. Policy 6..... A-4
 - A.4.7. Policy 7..... A-4
- A.5. Basic Land Use Compatibility A-5
- A.6. Accident Potential A-5
- A.7. Noise..... A-6

Appendix B Accident Potential ZonesB-1

- B.1. Guidelines For Accident Potential B-1
- B.2. Accident Potential Analysis B-1
- B.3. Definable Debris Impact Areas B-4
- B.4. Findings..... B-4

Appendix C Description of the Noise EnvironmentC-1

- C.1. Noise Environment Descriptor..... C-1
- C.2. Noise Event Descriptor C-1
- C.3. Noise Contour Production..... C-2
- C.4. Technical Information C-3

Appendix D Height and Obstructions CriteriaD-1

- D.1. Height And Obstructions Criteria..... D-1
 - D.1.1. General D-1
 - D.1.2. Explanation of Terms D-1
 - D.1.3. Planes and Surfaces. D-1
- D.2. Height Restrictions D-2

Appendix E Noise Level Reduction Guidelines E-1

LIST OF FIGURES

Figure B-1. Distribution of Air Force Aircraft Accidents.....	B-3
Figure B-2. Air Force Accident Data (1968-1972).....	B-3
Figure B-3. Air Force Accident Data [Updated] (1968-1995).....	B-3
Figure C-1. Day-Night Average A Weighted Sound Level.....	C-1
Figure C-2. Sound Exposure Level.....	C-2
Figure D-1. Airspace Control Surface Plan.....	D-3

LIST OF TABLES

Table B-1. Hazard Potential Location Analysis	B-2
Table B-2. Accident to Area Ratio: Ratio of Percentage of Accidents to Percentage of Area (Air Force Accident Data 1968-1995).....	B-4
Table D-1. Coordinates and Elevations, Luke AFB, Arizona.....	D-3

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

A.1. Concept

Federal legislation, national sentiment, and other external forces which directly affect the United States Air Force mission have served to greatly increase the Air Force's role in environmental and planning issues. Problems of airfield encroachment from incompatible land uses surrounding installations, as well as air and water pollution and socio-economic 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 planning depends upon creating an atmosphere of mutual trust and helpfulness. The Air Installation Compatible Use Zone (AICUZ) concept has been developed in an effort to:

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

The land use guidelines developed herein are a composite of a number of other land use compatibility studies that have been refined to fit the Luke AFB aviation environment.¹

A.2. Program

Base 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 governmental bodies and citizens be fully informed whenever AICUZ or other planning matters affecting the installation are under consideration. This includes positive and 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.
- 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 for sound suppressers 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.

¹ Note that in Arizona, state regulations override some of the AICUZ guidance and recommendations. See Section 3 for a discussion and comparison of Federal guidance and Arizona requirements. Except where noted, this Appendix describes only AICUZ recommendations.

A.3. 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:

- Accident potential zones (APZ) and clear zones (CZ) based on past Air Force aircraft accidents and installation operational data (Appendix B).
- Noise zones (NZ) produced by the computerized Day-Night Average A-Weighted Sound Level (D_{NL}) metric (Appendix C).
- The area designated by the Federal Aviation Administration and the Air Force for purposes of height limitations in the approach and departure zones of the base (Appendix D).

The APZs, CZ, and NZs are the basic building blocks for land use planning with AICUZ data. Compatible land uses are specified for these zones, and recommendations on building materials and standards to reduce interior noise levels inside structures are provided in Appendix E.

As part of the AICUZ program, the only real property acquisition for which the USAF has received congressional authorization and the base and Major Commands request appropriation are the areas designated as the clear zone (CZ). Real property interests are acquired by fee or easement giving the base control over the use of the property. Fee land so acquired may be leased out for agricultural or grazing purposes. Luke AFB has acquired land use control within its clear zones through easements. Compatible land use controls for the remaining airfield environs should be accomplished through the community land use planning processes.

A.4. 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. Luke AFB recommends the following policies be considered for incorporation into the comprehensive plans of agencies in the vicinity of the base environs:

A.4.1. 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.
- Protect the general economic welfare by restricting incompatible land use.

A.4.2. 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 Air Installation Compatible Use Zone concept into community land use plans, modifying them when necessary.
- Adopt appropriate ordinances to implement airfield environs land use plans.

A.4.3. Policy 3

Within the boundaries of the Clear Zone (CZ), 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.
- Uses that provide for structures within ten feet of aircraft approach-departure and/or transitional surfaces.

A.4.4. 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.).
- Recreation buildings and structures.

A.4.5. 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.4.6. 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 guidelines (Appendix E) for new construction should be implemented to permit certain uses where they would otherwise be prohibited.

A.4.7. 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 potential and constraints.
- Existing land use.
- Land ownership patterns and values.
- Economic and social demands.
- Cost and availability of public utilities, transportation, and community facilities.
- Other noise sources.

Each runway end at Luke AFB has a 3,000 foot by 3,000 foot clear zone and two accident potential zones (Appendix B).² Accident potential on or adjacent to the runway or within the clear zone 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 Congress to authorize and appropriate funds for the necessary real property interests in this area to prevent incompatible land uses. Clear zone easements have been acquired for each runway at Luke AFB which effectively restrict incompatible land uses.

Accident potential zone I is less critical than the clear zone, 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 acceptable.

Accident potential zone II is less critical than accident potential zone I, but still possesses potential for accidents. Accident potential zone 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 accident potential zone 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

² As discussed in Section 3.2, Arizona state regulations (A.R.S. 28-8461, Section 8(a)) define a High Noise or Accident Potential Zone of 30,000 feet long by 4,000 feet wide. It includes the Clear Zone and APZs I and II described above, and extends an additional 15,000 feet to the southwest, as illustrated in Figure 3-1.

operation. High density functions such as multi-story buildings, places of assembly (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. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in accident potential zone II is one dwelling per acre. For most non-residential usage, buildings should be limited to one story and the lot coverage should not exceed 20 percent.

A.5. Basic Land Use Compatibility

Research on aircraft accident potential, noise, and land use compatibility is ongoing at a number of federal and other agencies. These studies 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.
- Noise buffers, including topography.

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

A.6. Accident Potential

Land use guidelines for the two APZs 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 clear zone.
- In APZ I.
- In APZ II.
- In all other areas within a 10 nautical mile radius of the runway.

Accident potential on or adjacent to the runway or within the clear zone 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 engineering and 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 at prevention of 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 population, where disruption would have an adverse impact (telephone, gas, etc.).
- Concentrate people who are unable to respond to emergency situations, such as children, elderly, handicapped, etc.
- 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 these APZs. The 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

Nearly all studies on residential aircraft noise 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 65-75 dB there is currently no consensus. These areas may not qualify for Federal mortgage insurance in residential categories according to the Department of Housing and Urban Development (HUD) Regulation 24 CFR 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. Whenever possible, residential land use should be located below DNL 65 dB according to Air Force land use recommendations.

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 the normal background noise level is low.

The transportation, communications and utilities categories have a high 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. Where 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 Air Force 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.

With the exception of forestry activities and livestock farming, uses in the resources production, extraction, and open space category are compatible almost without restrictions.

This page intentionally left blank.

APPENDIX B — 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 aircraft crews. Despite stringent maintenance requirements and countless hours of training, past history makes it clear that accidents are going to occur.

When the AICUZ program began, there were no current comprehensive studies on accident potential. In support of the program, the Air Force completed a study of Air Force accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 percent of aircraft 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 (1,500 feet either side of the runway centerline) wide, 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, accident potential zone (APZ) I, and accident potential zone (APZ) II.¹ The clear zone starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The Air Force has adopted a policy of acquiring property rights to areas designated as clear zones because of the high accident potential. APZ I extends from the clear zone an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet in an area of further reduced accident potential.

The Air Force 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 accident potential zone concept.

The risk to people on the ground of being killed or injured by aircraft accidents is small. 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 the Air Force approaches this safety issue from a land use planning perspective.

B.2. Accident Potential Analysis

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 U.S. Air Force (USAF) performed a aircraft accident hazard study in order to identify land near airfields with significant accident potential. Accidents studied occurred within ten nautical miles of airfields.

¹ As discussed in Section 3.2, Arizona state regulations (A.R.S. 28-8461, Section 8(a)) define a High Noise or Accident Potential Zone of 30,000 feet long by 4,000 feet wide. It includes the Clear Zone and APZs I and II described above, and extends an additional 15,000 feet to the southwest, as illustrated in Figure 3-1.

The study reviewed 369 major USAF accidents during 1968-1972, and found that 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 that fighter and training aircraft accounted for 80 percent of the accidents.

Because 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 that 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 widths of 2,000, 3,000, and 4,000 total feet. The location analysis found the following:

Table B-1. Hazard Potential Location Analysis			
<i>Length from Both Ends of Runway</i>	<i>Width of Runway Extension</i>		
	<i>2,000 feet</i>	<i>3,000 feet</i>	<i>4,000 feet</i>
	Percent of Accidents		
On or adjacent to runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000 feet	35	39	39
3,000 to 8,000 feet	8	8	8
8,000 to 15,000 feet	5	5	7
	Cumulative Percent of Accidents		
On or adjacent to runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000 feet	58	62	62
3,000 to 8,000 feet	66	70	70
8,000 to 15,000 feet	71	75	77

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 runway extension, which would include the maximum percentage of accidents in the smallest area, is 3,000 feet.

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 accident statistics for the 1968-1972 study are shown in Figure B-2.

The original study (Figure B-2) was 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.

Using the designated zones and accident data, it is possible to calculate a ratio of percentage of accidents to percentage of area size (see Table B-2). These ratios indicate that the clear zone, with the smallest area size and the highest number of accidents, has the highest ratio, followed by the runway and adjacent area, APZ I and then APZ II.

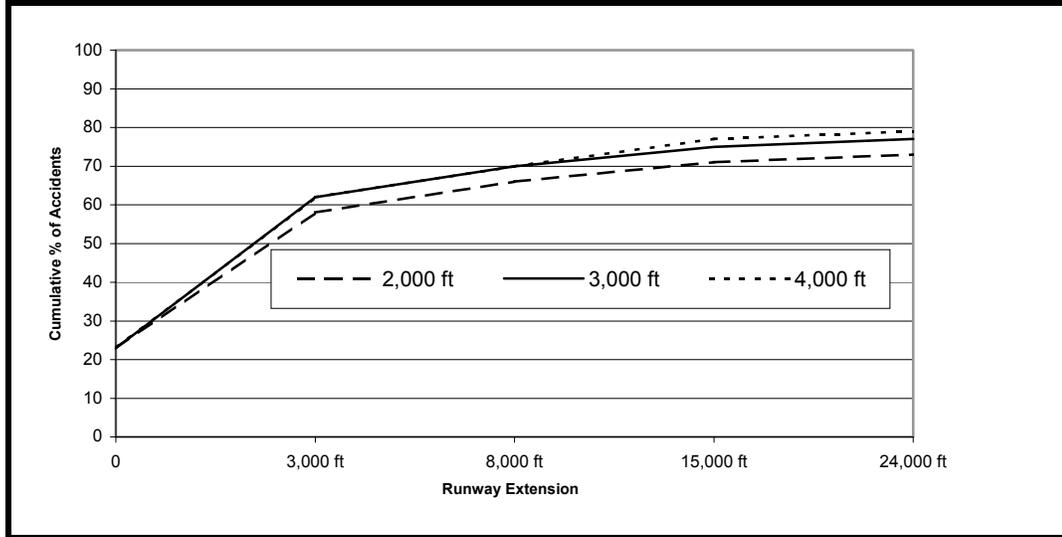
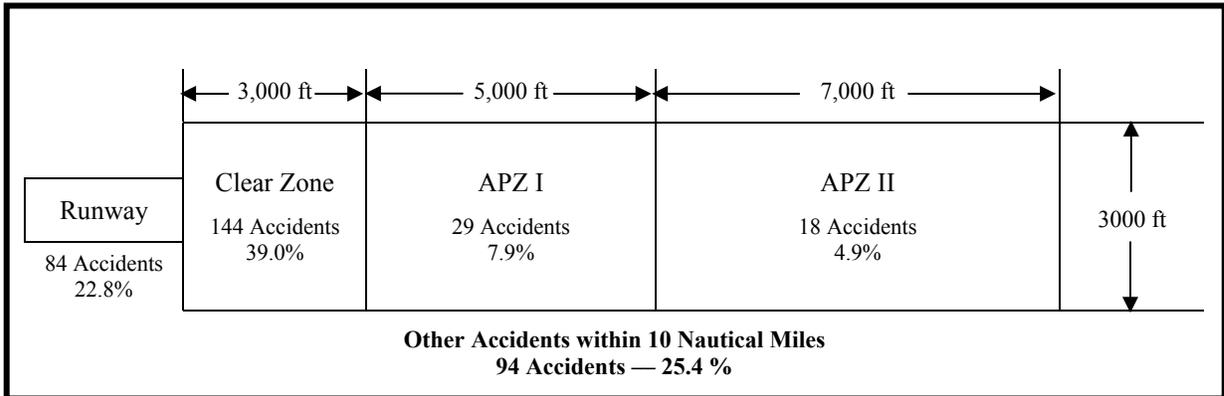
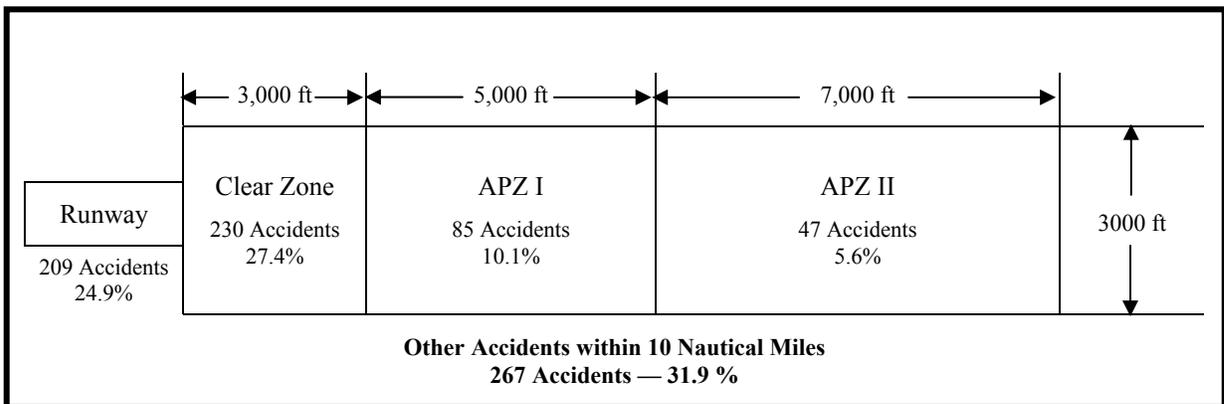


Figure B-1. Distribution of Air Force Aircraft Accidents



**Figure B-2. Air Force Accident Data
(369 Accidents — 1968-1972)**



**Figure B-3. Air Force Accident Data [Updated]
(838 Accidents — 1968-1995)**

**Table B-2. Accident to Area Ratio:
Ratio of Percentage of Accidents to Percentage of Area
(Air Force Accident Data 1968-1995)**

<i>Zone</i>	<i>Area (acres)¹</i>	<i>Number of Accidents</i>	<i>Accident per Acres</i>	<i>Percent of Total Area</i>	<i>Percent of Total Accidents</i>	<i>Ratio: Accident to Area³</i>
Runway Area ⁴	487	209	1 per 2.3	0.183	24.9	136
Clear Zone	413	226	1 per 1.8	0.155	27.4	177
APZ I	689	85	1 per 8.1	0.258	10.1	39
APZ II	964	47	1 per 20.5	0.362	5.6	15
Other	264,053	267	1 per 989	99.0425	31.9	0.3

Notes:

¹Area includes land within 10 nautical miles of runway (total of 266,606 acres).

²Total number of accidents is 838 (through 1995).

³Percent total accidents divided by percent total area.

⁴Runway dimensions are 2000 ft by 10,600 ft.

B.3. Definable Debris Impact Areas

The Air Force 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 Air Force used weighted averages of impact areas, for accidents occurring only in the approach and departure phase, to determine the following average impact areas:

Average Impact Areas for Approach and Departure Accidents

Overall Average Impact Area	5.06 acres
Fighter, Trainer and Misc. Aircraft	2.73 acres
Heavy Bomber and Tanker Aircraft	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. Air Force accident studies have found that aircraft accidents near Air Force 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.
- 25% occurred on the runway or within an area extending 1,000 feet out from each side of the runway.
- 27% 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.
- 15% 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.

U.S. Air Force aircraft accident statistics revealed that 75% 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.

This page intentionally left blank.

APPENDIX C — DESCRIPTION OF THE NOISE ENVIRONMENT

C.1. Noise Environment Descriptor

The noise contour methodology used herein is the Day-Night Average A-Weighted Sound Level (DNL) metric of describing the noise environment. Efforts to provide a national uniform standard for noise assessment have resulted in adoption by the Environmental Protection Agency of DNL as the standard noise descriptor. The Air Force uses the DNL descriptor in assessing the amount of aircraft noise exposure, and as a metric for community response to the various levels of exposure. The DNL values used for planning purposes are 65, 70, 75, and 80 dB. Land use guidelines are based on the compatibility of various land uses with these noise exposure levels.

It is generally recognized that a noise environment descriptor should consider, in addition to the annoyance of a single event, the effect of repetition of such events and the time of day in which these events occur. DNL begins with a single event descriptor and adds corrections for the number of events and the time of day. Since the primary development concern is residential, nighttime events are considered more annoying than daytime events and are weighted accordingly. DNL values are computed from the single event noise descriptor, plus corrections for number of flights and time of day (Figure C-1).

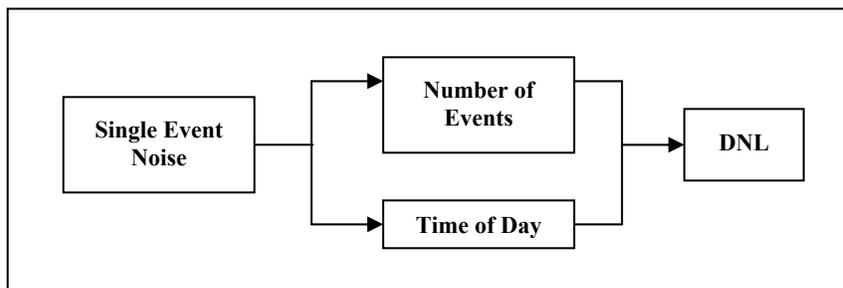


Figure C-1. Day-Night Average A-Weighted Sound Level

As part of the extensive data collection process, detailed information is gathered on the type of aircraft, the number, and time of day of flying operations for each flight track during a typical day. This information is used in conjunction with the single event noise descriptor to produce DNL values. These values are combined on an energy summation basis to provide single DNL values for the mix of aircraft operations at the base. Equal value points are connected to form the contour lines.

C.2. Noise Event Descriptor

The single event noise descriptor used in the DNL system is the Sound Exposure Level (SEL). The SEL measure is an integration of an “A” weighted noise level over the period of a single event such as an aircraft flyover, in dB.

Frequency, magnitude, and duration vary according to aircraft type, engine type, and power setting. Therefore, individual aircraft noise data are collected for various types of

aircraft/engines at different power settings and phases of flight. The following diagram shows the relationship of the single event noise descriptor (the SEL) to the source sound energy.

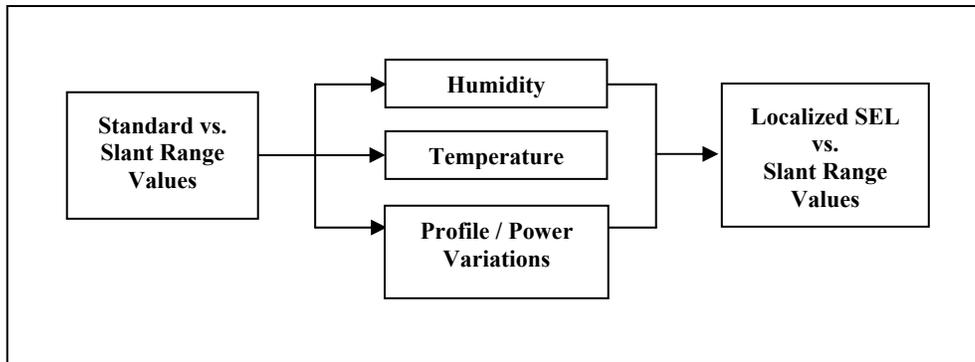


Figure C-2. Sound Exposure Level

SEL vs. slant range values are derived from noise measurements made according to a source noise data acquisition plan developed by Bolt, Beranek, and Newman, Inc., in conjunction with the Air Force's Armstrong Laboratory (AL) and carried out by AL. These standard day, sea level values form the basis for the individual event noise descriptors at any location and are adjusted to the location by applying appropriate corrections for temperature, humidity, and variations from standard profiles and power settings.

Ground-to-ground sound propagation characteristics are used for altitudes up to 500 feet absolute with linear transition between 500 and 700 feet and air-to-ground propagation characteristics above 700 feet.

In addition to the assessment of aircraft flight operations, the DNL system also incorporates noise resulting from engine/aircraft maintenance checks on the ground. Data concerning the orientation of the noise source, type of aircraft or engine, number of test runs on a typical day, power settings used and their duration, and use of suppression devices are collected for each ground run up or test position. This information is processed and the noise contribution added (on an energy summation basis) to the noise generated by flying operations to produce noise contours reflecting the overall noise environment with respect to aircraft air and ground operations.

C.3. Noise Contour Production

Data describing flight track distances and turns, altitudes, airspeeds, power settings, flight track operational utilization, maintenance locations, ground run-up engine power settings, and number and duration of runs by type of aircraft/engine is assembled by each individual AFB. The data is screened by the MAJCOM and HQ AFCEE/ECC. Trained personnel process the data for input into a central computer. Flight track maps are generated for verification and approval by the base/MAJCOM. After any required changes have been incorporated, DNL contours are generated by the computer using the supplied data and standard source noise data corrected to local weather conditions. These contours are plotted and prepared for photographic reproduction. A set of these contours is provided in the body of the report.

C.4. Technical Information

Additional technical information on the DNL procedures are available in the following publications:

Community Noise Exposure Resulting from Aircraft Operations: Applications Guide for Predictive Procedure, AMRL-TR-73-105, November, 1974, from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151.

Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with Adequate Margin of Safety, EPA Report 550/9-74-004, March, 1974, from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Adopted Noise Regulations for California Airports, Title 4, Register 70, No. 48-11-28-70, Subchapter 6, Noise Standards.

This page intentionally left blank.

APPENDIX D — HEIGHT AND OBSTRUCTIONS CRITERIA

D.1. Height And Obstructions Criteria

D.1.1. General

This appendix 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 ft above the ground at the site of the structure.

D.1.2. Explanation of Terms

The following will apply (See Figure D-1):

- Controlling Elevation. Whenever surfaces or planes within the obstructions criteria overlap, the controlling (or governing) elevation becomes that of the lowest surface or plane.
- Runway Length. Luke AFB has two runways (10,000 ft and 9,910 ft), for a total of 19, 910 ft of pavement designed and built for sustained aircraft landings and takeoffs.
- Established Airfield Elevation. The elevation for Luke AFB is 1,090 ft above mean sea level (MSL).
- Dimensions. All dimensions are measured horizontally unless otherwise noted.

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. The primary surface comprises surfaces of the runway, runway shoulders, and lateral safety zones and extends 200 ft beyond the runway end. The width of the primary surface for a single class “B” runway is 2,000 ft, or 1,000 ft on each side of the runway centerline.
- Clear Zone Surface. This surface defines the limits of the obstruction clearance requirements in the vicinity contiguous to the end of the primary surface. The length and width (for a single runway) of a clear zone surface at Luke AFB is 3,000 ft by 3,000 ft.
- Approach-Departure Clearance Surface. This surface is symmetrical about the runway centerline extended, begins as an inclined plane (glide angle) 200 ft beyond each end of the primary surface of the centerline elevation of the runway end, and extends for 50,000 ft. 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 ft above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 ft from the start of the glide angle. The width of this surface at the runway end is 2,000 ft; it flares uniformly, and the width at 50,000 ft is 16,000 ft.

- Inner Horizontal Surface. This surface is a plane, oval in shape at a height of 150 ft above the established airfield elevation. It is constructed by scribing an arc with a radius of 7,500 ft 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 ft to a height of 500 ft above the established airfield elevation. The slope of the conical surface is 20:1.
- Outer Horizontal Surface. This surface is a plane located 500 ft above the established airfield elevation. It extends for a horizontal distance of 30,000 ft from the outer periphery of the conical surface.
- Transitional Surfaces. These surfaces connect the primary surfaces, clear zone 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 the transitional surface slope at any point along the lateral boundary of the primary surface, including the clear zone, draw a line from this point to the runway centerline. This line will be at right angles to the runway axis. 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 into the air any substance which would impair visibility or otherwise interfere with the operation of aircraft (i.e. steam, dust, or smoke).
- Uses which produce light emissions, either direct or indirect (reflective), which would interfere with pilot vision.
- Uses which produce electrical emissions which would interfere with aircraft communications systems or navigational equipment.
- Uses which would attract birds or waterfowl, including but not limited to, operation of sanitary landfills, maintenance of feeding stations, or the growing of certain vegetation.
- Uses that provide for structures within ten ft of aircraft approach-departure and/or transitional surfaces.

D.2. Height Restrictions

City/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 Federal Aviation Regulations (FAR) Part 77 as described, in part, by the information contained in this Appendix.

Table D-1. Coordinates and Elevations, Luke AFB, Arizona	
Airfield Elevation	1,090 ft above Mean Sea Level (MSL)
Coordinates:	
West Runway (03L/21R)	North End: Lat 33.54° N., Long 112.38° W. South End: Lat 33.52° N., Long 112.40° W.
East Runway (03R/21L)	North End: Lat 33.55° N., Long 112.37° W. South End: Lat 33.53° N., Long 112.39° W.

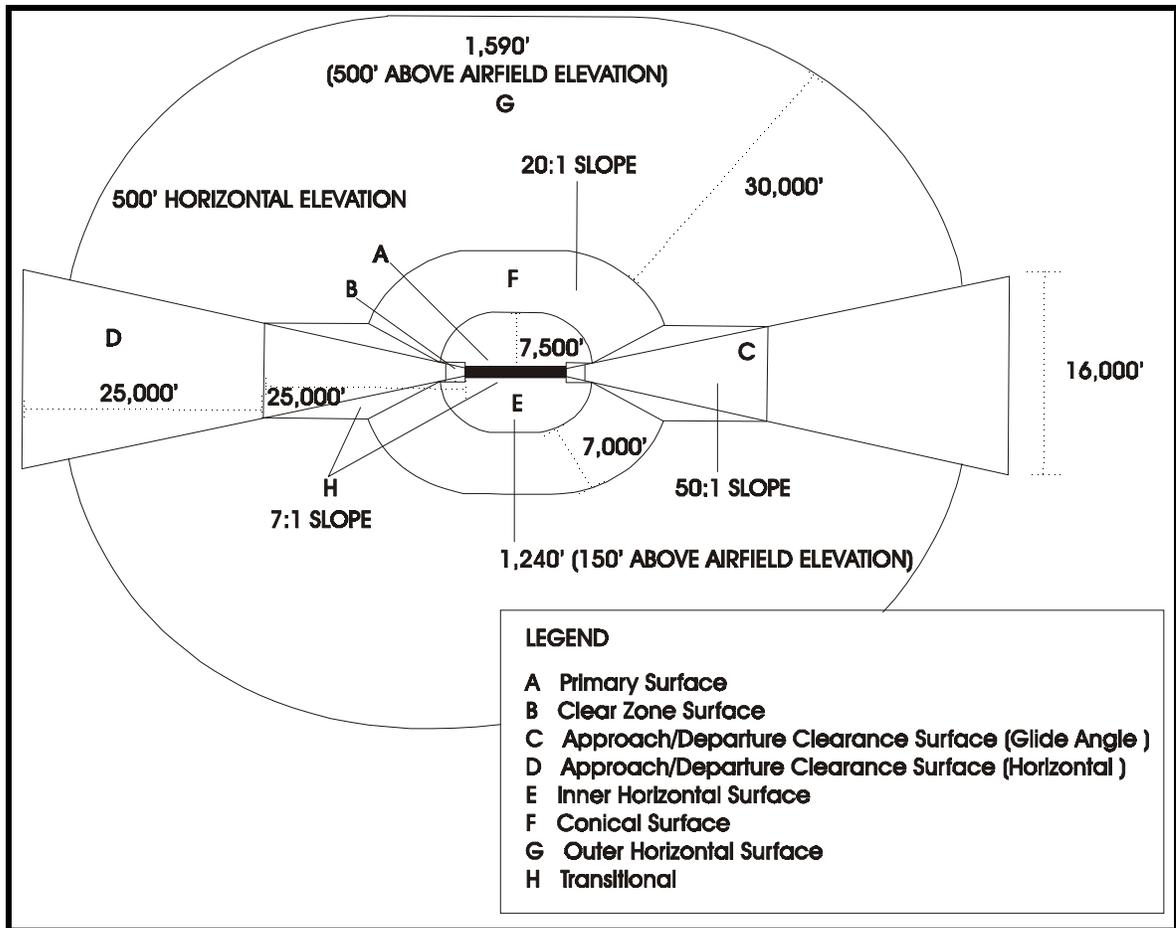


Figure D-1. Airspace Control Surface Plan

For a more complete description of airspace and control surfaces for Class A and Class B runways refer to FAR Part 77, Subpart C, or UFC3-260-01.

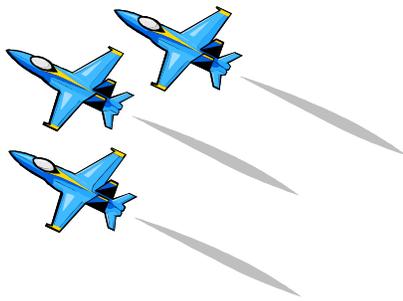
This page intentionally left blank.

APPENDIX E — NOISE LEVEL REDUCTION GUIDELINES

In-depth, state-of-the-art noise level reduction guidelines can be found in *Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations*, Wyle Research Report WR 89-7. This study was completed by Wyle Laboratories for the Naval Facilities Engineering Command and the Federal Aviation Administration in November 1989.

Copies of this study are available for review, upon request, from the Civil Engineering Office at Luke AFB.

This page intentionally left blank.



Printed on Recycled Paper