

Final
Air Installation Compatible Use Zone
(AICUZ)
Study Update

Joint Base Lewis-McChord



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Contract No. W91238-11-D-0016

May 2015

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List of Acronyms

AFB	Air Force Base
AFI	Air Force Instruction
AGL	above ground level
AICUZ	Air Installation Compatible Use Zone
APZ	Accident Potential Zone
ATC	air traffic control
BASH	Bird and Wildlife Aircraft Strike Hazard
CZ	Clear Zone
dB	decibel
dBA	A-weighted sound level
DNL	day-night average sound level
DOD	Department of Defense
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FEDS	Flexible Engine Diagnostic System
FIC	Federal Interagency Committee
GAAF	Gray Army Airfield
HUD	Housing and Urban Development
ILS	instrument landing system
INM	Integrated Noise Model
JBLM	Joint Base Lewis McChord
Leq	equivalent sound level
MP	Master Plan
MSL	mean sea level
NM	nautical mile
TACAN	tactical air navigation
UFC	Unified Facilities Criteria
USBEA	U.S. Bureau of Economic Analysis

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1 Purpose and Need

1.1 Introduction

This study is primarily an update of the 1998 McChord Airfield (formerly McChord Air Force Base [AFB]) Air Installation Compatible Use Zone (AICUZ) Study. In 2010, as a result of the Base Realignment and Closure Commission recommendations of 2005, McChord AFB was merged with Fort Lewis (Army) to form Joint Base Lewis-McChord (JBLM) under the jurisdiction of the United States Army Joint Base Garrison. Therefore, this AICUZ update also includes a study at Gray Army Airfield (GAAF) within the JBLM.

The update presents and documents changes to the McChord AICUZ for the period 1998-2012 and uses the 2012 aircraft operations condition as the basis and projects the near future operational conditions considered in the JBLM 2012 Master Plan (MP). This AICUZ Study reaffirms Department of Defense (DOD) policy of assisting local, regional, state, and federal officials in the areas neighboring JBLM by promoting compatible development around JBLM; and protecting JBLM aircraft operational capability from the effects of land use that are incompatible with aircraft operations. Specifically, the report documents changes in aircraft operations since the last study at McChord Airfield and provides noise contours and compatible use guidelines for land areas around the installation under the JBLM MP conditions. In addition to the McChord Airfield AICUZ update, the noise contours around the GAAF are also provided as part of the AICUZ update. However, the noise exposure predicted around the GAAF shows that incompatible land uses are within JBLM and do not affect local communities. Since the primary purpose of this study is to assist local communities and to serve as a tool for future planning and zoning activities, the AICUZ component for GAAF aircraft operations is presented in Appendix C.

Changes that occurred at McChord Airfield since the 1998 AICUZ study include:

- Updated flight profiles, altered flight tracks, and changes in aircraft types modeled in the 1998 AICUZ.
- Updated number of operations associated with aircraft types.
- Updated percentages of daytime and nighttime operations including planned future additional nighttime assault landing training due to the increase demand of modern combat missions.
- Modification of runway and flight track usages.
- Tempo increase anticipated in near future as part of MP requirement.
- Technical improvements to the NOISEMAP Version 7.357 computer modeling program.

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. As Pierce and Thurston Counties prepare and modify their land use development plans, recommendations from this updated AICUZ Study should be included in the planning process to prevent incompatible land use that could compromise the ability of JBLM to fulfill its mission. Accident potential and aircraft noise should be major considerations in the planning process.

DOD AICUZ guidelines reflect land use recommendations for the Clear Zones (CZ), Accident Potential Zones (APZ) I and II, and four noise zones exposed to noise levels at or above the 65 decibel (dB) Day-Night Average A-Weighted Sound Level (DNL). These guidelines were established on the basis of studies prepared and sponsored by several federal agencies, including the Department of Housing and Urban Development (HUD), U.S. Environmental Protection Agency (EPA), DOD, and 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 and Army do not want to recommend land use regulations which render property economically useless; they do, however, have an obligation to the inhabitants of the JBLM area of influence and the citizens of the United States to point out ways to protect the public investment in the installation and the people living in areas adjacent to the installation. The AICUZ area of influence includes the areas within the DNL 65 dB and greater noise exposure area and the areas within the CZs and APZs.

1.3 Process and Procedure

Preparation and presentation of this update to JBLM's AICUZ Study is part of the continuing Air Force and Army participation in the local planning process. Guidance for the AICUZ program is primarily contained in Air Force Instruction (AFI) 32-7063, *Air Installation Compatible Use Zone Program*, which implements DOD Instruction 4165.57, *Air Installations Compatible Use Zones*.

As local communities prepare land use plans and zoning ordinances, the Air Force and Army recognize they have the responsibility to provide input on their activities relating to the community. This study is presented in the spirit of mutual cooperation and assistance by JBLM to aid in the land use planning process around the installation.

The AICUZ program uses the latest technology to define noise levels in areas near both airfields within JBLM. Aircraft operational data used in this study were collected at McChord Airfield and GAAF in January 2012. The Air Force and Army reviewed and validated the data through a communicative process that was finalized in September 2012. Aircraft flight data were obtained to derive average daily operations by runway and flight tracks for each type of aircraft. Analysis of McChord Airfield's and GAAF's flying operations includes the types of aircraft, flight patterns utilized, variations in altitude, power settings, number of operations, and hours of maintenance run-ups. These data were supplemented by flight track information (where we fly), flight profile information (how we fly), and ground run-up information. After verification for accuracy, the data were input into the NOISEMAP Version 7.357 computer program to produce DNL noise contours to define the applicable noise zones around each airfield. The noise contours for both airfields were plotted and overlaid with the CZ and APZ areas for each airfield. These contours reflect noise from aircraft operations anticipated within 5 to 10 planning horizon years at JBLM as prescribed in the 2012 JBLM MP.

The DOD-adopted NOISEMAP computer program is the tool to predict noise impacts created by military aircraft operations. NOISEMAP is a suite of computer programs and components developed by the Air Force consisting of several sub programs:

- BASEOPS is the input module for NOISEMAP used to enter detailed aircraft flight track and profile and ground maintenance operational data.

- NOISEFILE is a comprehensive database of measured military and civil aircraft noise emission data. Aircraft operational information is matched with the noise measurements in the NOISEFILE after the detailed aircraft flight and ground maintenance operational data has been entered into BASEOPS.
- NMAP is the computational module in NOISEMAP taking BASEOPS input and using the NOISEFILE database to calculate the noise levels caused by aircraft events at specified grid points in the airbase vicinity. The output of NMAP is a series of georeferenced data points, specific grid point locations, and corresponding noise levels.
- NMPLOT is the program for viewing and editing the sets of georeferenced data points. NMPLOT plots the NMAP output in a noise contour grid that can be exported as files to be used in mapping noise foot prints around the studied airfield.

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2 Installation Description

2.1 Description of JBLM Airfields

Located in the heart of the Pacific Northwest's Puget Sound region, 9.1 miles (14.6 km) south-southwest of Tacoma (Figure 2-1), in Pierce and Thurston Counties, Washington, JBLM is the DOD's premiere military installation on the West Coast. JBLM provides world-class installation support to more than 40,000 active, Guard, and Reserve service members, and about 16,000 civilian workers. The base supports more than 60,000 family members who live on and off base, as well as almost 120,000 military retirees who live within 50 miles. Interstate 5 borders and passes through the installation. The surrounding lands to the east are considered typical rural areas with residential, while areas to the north of McChord Airfield in the cities of Tacoma and Lakewood which are heavily developed. Figure 2-2 shows land uses around the installation.

The installation is an amalgamation of the Army's Fort Lewis and the Air Force's McChord AFB, which merged in 2010 as a result of Base Realignment and Closure Commission recommendations of 2005. Therefore, there are two airfields within JBLM: McChord Airfield, home to a C-17 transport fleet operated by the Air Force, which has one active runway, 16-34; and GAAF primarily for helicopter aviation support missions operated by the Army with one active runway, 15-33.

2.2 Mission

McChord Airfield, approximately one mile south of the city of Tacoma, was opened in 1948 as home to many Air Force divisions and is currently home to the 62nd Airlift Wing, a C-17 transport fleet. The 62nd Airlift Wing is the primary Air Force active duty wing and is part of Air Mobility Command providing the DOD a fast, flexible, and responsive airlift capability for America's armed forces to any problem or combat area in the world through airlift of troops and equipment. In addition, as the provider of the Prime Nuclear Airlift Force, the 62nd Airlift Wing is the only wing in the DOD tasked to airlift nuclear weapons and materials.

The 62nd Airlift Wing Operations Group maintains the readiness of more than 2,500 active duty and civilian personnel, along with 43 permanently assigned C-17s based at McChord Airfield, to support combat and humanitarian contingencies. The Group consists of the four airlift squadrons and an operational support squadron:

- 4th Airlift Squadron
- 7th Airlift Squadron
- 8th Airlift Squadron
- 10th Airlift Squadron.

At McChord Airfield, the 62nd Airlift Wing is joined by its Reserve partner, the 446th Airlift Wing which has 13 squadrons. Together, the two wings fly a total of 48 C-17s to provide global combat airlift. The major tenant units at the base include the Western Air Defense Sector (Air National Guard), the 22nd Special Tactics Squadron.

GAAF is located approximately six miles southwest of McChord Airfield on JBLM and is the home to the 4th Battalion, the 160th Special Operations Aviation Regiment (SOAR), the special operations unit of the Army that provides helicopter aviation support for general purpose forces and special operations forces. Its missions have included attack, assault, and reconnaissance. GAAF is jointly operated by 160th SOAR, National Guard, Army Reserve, 16th Combat Aviation Brigade (CAB), and Army Materiel Command providing training for pilots and enhancing air-ground integration training between the combat aviation brigade and brigade combat teams. The GAAF has a total of 97 based aircraft in 2012 including:

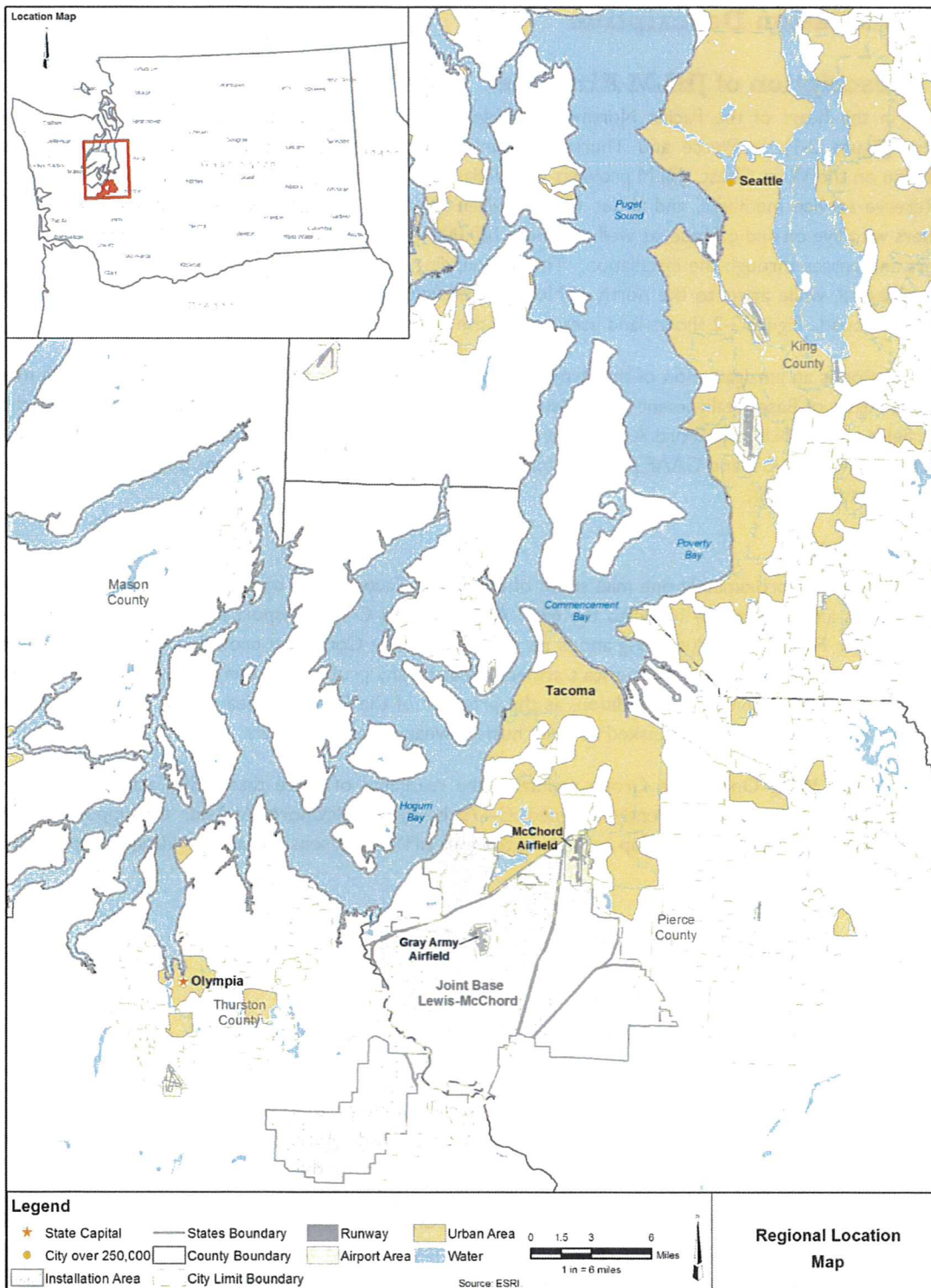


Figure 2-1. Joint Base Lewis-McChord Location Map

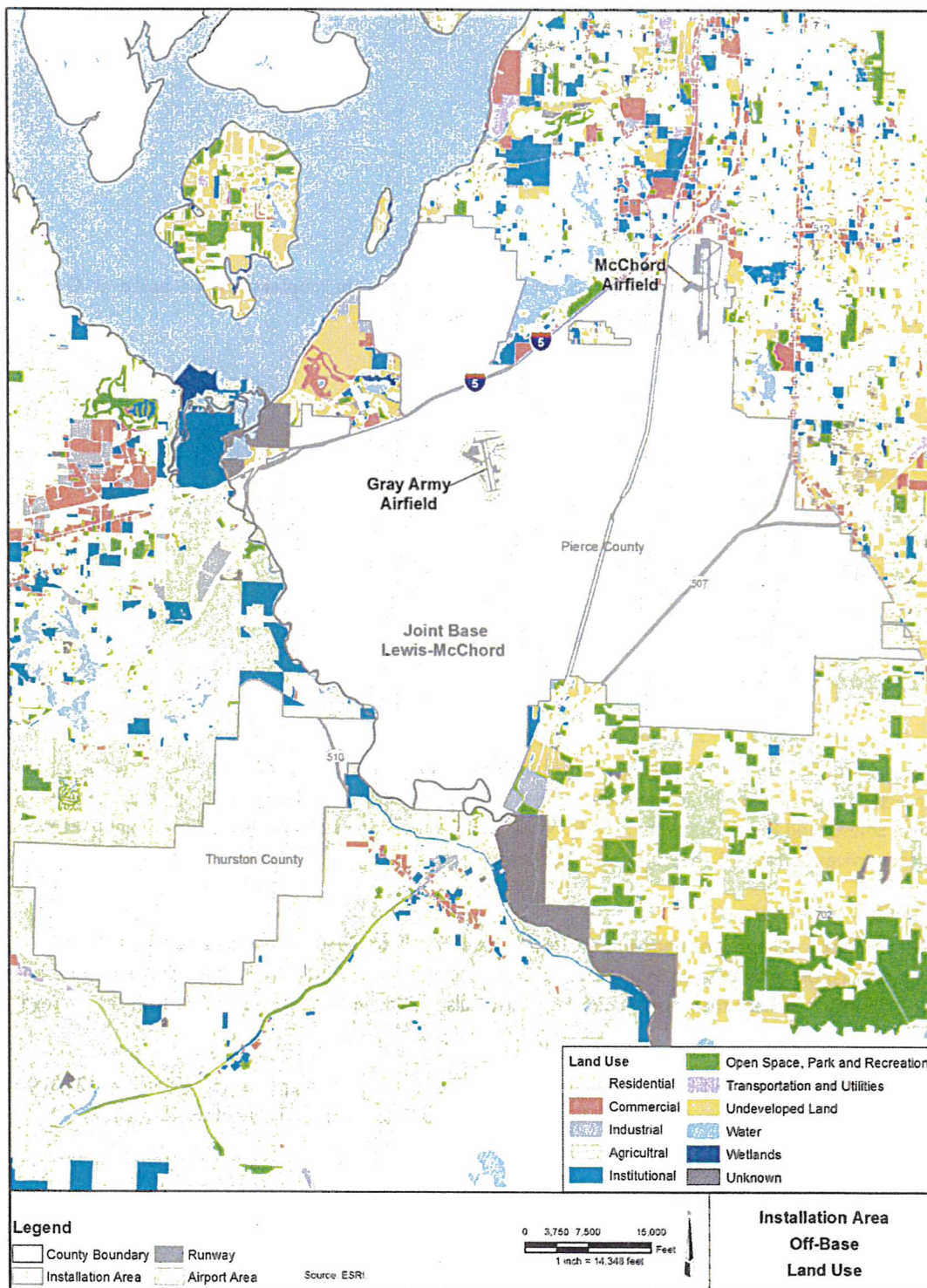


Figure 2-2. Off Installation Land Use Map at Joint Base Lewis-McChord

- 33 UH-60
- 26 CH-47
- 34 OH-58
- 3 C-12
- 1 C-23

Given increased training demand at JBLM, a total of 52 additional helicopters will be based at GAAP in 2013 resulting in a new fleet mix with a total of 148 based aircraft:

- 56 UH-60
- 31 CH-47
- 34 OH-58
- 24 AH-64
- 2 C-12
- 1 C-23

2.3 Economic Impact

2.3.1 Local Economic Characteristics

The local community consists of retirees, family members, soldiers, Marines, Airmen, DOD civilians, and citizens from nearby communities. JBLM provides many services to the community such as medical services; Post Exchange; Soldier and Family Support; Morale, Welfare and Recreation services; Army Career and Alumni Program; retirement services; and a wide array of other support activities.

Population

Washington State's overall population grew 14.1% from 2000 to 2010. As indicated in Table 2-1, Thurston County's population growth rate was higher than the state average at 21.7%, but as the population size of Thurston County is smaller than other counties, individuals moving in have a greater effect on the average growth rate.

More than 25,000 soldiers and civilian workers are present at JBLM. It supports approximately 120,000 retirees and more than 29,000 family members who live both on- and off-base (Army-Technology.com 2012).

Local Economic Characteristics

Data to profile the employment characteristics of the study area are compiled from the U.S. Bureau of Economic Analysis (USBEA) data on employment and presented in Table 2-2. The military provides about 10% of the jobs in Pierce County as compared to about 2.2% of jobs in Washington State.

Less than 1% of jobs in Thurston County are associated with the military. State and local governments, retail trade, and health care and social services are major employers in both counties.

Table 2-1. Population in Pierce and Thurston Counties

	Population 2000	Population 2010	Percent Change
Washington (State)	5,894,143	6,724,540	14.1%
Pierce County	700,818	795,225	13.5%
DuPont	2,452	8,199	234.4%
Roy	260	793	205.0%
Steilacoom	6,049	5,985	-1.1%
Tacoma	193,556	196,800	1.7%
Thurston County	207,355	252,264	21.7%
Lacey	31,226	42,393	35.8%
Olympia	42,514	46,478	9.3%
Tumwater	12,698	17,371	36.8%
Yelm	3,289	6,848	108.2%
Source: U.S. Census Bureau 2012			

Table 2-2. Employment by Industry in Pierce and Thurston Counties in 2010

Employment by Industry, Number of Jobs	Washington State	Pierce County	Thurston County
Farm employment	83,537	1,846	1,846
Non-farm employment	3,710,031	378,675	127,443
Forestry, fishing, and related activities	36,226	947	929
Mining	6,779	416	114
Utilities	5,300	685	180
Construction	200,663	23,255	5,623
Manufacturing	277,335	18,129	3,099
Wholesale trade	133,450	12,397	3,245
Retail trade	383,760	39,149	14,658
Transportation and warehousing	108,207	12,398	2,311
Information	113,007	3,667	1,284
Finance and insurance	166,015	14,972	4,605
Real estate and rental and leasing	173,021	17,259	5,473
Professional, scientific, and technical services	272,870	16,582	6,854
Management of companies and enterprises	34,261	1,009	730
Administrative and waste management services	186,278	18,803	5,381
Educational services	69,909	7,064	2,669
Health care and social assistance	384,753	43,411	14,365
Arts, entertainment, and recreation	90,052	7,358	2,752
Accommodation and food services	240,984	23,041	8,270
Other services, except public administration	195,140	21,377	7,375
Government and government enterprises	632,021	96,756	37,526
Federal, civilian	75,691	13,201	1,009
Military	81,698	37,547	812
State and local government	474,632	46,008	35,705
State government	151,725	11,791	24,276
Local government	322,907	34,217	11,429
Source: U.S. Bureau of Economic Analysis, 2012			

2.3.2 Base Impact

In 2009, direct defense spending in Washington (\$7.92 billion) was nearly 4% of the total State gross domestic product (GDP). JBLM is the third largest employer in Washington State with approximately 55,000 employees just behind Boeing and the State of Washington. Among these JBLM employees, McChord Airfield has approximately 17,000 personnel. Total military payroll at JBLM in 2010 was \$3.2 billion.

JBLM generates substantial revenues to local economies through wage and salary payments to military and civilian employees, construction contractor payments, and operating costs such as rent and lease payments for various types of equipment, utilities, telephone, office supplies, and non-construction contracts. According to the JBLM projections, approximately \$2.4 billion of construction is scheduled to occur on base between 2010 and 2016. In 2010, defense contracts awarded to firms located in the Tacoma and Lakewood area totaled over \$93 million. As a result of payroll expenditures and the estimated value of indirect jobs in the local area, JBLM has a significant total economic impact on the local economy. The majority of this economic impact is due to payroll and contracts provided by the installation.

Another measure of the relative impact of JBLM upon the economies of the surrounding communities is the number of jobs that are supported in the private sectors as a direct result of military troop and off-base expenditures. In addition to facilities on base, military personnel and their dependents make considerable use of off-base retail and service facilities, while various groups and commands on base annually contract or purchase millions of dollars in goods, services and equipment for area businesses. The concept of induced employment related to military installations has been addressed in a number of studies and these studies have developed multipliers which can be used to estimate the number of jobs which are created based upon an installation's military population and the number of civilians employed.

3 Aircraft Operations

This section describes the primary aircraft types, the number of aircraft operations, and the runways and flight routes used at McChord Airfield and GAAF. Operational tempo increase above the current level is consistent with the objectives prescribed in the 2012 JBLM MP. Additionally several operational changes anticipated in the near future at McChord Field are also considered in the study.

The projected 2012 AICUZ scenario is established based on the most recent data collected from both McChord Airfield and GAAF control towers in association with three future elements to be implemented at McChord Airfield listed below:

- Increasing C-17 nighttime assault landing pattern flight operations by 900 to meet growing demand as a result of current mission requirements.
- Reversing the usage percentage of Runways 16 and 34 for arrival flight operations to 1) implement overall energy saving initiatives at the installation by reducing flight operations against southern prevailing wind at McChord Airfield and 2) further reduce noise impacts in the cities of Tacoma and Lakewood.
- Increasing current tempo by 20 % as part of the 2012 MP objective to meet future JBLM mission requirement.

The same 20 % tempo increase element is also considered for flight operations at GAAF to reflect on-going expansion of training activities by the Army.

3.1 Flight Operations by Aircraft Type

Over 20,000 annual aircraft operations including approximately 8,000 pattern flight operations are currently conducted at McChord Airfield based on aircraft operations data validated in January 2012. This current level of flight operations represents an approximate 40 % reduction as compared to the 1998 AICUZ projected 2005 C-17 beddown operational condition primarily due to difference between the pattern flights from actual C-17 and other transient aircraft and the 1998-predicted level. This update considers the difference from the 1998 projected level and the current operational level plus the changes anticipated to occur in the near future as described above.

An aircraft operation is defined as one takeoff/departure, one approach/landing, or half a closed pattern. A closed pattern consists of two portions, a takeoff/departure and an approach/landing, i.e., two operations. A sortie is a single military aircraft flight mission from the initial takeoff through the termination landing. The minimum number of aircraft operations for one sortie is two operations, one takeoff (departure) and one landing (approach).

Table 3.1 summarizes the projected annual aircraft operations for each aircraft type associated with each flight pattern at the McChord Airfield based on information provided by the McChord aviation manager, 62nd Airlift Wing captain, and air traffic control tower chief. Approximately 80 % of flight operations are from McChord-based C-17 training activities. The remainder of the operations is from other military transient training aircraft utilizing essentially the same flight tracks used by C-17. Table 3-1 presents the annual operations data used in the AICUZ update by type of operation and time of day for each aircraft type. As shown in Table 3-1, a total of 27,669 annual flight operations for each aircraft type were projected to occur at McChord Airfield including:

- 80 % of operations are C-17
- 81 % of overall operations occur during daytime hours (7:00 a.m. – 10:00 p.m.)

Table 3-I. Projected Aircraft Operations at McChord Airfield

Aircraft	Operation Type	Annual Day	Annual Night	Annual Total	Average Day Ops	Average Night Ops	Average Daily Ops
C-17	Departures	5,220	1,218	6,438	14.50	3.38	17.88
	Straight-in Arrivals	3,460	611	4,071	9.61	1.70	11.31
	TACAN Arrivals	1,124	198	1,323	3.12	0.55	3.67
	Overhead Break Arrivals	461	274	735	1.28	0.76	2.04
	Overhead Break Assault Landing Arrivals	174	134	309	0.48	0.37	0.86
	Closed Pattern, Touch and go	3,596	931	4,527	19.98	5.17	25.15
	Closed Pattern, Low Approach	3,279	727	4,006	18.22	4.04	22.26
	RADAR Pattern	464	230	694	2.58	1.28	3.86
	Total	17,779	4323	22,103	69.77	17.25	87.03
C-9	Departures	171	30	201	0.48	0.08	0.56
	Straight-in Approach	127	22	149	0.35	0.06	0.41
	TACAN Approach	41	7	48	0.11	0.02	0.13
	Overhead Break Approach	3	1	4	0.01	0.00	0.01
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	40	7	47	0.22	0.04	0.26
	Closed Pattern, Low Approach	39	7	45	0.21	0.04	0.25
	RADAR Pattern	10	2	12	0.06	0.01	0.07
	Total	431	76	508	1.45	0.25	1.70
C-12	Departures	119	21	140	0.33	0.06	0.39
	Straight-in Approach	90	16	105	0.25	0.04	0.29
	TACAN Approach	29	5	34	0.08	0.01	0.10
	Overhead Break Approach	-	-	-	-	-	-
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	-	-	-	-	-	-
	Closed Pattern, Low Approach	-	-	-	-	-	-
	RADAR Pattern	7	1	9	0.04	0.01	0.05
	Total	245	43	288	0.70	0.12	0.82
C-130	Departures	297	52	350	0.83	0.15	0.97
	Straight-in Approach	217	38	255	0.60	0.11	0.71
	TACAN Approach	70	12	83	0.20	0.03	0.23
	Overhead Break Approach	10	2	12	0.03	0.01	0.03
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	121	21	143	0.67	0.12	0.79
	Closed Pattern, Low Approach	116	20	137	0.65	0.11	0.76
	RADAR Pattern	18	3	21	0.10	0.02	0.12
	Total	850	150	1000	3.07	0.54	3.61
KC-135	Departures	182	32	214	0.51	0.09	0.59
	Straight-in Approach	130	23	152	0.36	0.06	0.42
	TACAN Approach	42	7	49	0.12	0.02	0.14
	Overhead Break Approach	10	2	12	0.03	0.01	0.03
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	121	21	142	0.67	0.12	0.79

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Aircraft	Operation Type	Annual Day	Annual Night	Annual Total	Average Day Ops	Average Night Ops	Average Daily Ops
F-16	Closed Pattern, Low Approach	116	20	136	0.64	0.11	0.76
	RADAR Pattern	11	2	12	0.06	0.01	0.07
	Total	611	108	719	2.38	0.42	2.80
	Departures	122	21	143	0.34	0.06	0.40
	Straight-in Approach	87	15	102	0.24	0.04	0.28
	TACAN Approach	28	5	33	0.08	0.01	0.09
	Overhead Break Approach	7	1	8	0.02	0.00	0.02
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	82	14	96	0.45	0.08	0.53
	Closed Pattern, Low Approach	78	14	92	0.43	0.08	0.51
	RADAR Pattern	7	1	8	0.04	0.01	0.05
	Total	410	72	482	1.60	0.28	1.89
	Departures	324	57	382	0.90	0.16	1.06
	Straight-in Approach	216	38	254	0.60	0.11	0.71
	TACAN Approach	70	12	83	0.20	0.03	0.23
P3	Overhead Break Approach	38	7	45	0.11	0.02	0.12
	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	445	79	524	2.47	0.44	2.91
	Closed Pattern, Low Approach	426	75	502	2.37	0.42	2.79
	RADAR Pattern	37	7	44	0.21	0.04	0.24
	Total	1,557	275	1,832	6.85	1.21	8.06
	Departures	313	55	368	0.87	0.15	1.02
	Straight-in Approach	236	42	278	0.66	0.12	0.77
	TACAN Approach	77	14	90	0.21	0.04	0.25
	Overhead Break Approach	-	-	-	-	-	-
B757	Overhead Break Assault Landing Approach	-	-	-	-	-	-
	Closed Pattern, Touch and go	-	-	-	-	-	-
	Closed Pattern, Low Approach	-	-	-	-	-	-
	RADAR Pattern	-	-	-	-	-	-
	Total	626	111	737	1.74	0.31	2.05
	Departures	313	55	368	0.87	0.15	1.02
	Straight-in Approach	236	42	278	0.66	0.12	0.77
	TACAN Approach	77	14	90	0.21	0.04	0.25
Grand Total		22,510	5,158	27,669	87.57	20.39	107.96
Note: A closed pattern consists of two operations, one approach and one departure. B757 includes other transient aircraft types with limited operations at McChord Airfield that do not perform pattern flights. Numbers that do not exactly add up are due to rounding. Ops = Operations							

- 19 % of overall operations occurred during nighttime hours.

Since NOISEMAP requires input of the specific numbers of daily flight and aircraft maintenance engine run-up operations, a total of 360 annual flying days per year was assumed for both based and transient aircraft to determine daily operations.

Army helicopters and a small number of fixed wing aircraft also accomplish operations at the GAAF. Appendix C contains information on the GAAF operations.

3.2 Runway and Flight Track Utilization

Runway 16/34 is oriented 162°-342°magnetic, and is 10,108 feet long and 150 feet wide. The overruns at the ends of each runway are approximately 1,000 feet long. The airfield elevation is 282 feet above mean sea level (MSL).

An airfield operation is any takeoff or landing at an airfield. The takeoff and landing may be part of a training maneuver (or "pattern") in the vicinity of the runways or may simply be a departure or arrival of an aircraft. Several basic flight operations conducted at McChord Airfield are described below:

- Departure - an aircraft taking off from a runway.
- Straight In Arrival - an aircraft landing on a runway.
- Overhead Arrival - a special type of approach as an alternative to a straight-in arrival, the aircraft splits off to the left or right making a spiral-like descent to the ground, using visual flight rules. An aircraft generally approaches the runway 800 feet above ground level. Approximately halfway down the runway, the aircraft performs a 180-degree descending left turn for runway 16 and left or right turn for runway 34 to enter the landing pattern. Once established in the pattern, the aircraft lowers landing gear and flaps and performs the same 180-degree descending turn in the same direction to land on the runway.
- Close Pattern Low Approach – An aircraft approaches a runway while maintaining an altitude of 300 feet above the runway. The aircraft then climbs away again without ever touching down.
- Overhead Break Assault Landing - An aircraft performs overhead break landing in a shortened landing area.
- ILS (instrument landing system) Approach – Approach using an ILS, a ground-based instrument approach system that provides precision guidance to an aircraft approaching and landing on a runway.
- ATC (air traffic control) Vectors – ATC directs the aircraft heading.
- TACAN (tactical air navigational system) approach – TACAN is a navigation system used by military aircraft during approach. It provides the pilot with bearing and distance to a runway information from a ground unit.
- Touch and Go – An aircraft lands and takes off on a runway without coming to a full stop. After touching down, the pilot immediately goes to full power and takes off again.
- Radar Pattern – A closed loop or pattern made by an aircraft using the radar system. Such a pattern is usually quite large passing several miles downwind and crosswind to the runway.

Table 3-2 summarizes each representative runway associated flight track used at McChord Airfield.

Flight patterns specific to McChord Airfield result from several considerations, including:

- Takeoff patterns routed to avoid noise-sensitive areas as much as possible.
- 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 conflict with civil aircraft operations.

The flight tracks depicted in Figures 3-1 through 3-6 are the result of such planning and depict the representative flight tracks used for noise modeling. The flight track locations represent the various types of arrivals, departures, and closed patterns flown at McChord Airfield. The location for each track is representative for the specific track group within which individual flight events may vary slightly due to air traffic control, weather, and other reasons. These flight tracks are used for departures, arrivals, and close patterns associated with Runways 16 and 34.

Airfield planning considers three primary aircraft operational/land-use determinants: (1) aircraft accident potential to land users, (2) aircraft noise, and (3) hazards to operations from land uses (e.g., height obstruction). Each of these concerns is addressed in conjunction with mission requirements and safe aircraft operations to determine the optimum flight track for each aircraft type. As part of the planning process to reduce noise impacts in sensitive areas in the cities of Lakewood and Tacoma, JBLM directs the majority of departure operations to Runway 16 to avoid flying over sensitive areas. Moreover, as shown in Table 3-3, JBLM is considering implementation of a plan in the near future to reverse current arrival runway usage to further reduce flights through sensitive areas north of McChord Airfield. The updated flight track usage data used in the noise modeling was shown in Table 3-2. Table 3-3 shows overall runway usage percentages.

Table 3-2. Flight Tracks and Usage

Operation Type	Runway	Track Label	Track Description	Track Usage	
				Arrival/Departure Operations	Closed Pattern Operations
Departures ¹	16	16D1	Olympic south departure & Alder ATC vectors	5.7%	-
		16D2	Alder south departure route 1	4.8%	-
		16D3	Alder south departure route 2	29.6%	-
	34	34D1	Alder north departure	4.7%	-
		34D2	Olympic north departure	4.7%	-
		34D3	Alder north radar departure	1.15%	-
Arrivals ¹	16	16A1	ATC vectors northwest TACAN approach	0.95%	-
		16A2	ATC vectors northwest ILS approach	3.8%	-
		16A3	West radar TACAN approach	1.6%	-
		16A4	West radar ILS approach	1.6%	-
		16A5	10 mi arc TACAN approach	0.95%	-
		16A6	10 mi arc ILS approach	3.8%	-
		16A7	East radar TACAN approach	1.6%	-
		16A8	East radar ILS approach	1.6%	-
		16A9	Overhead left break arrival ²	-	0.65%
		16A10	Overhead left break assault landing ²	-	2.1%
	34	34A1	Vr331 (visual) approach	0.6%	-
		34A2	West 12 mi arc TACAN approach	0.4%	-
		34A3	West 12 mi arc ILS approach	0.4%	-
		34A4	East radar TACAN approach	2.8%	-
		34A5	East radar ILS approach	11.1%	-
		34A6	Overhead right break arrival ²	-	5.1%
		34A7	Overhead left break arrival ²	-	0.05%
		34A8	East 12 mi arc TACAN approach	2.8%	-
		34A9	East 12 mi arc ILS approach	11.1%	-
Closed Pattern	16	16C1	Closed pattern, touch and go	-	28.8%
		16C2	Closed pattern, low approach	-	28.0%
		16C3	Closed pattern, touch and go with circle	-	1.2%
		16C4	Radar pattern, north ILS approach ³	0.6%	-
		16C5	Radar pattern, south approach ³	0.6%	-
		16C6	Radar pattern, north TACAN approach ³	1.1%	-
	34	34C1	Closed pattern, touch and Go	-	17.4%
		34C2	Closed pattern, low approach	-	16.0%
		34C3	Closed pattern, touch and go with circle	-	0.7%
		34C4	Radar pattern ³	1.95%	-
Total				100%	100%
Notes:					
¹ 50/50% arrival/departure operations split.					
² Overhead break is 8% of closed pattern operations.					
³ RADAR pattern is 3% of arrival/departure operations.					

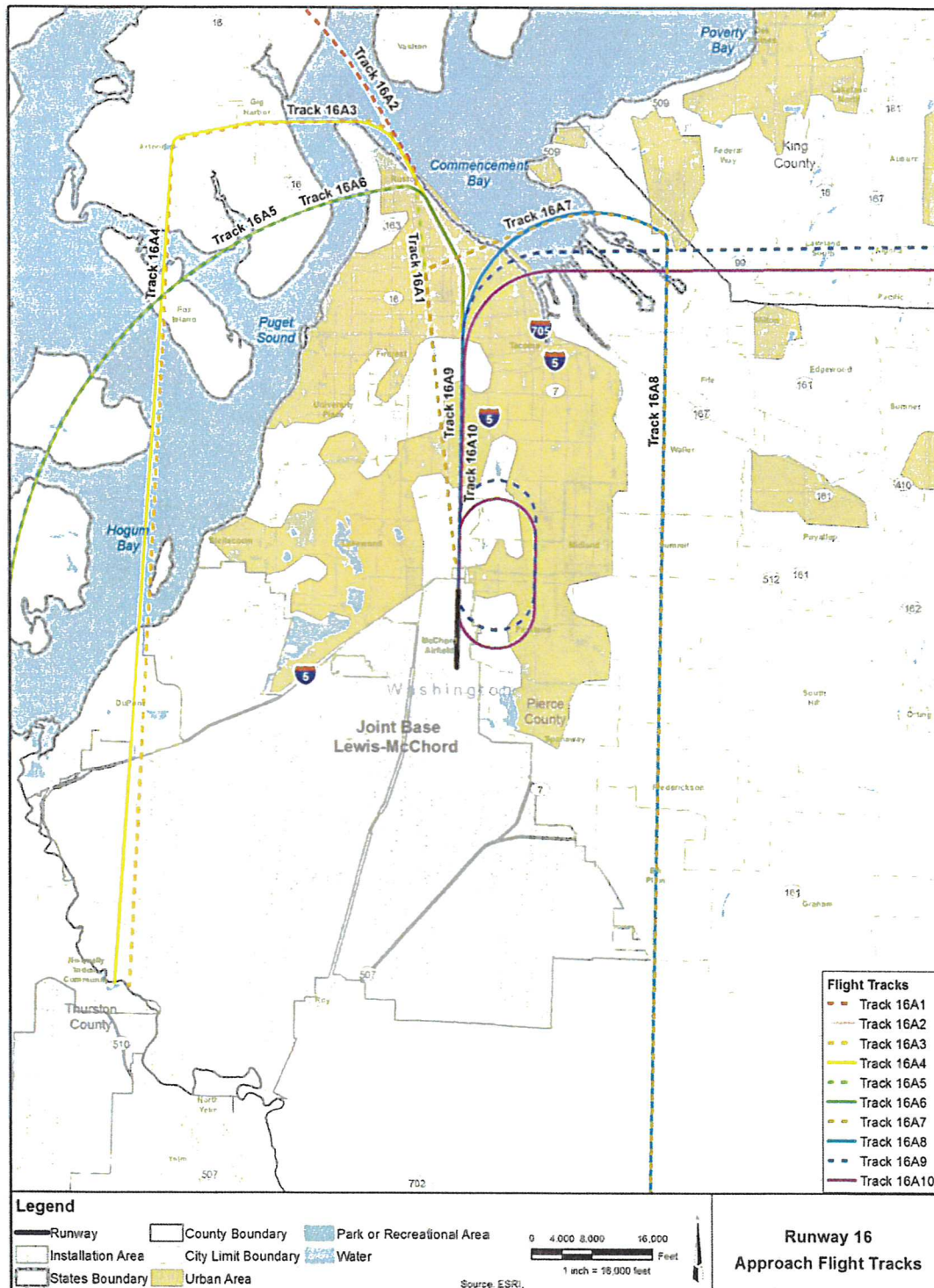


Figure 3-1. Runway 16 Approach Flight Tracks

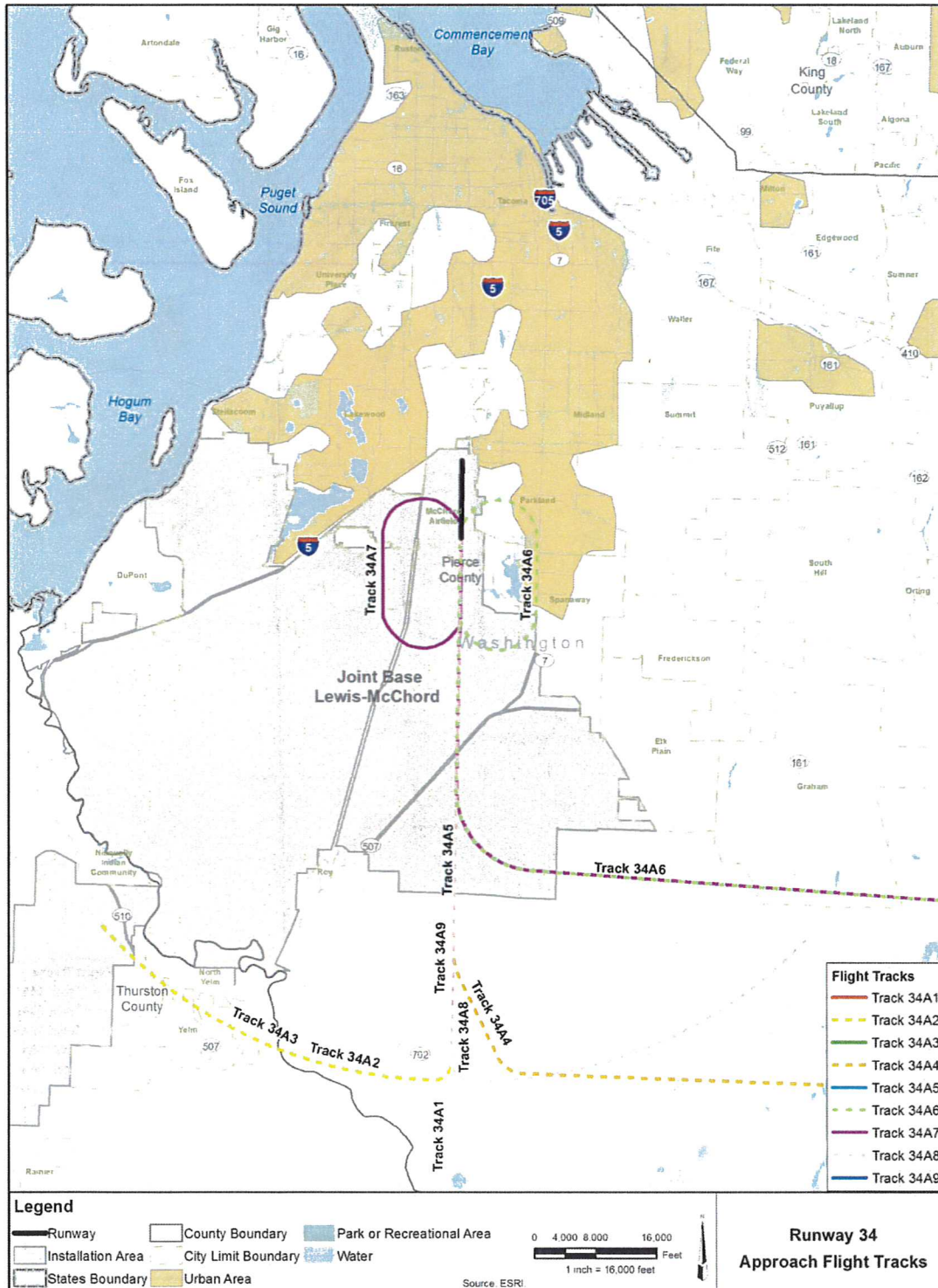


Figure 3-2. Runway 34 Approach Flight Tracks

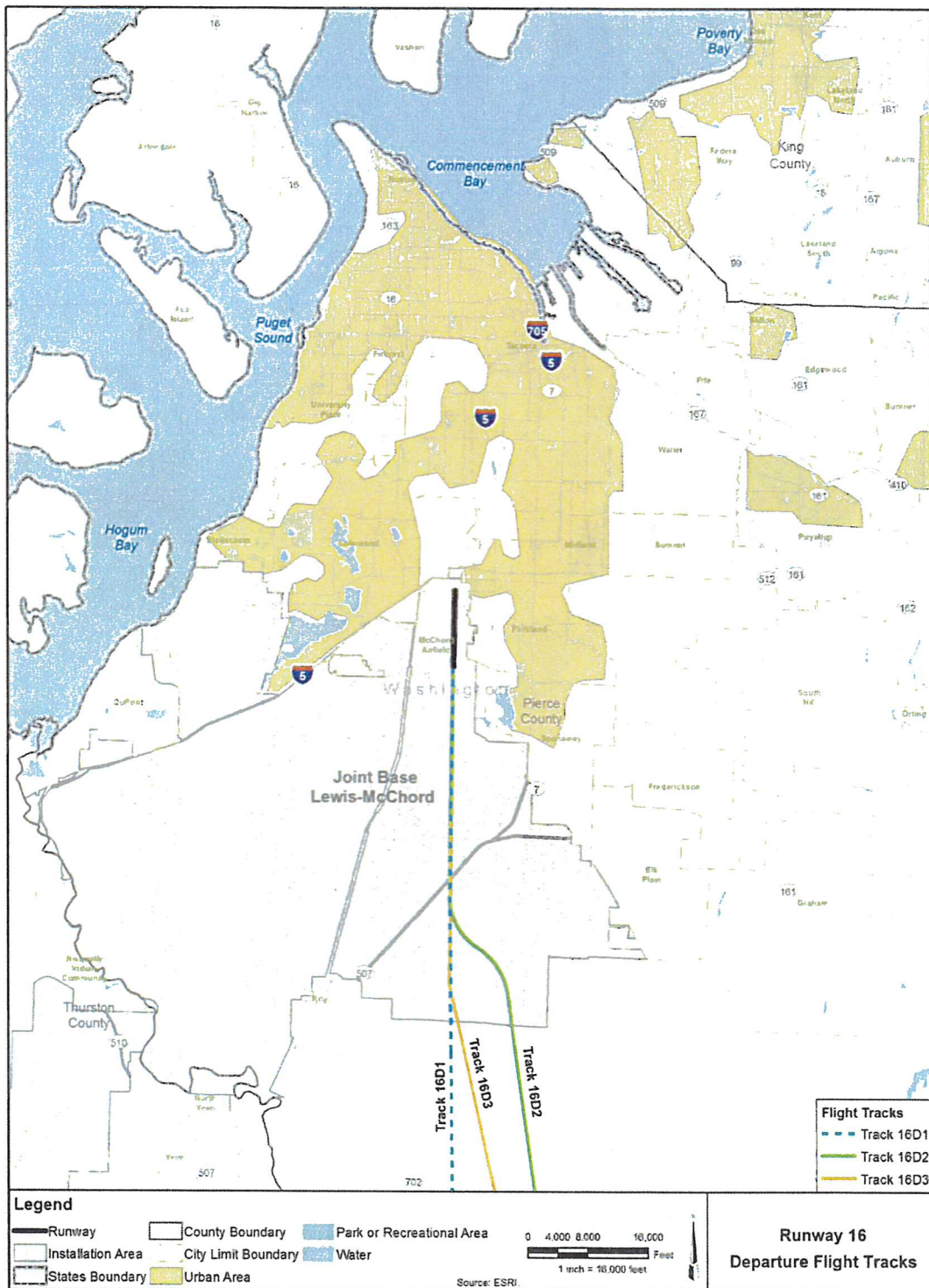


Figure 3-3. Runway 16 Departure Flight Tracks

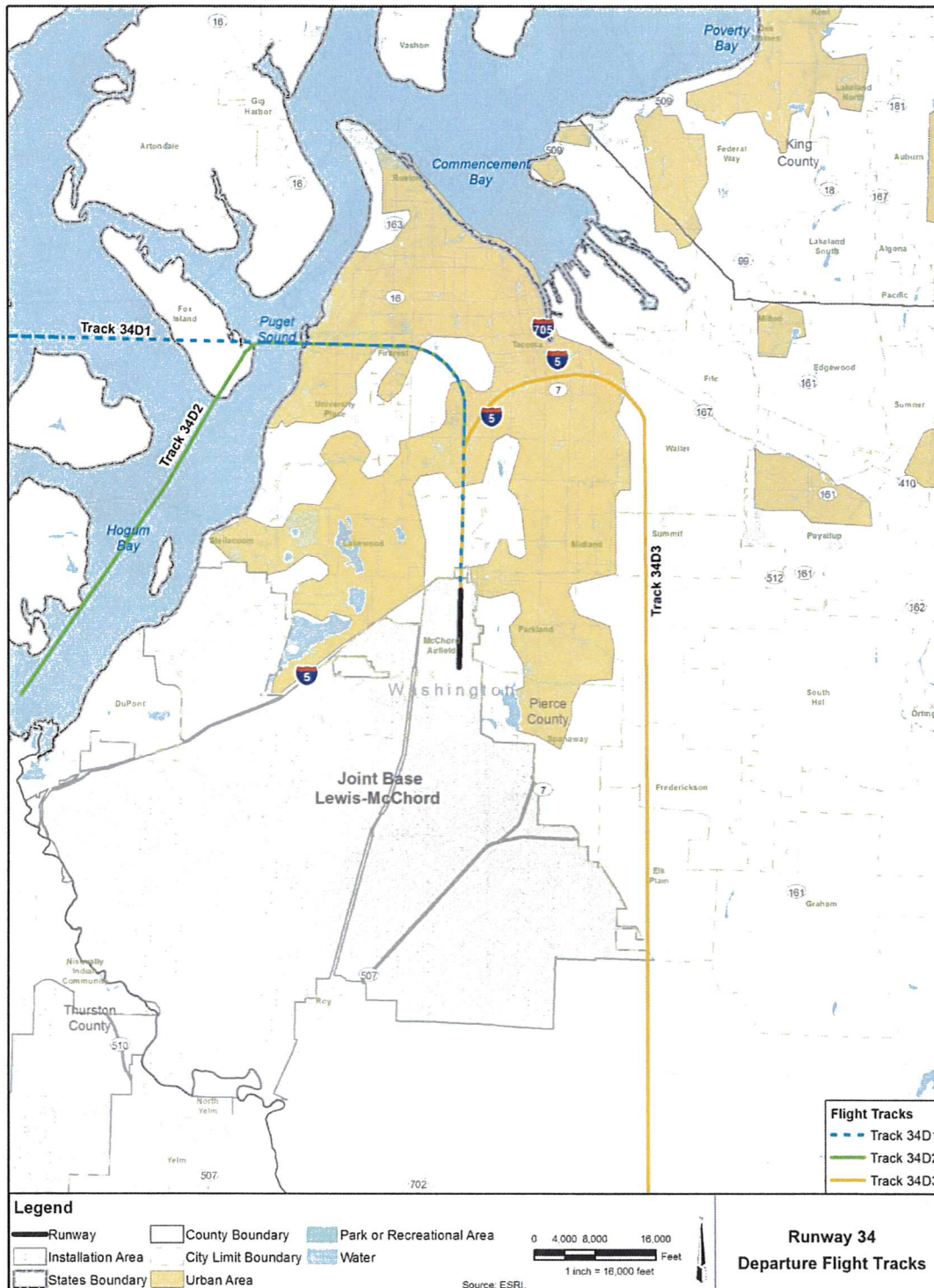


Figure 3-4. Runway 34 Departure Flight Tracks

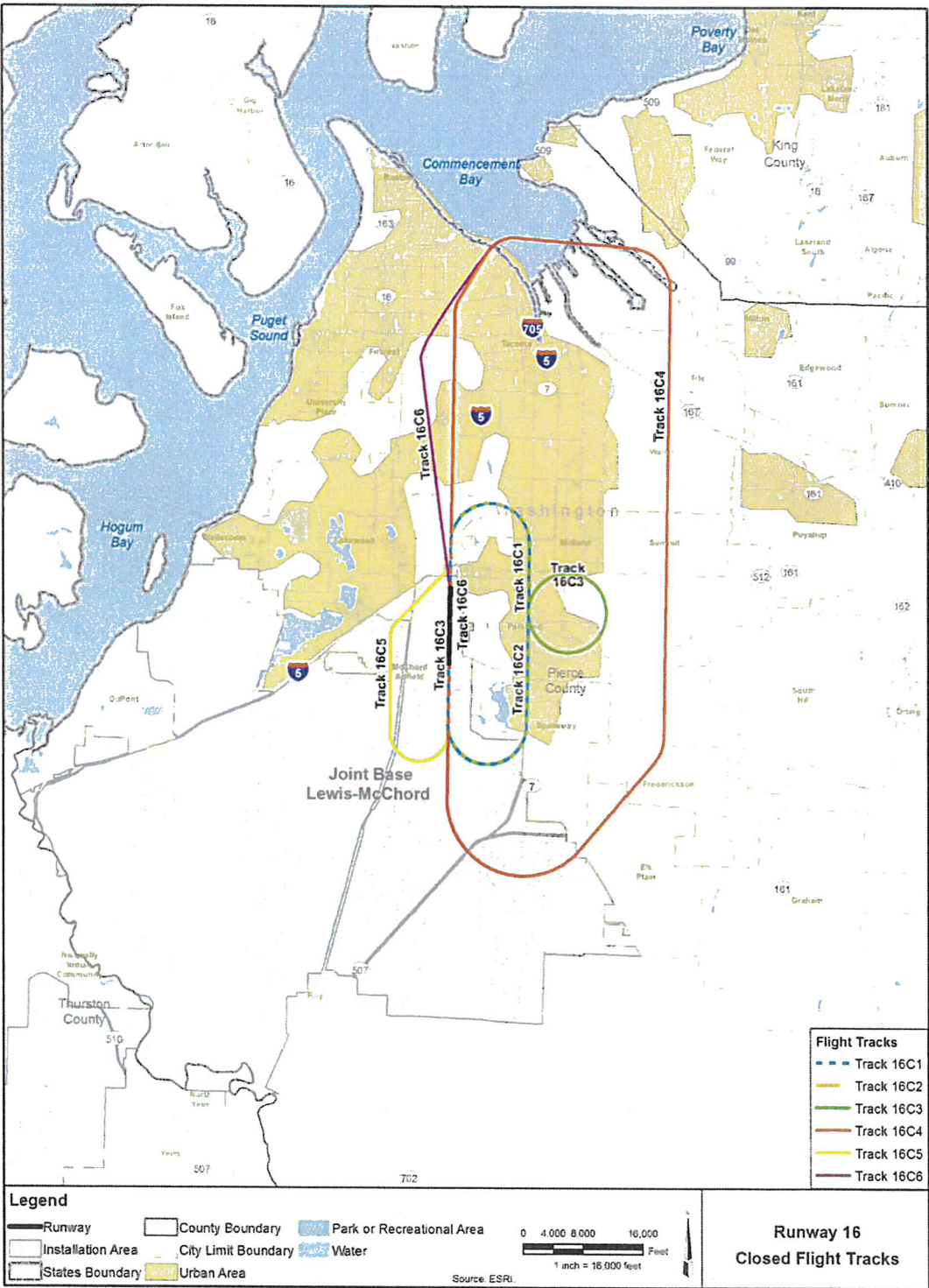


Figure 3-5. Runway 16 Closed Flight Tracks

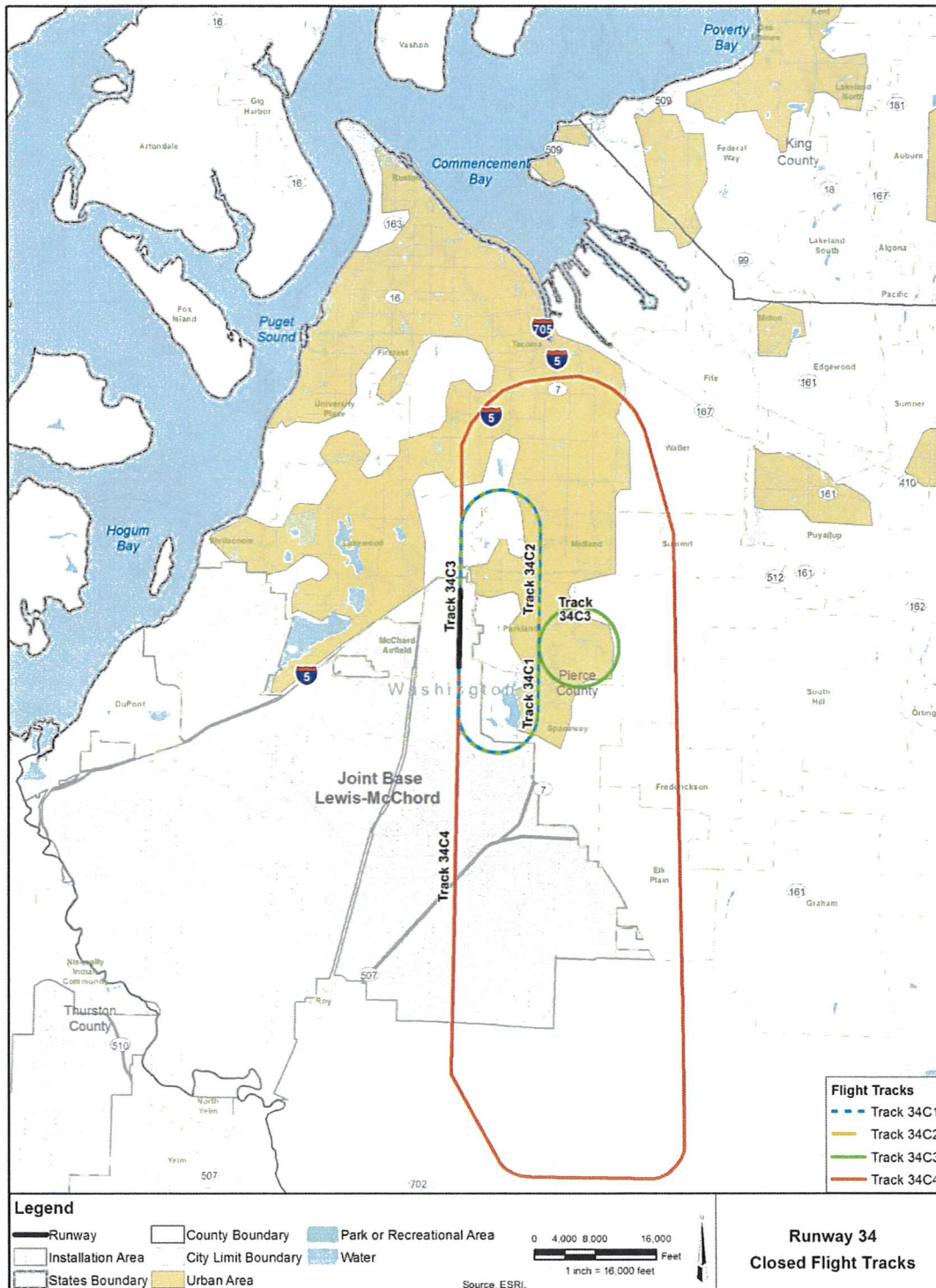


Figure 3-6. Runway 34 Closed Flight Tracks

Table 3-3. Runway Usage

Runway	Operation Type			
	Departures	Current Arrivals	Future Arrivals	Closed/Radar Pattern
16	80%	65%	35%	65%
34	20%	35%	65%	35%
Total	100%	100%	100%	100%

3.3 Aircraft Maintenance Run-up Operations

Aircraft maintenance engine run-up operations are accomplished by based flying units at locations shown in Figure 3-7. These maintenance activities have been established at locations to the maximum extent possible to minimize noise exposure for people on-base, as well as for those in the surrounding community. Typical base operations do not include late night engine run-ups; however, heavy workloads or unforeseen contingencies sometime require a limited number of nighttime engine run-ups with the approval from the base commander.

Weekly, monthly, and annual estimates of run-ups provided by McChord Airfield aircraft maintenance personnel were divided by the typical number of day's run-ups were performed over the respective period as shown in Table 3-4. Approximately 4 % of the total aircraft maintenance run-up tests occurs during nighttime hours (10:00 p.m. to 7:00 a.m.). Additionally the engine operations under the combat offload condition were also identified and quantified by the maintenance personnel as summarized in Table 3-5.

Table 3-4. Projected Annual Engine Run-up Operations at McChord Airfield

Power Setting	Joker Row		Delta Row	
	Daytime Test	Nighttime Test	Daytime Test	Nighttime Test
Idle	566	52	1,044	22
Power	589	47	1,939	47
Total	1,155	99	2,983	69
Notes: Thirty minutes per idle operation and ten minutes per power run-up operation. Four engines operating during idle and one engine during power operations.				

Table 3-5. Projected Annual Combat Offload Operations at McChord Airfield

Combat Offload	
Daytime Operations	Nighttime Operations
211	23
Notes: 10 seconds per operation. Four engines operating during combat offload operations.	



Figure 3-7. Engine Run-up Location

3.4 Aircraft Flight Profiles

For purposes of this AICUZ Study, aircraft "flight profiles" denote the aircraft power settings, altitudes above runway level, and airspeeds along each flight track. Aircraft flight profiles for based C-17's were obtained from 62nd Airlift Wing personnel. Generic flight profiles from the BASEOPS database and/or the 1998 AICUZ-established profiles were used to model operations for other military and civilian transient aircraft types with the height adjustment mandated by the Air Control Tower along each applicable flight track.

3.5 Climatological Data

Weather conditions, measured by temperature and relative humidity, are an important factor in the propagation of noise. Temperature and relative humidity affect sound absorption. The average temperature and humidity for each month of the year were provided by the McChord Airfield weather center and were input into BASEOPS, which then calculates the sound absorption coefficient representing the typical weather conditions at the installation with the temperature of 50 degrees Fahrenheit and 84 percent relative humidity.

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4 Flight Safety

4.1 Introduction

This section describes flight safety, an important AICUZ planning element. The Air Force has established policies and programs to protect the public's safety and to promote compatible land use development around airfields. These efforts are intended to minimize the risks from potential hazards, designate safety zones, and identify the land areas that should be regulated to prevent uses that might otherwise be hazardous to aircraft operations.

4.2 Runway Airspace Imaginary Surfaces

Aircraft operations around the airfield can be constrained by natural terrain and by natural objects or man-made structures, and other potential obstructions to air navigation. Height restrictions of man-made structures are necessary to ensure that no object will interfere with the safe aircraft operations at McChord Airfield. An obstruction-free zone is needed for the runway surface. The horizontal planes and transitional surfaces of this zone in terms of "Imaginary Surfaces" are defined to ensure that land development within these surfaces will not result in an aviation hazard.

Obstructions to air navigation are considered to be:

- Natural objects or man-made structures that protrude above the planes or imaginary surfaces; and/or
- Man-made objects that extend more than 500 feet above ground level (AGL) at the site of the structure.

Runway airspace imaginary surfaces, in graphical form, are the result of the application of obstruction height restriction criteria for McChord Airfield. Imaginary surfaces are surfaces in space around airfields in relation to runways. The surfaces are designed to define the obstacle-free airspace at and around the airfield. More complete descriptions of runway airspace imaginary surfaces for Class B runways can be found in Unified Facilities Criteria (UFC) 3-260-01, Airfield and Heliport Planning and Design. The obstruction criteria in UFC 3-260-01 are based on those contained in Federal Aviation Regulation (FAR) Part 77, Objects Affecting Navigable Airspace, Subpart C. FAR Part 77 provides guidance on submittal of FAA Form 7460-1, Notice of Proposed Construction or Alteration. The form is used to notify the FAA of construction or alteration of structures proximate to imaginary surfaces around airfields.

Figure 4.1 depicts the runway airspace imaginary surfaces for the McChord Airfield Class B runway. The definitions of the runway airspace imaginary surfaces for Air Force class B runway include:

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

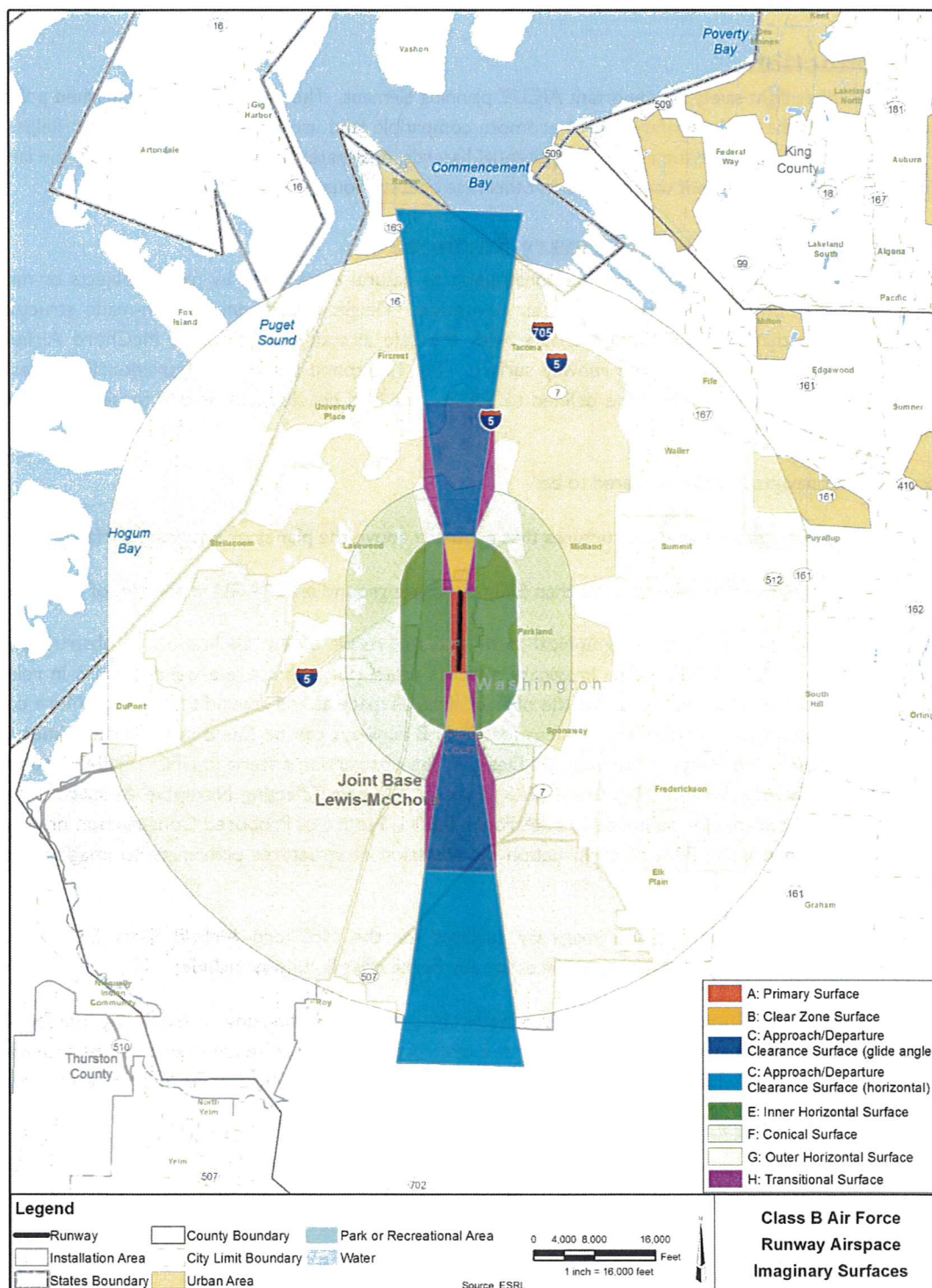


Figure 4-1. Runway Airspace Imaginary Surfaces

- Clear Zone (CZ) Surface - An obstruction-free surface (except for features essential for aircraft operations) on the ground symmetrically centered on the extended runway centerline beginning at the end of the runway and extending outward 3,000 feet. The CZ width is 3,000 feet (1,500 feet to either side of runway centerline).
- Accident Potential Zone (APZ) Surfaces - APZ I begins at the outer end of the CZ and is 5,000 feet long and 3,000 feet wide. APZ II begins at the outer end of APZ I and is 7,000 feet long and 3,000 feet wide.
- Approach-Departure Clearance Surface - This imaginary surface is symmetrically centered on the extended runway centerline, beginning as an inclined plane (glide angle) 200 feet beyond each end of the primary surface, and extending for 50,000 feet. The slope of the approach-departure clearance surface is 50:1 until it reaches an elevation of 500 feet above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 feet from the starting point. The width of this surface at the runway end is 2,000 feet, flaring uniformly to a width of 16,000 feet at the end point.
- Inner Horizontal Surface - This imaginary surface is an oval plane at a height of 150 feet above the established airfield elevation. The inner boundary intersects with the approach-departure clearance surface and the transitional surface. The outer boundary is formed by scribing arcs with a radius 7,500 feet from the centerline of each runway end and interconnecting these arcs with tangents.
- Conical Surface - This is an inclined imaginary surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation. The slope of the conical surface is 20:1. The conical surface connects the inner and outer horizontal surfaces.
- Outer Horizontal Surface - This imaginary surface is located 500 feet above the established airfield elevation and extends outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.
- Transitional Surface - This imaginary surface extends outward and upward at right angles to the runway centerline and extended runway centerline at a slope of 7:1. The transitional surface connects the primary and the approach-departure clearance surfaces to the inner horizontal, the conical, and the outer horizontal surfaces.

4.3 Clear Zones and Accident Potential Zones

Areas around airfields are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, accidents may still occur.

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

The AICUZ program includes three safety zones: the Clear Zone (CZ), Accident Potential Zone (APZ) I and APZ II. These zones were developed from analysis of over 800 major Air Force accidents that occurred within 10 miles of an Air Force installation between 1968 and 1995. Appendix B provides detail background and results of the analysis.

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

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

Figure 4-2 depicts the CZs and APZs for Runways 16/34 at McChord Airfield. Each end of the runway has a 3,000-foot by 3,000-foot CZ and two APZs.

4.4 Electromagnetic Interference

Complex electronic systems have been integrated in modern aircraft design to aid aircraft function in flight missions. The dependence on these automated technologies increases the sensitivity of aircraft communication, navigation, and other electrical systems to electromagnetic interference. Electromagnetic interference is defined as any electromagnetic disturbance that interrupts, obstructs, or limits the performance of electronics/electrical equipment. It can be induced intentionally, such as an electronic warfare, or unintentionally, such as a power line leakage, etc.

4.5 Dust, Steam, Smoke, and Lighting Emissions

Land uses around airfields that emit smoke, steam, dust, or other air pollutants has potential to impair visibility in the vicinity of the airfield, causing the concern of the safe operation of aircraft. Although off-base smoke, steam, and dust emissions have not been a significant issue to airfield operations in the past at McChord Airfield, the control of on- and off-base smoke, steam, and dust generating sources remains a concern for safe operation of aircraft missions.

Light emissions, either direct or indirect (reflective), in the vicinity of an airfield could interfere with pilot vision, especially at night. A sudden flash from a bright light is particularly dangerous at night that potentially requires a long time for a pilot to fully recover his vision. While the effects of existing light sources and glare are not currently a significant operational concern, initiatives should be pursued on- and off-base to ensure that future lighting sources are developed causing no impacts to McChord Airfield aircraft operations.

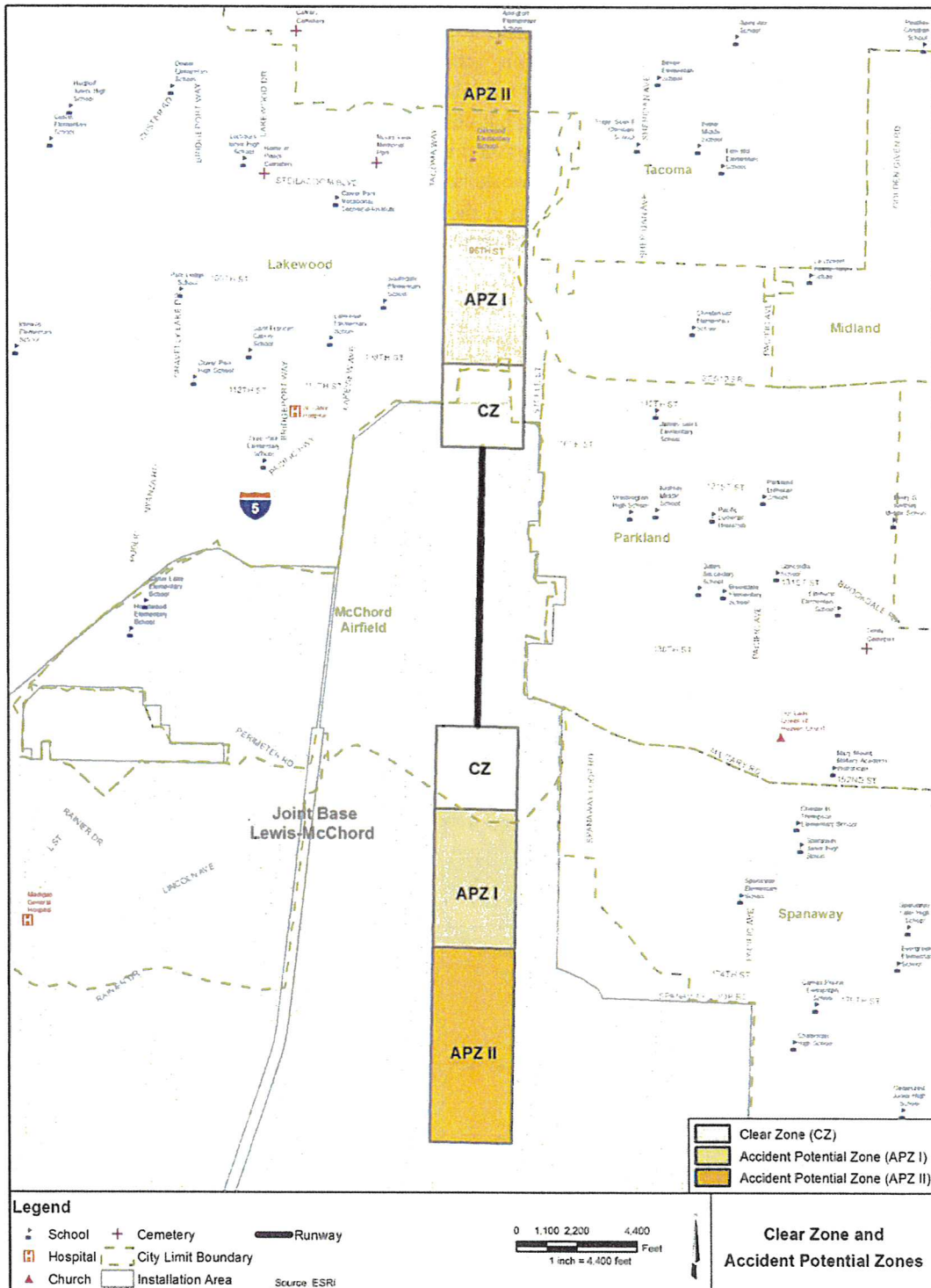


Figure 4-2. Clear Zone and Accident Potential Zones

4.6 Bird and Wildlife Aircraft Strike Hazard (BASH)

Bird and Wildlife Aircraft Strike Hazard (BASH) plans are required by the DOD for military installations where there is a potential for conflict between military flying activity and wildlife. BASH plans contain installation-specific information and guidelines to minimize the potential for collisions between aircraft and birds or other animals. Land uses that would attract birds or waterfowl, including but not limited to, operation of sanitary landfills, waste transfer facilities, maintenance of feeding stations, sand and gravel dredging operations, storm water retention ponds, created wetland areas, or the growing of certain vegetation would have potential to cause concern for flight safety. Although BASH has not been a significant issue to operations in the past at McChord Airfield, the control of off-base land use development that has potential to increase BASH requires attention as part of AICUZ planning.

5 Noise Exposure

5.1 Noise and Noise Zones

Noise can be described as unwanted sound. While most people conduct their daily lives in an environment full of sounds, some or all of these sounds can be undesirable and may detract from the quality of the human environment. A number of factors affect sound as it is perceived by the human ear. These factors include the actual level of the sound, the frequencies involved, the period of exposure, and changes or fluctuations in sound levels during exposure. Noise levels are measured in units called decibels (dB). Because the human ear cannot perceive all pitches or frequencies equally well, noise measures are adjusted to compensate for the human lack of sensitivity to low-pitched and high-pitched sounds. This adjusted unit is known as the A-weighted decibel (dBA). The A-weighted metric de-emphasizes both very low- and very high-pitched sounds, so measured levels better correlate with human perception.

Human response to changes in noise levels depends on a number of factors, including the quality of the sound, the magnitude of the changes, the time of day at which the changes take place, whether the noise is continuous or intermittent, and the individual's ability to perceive the changes. Human ability to perceive changes in noise levels varies widely with the individual, as does response to the changes. A change in noise level of less than three dBA is barely perceptible to most listeners while a 10 dBA change normally is perceived as a doubling (or halving) of noise. These thresholds allow for estimation of an average individual's probable perception of, and reaction to, changes in noise levels.

The dBA noise metric describes noise levels in a static way, whereas noise levels are rarely steady and unchanging. Therefore, methods to describe and evaluate changing noise levels over time have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific period as if it were a steady, unchanging sound. To this effect, a descriptor called the equivalent sound level (Leq) can be computed. The Leq descriptor is the constant sound level that, in a given situation and time period (e.g., one-hour Leq, or 24-hour Leq), conveys the same sound energy as the actual time-varying sound.

Alternatively, it is often useful when measuring noise levels to take into account the difference in perception and response between daylight, waking hours, and nighttime sleeping hours. To this end, a descriptor called the day-night noise level (DNL) has been developed. DNL is defined as the A-weighted average sound level during a 24-hour period, with a ten-dBA penalty weighting applied to noise occurring during nighttime (10 p.m. to 7 a.m.). The ten-dBA weighting accounts for the fact that noises at night are more perceptible because of lesser background noise levels.

The DNL descriptor has been recognized by HUD, the U.S. EPA, the FAA, and DOD as one of the most appropriate metrics for estimating the degree of nuisance or annoyance that increased noise levels would cause in residential neighborhoods. Therefore, DNL has been selected as the appropriate noise descriptor for this AICUZ study.

In June 1980, the Federal Interagency Committee (FIC) on Urban Noise published guidelines relating DNL to compatible land uses. This committee was composed of representatives of DOD, the Department of Transportation, HUD, the U.S. EPA, and the Veterans Administration. Since the issuance of these guidelines, federal agencies have generally adopted them for their noise studies. Following the lead of the committee, DOD has adopted the noise zone concept of land use compatibility in terms of a DNL level as the accepted measure of aircraft noise effect as summarized in Table 5-1.

Table 5-1. Noise Zones

Noise Zone	Aviation DNL (dBA)	Land Use Recommendation
I	< 65	Generally acceptable with any residential or noise-sensitive uses.
II	65–75	Normally not recommended with residential or noise-sensitive uses.
III	>75	Not recommended with any residential or noise-sensitive uses.

5.2 Noise Exposure Forecasts

The main sources of airfield noise are generally related to in-flight operations and pre-flight and maintenance run-up operations. The most recent version (7.357) of the NOISEMAP model was used to predict noise contours for land use planning purposes based on information about airfield operations described in Chapter 3, including:

- Type of operation
- Number of operations
- Time of operation
- Runway and flight track used
- Aircraft power settings, speeds, and altitudes
- Number and duration of maintenance run-ups
- Weather data

Three noise exposure zones as described previously in the AICUZ program are established from the NOISEMAP modeling: Noise Zone I includes areas with less than 65 dB DNL; Noise Zone II encompasses areas between 65 and 75 dB DNL; and Noise Zone III covers areas exposed to 75 dB DNL or higher.

Figure 5-1 depicts the DNL noise contours at both McChord Airfield and GAAF plotted in 5 dB increments, ranging from 65 dB DNL to 85 dB DNL. Since Noise Zone II (65 dB DNL or greater) from the aircraft operations at GAAF do not extend beyond JBLM, the GAAF aircraft noise analysis component in this AICUZ update is included in Appendix C and therefore the AICUZ discussions presented in this main document focus on noise contours as a result of McChord Airfield operations (Figure 5-2).

Table 5-2 shows the acreage and estimated population (off installation) within the 65 dB DNL and greater noise exposure contours. The population data used in preparing this estimate was obtained from the 2010 census (United States Census Bureau 2012). To estimate the affected population, it was assumed that population was equally distributed within a census tract area. Using this assumption, the total acreage and population in each census tract surrounding McChord Airfield were collected and assessed.

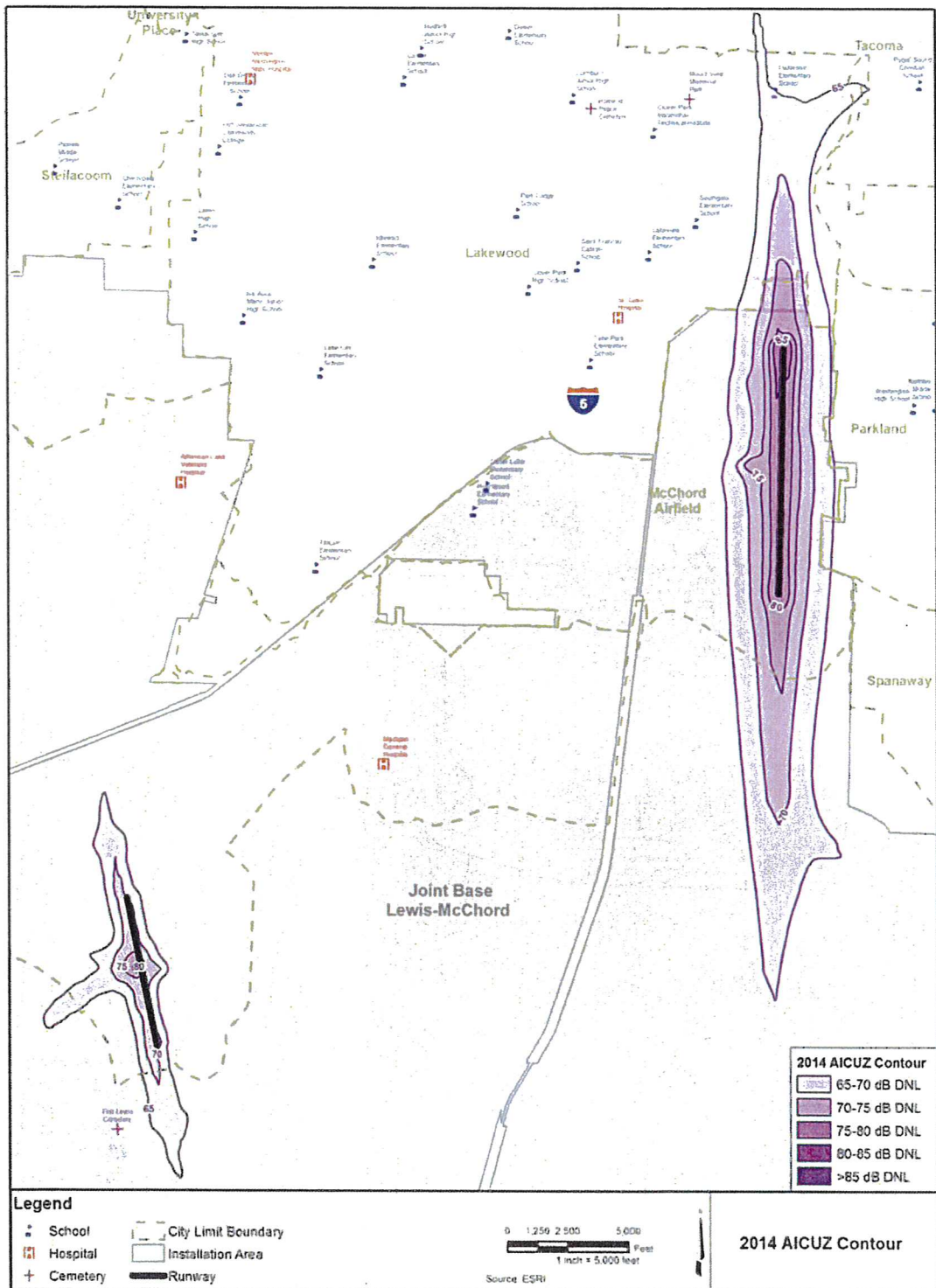


Figure 5-1. DNL Contours at JBLM

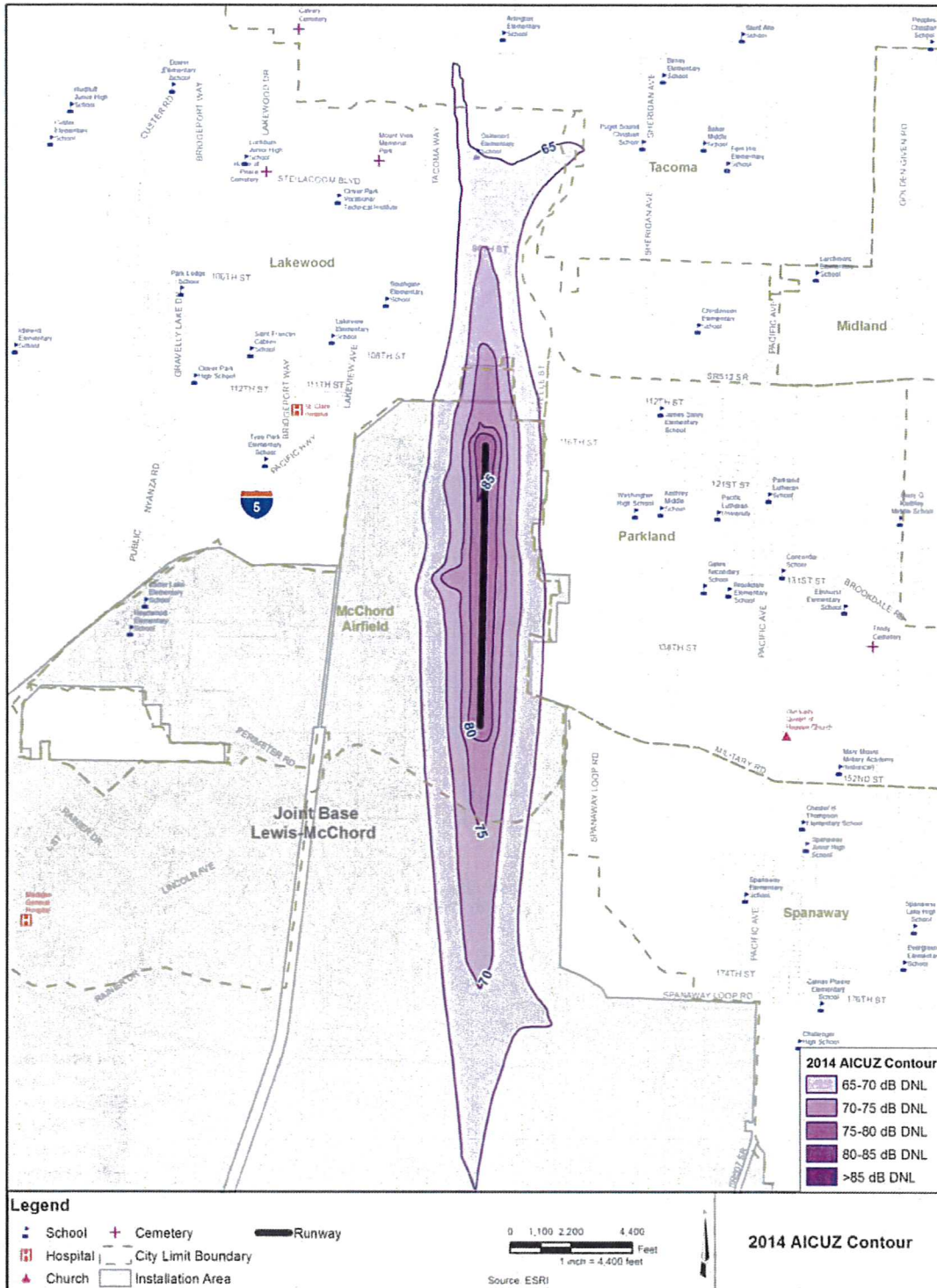


Figure 5-2. Noise Contours at McChord Airfield

Table 5-2. Area and Population within DNL 65 dB and Greater Noise Exposure Area (Off-Base)

DNL Noise Zone	Acres	Population (2010 Census)
65-69	479	2,251
70-74	89	116
75-80	11	0
>80	0	0
Total	579	2,367

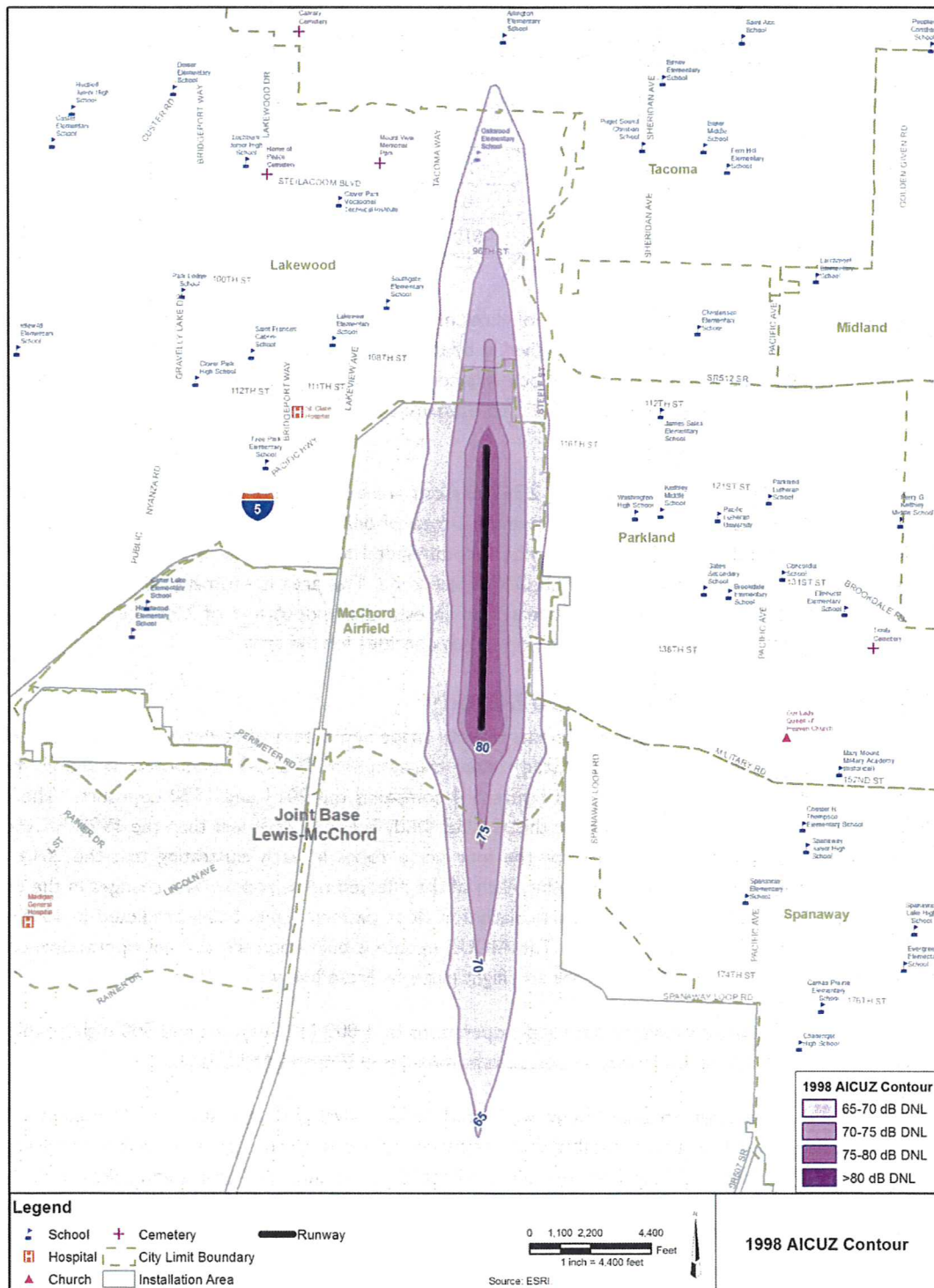
Using the noise contour information, the number of acres of off-base land in each noise zone (i.e., 65-69 dB, 70-74 dB, 75-79 dB, and 80 dB DNL and greater) was divided by the number of acres of land in each census tract/block to determine what portion of the census tract/block was contained within each noise zone. The population total in each block-group was then multiplied by this ratio to estimate population exposed to aircraft noise at and above 65 dB DNL.

According to Table 5-2, a total of 579 acres and 2,367 persons are expected to be in the off-base area within the 65 dB DNL and greater noise exposure area. However, a total of only 11 acres and no people are located within Noise Zone III (75 dB DNL or higher), a zone not recommended for any residential land use purposes. The largest affected population is within the 65-69 dB DNL noise zone. This area is estimated to contain 479 acres in off-base land area (83 % of the total impacted areas) and an estimated population of 2,251 persons (95 % of the total affected population) based on the calculated population densities for the area.

5.3 Comparison with 1998 AICUZ Study

Noise contours around McChord Airfield are similar in both shape and extent of coverage when compared to the noise contours established in the 1998 AICUZ Study under the assumed 2005 C-17 beddown condition. Figure 5-3 depicts the 1998 AICUZ Study contours and Figure 5-4 compares the 2014 and 1998 contours. The off-base land area exposed to 65 dB DNL or greater for this AICUZ Study is about 22 % less than the 1998 AICUZ Study. Table 5-3 provides the total noise exposure for the four noise zones in each illustrating that the 2014 AICUZ shows smaller incompatible land use acreage within each of the affected noise zones. The changes in the contours result from a greater number of operations particularly for close pattern flights being predicted in 1998 AICUZ when comparing this AICUZ update condition. The AICUZ update is built upon the current operational condition and incorporates the changes in flight operations and flight patterns listed below:

- Increasing C-17 assault landing pattern flight operations by 1,800 (900 daytime and 900 nighttime) to meet growing demand as a result of past and/or current missions in Iraq and Afghanistan.
- Reversing the usage percentage of Runways 16 and 34 for arrival flight operations to 1) implement overall energy saving initiatives at the installation by reducing flight operations against southern prevailing winds at McChord Airfield and 2) further reduce noise impacts in the cities of Tacoma and Lakewood.
- Increasing current tempo by 20 % as part of the 2012 MP objective to meet future JBLM mission requirement.



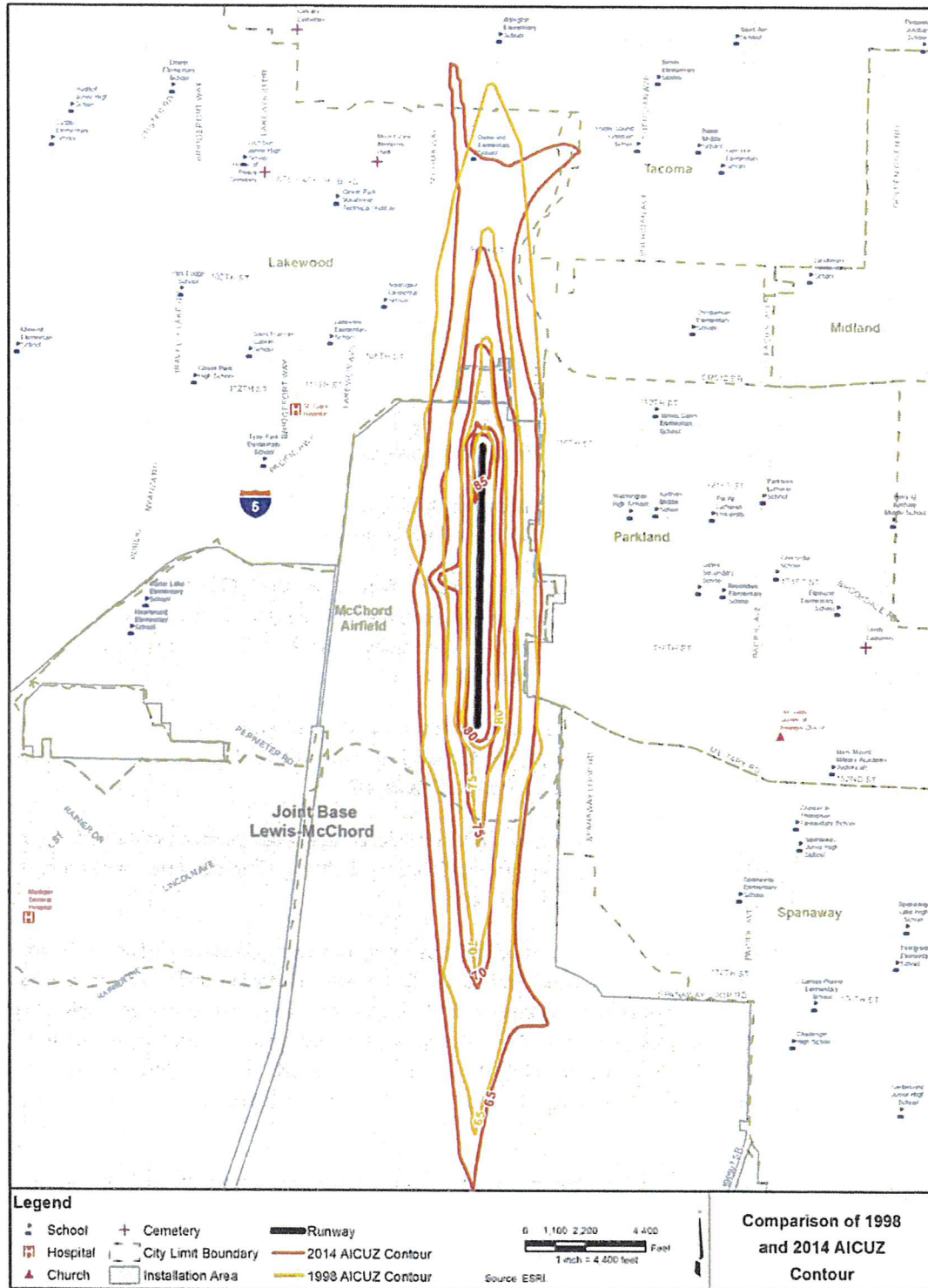


Figure 5-4. Comparison of 2014 and 1998 AICUZ Noise Contours

Table 5-3. Total Acres within the 2014 and 1998 AICUZ Study Noise Zones (Off-Base)

DNL Noise Zone	Acres	
	2014 AICUZ	1998 AICUZ
65-70	479	585
70-75	89	146
75-80	11	8
>80	0	0
Total	579	739

5.4 Land Use Compatibility Guidelines

The DOD developed the AICUZ program for military airfields. Using this program at its installations, the DOD works to protect aircraft operational capabilities and to assist local government officials in protecting and promoting the public's 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 reports describe three basic types of constraints that affect, or result from, flight operations. The first constraint involves areas that the FAA and the DOD identified for height limitations (see Subsection 4.2).

The second constraint involves noise zones based on the DNL metric and the DOD NOISEMAP method. Using the NOISEMAP program, which is similar to FAA's Integrated Noise Model (INM), the Air Force produces noise contours showing the noise levels generated by aircraft operations. The AICUZ report contains noise contours plotted in 5 dB increments, ranging from DNL 65 dB to 80+ dB.

The third constraint involves CZs and APZs based on statistical analysis of past DOD aircraft accidents. DOD analysis has determined that areas immediately beyond the ends of runways and along the approach and departure flight paths have greater potential for aircraft accidents (see Figure 4-2).

The land use compatibility guidelines adopted by the DOD AICUZ program can be found in Table 5-4 for CZ and APZ zones and Table 5-5 for noise zones, respectively (DOD, May 2, 2011). The designations are a combination of criteria listed in the note section at the end of each table.

According to the guidelines for noise exposure, some land use categories (e.g., manufacturing/industrial) are deemed compatible at lower noise exposure levels (less than 70 dB DNL) and compatible under specific conditions, i.e., "compatible with restrictions," at higher noise exposure levels. Compatible with restrictions generally requires the incorporation of additional noise attenuation measures in the design and construction of structures to achieve a greater Noise Level Reduction (NLR) than afforded by standard construction materials. These additional measures address noise reduction strategies for internal noise levels only and do not address increased noise exposure levels that may occur outside a dwelling.

Residential land use categories are incompatible with noise exposure levels at or above 75 dB DNL (Noise Zone III), incompatible with exceptions in areas within the 65 to 74 dB DNL contour (Noise Zone II), and compatible with restrictions within the 60 to 64 dB DNL contour (Noise Zone I). Residential uses are discouraged at noise exposure levels of 65-69 dB DNL and strongly discouraged in areas of 70-74 dB DNL, unless there is an absence of viable development options and a demonstrated community need could not be met without the development. Where a community determines that the residential development should be allowed, measures to achieve an NLR of at least 25 dB DNL in areas affected by 65-69 dB DNL, and an NLR of at least 30 dB DNL in areas of 70-74 dB DNL, should be incorporated into building codes and project approval requirements. Common measures used to achieve NLRs include

using a higher grade of insulation and double-pane windows. Since normal permanent construction typically provides an NLR of 20 dB DNL, the reduction requirements are sometimes stated as 5, 10, or 15 dB DNL over standard construction.

Compatibility guidelines associated with APZ's are similarly defined as shown in Table 5-4. Conditions placed on the compatibility, compatible with restrictions, incompatible with exceptions, and incompatible designations are based on the densities of people and structures, so site-specific evaluation of varying densities may be needed. In order to assist installations and local governments, general suggestions as to floor/area ratios are provided as a guide to density in some categories. In general, land use restrictions that limit commercial, services, or industrial buildings or building occupants to 25 per acre in APZ I and 50 per acre in APZ II are the range of occupancy levels considered to be low density.

In general, residential land use is incompatible with the accident potential in the CZ and APZs; however, detached single-family housing with a maximum density of one to two dwelling units per acre (DU/acre) is compatible with restrictions with accident potential in APZ II.

Table 5-4. Land Use Compatibility in CZ and APZs

SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
10	Residential				
11	Household Units				
11.11	Single units: detached	N	N	Y ²	Maximum density of 2 Du/Ac
11.12	Single units: semi-detached	N	N	N	
11.13	Single units: attached row	N	N	N	
11.21	Two units: side-by-side	N	N	N	
11.22	Two units: one above the other	N	N	N	
11.31	Apartments: walk-up	N	N	N	
11.32	Apartment: elevator	N	N	N	
12	Group quarters	N	N	N	
13	Residential hotels	N	N	N	
14	Mobile home parks or courts	N	N	N	
15	Transient lodgings	N	N	N	
16	Other residential	N	N	N	
20	Manufacturing ³				
21	Food and kindred products; manufacturing	N	N	Y	Maximum FAR 0.56 IN APZ II
22	Textile mill products; manufacturing	N	N	Y	Maximum FAR 0.56 IN APZ II
23	Apparel and other finished products; products made from fabrics, leather and similar materials; manufacturing	N	N	N	
24	Lumber and wood products (except furniture); manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
25	Furniture and fixtures; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
26	Paper and allied products; manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
27	Printing, publishing, and allied industries	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
28	Chemicals and allied products; manufacturing	N	N	N	
29	Petroleum refining and related industries	N	N	N	
30	Manufacturing ³ (continued)				
31	Rubber and miscellaneous plastic products; manufacturing	N	N	N	
32	Stone, clay, and glass products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II

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SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
33	Primary metal products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
34	Fabricated metal products; manufacturing	N	N	Y	Maximum FAR 0.56 in APZ II
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks	N	N	N	
39	Miscellaneous manufacturing	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
40	Transportation, communication, and utilities ^{3, 4}				
41	Railroad, rapid rail transit, and street railway transportation	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
42	Motor vehicle transportation	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
43	Aircraft transportation	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
44	Marine craft transportation	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
45	Highway and street right-of-way	Y ⁵	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
46	Automobile parking	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
47	Communication	N	Y ⁶	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
48	Utilities ⁷	N	Y ⁶	Y ⁶	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
48.5	Solid waste disposal (landfills, incinerators, etc.)	N	N	N	
49	Other transportation, communication, and utilities	N	Y ⁶	Y	See Note 6 below
50	Trade				
51	Wholesale trade	N	Y	Y	Maximum FAR of 0.28 in APZ I & 0.56 in APZ II
52	Retail trade - building materials, hardware and farm equipment	N	Y	Y	See Note 8 below
53	Retail trade ⁹ - including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	N	N	Y	Maximum FAR of 0.16 in APZ II

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SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
54	Retail trade - food	N	N	Y	Maximum FAR of 0.24 in APZ II
55	Retail trade - automotive, marine craft, aircraft, and accessories	N	Y	Y	Maximum FAR of 0.14 in APZ I & 0.28 in APZ II
56	Retail trade - apparel and accessories	N	N	Y	Maximum FAR of 0.28 in APZ II
57	Retail trade - furniture, home, furnishings and equipment	N	N	Y	Maximum FAR of 0.28 in APZ II
58	Retail trade - eating and drinking establishments	N	N	N	
59	Other retail trade	N	N	Y	Maximum FAR of 0.16 in APZ II
60	Services ¹⁰				
61	Finance, insurance and real estate services	N	N	Y	Maximum FAR of 0.22 in APZ II
62	Personal services	N	N	Y	Office uses only. Maximum FAR of 0.22 in APZ II.
62.4	Cemeteries	N	Y ¹¹	Y ¹¹	
63	Business services (credit reporting; mail, stenographic, reproduction; advertising)	N	N	Y	Maximum FAR of 0.22 in APZ II
63.7	Warehousing and storage services ¹²	N	Y	Y	Maximum FAR of 1.0 in APZ I; 2.0 in APZ II
64	Repair Services	N	Y	Y	Maximum FAR of 0.11 APZ I; 0.22 in APZ II
65	Professional services	N	N	Y	Maximum FAR of 0.22 in APZ II
65.1	Hospitals, nursing homes	N	N	N	
65.1	Other medical facilities	N	N	N	
66	Contract construction services	N	Y	Y	Maximum FAR of 0.11 APZ I; 0.22 in APZ II
67	Government Services	N	N	Y	Maximum FAR of 0.24 in APZ II
68	Educational services	N	N	N	
68.1	Child care services, child development centers, and nurseries	N	N	N	
69	Miscellaneous	N	N	Y	Maximum FAR of 0.22 in APZ II
69.1	Religious activities	N	N	N	
70	Cultural, entertainment and recreational				
71	Cultural activities	N	N	N	
71.2	Nature exhibits	N	Y ¹³	Y ¹³	
72	Public assembly	N	N	N	

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SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
72.1	Auditoriums, concert halls	N	N	N	
72.11	Outdoor music shells, amphitheaters	N	N	N	
72.2	Outdoor sports arenas, spectator sports	N	N	N	
73	Amusements - fairgrounds, miniature golf, driving ranges; amusement parks, etc.	N	N	Y	
74	Recreational activities (including golf courses, riding stables, water recreation)	N	Y ¹³	Y ¹³	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II
75	Resorts and group camps	N	N	N	
76	Parks	N	Y ¹³	Y ¹³	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II
79	Other cultural, entertainment and recreation	N	Y ¹¹	Y ¹¹	Maximum FAR of 0.11 in APZ I; 0.22 in APZ II
80	Resource production and extraction				
81	Agriculture (except livestock)	Y ⁴	Y ¹⁴	Y ¹⁴	
81.5, 81.7	Livestock farming and breeding	N	Y ^{14,15}	Y ^{14,15}	
82	Agriculture related activities	N	Y ¹⁴	Y ¹⁴	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
83	Forestry activities ¹⁶	N	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
84	Fishing activities ¹⁷	N ¹⁷	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
85	Mining activities ¹⁸	N	Y ¹⁸	Y ¹⁸	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives

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SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
89	Other resource production or extraction	N	Y	Y	Maximum FAR of 0.28 in APZ I; 0.56 in APZ II, no activity which produces smoke, glare, or involves explosives
90	Other				
91	Undeveloped land	Y	Y	Y	
93	Water areas ¹⁹	N ¹⁹	N ¹⁹	N ¹⁹	

Key to Table – Land Use Compatibility in APZs

SLUCM - Standard Land Use Coding Manual, U.S. Department of Transportation

Y (Yes) - Land uses and related structures are normally compatible without restriction

N (No) - Land use and related structures are not normally compatible and should be prohibited.

Y^x - Yes with restrictions. The land uses and related structures are generally compatible. However, see notes indicated by the superscript.

N^x - No with exceptions. The land uses and related structures are generally incompatible. However, see notes indicated by the superscript.

FAR - Floor Area Ratio. A floor area ratio is the ratio between the square feet of floor area of the building and the gross site area. It is customarily used to measure non-residential intensities.

Du/Ac - Dwelling Units an Acre. This is customarily used to measure residential densities.

Notes:

1. A "Yes" or a "No" designation for compatible land use is to be used only for general comparison. Within each, uses exist where further evaluation may be needed in each category as to whether it is clearly compatible, normally compatible, or not compatible due to the variation of densities of people and structures. In order to assist air installations and local governments, general suggestions as to FARs are provided as a guide to density in some categories. In general, land use restrictions that limit occupants, including employees, of commercial, service, or industrial buildings or structures to 25 an acre in APZ I and 50 an acre in APZ II are considered to be low density. Outside events should normally be limited to assemblies of not more than 25 people an acre in APZ I, and maximum assemblies of 50 people an acre in APZ II. Recommended FARs are calculated using standard parking generation rates for various land uses, vehicle occupancy rates, and desired density in APZ I and II. For APZ I, the formula is $FAR = 25 \text{ people an acre} / (\text{Average Vehicle Occupancy} \times \text{Average Parking Rate} \times (43560/1000))$. The formula for APZ II is $FAR = 50 / (\text{Average Vehicle Occupancy} \times \text{Average Parking Rate} \times (43560/1000))$.
2. The suggested maximum density for detached single family housing is two Du/Ac. In a planned unit development (PUD) of single family detached units where clustered housing development results in large open areas, this density could possibly be increased slightly provided the amount of surface area covered by structures does not exceed 20 % of the PUD total area. PUD encourages clustered development that leaves large open areas.

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SLUCM NO.	LAND USE NAME	CLEAR ZONE Recommendation ¹	APZ-I Recommendation ¹	APZ-II Recommendation ¹	DENSITY Recommendation ¹
3.	No structures (except airfield lighting and navigational aids necessary for the safe operation of the airfield when there are no other siting options), buildings, or above-ground utility and communications lines should normally be located in Clear Zone areas on or off the air installation. The Clear Zone is subject to the most severe restrictions.				
4.	Rights-of-way for fenced highways, without sidewalks or bicycle trails, are allowed.				
5.	No above ground passenger terminals and no above ground power transmission or distribution lines. Prohibited power lines include high-voltage transmission lines and distribution lines that provide power to cities, towns, or regional power for unincorporated areas.				
6.	Development of renewable energy resources, including solar and geothermal facilities and wind turbines, may impact military operations through hazards to flight or electromagnetic interference. Each new development should to be analyzed for compatibility issues on a case-by-case basis that considers both the proposal and potentially affected mission.				
7.	Within SLUCM Code 52, maximum FARs for lumberyards (SLUCM Code 521) are 0.20 in APZ-I and 0.40 in APZ-II. For hardware, paint, and farm equipment stores, SLUCM Code 525, the maximum FARs are 0.12 in APZ I and 0.24 in APZ II.				
8.	A shopping center is an integrated group of commercial establishments that is planned, developed, owned, or managed as a unit. Shopping center types include strip, neighborhood, community, regional, and super-regional facilities anchored by small businesses, a supermarket or drug store, discount retailer, department store, or several department stores, respectively. Included in this category are such uses as big box discount clubs, home improvement superstores, office supply superstores, and electronics superstores. The maximum recommended FAR for SLUCM 53 should be applied to the gross leasable area of the shopping center rather than attempting to use other recommended FARs listed in Table 1 under Retail or Trade.				
9.	Ancillary uses such as meeting places, auditoriums, etc., are not recommended.				
10.	No chapels or houses of worship are allowed within APZ I or APZ II.				
11.	Big box home improvement stores are not included as part of this category.				
12.	Facilities must be low intensity, and provide no playgrounds, etc. Facilities such as club houses, meeting places, auditoriums, large classes, etc., are not recommended.				
13.	Livestock grazing is a compatible land use, but feedlots and intensive animal husbandry are excluded. Activities that attract concentrations of birds creating a hazard to aircraft operations should be excluded.				
15.	Feedlots and intensive animal husbandry are included as compatible land uses.				
16.	Lumber and timber products removed due to establishment, expansion, or maintenance of Clear Zone lands owned in fee will be disposed of in accordance with applicable DOD guidance.				
17.	Controlled hunting and fishing may be permitted for the purpose of wildlife management.				
18.	Surface mining operations that could create retention ponds that may attract waterfowl and present bird/wildlife aircraft strike hazards (BASH), or operations that produce dust or light emissions that could affect pilot vision are not compatible.				
19.	Naturally occurring water features (e.g., rivers, lakes, streams, wetlands) are pre-existing, nonconforming land uses. Naturally occurring water features that attract waterfowl present a potential BASH. Actions to expand naturally occurring water features or construction of new water features should not be encouraged. If construction of new features is necessary for storm water retention, such features should be designed so that they do not attract water fowl.				

Table 5-5. Land Use Compatibility in Noise Zones

SLUCM NO.	LAND USE LAND USE NAME	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
10	Residential	N ¹	N ¹	N	N	N
11	Household units	N ¹	N ¹	N	N	N
11.11	Single units: detached	N ¹	N ¹	N	N	N
11.12	Single units: semidetached	N ¹	N ¹	N	N	N
11.13	Single units: attached row	N ¹	N ¹	N	N	N
11.21	Two units: side-by-side	N ¹	N ¹	N	N	N
11.22	Two units: one above the other	N ¹	N ¹	N	N	N
11.31	Apartments: walk-up	N ¹	N ¹	N	N	N
11.32	Apartment: elevator	N ¹	N ¹	N	N	N
12	Group quarters	N ¹	N ¹	N	N	N
13	Residential hotels	N ¹	N ¹	N	N	N
14	Mobile home parks or courts	N	N	N	N	N
15	Transient lodgings	N ¹	N ¹	N ¹	N	N
16	Other residential	N ¹	N ¹	N	N	N
20	Manufacturing					
21	Food and kindred products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
22	Textile mill products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y ²	Y ³	Y ⁴	N
24	Lumber and wood products (except furniture); manufacturing	Y	Y ²	Y ³	Y ⁴	N
25	Furniture and fixtures; manufacturing	Y	Y ²	Y ³	Y ⁴	N
26	Paper and allied products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
27	Printing, publishing, and allied industries	Y	Y ²	Y ³	Y ⁴	N
28	Chemicals and allied products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
29	Petroleum refining and related industries	Y	Y ²	Y ³	Y ⁴	N
30	Manufacturing (continued)					
31	Rubber and misc. plastic products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
32	Stone, clay and glass products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
33	Primary metal products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
34	Fabricated metal products; manufacturing	Y	Y ²	Y ³	Y ⁴	N
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y ²	Y ³	Y ⁴	N
40	Transportation, communication and utilities					

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SLUCM NO.	LAND USE LAND USE NAME	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
41	Railroad, rapid rail transit, and street railway transportation	Y	Y ²	Y ³	Y ⁴	N
42	Motor vehicle transportation	Y	Y ²	Y ³	Y ⁴	N
43	Aircraft transportation	Y	Y ²	Y ³	Y ⁴	N
44	Marine craft transportation	Y	Y ²	Y ³	Y ⁴	N
45	Highway and street right-of-way	Y	Y	Y	Y	N
46	Automobile parking	Y	Y	Y	Y	N
47	Communication	Y	25 ⁵	30 ⁵	N	N
48	Utilities	Y	Y ²	Y ³	Y ⁴	N
49	Other transportation, communication and utilities	Y	25 ⁵	30 ⁵	N	N
50	Trade					
51	Wholesale trade	Y	Y ²	Y ³	Y ⁴	N
52	Retail trade - building materials, hardware and farm equipment	Y	25	30	Y ⁴	N
53	Retail trade - including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	25	30	N	N
54	Retail trade - food	Y	25	30	N	N
55	Retail trade - automotive, marine craft, aircraft and accessories	Y	25	30	N	N
56	Retail trade - apparel and accessories					
57	Retail trade - furniture, home, furnishings and equipment					
58	Retail trade - eating and drinking establishments	Y	25	30	N	N
59	Other retail trade	Y	25	30	N	N
60	Services					
61	Finance, insurance and real estate services	Y	25	30	N	N
62	Personal services	Y	25	30	N	N
62.4	Cemeteries	Y	Y ²	Y ³	Y ^{4,11}	Y ^{6,11}
63	Business services	Y	25	30	N	N
63.7	Warehousing and storage	Y	Y ²	Y ³	Y ⁴	N
64	Repair services	Y	Y ²	Y ³	Y ⁴	N
65	Professional services	Y	25	30	N	N
65.1	Hospitals, other medical facilities	25	30	N	N	N
65.16	Nursing homes	N ¹	N ¹	N	N	N
66	Contract construction services	Y	25	30	N	N
67	Government services	Y ¹	25	30	N	N
68	Educational services	25	30	N	N	N
68.1	Child care services, child development centers, and nurseries	25	30	N	N	N

SLUCM NO.	LAND USE LAND USE NAME	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL 65-69	DNL or CNEL 70-74	DNL or CNEL 75-79	DNL or CNEL 80-84	DNL or CNEL 85+
69	Miscellaneous	Y	25	30	N	N
69.1	Religious activities	Y	25	30	N	N
70	Cultural, entertainment and recreational					
71	Cultural activities (& churches)	25	30	N	N	N
71.2	Nature exhibits	Y ¹	N	N	N	N
72	Public assembly	Y	N	N	N	N
72.1	Auditoriums, concert halls	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y ⁷	Y ⁷	N	N	N
73	Amusements	Y	Y	N	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	Y	25	30	N	N
75	Resorts and group camps	Y	25	N	N	N
76	Parks	Y	25	N	N	N
79	Other cultural, entertainment and recreation	Y	25	N	N	N
80	Resource production and extraction					
81	Agriculture (except livestock)	Y ⁸	Y ⁹	Y ¹⁰	Y ^{10,11}	Y ^{10,11}
81.5	Livestock farming	Y ⁸	Y ⁹	N	N	N
81.7	Animal breeding	Y ⁸	Y ⁹	N	N	N
82	Agriculture related activities	Y ⁸	Y ⁹	Y ¹⁰	Y ^{10,11}	Y ^{10,11}
83	Forestry activities	Y ⁸	Y ⁹	Y ¹⁰	Y ^{10,11}	Y ^{10,11}
84	Fishing activities	Y	Y	Y	Y	Y
85	Mining activities	Y	Y	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y	Y	Y

SLUCM NO.	LAND USE LAND USE NAME	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL	DNL or CNEL	DNL or CNEL	DNL or CNEL	DNL or CNEL
		65-69	70-74	75-79	80-84	85+

Key to Land Use Compatibility in Noise Zones:

SLUCM - Standard Land Use Coding Manual, U.S. Department of Transportation

Y (Yes) - Land use and related structures compatible without restrictions.

N (No) - Land use and related structures are not compatible and should be prohibited.

Y^x - Yes with restrictions. The land use and related structures generally are compatible. However, see note(s) indicated by the superscript.

N^x - No with exceptions. The land use and related structures are generally incompatible. However, see note(s) indicated by the superscript.

25, 30, or 35 - The numbers refer to noise level reduction (NLR) levels. NLR (outdoor to indoor) is achieved through the incorporation of noise attenuation into the design and construction of a structure. Land use and related structures are generally compatible; however, measures to achieve NLR of 25, 30, or 35 must be incorporated into design and construction of structures. However, measures to achieve an overall noise reduction do not necessarily solve noise difficulties outside the structure and additional evaluation is warranted. Also, see notes indicated by superscripts where they appear with one of these numbers.

DNL - Day-Night Average Sound Level.

CNEL - Community Noise Equivalent Level (normally within a very small decibel difference of DNL)

Ldn - Mathematical symbol for DNL.

Notes:

- General
 - Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged in DNL 65-69 and strongly discouraged in DNL 70-74. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, non-conforming land uses.
 - Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 decibels (dB) in DNL 65-69 and 30 dB in DNL 70-74 should be incorporated into building codes and be considered in individual approvals; for transient housing, an NLR of at least 35 dB should be incorporated in DNL 75-79.
 - Normal permanent construction can be expected to provide an 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, upgraded sound transmission class ratings in windows and doors, and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.
 - NLR criteria will not eliminate outdoor noise problems. However, building location, site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures that only protect interior spaces.
- 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.

SLUCM NO.	LAND USE LAND USE NAME	SUGGESTED LAND USE COMPATIBILITY				
		DNL or CNEL	DNL or CNEL	DNL or CNEL	DNL or CNEL	DNL or CNEL
		65-69	70-74	75-79	80-84	85+
3.	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.					
4.	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.					
5.	If project or proposed development is noise sensitive, use indicated NLR; if not, land use is compatible without NLR.					
6.	Buildings are not permitted.					
7.	Land use is compatible provided special sound reinforcement systems are installed.					
8.	Residential buildings require an NLR of 25.					
9.	Residential buildings require an NLR of 30.					
10.	Residential buildings are not permitted.					
11.	Land use that involves outdoor activities is not recommended, but if the community allows such activities, hearing protection devices should be worn when noise sources are present. Long-term exposure (multiple hours per day over many years) to high noise levels can cause hearing loss in some unprotected individuals.					

5.5 Participation in the Planning Process

The Air Force provides the AICUZ Study to local communities to assist them in preparing their local land use plans. Airspace obstructions, construction in the APZs, residential development, and the construction of other noise-sensitive uses near the airfield are of great concern to JBLM. JBLM is very interested in minimizing increases in incompatible usage and in encouraging voluntary conversion of non-compatible usage to compatible usage. Applying the categories for compatible land use described in Tables 5-4 and 5-5, the JBLM evaluates the impact aircraft operations have on surrounding properties and the effect new development or changes in land use might have on McChord Airfield operational capabilities.

In addition to working with local governing entities and planning professionals, the JBLM Public Affairs Office works to address complaints and concerns expressed by off-base neighbors. JBLM conducts active outreach to the community by meeting with various community groups and speaking with individuals as needed. The Civil Engineer and Public Affairs Offices work together providing public meetings and informational workshops to disseminate information about airfield operations, forecasts, plans, and mitigation strategies.

6 Land Use Compatibility Analysis

6.1 Introduction

Land use planning and control is a dynamic process. The specific characteristics of land use determinants reflect, to some degree, the changing conditions of the economic, social, and physical environment of a community, as well as changing public concern. The AICUZ planning process provides flexibility as decisions are usually based on generalized zoning area designations rather than strict boundary lines.

The compatibility of these local zoning designations with the noise and accident potential associated with McChord Airfield operations is assessed based on the DOD AICUZ guidelines. Zoning has been selected to represent local land use because:

- Zoning designations are required to be consistent with the underlying land use designation of a General Plan, therefore they are considered to be the most accurate indicator of current land use in an area, short of aerial photography and field surveys; and
- Zoning designations are a reasonable indicator of intended future land use as they represent the guidelines by which cities and counties approve new development.

Therefore, for the purposes of this land use compatibility analysis, zoning designations are used for the analysis of off installation land use conditions. This section examines existing land use and zoning and compares it to noise contours from the operation of McChord Airfield to identify areas that are incompatible.

6.2 Existing Land Use and Zoning

McChord Airfield was first established when Pierce County passed a bond measure to establish a military airfield just north of Fort Lewis in 1927. The airfield, called Tacoma Field, opened in 1930 and was renamed McChord Field in 1940. McChord Field separated from Fort Lewis when the U.S. Air Force was created in 1947 and was subsequently renamed McChord Air Force Base. Virtually all of Pierce County was rural when McChord Airfield was first established. Over the years, this area has become more developed and beginning in 1990's, intensive development and growth have taken place to the north of the airfield, particularly in the Cities of Lakewood and Tacoma and in unincorporated parklands to the east of the airfield.

For the purpose of this AICUZ, existing land uses shown on the noise contour figures are classified into one of the following generalized zoning land use categories established in local zoning codes particularly from the City of Lakewood and the County of Pierce where the affected land use areas are located:

Residential: all types of residential activity, such as single and multi-family residences and mobile homes, at a density greater than one dwelling unit per acre.

Commercial: all types of commercial related activity, such as offices, retail, restaurants, business service, and other types of commercial establishments.

Industrial: manufacturing, warehousing, and other similar uses.

Public Institutional: cemeteries, communication, cultural activities, educational services (school, colleges & libraries), fire stations, governmental services, hospital, postal services, religious services, and other public assembly land.

Open Space, Park and Recreation: land areas designated for open space and recreational activities including parks, forest, conservation areas.

Transportation and Utilities: aircraft/marine craft transportation, street/rail road right of way, utilities and well sites.

Air Corridor/Clear Zone: areas experiencing elevated aircraft noise that are zoned similar to industrial uses.

Mixed Use: areas mixed with commercial/industrial/residential land uses.

Areas immediately surrounding McChord Airfield are within the Cities of Lakewood and Tacoma, with some rural parklands owned by Pierce County, Washington. Areas immediately north of the airfield fronting the Interstate 5 (I-5) are the most heavily developed and contain several established commercial corridors. Areas immediately east of the airfield typically remain rural with residential, parklands and undeveloped lands. Figure 6-1 shows zoned land uses around McChord Airfield.

6.3 Land Use Compatibility Analysis

Computer technology enables JBLM to display its flight tracks and noise contours with a high degree of precision for land use planning purposes. The computer technology reveals the extent of the McChord Airfield's region of impact into the Cities of Tacoma and Lakewood and surrounding areas.

Figure 6-1 shows 65 dB DNL and greater noise exposure area for areas off the installation. The acreage of each land use category exposed to noise levels of 65 dB DNL and greater was calculated and is presented in Table 6-1. As seen in this table, the loudest DNL contour extending off installation that is not in an air corridor/clear zone is in the range 65-69 dB in Noise Zone II to the north of the airfield. Similarly, the acreage of each land use category exposed to CZ and APZs was calculated and is presented in Table 6-2. As seen in this table, no residential land use is within CZ; however, a total of 179 acres of residential land use are within APZs with 96 % in APZII.

The noise contours and CZ, APZ I, and APZ II were overlaid on the current generalized zoning land uses (off installation), as shown in Figures 6-2 and 6-3. There is a total of 875 acres of land within the McChord Airfield CZs and APZs, the majority of which (67.9 %) is air corridor/clear zone. The next most common land uses within the CZs and APZs are residential (20.5 %) and commercial (8.0 %).

Table 6-3 summarizes the acreage and land use zoning (off installation areas only) within DNL 65 dB and greater noise contours outside of the CZ and APZs (off installation). The noise level does not exceed the 65-69 dB contour in areas outside of the CZ and APZs and covered a total of 87 acres. Approximately 40.2 % of the area is in residential zoning, with 21.8 % in industrial zoning, 21.8 % in commercial zoning, 10.4 % in mixed use, 4.6 % in open space/recreation, and 1.2 % in air corridor/clear zone.

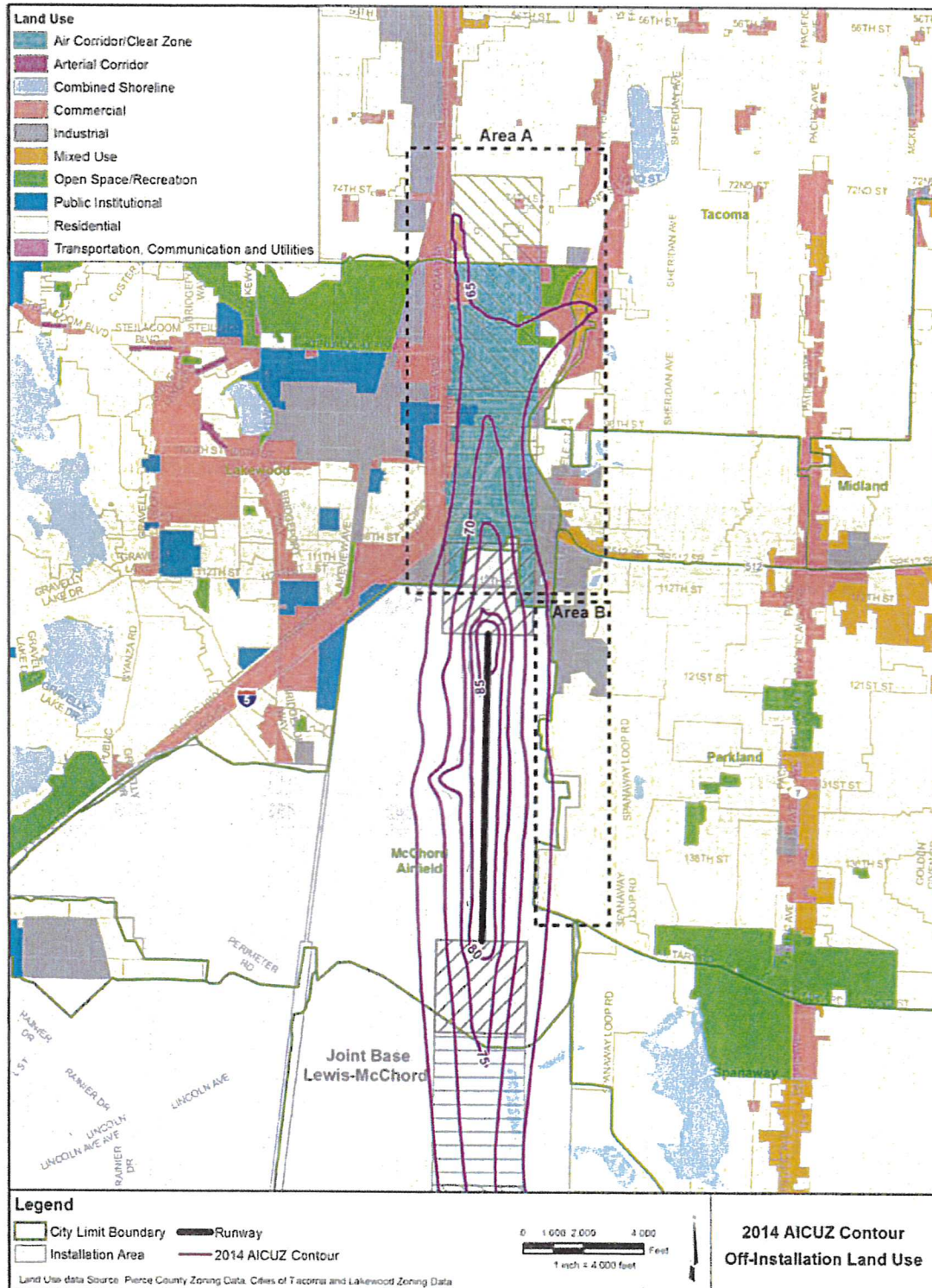


Figure 6-1. 2014 AICUZ DNL Contour

Table 6-1. Generalized Land Use Zoning Within DNL 65 dB and Greater Noise Exposure Area (Off Installation)

Land Use Category	Acreage within Noise Zones				Total Acreage
	65-69 dB	70-74 dB	75-79 dB	80+ dB	
Air Corridor/Clear Zone	349	89	11	0	449
Commercial	33	0	0	0	33
Industrial	24	0	0	0	24
Mixed Use	9	0	0	0	9
Open Space/Recreation	17	0	0	0	17
Public Institutional	8	0	0	0	8
Residential	39	0	0	0	39
Total	479	89	11	0	579

Table 6-2. Land Use Zoning Within Clear Zone and Accident Potential Zones (Off Installation)

Land Use Type	Acreage Within CZs and APZs			Total
	Clear Zone	APZ I	APZ II	
Air Corridor/Clear Zone	46	303	245	594
Commercial	0	21	49	70
Industrial	5	2	0	7
Open Space/Recreation	0	0	17	17
Public Institutional	0	8	0	8
Residential	0	8	171	179
Total	51	342	482	875

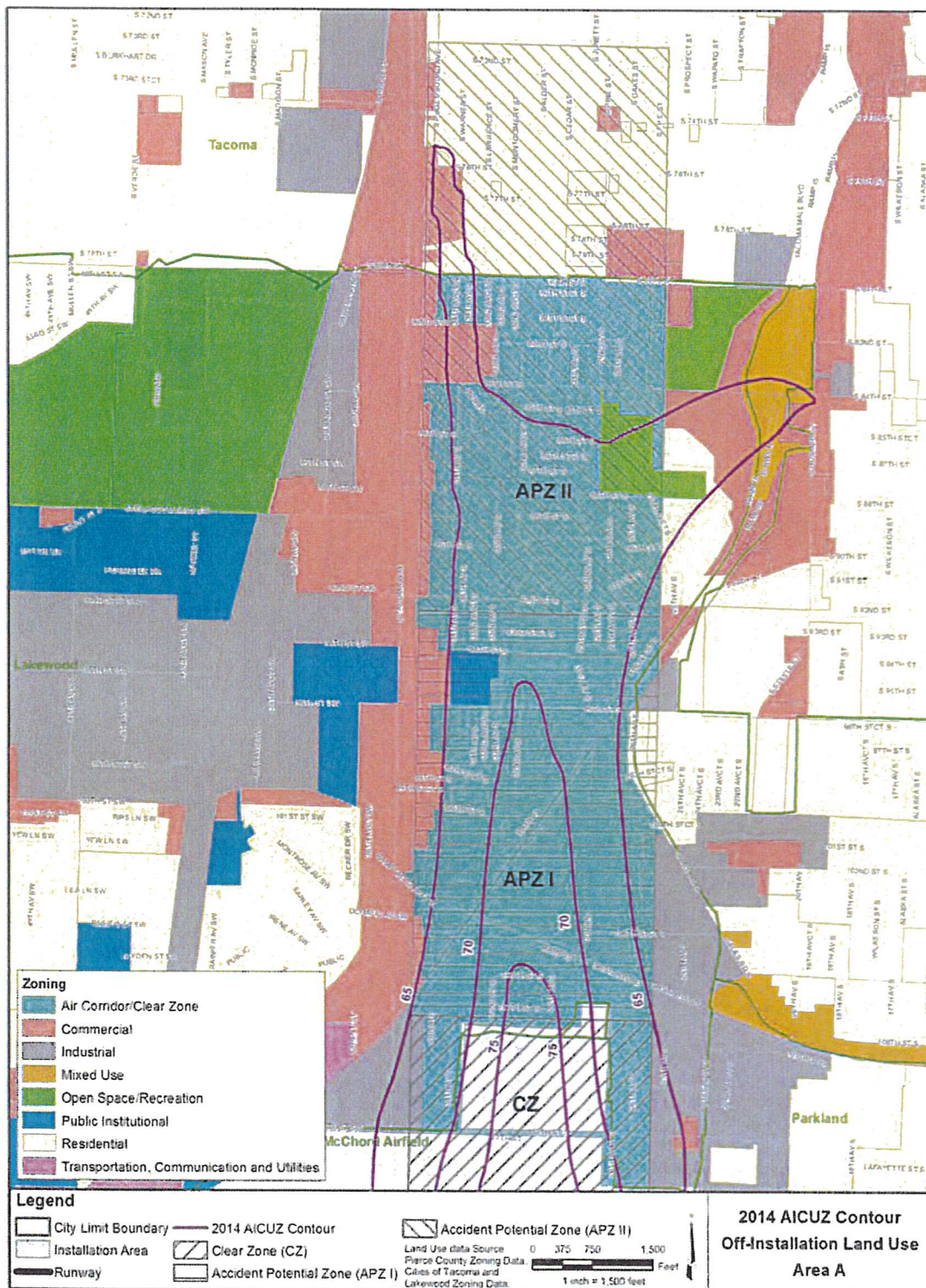


Figure 6-2. 2014 AICUZ DNL Contour in Area A

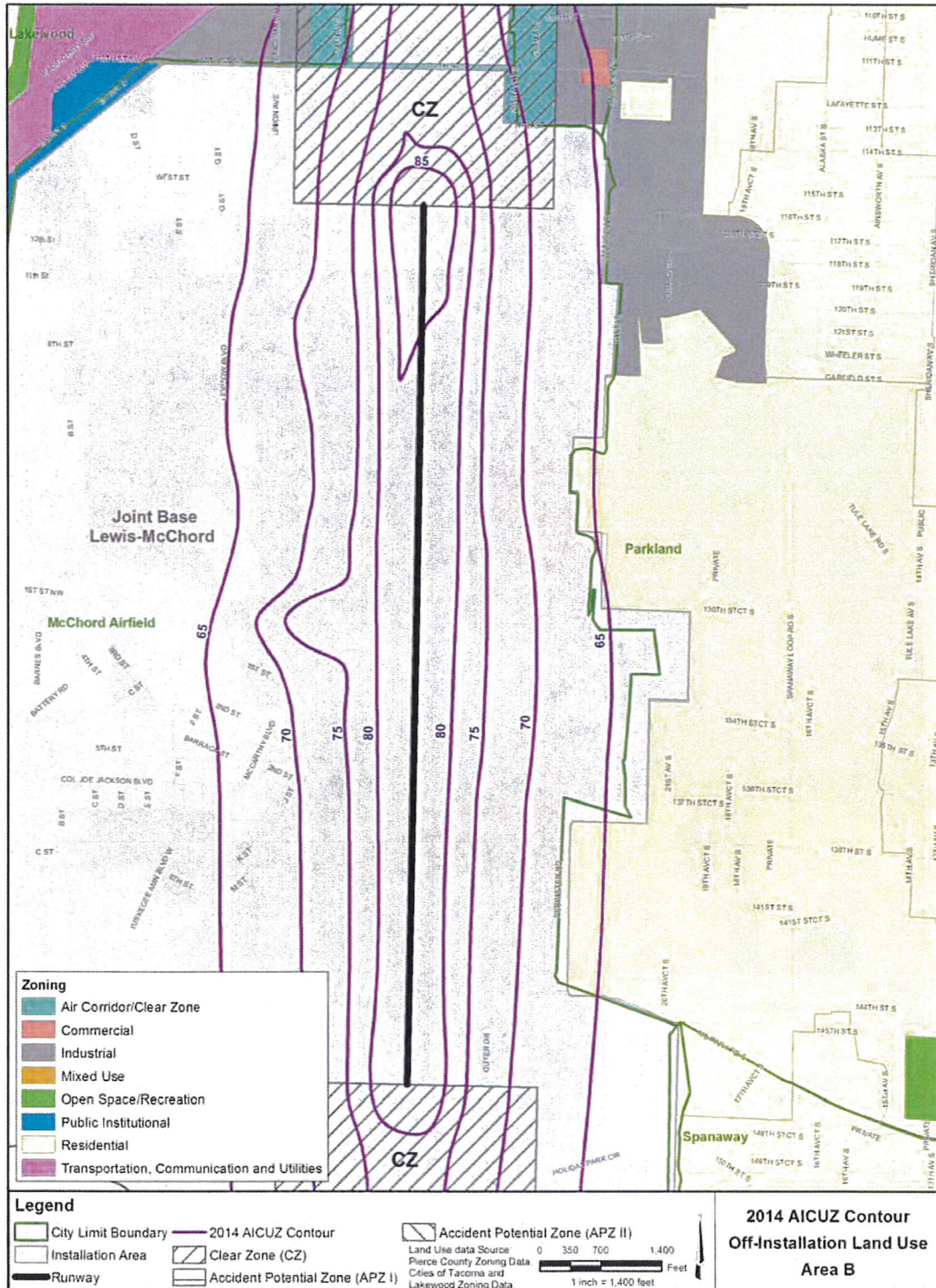


Figure 6-3. 2014 AICUZ DNL Contour in Area B

Table 6-3. Land Use Zoning Outside of Clear Zone and Accident Potential Zones (Off Installation)

Category	Acreage within Noise Zones, Not Included in CZ and APZs				Total
	65-69	70-74	75-79	80+	
Air Corridor/Clear Zone	1	0	0	0	1
Commercial	19	0	0	0	19
Industrial	19	0	0	0	19
Mixed Use	9	0	0	0	9
Open Space/Recreation	4	0	0	0	4
Residential	35	0	0	0	35
Total	87	0	0	0	87

Nearly all noise studies on residential compatibility recommend no residential uses in noise zones above 75 dB DNL; however, McChord Airfield operations would not result in such zones on residential uses. Usually, no restrictions are recommended below noise zone 65 dB DNL. There is currently no consensus on levels between 65-74 dB DNL. 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 its home loan guarantee program. Whenever possible, residential land use should be located in areas with noise levels below 65 dB DNL according to DOD land use recommendations.

Residential buildings within the 65-75 dB DNL noise contours should contain noise level reduction in accordance with the DOD land use compatibility guidelines listed in Tables 5-4 and 5-5. These guidelines state that residential use is discouraged in 65-69 dB DNL and strongly discouraged in 70-74 dB DNL. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, non-conforming land uses. Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 decibels (dB) in 65-69 DNL and 30 dB in 70-74 DNL should be incorporated into building codes and be considered in individual approvals; for transient housing, an NLR of at least 35 dB should be incorporated in 75-79 DNL.

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

Most industrial uses are compatible in the airfield area of influence. Exceptions are uses such as research or scientific activities that 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 nature of most uses in the public institutional category requires a quieter environment, and attempts should be made to locate these uses below 65 dB DNL (a DOD land use recommendation), or else provide adequate noise level reduction.

Although recreational use has often been recommended as compatible with high noise levels, however, a more conservative view considers that a DNL level above 75 dB would become a factor that limits the ability to enjoy such

uses. Where the requirement to hear is a function of the use (e.g., music shell, etc.), compatibility is limited. Buildings associated with golf courses and similar uses should be noise attenuated. Open spaces are compatible almost without restrictions.

6.4 Incompatible Land Uses

Table 6-4 shows land use compatibility as it applies to existing land use within the APZs and noise contours 65 dB DNL and greater for McChord Airfield. For a land use area to be considered compatible, it must meet land use compatibility guidelines in CZ, APZs and noise zones as established in Tables 5-4 and 5-5. Results of this analysis are shown in Table 6-4. The CZ, APZs, and noise zones south of the airfield are all within installation boundaries and are not discussed here.

Table 6-4. Incompatible Land Uses

Category	Acreage Within CZs and APZs			Acreage Within Noise Zones, Not Included in CZs and APZs				Total
	Clear Zone	APZ I	APZ II	65-69	70-74	75-79	80+	
Air Corridor/Clear Zone	46	-	-	-	-	-	0	46
Commercial	0	21	49	-	0	0	0	70
Industrial	5	-	-	-	-	-	0	5
Public/Institutional	0	8	0	-	0	0	0	8
Mixed Use ¹	0	0	0	9	0	0	0	9
Open Space/Recreation	0	0	17	-	0	0	0	17
Residential	0	8	171	35	0	0	0	214
Total	51	37	237	44	0	0	0	369
¹ Represents compatible land use 1. Mixed use was characterized as potential residential land use zone.								

6.4.1 Clear Zones and Accident Potential Zones

6.4.1.1 Clear Zone

Any land uses other than vacant are incompatible with the safety criteria established for a CZ. The majority of the Runway 16/34 CZ is located within the McChord Airfield boundary. However, approximately 51 acres of land zoned for industrial use, including Air Corridor zones, are within CZ and are considered incompatible (Table 6-4).

6.4.1.2 Accident Potential Zone I

In general, Air Corridor zones, industrial, and recreational /open land uses are compatible with the safety criteria established for APZ I. Compatibility of commercial uses within APZ I is dependent on densities and intensity of uses. The approximately 37 acres incompatible uses located in the APZ I include residential, commercial, and public institutional uses (Table 6-4).

6.4.1.3 Accident Potential Zone II

Most categories of land use are compatible with the safety criteria established for APZ II with the exception of some densities of residential, commercial, and recreational zoning. These land uses generally would be incompatible if residential densities are greater than two dwelling units per acre. Approximately 171 acres of residential land use primarily in the City of Tacoma north of the Air Corridor Zone Zoned for R2 single family dwelling use that exceed the density recommendations exist within the APZ II. Additionally, approximately 66 acres of commercial and parks are within APZ II.

6.4.2 Noise Zones

At noise levels between DNL 65-69 dB, the only incompatible land use type present near McChord airfield is residential without noise level reduction (NLR) materials. Residential uses within the 65-69 dB noise zone would be conditionally compatible upon incorporation of the appropriate amount of NLR. Based on the land use compatibility guidelines detailed in Table 5-4, residential use within the DNL 65-74 dB zone is discouraged unless there is a demonstrated community need and no viable alternate locations. Outside of CZ and APZs, approximately 44 acres of incompatible land uses including 35 acres of zoned residential uses exist within the 65-74 dB DNL zone to the north of the airfield and the east of Runway 16/34 (Table 6-4 and Figures 6-2 and 6-3).

6.5 Air Installation Compatible Use Zone Study Updates

2014 AICUZ noise contours describe the noise characteristics of a specific operational environment, and as such, will change if a significant operational change is made. An AICUZ Study should be evaluated for an update if the noise exposure map changes by two dB DNL or more in noise sensitive areas when compared to the noise contour map in the last publicly released AICUZ Study. With this in mind, this AICUZ Study updates the 1998 AICUZ Study and provides flight track, accident potential zone and noise zone information in this report, which reflects the most accurate picture of the installation's future aircraft activities as predicted under the 2012 MP.

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7 Implementation

7.1 Introduction

Implementation of the AICUZ Study must be a joint effort between the DOD and adjacent communities. The role of the DOD is to minimize impact on the local communities by McChord Airfield and GAAF aircraft operations. The role of the communities is to ensure that development in the surrounding area is compatible with accepted planning and development principles and practices.

7.2 DOD Responsibilities

In general, the DOD 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 a great deal to ensure that aircraft accidents are avoided. Despite the best aircrew training and aircraft maintenance intentions, however, history clearly shows that accidents do occur. It is imperative flights be routed over sparsely populated areas as regularly as possible to reduce the exposure of lives and property to a potential accident.

Commanders are required to periodically review existing traffic patterns, instrument approaches, weather, 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 DOD policy that 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. In an effort to reduce the noise effects of JBLM aircraft operations on surrounding communities, the installation routes flight tracks to avoid aircraft passing through populated areas.

Preparation and presentation of this JBLM AICUZ Study is one phase of continuing DOD participation in the local planning process. It is recognized that as the local community updates its land use plans, the DOD must be ready to provide additional input when needed.

It is also recognized that the AICUZ program is an ongoing activity even after compatible development plans are adopted and implemented. JBLM 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 the installation. JBLM personnel also are available to provide information, criteria, and guidelines to state, regional, and local planning bodies, civic associations, and similar groups.

Participation in land-use planning can take many forms. The simplest of these forms is straightforward, consistent two-way discussion and information sharing with both professionals and neighbors. Copies of the AICUZ Study, including maps, will be provided to regional planning departments and zoning administrators. Through this communication process, JBLM reviews applications for development or changed use of properties within the noise impact zones and safety areas, as well as other nearby parcels. JBLM coordinates closely with surrounding communities and counties on zoning and land-use issues.

7.3 Local Community Responsibilities

Residents in the area neighboring JBLM and JBLM personnel have a long history of working together for mutual benefit of the area around the installation. Local jurisdictions have taken a proactive approach in incorporating land use regulations into local plans and ordinances, which consider JBLM flying operations when considering development proposals. Adoption of the following recommendations will strengthen this relationship, increase the health and safety of the public, and help protect the integrity of the installation's flying mission:

- Incorporate AICUZ policies and guidelines into the comprehensive plans of both Pierce and Thurston Counties. Use overlay maps of the AICUZ noise contours and DOD Land Use compatibility Guidelines to evaluate existing and future land use proposals.
- Modify existing zoning ordinances and subdivision regulations to support the compatible land uses outlined in this study through implementation of a zoning overlay district based on noise contours and accident potential zones.
- Real Estate disclosure of noise impact to prospective property buyers of properties exposed to noise levels greater than DNL 65 dB.
- Implement height and obstruction ordinances to reflect current DOD and FAR Part 77 requirements.
- Modify building codes to ensure new construction within the AICUZ area of influence has the recommended noise level reductions incorporated into design and construction codes.
- Consider use of the transfer of development rights program. This program allows the owner of AICUZ impacted property to transfer the development rights to another organization or agency in exchange for compensation such as real estate, or the right to develop other property that does not have AICUZ compatibility issues.
- Support the Joint Land Use Study Program for the JBLM area to protect the area from encroachment.
- Continue to inform JBLM of planning and zoning actions that have the potential of affecting base operations. Develop a working group representing city planners, county planners, and base planners to meet at least quarterly to discuss AICUZ concerns and major development proposals that could affect airfield operations.

8 References

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AICUZ Appendix A:

Concept, Program, Methodology, and Policies

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A THE AICUZ CONCEPT, PROGRAM, METHODOLOGY, AND POLICIES

A.1 Concept

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

- Protect local citizens from noise exposure and accident potential associated with flying activities; and
- Prevent degradation of the DOD'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 JBLM's aviation environment.

A.2 Program

Installation commanders establish and maintain active programs to promote the maximum feasible land use compatibility between air installations and neighboring communities. The program requires that appropriate government 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; and
- Ensure that all reasonable, economical, and practical measures are taken to reduce or control the impact of noise-producing activities. These measures include such considerations as proper location of engine test facilities, provision of sound suppressors where necessary, and adjustment of flight patterns and/or techniques to minimize the noise impact on populated areas. This must be done without jeopardizing safety or operational effectiveness.

A.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 that are exposed to the health, safety, or welfare hazards of aircraft operations. The AICUZ includes:

- APZ and CZ based on past Air Force aircraft accidents and installation operational data (see Appendix B);
- NZ produced by the computerized DNL modeling of the noise created by aircraft flight and maintenance operations (see Section 5 of this study); and
- The area designated by the FAA and the DOD for purposes of height limitations in the approach and departure zones of the base (see Section 4 of this study).

The APZ, CZ, and NZ 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 Section 5 of this study.

As part of the AICUZ Program, the only real property acquisition for which the DOD has requested and received Congressional authorization, and for which the installation and major commands request appropriation, are the areas designated as the CZ. JBLM either owns or holds restrictive easements on property within the CZs. Compatible land use controls for the remaining airfield area of influence 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 land use planning and control actions are evaluated. JBLM recommends the following policies be considered for incorporation into the comprehensive plans of agencies in the vicinity of the installation:

A.4.1 Policy 1

To promote the public health, safety, peace, comfort, convenience, and general welfare of the inhabitants in the airfield area of influence, 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 destruction or impairment of the airfield and the public investment therein;
- Enhance the quality of living in the areas affected; and
- Protect the general economic welfare by restricting incompatible land use.

A.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 AICUZ concept into community land use plans, modifying them when necessary; and
- Adopt appropriate ordinances to implement airfield area of influence land use plans.

A.4.3 Policy 3

Within the boundaries of the 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; and
- Uses that provide for structures within 10 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.); and
- 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 (Tables 5-4 and 5-5 in this AICUZ) 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 area cannot be based solely on aircraft-generated effects. Allocation of land used within the AICUZ should be further refined by consideration of:

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

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 DOD policy to request Congress to authorize and appropriate funds for the necessary real property interests in this area to prevent incompatible land uses.

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

APZ II is less critical than APZ I, but still possesses potential for accidents. APZ II, also 3,000 foot wide, is 7,000 foot long extending to 15,000 feet from the runway threshold. Acceptable uses include those of APZ I, as well as

low density single family residential, and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High density functions such as multi-story buildings, places of assembly (theaters, churches, schools, restaurants, etc.), and high density office uses are not considered appropriate.

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

A.5 Basic Land Use Compatibility

Research on aircraft accident potential, noise, and land use compatibility is ongoing by a number of federal and other agencies. These 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 periods of aircraft operations and land use activities;
- Specific site analysis; and
- 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 that compares the relationship of accident occurrence for five areas:

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

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

Land use guidelines for APZs I and II have been developed. The main objective has been to restrict 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 explosives, 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.; and
- 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 a demand for land development. 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 noise studies on residential compatibility recommend no residential uses in noise zones above DNL 75 dB. Usually, no restrictions are recommended below noise zone DNL 65 dB. There is currently no consensus between DNL 65-74 dB. These areas may not qualify for federal mortgage insurance in residential categories according to the Department of 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 its home loan guarantee program. Whenever possible, residential land use should be located below DNL 65 dB according to Air Force land use recommendations. Residential buildings within the DNL 65-75 dB noise contours should contain noise level reduction in accordance with the DOD land use compatibility guidelines in the AICUZ Study, Table 5-3.

Most industrial/manufacturing uses are compatible in the airfield area of influence. Exceptions are uses such as research or scientific activities that 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 (a DOD 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 that limits the ability to enjoy such uses. Where the requirement to hear is a function of the use (e.g., 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.

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AICUZ Appendix B:

Clear Zones and Accident Potential Zones

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B CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

B.1 Guidelines for Accident Potential

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

When the AICUZ Program began, there were no current comprehensive studies on accident potential. To support the program, the Air Force completed a study of Air Force aircraft accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 % 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 wide (1,500 feet either side of the runway centerline), extending from the runway threshold along the extended runway centerline for a distance of 15,000 feet. The Air Force updated these studies and this information is presented later in this section.

The CZ, APZ I, and APZ II were established based on crash patterns. The CZ starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The Air Force adopted a policy of acquiring property rights to areas designated as CZs because of the high accident potential. APZ I extends from the CZ an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet in an area of further reduced accident potential.

Research in accident potential conducted by the Air Force was the first significant effort in this subject area since 1952 when the President's Airport Commission published "The Airport and Its Neighbors," better known as the "Doolittle Report." The recommendations of this earlier report were influential in the formulation of the APZ concept.

The risk to people on the ground 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 Air Force performed a service-wide aircraft accident hazard study to identify land near airfields with significant accident potential. Accidents studied occurred within 10 nautical miles of airfields.

The study reviewed 369 major Air Force accidents during 1968-1972, and found that 61 % of those accidents were related to landing operations, and 39 % were takeoff related. It also found that 70 % occurred in daylight, and that fighter and training aircraft accounted for 80 % 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 that 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. Table B-1 reflects the location analysis.

Table B-1. Location Analysis

Length from Both Ends of Runway (feet)	Width of Runway Extension (feet)		
	2000	3000	4000
Percent of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	35	39	39
3,000 to 8,000	8	8	8
8,000 to 15,000	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	58	62	62
3,000 to 8,000	66	70	70
8,000 to 15,000	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 that 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 was updated to include accidents through September 1995. This updated study 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. These ratios indicate the CZ, 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 as shown in Table B-2.

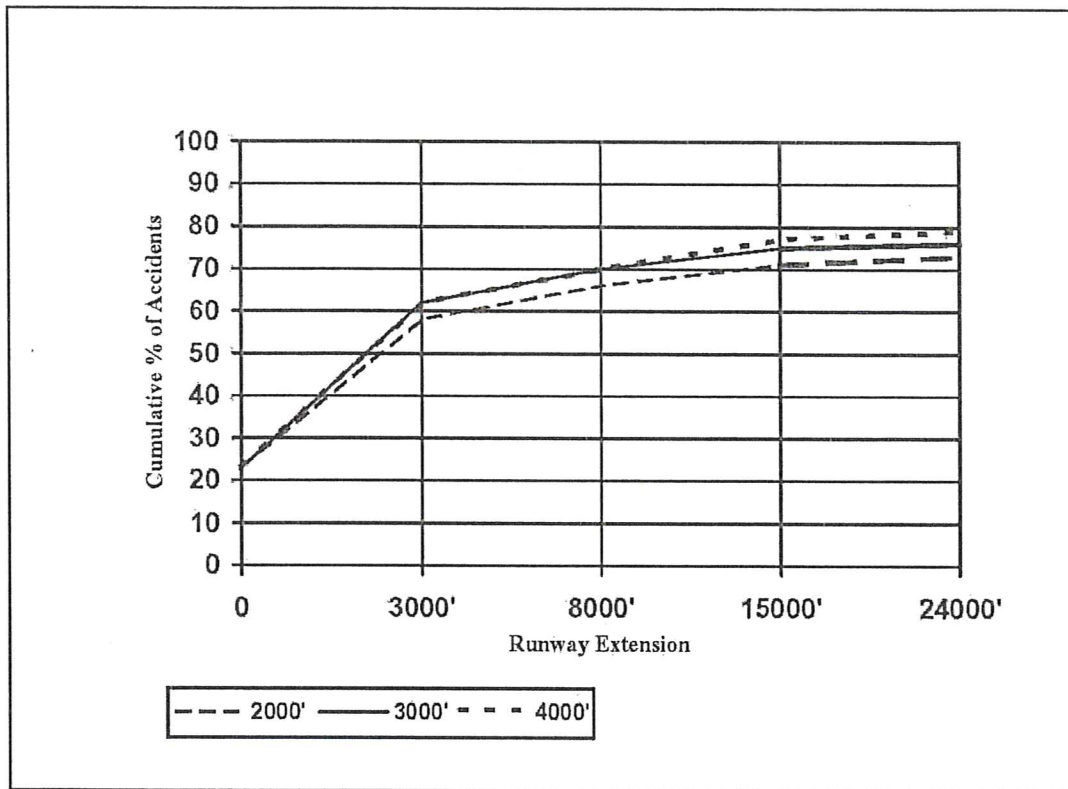


Figure B-1. Distribution of Air Force Aircraft Accidents (369 Accidents - 1968 - 1972)

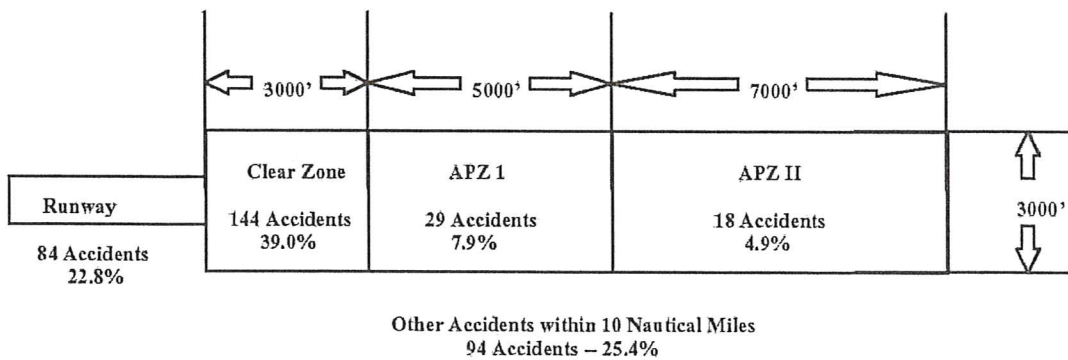


Figure B-2. Air Force Aircraft Accident Data (369 Accidents - 1968 - 1972)

Final Air Installation Compatible Use Zone Study

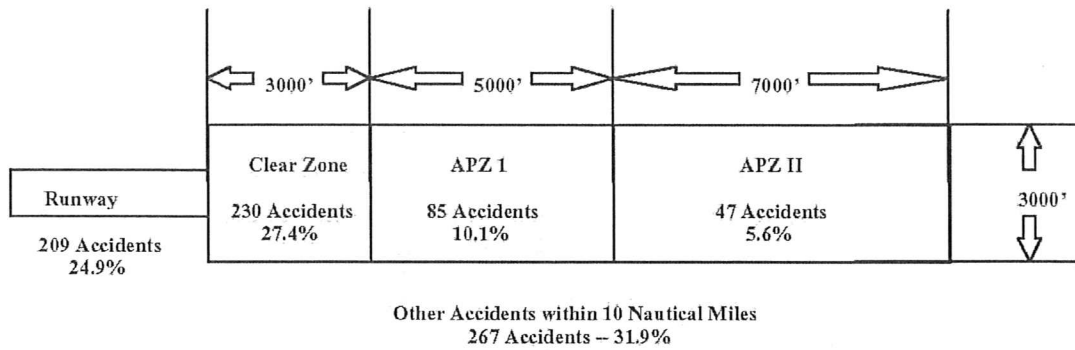


Figure B-3. Air Force Aircraft Accident Data (838 Accidents – 1968 – 1995)

Table B-I. Location Analysis

	Area ¹ (Acres)	Number ² Accident	Accident Per Acre	Percent of Total Area	Percent of Total Accidents	Ratio: ³ % Accidents to % Area
Runway Area	487	209	1 per 2.3 acres	0.183	24.9	136
Clear Zone	413	230	1 per 1.8 acres	0.155	27.4	177
APZI	689	85	1 per 8.1 acres	0.258	10.1	39
APZII	964	47	1 per 20.5 acres	0.362	5.6	16
Other Area	264,053	267	1 per 989 acres	99.042	31.9	0.3

Notes:
¹ Area includes land within 10 nautical miles of runway.
² Total number of accidents is 838 (through 1995).
³ Percent total accidents divided by percent total area.

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 % 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; and
- 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.

Air Force aircraft accident statistics found that 75 % of aircraft accidents resulted in definable impact areas. The size of the impact areas were:

- 5.06 acres overall average;
- 2.73 acres for fighters and trainers; and
- 8.73 acres for heavy bombers and tankers.

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AICUZ Appendix C:

Gray Army Airfield Noise Analysis

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C GRAY ARMY AIRFIELD NOISE ANALYSIS

The Gray Army Airfield (GAAF) is located six miles southwest of McChord Airfield on JBLM. GAAF has one Class B runway, Runway 15/33, which is oriented 149.9°-329.9°magnetic, and is 6,125 feet long and 150 feet wide. There are no overruns at the ends of the runway. The runway CZ and APZ's are shown in Figure C-1. The airfield elevation is 305.5 feet above MSL.

GAAF is jointly operated by National Guard, Army Reserve, 16th CAB, 160th Special Operations Aviation Regiment (Airborne) (SOAR), and Army Materiel Command providing ideal training for pilots and enhancing air-ground integration training between the combat aviation brigade and brigade combat teams.

The same NOISEMAP model used for predicting 2012 AICUZ contours at McChord Airfield was used to calculate and plot the DNL noise contours based on the average flight-day aircraft operations data collected from January 2012 and eventually updated and validated through September 2012 and described in below sections. The noise levels presented in this appendix are A-weighted DNL.

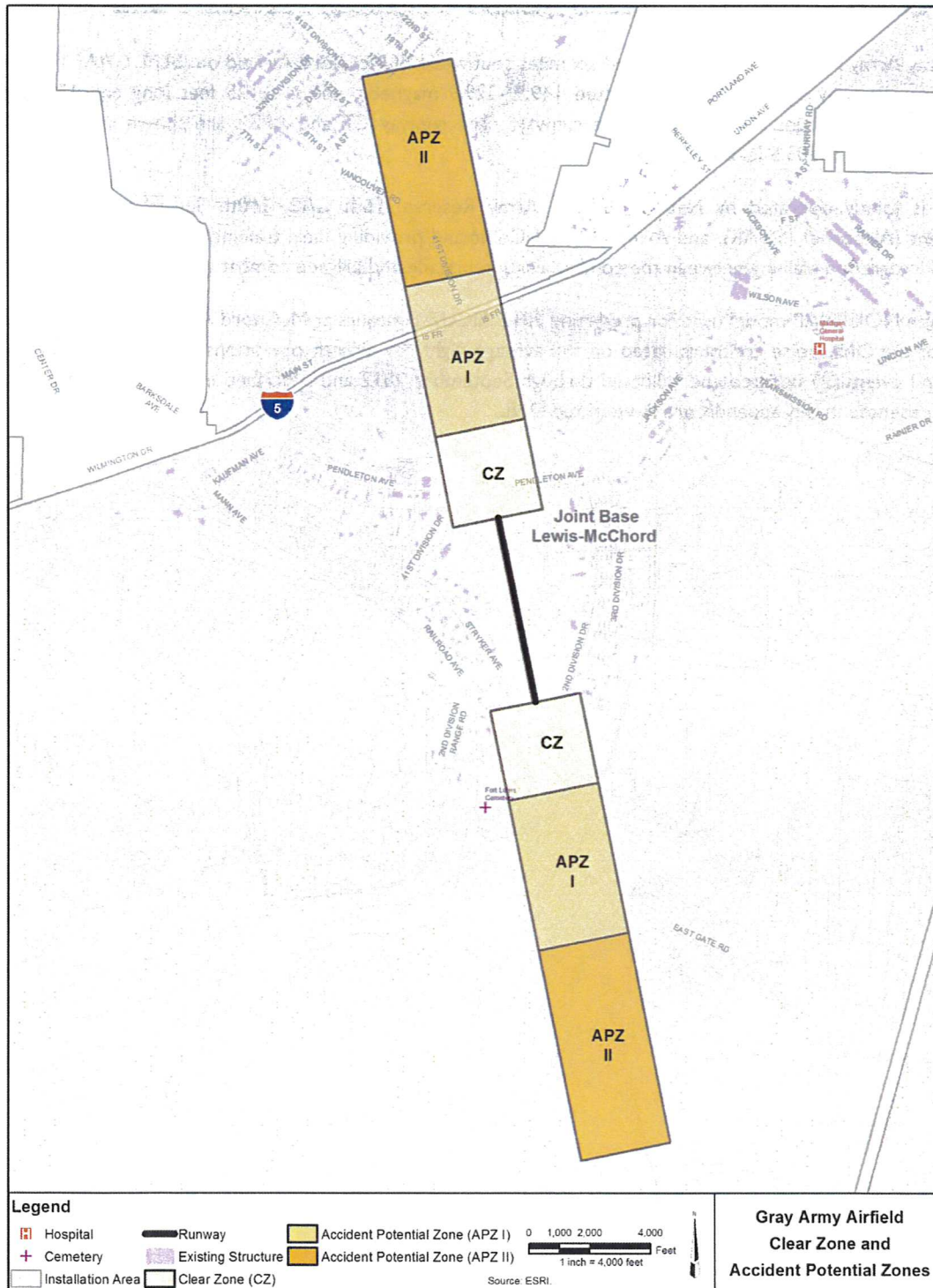


Figure C-1. GAAF Clear Zone and Accident Potential Zones

C.1 Aircraft Operations

A small number of fixed wing aircraft and occasionally C-17 aircraft from McChord Airfield use Runway 15/33 along flight tracks depicted in Figures C-2 through C-4 and helicopters based at GAAF use helipads adjacent to Runway 15/33 depicted in Figures C-5 through C-8. Table C-1 provides the forecasted future number of annual aircraft operations including:

- Departure - an aircraft taking off from a runway or helicopter pad.
- Arrival - an aircraft landing on a runway or helicopter pad.
- Touch and Go and close pattern - an aircraft lands and takes off on a runway or helicopter pad without coming to a full stop. After touching down, the pilot immediately goes full power and takes off again.
- Corridor - a helicopter takes off from a helicopter pad, follows a predetermined closed route, and returns to the helicopter pad for a landing.

Table C-2 shows runway and helipad usage data.

The representative flight tracks and flight profiles established through interviews with the aviation control manager and considered in the NOISEMAP modeling include:

- Non-instrument and instrument arrivals and departures from both helicopters and fixed wing aircraft.
- Close pattern flights from both helicopters and fixed wing aircraft.
- Close corridor flights for helicopters.

Table C-3 summarizes the anticipated annual helicopter engine run-ups to be performed at the proposed Flexible Engine Diagnostic System (FEDS) facility to be constructed at the location shown in Figure C-9.

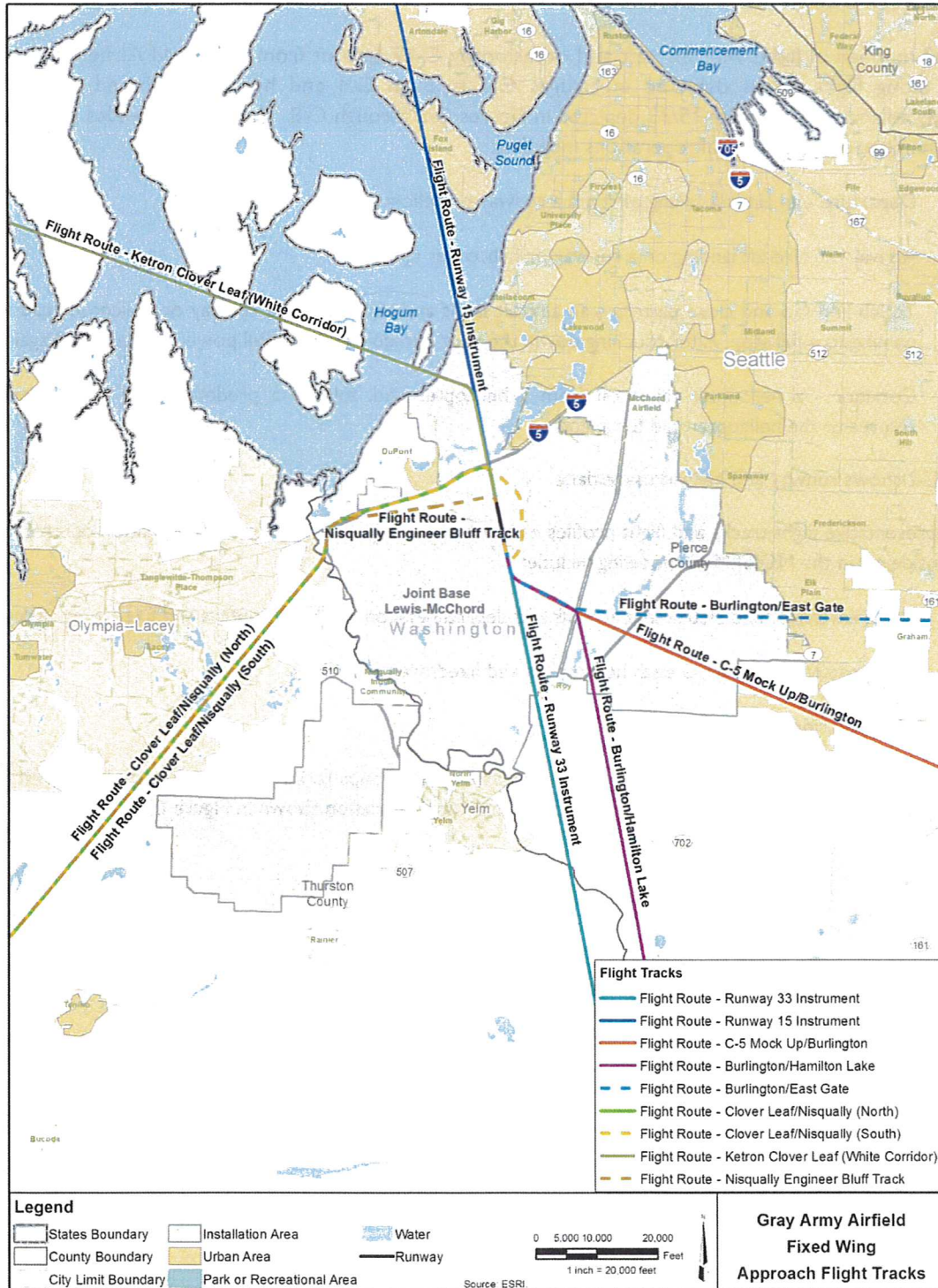


Figure C-2. Fixed Wing Approach Flight Tracks

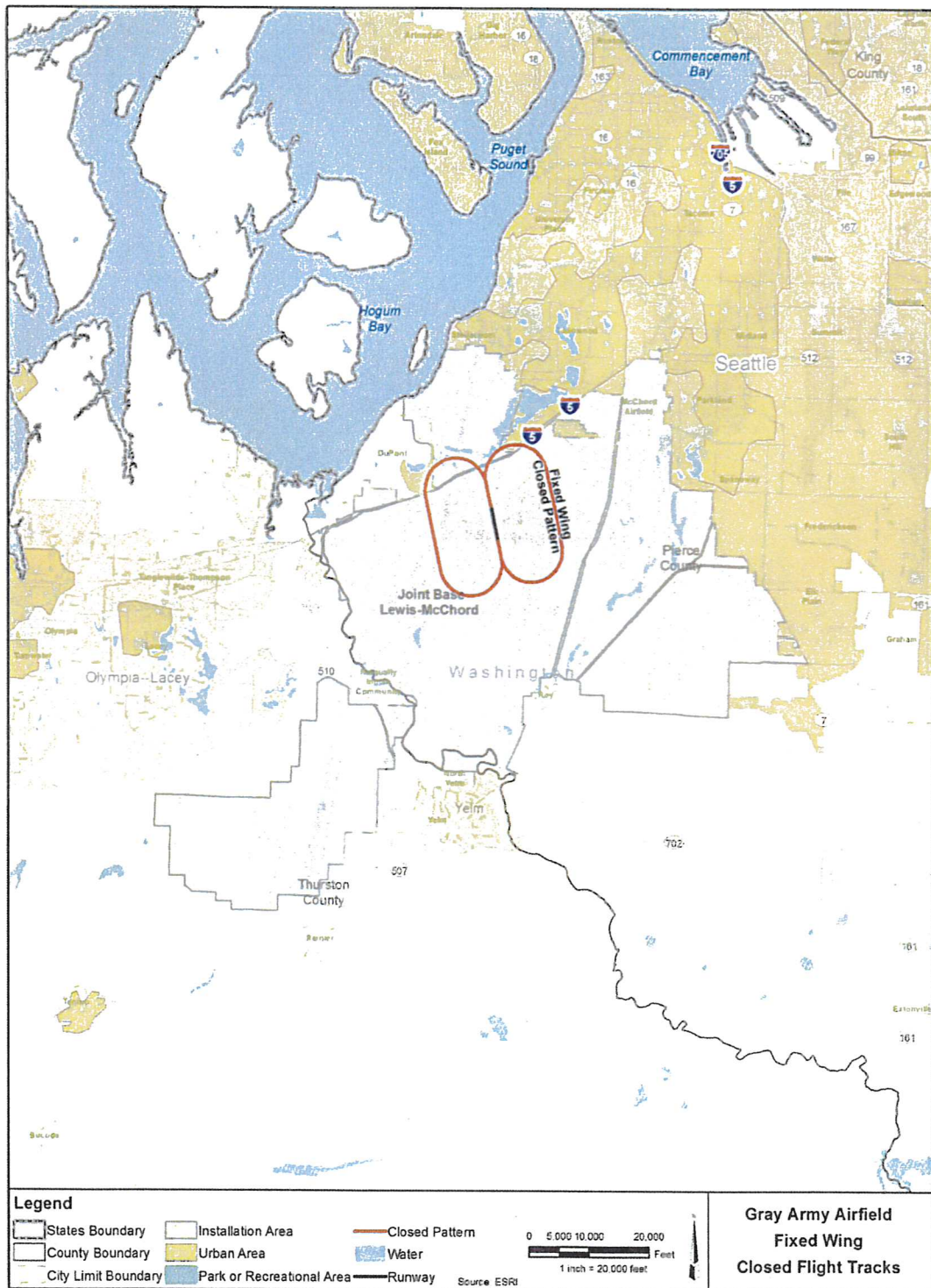


Figure C-3. Fixed Wing Closed Flight Tracks

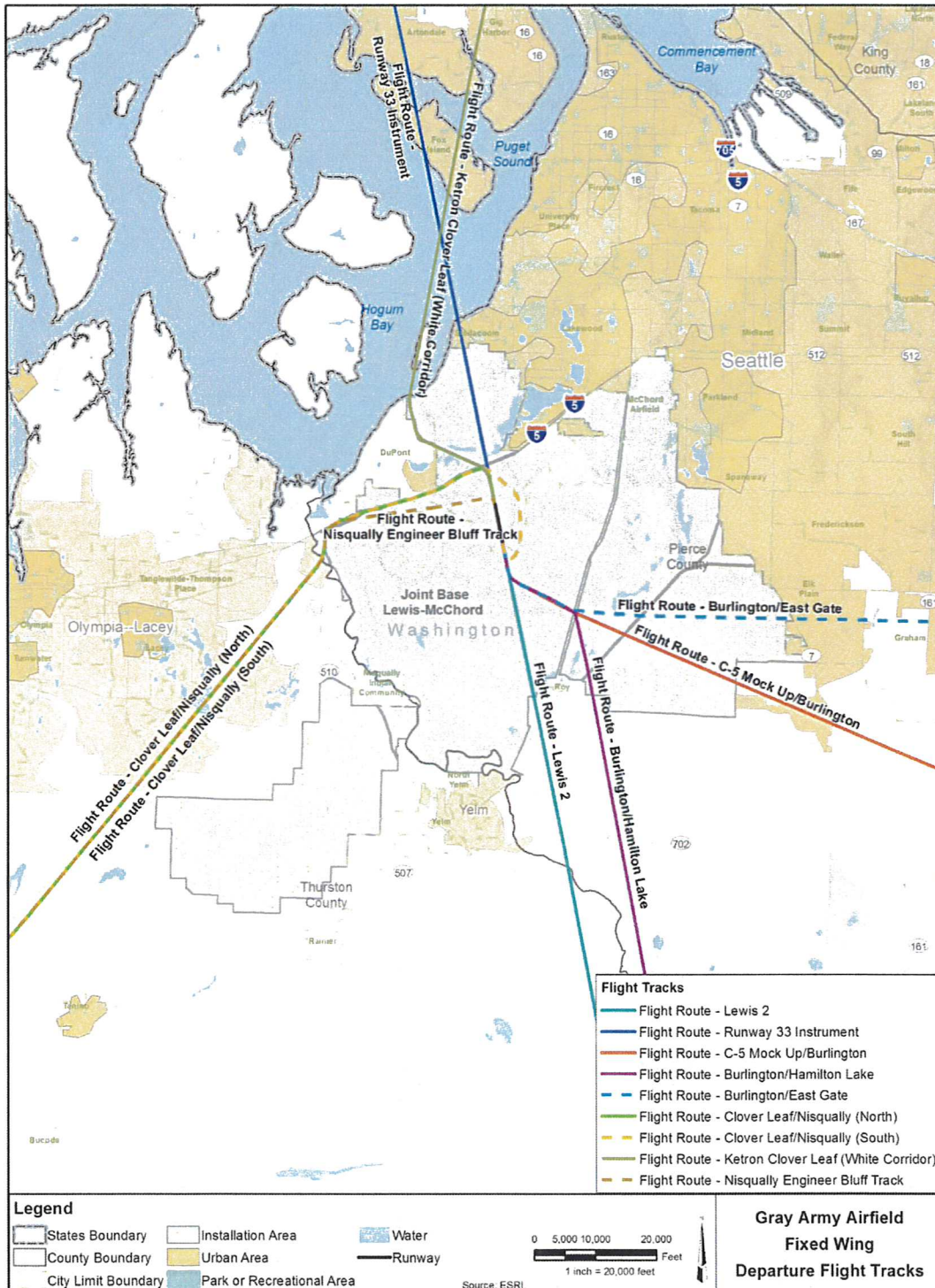


Figure C-4. Fixed Wing Departure Flight Tracks

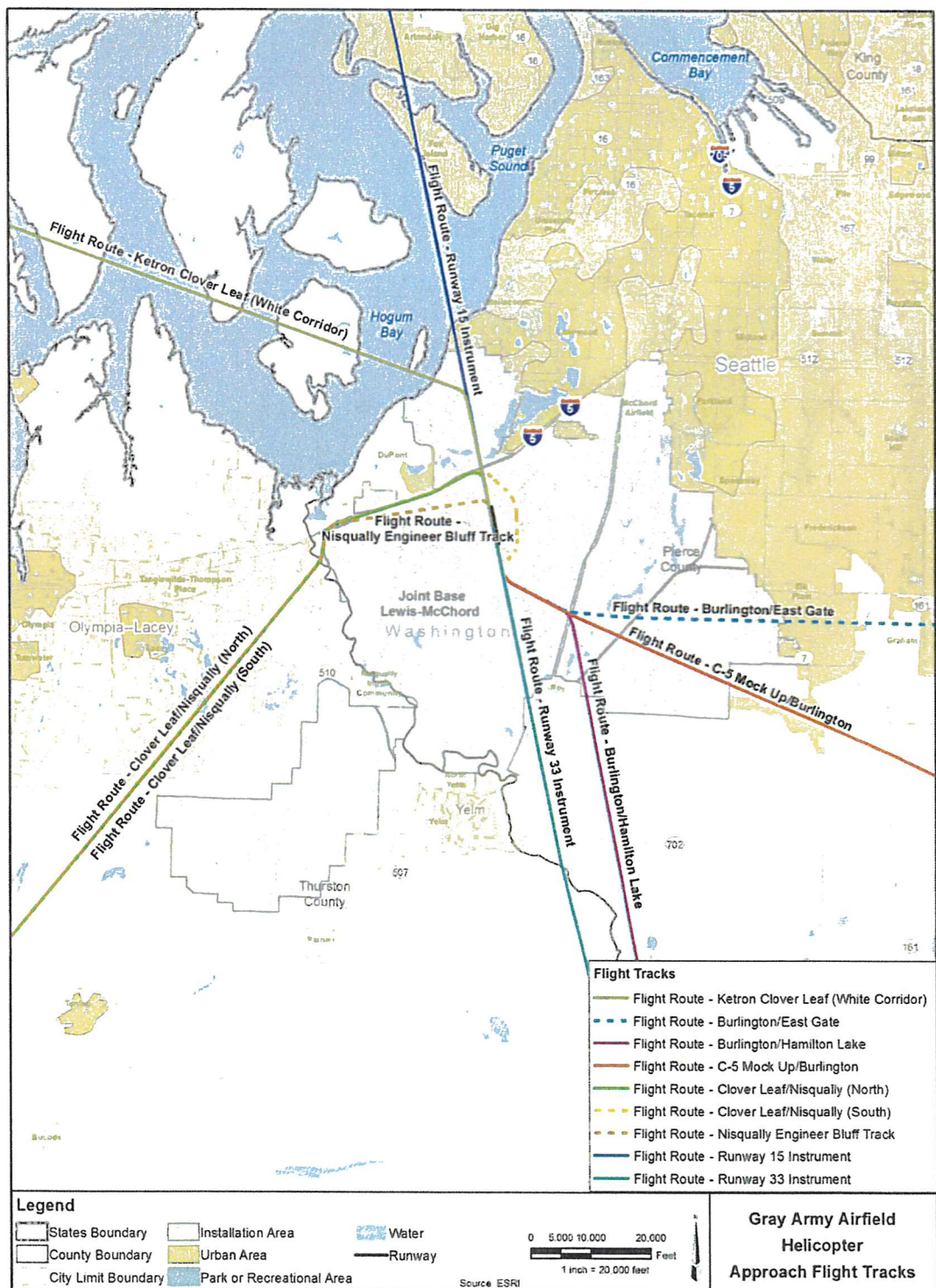


Figure C-5. Helicopter Approach Flight Tracks

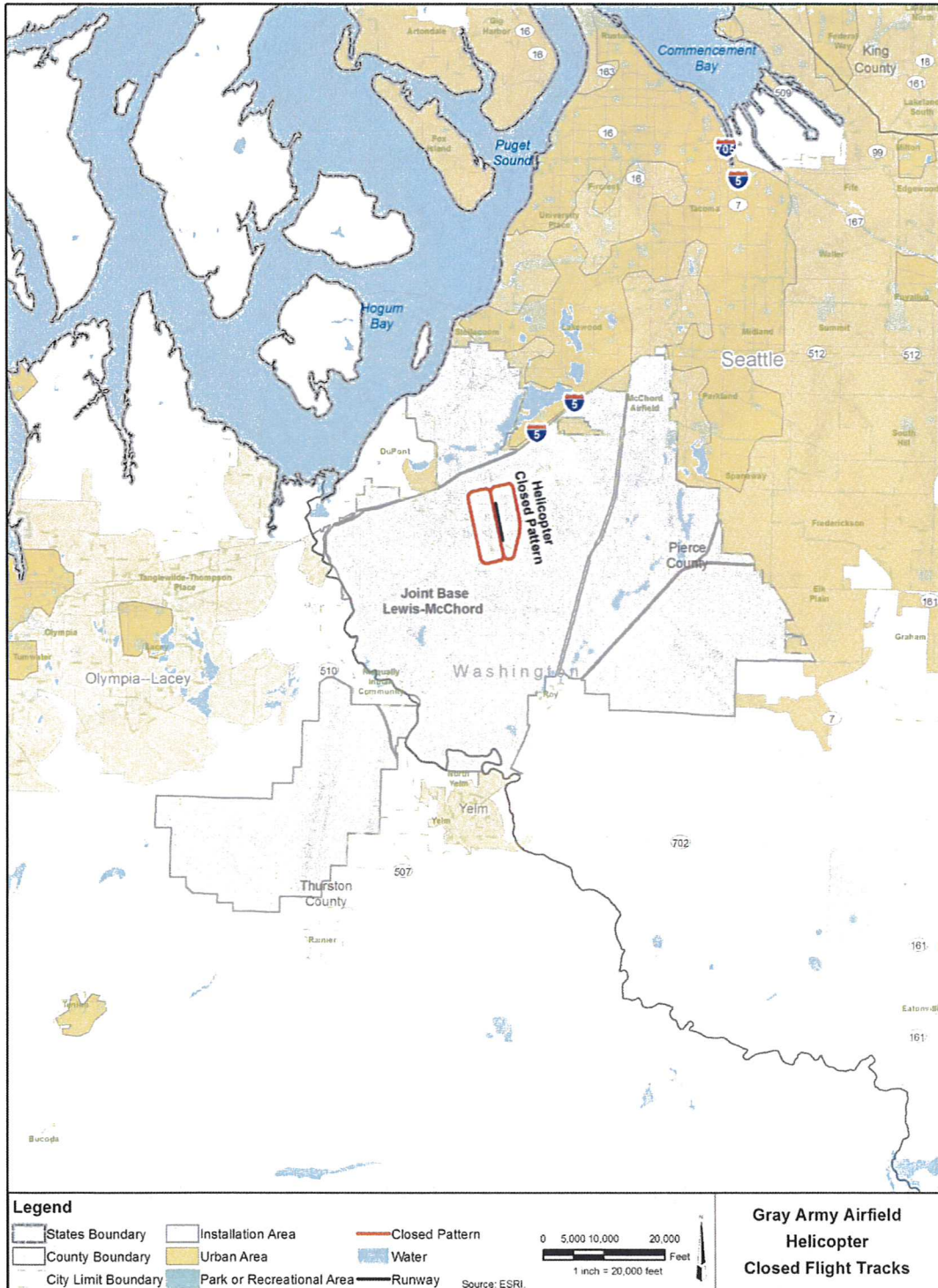


Figure C-6. Helicopter Closed Flight Tracks

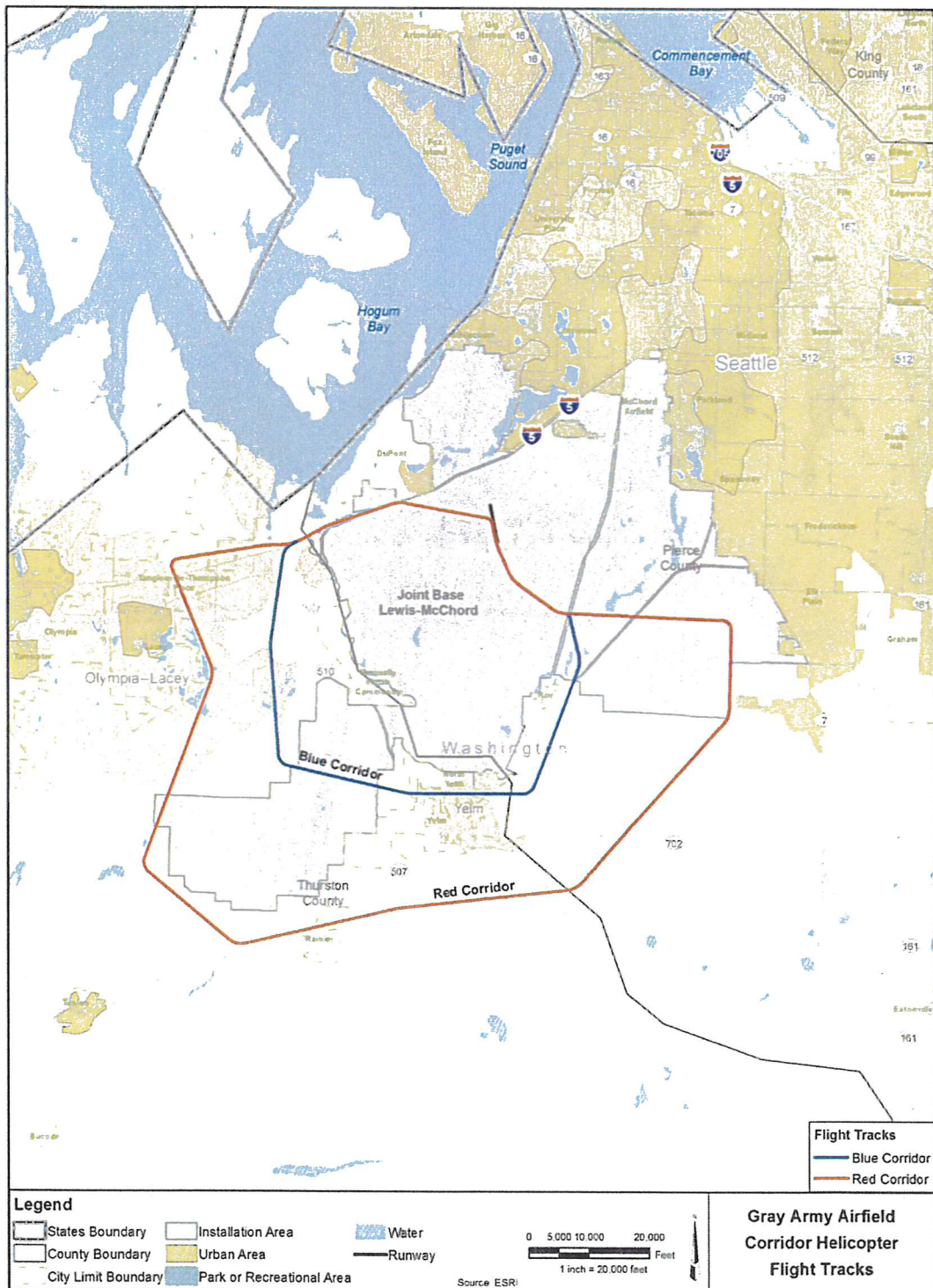


Figure C-7. Corridor Helicopter Flight Tracks

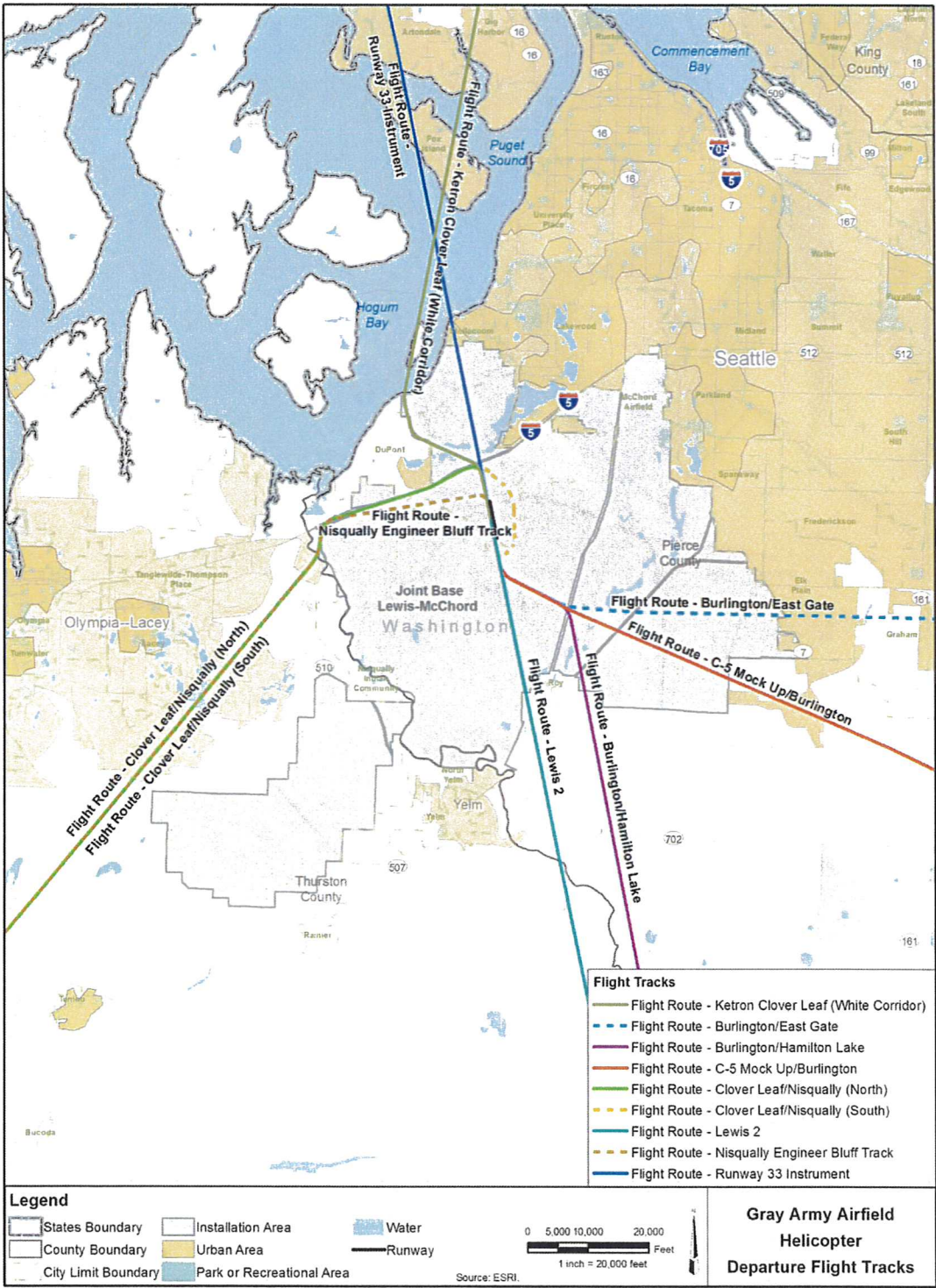


Figure C-8. Helicopter Departure Flight Tracks

Table C-1. Projected Aircraft Operations at Gray Army Airfield

Final Air Installation Compatible Use Zone Study

Aircraft	Operation Type	Annual Day	Annual Night	Annual Total	Average Day Ops	Average Night Ops	Average Total Ops
H-58	Departures	2,430	498	2,928	6.75	1.38	8.13
	Arrivals	2,430	498	2,928	6.75	1.38	8.13
	Closed Pattern	4,798	983	5,781	26.66	5.46	32.12
	Corridor	4,080	836	4,916	22.67	4.64	27.31
	Total	13,738	2,814	16,552	62.82	12.87	75.69
H-60	Departures	5,034	1,031	6,065	13.98	2.86	16.85
	Arrivals	5,034	1,031	6,065	13.98	2.86	16.85
	Closed Pattern	8,950	1,833	10,783	49.72	10.18	59.90
	Corridor	7,610	1,559	9,169	42.28	8.66	50.94
	Total	26,628	5,454	32,082	119.96	24.57	144.54
H-47	Departures	3,060	627	3,687	8.50	1.74	10.24
	Arrivals	3,060	627	3,687	8.50	1.74	10.24
	Closed Pattern	5,319	1,089	6,409	29.55	6.05	35.60
	Corridor	4,524	927	5,450	25.13	5.15	30.28
	Total	15,962	3,270	19,233	71.68	14.68	86.37
H-64	Departures	2,344	480	2,824	6.51	1.33	7.84
	Arrivals	2,344	480	2,824	6.51	1.33	7.84
	Closed Pattern	4,728	968	5,697	26.27	5.38	31.65
	Corridor	4,020	824	4,844	22.34	4.58	26.91
	Total	13,436	2,753	16,188	61.62	12.62	74.25
C-12	Departures	109	23	132	0.30	0.06	0.37
	Arrivals	109	23	132	0.30	0.06	0.37
	Closed Pattern	574	117	691	3.19	0.65	3.84
	Corridor	-	-	-	-	-	-
	Total	791	163	955	3.79	0.78	4.57
C-23	Departures	70	15	85	0.20	0.04	0.24
	Arrivals	70	15	85	0.20	0.04	0.24
	Closed Pattern	287	59	346	1.59	0.33	1.92
	Corridor	-	-	-	-	-	-
	Total	427	89	516	1.98	0.41	2.39
Gulf-GIIB	Departures	19	4	23	0.05	0.01	0.06
	Arrivals	19	4	23	0.05	0.01	0.06
	Closed Pattern	-	-	-	-	-	-
	Corridor	-	-	-	-	-	-
	Total	38	8	46	0.11	0.02	0.13
C-130	Departures	54	12	66	0.15	0.03	0.18
	Arrivals	54	12	66	0.15	0.03	0.18
	Closed Pattern	-	-	-	-	-	-
	Corridor	-	-	-	-	-	-
	Total	108	23	131	0.30	0.06	0.36

Table C-I. Projected Annual Flight Operations at Gray Army Airfield (con't)

Aircraft	Operation Type	Annual Day	Annual Night	Annual Total	Average Day Ops	Average Night Ops	Average Daily Ops
SD3-30	Departures	12	3	15	0.03	0.01	0.04
	Arrivals	12	3	15	0.03	0.01	0.04
	Closed Pattern	-	-	-	-	-	-
	Corridor	-	-	-	-	-	-
	Total	24	5	30	0.07	0.01	0.08
C-17	Departures	90	19	109	0.25	0.05	0.30
	Arrivals	90	19	109	0.25	0.05	0.30
	Closed Pattern	-	-	-	-	-	-
	Corridor	-	-	-	-	-	-
	Total	181	37	218	0.50	0.10	0.61
T-34	Departures	4	1	5	0.01	0.00	0.01
	Arrivals	4	1	5	0.01	0.00	0.01
	Closed Pattern	-	-	-	-	-	-
	Corridor	-	-	-	-	-	-
	Total	9	1	10	0.02	0.00	0.03
Note: A closed pattern consists of two operations, one approach and one departure. Numbers that do not exactly add up are due to rounding. Ops = Operations							

Table C-2. Runway/Pad Utilization by Operation Type Projected Conditions

Runway	Operation Type			
	Departures	Arrivals	Closed Pattern	Route
15	1.9%	2.0%	3.5%	0.0%
33	0.8%	0.8%	0.0%	0.0%
Helicopter Pad	97.3%	97.2%	96.5%	100.0%
Total	100%	100%	100%	100%

Table C-3. Projected Annual Engine Run-up Operations at FEDS Hanger

Aircraft	Power Setting	Duration (min)	Daytime Test	Nighttime Test
CH-47	Idle	5	48	NA
	Intermediate	10	48	NA
	Power	20	48	NA
	Total	-	144	NA
UH-60	Idle	2	48	NA
	Power	10	48	NA
	Total	-	96	NA
Notes:				
No nighttime operations.				
One engine operating during idle, intermediate, and power operations.				



Figure C-9. FEDS Engine Run-up Location

C.2 Noise Exposure and Incompatible Land Use

Noise contours at 65 dB DNL or greater from GAAF aircraft operations are within the JBLM installation boundary. Figure C-10 shows the DNL noise contours at 65 dB DNL and greater plotted in 5 dB increments. Table C-4 shows the on-installation noise exposure area in terms of acreage and estimated population.

Table C-4. Area within DNL 65 dB and Greater Noise Exposure Area (On Installation Only)

DNL Noise Zone	Acres	Population (2010)
65-69	386	92
70-74	120	8
75-79	15	1
80+	2	0
Total	523	101

As depicted in Figures C-1 and C-10, CZ and APZs, and noise contours at or greater than 65 dB DNL are entirely within the JBLM installation boundary. Therefore, there is no off installation incompatible land use due to aircraft operations at the GAAF when considering the CZ, APZ, and noise zone criteria in Tables 5-4 and 5-5 in Section 5 of this AICUZ.

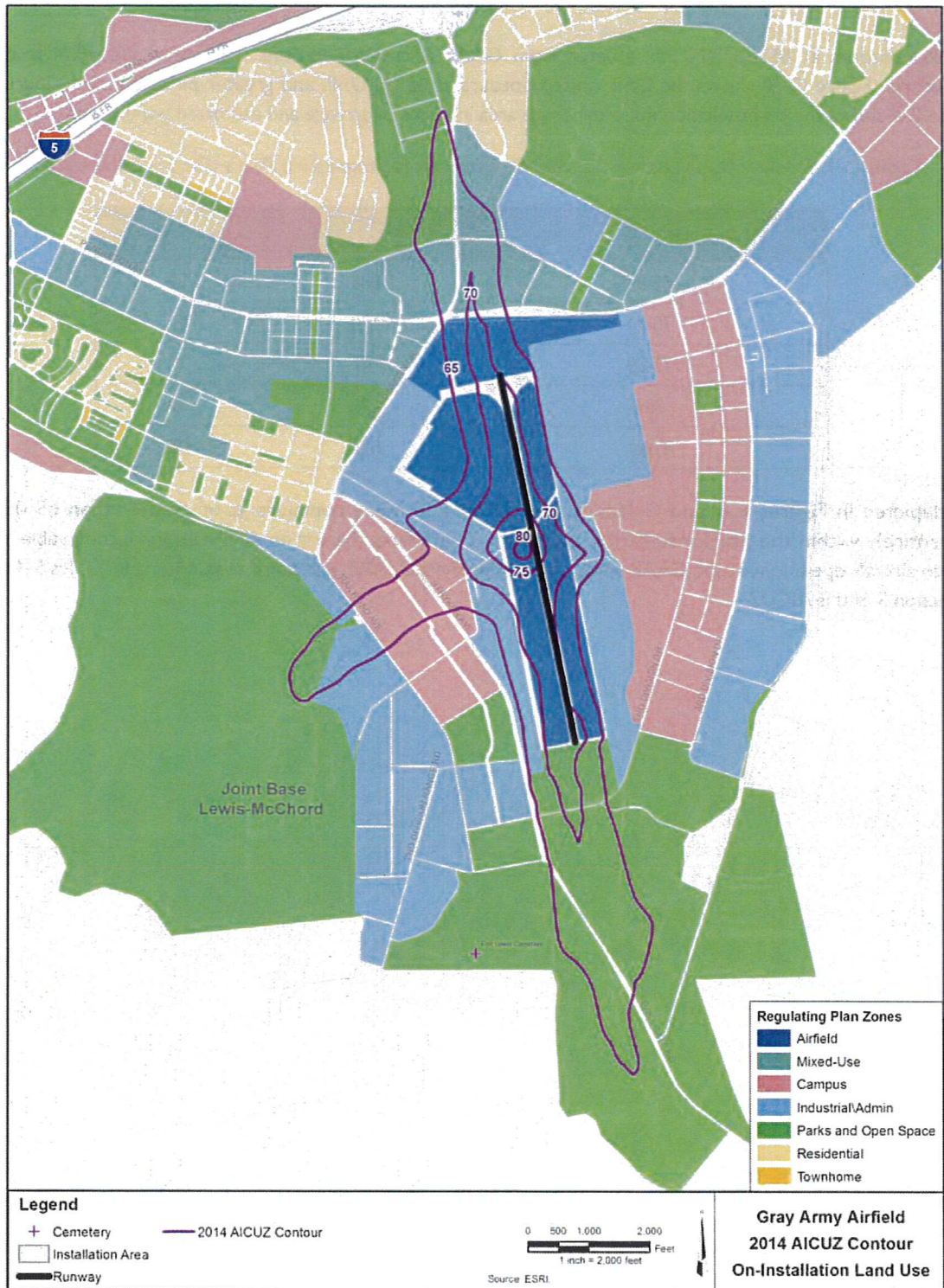


Figure C-10. GAAF DNL Contours