F-22 Aircraft Force Development Evaluation and Weapons School Beddown, Nellis AFB

Draft Environmental Impact Statement

June 1999

COVER SHEET
DRAFT ENVIRONMENTAL IMPACT STATEMENT
COVERING THE PROPOSED F-22 AIRCRAFT FORCE DEVELOPMENT EVALUATION AND WEAPONS SCHOOL BEDDOWN, NELLIS AIR FORCE BASE

a. *Responsible Agency:* U.S. Air Force

b. *Cooperating Agencies:* None

c. *Proposals and Actions:* This Draft Environmental Impact Statement covers two alternatives to address the need to provide for the beddown of Force Development Evaluation program and Weapons School for the F-22 Raptor, the U.S. Air Force's next-generation, air superiority fighter. The two alternatives consist of No-Action and the Proposed Action to beddown (station) 17 F-22 aircraft and implement the F-22 program into the existing Operational Test and Evaluation and Weapons School institutions at Nellis Air Force Base (AFB), Nevada. Under the No-Action Alternative, the proposed beddown and its associated construction and personnel actions would not occur at Nellis AFB. Likewise, the F-22 Force Development Evaluation programs and Weapons School would not be implemented at the base. The Proposed Action would involve (1) basing 17 F-22 aircraft at Nellis AFB in three phases between 2002 and 2008, (2) establishing the F-22 Force Development Evaluation program at the base in 2002 and the Weapons School in 2008, (3) constructing or externally modifying eight on-base facilities and internally modifying two buildings to support the F-22 program, a military construction program totaling approximately $25,000,000, (4) adding 367 personnel at Nellis AFB, (5) conducting a maximum of 4,472 sorties from Nellis AFB, of which 4,300 would use the Nellis Range Complex (NRC), and (6) conducting ordnance delivery activities using air-to-ground Joint Direct Attack Munitions on approved targets within the Nellis Air Force Range, and releasing chaff and flares in approved airspace.

d. *Comments and Inquiries:* Written comments on this document should be directed to F-22 Aircraft Beddown EIS, Mr. Don Kellogg, HQ AFCEE/ECP, 3207 North Road, Brooks AFB, TX 78235-5363. For telephone inquiries, please contact Mr. Kellogg at (210) 536-6544 or Mr. Mike Estrada, Air Warfare Center/Public Affairs, Nellis AFB, at (702) 652-6552.

e. *Designation:* Draft Environmental Impact Statement

f. *Abstract:* This Draft Environmental Impact Statement has been prepared in accordance with the National Environmental Policy Act to analyze the potential environmental consequences of the proposed F-22 beddown at Nellis AFB and the No-Action Alternative. The findings indicate the F-22 beddown would not impact or would negligibly impact airspace management, safety, hazardous materials and waste, earth and water resources, biological resources, cultural resources, transportation, recreation and visual resources, socioeconomics, land use, and air quality. The F-22 beddown would result in adverse impacts to noise and environmental justice. The proposed F-22 beddown would increase the number of people living around Nellis AFB affected by aircraft noise greater than 65 DNL by about 15,000 additional people. This area is zoned by Clark County for land uses above 65 DNL. Given this situation, the beddown of the F-22 would not represent a significant change from existing conditions. Noise levels of 65 DNL or greater under the Proposed Action would disproportionately affect minority and low-income populations according to environmental justice guidelines. The affected proportion of the minority population would be 2 percent more than the proportion in the region of comparison. For the low-income population, the affected proportion would be 8 percent greater than the proportion in the community. However, these populations occur in areas already zoned for land uses above 65 DNL. Nellis AFB will continue to employ noise abatement procedures to reduce noise effects in the surrounding communities. The Air Force will also continue to assist local officials who seek to establish or modify noise attenuation measures for residences. For Nellis Air Force Range and the encompassing NRC, flight and ordnance delivery activities proposed for the F-22s would negligibly change current conditions. There would be no perceptible change to subsonic noise levels. Sonic booms would increase by 4 to 6 per month within the Elgin and Coyote Military Operations Areas in the NRC; no other NRC airspace units would experience a change. Supersonic activity would increase noise on lands under the NRC airspace by 1 to 3 CDNL and overall noise by 1 DNL. Emissions of federally and state-regulated criteria air pollutants would not adversely affect air quality in the Las Vegas Valley or under the NRC. None would exceed federal or state air quality standards. Clark County and the Las Vegas area are currently in nonattainment for carbon monoxide (CO) and particulate matter (PM_{10}), so *de minimis* thresholds for these pollutants are 100 tons per year for CO and 70 tons per year for PM_{10}. The F-22 beddown would not exceed these thresholds or exceed regional significance, generating a maximum of 89 tons per year of CO and 6 tons per year of PM_{10}. No conformity determination is required. There are no significant cumulative impacts from the interaction of the F-22 Force Development Evaluation and Weapons School beddown with other reasonably foreseeable actions.

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EXECUTIVE SUMMARY

This Draft Environmental Impact Statement (EIS) describes the potential environmental consequences resulting from a U.S. Air Force (Air Force) proposal to base (beddown) F-22 aircraft and to implement Force Development Evaluation (FDE) program and Weapons School (WS) at Nellis Air Force Base (AFB) in Nevada. The beddown will allow for the development, testing, and establishment of actual war combat capabilities of this aircraft. This Draft EIS was prepared by the Air Force Headquarters Air Combat Command (HQ ACC) in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations implementing NEPA, and Air Force Instruction (AFI) 32-7061 directing all Air Force NEPA efforts.

PURPOSE AND NEED FOR THE ACTION

The F-22 Raptor is the Air Force's next-generation fighter and is designed to meet combat requirements well into the future. The F-22 possesses stealth technology, state-of-the-art radar and electronics, sophisticated weapon systems, and the capability to fly supersonic while minimizing fuel use. These characteristics make the F-22 a formidable deterrent to potential adversaries, enabling the United States to maintain and extend its combat superiority throughout the world.

For all new aircraft, like the F-22, the Air Force is required by law and policy to develop the aircraft's war combat capabilities. This includes testing and retesting aircraft systems, developing and refining the tactics and maneuvers it can perform, and training initial aircrews to fly the F-22 under combat conditions. This essential war-combat capability program is implemented under the FDE program, and it also includes interrelated WS activities. FDE program and WS are interrelated yet separate and will exist for the life of the F-22 in the Air Force inventory. They are essential programs ensuring the F-22 is being effectively used by its pilots in training and in combat.

To provide for successful F-22 FDE program and WS development activities, the Air Force proposes to beddown this aircraft at Nellis AFB. This Air Force base and its associated airspace and range complex are the only Air Force sites truly capable of providing the specific and unique requirements needed for the F-22 FDE program and WS, without major changes to airspace, land resources, and base infrastructure.

PROPOSED ACTION AND NO-ACTION ALTERNATIVE

ACC is responsible for implementing the F-22 FDE program and WS. Nellis AFB represents the only ACC base with Major Range and Test Facility Base components that meets the unique requirements for the F-22 FDE program and WS. A Major Range and Test Facility Base is a national asset that is sized, operated, and maintained primarily for DoD test and evaluation support mission, but is also available to all users having a valid requirement for its capabilities, including military trainers. Other bases, such as Holloman AFB and Edwards AFB, have Major Range and Test Facility Base components, but none meet all the requirements for FDE program and WS. These requirements include appropriate range instrumentation, threat simulation, support for large force

training exercises, an integrated battle space environment, and suitable existing infrastructure. No other bases were determined to be reasonable alternative locations for the F-22 FDE program and WS.

As a result of the alternatives identification process, two alternatives were carried forward for detailed analysis in this EIS: (1) the Proposed Action to beddown the F-22 FDE program and WS at Nellis AFB and (2) No-Action.

The Proposed Action would involve the following:

- basing 17 F-22 aircraft at Nellis AFB in three phases occurring in fiscal years (October through September) 2002 (6 aircraft), 2003 (2 aircraft), and 2008 (9 aircraft);
- implementing the F-22 FDE program at the base in 2002 and the WS in 2008;
- constructing or externally modifying eight on-base facilities and internally modifying two facilities to support the F-22 programs;
- adding 367 personnel at Nellis AFB;
- conducting an additional 4,472 annual sorties from Nellis AFB by 2008, of which 4,300 would use the Nellis Range Complex (NRC) and 172 would occur at remote ranges; and
- testing ordnance delivery on approved targets and releasing chaff and flares in approved airspace.

Under the No-Action Alternative, the F-22 beddown and its associated actions would not occur at Nellis AFB. Current flight operations, use of chaff and flares, and advance delivery would continue at the present level. Nellis AFB is the location of the Air Force's only existing fighter WS; no other location would satisfy the need to colocate the FDE program and WS for the F-22. No other base offers the specific physical or organizational infrastructure necessary to support unique requirements of the F-22 FDE program and WS. Nellis AFB and its ranges and airspace already exist and meet the F-22 testing and training program needs. Nellis AFB also offers the synergy of interaction with current Air Force FDE program and WS.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

No-Action Alternative

No element of the No-Action Alternative would alter current operations or infrastructure for the base or the NRC. This alternative would not result in any changes to current environmental conditions associated with the F-22.

Proposed Action: F-22 Beddown at Nellis AFB

Analysis in this EIS establishes that the proposed F-22 beddown would result in either negligible effects or would not change current environmental conditions at Nellis AFB or in the NRC (Table ES-1). Construction would be minor and confined to Nellis AFB. All construction would occur

Table ES-1. Effects of Proposed Action

DEIS Section	*Resource*	*Nellis AFB*	*NRC*
4.1	Airspace	■	■
4.2	Noise and Land Use		
	Subsonic	▼	■
	Supersonic	N/A	■
4.3	Air Quality	■	■
4.4	Safety	■	■
4.5	Hazardous Materials and Waste	■	N/A
4.6	Earth and Water Resources	■	N/A
4.7	Biological Resources	■	■
4.8	Cultural Resources	■	■
4.9	Transportation	■	N/A
4.10	Recreation and Visual Resources	■	■
4.11	Socioeconomics	■	N/A
4.12	Environmental Justice	▼	■
5.1	Cumulative Effects	■	■

■ = Negligible effects/no effects
▼ = Adverse effects
N/A = Not affected by Proposed Action (Refer to section 2.5 in DEIS)

within previously disturbed areas without cultural resources or important plant and wildlife habitat. These locations are flat and away from drainages, so erosion of soils and sedimentation would be negligible. Proposed additional personnel for the F-22 would represent less than 5 percent of total base personnel. With the number of major exercises that occur at Nellis AFB each year, variation in base population is common. The proposed personnel increase would have negligible effects on land use, water use, transportation networks, and the local economy. The F-22 beddown would increase the total number of aircraft at the base, but this total would be less than the base accommodated in

the past. For this reason, Nellis AFB has sufficient programs and procedures already established to handle environmental effects associated with the proposed beddown without potential degradation to the environment. Hazardous waste and materials management procedures already established for other similar aircraft would continue to be followed. If new materials or wastes are generated, then Air Force procedures would be established to contain and dispose of them.

In the NRC, the F-22s would fly 13 to 9 percent of the 200,000 to 300,000 sortie-operations that now occur annually. The F-22 would not use the NRC in substantively different ways than it is used now or has been used in the past. This use would negligibly affect environmental conditions in the NRC. The F-22 would deliver ordnance only on existing, previously disturbed targets. No new areas would be affected. The F-22 would also use defensive countermeasures, known as chaff and flares, but only in areas already subject to and approved for their use. Overall, the activities proposed for the F-22 at the NRC would be consistent with current activities and would not significantly affect the environment.

Public scoping raised particular concerns about the Proposed Action's potential impacts on subsonic noise and land use around Nellis AFB, sonic booms in the NRC, air quality associated with the base, and environmental justice in the vicinity of the base. Each of these is analyzed in detail in the EIS. The following summarizes the results of the analysis.

SUBSONIC NOISE AND LAND USE AT AND AROUND NELLIS AFB

Under the Proposed Action, noise conditions on and around Nellis AFB would remain generally consistent with the patterns of the past 20 years. Addition of F-22 flight activities would increase the area around the base affected by aircraft noise levels of 65 DNL or greater. The area around the base exposed to these noise levels would increase to approximately 23,000 acres, or 8,700 acres more than under baseline conditions. However, 99 percent of these lands are either zoned for and previously exposed to equivalent noise levels or are open undeveloped lands northeast of the base. Despite the increase in affected area relative to baseline conditions (derived from the updated 1997 noise study), the amount of change in noise levels would be 2 dB or less at any location.

The change in noise conditions would not alter land use in the area around the base. Clark County has established zones around the base to regulate development and define compatible land uses. These zones match areas affected by noise levels of 65 DNL or greater as presented in a 1992 Air Force study for Nellis AFB. Noise from the proposed beddown would affect less commercial, industrial, recreational and residential lands than encompassed by the Clark County noise zones. The Proposed Action would, however, affect approximately 8,300 acres more lands than are included in the county noise zones. About 90 percent of these lands are open or undeveloped. Approximately 85 percent of the lands affected by projected noise levels would consist of open, undeveloped land. Almost all of these lands lie northeast of the base and are used for grazing under the management of the BLM. Although the area affected by noise extends beyond the limits of the county zones, the projected noise levels would not be inconsistent with either the actual land use or the principles behind Clark County's regulations.

Nellis AFB will continue to employ noise abatement procedures to reduce aircraft noise in the communities around the base. The procedures include directing flight paths away from residential areas to the degree feasible, faster climbouts, and time restrictions on certain activities.

SUPERSONIC NOISE WITHIN THE NELLIS RANGE COMPLEX

During air combat maneuvering, the F-22 is estimated to fly supersonic approximately 10 percent of the time. All supersonic activity by the F-22 would occur within NRC airspace and at altitudes authorized for supersonic flight. Sonic boom levels and frequency of occurrence would be slightly higher than baseline conditions. Coyote and Elgin would experience the largest change, with a 1 to 3 CDNL increase and 4 to 6 additional sonic booms per month. All supersonic-authorized airspace would be subject to increases of 1 CDNL or less and less than 1 sonic boom per month.

Combined subsonic and supersonic noise would increase at most by 1 DNL in the Elgin MOA, Reveille MOA, EC West, and R74. In the remaining NRC areas, supersonic noise would not increase at all.

AIR QUALITY AT AND AROUND NELLIS AFB

Clark County which includes Nellis AFB, is currently considered by the U.S. Environmental Protection Agency to be in serious nonattainment for air quality, specifically for carbon monoxide (CO) and particulate matter (PM_{10}). The CO problem in Clark County is related primarily to automobile traffic and is made worse by regional topography and weather patterns resulting in strong temperature inversions. More than 19 million vehicle miles are traveled each day in the Las Vegas Metropolitan Area. Steady population growth is predicted to raise this by 1 million miles per day or more each year. Traffic congestion in and around the city center is considered the main cause of CO violations.

Emission of air pollutants into the area around Nellis AFB would increase under the Proposed Action but would not significantly impact local air quality. Potential sources of emissions at Nellis AFB would include facility construction, maintenance activities, refueling, private and government vehicle travel, and aircraft operations. These increased emissions (89 tons for CO and 6 tons for PM_{10}) would remain below *de minimis* levels (100 tons for CO and 70 tons for PM_{10}) and would not result in or contribute to exceedences of federal air quality standards. Since these quantities are below *de minimis* and are not regionally significant, no conformity determination is required. Emissions from Nellis AFB activities currently account for 2.1 percent of the overall CO budget for the Las Vegas Metropolitan Area and 0.062 percent of the overall PM_{10} budget. With the proposed F-22 beddown in 2008, these would increase to 2.2 percent for CO and 0.068 percent for PM_{10}.

ENVIRONMENTAL JUSTICE ISSUES AROUND NELLIS AFB

An increase in noise around Nellis AFB associated with the Proposed Action would disproportionately affect minority and low income populations. Currently, 26 percent and 11 percent of the population affected by noise levels of 65 DNL or greater are, respectively, minorities and have

low incomes. These figures exceed the 25 percent minority average and equal the 11 percent low-income average in Clark County. With implementation of the proposed F-22 beddown, the area affected by noise levels of 65 DNL or greater would increase and affect more of the population around the base, including 27 percent minority and 19 percent low-income populations. These areas containing minority or low-income populations have been exposed to similar or higher noise levels since at least 1992, occur in areas that Clark County has zoned for similar or higher noise levels, and would not be exposed to more than a 2 dB increase. Since 1996, Clark County zoning ordinances have required that all residential construction in areas affected by noise levels of 65 DNL or greater include noise attenuation features. The Air Force will work with local officials to support zoning ordinances and noise attenuation requirements. If changes are found to be needed to address noise conditions, the Air Force will assist local officials who seek to establish or modify noise attenuation measures. In addition, the Nellis AFB will continue to employ noise abatement measures designed to reduce noise effects in the surrounding community.

1.0 PURPOSE AND NEED FOR THE ACTION

1.0 PURPOSE AND NEED FOR THE ACTION

1.1 INTRODUCTION

Federal law and Air Force policy requires Force Development Evaluation (FDE) testing and Weapons School (WS) training of new aircraft. To meet this requirement for the F-22, the Air Force proposes to base, or beddown, F-22 aircraft at Nellis Air Force Base (AFB) in Nevada (Figure 1.1-1). This section presents the purpose and need of the Proposed Action.

1.2 BACKGROUND FOR THE PURPOSE AND NEED

1.2.1 F-22 Aircraft

Air superiority may well determine the outcome of any modern conflict. Air Force fighter aircrews and aircraft first deployed to a conflict will face the full weight of the enemy's air forces and surface-to-air defenses. These aircrews must be equipped, trained, and ready to overcome the enemy air forces and defenses quickly and decisively. Modern air battles tend to be brief and extremely dynamic. By winning air superiority rapidly and thoroughly, the United States (U.S.) can safely establish and maintain ground forces and other assets needed to conduct and win a war with minimum casualties. To ensure success of these and other operations, U.S. air superiority must extend deep into enemy territory.

Existing and developing foreign aircraft and air defense systems have reached levels of sophistication and effectiveness sufficient to pose a significant threat to current U.S. fighters. Emerging non-U.S. fighter aircraft with advanced technologies are expected to offer better capabilities than the Air Force's existing air superiority fighter, the F-15C. The worldwide prevalence of sophisticated air-to-air and surface-to-air missiles continues to grow, increasing the number of threats to which the F-15C is vulnerable. In 1985, Congress determined that a need existed to provide the Air Force with a next-generation fighter, to supplement the aging F-15C fleet, and to ensure air superiority well into the 21st century. Congress also determined that the F-22 would meet this need.

The Air Force has now developed the F-22. This aircraft embodies critical combat capabilities to fulfill its primary air superiority role. The F-22 epitomizes the characteristics needed for this role, offering a unique combination of capabilities:

- *Stealth*: Using design and radar-absorbent composite materials, the F-22 is harder to detect by radar than conventional aircraft of similar size.

- *Supercruise*: Because the combat capability allows the F-22 to sustain supersonic speeds without the use of afterburners (an afterburner greatly increases fuel consumption), it can operate longer at higher speeds and be less vulnerable to other aircraft and missiles.

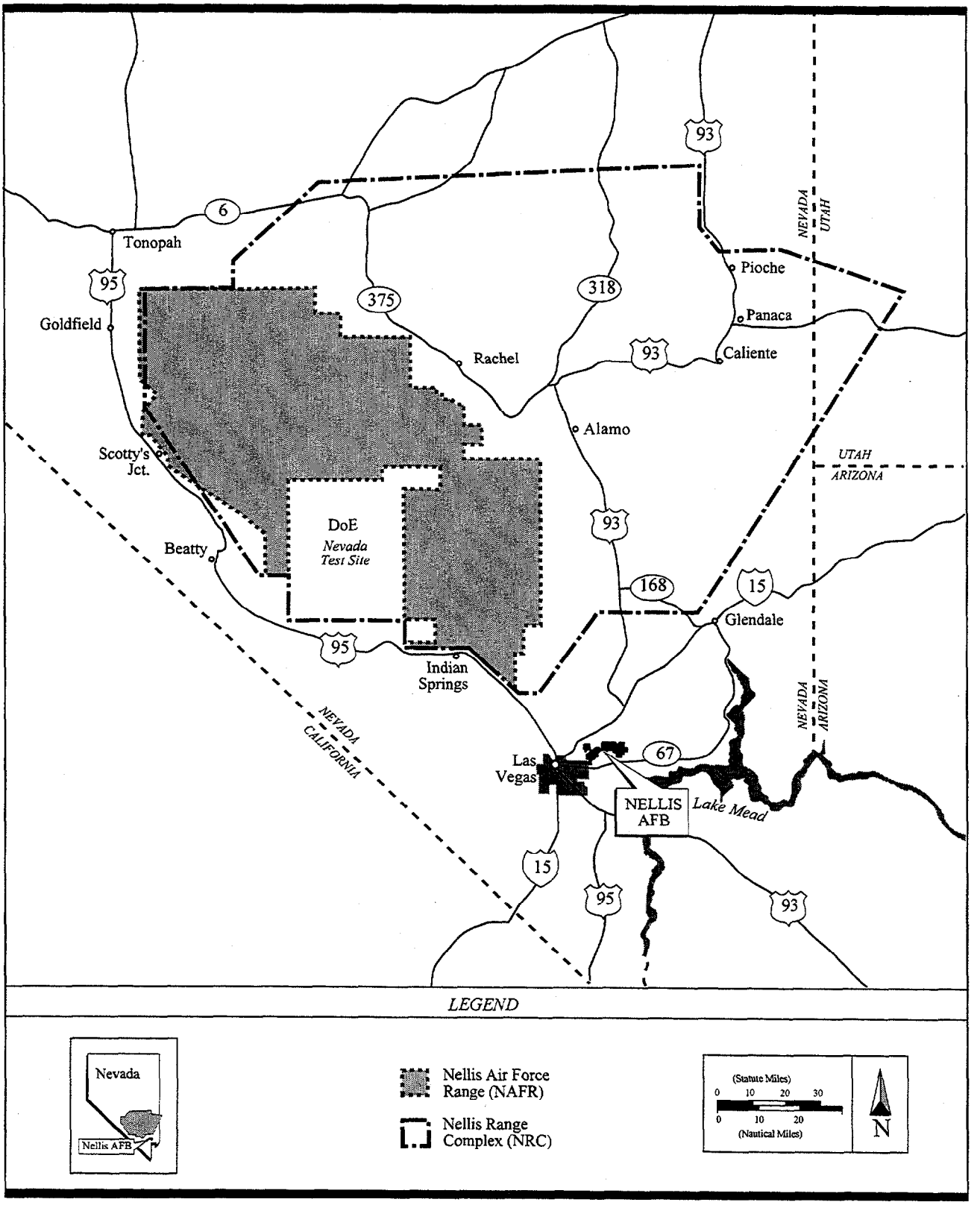

Figure 1.1-1. Nellis AFB and Nellis Range Complex Location Map

- *High maneuverability*: By directing engine thrust, an F-22 pilot can turn more rapidly and maintain better control than other fighter aircraft can and is better able to evade missile threats.

- *Comprehensive combat information systems*: Highly sophisticated avionics systems are integrated throughout the F-22 to provide the pilot information from many sources and produce a clear, simple picture of the combat situation.

- *Maintainability, sustainability, reliability, and responsiveness*: Computerized self-tests of all systems represent just one of the features designed to enhance the reliability and mission-readiness of the F-22.

The F-22, powered by two F119 Pratt and Whitney 100 jet engines each capable of supplying approximately 35,000 pounds of thrust, can fly Mach 1.4. Measuring approximately 62 feet long at the fuselage with a 44-foot wingspan, the F-22 uses air-to-air and air-to-ground guided weapons and a 20-mm cannon. It also employs defensive countermeasures such as chaff and flares. These characteristics will enable the F-22 to fly undetected into enemy territory, launch its weapons, outmaneuver enemy fighters, and evade enemy air defenses.

1.2.2 F-22 Development and Deployment Process

The Air Force uses a standard process for weapons system acquisition, production, testing, and deployment; this is the process being used for F-22 development. Figure 1.2-1 outlines the past, ongoing, and proposed phases, milestones, and associated environmental documentation for the F-22 development process. This systematic process guarantees the following:

1. The F-22 will receive thorough, intensive testing and evaluation to ensure its effective, safe operation;

2. FDE program and WS will continue to refine the capabilities of the F-22 and improve tactics employed in the F-22 for as long as the aircraft remains part of the Air Force inventory; and

3. Environmental documentation, developed in accordance with National Environmental Policy Act (NEPA), the Clean Air Act, and all other applicable regulations, has been or will be prepared for each major action within the process, including future beddowns of operational F-22 units.

The requirement that led to the F-22 was identified through the process described in Air Force Instruction (AFI) 10-601, *Mission Needs and Operational Requirements Guidance and Procedures*. During the early 1980s, the Air Force assessed its tactical capabilities against projected threats and determined that a mission deficiency would emerge in the near future. Such a deficiency could jeopardize the U.S.'s ability to ensure that its forces have the freedom of action to conduct operations against opposing forces. By 1984, the Air Force had defined the

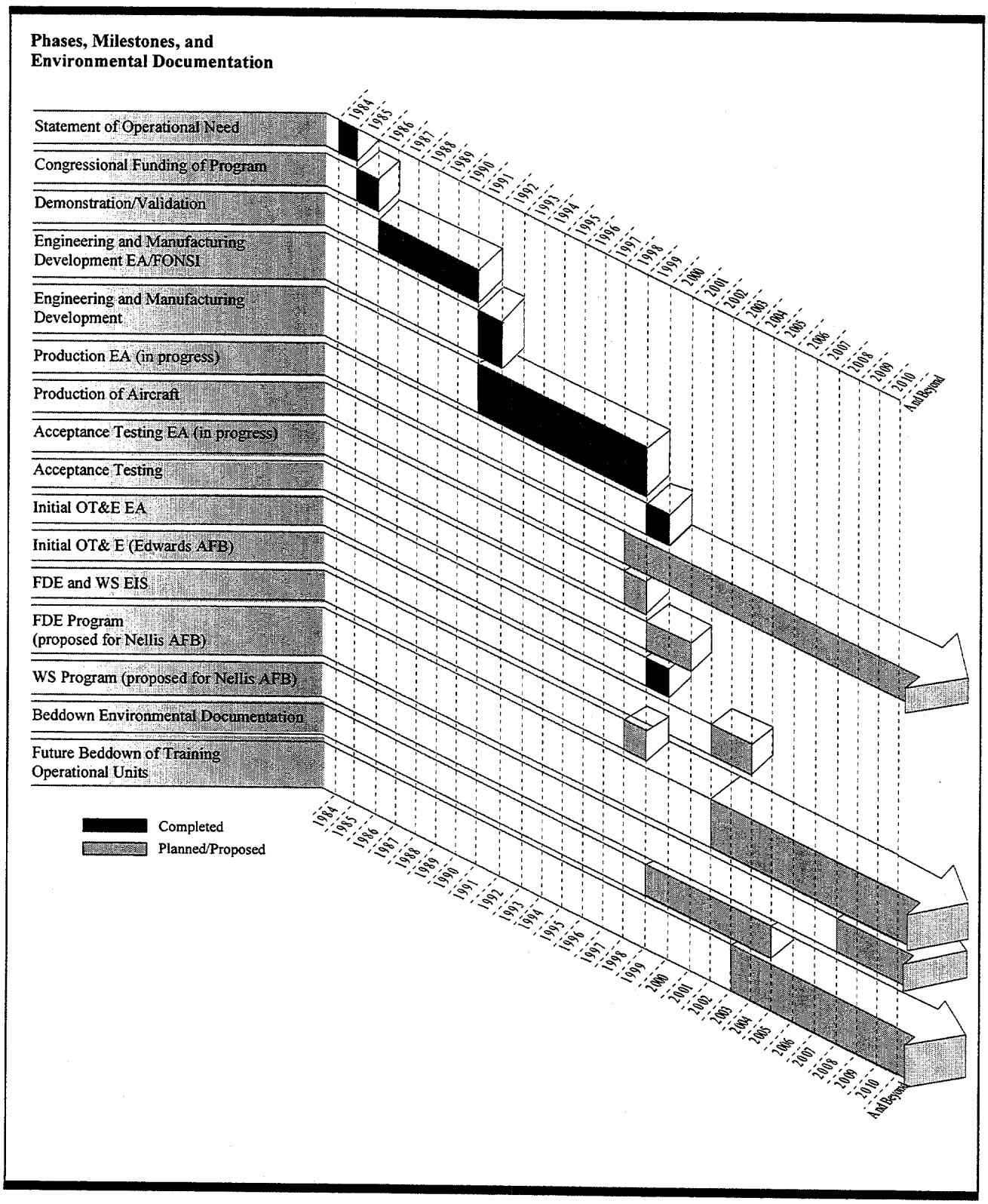

Figure 1.2-1. Past, Ongoing, and Proposed Elements of F-22 Development Process

requirements for an advanced tactical fighter, presenting them in a *Statement of Operational Need.*

Since 1986, the F-22 program has progressed from demonstration/validation and engineering and manufacturing development into Initial Operational Test and Evaluation (IOT&E). The first F-22s flew in 1997, and more than 204 flight hours have been completed as of March 1999.

F-22 FDE pilot training would occur in 2002, with actual FDE activities proposed to begin in 2003 after completion of IOT&E. FDE, like IOT&E, is a part of the overall OT&E program for the F-22. While IOT&E ensures that the F-22 meets mandatory operational capabilities, FDE , lasting as long as the aircraft is used, tests and evaluates the aircraft and its systems to ensure that it continues to meet operational requirements. FDE also explores the use of new flight techniques and tactics to satisfy deficiencies in aircraft performance and to develop training programs. By testing capabilities of an aircraft in tactical situations, including air-to-air, air-to-ground, and electronic combat operations, FDE provides essential input on tactics to the WS and operational units.

The WS represents an essential activity performed throughout the life of the aircraft in the Air Force inventory. As established in Multi-Command Regulation 55-120, the WS conducts graduate level instructor courses in weapons and tactics employment. The WS offers academic courses and flight training on specific aircraft to qualified instructor pilots. Upon completion of WS courses, which includes two weeks of combat training exercises, graduate officers return to their home units to provide advanced instruction to unit pilots on employing the aircraft for its mission. As currently planned, WS for the F-22 would start at Nellis AFB in 2008.

In 2003, Air Education and Training Command would receive F-22 aircraft to establish initial pilot training and begin qualifying pilots to fly the F-22. To accomplish this training, Air Education and Training Command would first establish a training squadron. Members of this squadron would complete pilot training to fly the F-22 and successfully perform the academic work and flying skills necessary to achieve instructor status. Some of these new instructor pilots would be assigned to operational units that will receive F-22s. Some would also become WS instructors. By 2008, a sufficient number of qualified instructor pilots would be ready to receive the advanced training of the WS.

The ultimate goal of the F-22 development and deployment process is to provide Air Force operational units with a proven, tested aircraft, as well as with tactics and operational guidance to meet mission requirements. The Air Force will prepare appropriate environmental analyses for any future F-22 beddowns for operational units.

1.3 PURPOSE AND NEED FOR THE ACTION

The purpose of the Proposed Action is to implement the FDE program and WS for the F-22. F-22 development and the manufacturing process have been initiated, and the aircraft is currently being evaluated. F-22 aircraft will be placed in operational units and available for combat missions by 2005.

In accordance with 10 U.S.C. 2399, the Department of Defense (DoD) and the Air Force must test major weapon systems. In addition, Air Force Instruction 99-102, *Operational Test and Evaluation*, directs that "OT&E (of which FDE is a part) will be conducted in as realistic an operational environment as possible and practicable, and identify and help resolve deficiencies as early as possible. These conditions must be representative of both combat stress and peacetime operational conditions." The AFI defines the needed elements of FDE and explains how the Air Force major command operating the aircraft plans and conducts FDE until the aircraft is retired. For the F-22, Air Combat Command (ACC) is the major command responsible for implementing the FDE program. FDE serves several important functions:

- refines employment doctrine and tactics in response to changing threats;
- develops or refines operational procedures and training programs;
- evaluates changes to the aircraft (F-22) to fix newly identified deficiencies and verifies they have been fixed throughout the entire time the aircraft is in the Air Force inventory;
- explores nonmateriel (e.g., tactics) means of meeting changing operational requirements as long as the aircraft remains in the inventory;
- evaluates routine software changes (operational flight programs), preplanned product improvements, modifications, upgrades, mission data updates, and other improvements or changes as long as the aircraft is in the inventory;
- researches, demonstrates, exercises, analyzes, and evaluates tactics against anticipated threats; and
- ensures proper aircraft performance in combat by providing training, information on operational capabilities, and new requirements.

Under Multi-Command Regulation 55-120, ACC must establish and maintain a WS for each aircraft type in its inventory. This program operates throughout the life of the aircraft, adapting to changes in technology, tactics, and threats. Feedback to and from the FDE program is essential to the WS since it applies, evaluates, and refines tactics developed under FDE. The WS provides up-to-date training for pilots already qualified to fly the aircraft. With tactics and combat training as its focus, the WS offers rigorous, intensive, and realistic instruction that enables WS graduates to effectively teach combat skills to members of their home operational units. The WS

- provides graduate-level training for weapons and tactics for a specific aircraft type;
- prepares graduates to instruct other pilots in the most up-to-date tactics and capabilities, thereby readying operational units with combat missions for potential enemy threats; and

- includes intensive combat training exercises offering the realism needed to test and hone the skills and knowledge of the graduates.

The FDE program and WS represent essential but distinct parts of the Air Force's overall mission. These two essential parts of the F-22 program have different purposes but very similar needs. The types of flying activities required in each program are similar and the fundamental supporting assets (i.e., base, airspace) needed by both programs also closely match. FDE could be established at a different base than WS, and the Air Force considered that possibility. But splitting the FDE program and the WS between two locations would not be an efficient or effective use of existing available infrastructure, training assets, and personnel. Economies of maintenance, training, and personnel would be achieved by establishing both the FDE program and WS at the same base and using the same airspace to conduct needed flight operations. Further economies would accrue if a base selected for the F-22 FDE program and WS already supported such programs for other fighter aircraft. Establishing the FDE and WS at two separate locations would also reduce the opportunity for the two programs to provide feedback to one another about the capabilities of the F-22 and the expansion of those capabilities for combat. Transitioning specific F-22 aircraft (airframes) from FDE to WS would be simpler and more effective if both programs resided at the same base. After considering the concept to duplicate the F-22 FDE program and WS at different bases and the factors described above, the Air Force concludes it would not be reasonable to separate the programs.

Individually and combined, the FDE program and WS involve unique requirements that differ from those associated with the training activities of operational units. Both programs need specific, similar assets to meet their unique requirements. For the F-22, these fall into three major categories:

- *Airspace and ranges*. The F-22 FDE and WS each need military airspace, secure training ranges, and associated ground facilities capable of accommodating specific operational and training activities. Such activities are very similar for both FDE and WS; only the purpose differs between the two programs.

- *Professional expertise and opportunities for realistic operations*. Basing of the F-22 must provide personnel with the opportunity to perform realistic operations and the training needed to realize the full value of the FDE program and WS.

- *Base*. A base for FDE and WS must offer the physical and organizational infrastructure to support these programs.

1.4 ENVIRONMENTAL IMPACT ANALYSIS PROCESS

1.4.1 Regulatory Requirements

This Environmental Impact Statement (EIS) was prepared in conformance with the National Environmental Policy Act (NEPA) and associated regulations. NEPA (Public Law 91-190, 42

U.S.C. 4321-4347, as amended) was enacted to establish a national policy for the protection of the environment. It also established the Council on Environmental Quality (CEQ) to implement the provisions of NEPA and review and appraise federal programs and activities in light of NEPA policy. CEQ developed regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508). These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing EISs to comply with NEPA. AFI 32-7061, which implements the CEQ regulations with regard to Air Force actions, defines the steps and milestones in the Environmental Impact Analysis Process (EIAP). The major milestones in the EIAP for the proposed F-22 beddown at Nellis AFB include the following:

- publishing a Notice of Intent (NOI) to prepare an EIS;
- inviting public and agency input to determine and define the significant issues to be addressed in the EIS;
- collecting data on the affected environment to provide a baseline for analyzing the effects of the alternatives;
- assessing the potential impacts of the Proposed Action and alternatives on the environment;
- preparing and distributing a Draft EIS for public review and comment;
- establishing a public review period, including public hearings to solicit comments on the analysis presented in the Draft EIS;
- preparing and distributing a Final EIS incorporating all comments received on the Draft EIS and responding to the substantive issues raised during the public review period; and
- publishing a Record of Decision (ROD), outlining the Air Force's decision, no sooner than 30 days after the availability of the Final EIS.

Appendix A lists other federal and state laws and regulations pertinent to the Proposed Action. This list is not encyclopedic. Rather it focuses on those laws and regulations that either 1) set regulatory thresholds for impacts that could occur as a result of implementing the Proposed Action, 2) enforce a process for the evaluation of potential impacts for a particular resource, or 3) set standards for the treatment of a resource. Only those laws and regulations that apply to resources affected by the Proposed Action are presented.

PERMITS: Should the Proposed Action be implemented, the Air Force would need to obtain new or update existing permits. These permits would apply to the removal and disposal of asbestos as a result of demolition of, and modifications to, on-base buildings; construction of new buildings; and updating of Nellis AFB's Title V permit under the Clean Air Act. Nellis AFB may also need

to update its Resource Conservation and Recovery Act (RCRA) Part B permit for hazardous waste.

Asbestos Removal and Disposal: Prior to demolition or additions to buildings, asbestos surveys are required by Air Force regulation. For the removal of asbestos, a notification process with Clark County, the state health board, the Environmental Protection Agency (EPA), and the base hazardous waste coordinator is required. Removal would be contracted out to state-certified and licensed contractors. Contractors would obtain the necessary permits for the removal, handling, and transportation of asbestos. Contractors must have access to a landfill permitted for disposal of asbestos.

Construction of New Buildings: The base would submit building plans and a request for location to the base zoning and development board. An air quality dust permit must be obtained from Clark County if the building site causes 0.25 acre or more of topsoil disturbance. The Clark County Surface Disturbance Permit would be applied for by Nellis AFB after finalization of the building footprints but prior to construction.

Title V Permit: Modifications to the current basewide Title V Permit would be required if equipment other than mobile aircraft maintenance equipment was added or replaced. Due to a base exemption, no modifications are required for changes or additions to mobile equipment used to maintain or service planes on the ground. However, Clark County air quality operating permits for individual pieces of equipment would have to be modified for all changes. All modifications to the Title V Permit and the Clark County air quality operating permits would be applied for by Nellis AFB after equipment needs are finalized.

RCRA Part B Permit: Nellis AFB currently holds a RCRA Part B permit for management of hazardous waste generated by maintenance and other activities. If any new waste streams are identified after the production model of the F-22 is finalized, the appropriate transportation, storage, and disposal procedures would be implemented and Nellis AFB's RCRA Part B permit would be modified as necessary.

AGENCY CONSULTATION: Both NEPA and CEQ regulations require intergovernmental notifications prior to any detailed statement of environmental impacts. Through the process of Interagency and Intergovernmental Coordination for Environmental Planning (IICEP), concerned federal, state, and local agencies (such as the U.S. Fish and Wildlife Service [USFWS], Bureau of Land Management [BLM], Nevada Division of Environmental Protection, and the Nevada State Historic Preservation Officer [SHPO]) must be notified and allowed sufficient time to evaluate potential environmental impacts of a proposed action. This was accomplished in two ways: (1) agencies were contacted early in the EIS process via letters to solicit their comments on the Proposed Action and No-Action Alternative, and (2) the Air Force also conducted scoping meetings. Appendix B, *Public Participation Summary*, provides a list of the agencies and governmental entities to which the letters were sent and any responses. Comments from these agencies were reviewed for incorporation into the environmental analysis.

GOVERNMENT-TO-GOVERNMENT CONSULTATION: Several laws and regulations address the requirement of federal agencies to notify or consult with American Indian groups or otherwise consider their interests when planning and implementing federal undertakings.

On April 29, 1994, the President issued the *Memorandum on Government-to-Government Relations with Native American Tribal Governments*, which specifies a commitment to developing more effective day-to-day working relationships with sovereign tribal governments. The intent of this memorandum has been incorporated in the *DoD American Indian and Alaska Native Policy* and Executive Order 13084, *Consultation and Coordination with Indian Tribal Governments*, which the Air Force is following. The DoD American Indian and Alaska Native policy supports tribal self-government and government-to-government relations with the Federal government. It specifies that DoD will meet its trust responsibilities to tribes and will address tribal concerns related to protected tribal resources, tribal rights, and Indian lands. The policy also addresses procedures for building stable and enduring relationships with tribes.

As part of the NEPA process, 17 tribes and one organization with historical ties to the land in the NRC vicinity were notified at the initiation of the project. Discussion of the F-22 is part of an ongoing government-to-government consultation between Nellis AFB and these tribes. This on-going consultation is directed through the Nellis AFB Native American Interaction Program. A list of the consulted tribes is presented in Appendix B.

1.4.2 Public Involvement Process

AFI 32-7061 and CEQ regulations require an early and open process for identifying significant issues related to a proposed action and obtaining input from the public prior to making a decision that could significantly affect the environment. These regulations specify public involvement at various junctures in the development of an EIS, including public scoping prior to the preparation of a Draft EIS, and public review of the Draft EIS prior to finalizing the document and making a decision. Appendix B of this EIS includes a summary of public participation in the EIAP.

Prior to the publication of the Draft EIS, the public process included publishing the NOI in the *Federal Register* on August 11, 1997. After public notification in newspapers and radio stations, three scoping meetings, averaging 3 hours in duration, were held August 26 through August 28 at the following southern Nevada locations: Tonopah, Las Vegas, and Caliente. A total of 22 people attended the meetings and provided comments. Of these 22, seven people provided oral input. By the end of the scoping period, September 30, 1997, 13 written comments had been received.

Following these scoping meetings, the Air Force prepared this Draft EIS and made it available to the public and agencies for review and comment. The document was sent to those in the public who requested a copy and was made available at selected public facilities such as libraries and local government agencies within southern Nevada. The public review and comment period for the Draft EIS will last 45 days. During this time hearings will be held to provide an opportunity for the public to evaluate the proposal and the analysis contained within the Draft EIS.

Comments received during the public review and comment period will be addressed in the Final EIS and provided to the decisionmaker for consideration. A copy of the Final EIS will be published and made available to the public. The Final EIS will include responses to comments and questions received during the public comment period. After a minimum of 30 days of review, the Air Force may publish a ROD. The ROD would specify the selected alternative, its implementation, and mitigation measures, if any, that could be employed to reduce environmental impacts.

SUMMARY OF ISSUES IDENTIFIED DURING SCOPING: Of the 20 written and oral comments received from individuals, agencies, or interest groups, noise was the issue receiving the most interest. Many citizens expressed concern about current sonic booms and any additional booms that could negatively impact their quality of life as well as recreational and tourist opportunities. In both Tonopah and Caliente, concern centered around the abundance of supersonic flights in the region. In Las Vegas, some residents of the El Dorado subdivision (near the base) hoped that the F-22 would not add more noise over their neighborhood.

Two other areas of concern were how the F-22 would operate and the way in which it would fly within current airspace. Several people were concerned that F-22 flights would occur at such an altitude or in such a manner as would conflict with commercial or private aviation activities, and others wondered if current airspace boundaries would need to be reconfigured.

Department of Interior agencies (USFWS and BLM) comments centered on wildlife populations and habitats, noise impacts on wildlife, and possible impairment of water quality because of hazardous materials generated on-base and construction activities. No comments were received from the Nevada SHPO.

ISSUES RAISED THAT ARE BEYOND THE SCOPE OF THIS EIS: The public scoping process resulted in comments questioning the decision to build the F-22 aircraft. However, the decision to manufacture the F-22 and incorporate it into the Air Force inventory was decided by Congress and environmental effects of its early development have been addressed in other NEPA documents.

1.4.3 Decisions To Be Made

After considering the environmental information presented in this EIS, as well as other factors relative to national defense, the Air Force will decide whether to implement the Proposed Action or to select the No-Action Alternative. A decision to proceed with the Proposed Action would result in basing the F-22 aircraft for FDE and WS at Nellis AFB, and implementing associated supporting actions. If the No-Action Alternative is selected, the F-22 aircraft beddown for the purposes of FDE and WS training would not occur at Nellis AFB. Selection of the No-Action Alternative may affect the timing of F-22 integration into the Air Force.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVE

This chapter presents a detailed description of the Proposed Action to implement the F-22 Force Development Evaluation (FDE) program and Weapons School (WS) at Nellis AFB. It also describes the No-Action Alternative, in which the FDE program and WS would not be implemented at Nellis AFB. Under the Proposed Action, the Air Force would base 17 F-22 aircraft at Nellis AFB in fiscal years 2002, 2003, and 2008. This proposal would also involve construction or external modification of eight base facilities and internal modification to two facilities, addition of 367 personnel, and implementation of flight activities for the FDE program and WS within the Nellis Range Complex (NRC). The details of the Proposed Action form the basis for analysis of potential environmental impacts. This section also describes the reasons why Nellis AFB and its associated airspace and ranges represent the single location that reasonably provides for the specific and unique requirements of the F-22 FDE program and WS.

2.1 BASING REQUIREMENTS FOR F-22 FDE PROGRAM AND WS

2.1.1 Overall Considerations

Three overall considerations must be taken into account when selecting a base to fulfill the FDE program and WS.

1. *Integrated Battlespace Environment for Testing and Training.* An integrated battlespace environment for testing and training consists of airspace, range, and other assets that support the full spectrum of operations that could be encountered in combat. Such an environment supports realistic activities, including major exercises involving many types of aircraft in addition to aircraft adopting the roles and tactics of adversaries. An integrated battlespace environment also offers a variety and arrangement of ground-based threats that require aircrews to operate and react as they would in combat. It provides for air-to-air and air-to-ground testing and training, employing the equipment and facilities to monitor and review aircraft and aircrew performance. Since the F-22 FDE program and WS must test and train under as realistic conditions as feasible, a location offering a nearby integrated battlespace environment is required.

2. *Interaction of F-22 FDE Program and WS.* Interaction between the staffs of the FDE program and WS enhances the professional expertise of each program. FDE staff tests and evaluates the operational capabilities of an aircraft and uses this information to develop tactics. These capabilities and tactics are then incorporated into the WS program. The WS staff also evaluates the utility and value of the tactics through its intensive training course, providing feedback to the FDE staff on changes and refinements in tactics. This feedback process forms a continuous improvement cycle, or synergy, between the two programs as long as the aircraft remains in the Air Force inventory. Locating both programs at the same base would enhance the synergy, allowing consistent interaction between the F-22 FDE program and WS.

3. *Maximum Use of Existing Infrastructure to Accommodate the F-22 FDE Program and WS.* A base that requires minimal changes to accommodate these F-22 programs would offer a more efficient and effective alternative than a site that needed extensive changes. Such efficiency and effectiveness can be measured in terms of costs. For example, minimized changes may also equate to less potential for environmental impacts. Fewer infrastructure changes mean less construction and ground disturbance that could affect the environment. Similarly, less infrastructure and personnel changes would translate into lower overall costs.

2.1.2 Flying and Mission Considerations

To fulfill their unique flying and mission requirements, the F-22 FDE program and WS need to be at a location that provides specific assets (see Section 2.1.3). These requirements apply specifically to implementing the F-22 FDE program and WS; they would not necessarily apply to other aspects of the F-22 development and deployment process, including future basing of operational units. Since the F-22 is a new aircraft and has no operational history, the operational requirements were defined as follows.

FUNCTIONAL AND OPERATIONAL CHARACTERISTICS OF THE F-22: The functional and operational characteristics designed into the F-22 include stealth, supercruise, agility and maneuverability. It contains comprehensive yet simple combat information systems and both air-to-air and air-to-ground combat roles, as well as maintainability, sustainability, reliability, and responsiveness. Table 2.1-1 outlines the characteristics and associated operational requirements for test and evaluation.

ANTICIPATED COMBAT ROLES FOR THE F-22: Air superiority represents the F-22's primary mission. The goal of air superiority is to dominate the skies over the battlefield, over U.S. and allied forces, and over as much of the enemy's territory as possible. To achieve and maintain air superiority, U.S. aircrews must identify, target, and neutralize enemy aircraft in the air and on the ground. They must also avoid detection and targeting by enemy airborne and ground-based radar, missiles, and anti-aircraft artillery systems. Success against enemy air and ground defenses requires employment of maneuvers, high and low speeds, changes in altitudes, and defensive countermeasures. The F-22 has a secondary air-to-ground mission employing air-to-ground ordnance, including the Joint Direct Attack Munition (JDAM).

During past conflicts, such as the Gulf War, air superiority fighters often flew as high as 50,000 feet above mean sea level (MSL). To evade enemy air and ground threats, the fighters changed altitudes rapidly, sometimes diving to below 500 feet above ground level (AGL). They also flew faster than the speed of sound when necessary to avoid enemy defenses or to optimize the use of sophisticated weapon systems. To respond to newer threats, it is expected that the F-22 would fly as high as 60,000 feet MSL and as low as 300 feet AGL.

PROJECTED TRAINING ACTIVITIES: The F-22 offers the capabilities to fulfill all of the mission elements described above. The F-22 FDE program and WS must occur at a location that permits the specific test and training activities that would eventually lead to successful performance of the

Table 2.1-1. F-22 Operational Characteristics and Requirements

Operational Characteristics	*Operational Requirements*
Stealth	• Ability to test and use stealth in tactics • Instrumentation and threat radar against which to employ stealth
Supersonic Cruise	• Sufficient airspace in which to fly supersonic during employment of tactics • Adversary aircraft simulating enemy capabilities and tactics
Agility and Maneuverability	• Adequate airspace in which to employ the full spectrum of tactics • Adversary aircraft and ground-based threats against which tactics can be employed
Comprehensive Combat Information Systems	• Opportunity to employ systems in large-force exercises involving numerous different aircraft types, including simulated adversaries • Ground-based simulated threats and instrumentation to test combat information systems and use in tactics
Maintainability, Sustainability, Reliability, and Responsiveness	• Adequate facilities to employ large-force, multi-day exercises simulating operations tempo for combat • Opportunity to employ full spectrum of tactics and capabilities to evaluate aircraft systems
Weapons Capability	• Ability to fire air-to-air missiles and 20mm gun • Opportunity to employ air-to-ground ordnance

mission elements in combat. To help define these activities for the F-22, it is necessary to use the programs for an existing, comparable aircraft type.

The F-15C is the aircraft type most comparable to the F-22. Although the F-22 offers superior capabilities to those of the F-15C, both aircraft have similar missions and combat roles, and the Air Force has slated the F-22 to replace the F-15C in the next century. The F-22 would also be used for some air-to-ground missions. The F-15C FDE program and WS operations represent the best available perspective on the nature and type of activities that the F-22 would conduct.

Table 2.1-2 outlines the representative test and training mission activities derived from F-15C programs and applied to the F-22. It also includes tactical training against surface attack. This table presents data on the types of airspace generally used for each activity, as well as the estimated flight parameters (speed, altitude, and duration).

2.1.3 Criteria for Basing F-22 FDE Program and WS

The overall considerations and the flying and mission considerations under the FDE program and WS determine the requirements used for basing the aircraft. Listed below are nine criteria describing the basing requirements for both the FDE program and WS:

Table 2.1-2. Projected Test and Training Activities Required for F-22

Activity	*Tasks*	*Airspace Type*	*Altitude (feet)*	*Speed*	*Duration*	*Time in Airspace*
Aircraft Handling Characteristics	G-force awareness, maneuverability, break turns, high angle of attack maneuvering, acceleration maneuvering, gun tracking, offensive and defensive positioning, simulated fueling, stall recovery	MOA[1] and ATCAA[2]	5,000 AGL to 60,000 MSL	100 KCAS[3] to Mach 1.4	1.0 hour	0.5 to 1.0 hour
Basic Fighter Maneuvers	Recognize all offensive/defensive weapons situations, defeat enemy weapons employment, G-force awareness, offensive/defensive maneuvering, visual missile defense, beyond visual range missile defense, maneuvering for weapons use, defensive countermeasure (flares/chaff) use	MOA and ATCAA	10,000 AGL to 30,000 MSL	100 KCAS to Mach 1.0	1.0 hour	0.5 to 1.0 hour
Air Combat Maneuvers	Multi-aircraft formations and tactics, systems check, G-force awareness, 2 vs. 4 and 4 vs. 6 aircraft intercepts, combat air patrol, defense of airspace sector from composite force attack, intercept and destroy bomber aircraft, avoid adversary fighters	MOA, Restricted Areas[4], and ATCAA	10,000 AGL to 60,000 MSL	100 KCAS to Mach 1.1	1.0 to 1.2 hours	0.5 to 1.0 hour
Low-Altitude Training	1 or 2 aircraft offensive and defensive operations at low altitude, G-force awareness at low altitude; handling, turns, tactical formations, navigation, threat awareness, defensive response, defensive countermeasure (flares/chaff) use, low-to-high and high-to-low altitude intercepts, missile defense, combat air patrol against low/medium altitude adversaries	MOA, Restricted Areas, and ATCAA	300 AGL to 20,000 MSL	100 KCAS to Mach 1.0	1.3 hours	0.83 to 1.0 hour
Tactical Intercepts	2 vs. 4 and 4 vs. 6 aircraft tactical intercepts, G-force awareness, electronic countermeasures, lead and formation flying	MOA, Restricted Areas, and ATCAA	300 AGL to 60,000 MSL	100 KCAS to Mach 1.4	1.2 hours	0.75 to 1.0 hour
Night Operations	4 vs. 4 aircraft intercepts and defense, defensive countermeasure (flares/chaff) use, maneuvering for weapons use	MOA, Restricted Areas, and ATCAA	10,000 AGL to 60,000 MSL	100 KCAS to Mach 1.4	1.2 hours	0.5 to 1.0 hour
Dissimilar Air Combat Tactics	Multi-aircraft and multi-adversary (involving dozens of aircraft) defense and combat air patrol, defense of airspace sector from composite force attack, intercept and destroy bomber aircraft, avoid adversary fighters, strike-force rendezvous and protection	MOA, Restricted Areas, and ATCAA	300 AGL to 60,000 MSL	100 KCAS to Mach 1.4	1.0 hour	0.75 to 1.0 hour
Mission Employment	Multi-aircraft and multi-adversary (involving dozens of aircraft) composite strike force exercise (day and night), systems check, air refueling, strike force defense and escort, air intercepts, electronic countermeasures, combat air patrol, defense against composite force, bomber intercepts, defensive countermeasure (flare/chaff) use	MOA, Restricted Areas, and ATCAA	300 AGL to 60,000 MSL	100 KCAS to Mach 1.4	1.5 hours	1.5 hours
Attack Tactics	2 vs. 2, 2 vs. 4 or 4 vs. 4 aircraft, low-to-high altitude tactical weapons delivery and escape maneuvers (day and night)	MOA, Restricted Areas (over weapons delivery ranges), and ATCAA	Surface to 60,000 MSL	350 to 600 KCAS	1.5 hours	0.75 to 1.0 hour

1. Military Operations Area (see section 2.2.2 for definition)
2. Air Traffic Control Assigned Airspace (see section 2.2.2 for definition)
3. Knots Calibrated Airspeed
4. Restricted Area (see section 2.2.2 for definition)

1. *Air Combat Command (ACC) and Major Range and Test Facility Base.* Under Air Force policy and instructions, implementation of the FDE program and WS is the responsibility of the major command operating the new aircraft. FDE activities occur at a base with a Major Range and Test Facility Base components as described in DoD Directive 3200.11. ACC is the major command receiving the F-22s and is the Air Force's primary fighter command, so ACC is responsible for the F-22 FDE program and WS, as well as eventual deployment of the aircraft to operational units. To ensure it meets its responsibilities, ACC would maintain command and control over these programs throughout their existence. Basing the F-22 FDE program and WS at an ACC base with associated Major Range and Test Facility Base components would also fulfill these responsibilities because of the special funding authorities and assets associated with such bases.

2. *Runway Length.* The landing and takeoff for the F-22 under the FDE program and WS require an 8,000-foot runway that includes an arresting cable.

3. *Ramp Space.* The fully established FDE program and WS would require a total of 17 F-22 aircraft for testing and tactics development and graduate-level combat training of instructor pilots. Therefore, a base must offer sufficient ramp space to park 17 F-22s for the FDE program and WS.

4. *Security Restrictions.* Because the F-22 represents the newest and most sophisticated fighter aircraft in the world, knowledge of its systems and capabilities would provide a potential advantage to adversaries. For this reason, the ability to observe specific F-22 FDE flying activities must be restricted. Both the base for the F-22 beddown and the ground underlying the airspace associated with the base must prohibit unauthorized observation of these aircraft operations.

5. *Airspace.* The F-22 FDE program and WS need a large airspace area that overlies land and accommodates supersonic flight activities. To provide sufficient area for air-to-air combat maneuvering by F-22 aircraft, the base must have nearby Military Operations Area (MOA), restricted airspace, or a combination of both measuring 100 by 50 nautical miles (NM) and must overlie land to accommodate range instrumentation and realistic threat simulation. This area should offer sufficient airspace for an F-22 to identify an adversary aircraft, lock-on with a weapons system, and close with the opposing aircraft. Due to the increasing capabilities of non-U.S. advanced fighters and air-to-air missiles, airspace offering 100 NM separation between opposing aircraft should be considered a minimum. The airspace must also permit substantial vertical maneuvering, offering altitudes from surface or near surface to 60,000 feet MSL. Since the upper altitudes of MOAs generally stop at 18,000 feet MSL, the airspace also needs to include Air Traffic Control Assigned Airspace (ATCAA) above the MOA(s) to accommodate the flight training requirements.

6. *Ordnance Use and Ranges.* Under an FDE program and WS, the functionality of all systems, including ordnance delivery systems, requires evaluation and use under tactical conditions. To fully evaluate and use these systems, the FDE program and WS must

conduct test and training activities at a range that permits delivery of training (inert or nonexplosive) and live (explosive) ordnance. Performance of the aircraft and the weapons must also be monitored from the point of release to the point of impact. For the F-22 FDE program and WS, a range must be available that provides full instrumentation for use of weapons with the aircraft.

7. *Range Instrumentation System.* A significant proportion of FDE program and WS activities for the F-22 would involve employing and evaluating the full range of maneuvers that would be used in combat. These activities, in part, test the capabilities of the aircraft and pilot in realistic combat training situations. To provide the realism needed for these activities, the F-22 must engage in combat training with other aircraft and against adversary aircraft. Given the speed of modern aircraft and the pace of combat engagements expected in the F-22 programs, a range instrumentation system must provide for live monitoring and recording of flight activities. Instructors and pilots can then review the training engagement and use the feedback to improve performance and tactics. Air combat engagements for testing and training regularly involve dozens of aircraft, so the base and airspace supporting the F-22 FDE program and WS must offer an instrumentation system capable of monitoring and recording multiple aircraft simultaneously.

8. *Realistic Threats.* An important element of the F-22's value to the Air Force stems from its expected capability to avoid and defeat the variety of ground-based surface-to-air missile and anti-aircraft-artillery systems maintained by potential enemies of the U.S. To ensure and refine that capability and the tactics used in its employment, the F-22 FDE program and WS need to operate against simulated ground-based threats that provide the variability and realism expected in actual combat. Therefore, the F-22 should operate in airspace that overlies an array of realistic, flexible electronic emitters that simulate the types of enemy radar anticipated in a variety of combat scenarios.

9. *Training Exercises.* The FDE program and WS contribute to pilot readiness to successfully perform combat missions. To augment the synergy needed for FDE program and WS, the F-22 must engage in realistic combat training with other aircraft and against adversary aircraft. To achieve this type of training, a base must offer an organizational structure and mission, as well as access to airspace and other interrelated training assets, that promote interaction of the F-22 with a variety of other aircraft through major exercises.

2.1.4 Identification of Basing Location for F-22 FDE Program and WS

To meet the specific and unique requirements of the F-22 FDE program and WS, a location must satisfy the overall considerations as well as fulfill each basing criteria. Only one location, Nellis AFB and the associated NRC, best meets these requirements.

APPLYING OVERALL CONSIDERATIONS TO NELLIS AFB: Nellis AFB and its associated ranges and airspace (i.e., NRC) meet the overall considerations important to basing the F-22 FDE program and WS, as outlined in section 2.1.1.

1. *Integrated Battlespace Environment for Testing and Training.* The NRC offers one of the best sets of facilities, ranges, infrastructure, and airspace to provide an integrated battlespace environment.

2. *Interaction of the F-22 FDE Program and WS.* Nellis AFB offers the unique opportunity for interaction between the F-22 FDE program and WS. The Air Force needs to test and evaluate the operational characteristics of the F-22 aircraft through the FDE program. The WS staff need to incorporate the results of tactics developed through test and evaluation into the WS curriculum so that state-of-the-art tactics and techniques can be taught to the pilots from operational F-22 squadrons located throughout the world. F-22 tactics developed by the WS would be used in a wide range of simulated combat conditions by the FDE program. As threats change through time, tactics would require consistent re-evaluation and refinement by the FDE and WS staff. Co-locating the FDE program and WS on the same facility would create a continuous tactics improvement cycle. Nellis AFB has been and remains the Air Force's only location for both the fighter aircraft FDE program and WS. This personnel interaction between the FDE program and the WS at Nellis AFB has existed for many years and currently exists for other aircraft (e.g., F-16s, F-15s). This interaction, or synergy, has proven invaluable to developing the full combat potential of the aircraft and the aircrews.

3. *Maximum Use of Existing Infrastructure.* Basing the F-22 FDE program and WS at Nellis AFB would require minimal changes to its infrastructure. To accommodate the specific requirements of these programs, no changes would need to occur in Nellis AFB's organization, its associated ranges or airspace, security measures, range instrumentation and threat simulators, or major force exercises. Only minor construction and facility upgrades on-base would be needed. The F-22 FDE program and WS could be directly integrated into the long-established testing and training activities that form part of the daily routine for the base.

APPLYING BASING CRITERIA TO NELLIS AFB: The basing criteria, as well as the flying and mission considerations listed in section 2.1.2, are addressed below.

1. *ACC Major Range and Test Facility Base.* As an ACC base with Major Range and Test Facility Base components, NRC, and the 422nd Test and Evaluation Squadron, Nellis AFB meets this criterion. There already exists a Test and Evaluation Squadron and Weapons School at Nellis AFB to receive the F-22s and incorporate them into their missions without duplication of personnel and resources.

2. *Runway Length.* Nellis AFB includes two runways, each measuring longer than 10,000 feet and exceeding the 8,000-foot criterion for the F-22 FDE program and WS.

3. *Ramp Space.* Nellis AFB can accommodate over 150 aircraft on its ramps at the same time. No additional ramp space would be needed for the F-22 beddown.

4. *Security Restrictions.* Nellis AFB offers standard, high-level Air Force security, particularly along the flightline and ramp areas. No unauthorized individuals may enter

the base, and security forces guard all entry points and the base boundary. Nellis Air Force Range (NAFR), as part of the NRC, offers more than 3 million acres of land restricted from public entry and patrolled by security forces.

5. *Airspace*. Airspace comprising the NRC lies within 20 NM of Nellis AFB. It includes MOAs and restricted areas that cover approximately 150 by 80 NM and contiguous airspace that exceeds the 100 by 50 NM criterion. All of this airspace overlies land, with roughly one-half extending from the surface to unlimited altitudes and the other half extending from 100 feet AGL to 60,000 feet MSL (including ATCAA). Range instrumentation and realistic threats underlie this airspace. Approximately 70 percent of the NRC airspace supports supersonic flight, with portions authorized for flights as low as 100 feet AGL (in a restricted area only) and 60,000 feet MSL or higher. With these attributes, the NRC airspace associated with Nellis AFB meets the specific criteria for basing the F-22 FDE program and WS.

6. *Ordnance Use and Ranges*. NAFR, managed and operated by Nellis AFB, meets this basing criterion. It includes more than 1,300 targets within 174 target complexes. A total of 73 target complexes permit ordnance delivery with live (explosive) weapons ranging from 20 mm cannon rounds to 2,000-pound bombs. Targets within NAFR also permit use of training ordnance. Almost every type of conventional (i.e., non-nuclear) air-to-ground ordnance is authorized for use on NAFR. Live fire of air-to-air munitions is not conducted at Nellis AFB. The subranges and target complexes within NAFR provide monitoring and scoring instrumentation for ordnance delivery.

7. *Range Instrumentation System*. NAFR provides extensive live monitoring, recording, and tracking instrumentation to support testing and training. The Range Control Center at Nellis AFB can track and monitor a single aircraft's entire mission or a multi-aircraft exercise (up to 100 aircraft simultaneously). The range instrumentation system available at Nellis AFB provides coverage for the NRC airspace. For these reasons, it meets this basing criterion.

8. *Realistic Threats*. NAFR offers realism and simulated threats required to meet the basing criteria for the F-22 FDE program and WS. NAFR includes multiple electronic threat simulators and communications jamming equipment that defend 174 target complexes containing more than 1,300 simulated targets. These established electronic threats are used to train and test aircrews and weapon systems in a realistic battlespace environment. These threats simulate the full range of anticipated enemy air defenses, including radar units for target acquisition, surface-to-air missiles, and anti-aircraft artillery. This substantial array of equipment provides realistic threats for both testing and training operations.

9. *Training Exercises*. Nellis AFB, along with the NRC, represents the Air Force's premier location to conduct complex, multi-aircraft combat training exercises. Nellis AFB conducts Red Flag and Green Flag large-force exercises every year, as well as numerous other exercises. Red and Green Flag are special large-force training exercises that realistically simulate aircrew deployment, actual battlefield combat, and the intense

tempo of air warfare. The FDE program and WS would also participate in these exercises. In terms of the F-22 programs, participating in these Nellis AFB programs would fulfill the basing requirement defined above.

2.1.5 Alternatives Considered But Not Carried Forward

In compliance with NEPA and Air Force Instruction (AFI) 32-7061, which implements the NEPA process, the Air Force must consider reasonable alternatives to the Proposed Action. Only those alternatives determined as reasonably able to fulfill the need for a proposed action warrant detailed analysis. The following presents the analysis of possible alternatives for basing the F-22 FDE program and WS.

The purpose of the action discussed in this EIS is to implement both the F-22 FDE program and WS. To achieve that purpose, the Air Force must implement the FDE program and WS at a base that meets the specific and unique requirements of each program. Although many bases are capable of accommodating F-22 operational units, the FDE program and WS have requirements different from those needed for the operational units.

OTHER BASES: Of the 61 bases within the Air Force with an active flying mission, only two represent ACC bases with Major Range and Test Facility Base components: Nellis AFB, Nevada, and Holloman AFB, New Mexico. Other bases, such as Edwards AFB in California, have Major Range and Test Facility Base components, but are not under ACC command and control.

Holloman AFB primarily supports operational and training units of F-117, F-4, T-38, and Tornado (German Air Force) aircraft. This base is organized and structured for these operational and training units, not for FDE program and WS. It operates the White Sands Missile Range, Major Range and Test Facility Base components, although it also conducts testing on the nearby White Sands Missile Range. Testing at the White Sands Missile Range emphasizes ground-based engineering, as well as radar, missile, and aircraft testing. While it represents a DoD center of excellence for these capabilities and supports diverse operational units, Holloman AFB does not meet the specific and unique requirements for the F-22 FDE program and WS. At a minimum, it does not meet the considerations and criteria enumerated in section 2.1.1 and 2.1.3 because it lacks the following elements: integrated battlespace environment (consideration 1), existing infrastructure for an FDE program (consideration 3), range instrumentation for tracking and providing feedback to numerous aircraft simultaneously (criterion 7), threat simulation for a realistic battlespace environment (criterion 8), and support for large-force training exercises involving a broad spectrum of aircraft and situations (criterion 9).

Edwards AFB and its Air Force Flight Testing Center serve as the primary location for flight testing new aircraft in their initial or developmental stages. The base offers infrastructure to support many types of test aircraft. Airspace and ranges associated with or near the base provide the assets and instrumentation needed for the specific type of aircraft testing performed at Edwards AFB. Although an important test center for the Air Force, Edwards AFB does not meet the specific and unique requirements for either the F-22 FDE program or the WS. It does not meet the overall consideration presented for these F-22 programs (refer to section 2.1.1), since it

does not offer an integrated battlespace environment. Placement of the F-22 programs at Edwards AFB would require major changes to base and training range infrastructure. Of the nine basing criteria listed in section 2.1.3, Edwards AFB and associated assets fail to meet five. It is not an ACC base (criterion 1), it lacks the range instrumentation (criterion 7) and realistic threat environment (criterion 8) essential to the FDE program and WS, and it offers neither the ranges (criterion 6) nor support for large-force training exercises (criterion 9).

COSTS: It is not possible to exactly quantify the costs to duplicate the existing infrastructure, airspace, and personnel for FDE program and WS at an installation other than Nellis AFB and the NRC. Multiple actions would be needed at Holloman AFB and nearby Army training ranges to duplicate FDE program and WS capabilities existing at Nellis AFB. Similar changes would be needed to alter Edwards AFB to duplicate the capabilities at Nellis AFB. A conservative list of these actions includes enhancing electronic threats and targets; improving range instrumentation with tracking, scoring, and related teaching facilities; adding security and airspace modifications; and providing new or relocated personnel to perform comprehensive FDE program and WS functions. Additional construction would be needed at either Holloman AFB or Edwards AFB. The net result would cost an additional $45 to $80 million to duplicate most FDE program and WS capabilities currently available at Nellis AFB and the NRC.

SPLITTING THE PROGRAMS: Splitting the programs, with FDE at one location and WS at another, would not represent a reasonable alternative. It would eliminate the synergy achieved when both reside at a single base and subsequently increase the costs and resources involved. The changes outlined above would be required at both locations if either program were placed at a location other than Nellis AFB. Holloman AFB would require additional ramp space and new maintenance, support, and operations facilities, costing approximately $80 million in order to support the beddown of the FDE program. Edwards AFB would also require new facilities to support the beddown at a cost of approximately $45 million. This increase in cost and lengthening of the timeline to implement the beddown could delay the entire program, potentially diminishing national defense capabilities.

SUMMARY: Basing the F-22 FDE program or WS at a base other than Nellis AFB would not represent a reasonable alternative. Other bases would need to make extensive changes to their infrastructure, organization, existing programs, and airspace and ranges in order to meet the requirements of the F-22 FDE program and WS. To provide the integrated battlespace environment and level of training exercises important to FDE program and WS, the Air Force would need to make wholesale changes to the ranges and the exercises held there. Such changes would conflict with the overall basing consideration regarding minimizing change by employing existing assets and would:

- require additional time to establish the FDE program and WS, delaying the entire F-22 program and potentially diminishing national defense capabilities;
- increase the costs of implementing the F-22 program substantially; and
- could result in more extensive actions with greater effects on the environment than those potentially occurring from the Proposed Action.

No location or combination of locations other than Nellis AFB would meet the specific requirements for basing the F-22 FDE program and WS. No reasonable action alternative to Nellis AFB exists, since none would fulfill the purpose and need for the proposal.

2.1.6 Alternatives Carried Forward for Analysis

The Air Force and ACC's existing fighter FDE program and WS are currently located at Nellis AFB, so it represents the location of the Proposed Action. Nellis AFB, its ranges, and its airspace already exist and meet both F-22 program needs. Therefore, two alternatives were carried forward for detailed analysis in this EIS: No-Action and the proposed beddown of the F-22 at Nellis AFB. The No-Action Alternative is detailed in section 2.2, and a description of the Proposed Action follows in section 2.3.

2.2 NO-ACTION ALTERNATIVE

Under NEPA, "No-Action" means that the Proposed Action (i.e., F-22 beddown at Nellis AFB) would not take place, and the resulting environmental effects from taking no action would be compared to the effects of permitting the Proposed Action to go forward. Under the No-Action Alternative for this EIS, no F-22 beddown would occur at Nellis AFB, no on-base construction or personnel increases would be implemented, and the FDE program and WS for the F-22 would not use the NRC.

The following sections describe the current activities at Nellis AFB and the NRC. Nellis AFB, its location, infrastructure, operations, and personnel are discussed first; a description of the NRC follows. These descriptions of the current status of Nellis AFB and NRC provide a context for presenting the changes associated with the Proposed Action (section 2.3).

2.2.1 Nellis AFB

Nellis AFB is located in the southeast corner of the state of Nevada, adjacent to the cities of Las Vegas and North Las Vegas in Clark County (refer to Figure 1.1-1). Nellis AFB is the point of departure and return for most of the training and testing activities conducted at the NRC. Nellis AFB provides logistics support for the NRC and for the aircraft and personnel using it. The base is the command, communications, and operations center for units using the NRC.

The base lies five miles northeast of the City of Las Vegas. The unincorporated town of Sunrise Manor and undeveloped portions of Clark County encompass the majority of the base. Covering 11,450 acres, the base contains three major functional areas (Figure 2.2-1). Area I, the main base, is located east of Highway 604. Northeast of the main base lies Area II, and west of Highway 604 is Area III. The areas north, east, and southeast of Nellis AFB are primarily open range and mountains, with urban uses along Highway 604. Directly southwest of the base, commercial and residential land use dominates, although there are some industrial activities.

The mission of Nellis AFB is to provide realistic combat training involving every type of aircraft in the Air Force inventory. It also supports test and evaluation programs and weapons schools for all Air Force fighter aircraft: F-15C/Ds, F-15Es, and F-16s. The organizational structure of

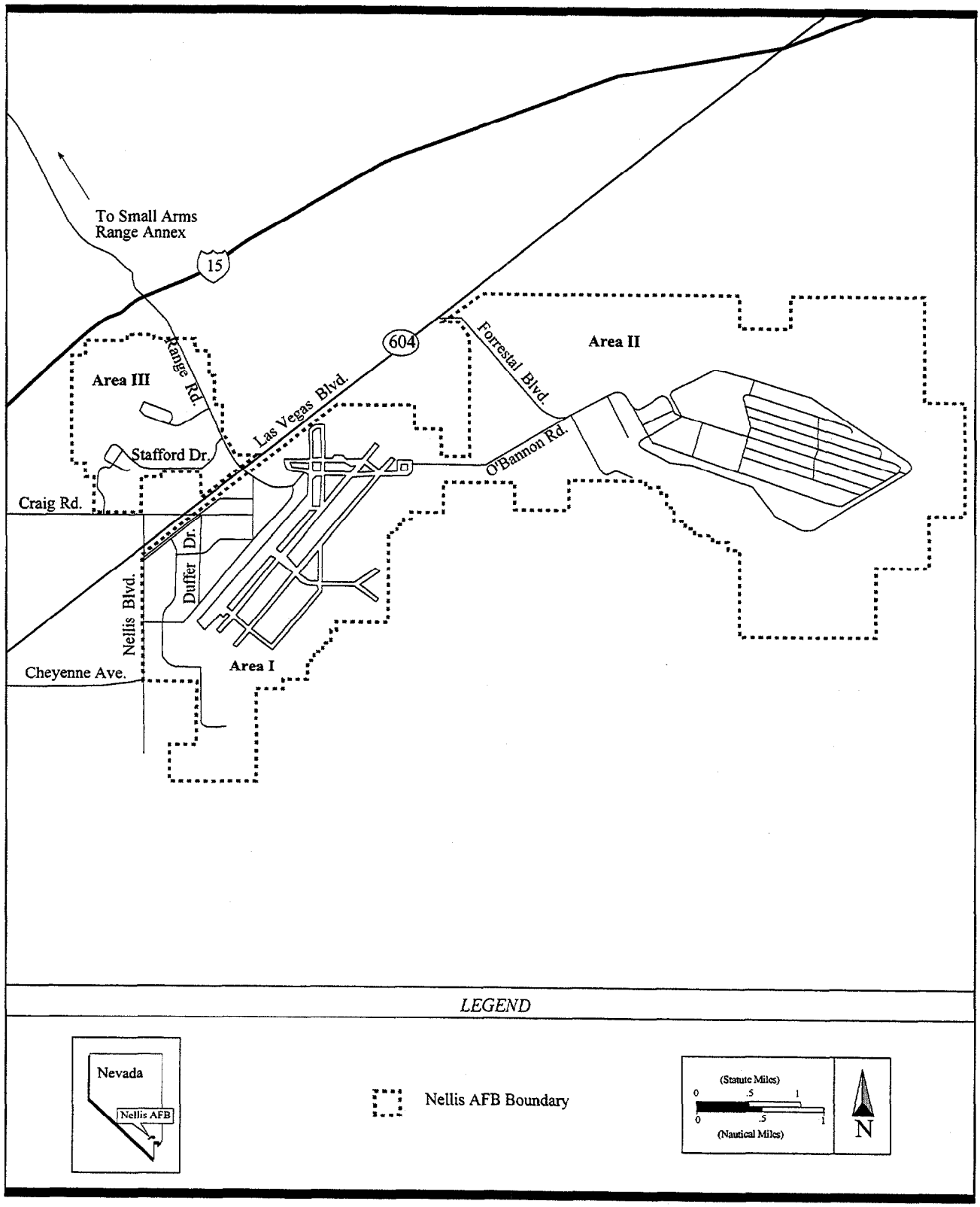

Figure 2.2-1. Nellis AFB

Nellis AFB includes two major wings and several other units. Table 2.2-1 summarizes the major units relevant to the FDE program and WS and their functions.

Table 2.2-1. Nellis AFB Units Relevant to the No-Action Alternative and Proposed Action

Unit	*Relevant Functions*
Air Warfare Center	• Manages advanced pilot training and integrates test and evaluation requirements • Operates, maintains, and develops NAFR • Manages NRC airspace
99th Air Base Wing	• Host wing for Nellis AFB • Oversees all day-to-day operations and functions
57th Wing	• Ensures realistic training in combined air, ground, and electronic threat environment • Oversees Air Force Weapons School
414th Combat Training Squadron	• Conducts large-force exercises involving combat training for multiple "friendly" and "adversary" forces
422nd Test and Evaluation Squadron	• Performs operational test and evaluation of aircraft and equipment • Develops tactics • Operates A-10, F-15C/D, F-15E, and F-16C aircraft
Air Force Weapons School	• Provides an advanced combat training course in weapons and tactics • Trains graduate-level fighter aircrews for all fighter aircraft

In addition to the 422nd Test and Evaluation Squadron, which conducts operational test and evaluation for all Air Force fighter aircraft, and the Air Force Weapons School, which provides graduate level training in weapons and tactics for fighter aircraft, Nellis AFB hosts and conducts large-force exercises in the NRC for U.S. and allied air forces.

The 414th Combat Training Squadron conducts large-force exercises that maximize the combat readiness and survivability of participants by providing a realistic training environment. Red Flag and Green Flag are special multi-week large-force exercises that realistically simulate aircrew deployment and combat situations. Red Flags are complex, full-scale simulated wars, complete with aggressor aircraft using potential adversary tactics. These exercises teach units how to deploy and operate in an integrated manner. In a typical Red Flag exercise, Blue Forces (friendly) engage Red Forces (aggressor) in combat situations. Blue Forces are made up of units from ACC, Air Mobility Command, U.S. Air Forces Europe, Pacific Air Forces, Air National Guard, U.S. Air Force Reserve, Army, Navy, Marine Corps, and allied air forces. They are led by a Blue Forces commander, who orchestrates the deployment plan. Red Forces are composed of Red Flag's Adversary Tactics Division and provide realistic threats through the emulation of

enemy tactics. In a typical year, the Air Force plans five Red Flag exercises at Nellis AFB and the NRC.

Green Flag, the Air Force's premier electronic warfare flying exercise, is held once a year and usually involves about 400 people drawn from allied and U.S. Air Force units from around the world. The event is subdivided into three consecutive two-week programs, with new units involved in each. Green Flag focuses on military intelligence, which is gathered, analyzed, and distributed during the exercise. Each two-week segment is normally commanded by a general officer functioning as a joint force, air component commander and involves air operations and battle planning staffs. Intelligence-gathering aircraft play a key role in these events.

NELLIS AFB ASSIGNED AIRCRAFT AND AIRFIELD OPERATIONS: Under the No-Action Alternative, the number and nature of aircraft assigned to Nellis AFB and the quantity and type of airfield operations would remain unchanged from the baseline conditions described below. Table 2.2-2 lists the aircraft force structure currently stationed at Nellis AFB. Since Nellis AFB supports major force exercises such as Red Flag and Green Flag, more than a dozen types of transient aircraft (visitors not based at Nellis AFB) temporarily operate from the base during exercises. These aircraft range from U.S. B-1B bombers to fighters such as the Mirage 2000 and Tornado, which are operated by U.S. allies. Table 2.2-3 summarizes the principal operational tasks of the major types of aircraft that are stationed at Nellis AFB, use the base as transients, or operate on the NRC. Other aircraft at Nellis AFB are minor transient users and are not listed.

Table 2.2-2. Aircraft Assigned to Nellis AFB

Aircraft Type	HH-60[1]	A-10	F-15C	F-15E	F-16C	Total
Number of Aircraft	15	18	26	17	52	128

1. Helicopter

The Nellis AFB airfield airspace environment is included in Class B airspace that the Federal Aviation Administration (FAA) designates around the nation's busiest airports. Designed for air traffic operating under instrument flight rules, Class B airspace for Nellis AFB extends around Nellis AFB and Las Vegas' McCarran Airport (Figure 2.2-2). Class B airspace requires that all aircraft operating within the area be in contact with the air traffic control facility. Stealth aircraft use a transponder to transmit locations to air traffic controllers. Figure 2.2-2 also shows aircraft departure and arrival routes in the immediate vicinity of Nellis AFB for the parallel runways serving the base. These runways extend northeast-southwest.

Throughout this document, three terms are used to describe aircraft activities: *sortie, airfield operation,* and *sortie-operation.* Each has a distinct meaning and commonly applies to a specific set of activities in particular airspace units. A *sortie* consists of a single military aircraft from takeoff through landing. For this DEIS, the term sortie is commonly used to summarize an amount of flight activity from Nellis AFB. In contrast, an *airfield operation* represents the single movement or individual portion of a flight in the base airfield airspace environment, such as one takeoff, one landing, or one transit of the airport traffic area. A single sortie generates at least

Table 2.2-3. Major Types of Aircraft Operating at Nellis AFB and in the Nellis Range Complex

Aircraft Type	*Status*	*Description*
A-10 and OA-10 Thunderbolt II	B/T	Low-altitude, heavily protected aircraft designed to defeat armored vehicles and act as forward air controller
AV-8B Harrier	T	Close support attack aircraft used by the Marine Corps; has short takeoff and vertical landing capabilities
B-1B Lancer	T	Long-range, high- low-altitude bomber performing deep interdiction strikes
B-2 Spirit	T	Long-range, high- low-altitude bomber performing deep interdiction strikes with stealth technology
B-52H Stratofortress	T	Long-range, high- low-altitude bomber performing deep interdiction strikes.
C-130 Hercules	T	Four engine turboprop transport
C-17A Globemaster	T	Long-range, heavy lift cargo transport
E-3 Sentry	T	Airborne Warning and Control System (AWACS) capable of high- or low-level surveillance of air vehicles over all types of terrain
E-8C Joint STARS	T	Multi-engine aircraft modified with a side-looking radar for ground surveillance, targeting, and battle management missions
EA-6B Prowler	T	Navy all-weather, electronic warfare aircraft capable of detecting, locating, jamming, and destroying enemy air defense radar; now employed by the Air Force to replace the EF-111
F/A-18C/D Hornet	T	Navy, Marine, and Canadian Air Force twin-engine, multi-mission tactical air-to-air and air-to-ground fighter aircraft
F-4 Phantom	T	Multi-role fighter for air-to-air combat and close support interdiction missions
F-14 Tomcat	T	Navy long-range, swing-wing fighter specializing in air-to-air combat and interdiction strikes
F-15C Eagle	B/T	Performs air-to-air combat and air intercept operations. No surface attack missions
F-15E Strike Eagle	B/T	Air-to-ground fighter performing air strike missions
F-16C/D Fighting Falcon	B/T	Multi-role fighter performing close air support, air-to-air combat, interdiction strikes, and suppression of enemy air defenses
F-117A Night Hawk	T	Light bomber with stealth technology
HH-60G Pave Hawk	B	Combat search and rescue helicopter designed for long-range, rapid-response missions
KC-135R, KC-10A	T	High-altitude air refueling aircraft to support varied aircraft missions
Mirage 2000	T	High performance delta-winged fighter-bomber used by foreign air forces
Unmanned Aerial Vehicles	B*	Unmanned aerospace vehicles providing long endurance, unmanned aerial reconnaissance, surveillance, and target acquisition
RC-135 Rivet Joint	T	Surveillance aircraft equipped with sophisticated intelligence-gathering devices for monitoring enemy electronic activity
C-141 Starlifter	T	Transport aircraft for supplies, equipment, and troops
Tornado	T	Supersonic swing-wing interceptor, attack, and reconnaissance aircraft used by air forces of the United Kingdom, Italy, Germany, and Saudi Arabia

Notes: B = Based, T = Transient for exercises, B*= Based at Indian Springs Air Force Auxiliary Field and operated only in NAFR

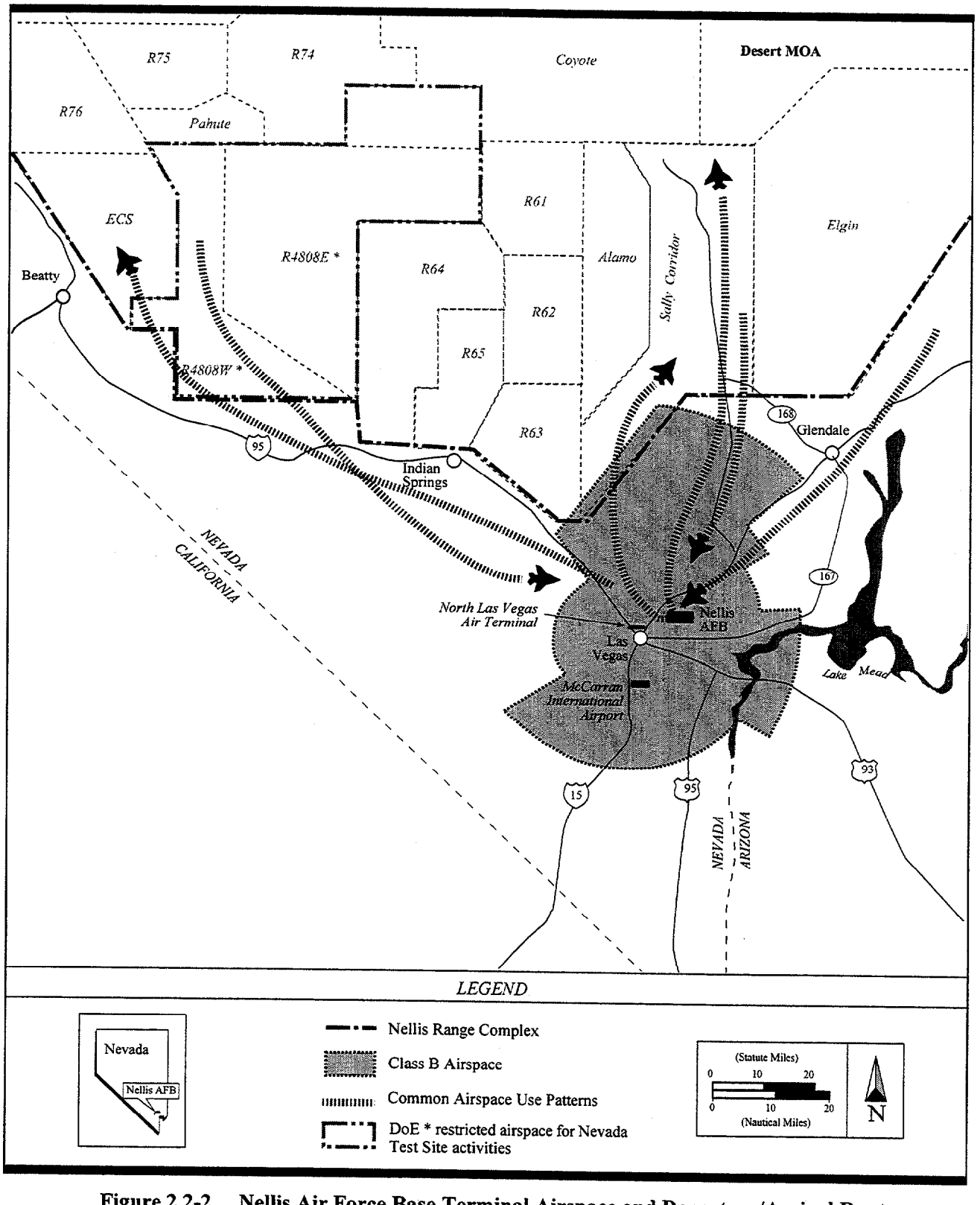

Figure 2.2-2. Nellis Air Force Base Terminal Airspace and Departure/Arrival Routes

two airfield operations (takeoff and landing), and a sortie can result in more than one *sortie-operation*. A sortie-operation is defined as the use of one airspace unit (e.g., MOA, Restricted Area) by one aircraft. Sortie-operation applies to flight activities outside the airfield airspaceenvironment. Each time a single aircraft conducting a sortie flies in a different airspace unit, one sortie-operation is counted for that unit.

Annual airfield operations at Nellis AFB since 1987 (Air Force 1997f) have varied between 61,000 and 181,000. This variation has resulted from budget constraints, aircraft realignments, and changes in the number, composition, and duration of the exercises conducted at Nellis AFB. Table 2.2-4 presents the annual airfield operations and annual sorties at Nellis AFB for 1997 by aircraft type and according to day or night operations. In 1997, airfield operations totaled about 68,000, and this total is representative of airfield use in recent years.

Table 2.2-4. 1997 Annual Airfield Operations and Sorties at Nellis AFB

Aircraft Type	*Annual Airfield Operations*		*Annual Sorties*
AIRCRAFT BASED AT NELLIS AFB	Day (7:00 AM – 10:00 PM)	Night (10:00 PM – 7:00 AM)	
A-10	4,558	81	2,319
F-15	10,938	1,344	6,141
F-16	20,420	2,876	11,648
HH-60	3,892	65	1,978
TRANSIENT AIRCRAFT	22,958	624	11,791
TOTAL	62,766	4,990	33,877

In 1997, sorties for aircraft based at Nellis AFB, including those for A-10s, F-16s, F-15s, and HH-60 helicopters, totaled roughly 22,000, with approximately 12,000 additional sorties conducted by transient aircraft.

FACILITIES AND INFRASTRUCTURE: Nellis AFB includes a well-developed infrastructure supporting a broad spectrum of functions and organizations. Covering 11,450 acres, the base consists of three functional areas (see Figure 2.2-1). Area I, the main base, occupies about 3,450 acres and contains runways, flightline, industrial facilities, housing, and administrative and support facilities. This main area contains over 2,000 buildings, including more than 1,200 family housing units, dormitories, and billeting facilities. Area II (approximately 6,800 acres) includes primarily weapons storage and a small housing area and recreational facilities, whereas Area III (about 1,200 acres) supports housing, recreational facilities, and some light industrial areas interspersed with open space. Under the No-Action Alternative, no change to the existing infrastructure would occur.

PERSONNEL: No additions of personnel would occur under the No-Action Alternative. Estimated personnel levels at Nellis AFB would remain unchanged from the present, as shown in Table 2.2-5.

Table 2.2-5. Nellis AFB Personnel			
	Military	*Civilian*	*Total*
Nellis Personnel	6,400	2,600	9,000
Source: Estimated from Air Force 1996d			

2.2.2 Nellis Range Complex

The NRC (Figure 2.2-3) refers to the NAFR and its associated airspace, as well as military training airspace adjacent to NAFR. The airspace overlying these two areas covers approximately 12,000 square NM. Two airfields, Indian Springs Air Force Auxiliary Field and Tonopah Test Range Airfield, lie within NAFR and support the activities performed within the complex. Under the No-Action Alternative, no change would occur to the size, structure, or management of the NAFR or the airspace associated with the NRC.

NELLIS AIR FORCE RANGE: NAFR was established by Executive Order in 1940 as the Las Vegas Bombing and Gunnery Range. From 1942 until 1959, the range operated under numerous Executive Orders and Public Land Orders. In 1959, operating authority was established in compliance with the Engle Act (Public Law 87-310). During the 1960s, 1970s, and 1980s, Air Force requirements to test advanced weapons and tactics necessitated increased security for the range. Redesignated the Nellis Air Force Range, the range extended its exclusive military use with enactment of Public Law 99-606, the Military Land Withdrawal Act of 1986. Unless renewed, this withdrawal or exclusive-use authorization terminates in 2001. A Final Legislative EIS (Air Force 1999) has been prepared to address the renewal of the withdrawal; it was released in March 1999.

NAFR presents a unique national asset that provides opportunities for testing weapons systems and providing the highest level of training available for military personnel. It is the only location in the U.S. where both individual and large-force training is provided in highly sophisticated exercises that equate to full-scale battlefield scenarios. This training tests tactics, equipment, and personnel. NAFR also supports specialized test and evaluation activities for aircraft, weapons, and reconnaissance systems. NAFR testing and training facilities include realistic threats, operational space, topographic complexity, security, and public safety buffers.

NAFR consists of two main functional areas, the North Range and South Range, both of which accommodate the delivery of live and inert ordnance as well as electronic combat operations (Figure 2.2-4). In total, NAFR covers about 3.1 million acres. Figure 2.2-5 depicts target and electronic threat sites on the North Range and South Range.

The North Range comprises approximately 1.9 million acres of withdrawn land. This includes land withdrawn for exclusive military use by Public Law 99-606 and its amendment (Public Land Order 100-338) of June 17, 1988, which added approximately 89,000 acres to the North Range. An additional withdrawal of 3,972 acres of the Safety and Security Buffer (Public Land

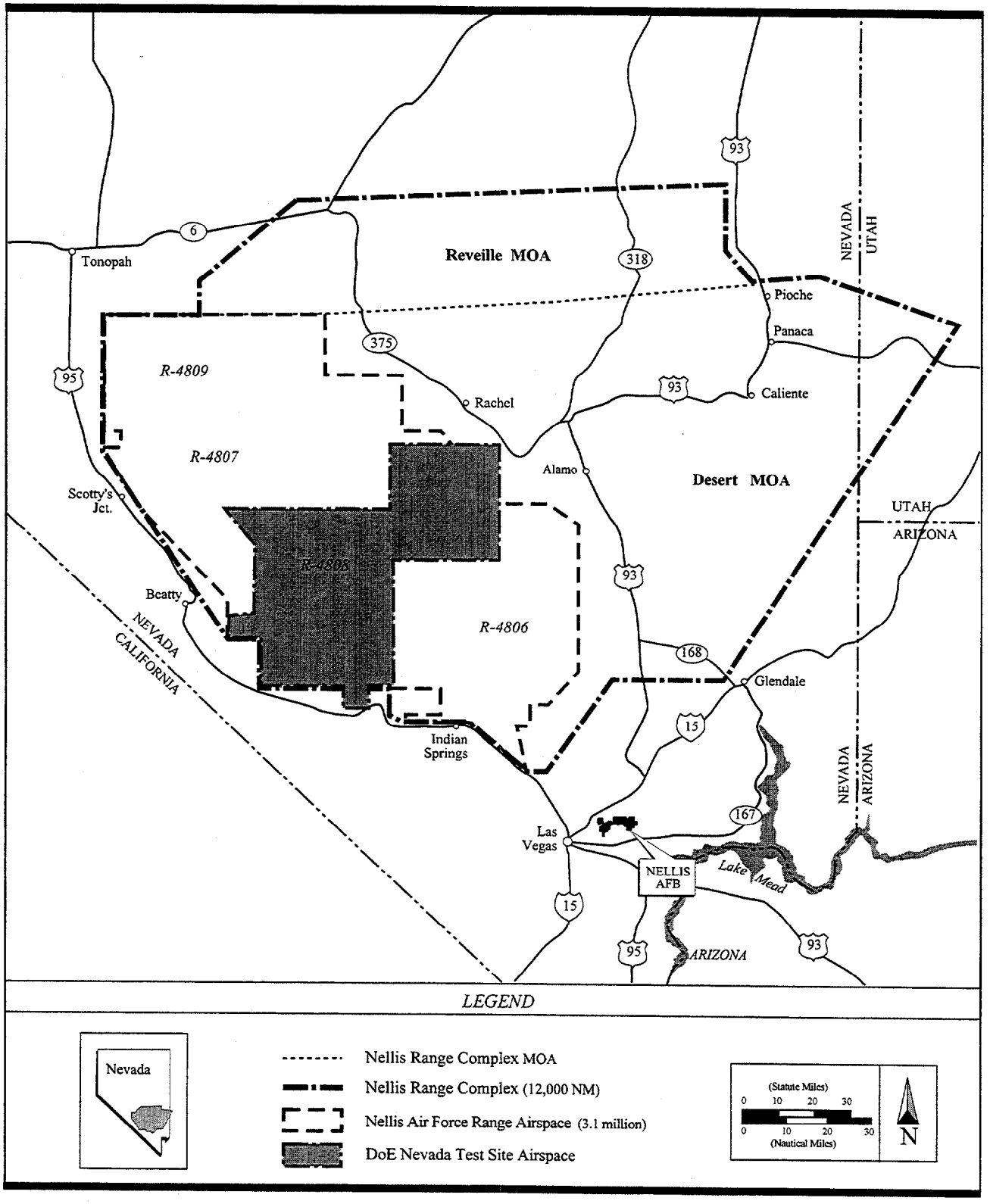

Figure 2.2-3. Nellis Range Complex Airspace

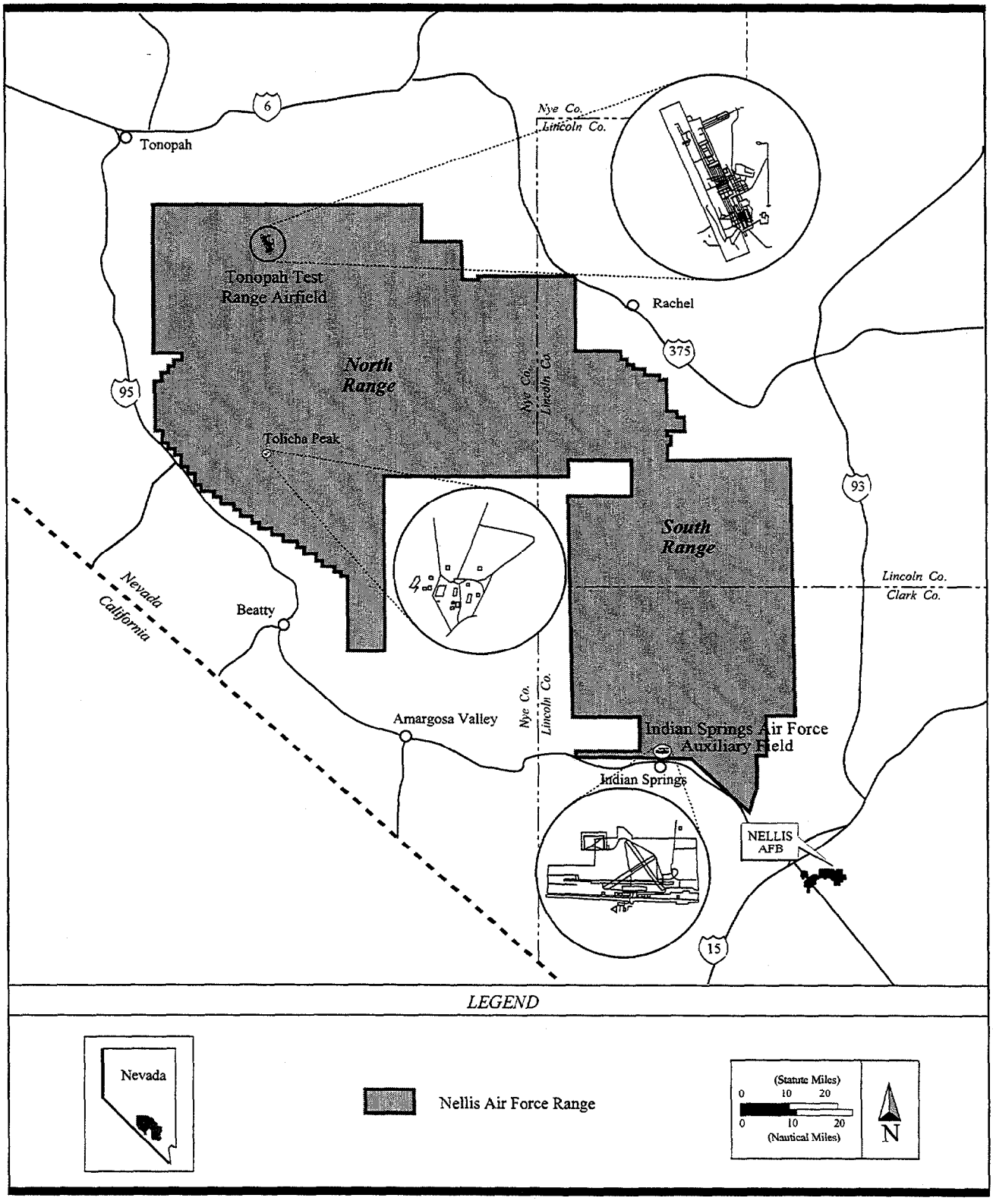

Figure 2.2-4. Nellis Air Force Range, North and South Ranges

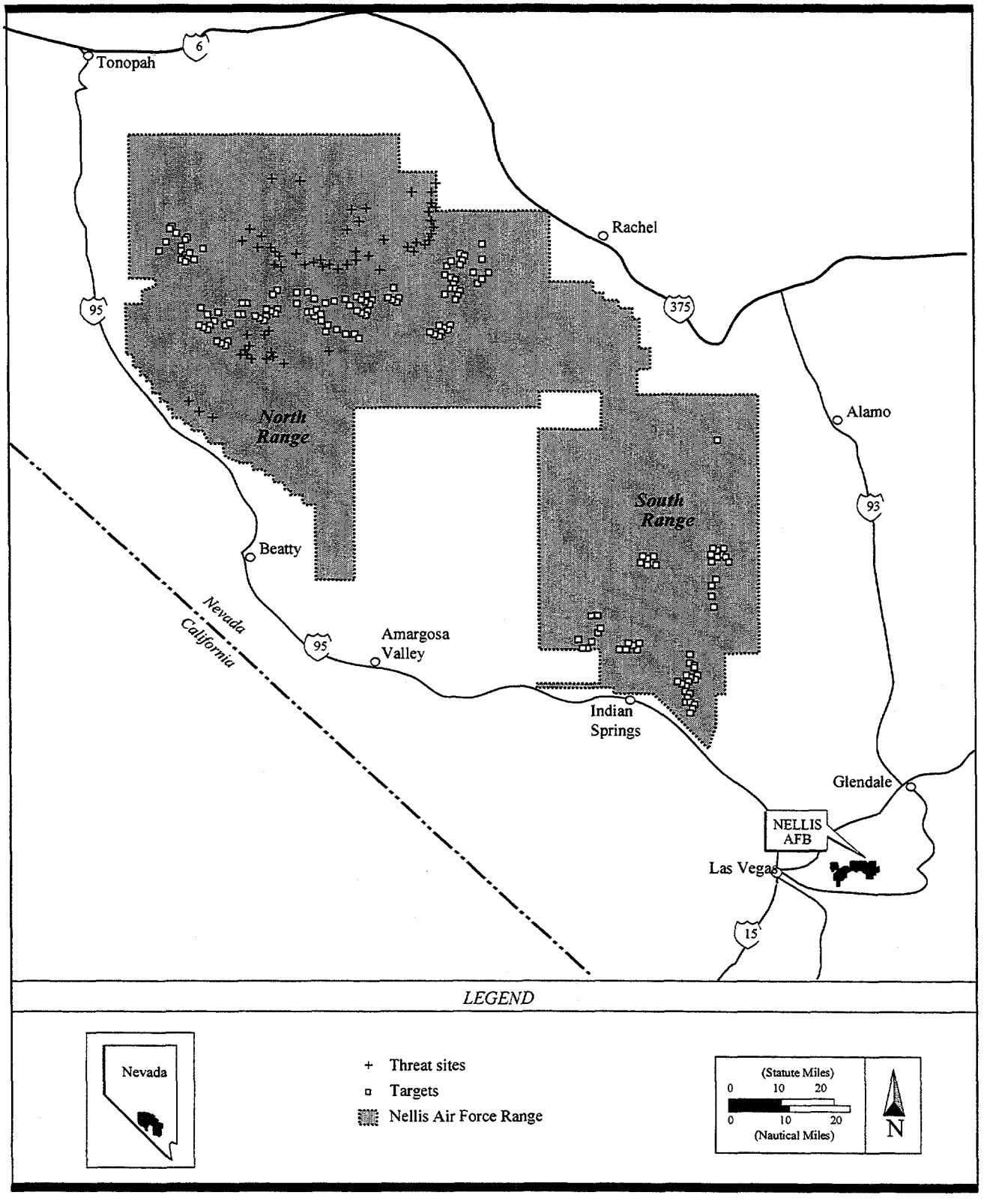

Figure 2.2-5. Nellis Air Force Ranges, Targets, and Electronic Threat Sites

Order 7131) along the eastern edge of the range was completed in 1993. The North Range also includes Pahute Mesa which is used by the Department of Energy (DoE) through mutual agreement.

The North Range contains four unmanned weapons delivery subranges. It also includes multiple and dispersed facilities supporting three Electronic Combat Ranges: Tonopah Electronic Combat Range, Tolicha Peak Electronic Combat Range, and Electronic Combat South Range. These ranges provide a range of high-to-low electronic threat environments.

The South Range comprises approximately 1.2 million acres of withdrawn land located in the southeastern portion of NAFR. Most of the South Range lands were withdrawn for exclusive military use by Public Law 99-606. The South Range contains five weapons delivery areas consisting of two manned subranges and three unmanned subranges. The area also contains three air-to-air subranges.

The South Range overlaps a portion of the Desert National Wildlife Range, which was established in 1936 for the protection and preservation of desert bighorn sheep. The Memorandum of Understanding between the Air Force and USFWS regarding this overlap has been updated and amended, with the latest version in 1997, to ensure proper management by the respective agencies.

Overall NAFR currently includes 174 tactical target complexes that offer more than 1,300 simulated targets. A total of 73 target complexes permit live ordnance delivery with weapons ranging from 20 mm cannon rounds to 2,000-pound bombs. To improve target complex realism, targets are enhanced with actual or simulated military assets, including a tank battlefront, truck convoys, airfields, industrial complexes, surface-to-air missile sites, and a railroad complete with marshaling yards and a railroad tunnel. Many of these target complexes are defended by electronic threat simulators. These provide a realistic arena for operational testing of weapons systems, tactics, and combat readiness. Threat simulators are electronically and, in many cases, visually similar to equipment likely to be encountered in actual combat. Radar units simulate early warning, ground control intercept, target acquisition, and surface-to-air and anti-aircraft artillery defenses and guidance.

NAFR ground equipment includes radar and communications jamming equipment designed to test and improve the quality of aircrew combat training. Many of the threat simulators are equipped with instruments to collect data that can be used to evaluate and score surface-to-air engagements.

Extensive monitoring and tracking equipment are deployed throughout the range to support testing and training. Data collected on the range and in the supporting airspace are processed by computers located in the Range Control Center at Nellis AFB. The Range Control Center can track a multi-force engagement (up to 100 aircraft simultaneously) or a single aircraft's entire mission. Several different kinds of two- and three-dimensional graphic displays from varying perspectives are produced for evaluation of performance and rapid feedback for tests and training.

NAFR supports extensive testing and training activities:

1. Air-to-air testing and training involves ground-based instrumentation to measure air combat maneuvering, air-to-air gunnery range for aircraft gun bore sight testing, aircraft and missile targets testing, and dynamic and static infrared targets testing.

2. Air-to-ground test capability includes ground-based command, control, communications, and intelligence evaluation; open-air weapons evaluation; aerial targets evaluation; ground, fixed, and mobile targets evaluation; radio frequency and sensor targets (nondestructive) evaluation; sea targets evaluation; cruise missile flight tests; multi-mode missiles and munitions testing; weapons system dispensing (submunitions) testing and evaluation; aircraft and missile targets usage; and dynamic and static infrared targets usage and testing.

3. Electronic combat testing and training uses ground-based instrumentation such as threat simulators, radar tracking units, and electronic scoring systems; these capabilities predominantly support tactics development and integration testing.

NAFR supports realistic training by permitting the use of ground ordnance, both live and inert. Aircrews must be skilled in the use of the full range of conventional Air Force weapons, from unguided ordnance to laser-guided bombs to air-to-ground missiles. NAFR provides for safe training, testing, and evaluation of weapons systems in support of potential technological improvements in hardware, software, tactics, and training. Testing capabilities for weapons systems and live ordnance are prime purposes of the exclusive military use of large land areas. Ordnance testing, particularly of rocket-propelled live ordnance, requires control of all land within range of the ordnance for safety and security.

In recent years, the amount of ordnance used annually on NAFR has varied, with a high of 4,500 tons and a low of 3,000 tons. Inert ordnance represents slightly more than 50 percent of the ordnance expended on the NAFR. Nuclear, chemical, or biological weapons are not used on the range. Use of ordnance is not directly linked to the number of sortie-operations flown in the NRC. Therefore, the amount of ordnance tends to vary year-to-year and would continue to do so under the No-Action Alternative.

The Air Force can currently support use of an extensive inventory of conventional live and inert training ordnance on NAFR. These include a wide range of air-to-ground weapons: so-called "iron" (unguided) bombs; guided bombs and air-to-ground missiles; cluster bombs; rockets; cannon; and soon, a new generation of guided bombs and air-to-ground missiles, some of which contain packages of guided submunitions.

Training ordnance includes no high explosives and commonly consists of a small steel projectile or steel-encased concrete projectile. Constructed to function like actual munitions, inert ordnance ranges in weight from about 10 pounds to 2,000 pounds. Some inert ordnance contains a small spotting charge that generates a puff of smoke to aid in scoring weapons delivery. Live ordnance, as the designation indicates, includes high explosive charges. Live ordnance used in training and testing at NAFR is identical to that used in actual combat. Live ordnance ranges from cluster bomb units to general purpose bombs weighing 2,000 pounds and containing almost 1,200 pounds of TNT-equivalent high explosive. Air-to-ground missiles, such as the AGM-65 Maverick (300-pound explosive warhead) and 2.75-inch rockets are also used on authorized

targets at the NAFR. While air-to-air missile training occurs at the range, safety rules require the missiles remain fixed to the aircraft. No actual launching of air-to-air missiles is permitted over NAFR.

Air Force control of NAFR enables flight and ground operations to train and test equipment for the defense of national security interests while minimizing risks to the public. Public protection is ensured at NAFR by excluding the public and non-required military personnel from locations simulating an active, high-stress battlefield environment. The Air Force uses Operational Risk Management for making decisions that promote safe operations. These management procedures produce standards to protect the public, military personnel, and equipment from ordnance impacts.

All firing or release of weapons must be conducted in a manner that ensures impact within the hazard area. For air-to-ground missiles and free-fall guided weapons, the land area and airspace must be large enough to contain the entire flight envelope of the weapon from launch/release to impact. Weapons safety buffers are developed for all aircraft, weapons, and delivery systems employed in training and testing. Safety buffers for all weapons encompass the target area and several miles on either side of the target. As the largest exclusive-use, land-based range in the continental U.S., NAFR can accommodate existing and projected future safety buffers.

Training on NAFR includes realistic threats, so electronic threat emitters are deployed throughout the range. The majority of these threat systems are mobile. Exclusive-use land that extends to the limit of the equipment hazard is required. Some of these systems pose hazards to personnel, who are directed to maintain a safe distance from operating systems. Ground-launched simulated threats, such as simulated Smokey surface-to-air missiles, also present a falling-object hazard and require exclusive-use land to ensure public safety.

Isolation of hazardous materials and dangerous operations from the public and untrained military personnel provides the greatest safety margin. Each weapon system is evaluated for hazards associated with operations, maintenance, and military capability. Operational rules, regulations, and practices minimize the chance of personnel injuries.

NELLIS RANGE COMPLEX AIRSPACE AND AIRSPACE USE: The NRC includes special-use airspace that overlies NAFR withdrawn lands and the adjacent supporting MOA airspace as shown in Figure 2.2-6 and listed in Table 2.2-6. Training activities within the NRC predominantly involve subsonic flight. The restricted areas comprise special use airspace within which the FAA has determined that potentially hazardous activities occur, including air-to-ground ordnance delivery. Nonparticipating military and civil aircraft are precluded from flying within the airspace when the restricted areas are in use. For purposes of scheduling airspace use and tracking sortie-operations, Nellis AFB has subdivided all NRC and DoE special use airspace into areas that are more closely aligned with airspace uses associated with the different target areas, electronic combat ranges, and other support facilities.

Under the No-Action Alternative, the structure, function, and use of the NRC would not change. Variation in the amount of use is likely to occur, but it would remain within the range of variability noted over the past decade or more.

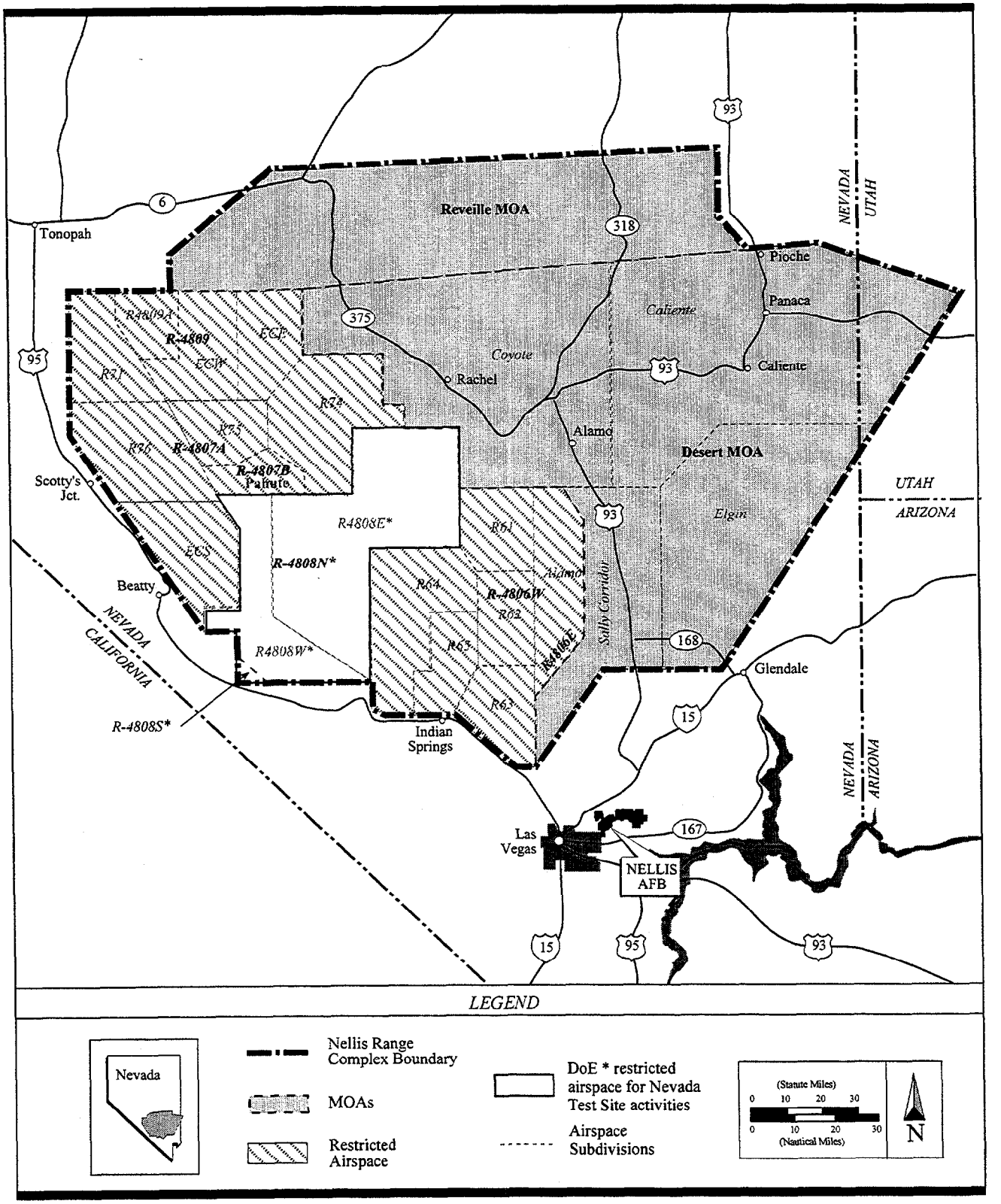

Figure 2.2-6. Nellis Range Complex Airspace Units

Table 2.2-6. Airspace Associated with the Nellis Range Complex

Airspace Unit	*Floor (lower) Altitude*	*Ceiling (upper) Altitude*	*Supersonic Flight Authorized*
Reveille MOA	100 feet AGL	<18,000 feet MSL	Above 5,000 feet AGL
Desert MOA	100 feet AGL	<18,000 feet MSL	Portions above 5,000 feet AGL
Restricted Area R-4806E/W	100 feet AGL	Unlimited	Portions above 5,000 feet AGL
Restricted Area R4807A/B	Surface	Unlimited	Portions above 100 feet AGL Portions above 5,000 feet AGL
Restricted Area R-4809	Surface	Unlimited	Not authorized
Restricted Area R-4808N/S[1]	Surface	Unlimited	Not authorized

1. DoE airspace over the Nevada Test Site (NTS); it is not part of the NRC, but its western portion is used by NRC aircraft to transit to and from the North Range.

The airspace comprising the NRC consists of the Desert and Reveille MOAs, with their overlying ATCAA and restricted areas: R-4806E/W, R-4807A/B, and R-4809, which include multiple subdivisions. Discussions concerning NRC airspace use and sortie-operations throughout this EIS are described in relation to the internal subdivisions (i.e., R-4808E/W). Table 2.2-7 describes each airspace subdivision and its uses as they relate to the NRC operations.

MOAs overlying the NRC include the Reveille and Desert MOAs. Nellis AFB has further subdivided the Desert MOA to enhance scheduling and training opportunities. MOAs consist of special-use airspace that provides substantial vertical and horizontal maneuvering room for military aircraft training and separates that training from other air traffic. MOAs also identify areas where concentrated military aircraft operations may occur. When a MOA is active, the FAA normally routes other air traffic around it, although nonparticipating military and civil aircraft may enter an active MOA by employing see-and-avoid procedures.

ATCAA overlies both MOAs, extending from 18,000 feet MSL to the altitude assigned by the FAA. ATCAA is assigned on an as-needed basis by the FAA to provide additional maneuvering airspace for training. Since federal rulings limit the ceiling of MOAs to altitudes up to, but not including, 18,000 feet MSL, ATCAA is provided on an as-needed basis by the FAA to extend airspace from 18,000 feet MSL to the higher altitudes needed to accommodate the flight training requirements. ATCAAs are only activated for use while scheduled aircraft operations are being conducted within the higher altitudes above the MOAs.

A restricted area is airspace within which flight by non-participating aircraft, while not wholly prohibited, is subject to restriction during scheduled periods when hazardous activities are being performed. With the exception of R-4806E (which begins at 100 feet AGL), all of these restricted areas extend from the surface up for an unlimited distance into the atmosphere. Restricted area R-4806W, R-4807A, and R-4809 overlie portions of the NAFR. Lands under

Table 2.2-7. Nellis Range Complex Airspace and Subdivisions

NRC Special-Use Airspace	*Nellis AFB Designated Subdivision*	*Primary Use*	*Additional Data*
Reveille MOA	None	Air-to-air training	Requires advance scheduling with FAA Salt Lake
Desert MOA	Alamo	Air-to-air training	Reverts to R-4806E for air-to-ground training only
	Elgin	Air-to-air training	Instrumented for air combat
	Caliente	Air-to-air training	
	Coyote	Air-to-air training	
	Sally	NRC entry/exit corridor	
R-4806E	Alamo	Air-to-ground training Air-to-air training	Reverts to Desert MOA Alamo for air-to-air only
R-4806W	R61-65[1]	Air-to-ground training Air-to-air training	Conventional ordnance and gunnery testing/training
R-4807A	R71, R74-76	Air-to-ground and electronic combat threat training Air-to-air training	Targets and combat threat emitters
R-4807B	Pahute Mesa	Overflight	No target or threat facilities
R-4809	R-4809A	Tonopah Test Range Airfield Air-to-air training	NRC emergency airfield and Sandia National Laboratory test activities
	ECW	Electronic combat threat training Air-to-air training	Threat emitters
R-4808N[2]	R-4808E/W	Overflight only	Western portion of R-4808N (R-4808W) used as NRC entry/exit corridor
R-4808S[2]	R-4808W	Overflight only	Part of R-4808W NRC entry/exit corridor; FAA overflights

1. R = Range.
2. Not part of NRC airspace; DoE airspace over the NTS.

R-4806E do not contain any targets. Most of R-4806 E/W are within the DNWR and aircraft normally remain above 2,000 feet AGL. R-4807B is used for overflights of a land area used by the DoE as an annex to the NTS.

Adjacent to the NRC airspace is R-4808N/S, which is controlled by the DoE for Nevada Test Site (NTS) activities. Through agreement with the DoE, NRC aircraft are able to use the western portion of this restricted airspace as a transit corridor between 14,000 and 27,000 feet MSL for entering and exiting the North Range. Nellis AFB has subdivided this restricted airspace into R-4808E/W to internally schedule and track aircraft operations through this airspace. Further internal subdivision of this restricted airspace is being coordinated with DoE to accommodate internal changes in the use and scheduling of these areas. These changes do not affect the purpose for which R-4808N/S was established, nor do they affect surrounding airspace uses.

About 70 percent of NRC airspace is authorized for supersonic flight activities (Figure 2.2-7. Within authorized airspace, supersonic flight activities primarily occur during air-to-air combat and, to a lesser degree, during evasive maneuvers in response to ground threats or adversary aircraft. Not all aircraft using the NRC conduct supersonic flight. For supersonic aircraft, supersonic flight occurs between 3 and 10 percent of the time during air-to-air combat on a typical training flight. The F-15C, the aircraft most similar to the F-22, conducts supersonic flight about 7.5 percent of the time during air-to-air combat.

Military use of the NRC varies from year-to-year, depending on many factors. These factors include congressional funding levels, weapons testing requirements, aircrew training requirements, scheduling conflicts, and the actions of enemies that may pose a threat to the security interests of the U.S. or our allies. Due to these year-to-year variations in use, and the expectation that they will continue, the Air Force conducted a comprehensive review of NRC aircraft sortie-operations (Appendix C). Air Force support of these national priorities has created the establishment of local-use priorities. Large scale test efforts and large-force exercises lead the list of eight to ten priority activities. During both exercise and non-exercise days, NAFR is heavily scheduled by established priority users.

Since the NRC airspace includes several subdivided MOAs, and restricted areas, sorties at the NRC commonly result in multiple sortie-operations, particularly during major exercises. For example, an average F-15C sortie from Nellis AFB uses six different airspace units, and a sortie-operation is counted for each. Figure 2.2-8 shows common patterns of aircraft operations within the NRC. Each of these patterns flies through multiple airspace units, resulting in multiple sortie-operations.

Review of NRC sortie-operations establishes a low-to-high range for annual sortie-operations in order to account for year-to-year variations in use. For a low-use year, a total of 200,000 sortie-operations occur in the NRC airspace. A total of 300,000 sortie-operations represents a high-use year. Table 2.2-8 presents sortie-operations by airspace unit for a low-use and high-use year. Air Force anticipates that sortie-operations in NRC airspace under the No-Action Alternative would continue to range between 200,000 and 300,000 per year in the foreseeable future.

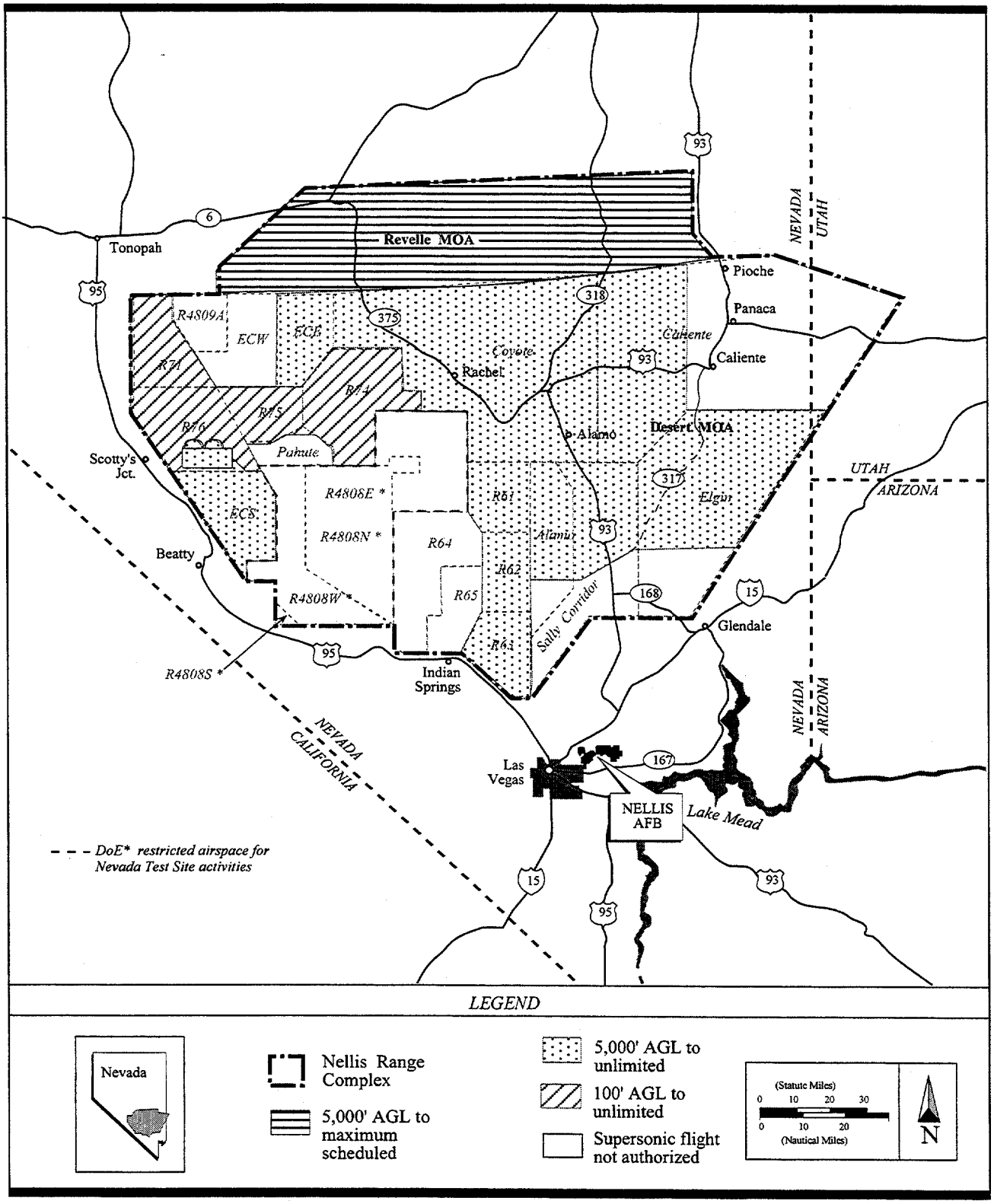

Figure 2.2-7. Supersonic Authorized Areas within the Nellis Range Complex

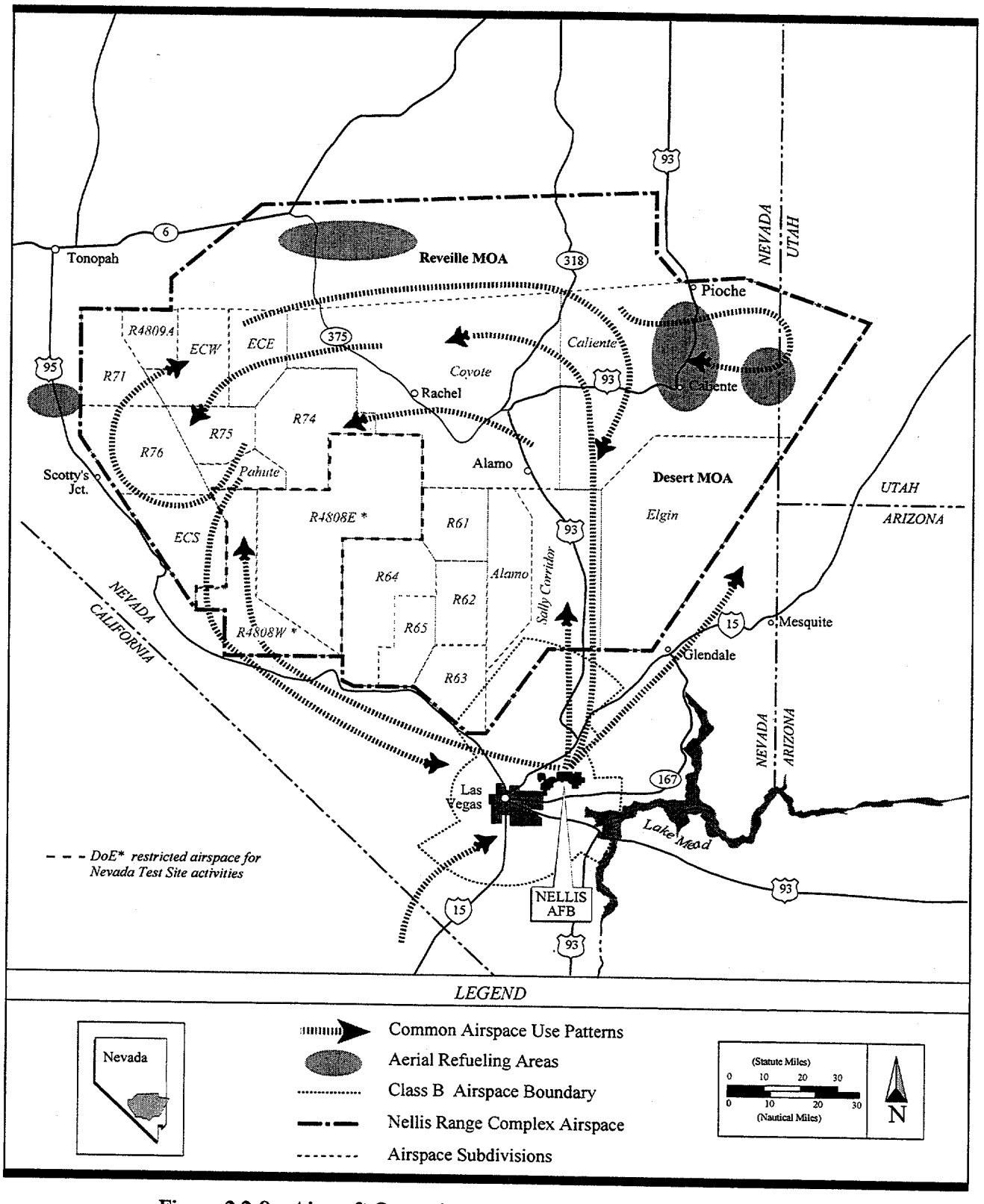

Figure 2.2-8. Aircraft Operations Associated with the Nellis Range Complex

Table 2.2-8. Baseline Sortie-Operations by Airspace Unit			
		LOW USE - 200,000 ANNUAL SORTIE-OPERATIONS	HIGH USE - 300,000 ANNUAL SORTIE-OPERATIONS
Airspace Unit	*Airspace Subdivision*	*Total Baseline Sortie-Operations*	*Total Baseline Sortie-Operations*
Desert MOA			
	Caliente	23,424	35,136
	Coyote	13,947	20,921
	Elgin	12,520	18,779
SUBTOTAL		***49,891***	***74,836***
Reveille MOA		13,746	20,619
SUBTOTAL		***13,746***	***20,619***
R-4806			
	R61	3,173	4,759
	R62	4,578	6,867
	R63	4,800	7,200
	R64	5,823	8,735
	R65	5,907	8,860
	Alamo	3,722	5,583
SUBTOTAL		***28,003***	***42,004***
R-4807			
	Electronic Combat South (ECS)	6,331	9,497
	Pahute Mesa	5,184	7,777
	R71	9,607	14,410
	R74	20,479	30,718
	R75	17,956	26,934
	R76	16,457	24,685
SUBTOTAL		***76,014***	***114,021***
R-4808[1]			
	R-4808W	9,844	14,765
	R-4808E	4,256	6,385
SUBTOTAL		***14,100***	***21,150***
R-4809			
	R-4809	2,518	3,777
	Electronic Combat East (ECE)	7,764	11,646
	Electronic Combat West (ECW)	7,964	11,947
SUBTOTAL		***18,246***	***27,370***
TOTAL		**200,000**	**300,000**
1. DoE airspace overlying NTS; sortie-operations are transit only			

As with ordnance described previously, chaff and flare use in the NRC varies yearly, depending upon the nature of testing and training performed. Chaff use has and would continue to range from approximately 370,000 to 405,000 bundles per year. Flare use would vary from about 60,000 to 95,000 units per year.

Chaff and flares are the principal defensive mechanisms dispensed from military aircraft to avoid detection or attack by adversary air defense systems. A bundle of chaff consists of approximately 0.5 to 3.1 million one-inch long fibers smaller than the size of a hair that reflect radar signals and, when dispensed in sufficient quantities from aircraft, form a "cloud" that breaks the radar signal and temporarily hides the aircraft from radar detection. Flares provide high-temperature heat sources ejected from aircraft that mislead heat-sensitive or heat-seeking targeting systems. Chaff and flares are used to keep aircraft from being targeted by weapons such as surface-to-air missiles, anti-aircraft artillery, and other aircraft. Section 3.4 provides additional details on the composition and attributes of chaff and flares.

Effective use of chaff and flares in combat requires training and frequent use by aircrews to master the timing of deployment and the capabilities of the devices and by ground crews to ensure safe and efficient handling. Flare and chaff deployment throughout the NRC airspace is governed by a series of regulations based on safety and environmental considerations and limitations (see Appendix A). These regulations establish procedures governing the use of flares and chaff over ranges, other government- owned and controlled lands, and nongovernment-owned or controlled areas. ACC has set standard minimum-release altitudes (ACC Supplement to AFI 11-214) for flares over government-owned and controlled ranges and lands (Table 2.2-9). These standards, which vary from 400 to 900 feet AGL according to aircraft type, are designed to allow the flares to burn out completely at least 100 feet AGL. Over nongovernment-controlled lands, flare release is restricted to 2,000 feet AGL and above.

Table 2.2-9. Minimum Flare Release Altitudes

Aircraft Type	*ACC Standard Minimum Altitude (AGL) over Government Land*	*NAFR Minimum Altitude (AGL)*	*NRC MOAs Minimum Altitude (AGL)*
A-10/OA-10	400 feet*	700 feet	5,000 feet
F-4	600 feet	700 feet	5,000 feet
F-15, F-16, F-111, B-1	700 feet	700 feet	5,000 feet
B-52	900 feet	900 feet	5,000 feet

* Depends on flare type
Source: AFI 11-214 ACC1

Flare use in the NRC is regulated according to location of release, altitude of release, and fire risk conditions on the ground. No flares may be dispensed anywhere in the NRC over manned sites and ground parties or within 3 NM of forested areas. During the dry season when the fire code is "extreme," flare use is prohibited. Flares may be used over the numbered and electronic combat

ranges of NAFR and in the MOAs, but altitude minimums are stricter than ACC standards. Minimum-release altitude for NAFR's numbered and electronic combat ranges is 700 feet AGL for all aircraft except B-52s (900 feet AGL). In the MOAs, minimum flare-release altitude is 5,000 feet AGL.

In accordance with Nellis AFB Supplement 1 to AFI 13-212, chaff may be employed in all numbered ranges and MOAs between 300 feet AGL and 10,000 feet AGL, except in Range 63, Range 65, Range 74A, Wilderness Areas, Wilderness Study Areas, National Parks, and populated areas. Chaff use is authorized to 25,000 feet AGL in R-4807, Electronic Combat West, the Coyote subdivision of the Desert MOA, and Reveille MOA/ATCCA, and up to 20,000 feet AGL in the Caliente and Elgin subdivisions of the Desert MOA and R-4806. Additional restrictions may be imposed dependent on weather conditions.

2.3 PROPOSED ACTION

In three phases between fiscal years 2002 and 2008, the Air Force proposes to base 17 F-22 fighter aircraft at Nellis AFB. The aircraft would be assigned to the FDE program and WS at Nellis AFB. Flight activities would occur at Nellis AFB and the NRC. Some sorties (less than 4 percent) would occur at ranges and in airspace away from the NRC. For instance, firing of air-to-air missiles under the FDE program and WS traditionally has been done at places like the range associated with Eglin AFB.

2.3.1 Nellis AFB

PROPOSED BEDDOWN OF THE F-22: The Air Force proposes to establish an F-22 Division of the 422nd Test and Evaluation Squadron and an F-22 Division of the Air Force Weapons School at Nellis AFB. The beddown of 17 F-22s would occur in three phases: six aircraft are scheduled to be assigned to the 422nd TES in FY 2002, two additional F-22s assigned to the 422nd TES in FY 2003, and nine aircraft assigned to the WS in FY 2008. These aircraft would remain at Nellis. AFB into the foreseeable future beyond 2008, since the requirements for the FDE program and WS would remain as long as the Air Force retains the F-22.

Although the F-22 represents the eventual replacement for the F-15C, the specific timing of that transition currently cannot be defined. The Proposed Action and the analysis in this DEIS are based on the assumption that the existing complement of F-15Cs would remain at Nellis AFB even after completion of the F-22 beddown.

The overall inventory of aircraft based at Nellis AFB (refer to Table 2.2-2) would remain unchanged with the exception the added 17 F-22s. The Proposed Action would increase the based aircraft inventory from 128 to 145. Nellis AFB has accommodated more than 150 aircraft in the past.

PROPOSED NELLIS AFB AIRFIELD OPERATIONS: By 2008, the 17 F-22s would conduct approximately 8,900 (8,944 actual) airfield operations annually. Table 2.3-1 presents details regarding the total airfield operations that would occur at the completion of the beddown.

Table 2.3-1. Projected F-22 Airfield Operations at Nellis AFB by 2008

Details of Airfield Operations	*Baseline Nellis AFB Airfield Operations*[1]	*Proposed F-22 Airfield Operations*	*Total With F-22*
Day (7:00 A.M. - 10:00 P.M.)	63,000	8,400	71,400
Night (10:00 P.M. - 7:00 A.M.)	5,000	544	5,544
Per Year (from 2008 on)	68,000	8,944	76,944

1. Based on 1997 Data (refer to Table 2.2-4), Nellis AFB.

Approximately 94 percent of the airfield operations would occur during the day (7:00 A.M. - 10:00 P.M.) as defined for the purposes of environmental analysis. Additional F-22 airfield operations would result in a 13 percent increase in overall day operations at the base and a 11 percent increase in overall night (10:00 P.M. - 7:00 A.M.) operations. The total airfield operations after completion of the F-22 beddown (approximately 76,944 airfield operations) would exceed representative use (68,000 airfield operations) during recent years. However, it would represent roughly 40 percent of the peak total (181,000 airfield operations) for recent past airfield activities at the base.

Existing standard departure and arrival routes would be used by the F-22. Approximately 56 percent of the flying missions would involve a northeastward departure (without afterburner), with the aircraft following existing tracks to the north for entry into the NRC. Approximately 44 percent of the flights would involve a southwestward departure (without afterburner) and follow existing tracks to the north into the NRC.

PROPOSED FACILITIES AND INFRASTRUCTURE CONSTRUCTION AND MODIFICATION: The proposed F-22 beddown would require construction of new facilities, alteration of existing facilities, and demolition of existing facilities. Table 2.3-2 summarizes the construction, alteration, and demolition to support the proposed beddown at Nellis AFB. It also presents the anticipated sequence of infrastructure changes over the period from 2000 through 2006.

Construction would encompass about three acres with an additional acre used for construction activities. Affecting only existing structures and previously disturbed land, these facilities would be primarily completed before the aircraft beddown began to ensure availability of needed support functions for the F-22. The majority of construction, alteration, and demolition actions would occur along the flightline in Area I (Figures 2.3-1 and 2.3-2). The Air Force also anticipates the need to internally alter several miscellaneous facilities along the flightline in Area I.

In Area II, the ammunitions maintenance and storage facilities would be constructed for the JDAMs used by the F-22. These facilities would lie in the northeast portion of Area II, in association with other munitions storage areas. The location would be consistent with safety requirements that specify sufficient separation between munitions facilities and other land uses.

Table 2.3-2 Proposed Construction, Alteration, and Demolition Actions for the F-22 Beddown

Nellis AFB Area	*Actions*	*Building/ Location*	*Size (Square Feet)*	*Fiscal Year*
I	Demolish existing building; construct Maintenance Hangar/Aircraft Maintenance Unit	287	34,970	2000
I	Construct addition to 422nd Squadron Operations Building	878	6,460	2000
I	Construct F-22 parts warehouse	Attach to 290	6,460	2000
I	Modify building to construct Phase One Composites Shop	252	Internal Alterations Only	2000
I	Demolish existing building; construct Phase Two Composites Shop	254	16,140	2000
I	Construct additions to Weapons School Building	282	27,000	2000
I	Construct additions and alterations to existing building for Maintenance Training Facility	586	4,200	2005
I	Alterations to miscellaneous facilities	Unknown	Internal Alterations Only	2000 - 2006
II	Construct Munitions Maintenance and Storage Facility	Northeast Area II	6,458	2002
To Be Determined	Construct 84-person dormitory	To Be Determined	29,820	2005
Total Square Feet/Total Acres			131,508/3.0	

To support the WS program, the Air Force proposes to construct an 84-person dormitory. The location of this dormitory remains to be sited, although it would be consistent with existing land use plans for Nellis AFB. Siting would avoid significant habitat, cultural resources, and areas posing a safety concern.

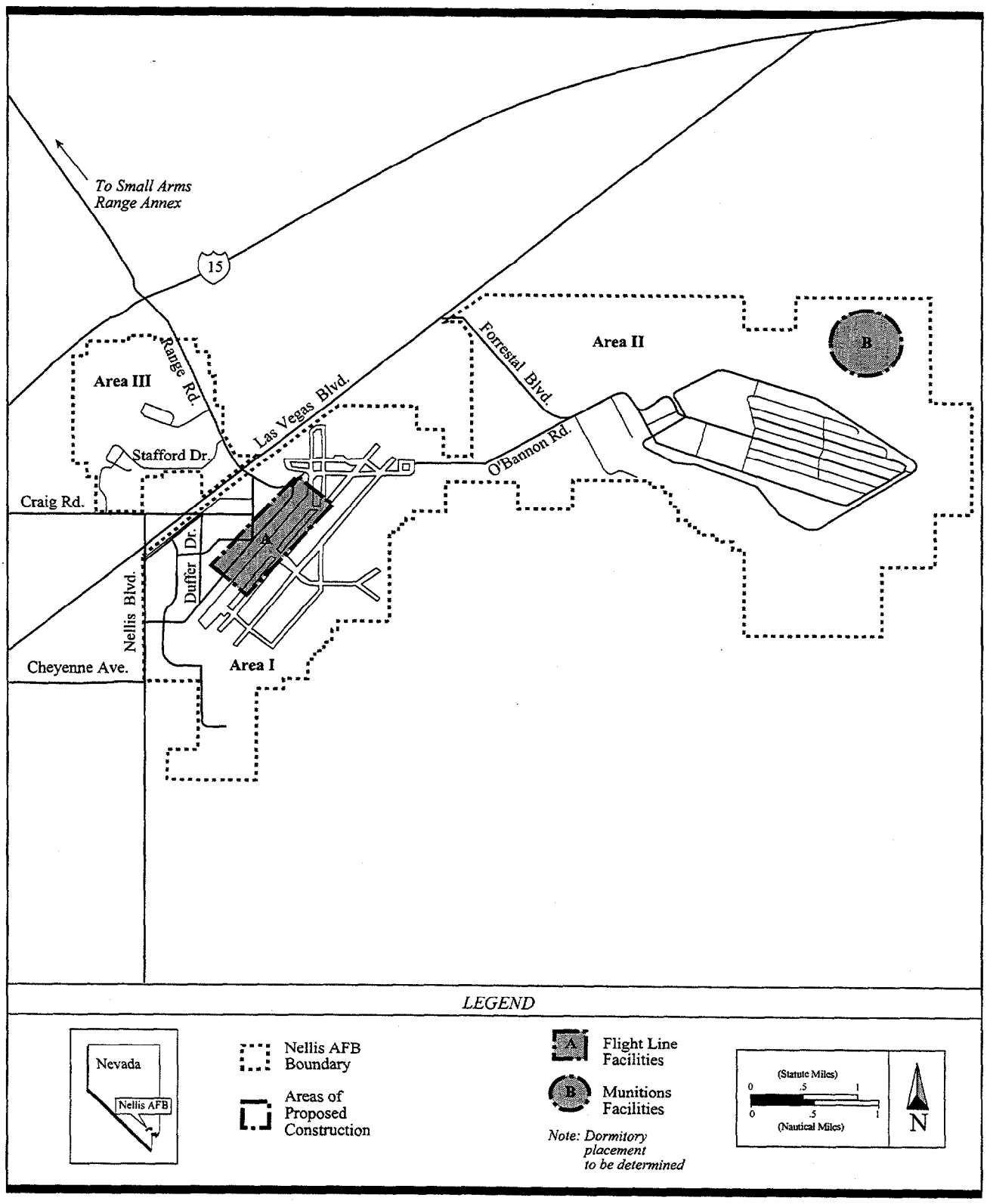

Figure 2.3-1. Nellis AFB and Proposed Construction Areas

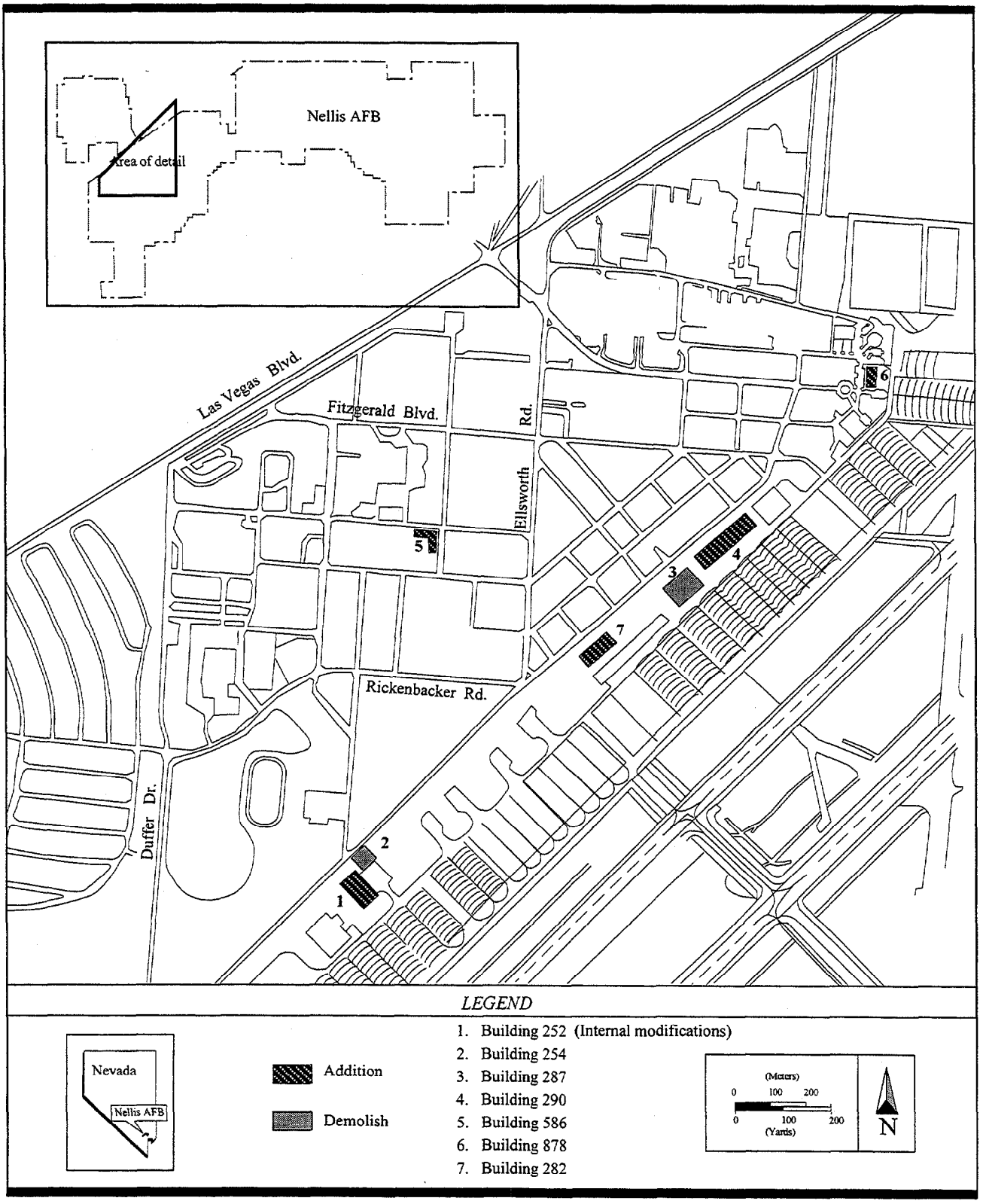

Figure 2.3-2. Nellis AFB Detail of Proposed Construction

PROPOSED PERSONNEL CHANGES: An additional 367 personnel would be added to Nellis AFB in two phases (Table 2.3-3). In 2002, a total of 172 personnel would be added at the base to support the FDE program starting that same year. In 2007, before the start of the WS program, another 195 personnel would be added. These personnel levels would continue throughout the life of the program. The addition of F-22 program personnel would constitute a 4 percent increase in overall base personnel levels.

Table 2.3-3. Projected Nellis AFB Personnel

	Military	*Civilian*	*Total*
Current	6,400	2,600	9,000
F-22 FDE & WS			
2002	169	3	172
2007	191	4	195
TOTAL	6,760	2,607	9,367

2.3.2 Nellis Range Complex

PROPOSED USE OF NELLIS AIR FORCE RANGE: The Proposed Action of the F-22 beddown would not alter the structure, management, or safety procedures at NAFR. Existing instrumentation, currently planned upgrades, and threat emitters would suffice for the F-22 FDE program and WS.

By 2008, the F-22 aircraft in the FDE program and WS would conduct ordnance delivery of any air-to-ground munitions capable of being employed by the F-22. The primary air-to-ground munition carried by the F-22 is expected to be the JDAM. JDAMs consist of 1,000-pound bombs guided to the target by an attached Global Positioning System (GPS) receiver. Once the weapon has been programmed with the target position in GPS coordinates, it can be delivered in any weather. These weapons do not require any laser guidance. For the F-22, most releases of the JDAMs would occur between 20,000 feet and 50,000 feet MSL.

The Mark-82 ordnance used in JDAMs can be inert or live. Roughly 50 percent of the JDAMs used by the F-22s would consist of inert ordnance; the other 50 percent would be live ordnance. All munitions releases would occur on approved targets and ranges within NAFR. Based on the total tonnage of ordnance used on NAFR from 1991 through 1995 (between 3,000 to 4,500 tons per year), use of ordnance by the F-22s would represent a 3 to 5 percent contribution to the total depending on year-to-year variations.

The F-22 would use ordnance within the parameters and restrictions applicable to NAFR. No new safety procedures or restrictions would be needed to accommodate F-22 testing and WS activities at NAFR.

PROPOSED F-22 USE OF THE NELLIS RANGE COMPLEX AIRSPACE: As an eventual replacement for the F-15C aircraft, the F-22 would adopt similar missions and training programs. Therefore, the

Air Force expects that the F-22 FDE program and WS would use the NRC in a manner almost identical to those of the F-15C programs. No changes would occur to the airspace structure or management for the NRC as a result of the Proposed Action. F-22 sortie-operations in the NRC would take place in existing approved airspace.

The nature and duration of F-22 flight activities would be the same under both the FDE program and WS. Although each program focuses on different goals and requires different instrumentation, they provide feedback to each other in order to produce the best available tactics and capabilities (refer to Table 2.1-2, which details the nine primary test and training activities projected for F-22s under the FDE program and WS).

Missions flown by aircraft assigned to either the FDE program or the WS would operate within the general flight parameters discussed previously. FDE F-22 missions would concentrate on testing and evaluating flight maneuvers and tactics to fully develop the combat capability of the aircraft. The WS F-22 flight activities would follow a syllabus of approximately 35 missions over 5.5 months designed to simulate different combat scenarios and teach advanced tactics developed and/or evaluated by the FDE program. Some of the F-22 missions would include aerial refueling with KC-10 or KC-135R tankers, using existing tanker aircraft already operating in the NRC. Existing high-altitude aerial refueling tracks would be used to support F-22 activities.

Using the full, authorized capabilities of the NRC, the F-22 would operate from surface up to 60,000 feet MSL. The F-22 would most often operate at 30,000 feet MSL or higher. Figure 2.3-3, which compares the F-22 flight at altitude with that of the F-15C, demonstrates that the F-22 would operate at higher altitudes during a greater percentage of each flight hour. F-22s would use altitudes below 10,000 feet AGL about 11 percent of the total time in each sortie, with less than 5 percent below 1,000 feet AGL.

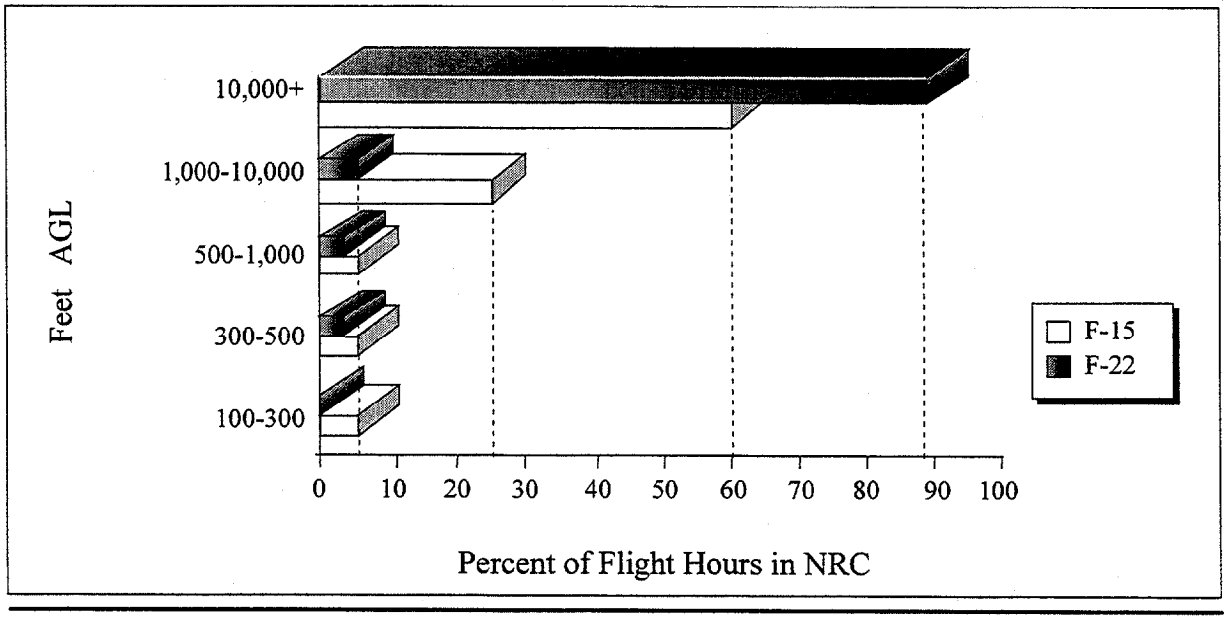

Figure 2.3-3. Percent of F-15 and F-22 Altitude Use Per Flight Hour

To test and train with the full capabilities of the aircraft, the F-22 would employ supersonic flight. All supersonic flight would occur at altitudes and within airspace authorized for such activities. Flight activities leading to supersonic events would commonly involve use of the Elgin and Coyote Subdivisions of the Desert MOA and restricted airspace over R74. Due to the mission of the F-22, the Air Force anticipates that approximately 10 percent of the time spent in air combat maneuvers would involve supersonic flight. In comparison, F-15C aircraft conduct supersonic flight for about 7.5 percent of the time spent in air combat maneuvers. Inclusion of F-22 sortie-operations would raise overall supersonic activity in the NRC by less than 1 percent, most of which is anticipated to occur above 30,000 MSL.

By the 2008 completion of the proposed beddown, the F-22 would fly 4,500 (4,472 actual) annual sorties from Nellis AFB. Of these sorties, 4,300 would be in the NRC for testing and training. The remaining 172 sorties (less than 4 percent) would involve operations at remote ranges and airspace such as those associated with Edwards AFB, Eglin AFB, Hill AFB, and others. These activities would form a minor part of the overall program. Any of these activities not already covered by existing environmental analyses would be assessed in separate environment documentation.

The 4,300 *sorties* in the NRC would represent approximately 25,800 *sortie-operations* in the numerous airspace units encompassed by the NRC (Table 2.3-4). The number and distribution of F-22 sortie-operations derive directly from the use patterns of the FDE program and WS for the F-15C aircraft. F-22 sortie-operations would represent a 13 percent contribution to the total NRC sortie-operations under the low-use (200,000 annual sortie-operations) scenario and a 9 percent contribution under the high-use (300,000 annual sortie-operations) scenario. Total sortie-operations, even with those by the F-22s, would remain between the variation defined by low-use and high-use scenarios.

Although the F-22's stealth features reduce its detectability, it needs to employ chaff and flares as defensive countermeasures. For the FDE program and WS, the F-22s would dispense chaff as part of testing and training. Chaff use would follow all requirements and restrictions currently applicable at the NRC. Under the Proposed Action, F-22s would use 36,000 bundles of chaff per year (in 2008 and after). This amount contributes 9 to 10 percent of the total chaff use for the NRC relative to established variations in annual use levels (i.e., 370,000 to 405,000 bundles of chaff). Annual chaff use would remain within the range for total use (370,000 to 405,000 bundles). Due to the lack of major or numerous surface waters under the NRC, significant quantities of chaff are not expected to accumulate in surface waters or be transported into major surface waters. The extensive area over which the chaff would be dispensed also diminishes this potential. Approximately 60,000 to 95,000 flares are currently dispensed over the NRC annually. Flare use operates under minimum altitude restrictions to ensure safety (refer to section 2.2.2, Table 2.2-9). These minimum altitudes provide sufficient time for complete combustion and consumption of the flares before potential contact with the ground. The altitude restrictions provide a considerable buffer against inadvertent low releases that might result in burning material contacting the ground.

Flare and chaff use for the F-22s would adhere to all Nellis and ACC directives. F-22s are anticipated to use the same types of flares as other fighter aircraft (e.g., F-15) use. As with these

Table 2.3-4. Projected F-22 Sortie-Operations by Airspace Unit

		Low-Use - 200,000 Annual Sortie-Operations			High-Use - 300,000 Annual Sortie Operations		
Airspace Unit	*Airspace Subdivision*	*Projected F-22 Sortie-Operations*	*Total Projected Sortie-Operations*	*F-22 Percent of Total*	*Projected F-22 Sortie-Operations*	*Total Projected Sortie-Operations*	*F-22 Percent of Total*
Desert MOA							
	Caliente	3,559	23,424	15%	3,559	35,136	10%
	Coyote	2,091	13,947	15%	2,091	20,921	10%
	Elgin	1,942	12,520	16%	1,942	18,779	10%
SUBTOTAL		***7,592***	***49,891***	***15%***	***7,592***	***74,836***	***10%***
Reveille MOA		2,094	13,746	15%	2,094	20,619	10%
SUBTOTAL		***2,094***	***13,746***	***15%***	***2,094***	***20,619***	***10%***
R-4806							
	R61	293	3,173	9%	293	4,759	6%
	R62	374	4,578	8%	374	6,867	5%
	R63	404	4,800	8%	404	7,200	6%
	R64	334	5,823	6%	334	8,735	4%
	R65	342	5,907	6%	342	8,860	4%
	Alamo	373	3,722	10%	373	5,583	7%
SUBTOTAL		***2,120***	***28,003***	***8%***	***2,120***	***42,004***	***5%***
R4807							
	EC South	653	6,331	10%	653	9,497	7%
	Pahute Mesa	741	5,184	14%	741	7,777	10%
	R71	1,104	9,607	11%	1,104	14,410	8%
	R74	2,984	20,479	15%	2,984	30,718	10%
	R75	2,508	17,956	14%	2,508	26,934	9%
	R76	2,040	16,457	12%	2,040	24,685	8%
SUBTOTAL		***10,030***	***76,014***	***13%***	***10,030***	***114,021***	***9%***
R-4808[1]							
	R-4808W	1,425	9,844	14%	1,425	14,765	10%
	R-4808E	227	4,256	5%	227	6,385	4%
SUBTOTAL		***1,652***	***14,100***	***12%***	***1,652***	***21,150***	***8%***
R-4809							
	R-4809	85	2,518	3%	85	3,777	2%
	EC East	1,203	7,764	15%	1,203	11,646	10%
	EC West	1,024	7,964	13%	1,024	11,947	9%
SUBTOTAL		***2,312***	***18,246***	***13%***	***2,312***	***27,370***	***8%***
Total		**25,800**	**200,000**	**13%**	**25,800**	**300,000**	**9%**

1. DoE Airspace overlying NTS; Sortie-Operations are transit only.

other fighter aircraft, F-22 minimum flare release altitudes over NAFR's numbered and electronic combat ranges would be 700 feet AGL. This minimum ensures complete burn-out of flares at least 100 feet above the ground. In the NRC's MOAs, the minimum flare-release altitude would remain unchanged at 5,000 feet AGL for all aircraft including F-22s. Based on the emphasis on flight at higher altitudes for the F-22 (refer to Figure 2.3-3), roughly 89 percent of F-22 flare release throughout the NRC would occur above 10,000 feet AGL. The F-22 would release a maximum total of 8,000 flares per year over the NRC and contribute 8 to 13 percent to total flare use by all aircraft, depending upon annual variations in activities (i.e., annual total flare use varies from 60,000 to 95,000 in the NRC).

SUMMARY OF PROPOSED ACTION: Table 2.3-5 provides a chronological summary of the elements of the proposed F-22 Beddown. It offers, at a glimpse, the estimated flow and schedule of proposed F-22 activities.

Table 2.3-5. Summary of Proposed Action

Fiscal Year	*F-22s Beddown/ Total Based at Nellis AFB*	*Projected Annual F-22 Airfield Operations at Nellis AFB*	*Number of F-22-Related Construction Activities Per Year*[1]	*F-22 Personnel Additions/ Total F-22 Personnel*	*Projected Annual F-22 Sortie-Operations in NRC*[2]	*Projected Annual F-22 Chaff/Flare Use on NRC*
2000	0	0	5	0	0	0
2001	0	0	0	0	0	0
2002	6/6	3,156	1	172/172	9,468	12,700/2,800
2003	2/8	4,280	0	0/172	12,840	16,900/3,670
2004	0/8	4,280	0	0/172	12,840	16,900/3,670
2005	0/8	4,280	2	0/172	12,840	16,900/3,670
2006	0/8	4,280	0	0/172	12,840	16,900/3,670
2007	0/8	4,280	0	195/367	12,840	16,900/3,670
2008	9/17	8,944	0	0/367	25,800	36,000/8,000
2009-onward	0/17	8,944	0	0/367	25,800	36,000/8,000

Note: 1. Excludes internal alteration projects spanning 2000-2006; so 8 total projects shown.
2. Estimated

2.4 RELATIONSHIP OF THE RENEWAL OF THE NELLIS AIR FORCE RANGE LAND WITHDRAWAL LEGISLATIVE EIS AND THIS F-22 BEDDOWN EIS

Public scoping identified questions regarding the relationship of the proposed F-22 actions in this EIS and the ongoing land withdrawal renewal process that is addressed in a recently released Legislative EIS (LEIS). The F-22 beddown is a specific test and training action determined by the Air Force. The NAFR land withdrawal renewal is a land-use policy decision to be made by Congress.

The Air Force will decide on the best course to achieve specific weapons system operations to perform testing and training. F-22 FDE program and WS beddown is a stand-alone decision, independent of any congressional decisions on the NAFR land withdrawal renewal. A decision to beddown, test, and train with the F-22 is not automatically triggered by any land withdrawal renewal decision, nor would a decision regarding the F-22 substantively change the use of NAFR.

2.4.1 Renewal of the Nellis Air Force Range Land Withdrawal

NAFR has been used for test and training of numerous weapons systems or weapons system modifications for nearly 60 years. Section 2.2 describes NAFR and explains that a congressionally directed (Public Law 99-606) land withdrawal renewal process is underway to identify the environmental consequences of continuing exclusive military use at NAFR. The final LEIS for the land withdrawal renewal was released to the public in March 1999.

The purpose for renewing the land withdrawal for NAFR is to continue to provide a safe and secure location that permits testing of high performance equipment and tactics and training for military personnel to meet nationally directed missions. These missions include ensuring and protecting national security, training for the full spectrum of potential military operations, and ensuring continued public safety.

The proposal to continue DoD use of NAFR includes use of ground-based facilities on the range that continue to support existing, projected, and unanticipated future test and training activities. The ground-based facilities consist of airfields, housing, maintenance, transportation, tracking, test equipment, threat emitters, targets, and safety and security buffers. A future decision to renew NAFR would include continued use of this ground-based equipment.

2.4.2 Training and Testing of New Weapons Systems

NAFR ground-based equipment is used to test and train for improvements to all types of weapons systems, other military equipment, tactics, and personnel. F-22 aircraft, proposed to be based at Nellis AFB and use NRC for the FDE program and WS, would be part of this continuing test and training activity. This use is consistent with past and projected future uses of NRC and the NAFR. Any specifics regarding new facilities needed at Nellis AFB or changes in flight characteristics resulting from the F-22 are addressed in this Draft EIS.

This F-22 program-specific EIS has provided input into the cumulative analysis of the NAFR land withdrawal renewal LEIS. Similarly, data developed for the land withdrawal renewal have been integrated into the baseline, No-Action Alternative, and cumulative effects for the F-22 EIS.

2.5 SCOPING OF ISSUES FOR ANALYSIS

The implementing regulations (40 CFR, Parts 1500-1508) for NEPA require the following:

- "An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR, Par 1501.7); and

- An EIS to discuss "impacts in proportion to their significance," and to include only enough discussion of other than significant issues "to show why more study is not warranted" (40 CFR, Part 1502.2[b]).

This F-22 EIS adheres to these requirements by using public scoping and federal, state, and local agency input to assist in focusing the discussion on potentially significant issues. Identifying those issues and topics warranting detailed discussion in this EIS involved three primary steps: (1) solicit issues from the public through the scoping process and from agencies and Indian tribes through the Intergovernmental and Interagency Coordination of Environmental Planning (IICEP) process; (2) review all identified issues and determine if they would actually be affected by the Proposed Action; and (3) determine those resources (e.g., air quality, land use) and subsets of resources (e.g., minerals as a part of earth resources) that represent significant issues. Those issues determined to not warrant detailed further study are described, along with the justification for their exclusion, in the following sections.

2.5.1 Issues Derived from Public Scoping and IICEP

Scoping yielded 20 comments, and IICEP letters sent to 21 federal, state, and local agencies and Indian tribes yielded 4 responses. Agencies and the public raised concerns about the effects of noise, especially sonic booms on humans, wildlife, recreation, and general quality of life. Structural damage on homes and historic structures due to sonic booms was also of concern. Airspace issues focused on potential conflicts between military aircraft and local aviation activities. Agency comments centered on potential effects of noise on wildlife and the potential for hazardous wastes on base to affect water quality.

2.5.2 Assessment of Identified Issues

Identified issues correlate to one or more resource categories used in environmental analysis. For example, an issue raised concerning the effects of sonic booms would apply to several resource categories including noise, land use, biological resources (wildlife), cultural resources, and recreation. Scoping, IICEP, and Air Force internal evaluation yielded potential issues correlating to 15 resource categories (Table 2.5-1). Each resource category (and its subsets) was analyzed to determine if and how the Proposed Action would affect it. This analysis was accomplished through the following actions:

- Identifying the types and location of all elements of the Proposed Action;
- Determining the relationship or interaction of these elements with the resources and their subsets; and
- Assessing if and how these resources and subsets would be affected.

This analysis revealed that several subsets of resource categories, and resource categories within a particular ROI, would not be appreciably affected by the Proposed Action.

Table 2.5-1. Scoping of Issues for Environmental Impact Analysis Process

Resource	*Public/Agency/ Air Force Scoping*	*Affected Area*		*Excluded from Further Detailed Discussion*	*Location in EIS*
		Nellis AFB	*NRC*		
Airspace	X	X	X		Section 4.1
Noise: Subsonic Supersonic	X X	X NA	X X		Section 4.2
Land Use	X	X	X		Section 4.2
Air Quality	X	X	X		Section 4.3
Safety	X	X	X	Radio frequency	Section 4.4
Hazardous Material/Waste	X	X	NA	Solid waste, hazardous waste on NAFR; storage tanks, PCBs, pesticides, radon on Nellis AFB	Section 4.5
Earth	X	X	NA	Earth Resources on NAFR	Section 4.6
Water	X	X	NA	Surface water and sedimentation on NAFR	Section 4.6
Biological	X	X	X		Section 4.7
Cultural	X	X	X		Section 4.8
Transportation	X	X	NA	Transportation on NRC	Section 4.9
Recreation	X	X	X		Section 4.10
Visual	X	NA	X	Visual resources on Nellis AFB	Section 4.10
Socioeconomics	X	X	NA	Socioeconomics in NRC	Section 4.11
Environmental Justice	X	X	X		Section 4.12

Notes: NA = Analysis not discussed in detail in EIS

2.5.3 Definition of Resource Analysis in This EIS

Further detailed analysis of some resource categories has been limited in this F-22 EIS because they were not potentially affected by any aspect of the Proposed Action and because they were not identified during the public scoping process. The topics that did not warrant further detailed discussion in the body of this EIS include radio frequency emissions from emitters used in training; soils and water on the NAFR; certain aspects of hazardous materials and wastes; visual resources on Nellis AFB; and solid waste, transportation, and socioeconomics on the NRC. The topics are discussed below, and explanation is provided as to why further analyses are not warranted.

2.5.4 Resources Eliminated from Further Detailed Analysis

SAFETY

RADIO FREQUENCIES EMISSIONS ON NAFR: Use of electronic emitters to provide training in electronic warfare and add realism to other types of training activity on NAFR would continue. Electronic emitters give off radio frequency emissions. Safe separation distances from these emissions have been established for each emitter type and vary from 53 to 783 feet. All emitters are located on NAFR, and each is surrounded by a safety zone that ensures safe separation. Since NAFR is closed to public entry, public safety is not and would not be a concern. Under the Proposed Action, operation of these emitters would continue with required safety zones established and maintained. Because the F-22 beddown would not alter the use or locations of these emitters, no potential impacts exist and no further analysis is needed.

HAZARDOUS MATERIAL AND WASTE

SOLID WASTE: Beddown of the F-22 and its additional personnel would increase the amount of solid waste on Nellis AFB by about 5,000 pounds per year or 5 percent. Existing non-hazardous solid waste collection and disposal procedures for the base and NRC would be adequate for the amount of waste generated. The limited domestic solid waste generated by the F-22 beddown would be transported to and disposed of through a commercial solid waste collection agency, as are solid wastes today. Solid waste, therefore, requires no further detailed analysis.

STORAGE TANKS: Although beddown of F-22 aircraft would increase aircraft fuel transfers, this increase would not impact the overall base fuels management procedures or storage capabilities. Implementation of the Proposed Action would not require new fuels storage and distribution facilities but may increase the frequency of fuel transfer operations. Nellis AFB now and in the past has supported more than 200 aircraft and has demonstrated the procedures and capabilities to ensure safe handling of petroleum, oils, and lubricants. No changes to refueling procedures would occur. No environmental impact is expected, so no further analysis is needed.

POLYCHLORINATED BIPHENYLS (PCBS): The accommodations necessary for F-22 aircraft would have no effect on the quantity of PCB-containing or PCB-related material found on base. Lighting in new facilities associated with the Proposed Action would be provided with fluorescent lamps containing non-PCB lamp ballasts. Therefore, further analysis of PCBs is not warranted.

INSTALLATION RESTORATION PROGRAM: The Air Force has established the Installation Restoration Program to plan and implement remedial actions to mitigate the effects of these materials on the environment. The sites addressed by the Installation Restoration Program include ordnance trenches, disposal pits, landfills, surface spills, storage terminals, fire training sites, waste ponds, and storm drains. None of the proposed construction associated with the F-22 beddown would occur on, or affect Installation Restoration Program sites. Thus, no impacts to or from Installation Restoration Program sites would occur, and no additional analysis is needed.

HAZARDOUS WASTE ON NAFR: Operations at NAFR affecting hazardous wastes would continue unchanged under the Proposed Action, with maintenance and support requirements for the range being met through current processes and procedures. Range personnel would continue to perform all of the support requirements identified under current operations. F-22 projected use of NAFR would be restricted to existing, disturbed target areas and involve the same types of ordnance already used there. No new waste streams or types would be added, so further analysis is not required.

EARTH AND WATER

EARTH RESOURCES: Ordnance delivery represents the aspect of the Proposed Action that could affect earth resources. However, ordnance delivery impacts would occur only on DoD-controlled target areas at the NAFR. This type of activity can reduce groundcover, thereby increasing the potential for soil erosion. Both the craters resulting directly from ordnance impacts and ordnance-caused fires can temporarily eliminate groundcover. However, several factors indicate that the use of the range under the Proposed Action would not measurably increase erosion or accelerate soil loss. The projected type and amount of ordnance used on the range would be negligible (3 to 5 percent of total ordnance use) in comparison to the amount (3,000 to 4,500 tons) of ordnance that is presently delivered per year. The small amount of ordnance delivered by F-22s would impact the same, already disturbed target areas that are currently used. There would be no increase in maintenance activities affecting groundcover and soils (i.e., disking of targets and ordnance disposal). Groundcover is absent or very sparse over most of the existing target areas and vicinities, so little opportunity exists for weapons impacts to reduce groundcover. Areas that do receive the most intensive weapons impacts (i.e., targets) occupy relatively flat topography, which is unsuitable for generating extensive erosion or soil loss. Low precipitation and low runoff rates further reduce the potential for soil loss and erosion.

Implementing the Proposed Action would not alter the current situation with mining and mineral resources since the NAFR is currently withdrawn from mineral entry.

Paleontological surveys have not been completed at NAFR (personal communications, S. Rolf 1997; B. Reynolds 1997), but important fossil localities have been documented. All of these localities lie away from existing target areas that could be affected by the F-22. As was noted for soils, the target areas potentially affected by F-22 ordnance use have been disturbed for years and do not include the types of sediments associated with fossils. Paleontological resources are also unlikely to occur in the sediments and disturbed areas on Nellis AFB. For these reasons, no further analysis of paleontological resources is warranted.

WATER RESOURCES ON THE NRC: Factors considered with regard to water resources on NRC include ordnance delivery and chaff use. Ordnance delivery would occur only on existing, previously disturbed target areas within NAFR. No aspect of ordnance delivery with the potential to affect water resources (surface and groundwater) would change with the beddown of the F-22. Although unrecovered ordnance debris could retain residues from charges, several factors demonstrate that no potential for surface water or groundwater contamination would exist. Low precipitation and runoff rates, coupled with flat topography, limit surface transport of materials.

Regular cleanup activities eliminate most ordnance residues, and the small amount of residual chemicals quickly dissipates. Intermittent ordnance delivery on NAFR would not be expected to contaminate surface waters or groundwaters. Since no changes to the elements with a potential to affect water resources on NAFR would occur, no further analysis is needed.

Use of chaff throughout the NRC would continue under the Proposed Action, with the F-22 dispensing about 36,000 bundles per year after 2008. Because chaff is relatively insoluble in water, chaff landing on water would either be submerged or driven across the surface by the wind. No change in dissolved oxygen content or temperature from chaff in the water would be expected. A study in which a water body was spiked with chaff resulted in extremely low increases in the concentration of aluminum or other metals. No appreciable increases were noted after 13 days (Air National Guard Readiness Center 1990). Given these factors, water quality would not be adversely impacted. In addition, because the material is nontoxic, chaff landing in surface waters poses an insignificant health risk, if any. Surface water in the NRC is rare and confined to small springs and similar features. Moreover, total chaff use would not increase for the NRC after the F-22 beddown. All of these factors, taken in combination, demonstrate that chaff use associated with F-22 sortie operations would not result in impacts to water in the NRC. No further analysis is warranted.

TRANSPORTATION

There are no anticipated changes to transportation resources within the NRC due to implementation of the Proposed Action. No roads would be constructed or modified and no effects to transportation networks are expected. Transportation resources within the NRC were eliminated from further analysis.

VISUAL RESOURCES

All proposed facilities would be sited on previously disturbed land on the industrially developed portion of Nellis AFB. They would be built of similar materials and landscaped as other structures on base. These types of military buildings are a common sight on Nellis AFB and are not expected to impact the visual environment of the base or require further analysis. Visual resources on NRC are analyzed in section 4.10.

SOCIOECONOMIC RESOURCES

Clark, Lincoln, and Nye counties underlie the NRC. Potential socioeconomic effects from the Proposed Action occur in the vicinity of Nellis AFB, including additional income and school use from an increase in personnel and an increase in economic value from construction projects. These effects are addressed in section 4.11. No construction or population increase is expected outside the Las Vegas metropolitan area. Socioeconomic effects within the lands underlying the NRC were eliminated from further analysis.

2.6 SUMMARY OF IMPACTS

Table 2.6-1 presents a summary of the impacts associated with the proposed beddown of 17 F-22 aircraft for the FDE program and WS at Nellis AFB. The table compares the effects of the Proposed Action to those of the No-Action Alternative.

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 1 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
AIRSPACE (Section 4.1)	
Nellis AFB	
• Existing departure and arrival routes established for safety and noise abatement • Recent average of over 68,000 annual aircraft operations • Night (10:00 P.M. - 7:00 A.M.) operations of about 5,000	• Use and structure of departure and arrival routes unchanged • 8,944 additional F-22 operations in airfield area; 13% increase • An increase of 544 F-22 annual night operations
NRC	
• NRC airspace consists of two MOAs and five restricted areas • Desert MOA and Restricted Area R-4807 receive 25% and 38% of total use • No impediments to civil and commercial aviation • 200,000 to 300,000 annual sortie-operations in NRC • Supersonic activity estimated to be 3% to 10% of time spent in air combat maneuvers	• Airspace structure and management unaffected • No change to airspace use patterns • No aspect of F-22 activities affect civil or commercial aviation use • Total (200,000 - 300,000) sortie-operations unchanged • About 25,800 annual F-22 sortie-operations contribute 13 to 9% to total • F-22s would fly 89% of average sortie above 10,000 feet AGL • Overall supersonic activity in NRC approved airspace would increase less than 1%
NOISE AND LAND USE (Section 4.2)	
Nellis AFB	
• Approximately 15,000 to 21,000 acres exposed to noise greater than 65 DNL over the last 20 years	• Noise levels on base consistent with existing levels • Approximately 23,000 acres exposed to noise greater than 65 DNL with F-22 beddown

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 2 of 7)	
No-Action Alternative	*Proposed Action: F-22 Beddown*
NOISE AND LAND USE (Section 4.2) continued	
Nellis AFB continued	
• Surrounding area includes industrial, commercial, open, recreational and residential land uses • Current noise contours exceeding 65 DNL affect about 22,800 people • Current noise in residential areas already zoned for noise levels above 65 DNL • Seven noise-sensitive receptors subject to noise above 65 DNL	• Areas with noise greater than 65 DNL primarily affects open lands (85%) • Noise contours exceeding 65 DNL could affect about 37,750 people. • Increase in noise occurs in areas zoned for noise level above 65 DNL and no increase above 2 dB. • Thirteen additional noise-sensitive receptors subject to noise above 65 DNL
NRC	
• Total of 20 sonic booms per month in Elgin MOA; 4 in Coyote MOA; and 2 in Reveille MOA and EC East and RF-74 training ranges • Subsonic noise levels vary from 63 DNL to <45 DNL • Supersonic noise varies from 56 CDNL to <45 CDNL • Combined DNL and CDNL from 54 to 62 in NRC airspace • Sound exposure levels (SEL) at 500 feet AGL vary from 95 to 112 dB for range of aircraft using NRC • NRC lands primarily managed by DoD, BLM and USFS • Special Use Areas include Wilderness Study Areas, National Wildlife Refuges, state parks, and Wild Horse Management Area	• Increase to 24 sonic booms per month in Elgin; 10 in Coyote. Still 2 in Reveille, EC East, and RF-74 • No perceptible change in subsonic noise in NRC • Increase of 1 to 3 CDNL in Elgin, Coyote airspace from supersonic operations • Combined DNL and CDNL would increase by no more than 1 DNL • F-22 SEL at 500 feet AGL is 114 dB, but F-22 operates 89% of time above 10,000 feet AGL so noise likely reduced • No change in land status or land-use management • No change in supersonic restricted areas (i.e., Desert National Wildlife Range); no change in noise levels over Special Use Areas

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 3 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
AIR QUALITY (Section 4.3)	
Nellis AFB	
• Current tons/year emissions: Carbon monoxide (CO): 2,644 Volatile organic compounds (VOC): 533 Oxides of Nitrogen (NO_x): 659 Sulfur dioxide (SO_x): 372 Particulate matter (PM_{10}): 54	• Projected (maximum) increase tons/year emissions: CO: 89 (3.4% increase) VOC: 12 (2.3% increase) NO_x: 124 (19.1% increase) SO_x: 7 (1.9% increase) PM_{10}: 6 (11.1% increase)
• Clark County (which contains Nellis AFB) in serious nonattainment for CO and PM_{10} due to traffic and development in Las Vegas metropolitan area	• F-22 beddown would not contribute to nonattainment for CO or PM_{10} or exceed regional significance. • CO *de minimis* 100 tons/year; projected CO would be 89 tons/year • PM_{10} *de minimis* 70 tons/year; projected PM_{10} would be 6 tons/year
• Emissions from Nellis AFB account for 2% of overall CO budget and 0.06% of overall PM_{10} budget for Las Vegas Metropolitan Area	• F-22 beddown increases Nellis AFB contribution to 0.1% for CO and 0.068% for PM_{10} in 2008
NRC	
• Current emissions unchanged	• F-22 contributions to emissions would be within annual variation • No exceedences of federal, state or regional air quality standards.
SAFETY (Section 4.4)	
Nellis AFB	
• Existing ground safety procedures sufficient	• No diminishment of ground safety or increase in risks
• One Class A mishap recorded in 10 years for WS, same for FDE.	• No change in safety risk in Nellis AFB vicinity
• Historical average of 13.5 bird-aircraft strikes per year in base vicinity	• No substantive change in bird-aircraft strikes expected

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 4 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
SAFETY (Section 4.4) continued	
NRC	
• Munitions safety and handling procedures meet standards and ensure public safety	• Annual use of ordnance including JDAMs would not affect targets, procedures, or safety
• Weapons safety footprints established on ranges provide safety margins for live and inert ordnance delivery	• JDAMs would fall well within existing range areas
• Probability of Class A aircraft mishap in NRC MOAs is 0.00003	• F-22 may have higher Class A mishap rate at onset of development, but it would decrease due to pilot experience, FDE program and WS
• Historical average of 1 bird-aircraft strike per year in NRC	• No increase in bird-aircraft strikes anticipated
• 370,000 to 405,000 bundles of chaff and 60,000 to 95,000 flares used annually	• 36,000 bundles of chaff used by F-22s contribute 9% to total chaff use; 8,000 flares used by F-22s contribute 8% total flare use
	• No health risk to people or animals from chaff; minimal risk of fire from flares
HAZARDOUS MATERIALS AND WASTE (Section 4.5)	
Nellis AFB	
• Approved hazardous waste management and pollution prevention programs used on base	• Additional F-22 maintenance and operations consistent with and accommodated by existing programs
• Hazardous waste accumulation sites on base adequate for quantity	• No change to waste generator status
EARTH AND WATER RESOURCES (Section 4.6)	
Nellis AFB	
• Existing soil conditions unchanged	• Construction affects approximately 4 acres of mostly previously disturbed soils
	• Best management practices would minimize soil loss and erosion

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 5 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
EARTH AND WATER RESOURCES (Section 4.6) continued	
Nellis AFB continued	
• Existing water availability and use rates adequate for base	• Aircraft beddown and personnel additions increase water use by about 400 to 500 AFY, existing availability sufficient to support change • Surface and groundwater not affected by construction • Best management practices for construction would make potential for sedimentation negligible
BIOLOGICAL RESOURCES (Section 4.7)	
Nellis AFB	
• Base supports 1 sensitive plant species, which is under protective management • Base contains or has potential to contain 18 protected and/or sensitive wildlife species; one listed as threatened (desert tortoise) • Current areas affected by noise levels of 65 DNL or greater not adversely affecting protected and/or sensitive wildlife species.	• Construction avoids plant habitat, uses previously disturbed locations or those lacking native habitat • Construction avoids known species habitat; no adverse effects anticipated • Expansion of area under 65 DNL contour around the base unlikely to affect protected and/or sensitive wildlife species because noise levels would remain within levels occurring over last 20 years
NRC	
• No sensitive plant species in target areas used for actual ordnance delivery • Approximately 90,000 acres of disturbed areas centered around targets • 9 federally designated threatened or endangered species • Potentially noise-sensitive wildlife occur within NRC	• No change to or effects on sensitive plant species • No change to number of disturbed acres around targets • No direct impacts expected from subsonic noise, overflights, or ordnance delivery to T & E species • Sonic booms increase by 4 to 6 per month in NRC airspace authorized for supersonic flight, but are unlikely to adversely disturb wildlife

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 6 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
CULTURAL RESOURCES (Section 4.8)	
Nellis AFB	
• 22 significant archaeological sites in Area II, 5 significant architectural resources on base • 14 potentially significant sites surround base • No traditional resources on base or in area surrounding base	• Construction avoids archaeological sites and significant architectural resources • Increase in noise would not affect significant cultural resources • No effect on traditional resources
NRC	
• 5,000 archaeological sites estimated within NRC • Over 50 historic mining sites, 15 mining districts, rock art, traditional use areas, and sacred sites in NRC • Traditional cultural properties include rock art sites, landscapes, hunting and gathering areas.	• Noise and sonic booms unlikely to affect archaeological sites or architectural resources • Slight increase in sonic booms could be considered to affect setting of sacred and traditional use areas, but not significantly
TRANSPORTATION (Section 4.9)	
Nellis AFB	
• Two roads surrounding Nellis AFB below minimum design standard, 11.5 miles reaching maximum capacity	• Additional base traffic increases slightly, but within existing capacity
RECREATION AND VISUAL RESOURCES (Section 4.10)	
Nellis AFB	
• On-base recreation offered through a variety of indoor and outdoor facilities • Noise above 65 DNL affects two local parks around Nellis AFB	• No change in recreational opportunities on base • Noise above 65 DNL affects four local parks around Nellis AFB
NRC	
• NRC overlies state parks, national forests, wildlife refuges, hunting areas, wilderness study areas • No effect on visual resources	• Increase from 20 sonic booms per month to 24 per month in Elgin MOA and from 4 to 10 in Coyote MOA; could annoy some users, but not significantly • No effect on visual resources

Table 2.6-1. Comparison of Alternatives by Resource and Potential Impact (Page 7 of 7)

No-Action Alternative	*Proposed Action: F-22 Beddown*
SOCIOECONOMICS (Section 4.11)	
Nellis AFB (Clark County)	
• Base supports about 9,000 employees • Average annual base payroll $555 million • Military population associated with base equals approximately 27,000 • Clark County fastest growing metropolitan county in U.S. (1.2 million in 1996) • On-base housing of 1,212 multifamily units, 1,136 dormitory beds, and 482 billeting facilities • More than 180 public schools	• Additional 367 personnel associated with the beddown (4% increase) • F-22 beddown adds $9.1 million/year to payroll • About 1,109 additional base personnel and dependents (4% increase) • F-22 beddown results in 0.09% increase in population of Clark County • On-base housing combined with expanding off-base housing and construction of a new dormitory would accommodate proposed personnel increases • Negligible effect on educational facilities
ENVIRONMENTAL JUSTICE (Section 4.12)	
• Baseline noise levels above 65 DNL disproportionately affect about 5,913 people (26%) belonging to minority groups, but do not disproportionately affect low-income populations • Within the county, the minority population is 25% and the low-income population is 11%	• Noise levels above 65 DNL would disproportionately affect about 10,050 people (27%) belonging to minority groups and 7,045 low-income people (19%), but occurs within areas zoned for noise above 65 DNL
NRC	
• No noise above 65 DNL, therefore no adverse effect to populations	• No noise above 65 DNL, therefore no adverse effect to populations

3.0 AFFECTED ENVIRONMENT

3.0 AFFECTED ENVIRONMENT

The analysis of environmental conditions is directly related to the expected environmental consequences of the alternatives. NEPA requires that the analysis address those areas and the components of the environment with the potential to be affected by the alternatives. Locations and resources with no potential to be affected need not be analyzed. The public scoping for this environmental impact analysis process (EIAP) analyzed 12 resources identified as important by agencies or the public. This chapter discusses all areas and lands that might be affected, as well as the natural, cultural, and socioeconomic resources they contain or support.

In the environmental analysis process, analysts first identify the resources to be analyzed and then examine the expected geographic scope of potential impacts, known as Regions of Influence (ROIs). For the F-22 beddown the Air Force examined eight resources within two distinct geographic areas or ROIs: Nellis AFB and the NRC. Four resources were either examined on Nellis AFB or on the land underlying the NRC. These ROIs provide borders within which analysts collected baseline data and conducted analyses.

REGIONS OF INFLUENCE

ROI ONE

ROI One, Nellis AFB, consists of the base itself and extends to the limits of aircraft approaches and departures. For one resource, socioeconomics, ROI One includes a larger area in order to fully capture the affected environment and because most socioeconomic data are compiled at city- or county wide levels. In ROI One, elements of the Proposed Action potentially affecting resources include limited ground disturbance from construction and alteration of structures, noise and safety risks associated with airfield aircraft operations, additional income to the region from increased personnel and construction projects, and construction dust and aircraft emissions. Data used to identify the conditions within the affected environment for ROI One included existing reports, studies, maps, plans, and other documents, as well as interviews with knowledgeable individuals.

ROI TWO

ROI Two includes the airspace and lands associated with the air-to-ground training ranges, airfields, emitter and instrumentation sites, MOAs, restricted airspace, and other assets within the NRC. The NRC represents a separate, far more extensive ROI than ROI One. Within ROI Two, both current and proposed activities differ substantially from those that could affect the environment in ROI One. For example, the NRC supports a wide variety of training activities, including air-to-air combat, weapons delivery, electronic combat, low-altitude navigation, and large-force exercises involving numerous, diverse aircraft. Due to the differences in the activities and potential effects within each ROI, the EIS will describe them separately under each resource.

Analysis focused on those resources most likely to be affected by aircraft overflights and associated noise, since these constitute the primary effects of the proposed F-22 operations.

Resources such as wildlife, recreation, land use, and traditional American Indian resources received the greatest attention relative to the potential effects. In contrast, the Proposed Action would involve minimal ground disturbance as a result of ordnance delivery, since existing targets on the NAFR will be used. No construction or other ground disturbance would occur. For this reason, resources such as rare plants, soils, water, hazardous waste, transportation, and archaeological sites received less detailed description. The types of data sources used to portray the affected environment in ROI Two matched those used for ROI One.

A small portion of the NRC extends into Utah. This portion of the NRC was not included in the analysis process because it is rarely used by military aircraft, supersonic speeds are not authorized in this area, and the Proposed Action would not change either the frequency or type of use. No change to airspace use, noise, safety, or other possible effects from the Proposed Action would occur in this area.

RESOURCES TO BE ANALYZED

Table 3.0-1 presents information on the specific definition of the locations used to identify the affected environment within both ROIs for each resource. Because the nature of potential effects could vary among the resources, the affected environment tends to differ from resource to resource.

Table 3.0-1. Region of Influence by Resource

Resource	*ROI One: Nellis AFB*	*ROI Two: NRC*
Airspace	Approach and departure routes; airfield environment	NRC
Noise and Land Use	Nellis AFB; approach and departure routes; Nellis AFB and areas with > 65 DNL contour	NRC at sensitive resource locations; towns; Special Use Land Management Areas
Air Quality	Nellis AFB; Las Vegas Valley; Clark County	NRC; target areas
Safety	Nellis AFB; approach and departure routes; airfield environment; munitions	NRC; target areas
Hazardous Material and Waste	Nellis AFB; munitions and maintenance areas	Not applicable
Earth and Water	Nellis AFB; ground disturbance areas; associated water supply and wastewater processing locations	Not applicable
Biological	Nellis AFB, ground disturbance areas (vegetation, wetlands, and wildlife); approach and departure routes (wildlife)	NRC target areas; habitat for noise-sensitive wildlife; flare and chaff use areas
Cultural	Nellis AFB ground disturbance areas, approach and departure routes	NRC target areas; noise-sensitive cultural resources
Transportation	On-base transportation routes and main arterials	Not applicable
Recreational/Visual	Nellis AFB and major recreation sites within approach and departure routes	NRC; noise-sensitive recreation areas, Special Use Land Management Areas
Socioeconomics	Las Vegas, Clark County	Not applicable
Environmental Justice	Las Vegas, Clark County	NRC

3.1 AIRSPACE

The safe, orderly, and compatible use of the nation's airspace is made possible through a system of flight rules and regulations, airspace management actions, and air traffic control procedures just as use of the nation's highway system is governed by traffic laws and rules for operating vehicles. The national airspace system is designed and managed to protect aircraft operations around most airports and along air traffic routes connecting these airports, as well as within special areas where activities such as military flight training are conducted. The FAA has the overall responsibility for managing the airspace system and accomplishes this through close coordination with state aviation and airport planners, military airspace managers, and other entities.

This section describes how the airspace, flight routes, and operating procedures have been designed to accommodate both military training and civil aircraft operations in the ROIs encompassing Nellis AFB and the NRC. Discussions of the NRC include the restricted areas and Military Operations Areas (MOAs) supporting NAFR. Information was obtained from current aeronautical maps, flight information publications, Nellis AFB documents, and contacts with Air Force and FAA airspace and air traffic control management personnel.

3.1.1 Nellis AFB

Nellis AFB is one of the few military airfields located within the type of airspace (Class B) established around the nation's busiest airports. The outer lateral boundaries of this airspace are shown in Figure 2.2-2. Class B airspace requires all aircraft operating within the lateral and vertical limits of this area to be in communications with and under the positive control of an air traffic control facility to maximize the safe, orderly flow of all aircraft operating within this congested area. Designation of Class B airspace for the Las Vegas area was based on the high density aircraft operations conducted regularly at both Nellis AFB and McCarran International Airport and operations at the other airports in the area. In total, over a half million cumulative takeoffs and landings are conducted yearly at Nellis AFB and McCarran.

Departure and arrival flight routes established for each runway direction at Nellis AFB segregate base flight operations from civil air traffic at other local airports and standardize the flow of military flights between the base and the NRC. Two parallel runways (21L/3R and 2IR/3L) are oriented in a northeast-southwest direction (Figure 3.1-1). In general, the flight routes follow both a north-south flow through the "Sally" Corridor portion of the MOA for flights entering/exiting the eastern portion of the NRC. East-west flow (paralleling highway 95) is used for entering and exiting western portions of the NRC airspace. These routes contain specific directional and altitude requirements and advisory information that separate inbound/outbound aircraft while minimizing noise impacts on populated areas and maintaining safety buffers from the North Las Vegas Airport and its training area. Departing aircraft expedite their turns and climbs after takeoff to abate noise and to avoid populated areas around the base.

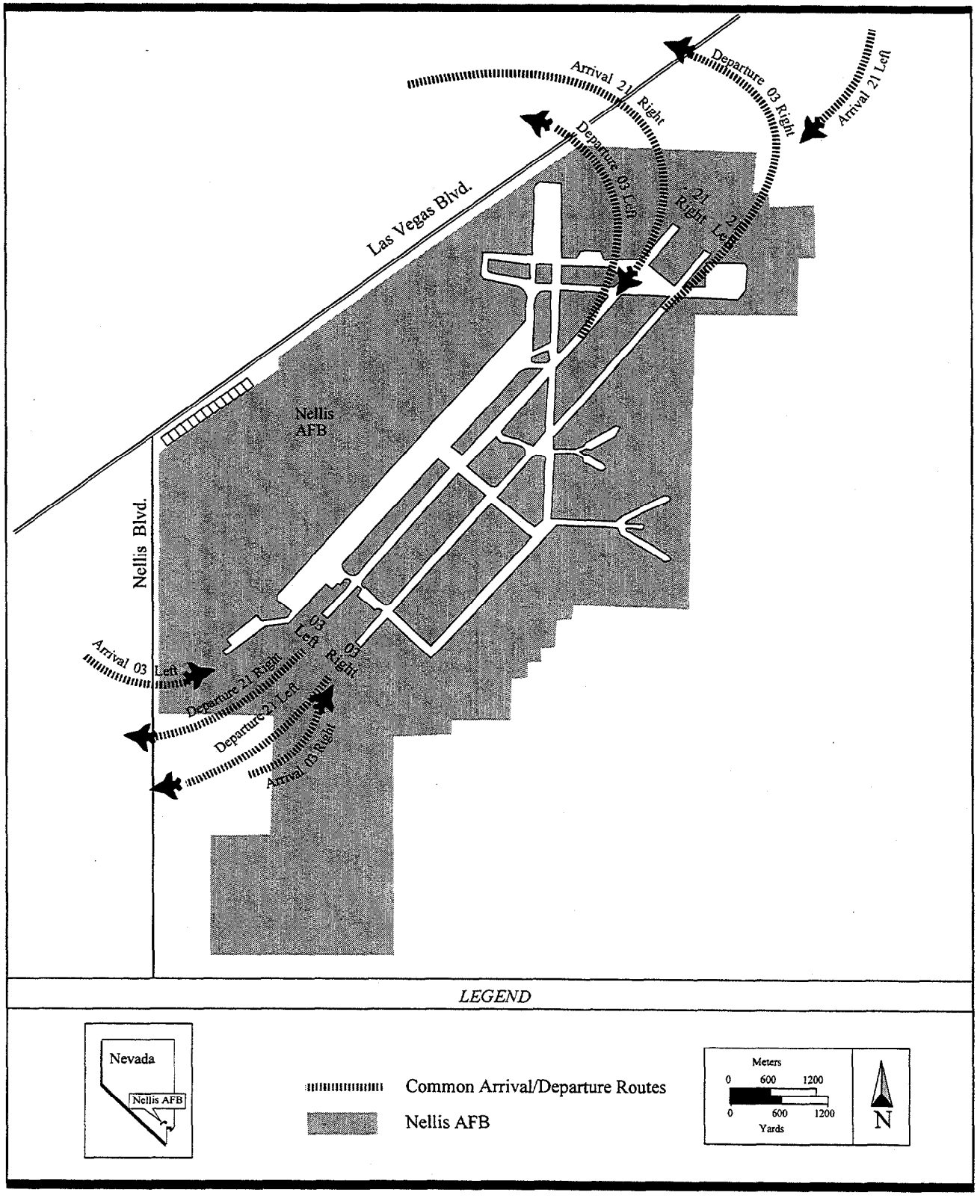

Figure 3.1-1. Nellis AFB Arrival and Departure Areas

Factors such as local wind and weather conditions, noise abatement, mission requirements, and emergency conditions are considered for runway selection. Normal weekday daytime operations consist of aircraft departing to the southwest and making immediate right turns to the north or northwest.

Night operations normally depart to the northeast (runway 3) to further abate aircraft noise. Arrivals follow the same flows inbound to Nellis AFB and are funneled by air traffic control to a point 5 to 10 miles northeast of the base where they proceed straight inbound for landing on runway 21. Refer to Figure 2.2-2, which depicts those primary routes most commonly flown between Nellis AFB and the NRC.

A summary of yearly Nellis AFB airfield traffic counts since 1987 indicates that annual airfield operations have varied between 61,000 and 181,000 take-offs and landings (Air Force 1997d). There were over 68,000 aircraft operations (takeoffs and landings) at Nellis AFB in Fiscal Year 1997. The majority of these operations include NRC arrivals and departures. Of that majority, about 70 percent enter and exit the NRC through the Sally Corridor.

3.1.2 Nellis Range Complex

The NRC consists of the Desert and Reveille MOAs and five restricted areas: R-4806 (E & W), R-4807 (A & B), and R-4809 as described in section 2.2. Approximately 70 percent of the NRC has been assessed and approved for tactical maneuvers at supersonic speeds. The areas shown in Figure 2.2-7 that are authorized for supersonic flight provide protection for noise-sensitive locations beneath the NRC.

Low-altitude avoidance and noise-sensitive areas are identified in NAFR flight instructions for various locations within and adjacent to NRC and FAA rules state that all aircraft must avoid persons, vehicles, and structures by 500 feet. Military pilots are instructed to avoid these locations by horizontal and vertical distances to enhance flight safety, noise abatement, and environmental sensitivity.

RESTRICTED AIRSPACE: Federal aviation regulations define a restricted area as airspace within which flight by non-participating aircraft, while not wholly prohibited, is subject to restriction. Restricted areas are primarily established to contain hazardous activities and exclude any nonparticipating military or civil aircraft from entry when these activities are being conducted. Restricted Areas R-4806E/W and R-4807A/B are delegated by the FAA to Nellis AFB for military operations; R-4808N and R-4809 are delegated to the DoE for those operations supporting Nevada Test Site (NTS) activities, but portions of these restricted areas are jointly used by both the DoE and Nellis AFB; and R-4808S is used jointly by Nellis AFB and the FAA at or above 28,000 feet MSL for overflights.

R-4806W is subdivided and used for conventional bombing and gunnery testing and training. Lands beneath R-4806E do not contain any targets. Except for the extreme northern portion of these restricted areas, all of R-4806E/W is within the Desert National Wildlife Range (DNWR).

Aircraft operate within the DNWR in accordance with a Letter of Agreement between the Air Force and the U.S. Fish and Wildlife Service (USFWS). R-4807A is subdivided into several subsections that contain an electronic battlefield with numerous simulated tactical targets such as tank convoys, munitions storage and sites, regimental/battery, air defense artillery units, and others. R-4807B is used for overflights of a land area (Pahute Mesa) used by the DoE as an annex to the NTS. Portions of R-4809 are used jointly by the DoE and the Air Force. R-4809 is normally used by NRC aircraft in conjunction with other R-4807 subdivisions. The Tonopah Test Range Airfield, located beneath R-4809, can be used as a divert base for in-flight emergencies and other nonroutine operations. R-4809 also includes an electronic combat range subdivision.

MOAS: A MOA separates and segregates certain nonhazardous military activities from instrument flight rules aircraft and identifies for visual flight rules aircraft where these activities are conducted. Visual flight rules pilots fly using visual cues along their desired route, as long as appropriate visibility conditions exist. Instrumental flight rules pilots undergo much more training and operate under greater restrictions.

The Desert and Reveille MOAs are used for air-to-air intercept training and abrupt maneuvers that may involve supersonic flight at and above 5,000 feet AGL. The base altitude of these MOAs is 100 feet AGL. Since a MOA, by definition, only extends up to, but does not include, 18,000 feet MSL, Air Traffic Control Assigned Airspace (ATCAA) is provided by the FAA as needed to extend training airspace to higher altitudes in accordance with a Letter of Agreement with Nellis AFB.

The Desert MOA/ATCAA comprises the eastern half of NRC and is divided into three subdivisions (Caliente, Coyote, and Elgin). These are used individually or in combination for air-to-air training. The Sally Corridor portion of the MOA is the primary transition route between Nellis AFB and most portions of the NRC. The Reveille MOA/ATCAA is located in the northern portion of the NRC. This airspace is normally controlled by the FAA Salt Lake Air Route Traffic Control Center when not activated for NRC use.

Since MOA operations are considered nonhazardous, visual flight rules pilots may fly through a MOA when it is in use while exercising see-and-avoid clearance precautions. Military pilots are also aware of other aircraft during their maneuvers, both visually and through use of cockpit radar displays, to identify and remain well clear of nonparticipating air traffic that may be operating in the MOA. Depending upon terrain and an aircraft's position and use of transponder equipment (electronic beacon), aircraft radar displays are capable of detecting aircraft, including smaller general aviation aircraft, within 100 miles. Visual flight rules pilots can obtain MOA use status and radar traffic advisories from Nellis AFB air traffic control while operating through this airspace.

CIVIL AND COMMERCIAL AVIATION AIRSPACE USE: Several Federal Airways and Jet Routes flown by instrument flight rules aircraft border the NRC airspace and provide nearly direct routing between key airports in the West and Midwest. When air traffic control routes this traffic

through NRC airspace, separation is provided from all military operations. The few public airports or airfields located adjacent to or beneath portions of the NRC airspace are shown in Figure 3.1-2. With the exception of Tonopah, none of the airfields shown have over 1,000 aircraft operations a year (Nevada Department of Transportation 1995). General aviation airports within the state provide convenient air transportation access to many areas that depend heavily on this service, even though their based aircraft and operational activities are low in the rural airports (Nevada Department of Transportation 1995).

Commercial aircraft activity in Nevada has increased considerably and is expected to grow over the next 20 years. Most of this present and anticipated growth is at the Las Vegas and Reno airports. Commercial operations are expected to increase 54 percent. General aviation activity is expected to grow by about 17 percent by 2015 (Nevada Department of Transportation 1995).

Visual flight rules aircraft operating between any of the airports in the Las Vegas area and other airports or airfields adjacent to the NRC airspace must either remain clear of restricted airspace or may fly through the Desert and Reveille MOAs. Nellis AFB operations/airspace representatives provide periodic briefings to civil aviation pilots in the area on the types and locations of all military aircraft operations out of Nellis AFB as part of the ongoing Midair Collision Avoidance Program.

The USFWS conducts periodic flights in the Desert National Wildlife Refuge for aerial census and tracking of bighorn sheep and maintenance of water facilities. These flights, occurring during the spring and fall about three to five times a year, are coordinated through the Nellis AFB range control and scheduling functions (personal communication, Ken Voget 1997).

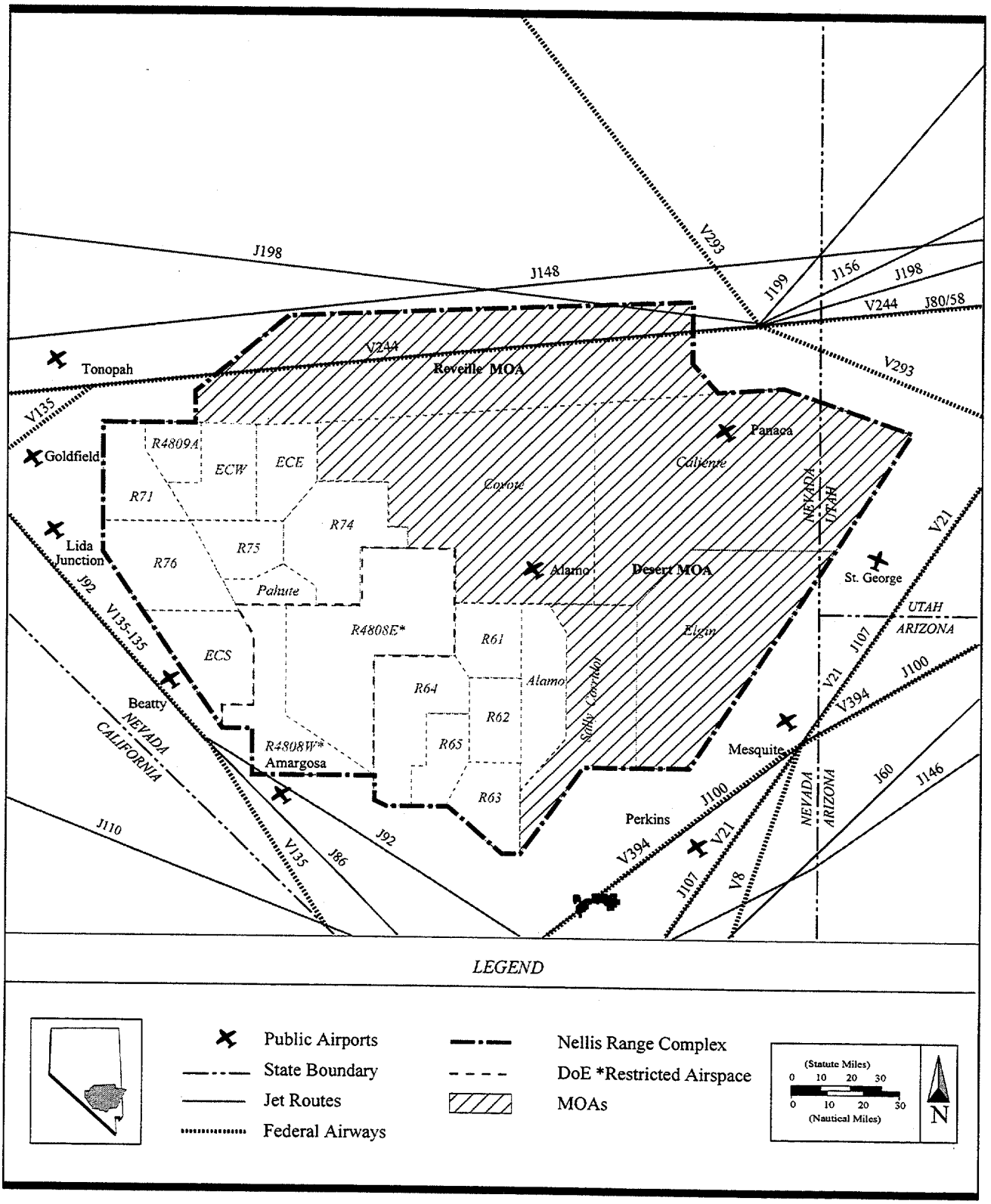

Figure 3.1-2. Nellis Range Complex Airspace, Regional Airfields, Federal Airways, and Jet Routes

3.2 NOISE AND LAND USE

The effect of aircraft noise from the F-22 beddown was the most common public concern expressed during the scoping period. Concerns regarding aircraft noise related to certain potential impacts such as hearing loss, non-auditory health effects, annoyance, speech and sleep interference, and effects on domestic animals and wildlife, structures, terrain, and historical and archaeological sites. Noise levels from aircraft in residential areas near Nellis AFB and the occurrence of sonic booms in the NRC were also common concerns. Noise and land use are discussed together in this section for the following reasons:

- Noise from aircraft operations represents the primary potential source of effects on land use; and
- Knowledge of noise conditions often provides cities and other agencies with a way to evaluate and guide land use policies.

Noise is often defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, diminishes the quality of the environment, or is otherwise annoying. Response to noise varies by the type and characteristics of the noise source, distance from the source, receptor sensitivity, and time of day. Noise may be intermittent or continuous, steady or impulsive, and it may be generated by stationary or mobile sources. Although aircraft are not the only source of noise in any area, they are readily identifiable to those affected by their noise emissions and are routinely singled out for special attention and criticism.

There are two kinds of noise discussed in this EIS. The first and most familiar kind is conventional subsonic noise as generated by an aircraft's engines and airframe. This kind is heard while an aircraft is within some distance of a receptor. The second type of noise is supersonic. Sonic booms are brief, impulsive sounds, generated by the aircraft when it flies faster than sound. Supersonic flight by many different types of aircraft occurs regularly within approved NRC airspace.

Assessment of subsonic and supersonic aircraft noise requires a general understanding of the measurement and effects of these two kinds of noise. Appendix D contains additional discussion of noise, the quantities used to describe it, and its effects. That appendix may be referred to for explanations of concepts that are briefly defined in this section.

Noise is represented by a variety of quantities, or "metrics." Each noise metric was developed to account for the type of noise and the nature of what may be exposed to the noise (i.e., receptor). Human hearing is more sensitive to medium and high frequencies than to low and very high frequencies, so it is common to use "A-weighted" metrics, which account for this sensitivity. Impact of impulsive supersonic noise depends on factors other than human hearing. It is often quantified by "C-weighted" metrics, which are flat over a broad frequency range.

Different time periods also play a role with regard to noise. People hear a sound such as an aircraft flyover, at a given time, so they think the noise level is instantaneous. However, the effects of noise over a period of time depend on the total noise exposure over extended periods,

so "cumulative" noise metrics are used to assess the impact of ongoing activities such as those that occur at Nellis AFB and on the NRC.

Within this EIS, noise is described by the sound level (L), the Sound Exposure Level (SEL), Day-Night Average Sound Level (DNL), and Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}). A-weighted levels are used for subsonic aircraft noise, and C-weighted levels are used for sonic booms and other impulsive noises. A "C" is included in the symbol to denote when C-weighting is used. Each of these metrics is summarized below and discussed in detail in Appendix D.

- Sound Level (L) is the amplitude (level) of the sound that occurs at any given time. When an aircraft flies by, the level changes continuously, starting at the ambient (background) level, increasing to a maximum as the aircraft passes closest to the receptor, and then decreasing to ambient as the aircraft flies into the distance. Sound levels are on a logarithmic decibel scale; a sound level that is 10 decibels (dB) louder than another will be perceived as twice as loud. Figure 3.2-1 depicts sound levels for common activities and noise sources.

- Sound Exposure Level (SEL) accounts for both the maximum sound level and the length of time a sound lasts. SEL does not directly represent the sound level heard at any given time. Rather, it provides a measure of the total sound exposure for an entire event.

- Day-Night Average Sound Level (DNL) is a noise metric combining the levels and durations of noise events and the number of events over an extended time period. It is a cumulative average computed over a given time period like a year to represent total noise exposure. DNL also accounts for more intrusive night time noise, adding a 10 dB penalty for sounds after 10:00 P.M. and before 7:00 A.M. DNL is the appropriate measure to account for total noise exposure around airfields such as Nellis AFB.

- Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) is the measure used for subsonic aircraft noise in military airspace such as the NRC. This metric accounts for the fact that when military aircraft fly low and fast, the sound can rise from ambient to its maximum very quickly. Known as an onset-rate, this effect can make noise seem louder than its actual level. Penalties of up to 11 dB are added to account for this onset-rate.

- C-Weighted Day-Night Sound Level (CDNL) is day-night sound levels computed for areas subject to sonic booms, such as portions of the NRC. These areas are also subjected to subsonic noise assessed according to L_{dnmr}.

Land use generally refers to human modification of the land, often for residential or economic purposes. It also refers to use of land for preservation or protection of natural resources such as wildlife habitat, vegetation, or unique features. Human land uses include residential, commercial, industrial, agricultural, or recreational uses; natural features are protected under designations such as national parks, national forests, wilderness areas, or other designated areas. The attributes of land use include general land use and ownership, land management plans, and special land-use management areas. Land ownership is a categorization of land according to type of owner; the

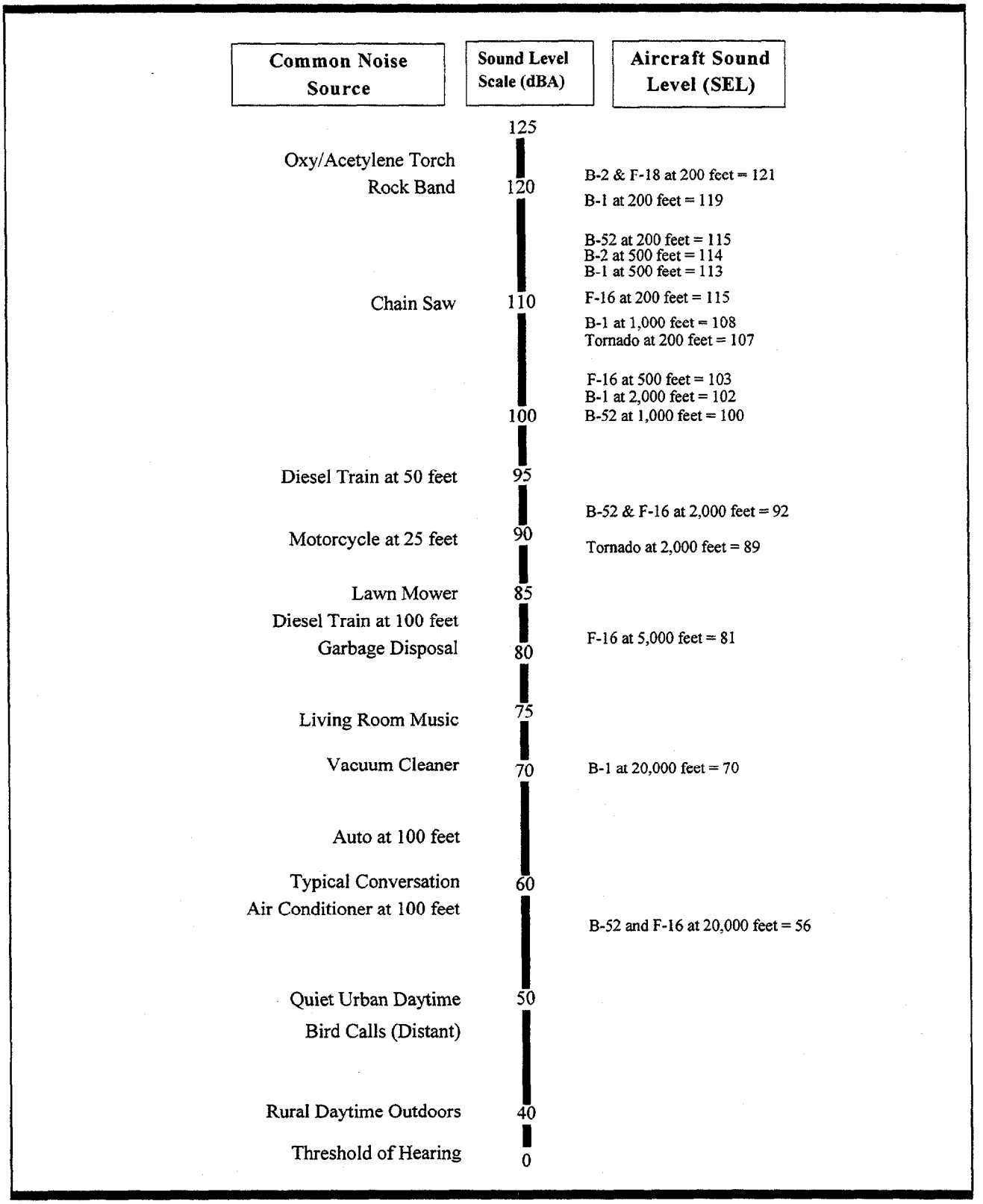

Figure 3.2-1 . Typical Noise Levels of Common Sounds

major land ownership categories include federal, state, and private. Federal lands within the ROIs for this EIS are further designated by who manages them: BLM, USFS, USFWS, DoE, and DoD. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive uses. Special land-use management areas are identified by agencies as being worthy of more rigorous management.

Noise and land use have two ROIs, consisting of Nellis AFB and the NRC. The ROI for Nellis AFB extends to the area outside the base that is affected by noise from aircraft operations, whereas the ROI for the NRC extends only to the boundary of the NRC.

3.2.1 Nellis AFB

NOISE MODELING: Nellis AFB has supported operations of nearly every type of aircraft in the DoD inventory. It has served as a home station for a variety of attack and fighter aircraft as well as helicopters. The base has also supported a wide range of transient aircraft participating in major exercises in the NRC. Through its more than 58 years of operation, the mix of based and transient aircraft using Nellis AFB has varied, and the shape and extent of areas affected by noise has varied accordingly. Published studies (Air Force 1981, 1992a) have characterized the noise conditions for the base and surrounding area in 1981 and 1992.

To define baseline noise conditions, a 1997 noise study for Nellis AFB was updated to reflect the current aircraft mix and use patterns. This study included 80 airfield operations by based aircraft and 250 airfield operations by transient aircraft as an average busy day. The 1981 and 1992 studies modeled 460 and 614 airfield operations, respectively.

Each of these studies expressed noise levels (in DNL) as contours that were developed using the following data: aircraft types, runway utilization patterns, engine power settings, altitude profiles, flight track locations, airspeed, number of operations per flight track, engine maintenance, and time of day (personal communication, L. DeVine 1998). These studies were based on an average busy day which represents airfield activity during a 24-hour period when the airfield is in full operation. The advantage of the "average busy day" approach is that it is unaffected by daily, monthly, and yearly fluctuations in the tempo (rate) of use by individual aircraft at the base.

All of these studies employed the same fundamental computer-aided modeling approach, although the sophistication of noise modeling has increased over the time span of these studies. The 1992 and baseline studies employed the NOISEMAP model (Versions 6.0 and 6.5, respectively). The 1981 study used an earlier version of the NOISEMAP model.

Describing the 1981 and 1992 studies helps to provide an understanding of the history and range of aircraft noise around Nellis AFB. These studies, as outlined below, establish that while noise conditions have varied through time, higher noise levels than under baseline conditions have affected larger areas.

NOISE ENVIRONMENT: Noise conditions around Nellis AFB have been similar for about the last twenty years, although the size and shape of the area affected have varied. Noise studies

completed under the Air Installation Compatible Use Zone (AICUZ) program from 1981 (see Appendix D, Figure D-5) and 1992 (see Appendix D, Figure D-6) show that noise levels above 65 DNL affected larger areas than those exposed under baseline conditions (Table 3.2-1). In 1981, noise levels of 65 DNL or greater affected almost 7,000 acres more than under baseline conditions. Much of this additional acreage lay southwest and northwest of the base. Since 1981, the overall area affected by aircraft noise has decreased. Noise levels greater than 65 DNL in 1992 affected almost 5,000 acres less than in 1981, and baseline conditions affect about 1,000 acres less than in 1992. The majority of the area affected in 1992 extended from the southwest corner of the base, forming a long curving "tail" to the west and northwest. Under baseline conditions, the majority of the affected area lies northeast of the base (Figure 3.2-2). Comparison of 1992 conditions to baseline conditions (Figure 3.2-3) shows a shift in the locations affected by aircraft noise from developed areas southwest and west of the base to open lands northeast of the base.

Table 3.2-1. Acreage under Noise Contours in the Vicinity of Nellis AFB

Noise Contour (DNL)	*65-70*	*70-75*	*75-80*	*80-85*	TOTAL
1981 Acreage[1]	11,736	5,766	2,587	1,290	21,379
1992 Acreage[1]	9,217	4,309	1,613	494	15,633
Baseline Acreage[1,2]	9,621	3,400	1,082	411[3]	14,514

1. Nellis AFB acreage not included
2. Baseline acreage based on update of 1997 noise study
3. Baseline acreage at 80-85 DNL: 391
   >85 DNL: 20

Differences in the number of aircraft operations from year to year account for much of the variation in noise conditions from 1981 to the present. For example, aircraft operations have varied from 61,000 to 181,000 since 1987. Baseline operations total 68,000 annually, which is at the low end of the range. Since many factors (number of exercises, funding, overseas deployments) can affect yearly numbers of aircraft operations, noise conditions and the area affected by noise can be expected to continue to vary.

ON-BASE LAND USE: Land uses on Nellis AFB are detailed in the *Nellis Air Force Base Comprehensive Plan* (Air Force 1991); the following summarizes those uses. Nellis AFB, located in southern Nevada, is about 8 miles northeast of Las Vegas in Clark County and composed of 11,370 acres (refer to Figure 1.1-1). The 18 square miles of land associated with Nellis AFB are divided into three areas: Area I, the Main Base; Area II, the Munitions Storage Area; and Area III, which include Manch Manor housing and an industrial area (refer to Figure 2.2-1).

Area I is located east of Las Vegas Boulevard (Highway 604) and contains 5.4 square miles, 30 percent of the total base land area. Area I contains the greatest variety of land use activities,

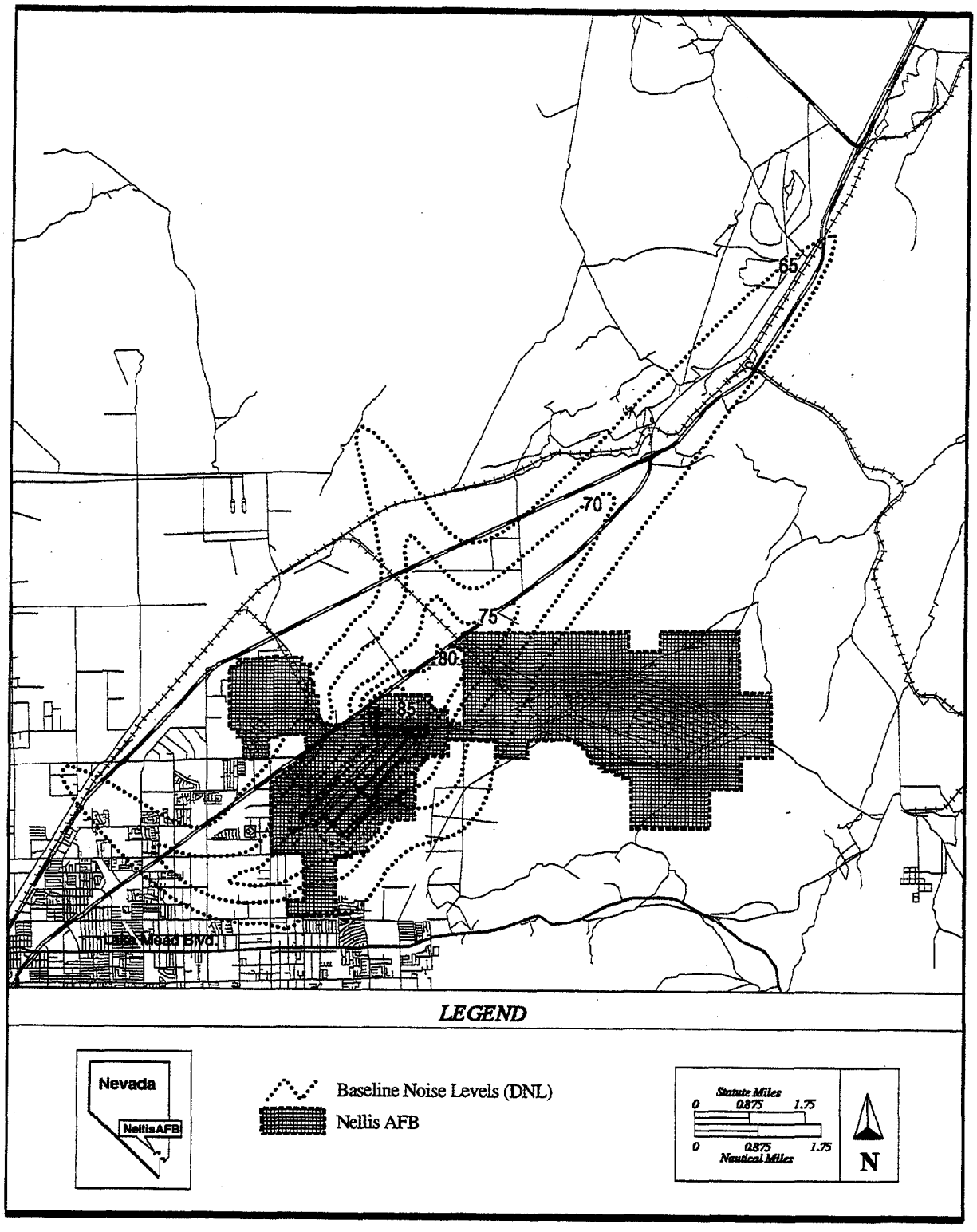

Figure 3.2-2. Baseline Noise Levels in the Vicinity of Nellis AFB

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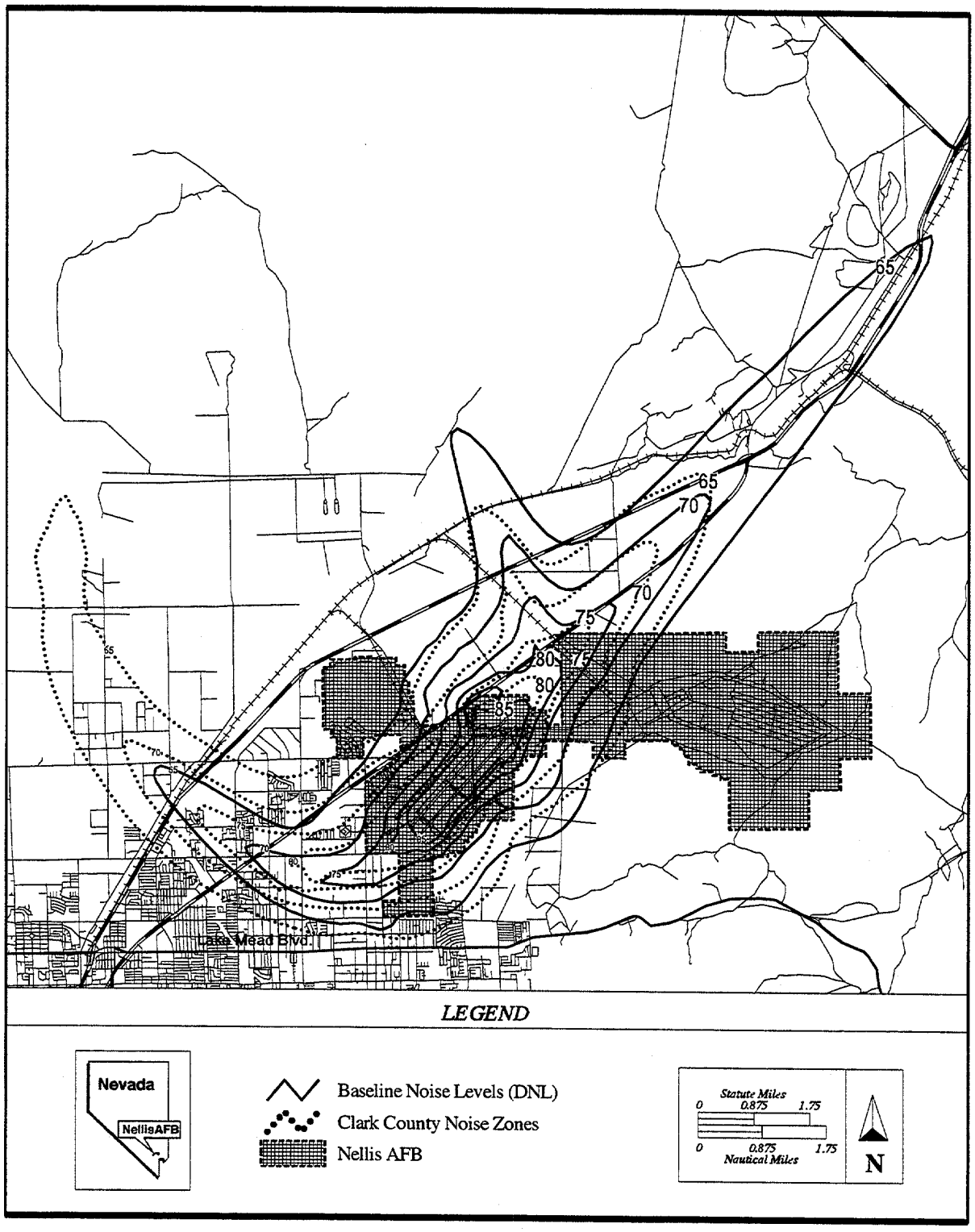

Figure 3.2-3. Baseline and Clark County Noise Zones in the Vicinity of Nellis AFB

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including runways, industrial facilities, housing areas, and most of the base's administrative, training, and support facilities. There are more than 2,000 buildings with about 1,200 family housing units (enlisted and officers), dormitories, and billeting facilities.

Area II is located northeast of the Main Base and includes the munitions storage area and associated facilities. This area is 10.6 square miles, or 59 percent of the total base land area. The majority of Area II is set aside for safety zones, open space, and industrial use. There is also a minor allocation of land and facilities to administrative and commercial uses, dormitories, and outdoor recreation.

West of Highway 604 is Area III, containing 1.9 square miles, or 11 percent, of the total base land area. Land use at Area III consists of housing, recreational facilities, and some light industrial areas, interspersed with considerable open space.

Open space accounts for about 60 percent of all Nellis AFB land; however, a great deal of this is mandatory open space to provide safety zones around munitions storage or similar facilities. Of the total open space, 75 percent is located in Area II. Most of this land is unavailable for future development because it is mandatory open space for explosive safety zones and clear zones. When munitions storage and directly associated facilities and safety zones are combined, munitions operations account for approximately half of the total Nellis AFB land area.

Another land use on and around Nellis AFB is designed to minimize the effects of a potential aircraft accident. Clear, safety, and accident potential zones have been established around the airfield. The safety zones occur both on the base and extend to off-base lands not owned by DoD. Within clear and safety zones, construction is either prohibited (clear zone) or limited in terms of placement and height (safety zone).

A clear zone and two accident potential zones (APZ) define three geographic areas around the airfield where historic Air Force data regarding aircraft mishaps have shown most aircraft accidents occur. The clear zones and APZs are associated with the ends of the runways at Nellis AFB (Figure 3.2-4). The southwest clear zone lies within Nellis AFB, but the northeast clear zone extends beyond the boundaries of Nellis AFB to include 8 acres of open land. Nellis AFB officials are negotiating to ensure that incompatible land uses do not occur in this area.

APZ I is an area beyond the clear zone that has a significant potential for accidents, although less than for the clear zone. DoD recommends that land uses in this zone be limited to light industrial, manufacturing, transportation, communications utilities, wholesale trade, open space, and agricultural uses. Uses that concentrate people in small areas are not considered acceptable.

APZ II, which has the lowest potential of the designated zones for aircraft accidents, extends beyond APZ I. Recommended land uses within APZ II include all of those considered compatible with APZ I, as well as low-density residential, service, and retail trade. Uses that concentrate high densities of people in small areas are not considered appropriate.

F-22 Force Development Evaluation and Weapons School Beddown, Nellis AFB

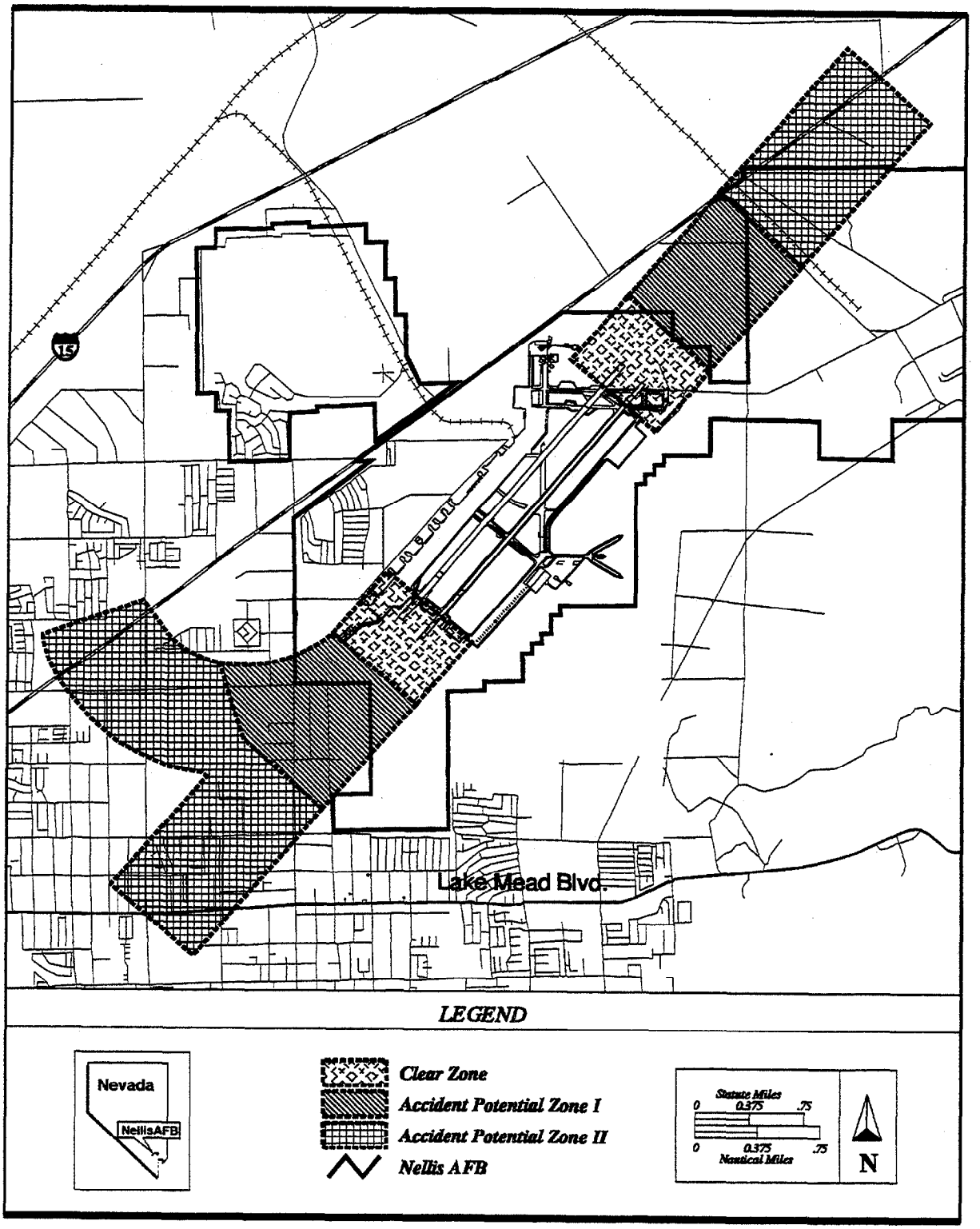

Figure 3.2-4. Clear and Accident Zones at Nellis AFB

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Current noise levels of 65 DNL to greater than 85 DNL affect the base, with the highest noise levels on and around the runway and flightline. All of Area I underlies noise contours of 65 DNL or greater, whereas large portions of Areas II and III lie outside the 65 DNL contours.

OFF-BASE LAND USE: Population growth and accompanying residential, industrial, and commercial development has been the norm for the area around Nellis AFB for more than 20 years. Clark County and the unincorporated communities of North Las Vegas and Sunrise Manor (Figure 3.2-5), surround the base. The Air Force has provided recommendations regarding land uses compatible with aircraft accident hazards and noise exposure through the AICUZ program in the 1981 and 1992 studies mentioned above. In these studies, the Air Force identified areas around the base with incompatible development and presented suggestions for preventing future incompatible land uses.

The general pattern of land use in the vicinity of Nellis AFB has been consistent since the 1980s. Most of the development has occurred south and west toward the Las Vegas urban area and in the communities of Sunrise Manor and North Las Vegas. To the north and east, most of the land is open range and mountain areas. Urban uses (e.g., fuel storage, race track) exist along Las Vegas Boulevard in the area west of the golf course. To the south, land use is characterized by vacant strip commercial parcels, mobile homes, single family homes, and industry. To the west, uses are strip commercial, residential, and industrial. There is also a large amount of vacant, undeveloped land. Land ownership for the area outside Nellis AFB encompassed by baseline noise levels 65 DNL or greater contains 57 percent (about 8,200 acres) privately owned land. This land lies primarily to the southwest and west of Nellis AFB. The remaining 43 percent of the land (about 6,300 acres) consists of federal land managed by the BLM and located northeast of the base. This land includes no development.

Land Use Regulations and Baseline Conditions: The City of North Las Vegas Comprehensive Plan (City of North Las Vegas 1999), *the Clark County Comprehensive Plan and Component Plan Updates* (Clark County 1983), and the *Sunrise Manor Land Use and Development Guide* (Clark County 1996c) provide direction for off-base land use decisions in the vicinity of Nellis AFB. Clark County has also established ordinances regulating development in the vicinity of Nellis AFB. The ordinances or regulations, as enacted in 1996, define compatible land uses relative to the clear zones, APZs, and noise levels. Compatibility requirements in the regulations directly correspond to the noise contours and zones defined in Nellis AFB's 1992 AICUZ study (Figure 3.2-6). For example, the area associated with Clark County's A-E65 compatibility requirements matches the 65 to 70 DNL contour derived in the 1992 study. Table 3.2-2 describes the compatible land uses within these zones. In general, the regulations prohibit development within clear zones (A-E RPZ) and discourage anything other than low-density commercial, industrial, and open/public development in APZ I and APZ II. The regulations are also designed to restrict residential land use to low-density developments with noise attenuation (i.e., construction features to reduce noise) in zones A-E80, A-E75, and A-E70. In zone A-E65, higher density residential development is permitted with noise attenuation. Compatible land uses for specific noise levels adopted by Clark County are similar to 1991 HUD guidelines (Table 3.2-3).

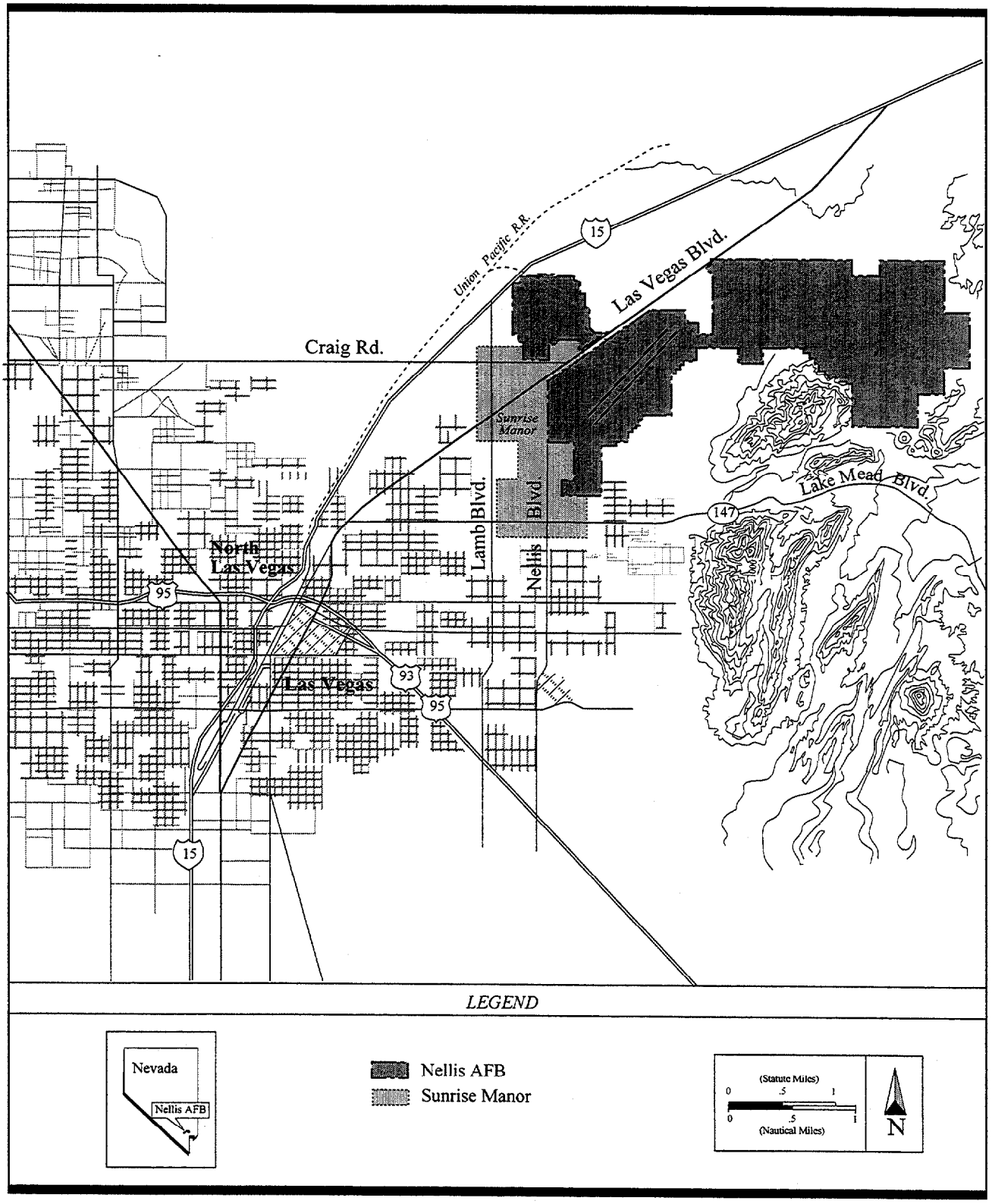

Figure 3.2-5. General Land Use Patterns Around Nellis AFB and Vicinity

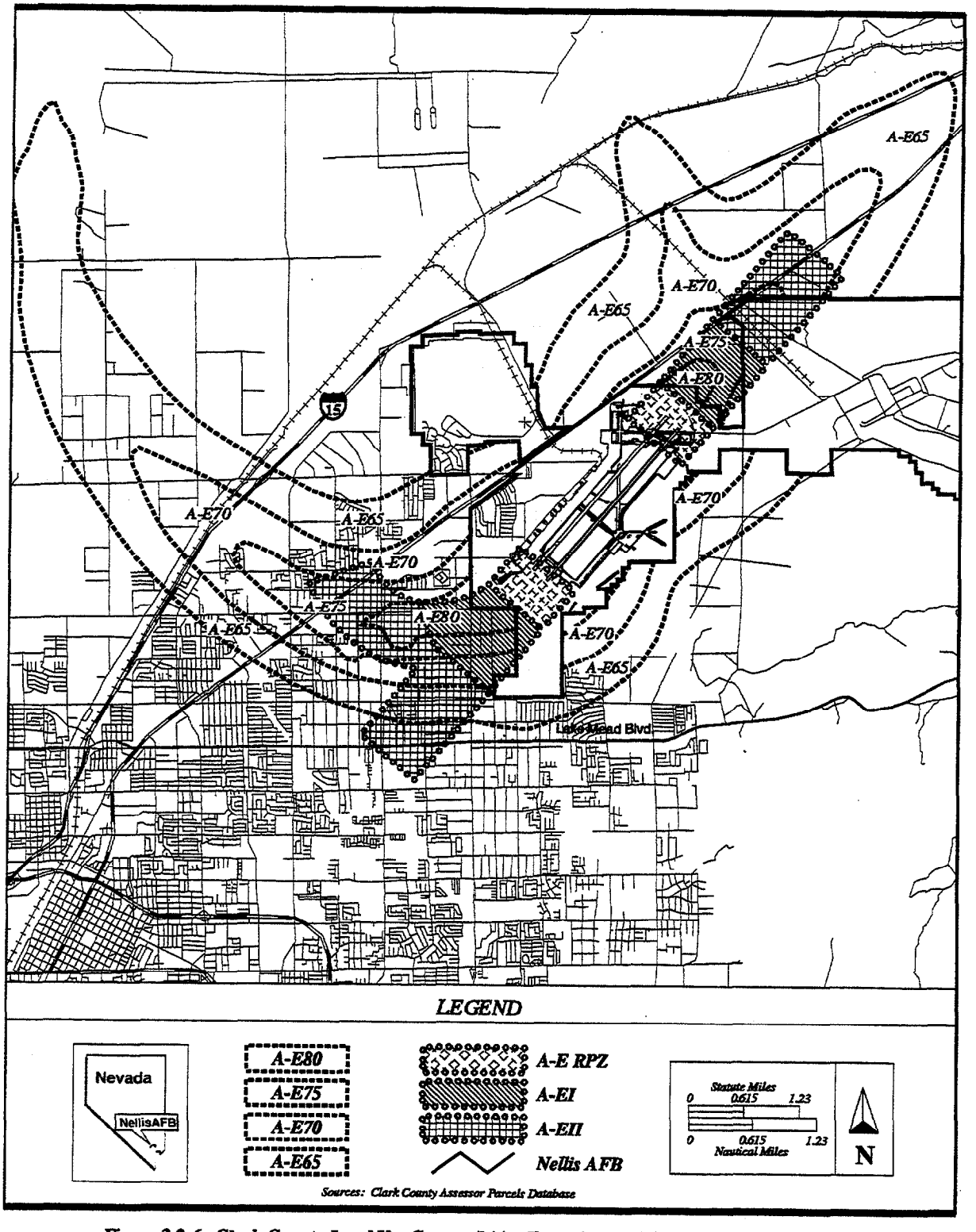

Figure 3.2-6. Clark County Land Use Compatibility Zones for Nellis AFB Airport Environs

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Table 3.2-2. Clark County Land-Use Compatibility in the Airport Environs

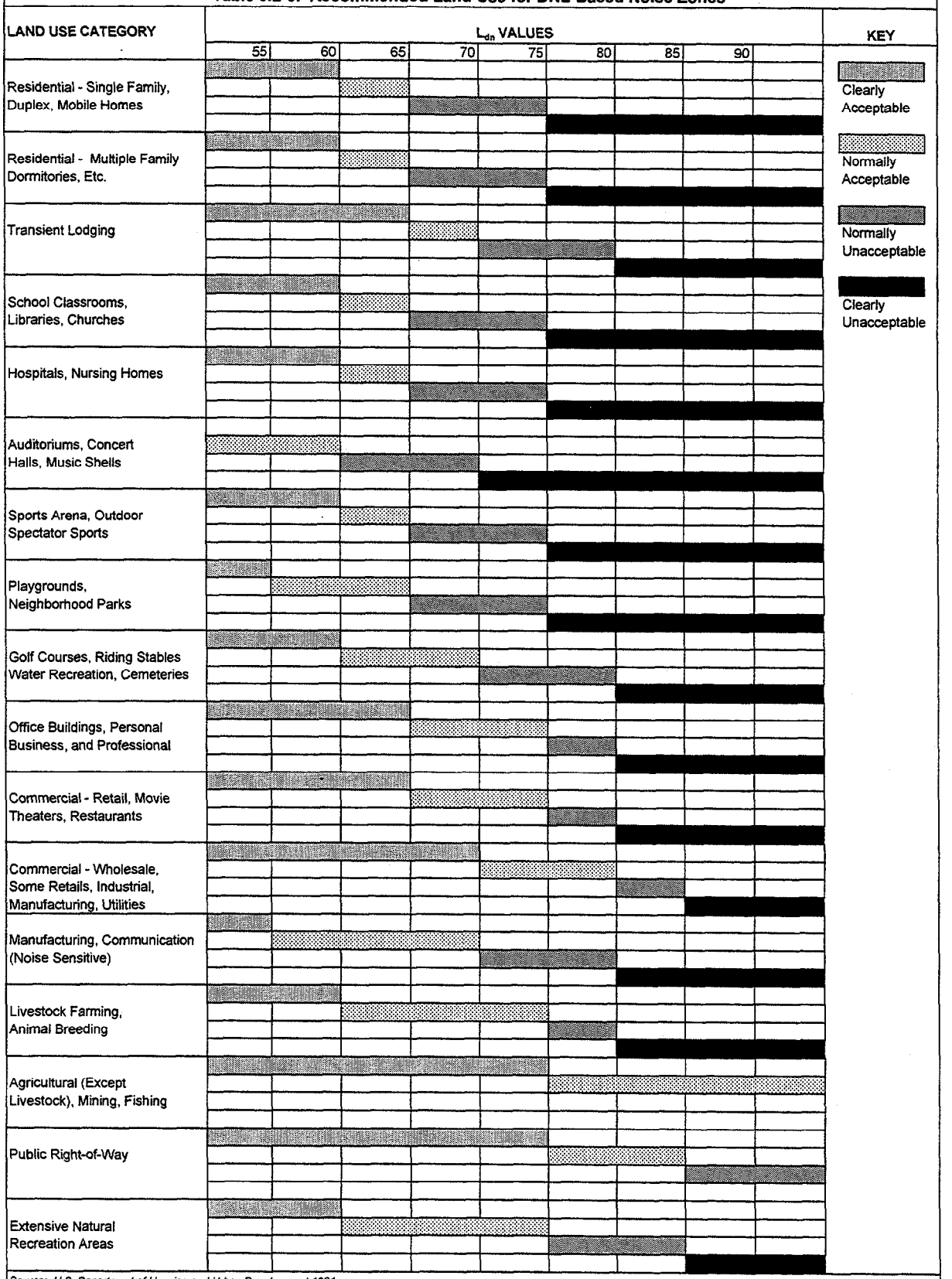
Land Use	*A-E65*	*A-E70*	*A-E75*	*A-E80*	*A-E RPZ*	*APZ I*	*APZ II*
Commercial	Yes	Yes[5]	Yes[5]	Yes[5]	No	No	Yes[3]
Industrial	Yes	Yes	Yes[5]	Yes[5]	No	Yes[3]	Yes[3]
Open/Public[7]	Yes	Yes	Yes[5]	No[1]	No[1]	Yes	Yes
Recreational	Yes	Yes	No[6]	No[6]	No[2]	No	Yes[3]
Residential	Yes[5]	No[4]	No[4]	No[4]	No	No	No[4]

Notes:
1. Open land acceptable
2. Golf courses; driving ranges acceptable
3. Low density/intensity only
4. Fewer than 2 single family units per acre acceptable
5. With noise attenuation features
6. Indoor recreation with noise attenuation acceptable
7. Public consists of utility corridors and sites, transportation rights-of-way, railroad corridors

Land uses inconsistent with Clark County's regulations currently occur within the area surrounding Nellis AFB (Table 3.2-4). Under these regulations, residential land uses are generally restricted in zones A-E70 through A-E80, yet these zones contain over 700 acres of residential development. While the regulations do permit low density (two single family units per acre) in these zones, actual densities exceed this limit in many locations southwest and west of the base. Zone A-E65 also includes more than 1,300 acres of residential development. Regulations permit such development in this zone as long as the dwellings have noise attenuation features. Standard construction practices for housing units such as these provide 20 dB of noise attenuation and meet Clark County Regulations.

More than 30 acres of recreational land uses within zones A-E75 and A-E80 are also inconsistent with existing regulations. These outdoor facilities (e.g., parks) do not meet the standards for acceptability under the regulations. Other land uses, including commercial, industrial, and open/public, are consistent with Clark County compatibility regulations.

Table 3.2-3. Recommended Land Use for DNL-Based Noise Zones



Source: U.S. Department of Housing and Urban Development 1991.

Table 3.2-4. Land Use within Clark County Zones around Nellis AFB (in acres)

	LAND USE ZONES					
Land Use Category	*A-E65*	*A-E70*	*A-E75*	*A-E80*[1]	*Total Acres*	*Total (%)*
Commercial	643	701	99	30	1,473	9
Industrial	137	207	34	57	435	3
Open/Public	7,087	2,969	1,219	320	11,595	74
Recreational	8	29	16[2]	19[2]	72	<1
Residential	1,342[3]	403[2]	245[2]	68[2]	2,058	13
TOTAL	9,617	4,309	1,613	494	15,633	100

[1] Includes areas with noise levels above 80 DNL
[2] Potentially incompatible with Clark County land use regulations; refer to Table 3.2-3
[3] Housing must include noise attenuation features

Areas affected by actual baseline noise levels of 65 DNL or greater (Figures 3.2-7 and 3.2-8) include about 1,000 acres less than the area covered by noise zones associated with Clark County regulations (Table 3.2-5; compare to Table 3.2-4). Most (84 percent) of the affected area consists of open lands.

Table 3.2-5. Land Use under Baseline Noise Levels around Nellis AFB (in acres)

	BASELINE NOISE CONTOURS (DNL)						
Land Use Category	*65-70*	*70-75*	*75-80*	*80-85*	*>85*	*Total Acres*	*Total (%)*
Commercial	304	645	290	0	0	1,239	8
Industrial	108	100	18	0	0	226	2
Open/Public	8,471	2,572	749	391	20	12,204	84
Recreational	39	15	4	0	0	58	<1
Residential	699	68	21	0	0	788	6
TOTAL	9,621	3,400	1,082	391	20	14,514	100

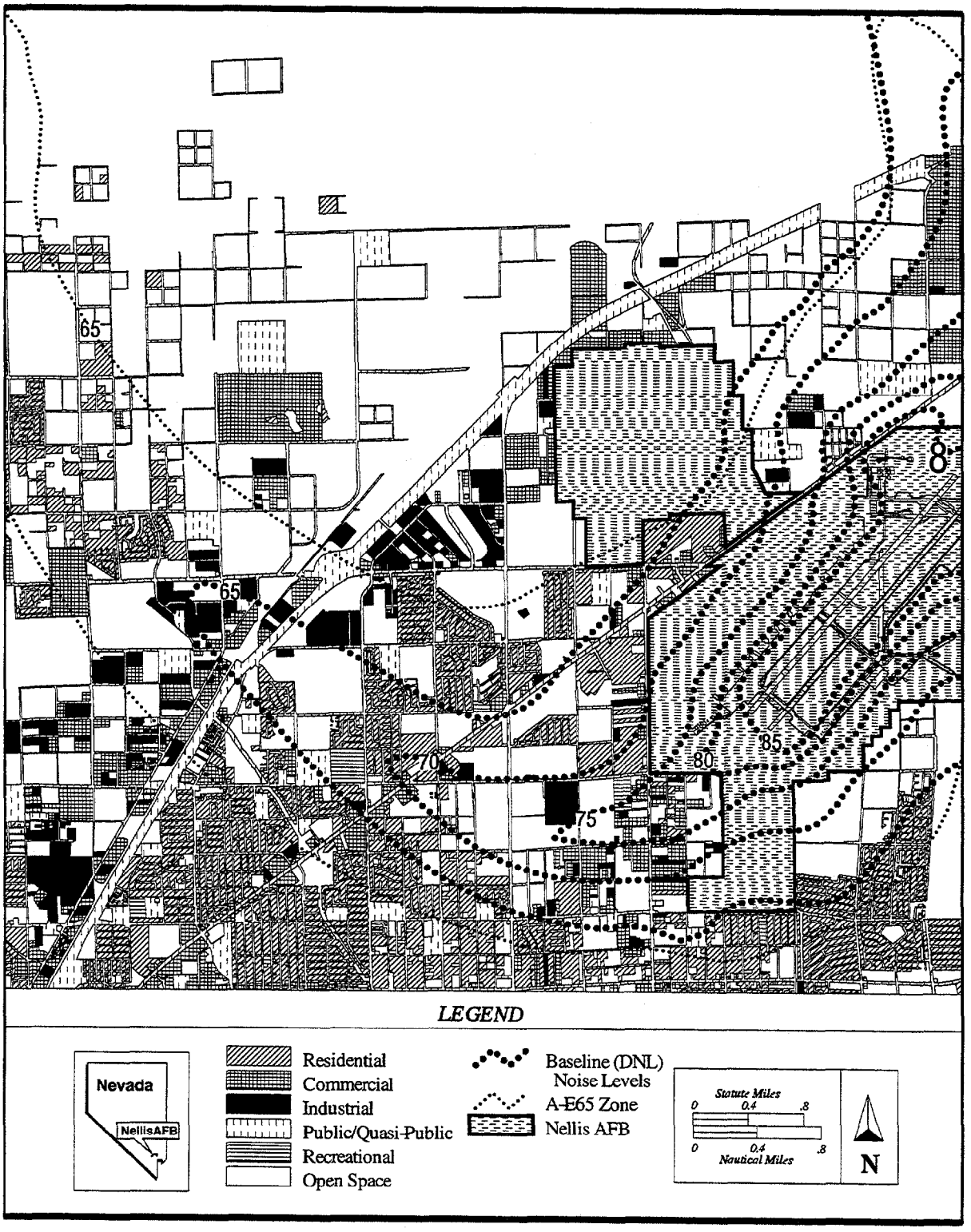


Figure 3.2-7. Land Use and Baseline Noise Levels - Sunrise Manor and North Las Vegas

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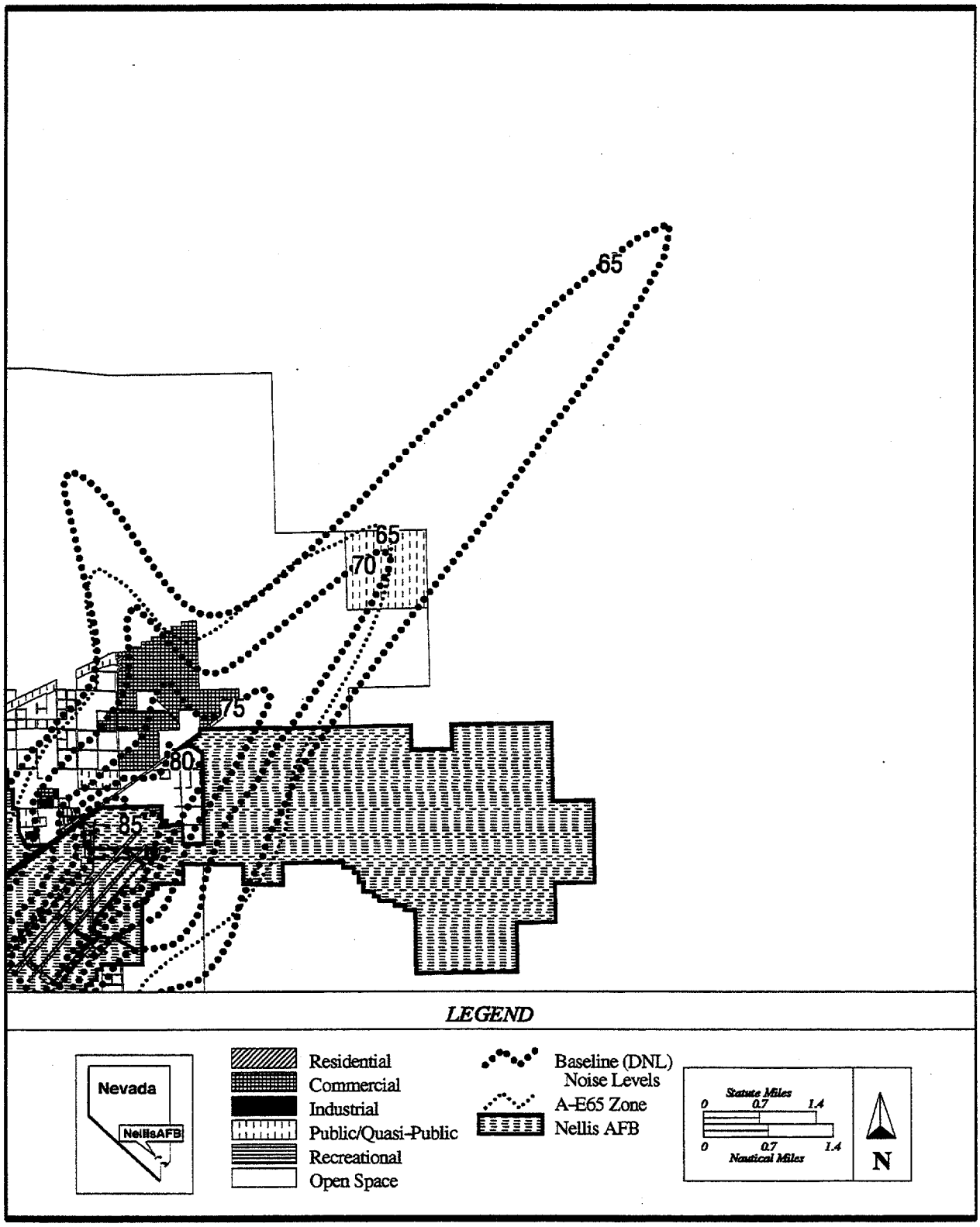


Figure 3.2-8. Land Use and Baseline Noise Levels - Northeast of Nellis AFB

/net/pulsa/oahu/f22/plots/figures/noisefigs11.aml 04/06/99

In addition, the area affected by baseline noise levels extends further to the northeast than Clark County's zones. This area encompasses open, undeveloped lands managed by the BLM. Southwest and west of Nellis AFB, the affected area includes less total lands, as well as less residential and recreational lands, than are within the Clark County zones. About 90 acres of residential development underlay baseline noise levels of 70 to 80 DNL, while more than 700 acres of such development occurs within equivalent zones established by Clark County. Overall, approximately 1,300 fewer acres of residential development underlie noise levels of 65 DNL or greater than are included within the county noise zones. Fifty-eight acres of recreational land use are affected by a baseline noise level of 65 DNL or greater as compared to 72 acres within the county noise zones.

Off-base portions of the APZs also include land uses inconsistent with Clark County's 1996 regulations. Over 300 acres of residential development lies within the APZs (Table 3.2-6) of which 65 acres are contained within APZ II. Such development is prohibited without exception according to the county regulations. The remainder of the area within the APZs consists of a mixture of all other land-use types. All but 8 acres of the clear zone are located on base. Since these acres comprise open lands, they are consistent with land use policies.

Table 3.2-6. Land Use within Clear Zones and Accident Potential Zones (in acres)

	EXISTING LAND USE (ACRES)		
Land-Use Category[1]	*Clear Zone*	*APZ I*	*APZ II*
Commercial	0	92	160
Industrial	0	30	91
On Base	538	252	271
Open/Public	8	559	1,127
Recreational	0	19	4
Residential	0	65	236
TOTAL	546	1,017	1,889

[1] Refer to Table 3.2-3 for regulated off-base land uses

Affected Population and Annoyance: Past and ongoing development has led to higher residential housing densities around Nellis AFB than anticipated in the 1996 Clark County regulations. The area regulated by Clark County for noise levels of 65 DNL or greater (A-E65 through A-E80; refer to Appendix D, Figure D-6) contains approximately 45,000 people (Table 3.2-7). In contrast, the area affected by actual baseline noise levels of 65 DNL or greater includes about half as many people (i.e., 23,000). All of these people currently reside in locations zoned for the current or greater noise levels and have been exposed to the similar or higher noise levels since at least 1981.

Table 3.2-7. Affected Population and Annoyance Estimates around Nellis AFB

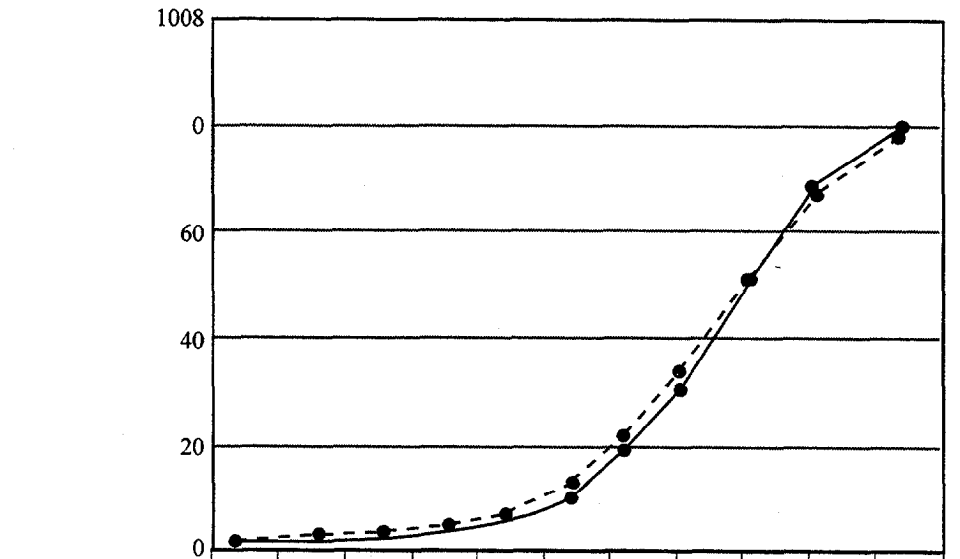
Noise Level (DNL)	*Population Affected* [1]		*Percentage of People Potentially Highly Annoyed* [2]	*Number of People Potentially Highly Annoyed Under Baseline Noise Contours*
	Within Clark County Zones	*Under Baseline Noise Contours*		
65-70	26,005	21,276	12	2,553
70-75	11,482	1,404	22	309
75-80	6,357	121	37	45
80-85	764	0	54	0
>85	0	0	70	0
TOTAL	44,608	22,801		2,907

1. Nellis AFB population excluded; estimated from 1998 count of housing units multiplied by 3.02 people per unit (regional average)
2. Percent reflects low end of noise level range

To determine the potential effects of aircraft noise on underlying populations, a measure of annoyance is used. Annoyance is based on perception. Studies of community annoyance to numerous types of environmental noise show that DNL level correlates with the effect noise has on people. Schultz (1978) and Finegold and others (1994) show a consistent relationship between noise levels and human annoyance (Figure 3.2-9). The most updated form of the noise-annoyance relationship (Finegold *et al.* 1994) is preferred over the original (Schultz 1978), although the differences between the two are minimal. These past studies show that the percentage of people who express various degrees of annoyance can be predicted from DNL noise levels. The higher the noise level, the higher the percentage of people potentially highly annoyed.

Based on the annoyance factors, a total of approximately 2,900 people could be highly annoyed as a result of exposure to baseline noise levels. This represents an estimate since individual responses to aircraft noise vary significantly. Standard construction practices for buildings and houses provide noise attenuation and it can be conservatively estimated that noise levels are reduced by 20 dB.

Sensitive Receptors: Public facilities such as schools, churches, and parks also occur within the area affected by baseline noise levels of 65 DNL or greater (Table 3.2-8). Currently, six churches, schools, and parks are found in areas with noise levels between 65 and 70 DNL, and one park occurs in an area with noise levels exceeding 70 DNL. Within the area defined by the 1996 Clark County land use regulations, 12 noise-sensitive receptors are found in the A-E65 zone (65-70 DNL), 6 in the A-E70 zone (70-75 DNL), and 2 in the A-E75 zone (75-80 DNL).



Day-Night Average Sound Level in dB	40	45	50	55	60	65	70	75	80	85	90
Calculated % HA Points: USAF	0.41	0.83	1.66	3.31	6.48	12.3	22.1	36.5	53.7	70.2	82.6
Calculated % HA Points: SCHULTZ	0.58	1.11	2.12	4.03	7.52	13.6	23.3	37.1	53.3	68.8	81

LEGEND

USAF (Finegold *et al.* 1992) DATA 400 POINTS
%HA = 100/[1 + EXP (11.13 - 0.141 LDN)]

SCHULTZ DATA 161 POINTS
%HA = 100/[1 + EXP (10.43 - 0.132 LDN)]

HA = Highly Annoyed

Figure 3.2-9. Community Surveys of Noise Annoyance

Table 3.2-8. Noise Sensitive Receptors within Clark County Noise Zones and Baseline Noise Contours[1]

Noise Receptor	*A-E65*	*65-70 DNL*	*A-E70*	*70-75 DNL*	*A-E75*	*75-80 DNL*	*A-E80*	*80-85 DNL*	*NA[2]*	*>85 DNL*
Schools	9	3	1	0	1	0	0	0	0	0
Churches	2	2	3	0	0	0	0	0	0	0
Parks	4	1	2	1	1	0	0	0	0	0
TOTAL	15	6	6	1	2	0	0	0	0	0

1. Nellis AFB excluded
2. Clark County defines no zone at this noise level

Noise Abatement Procedures: Nellis AFB currently has a program to reduce noise over residential areas. Existing noise abatement procedures for flights over Sunrise Manor and North Las Vegas generally include the following:

- expedited climb to 6,000 feet MSL for fighter aircraft and 2,500 to 3,500 feet MSL for others;
- 60-degree banked right turn upon departure;
- a departure to the north before 9 A.M.; and
- practice approaches after 9 A.M. on weekends and holidays.

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

3.2.2 Nellis Range Complex

NOISE MODELING: Prediction of aircraft noise in an airspace environment requires two sets of data. The first is a quantitative understanding of aircraft operations such as the numbers of aircraft and their speeds, altitudes, and locations. The data also derive from the physical modeling of the noise accumulated for all aircraft operations.

Aircraft operations (defined as sortie-operations) in the NRC have been described in section 2.2 and Appendix C. Activity varies from year to year. Therefore, historical data were gathered from 1983 through 1997 to develop scenarios representing high- and low-range levels of activity. Appendix A includes documentation supporting development of the 200,000 (low) and 300,000 (high) sortie-operation scenarios.

Noise analysis requires data defining aircraft activity in terms of time in the NRC, as well as the speed, altitude, power setting, and position information. One source of data for this information derives from the NRC airspace manager, who maintains records on the use of NRC airspace units. A second data source, which tracks aircraft, was also analyzed. Activity during Red Flag and Green Flag exercises is recorded for up to 36 aircraft by the Red Flag Measurement and Debriefing System (RFMDS). RFMDS uses instrumentation pods mounted on the aircraft and ground tracking stations to record pertinent data. RFMDS data from 1991 and 1992 were used for prior noise analysis in the NRC (Frampton *et al.* 1993a). In this study, 1991 RFMDS data and 1991 range schedule data were used to develop required inputs. For this EIS, 1997 RFMDS data have been processed and analyzed to update previous analyses. This updated RFMDS analysis has been incorporated into the low and high sortie-operation data to provide the data required for input to the noise models. It accounts for the number, type, duration, speed, and altitude of all sortie-operations.

In addition to RFMDS in the areas used extensively by Red Flag and Green Flag exercises, the Elgin MOA is equipped with an Air Combat Maneuvering Instrumentation system. This system is similar to RFMDS, except that data are obtained for up to eight aircraft and altitude coverage is above 5,000 feet AGL. This system records aircraft engaging in Air Combat Maneuvering training, which takes place at those higher altitudes. Six months of Air Combat Maneuvering Instrumentation data were analyzed as part of a six-month sonic boom monitoring study in the Elgin MOA in 1992 (Frampton *et al.* 1993b). The implications of those data were incorporated into the BOOMAP 96 sonic boom model (Frampton *et al.* 1993c; Plotkin 1996) for this EIS analysis in order to evaluate the number, nature, and location of sonic booms within NRC airspace.

NOISE ENVIRONMENT: Within MOAs and restricted areas, subsonic flight often occurs randomly, or, due to either airspace configuration or training scenarios, it may be concentrated, or channeled, into specific areas or corridors. The Air Force has developed the MR_NMAP (MOA-Route NOISEMAP) computer program (Lucas and Calamia 1996) to calculate subsonic aircraft noise in these areas. MR_NMAP can calculate noise for both random operations and operations channeled into corridors. It is supported by measurements in several military airspaces (Lucas *et al.* 1995).

The NRC includes MOAs and restricted areas in which random aircraft operation is the norm. There are MTRs in the region, but for the most part these exist outside the airspace overlying the NRC. Therefore, the noise levels associated with these routes will not be specifically considered. Operations within route segments that are within the NRC are included in the total noise analysis.

The primary noise metric calculated by MR_NMAP for this assessment is L_{dnmr}. This quantity has been computed for each of the 21 airspace units potentially affected by the Proposed Action and No-Action Alternative. As discussed above and in Appendix D, this cumulative metric represents the most widely accepted method of quantifying noise impact. However, it does not provide an intuitive description of the noise environment. People often desire to know what the loudness of an individual aircraft will be; MR_NMAP and its supporting programs can provide

the SEL for individual aircraft at various distances and altitudes. Table 3.2-9 shows the SEL noise levels at various altitudes for aircraft using the NRC.

Table 3.2-9. Sound Exposure Level (SEL) in dB at Various Altitudes*

	ALTITUDE IN FEET ABOVE GROUND LEVEL						
Aircraft Type	*300*	*500*	*1,000*	*2,000*	*5,000*	*10,000*	*20,000*
B-1	115	112	107	101	92	82	69
F-15C	116	112	107	101	90	80	65
F-16	106	103	98	91	81	70	56
F-18	118	114	108	101	89	77	62
A-10	99	95	89	82	72	63	53
C-130	99	96	91	85	77	69	61

* Level Flight, steady high-speed conditions

Figure 3.2-10 and Table 3.2-10 show the baseline noise levels for 21 of the scheduled airspace units described in section 3.1. Noise was not explicitly computed for the Sally Corridor, which is primarily a transit corridor for aircraft traversing between Nellis AFB and the north range. Sortie-operation rates are comparable to those in the surrounding airspace units, while altitudes tend to be higher. Therefore, noise levels in the Sally Corridor are comparable to or slightly less than those in the adjacent airspace units. Cumulative noise levels are all below 65 L_{dnmr}. Noise levels below 45 L_{dnmr} are presumed to be at ambient levels.

Supersonic flight in the NRC is primarily that associated with Air Combat Maneuvering. This occurs in the Elgin MOA, which is an Air Combat Maneuvering training arena. It also occurs in various locations of the Desert MOA, primarily in Coyote and adjacent airspaces as part of Red Flag and Green Flag exercises.

A sonic boom, resulting from supersonic flight, depends on an aircraft's size, weight, geometry, flight altitude, Mach number (i.e., speed), and maneuvering. When comparing the sonic boom from two aircraft, differences in boom are related to differences in size, weight, and geometry.

Aircraft exceeding Mach 1 always create a sonic boom; however, not all supersonic flight activities will cause a boom at the ground. As altitude increases, air temperature decreases and these layers of temperature change cause booms to be turned upward as they travel toward the ground. Depending on the altitude of the aircraft and the Mach number, many sonic booms are bent upward sufficiently that they never reach the ground. This same phenomenon, referred to as "cutoff," also acts to limit the width (area covered) of the sonic booms that reach the ground.

Sonic booms from Air Combat Maneuvering activity have an elliptical pattern. Aircraft will set up at positions up to 100 NM apart, before proceeding toward each other for an engagement. The airspace used tends to be aligned, connecting the setup points in an elliptical shape. Aircraft will fly supersonic at various times during an engagement exercise. Supersonic events can occur as

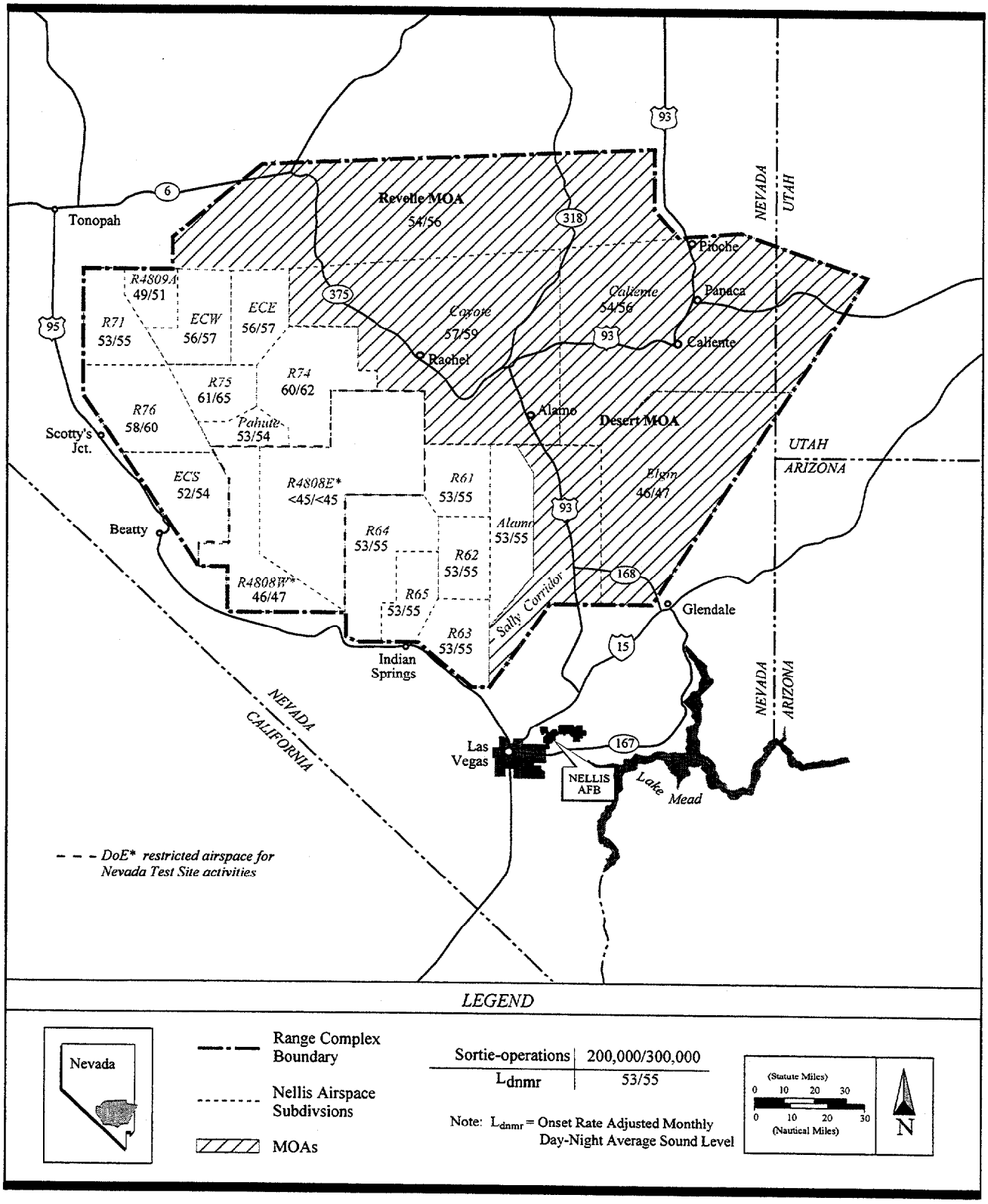


Figure 3.2-10. Existing Noise Levels by Airspace Unit

Table 3.2-10. Baseline Noise Levels (L_{dnmr}) for Nellis Range Complex		
	200,000 SORTIE-OPERATIONS	300,000 SORTIE-OPERATIONS
Airspace	L_{dnmr}	L_{dnmr}
Caliente	54	56
Coyote	57	59
Elgin	46	47
Reveille	54	56
R61	53	55
R62	53	55
R63	53	55
R64	53	55
R65	53	55
Alamo	53	55
EC South	52	54
Pahute Mesa	53	54
R71	53	55
R74	60	62
R75	61	63
R76	58	60
R4809A	49	51
EC East	55	57
EC West	56	57
R4808W[1]	46	47
R4808E[1]	<45	<45
1. DoE airspace over the NTS		

the aircraft accelerate toward each other, during dives in the engagement itself, and during disengagement. The long-term average (CDNL) sonic boom patterns also tend to be elliptical.

Long-term sonic boom measurement projects have been conducted in four airspaces: White Sands (Plotkin *et al.* 1989), the eastern portion of the Goldwater range (Plotkin *et al.* 1992b), the Elgin MOA at Nellis (Frampton *et al.* 1993b), and the western portion of the Goldwater range (Page *et al.* 1994). These studies included analysis of schedule and Air Combat Maneuvering Instrumentation data and they supported development of the 1992 BOOMAP model (Plotkin *et al.* 1992b). The current version of BOOMAP (Frampton *et al.* 1993c; Plotkin 1996) incorporates results from all four studies.

A variety of aircraft conducting testing and training perform flight activities that include supersonic events. Predominately, these events occur during air-to-air combat, often at high altitudes. Roughly 3 to 10 percent of Air Combat Maneuvering flight activities, depending upon aircraft type, result in supersonic events within the approved airspace in the NRC.

Table 3.2-11 and Figure 3.2-11 show baseline supersonic noise levels and sonic booms, CDNL, in affected airspace. This airspace includes the northern portion of Elgin (which is used for Air Combat Maneuvering training) and Coyote as well as other surrounding airspace units used for Air Combat Maneuvering training and air battles as part of flag exercises. As with subsonic noise, levels below 45 CDNL are not shown. The values pertain to only those portions of Caliente and Elgin that allow supersonic flight.

Table 3.2-11. Baseline Supersonic Noise Levels (CDNL) and Sonic Booms

	200,000 SORTIE-OPERATIONS		300,000 SORTIE-OPERATIONS	
Airspace	*CDNL*	*Booms per Month*	*CDNL*	*Booms per Month*
Elgin	54	20	56	30
Coyote	48	4	50	7
R74	<45	2	<45	2
Reveille	<45	2	<45	2
EC East	<45	2	<45	2

Table 3.2-11 shows, in addition to CDNL, the estimated number of booms per month that would be heard on the ground at an average location in each airspace. Individual sonic boom footprints would affect areas from about 10 square miles to 100 square miles, which is a small portion (0.08-0.8 percent) of the area under the airspace. The booms per month values, accounting for the total number of booms and the average area affected by each, represent the number that would be heard, on average, by an individual on the ground under the airspace.

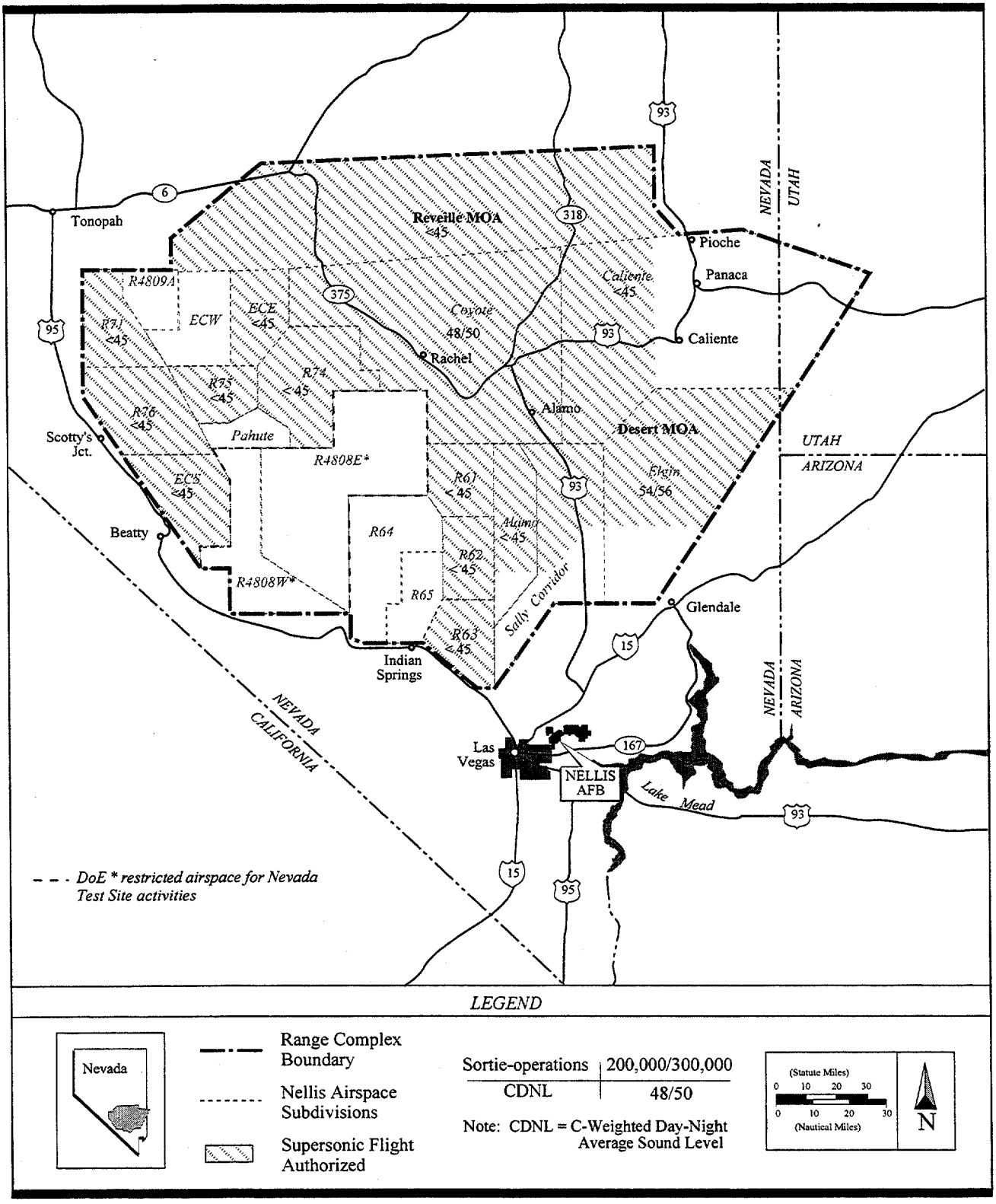


Figure 3.2-11. Baseline Supersonic Noise Levels on Nellis Range Complex

Supersonic events also contribute to overall noise levels. Table 3.2-12 shows the combined effects of subsonic and supersonic noise for airspace units with supersonic noise greater than 45 CDNL. These combined noise levels are 0 to 1 DNL higher than the baseline subsonic noise levels.

Table 3.2-12. Combined Noise Levels[1] under Baseline

Airspace	*200,000 Sortie-Operations DNL*	*300,000 Sortie-Operations DNL*
Elgin	58	60
Coyote	58	60
Reveille	54	56
EC West	54	56
R74	60	62

1. DNL equivalents for CDNL calculated by correlating CDNL values to Schultz Curve [see Appendix D].

LAND USE AND MANAGEMENT: The NRC consists primarily of NAFR and federal land managed by BLM for multiple use with additional areas managed by DoE, USFS, USFWS, the State of Nevada, and private individuals. Land uses on NAFR are discussed in the *Land Use Study for Nellis Air Force Range* (Air Force 1996c) and in the *Finalt Legislation EIS for the NAFR Withdrawal Renewal* (Air Force 1999b). Areas within the NAFR are managed by the Air Force, BLM, and USFWS. Land encompassed by NAFR was once used primarily for mining and some grazing until the range was established in the 1940s. Since then, the land has been used for military purposes, although some mining and controlled recreational activities are permitted and continue to occur within the confines of the range. The land also provides habitat for wild horses, bighorn sheep, desert tortoises, and other wildlife species. BLM, through Air Force concurrence, has granted rights-of-way in the range for specific purposes.

In accordance with the Federal Land Policy and Management Act (FLPMA), National Environmental Policy Act (NEPA), and Military Lands Withdrawal Act (MLWA) of 1986, BLM developed the *Nellis Air Force Range Resource Plan and Record of Decision* (BLM 1992a) to guide management of land comprising NAFR. BLM's guiding principle of multiple use extends to the use of federal lands withdrawn for national defense and security, which, although not available for public use, remain under BLM's jurisdiction and management. All uses, policies, and programs within withdrawn lands must meet federal requirements mandated and administered through BLM. The NAFR plan was directed at "improving rangeland vegetative conditions and wildlife habitat by achieving and maintaining a thriving ecological balance for the wild horse population on the planning area" (BLM 1992a). Management objectives were derived for the following resources: vegetation, wildlife habitat, wild horses, visual resources, Areas of Critical Environmental Concern (ACEC), access, minerals, soil, water, and air resources, forestry,

livestock grazing, cultural and paleontological resources, recreation, wilderness and natural areas, and fire management.

The Wild Horse and Burro Act of 1971 (16 U.S.C. 1331-1340) and regulations of the Secretary of the Interior (43 CFR Part 4700) place the responsibility for protection, management, and control of wild free-roaming horses and burros with BLM when such animals use federal lands administered by BLM as all or part of their habitat. Wild Horse Management Areas (WHMAs) are special-use areas established to maintain populations of wild horses. WHMAs delimit areas within which specified numbers of wild horses are protected from overpopulation and harassment. As the federal agency responsible for protection, management, and control of wild horses and burros using federal lands, BLM, in cooperation with the Air Force, designated lands within NAFR as a wild horse management area. A Cooperative Agreement between BLM and the Air Force, signed in 1974, provides direction and procedures for the care and management of the wild horse population that roams the area. Management tools include periodic monitoring of population numbers, water sources, distribution patterns, and the condition of adults and foals. In accordance with these regulations, BLM, with Air Force concurrence, established a WHMA within the confines of NAFR to facilitate management of the wild horses and burros that use land within the range.

Noise levels in the Wild Horse Management Area for most airspace segments range between 49 and 60 L_{dnmr} at 200,000 sortie-operations and 55 and 60 L_{dnmr} at 300,000 operations. R75 experiences 61 and 63 L_{dnmr} at 200,000 and 300,000 sorties respectively. The lowest noise levels over Wild Horse Management Areas, 46 L_{dnmr} at 200,000 sorties and 47 L_{dnmr} at 300,000, are under the Elgin MOA.

Desert National Wildlife Range (DNWR), also a special use area within the NAFR, was originally established by Public Land Order 7373 in 1936 and became part of the National Wildlife Range System in 1976. As amended in 1966, it currently consists of approximately 1.6 million acres, with 826,000 acres withdrawn for military use. The refuge is located within and adjacent to the southeastern area of NAFR. Its southernmost boundary is about one half mile from the city limits of Las Vegas.

The DNWR falls under eight existing airspace segments including R 4808E, R 61, R 62, R 63, R 64, and R 65, Alamo and the Sally Corridor. Baseline noise levels for R 4808E are less than 45 L_{dnmr} based on either 200,000 or 300,000 sortie-operations. Noise levels for all other airspace units over the DNWR are currently 53 L_{dnmr} based on 200,000 sortie-operations and 55 L_{dnmr} at 300,000 sortie-operations.

The use of DNWR for military purposes began during World War II when portions of the area near Indian Springs were identified as suitable for military training, and a proclamation by President Roosevelt designated the area for such use. The Secretary of the Interior granted permission for military use of the area until the end of the Korean War. Sporadic use of the area for military training activities has continued to the present.

All grazing rights or privileges within the joint-use area of DNWR have been eliminated through purchase or termination of permits. Use and public access to the joint-use area of DNWR and

NAFR are restricted by an MOU between the Air Force and the Department of the Interior and the MLWA of 1986. A description of recreational opportunities available in DNWR is provided in section 3.10, Recreation and Visual Resources. A description of wildlife resources and management within DNWR is provided in section 3.7, Biological Resources.

Inclusion of land into the National Wilderness Preservation System is intended to preserve areas in a primitive state that possess little evidence of human activity. The Wilderness Act of 1964 identified criteria for evaluating areas for wilderness characteristics and gave direction on how designated wilderness areas should be managed. Subject to certain exemptions, use of motor vehicles or other motorized equipment, landing of aircraft, and construction of structures and roads are prohibited in wilderness areas. Wilderness and special use areas located beneath affected airspace, including the Quinn Canyon and Grant Range wilderness areas in the Humboldt National Forest (Figure 3.2-12), are currently exposed to noise levels of 54 to 56 DNL.

Each federal agency is responsible for evaluating, nominating, and protecting potential wilderness areas within the lands they manage. In 1975, the USFWS proposed approximately 88 percent of the DNWR for inclusion in the National Wilderness Preservation System. Areas excluded from the wilderness proposal included land on which NAFR target facilities are located; target areas are generally located in valleys below 4,000 feet (below 3,600 feet in Three Lakes Valley). The proposed wilderness area within DNWR is currently managed as *de facto* wilderness so as not to impair its wilderness qualities. Aircraft operations are generally restricted to a minimum of 2,000 feet above ground level, except for special training missions. The *Public Land Withdrawal Environmental Impact Statement* (DOI and BLM 1979) states that the wilderness designation will not affect the Air Force's use of NAFR for bombing and gunnery practice and that continued military use, as described in the MOU between the USFWS and the Air Force, will not preclude the USFWS from managing the area as *de facto* wilderness.

Most of the area within the NRC consists of federal lands managed by BLM. The BLM manages lands in units referred to as districts or field offices. The NRC encompasses lands within the Las Vegas Field Office, the Battle Mountain Field Office, and the Ely District in Nevada. Management of these lands is guided by the *Caliente Management Framework Plan,* which establishes guidelines for the classification of lands for multiple uses, including agriculture, residential, commercial, industrial, recreation, and public purposes (BLM 1980). By coordinating land acquisition and disposal, establishing rights-of-way and discouraging trespass, the plan provides support for other resource management programs. In addition, the plan designates guidelines to determine lands suitable for agriculture production, mandates continued use of existing communication sites and continued usage of existing corridors for utility systems to limit disturbance, and determines the suitability of land for public sale. The BLM is amending the *Caliente Management Framework Plan* specifically to address the management of the threatened desert tortoise habitat (personal communication, McGinty 1998). The *Caliente Management Framework Plan* is intended to guide resource management for 20 to 25 years, addressing relevant activities (such as grazing and recreation) and managing these activities by incorporating a balanced multiple-use approach.

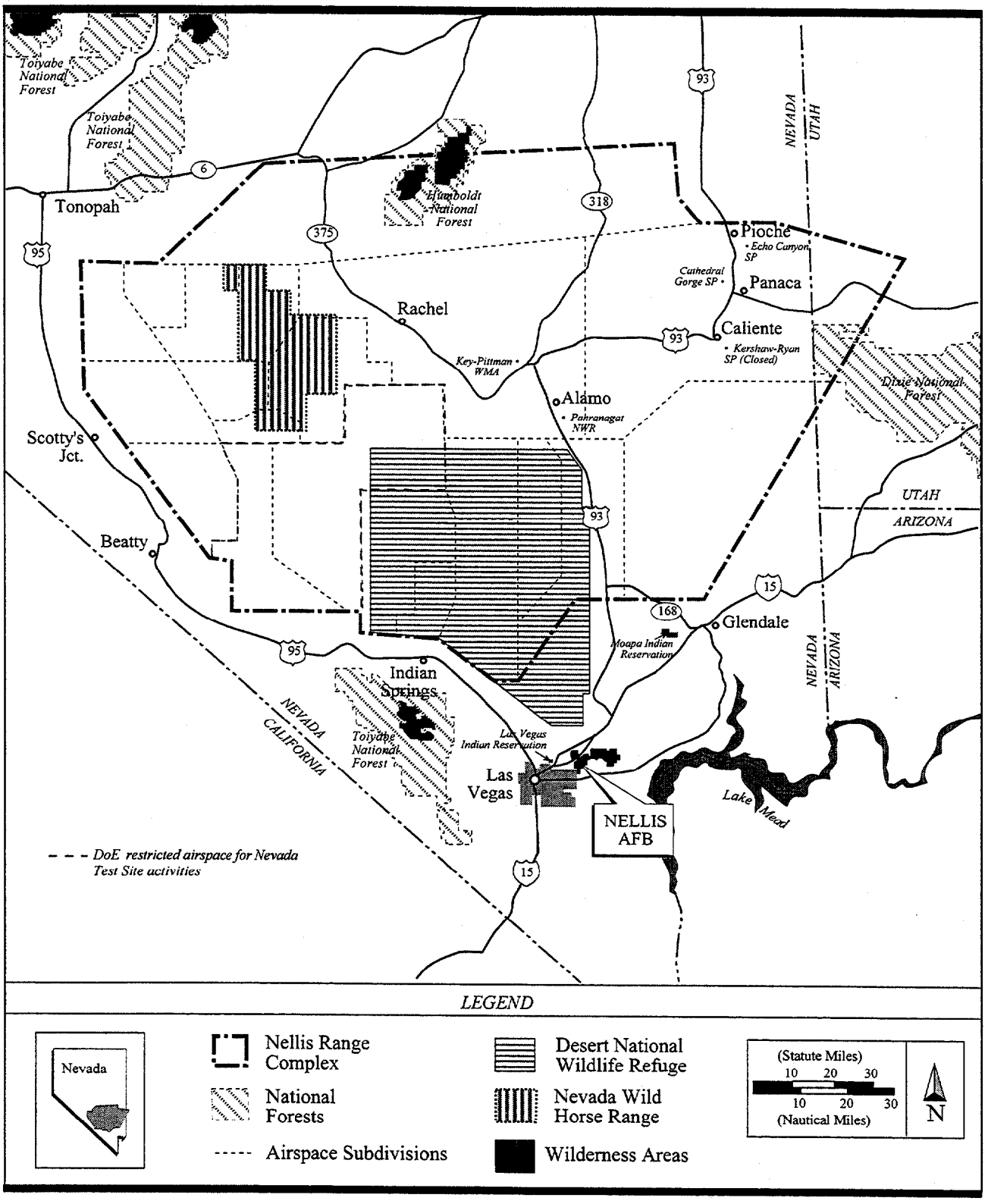


Figure 3.2-12. Communities and Special Use Areas under Nellis Range Complex

The Tonopah Resource Area includes 6.1 million acres of public land and approximately 165,000 acres of private land. The *Tonopah Resource Area Management Plan and Final Environmental Impact Statement* (BLM 1994) provides a comprehensive framework for managing the public lands located in the Tonopah Resource Area for the next 10 to 20 years. Specific management objectives are provided within the plan for watershed, vegetation, visual resources, wildlife habitat, special status species, riparian habitat, forestry and vegetation products, livestock grazing, wild horses and burros, forage allocation, cultural resources, lands and rights-of-way, ACECs, recreation, wilderness, utility corridors, minerals, and fire management.

The BLM, in accordance with Section 603(c) of FLPMA, reports to Congress on the federal lands under its management that are suitable for inclusion in the National Wilderness Preservation System. To accomplish this task, BLM inventoried and evaluated federal lands under its jurisdiction to determine areas suitable for wilderness designation. The result of the land inventory was the identification of a number of wilderness study areas (WSAs). The major factors evaluated for each WSA include wilderness qualities such as naturalness, size, solitude, and special features; additional wilderness quality factors include multiple resource benefits, balance of the geographic distribution of wilderness areas, diversity of natural systems, and manageability (BLM 1991). BLM submitted recommendations for designation of these lands to the Secretary of the Interior for eventual congressional action. Because the congressional review process is still underway, BLM manages WSAs as *de facto* wilderness so as to not impair their suitability for wilderness designation. The NRC contains 16 WSAs (Table 3.2-13) with current noise levels between 48 and 59 DNL.

Table 3.2-13. Wilderness Study Areas (WSA) Underlying the Nellis Range Complex

Number	*WSA*	*Acres*
NV-040-242	Worthington Mountains	47,633
NV-040-246	Weepah Spring	61,137
NV-050-132	South Pahroc Range	28,600
NV-050-139	Clover Mountains	84,935
NV-050-156	Meadow Valley Mountains	185,744
NV-050-161	Mormon Mountains	162,887
NV-050-166	Tunnel Spring (Cougar Canyon)	5,400
NV-050-177	Delamar Mountains	126,257
NV-050-201	Fish and Wildlife #1	11,090
NV-050-215	Arrow Canyon Range	32,853
NV-050-216	Fish and Wildlife #2	17,242
NV-050-217	Fish and Wildlife #3	22,002
NV-050-1R-16	Evergreen A, B, C	2,964
NV-060-019	Kawich	54,320
NV-060-112	Palisade Mesa/South Reveille	99,550
NV-060-163	The Wall	38,000

Other federal lands underlying the NRC include the Nevada Test Site, managed by DoE; portions of the USFWS Desert National Wildlife Range; Pahranagat NWR; as well as portions of the Humboldt and Dixie National Forests. Land use in the national forests consists of grazing, recreation, wildlife and wildlife habitat preservation, timber production, and mining (USFS 1985). The State of Nevada maintains two state parks and one state recreation area on lands under NRC airspace but outside the NAFR. Noise levels in these areas range from 45 to 59 DNL, but most areas experience noise levels around 53 to 56 DNL.

National Wildlife Refuges are designated and managed by USFWS to "preserve a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources of the U.S. for the benefit of present and future generations." The Pahranagat, Moapa Valley National Wildlife Refuges, and Key Pittman Wildlife Management Area underlie NRC airspace. Noise levels range from 48 to 57 DNL.

Cathedral Gorge State Park, Beaver Dam State Park, and Echo Canyon State Recreation Areas all underlie the NRC (refer to Figure 3.2-12). A discussion of these areas is provided in section 3.10, Recreation.

A Five-Party Cooperative Agreement (1997) between Nellis AFB, USFWS, BLM, State of Nevada Clearinghouse, and the DoE was implemented to enhance management of the natural resources within the Great Basin and Mojave Desert ecosystems located on the NAFR, DNWR, and NTS.

Sections of privately owned land occur within the NRC, the largest of which is associated with the northern portions of the Las Vegas metropolitan area. Other communities are located along the roadways to the east of NAFR (refer to Figure 3.2-12). Noise levels in these areas range from 53 to 55 DNL.

3.3 AIR QUALITY

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. The significance of a pollutant concentration is determined by comparing it to federal (national) and state air quality standards. National Ambient Air Quality Standards (NAAQS) are established by the U.S. Environmental Protection Agency (EPA) for criteria pollutants including ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter equal to or less than ten micrometers in diameter (PM_{10}), and lead (Pb). NAAQS represent the maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare. Short-term standards (1-, 8-, and 24-hour periods) are established for pollutants contributing to acute health effects, while long-term standards (annual averages) are established for pollutants contributing to chronic health effects.

The Nevada Division of Environmental Protection (NDEP), Bureau of Air Quality, has adopted the NAAQS to regulate air pollutant levels within the state, with the following exceptions and additions: (1) the state annual SO_2 standard is more stringent than the national standard, (2) Nevada has added an 8-hour CO standard specific to elevations greater than 5,000 feet above mean sea level, and (3) Nevada has added standards for visibility impairment and 1-hour hydrogen sulfide (H_2S) concentrations. The national and state ambient air quality standards are shown in Table 3.3-1.

Pollutants considered in the analysis for this EIS include the criteria pollutants measured by federal and state standards. These include volatile organic compounds (VOCs), which are precursors to (indicators of) O_3; nitrogen oxides (NO_X), which are also precursors to O_3 and include NO_2 and other compounds; CO; and PM_{10}. The methods used in the air quality analysis are presented in Appendix E.

Defining an ROI for air quality requires knowledge of (1) the types of emissions, (2) location(s) of the sources of emissions (for stationary sources) and the horizontal and vertical extent of emissions from mobile sources such as aircraft, (3) emission rates of the pollutant sources, (4) the nearness of existing emission sources to those sources associated with the Proposed Action, and (5) local and regional climate conditions. An ROI for emissions can vary from 0.3 to 2.5 miles (urban scale) up to 2 to 31 miles or more (regional scale), depending on the pollutant being studied. These scales are adopted from EPA regulations concerning ambient air quality monitoring. The ROI for emissions of inert pollutants (pollutants other than O_3, its precursors, or NO_3) is generally limited to a few miles downwind from the source. This would equate roughly to the "urban scale." The ROIs for O_3 and NO_2 generally extend much farther downwind than the ROI for inert pollutants: in the presence of radiation from the sun, the maximum effect of precursor emissions on O_3 formation levels, and the transformation of NO_X emissions to NO_2, usually occurs several hours after their emission. The time delay in O_3 and NO_2 formation can permit winds and other climatic conditions to transport these emissions several miles from their source. In this instance, a "regional scale" ROI would be applicable.

Table 3.3-1. National and Nevada Ambient Air Quality Standards

			NATIONAL STANDARDS [a]	
Pollutant	*Averaging Time*	*Nevada Standards* [a]	*Primary* [b,c]	*Secondary* [b,d]
Ozone (O_3)	1-hour	0.12 ppm (235 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as primary
	8-hour	0.08 ppm (160 $\mu g/m^3$)	0.08 ppm (160 $\mu g/m^3$)	Same as primary
Carbon monoxide (CO)	8-hour	9 ppm [e] (10 mg/m^3) 6 ppm [f] (6.67 mg/m^3)	9 ppm (10 mg/m^3)	—
	1-hour	35 ppm (40 mg/m^3)	35 ppm (40 mg/m^3)	—
Nitrogen dioxide (NO_2)	Annual	0.053 ppm (100 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	Same as primary
Sulfur dioxide (SO_2)	Annual	0.02 ppm (60 $\mu g/m^3$)	0.03 ppm (80 $\mu g/m^3$)	—
	24-hour	0.14 ppm (365 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	—
	3-hour	—	—	0.5 ppm (1,300 $\mu g/m^3$)
Suspended Particulate Matter (PM_{10})	Annual	50 $\mu g/m^3$	50 $\mu g/m^3$	Same as primary
Lead (Pb)	Cal. quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$	Same as primary
Visibility	Observation	In sufficient amount to reduce the prevailing visibility to less than 30 miles when humidity is less than 70%	—	—
Hydrogen sulfide (H_2S)	1-hour	112 $\mu g/m^3$	—	—

Notes: (a) Standards, other than 1-hour O_3, 8-hour O_3, 24-hour PM_{10}, and those based on annual averages, are not to be exceeded more than once a year. The 1-hour O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one. The 8-hour O_3 standard is attained when the 3-year average of the annual 4th-highest daily maximum 8-hour concentrations is below 0.08 ppm. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile 24-hour concentrations is below 150 $\mu g/m^3$.

(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units are given in parenthesis.

(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

(e) Applies at elevations less than 5,000 feet above mean sea level.

(f) Applies at elevations equal to or greater than 5,000 feet above mean sea level.

An ROI for air quality also has a vertical dimension since the emissions occur in a volume of air. This vertical dimension depends upon climatic conditions. The upper vertical limits of an ROI equate to the mixing height for emissions, which varies region to region based on daily temperature changes, amount of sunlight, winds, and other climatic factors. Emissions released

above the mixing height become so widely dispersed before reaching ground level that any potential ground-level effects would not be measurable.

Studies using 62 National Weather Service stations throughout the U.S. (Holzworth 1972) provide a measure of the meteorological conditions to define mixing heights. For the areas encompassing Nellis AFB and the NRC, mixing heights average about 1,100 feet above ground level (AGL) in the morning and 8,000 feet AGL in the afternoon. Based on this pattern and other meteorological conditions, the average mixing height for Nellis AFB and the NRC is considered to be 5,000 feet AGL for this analysis.

Two ROIs have been established for the purpose of the EIS. One centers on and surrounds Nellis AFB, extending outward to include the area around the base that is subject to emissions from aircraft operations. The other ROI encompasses the NRC. The meteorological conditions of the ROIs encompassing the base and NRC tend to cause good to fair dispersion of emissions. Las Vegas is situated near the center of a broad desert valley that is almost surrounded by mountains ranging from 2,000 to 10,000 feet higher than the floor of the valley. These mountains and associated valleys in both ROIs can be subject to strong surface-based temperature inversions in the winter months (December through February). Such inversions can result in poor dispersion of emissions. The Las Vegas Valley, which encompasses Nellis AFB, runs from northwest to southeast and slopes gradually upward on each side toward the surrounding mountains. In the NRC, the mountains tend to be higher and cause greater variations in climatic conditions. Winds usually downslope toward the center, or lowest portion of the valleys, and range from 9 to 11 miles per hour (mph) in the morning and 11 to 13 mph in the afternoon, helping to disperse pollutants. Winds of 50 mph are infrequent; when they do occur, however, the Las Vegas Valley as well as areas of the NRC are particularly subject to blowing dust and sand which produces reduced visibility.

The Clean Air Act of 1970 and its Amendments of 1990 (see Appendix A) place most of the responsibility to achieve and maintain the NAAQS on individual states. The primary mechanism for implementation is known as the State Implementation Plan (SIP), which the EPA requires each state to prepare. Each SIP identifies goals, strategies, schedules, and enforcement actions that will lead the state into compliance with all federal air quality standards.

Section 176, General Conformity, of the Clean Air Act prohibits federal agencies from supporting any activities that do not conform to an EPA-approved SIP. The EPA has issued regulations clarifying the applicability of any procedures for ensuring that federal activities comply with the Clean Air Act Amendments. Conformity means compliance with a SIP for the purpose of attaining or maintaining the NAAQS. Specifically, this means ensuring the federal activity (such as the proposed beddown of the F-22) will (1) not cause a new violation of existing NAAQS, (2) not contribute to an increase in the frequency or severity of violations of existing NAAQS, or (3) not delay the timely attainment of any NAAQS, interim milestones, or other milestones to achieve attainment. The current ruling applies to federal actions in NAAQS nonattainment or maintenance areas only. The Final Conformity Rule applies to all federal agencies until the applicable state's SIP conformity requirements are approved by the EPA.

Under this rule, certain actions are exempted from conformity determinations, while others are presumed to be in conformity if total project emissions for a given pollutant are below the *de minimis* levels established by regulation. These *de minimis* levels are represented in tons per year. Total project emissions include both direct and indirect emissions that can be controlled by a federal agency. No proposed federal action is exempt, and Clark County, Nevada (i.e., the location of Nellis AFB) is a nonattainment area for two criteria pollutants (i.e., CO and PM_{10}), so an analysis of the action must include a review to assess whether a conformity determination is needed.

The Clean Air Act also established Prevention of Significant Deterioration (PSD) regulations to protect the air quality in regions that already meet the NAAQS. PSD requirements affect construction of new major stationary sources and are a preconstruction permitting system. Mobile sources such as aircraft are generally exempt from PSD permit review. The major requirement of the PSD regulations is that the air quality impacts from new or modified PSD sources in combination with impacts from other PSD sources must not exceed the maximum allowable incremental increases for NO_2, PM_{10}, or SO_2.

Section 169A of the Clean Air Act declares the national goal of preventing impairment of visibility from manmade air pollution in the mandatory Class I federal areas. In Section 162 of the Clean Air Act, Congress assigned mandatory Class I status to all international parks, national wilderness areas which exceeded 5,000 acres, national memorial parks which exceeded 5,000 acres, and national parks which exceeded 6,000 acres which were in existence on August 7, 1977. In Class I areas, visibility impairment is defined as a reduction in regional visual range and atmospheric discoloration. Stationary sources, such as industrial complexes, are typically the issue for visibility within a PSD Class I area.

3.3.1 Nellis AFB and Vicinity

The EPA assigns classifications to areas throughout the United States with respect to air quality conditions. When an area is considered for classification, there are three possible outcomes of the designation process for each of the criteria pollutants:

(i) Nonattainment—any area that does not meet (or that contributes to ambient air quality in an area that does not meet) the national primary or secondary standard for the pollutant. Former nonattainment areas that have achieved attainment of NAAQS are designated as maintenance areas;

(ii) Attainment—any area (other than an area identified in clause [i]) that meets the national primary or secondary ambient air quality standard for the pollutant; or

(iii) Unclassifiable—any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant (EPA 1996a).

Portions of Clark County immediately surrounding Las Vegas and encompassing Nellis AFB are designated as a "serious" CO nonattainment area and a "serious" PM_{10} nonattainment area (40

CFR Part 81.329). The CO problem was recently changed from "moderate" to "serious" nonattainment.

In terms of CO, Clark County air quality has been improving since 1990. Both the number and severity of exceedences of the NAAQS for CO have decreased over this period. Despite this steady improvement, the county did not meet EPA requirements to achieve and maintain the CO attainment by the end of 1996. As a result, the EPA was bound by regulation to redesignate Clark County as a serious nonattainment area for CO.

To achieve attainment of the NAAQS for CO and PM_{10}, the Clark County Air Pollution Control District (CCAPCD) has prepared two plans: (1) *CO Air Quality Implementation Plan for the Las Vegas Valley Nonattainment Area, Clark County, Nevada* (Clark County 1995b) and (2) *PM (PM_{10}) Air Quality Implementation Plan for the Las Vegas Valley Nonattainment Area, Clark County, Nevada* (Clark County 1995c). Now that Clark County has been redesignated to serious nonattainment for CO, a revised SIP must be submitted to EPA (expected to be submitted in September, 1999). Until the revised SIP is approved by EPA, regional CO emissions will be addressed with respect to the existing *CO Air Quality Implementation Plan*. This plan specifies the total daily CO emissions budget for the Las Vegas Valley is 338 tons, or roughly 123,000 tons per year. A draft SIP for PM_{10} was submitted to the EPA at the end of 1997, but has not been approved (personal communication, M. Naylor 1999).

The CO problem in Clark County is related primarily to automobile traffic and is made worse by regional topography and weather patterns resulting in strong temperature inversions. Roughly 96 percent of the CO in Clark County comes from cars and trucks. Traffic congestion in and around the city center is considered to be the main cause of CO violations. More than 19 million vehicle miles are traveled each day in the Las Vegas area. Steady population growth is predicted to raise this by 1 million miles per day or more each year. Wood-burning stoves and fireplaces form the second largest source of CO in the county (Clark County 1998).

An inventory (Clark County 1995c) established that total annual emissions for PM_{10} in the Las Vegas Valley were about 87,000 tons. For PM_{10}, fugitive dust from construction activities, unpaved roads, and disturbed vacant lands represent the dominant source of the nonattainment problem. These sources account for 60 percent of the annual PM_{10} emissions in the Las Vegas Valley. With the current and projected population growth in the area and its associated construction, these sources are likely to remain dominant.

Table 3.3-2 provides a summary of baseline air emissions associated with Nellis AFB. Ground-based emissions were calculated as part of the 1995 Nellis AFB emission inventory (Radian 1995) and include sources such as jet engine test cells, fuel transfer operations, aircraft support equipment, and emergency generators.[1] Emissions associated with airfield operations (landing, takeoff, touch-and-go) were calculated based on aircraft activity summaries generated in support of the 1997 noise study. These data include the numbers of aircraft operations conducted by

[1] The 1995 emission inventory includes Indian Springs Air Force Auxiliary Field, but it is not addressed here.

base-assigned and transient aircraft and use the same information as used to characterize the airfield noise environment.

Table 3.3-2. Summary of Baseline Emissions at Nellis AFB (Tons/Year)

Source	*CO*	*VOC*	*NO_x*	*SO_x*	*PM_{10}*
Ground-Based[1]	1,805	228	339	34	34
Aircraft[2]	839	305	320	338	20
TOTAL	2,644	533	659	372	54

Notes: 1. Nellis AFB 1995 Air Emissions Inventory (Radian 1995)
2. Includes landing and takeoff and touch-and-go emissions for all aircraft at Nellis AFB only. Indian Springs Air Force Auxiliary Field aircraft activity not included. (Radian 1995)

The total annual CO emissions for Nellis AFB represent about 2 percent of the CO emissions budget for Clark County under its current plan. PM_{10} emissions for Nellis AFB are about 0.06 percent of the Clark County total. Neither represents a substantive contributor to CO and PM_{10} nonattainment for the Las Vegas area. Other emissions (VOC, NO_X, and SO_X) are also minimal.

Nellis AFB currently holds a Title V/Part 70 permit for stationary emissions sources including generators, internal combustion engines, abrasive cleaning, jet engine testing, fuel dispensing, welding, and surface coating. Mobile emissions sources such as aircraft and on-road vehicles are not regulated by the Title V/Part 70 of the Clean Air Act Amendments or the Clark County Part 70 permitting program (Air Force 1997f).

3.3.2 Nellis Range Complex

With the exception of its very southern extent nearest Las Vegas (R63 within R-4806W), the NRC is unclassified for state and federal air quality standards. The very southern extent (less than 5 percent) falls within the area designated as nonattainment for CO and PM_{10} generated by the Las Vegas Metropolitan Area.

Total annual emissions associated with aircraft activity in NRC were calculated based on scenarios reflecting the range of 200,000 or 300,000 annual sortie-operations. As with the aircraft emissions calculations for the base, aircraft emissions estimates for the NRC were based on aircraft operation summaries developed to support noise analyses. Aircraft activity in NRC airspace is described in terms of annual sortie-operations, typical engine power settings, and typical altitude distributions for a given aircraft type. Emission factors for aircraft were derived primarily from calculation methods for Air Pollutant Emission Criteria Inventories (Air Force 1978). Tables 3.3-3 and 3.3-4 provide summaries of estimated aircraft emissions for the low-use 200,000 and high-use 300,000 sortie-operation scenarios respectively.

Table 3.3-3. Estimated Aircraft Emissions in Nellis Range Complex Airspace, 200,000 Sortie-Operations (Tons/Year)

	Desert MOA	*Reveille MOA*	*R-4806*	*R-4807*	*R-4809*	*R-4808*[1]	*NRC Total*
CO	55	8.8	8.5	31	5	2.2	110.5
NO_x	1033.9	180.4	125.9	611.6	98.7	32.6	2083.1
VOC	8.2	1.6	0.8	3.5	0.7	0.2	15.0
SO_x	39.8	6.8	5.7	24.1	3.8	1.3	81.8
PM_{10}	17.9	2.9	1.7	10.2	1.6	0.7	35

1. NTS airspace managed by DOE; used for aircraft transit only.

Table 3.3-4. Estimated Aircraft Emissions in Nellis Range Complex Airspace, 300,000 Sortie-Operations (Tons/Year)

	Desert MOA	*Reveille MOA*	*R-4806*	*R-4807*	*R-4809*	*R-4808*[1]	*NRC Total*
CO	82.6	13.1	12.6	46.5	7.5	3.3	165.6
NO_x	1550.8	270.5	188.8	917.4	148	48.9	3124.4
VOC	12.2	2.4	1.2	5.3	1.1	0.3	24.3
SO_x	59.7	10.2	8.7	36	5.8	2.1	122.5
PM_{10}	26.9	4.4	2.5	15.4	2.5	1.1	52.8

1. NTS airspace managed by DE; used for aircraft transit only.

In both scenarios, the total emissions for the NRC airspace are dispersed over a volume of air measuring approximately 13,000 cubic miles. Given this volume, the concentrations of emissions are very low. The highest potential for concentration of emissions would occur during low-altitude aircraft activity near ordnance delivery ranges where aircraft make multiple passes over the same point on the ground over short periods of time. The computerized Multiple Aircraft Instantaneous Line Source (MAILS) dispersion model was used to assess concentrations of ground-level pollutants resulting from aircraft flight activities. Using data from overall sortie-operations in the NRC, a conservative scenario of low-altitude flight activities over an NRC range was used. The scenario involved a total of 60 fighter, bomber, and transport aircraft flying 500 feet AGL and passing the same point on the ground within one hour. This scenario would apply under use levels of 200,000 to 300,000 sortie-operations in the NRC. The mixing height was set at 5,000 feet in accordance with regional meteorological conditions. Emission concentrations

calculated for a 1-hour period were scaled to represent maximum use in 3-, 8-, 24-hour and annual periods. Resulting pollutant concentrations were compared to the NAAQS and PSD standards to determine if exceedences would occur (Table 3.3-5).

Table 3.3-5. Estimated Ground-Level Pollutant Concentrations for the Nellis Range Complex Using MAILS

Pollutant	*Averaging Periods*	*Estimated Concentration* $\mu g/m^3$	*NAAQS* $(\mu g/m^3)$	*% of NAAQS*	*PSD Increments* $\mu g/m^3$	*% PSD Increments*
CO	1-hour	8.02	40	20	-	-
	8-hour	0.66	10	7	-	-
NO_2	Annual	0.16	100	0.2	2.5	6
SO_2	3-hour	0.44	-	-	25	1.8
	24-hour	0.06	365	0.02	5	1.2
	Annual	<0.01	80	<0.01	2	<0.5
PM_{10}	24-hour	0.06	150	0.04	10	0.6
	Annual	<0.01	50	<0.02	5	<0.02

There is one PSD Class I area within 50 miles of the NRC borders. The closest Class I area is in Utah, Zion National Park, approximately 37 miles east of the NRC. The combination of low total emissions from NRC operations and the distance to this PSD Class I areas indicates that visibility is not impaired, especially since the emission sources (aircraft) are mobile and transitory.

MAILS modeling results demonstrate that even intensive, low-altitude flight activity over a range within the NRC does not result in exceedences of NAAQS or PSD increments. Estimated concentrations fall well below NAAQS or PSD thresholds. Flight activities in most, if not all, of the NRC airspace are less intensive and distributed at higher altitudes than the scenario used in the MAILS model. For this reason, ground level pollution concentrations would be less than estimated in the modeled scenario. For example, sortie-operations in R63 (part of R-4806W) average between 18 and 28 per day, far fewer than the 60 per hour assessed in the MAILS model. This lesser amount of sortie-operations generated only a fraction of the NAAQS and PSD standards. As such, emissions from these sortie-operations do not measurably affect nonattainment for any criteria pollutants.

3.4 SAFETY

This section addresses ground, flight, and munitions safety associated with activities conducted by units stationed at or operating from Nellis AFB. These operations include activities at the base itself, as well as testing and training conducted in the military airspace that collectively comprise the NRC. Ground safety considers issues associated with operations and maintenance activities that support base and range operations, including fire and crash response. For the NRC, particularly NAFR, safety also considers fire risk and management. Flight safety considers aircraft flight risks such as aircraft accidents, and bird-aircraft strikes. Munitions safety assesses the management and use of ordnance or munitions associated with air base operations and training activities conducted at NAFR.

3.4.1 Nellis AFB

OPERATIONS AND MAINTENANCE: Day-to-day operations and maintenance activities conducted on Nellis AFB are performed in accordance with applicable Air Force safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health requirements. The handling, processing, storage, and disposal of hazardous by-products of these activities are accomplished in accordance with all federal and state requirements applicable to the substance generated. Additional specific data pertaining to hazardous material and waste management are contained in section 3.5 of this DEIS.

FIRE AND CRASH RESPONSE: The Nellis AFB military fire department provides crash response. Under current operations, the unit is fully capable of meeting its requirements. There are no identified equipment shortfalls or limiting factors.

The base maintains detailed mishap response procedures for a wide range of potential incidents. These processes assign agency responsibilities and prescribe functional activities necessary to react to major mishaps, on or off base. Initial response to a mishap considers such factors as rescue, evacuation, fire suppression, safety, elimination of explosive devices, ensuring security of the area, and other actions immediately necessary to prevent loss of life or further property damage. After these tasks are accomplished, the mishap is investigated. After all required actions on the site are completed, the base civil engineer ensures cleanup of the site.

AIRCRAFT MISHAPS: The primary public concern with regard to flight safety is the potential for aircraft accidents. Such mishaps may occur as a result of mid-air collisions, collisions with manmade structures or terrain, weather, mechanical failure, or pilot error. Flight risks apply to all aircraft; they are not limited to the military.

The Air Force defines four categories of aircraft mishaps: Classes A, B, C, and High Accident Potential. Class A mishaps result in loss of life, permanent total disability, a total cost exceeding $1 million, destruction of an aircraft, or damage to an aircraft beyond economical repair. Class B mishaps result in total costs between $200,000 and $1 million or result in permanent partial disability. Class C mishaps involve costs between $10,000 and $200,000 or loss of worker productivity for more than eight hours. High Accident Potential represents minor incidents not

meeting any of the criteria for Class A, B, or C. This EIS focuses on Class A mishaps because of the potential magnitude of their results. Class C mishaps and High Accident Potential are the most common occurrences involving minor damage and injuries and rarely affecting property or the public.

It is impossible to predict the precise location of an aircraft accident. Major considerations in any accident are loss of life and damage to property. The probability of an aircraft crashing into a populated area is extremely low, but it cannot be totally discounted. Several factors are relevant: first, FAA regulations instruct pilots to avoid direct overflight of population centers at very low altitudes; second, the limited amount of time the aircraft is over any specific geographic area limits the probability that impact of a disabled aircraft in a populated area would occur; and third, design and location of the clear zone and accident potential zones identify areas subject to higher risk from a crash.

Secondary effects of an aircraft crash include the potential for fire and environmental contamination. Again, because the extent of these secondary effects is dependent on the situation, they are difficult to quantify. When an aircraft crashes, it may release petroleum, oil, and lubricants that may not all be consumed in a fire and could contaminate soil and water. The potential for contamination is dependent on several factors. The porosity of the surface soils will determine how rapidly contaminants are absorbed. The soils are not very permeable on and near Nellis AFB. The locations and characteristics of surface and groundwater in the area will also affect the extent of contamination to those resources.

Aircraft flight operations from Nellis AFB are governed by flight standard rules. Specific procedures for the base are contained in standard operating procedures that must be followed by all aircrews operating from the installation (Air Force 1995). In the last five years, there has been only one aircraft accident on Nellis AFB, while over 325,000 airfield operations have been conducted. Since 1990, there has been one Class A mishap in the NRC involving an aircraft assigned to the OT&E squadron and one mishap of an aircraft assigned to the WS.

BIRD-AIRCRAFT STRIKE HAZARDS: Bird-aircraft strikes constitute a safety concern because of the potential for damage to aircraft or injury to aircrews or local populations if an aircraft crashed in a populated area. Aircraft may encounter birds at altitudes of 30,000 feet MSL or higher, though over 95 percent of reported bird strikes occur below 3,000 feet AGL. Approximately 50 percent of bird strikes happen in the airport or airfield environment, and 25 percent occur during low-altitude flight training (Worldwide Bird-Aircraft Strike Hazard Conference 1990).

Migratory waterfowl (e.g., ducks, geese, and swans) are the most hazardous birds to low-flying aircraft because of their size and their propensity for migrating in large flocks at a variety of elevations and times of day. The potential for bird-aircraft strikes is greatest during spring and fall migratory seasons in areas used as migration corridors (flyways) or where birds congregate for foraging or resting (e.g., open water bodies, rivers, and wetlands). These birds typically migrate at night and generally fly between 1,500 to 3,000 feet AGL during the fall migration and from 1,000 to 3,000 feet AGL during the spring migration.

Although waterfowl are the greatest threat, raptors, shorebirds, gulls, herons, and songbirds also pose a hazard. Peak migration periods for raptors, especially eagles, are from October to mid-December and from mid-January to the beginning of March. In general, flights above 1,500 feet AGL would be above most migrating and wintering raptors. Songbirds are small birds, usually weighing less than one pound. During nocturnal migration periods, they navigate along major rivers, typically between 500 to 3,000 feet AGL.

For aircraft conducting airfield operations at or near Nellis AFB, the bird-aircraft strike data maintained by the base indicate that from 1985 through 1995, aircraft experienced 135 bird strikes. Given that airfield operations at Nellis AFB exceeded 700,000 during that same period, the occurrence of bird-aircraft strikes in the airfield environment is very low. Nellis AFB and its vicinity include no migration corridors or areas supporting major concentrations of birds. The majority of these bird-aircraft strikes (56.3 percent) occurred at altitudes of 1,000 feet AGL or less. Of this total, 10 percent were classified as Class C mishaps; there were no Class A or Class B mishaps (personal communication, AWFC/SEF 1997).

MUNITIONS USE AND HANDLING: Personnel at Nellis AFB control, maintain, and store all ordnance and munitions required for mission performance. This includes training and inert bombs and rockets, live bombs and rockets, chaff, flares, gun ammunition, small arms ammunition, and other explosive and pyrotechnic devices. Munitions are handled and stored in accordance with Air Force explosive safety directives (Air Force n.d.), and all munitions maintenance is carried out by trained, qualified personnel using Air Force-approved technical data. The airfield area also has specific areas designated for the loading of live ordnance, parking of aircraft loaded with live ordnance, and arming and dearming of ordnance and guns (Air Force 1995). There are two live ordnance loading areas (LOLA), LOLA north and LOLA south. Both are located to the east of Runway 03R/21L. The "hot cargo" pad is located at the northern end of the flightline, just east of Runway 03R/21L. Arm/dearm pads are located at the north and south ends of the flight line, and immediately adjacent to the ends of the runways. The northern pad is located to the west of Runway 21R. There are two pads at the southern end of the flight line. One is located just west of Runway 03L and the other is just east of Runway 03R. If a malfunction prevents release of ordnance during a mission and the pilot must return to the base with "hung" ordnance, the aircraft is parked in revetments in the hung ordnance area while the ordnance is rendered safe. This area is located east of Runway 03R and south of LOLA south (Air Force 1995). Sufficient storage facilities exist for current types and amounts of ordnance, and all facilities are approved for the ordnance they store. The LOLA quantity-distance arc extends past the base boundary (personal communication, Reynolds, Master Sergeant 1997). The Air Force is working with the BLM, local communities, and landowners to resolve this issue.

3.4.2 Nellis Range Complex

FIRE RISK AND MANAGEMENT: The Nellis AFB military fire department provides crash response by convoy to those ranges within the NRC that are close to Nellis AFB. The unit is fully equipped and staffed with qualified personnel. There are no identified equipment shortfalls or limiting factors (personal communication, Ploense 1998). Elements of the fire department are dispersed throughout NAFR and would respond to range fires on DoD-withdrawn lands. If

required, additional response support could be provided by BLM in accordance with a memorandum of agreement. Under current operations, approximately four to five small fires occur annually on the ranges. Fire and crash response on the South Range is provided by the Air Force fire department at Indian Springs Air Force Auxiliary Field. Additional assistance can be provided under an existing mutual support agreement between the Air Force and the community fire department at Indian Springs. Fire suppression on the North Range is the responsibility of the Air Force fire department at Tonopah, with additional assistance available under mutual support agreements and a memorandum of agreement with BLM (personal communication, Garner 1998). BLM has primary responsibility for suppression of wildland fires on NAFR.

SONIC BOOMS: Some high-performance aircraft using the NRC may fly supersonic while training for air combat maneuvering. When an aircraft flies faster than the speed of sound, it forms a shock wave that is projected along its flight path. When this shock wave reaches the ground, it is manifested as an overpressure and sensed as a sonic boom. A sonic boom is characterized as a rapid rise in pressure, followed by a rapid drop-off before the pressure returns to normal atmospheric levels. This change occurs rapidly (i.e., in significantly less than one second). The overpressures created are, in the vast majority of cases, well below those that would begin to cause physical injury or damage to structures. In rare cases, a sonic boom could cause physical damage, as to a window, if the overpressure is of sufficient magnitude. Sonic booms are alleged to cause startle effects in humans and animals, resulting in safety issues. The Air Force has established procedures for documenting any such cases and for working with affected parties.

AIRCRAFT MISHAPS: Based on historical data on mishaps at all installations and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory (combat losses are excluded from these mishap statistics). In the case of MOAs and restricted areas, an estimated average sortie-operation duration may be used to estimate annual flight hours in the airspace for each aircraft type. Then, the Class A mishap rate per 100,000 flying hours can be used to compute a statistical projection of anticipated time between Class A mishaps in each applicable element of airspace for each aircraft type. In evaluating this information, it should be emphasized that those data considered are only statistically predictive. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft.

Table 3.4-1 summarizes the statistically estimated time between Class A mishaps for each of major airspace categories within the NRC. These data reflect the highest risk associated with potential aircraft mishaps in each airspace unit under high and low sortie-operation scenarios. The high-use scenario considers 300,000 annual sortie-operations flown in the airspace, while the low-use scenario considers 200,000 annual sortie-operations.

Several factors can influence the calculation of this projected time interval between Class A mishaps. Since the calculation is based on hours of flight time per year, an indication of increased risk can result from a large number of aircraft flying in the airspace or from a smaller number flying for extended periods of time. To place these values into context, it is also number flying for extended periods of time. To place these values into context, it is also appropriate to

Table 3.4-1. Class A Mishaps under Current Operations

Airspace	200,000 ANNUAL SORTIE-OPERATIONS		300,000 ANNUAL SORTIE-OPERATIONS	
	Minimum Time between Class A Mishaps (in Years)	*Probability of Class A Mishap per Year*	*Minimum Time between Class A Mishaps (in Years)*	*Probability of Class A Mishap per Year*
Desert MOA	3.0	0.000030	2.0	0.000030
Reveille MOA	12.7	0.000012	8.5	0.000012
R-4806	36.5	0.000010	24.3	0.000010
R-4807	7.7	0.000013	5.2	0.000013
R-4809	26.9	0.000009	17.9	0.000009
R-4808[1]	67.5	0.000003	45.0	0.000003

1. DoE airspace over NTS

Sources: Mishap Rates: personal communications, Air Force, Navy Flying Safety Centers
Aircraft Sortie Operations: personal communication, Air Combat Command 1997

consider the probability of a mishap, which accounts for each aircraft's exposure. Although the greatest indicated risk is associated with MOA airspace (2.0 years), the probability of a mishap remains very low. The aircraft associated with these data is the single-engine F-16, which will fly an estimated 17,000 annual sortie-operations in the Caliente MOA under the high-use scenario. All other aircraft in that MOA, as well as all other aircraft in every airspace element, indicate significantly less risk. Overall, there is low risk associated with flight operations within the NRC. In fact, over the last 5 years, there have been 10 Class A mishaps within the NRC (personal communication, AWFC/SEF 1998). Since 1990, one Class A mishap involved an aircraft assigned to the testing squadron and one to the WS. During this period, over 1,800,000 sortie-operations have been conducted within the NRC.

BIRD-AIRCRAFT STRIKE HAZARD: The Air Force Bird-Aircraft Strike Hazard (BASH) Team maintains a database that documents all reported bird-aircraft strikes. Historic information for the last 10 years for the NRC airspace indicate that 10 bird-aircraft strikes have been reported. These data reflect total strikes experienced by all users of the airspace, not just aircraft from Nellis AFB. Of these, one resulted in a Class B mishap and three in Class C mishaps. Given that the sortie-operations within the NRC account for tens of millions of miles flown at all altitudes, the occurrence and probability of bird-aircraft strikes are negligible.

ORDNANCE USE AND HANDLING: Use of ordnance during training is limited to ranges within the NAFR. Air Force safety standards require safeguards on weapons systems and ordnance to ensure against inadvertent releases. All munitions mounted on an aircraft (as well as the guns carried in the aircraft) are equipped with mechanisms that preclude release or firing without activation of an electronic arming circuit.

System malfunctions or materiel failures, possibly resulting in either an accidental release of ordnance or the release of a dud component that fails to operate properly, cannot be totally discounted. However, studies have shown that the probability of such an accidental release occurring and resulting in injury to a person or damage to property is so small that the risk associated with the occurrence can be essentially discounted (Air Force 1995).

Air-to-ground ranges in NAFR support delivery of a wide range of ordnance. Approximately 80 percent of the ranges accommodate training or inert bombs and rockets; approximately 64 percent accommodate live bombs, rockets, and missiles; and approximately 61 percent accommodate strafing. In 1995, approximately 4,504 tons of ordnance were expended on NAFR (refer to section 2.2.2). Of this, approximately 2,103 tons (46.7 percent) was live (high-explosive) ordnance.

Based on historical data, "footprints" have been developed that describe a geographic area within which a training munition may ultimately be expected to come to rest on the ground. These zones have a long- (i.e., beyond the target), short- (i.e., in front of the target), and cross-range dimension. Based on data developed from varied attack profiles flown by varied aircraft, and the type of ordnance delivered, frequency distributions for the dispersion of these munitions have been developed. With a 95 percent confidence level, a geographic area within which 99.99 percent of the delivered munitions will be contained has been described (Air Force 1996a, b). This geographic area, called the weapon footprint, is unique for each weapon system, aircraft, ordnance type, and delivery profile. The weapon footprints are used to define the area where people are prohibited from entry when the range or targets are in use. Application of these footprints is a prime safety concern and is one of the elements contributing to the target/ordnance compatibility documentation contained in Nellis AFB Supplement 1 to AFI 13-212, Volume 2 (Air Force 1996b).

CHAFF AND FLARES: Chaff and flares are also used throughout many portions of the NRC. Their use is controlled in accordance with standard operating procedures detailed in AFI 13-212, Volume 2, Nellis AFB Supplement 1 (Air Force 1996b). Types of use, locations, and altitudes authorized for release vary depending on the type of chaff and flares used. Section 2.2.2 details the restrictions on chaff and flare use in the NRC. When fire danger is extreme, flare use ceases.

Chaff consists of very small fibers of aluminum-coated mica that reflect radar signals and, when dispensed from an aircraft, form a cloud that temporarily hides the aircraft from radar detection. Although the chaff may be ejected from an aircraft using a pyrotechnic charge, the chaff itself is not explosive. Chaff is composed of silicon dioxide fibers ranging in diameter from 0.7 to 1 mil (thousandth of an inch) and coated with an aluminum alloy and a slip coating of stearic acid (fat). Analyses of the materials comprising chaff indicate that they are nontoxic in the quantities used (Air Force 1997c). About 500,000 to 3,000,000 fibers are contained in each chaff bundle.

The public has raised concerns regarding human health risks associated with the use of chaff. In response, the General Accounting Office has reviewed the available information on chaff and asked the DoD to evaluate the need to conduct further studies on potential health risk. Available information, as summarized below, indicates that chaff does not pose a significant health risk (Air Force 1997c).

Silicon dioxide is an abundant compound in nature that is prevalent in soils, rocks, and sands. The trace quantities of metals included in the mica fibers are not present in sufficient quantities to pose a health risk. Aluminum is nontoxic and one of the most abundant metals in the earth's crust, water, and air. Trace quantities of silicon, iron, copper, manganese, magnesium, zinc, vanadium, or titanium may be found in the alloy, but the quantities involved are a minuscule percentage of levels that might cause concern. Stearic acid is found naturally as a glyceride in animal fat and some vegetable oils.

Air quality concerns regarding chaff use addresses the potential for chaff to break down into respirable particles and the possibility that hazardous air pollutants are generated from the cartridges used with some chaff types. Chaff has been test-fired in a controlled environment to determine its potential to break down into respirable particulates. Findings of this test and a screening health risk assessment (Air Force 1997c) concluded that chaff posed no significant air quality or respiration concerns.

The potential for chaff to affect soil and water is remote. Laboratory tests of chaff indicated little or no potential for adverse effects on soil (Air Force 1997c). No adverse impacts on biological resources have been identified with regard to ingestion or inhalation of chaff. The extensive dispersal and decomposition of chaff fibers on lands under the NRC would limit the exposure of grazing and foraging animals to chaff. Studies on grazing and foraging livestock (Air Force 1997c) provide an indicator of the lack of effects of chaff on animals. Livestock apparently avoided eating clumps of chaff when mixed with feed. Only when the mixture of chaff and feed were coated in molasses would the animals eat it. None of the subject livestock exhibited any observable health effects.

Inhalation of chaff fibers also does not cause adverse effects on wildlife. Data from livestock have shown that the chaff fibers tend to be too large to penetrate the larynx (Air Force 1997c). Such fibers would be expelled through the nose or swallowed. Furthermore, chaff particles would represent a small percentage of the particulates (e.g., dust, vegetal material) regularly inhaled by animals (Air Force 1997c).

Impacts on land use and visual resources are directly related to the visibility and accumulation of chaff debris. Chaff does not constitute litter under the EPA definition, nor is it readily visible on the ground. Field studies (one of which was conducted on NAFR) of the visibility of chaff and incidental debris in different environmental contexts concluded that noticeably adverse aesthetic effects are unlikely (Air Force 1997c).

Records indicate the release of approximately 395,000 bundles of chaff within the NRC airspace annually. Assuming a conservative average of 3 million fibers per bundle and even distribution throughout the NRC, the area could contain one chaff fiber per 22 square feet. Field studies from the NAFR observed a density lower than this estimate (Air Force 1997c), probably due to the fragmentation of the fibers.

Approximately 90,000 flares are released over the NRC annually. Flares consist of magnesium and teflon pellets that burn rapidly and completely after being dispensed. A flare begins burning immediately after it is expelled, reaching its highest temperature (1,000° Fahrenheit) by the time

it passes the tail of the aircraft. The actual amount of time it takes for a flare to burn out completely is classified. But, the ACC standard minimum release altitudes for different flare types (refer to Table 2.2-9) provide sufficient time for a flare to burn completely at least 100 feet above the ground. Stricter release-altitude standards for NAFR and the NRC MOAs provide an additional margin of safety to prevent burning flare material from contacting the ground. Complete cessation of flare use during periods of extreme fire risk further reduce the potential for flare-caused fires.

Fires, some caused by flares, do occur on lands under the NRC. While an average of four to five small (less than three acres) fires occur on NAFR each year, they result from a variety of sources, including flares. Under the NRC MOAs, fires tend to be larger (less than 100 acres), but most were likely to have been caused by cigarettes, matches, vehicle sparks, or fireworks (Air Force 1997c).

Compared with the number (90,000) of flares dispersed over the NRC annually, fires attributable to flares are rare for several reasons. Foremost, the altitude and other restrictions on flare use minimize the possibility for burning material to contact the ground. Second, to start a fire, burning flare material must contact vegetation that is susceptible to burning at the time. Tests by the U.S. Forest Service on the ignition of dry grass by burning cigarettes revealed only a few ignitions despite hundreds of trials (Air Force 1997c). Similarly, the probability of a flare igniting vegetation would be expected to be equally minimal. Third, the amount and density of vegetation, as well as climate conditions, must be capable of supporting the continuation and spread of fire.

Toxicity of flare materials is not a concern because magnesium, the primary material found in flares, is considered not likely to be ingested by humans or animals. Impulse cartridges and initiators used with some flares contain chromium and, in some cases, lead -- hazardous air pollutants under the Clean Air Act. However, a screening health risk assessment concluded that they do not present a health risk in the quantities involved. Laboratory analyses of flare pellets and flare ash indicate that these materials have little potential for affecting soil or water resources (Air Force 1997c).

Field studies similar to those conducted for chaff indicate that flare debris does not accumulate in noticeable quantities; therefore, there is little potential to impact aesthetic resources (Air Force 1997c).

3.5 HAZARDOUS MATERIALS AND WASTE

Hazardous materials, listed under the Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA), and the Emergency Planning and Community Right-to-Know Act, are defined as any substance that, due to quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health, welfare, or the environment. Examples of hazardous materials include petroleum products, synthetic gases, and toxic chemicals. Hazardous wastes, listed under the Resource Conservation and Recovery Act (RCRA), are defined as any solid, liquid, contained gaseous, or semisolid wastes, or any combination of wastes that pose a substantial present or potential hazard to human health or the environment. Additionally, hazardous wastes must either meet a hazardous characteristic of ignitability, corrosivity, or reactivity under 40 Code of Federal Regulations (CFR) 261, or be listed as a waste under 40 CFR 263.

Hazardous materials and wastes are federally regulated by the EPA, in accordance with the Federal Water Pollution Control Act, Clean Water Act, Toxic Substance Control Act, RCRA, CERCLA, and Clean Air Act. The federal government is required to comply with these acts and all applicable state regulations under Executive Order 12088 and DoD Directive 4150.7, AFI 32-1053. Additionally, Executive Order 12088, under the authority of the EPA, ensures that necessary actions are taken for the prevention, management, and abatement of environmental pollution from hazardous materials or hazardous waste due to federal activities.

Other topics commonly addressed under hazardous materials and waste include underground storage tanks, potential contaminated sites designated under the Air Force's Installation Restoration Program, polychlorinated biphenyls (PCBs), and radon. For each of these issues, Nellis AFB has implemented or completed investigative removal and clean-up programs under appropriate federal regulations. Review of baseline conditions relative to the elements of the Proposed Action established that no proposed construction or other on-base activity would affect or be affected by underground storage tanks, Installation Restoration Program sites, transformers or other materials containing PCBs, and structures associated with radon levels above EPA action levels. Therefore, this EIS does not address these topics further.

The ROI for potential impacts related to hazardous materials and waste consists of Nellis AFB (ROI One), with an emphasis on aircraft maintenance and munitions handling areas. Since the proposed F-22 FDE program and WS aircraft operations within the NRC would not generate or require disposal of hazardous wastes, a discussion of hazardous wastes within the NRC airspace is not provided.

3.5.1 Nellis AFB

3.5.1.1 Hazardous Materials and Hazardous Waste Generation

Activities at Nellis AFB require the use and storage of a variety of hazardous materials that include flammable and combustible liquids, acids, corrosives, caustics, anti-icing chemicals, compressed gases, solvents, paints, paint thinners, and pesticides.

Nellis AFB uses a hazardous material pharmacy pollution prevention system to manage hazardous materials. This process provides centralized management of the procurement, handling, storage, and issuing of hazardous materials, as well as the turn-in, recovery, reuse, recycling, and disposal of hazardous wastes. The pharmacy approval process also includes review and approval by Air Force personnel. In addition, the base has a *Spill Prevention and Response Plan, Nellis AFB Plan 19-1* and a *Facilities Response Plan* included as appendices in the *Nellis AFB Hazardous Waste Management Plan* (Air Force 1997j).

The *Nellis AFB Hazardous Waste Management Plan* provides guidance and procedures for proper management of RCRA and non-RCRA hazardous waste generated on the base to ensure compliance with applicable regulations. Base management plans and DoD directives, serving to implement these laws and regulations, include hazardous material management plans, spill prevention and contingency plans, and pollution prevention plans that are regularly updated to reflect any changes in the base mission.

Nellis AFB is expected to generate more than 110,000 pounds of RCRA hazardous waste in 1998 and is therefore considered a large quantity generator by the EPA. Hazardous waste at Nellis AFB is accumulated at approved 90-day storage areas on the base or at satellite accumulation points that must be located at or near the same areas where waste streams are generated. Each accumulation point must comply with requirements for siting, physical construction, operation, marking, labeling, and inspection and must maintain a container inspection log. Generators of hazardous wastes are responsible for properly segregating, storing, characterizing, labeling, marking, packaging, and transferring all hazardous waste for disposal. Wastes generated on base are turned into the Central Accumulation Site on base, and the Defense Reutilization and Marketing Office manages these wastes under regulations set forth in Nellis AFB's RCRA Part B storage permit. Transporters of hazardous waste must ensure that waste is transported in a proper U.S. Department of Transportation-approved container. The proper container can be determined by reference to the Hazardous Materials Table in 49 CFR 172.101. A total of 83 satellite accumulation points are located at Nellis AFB (Air Force 1997j). Two 90-day storage areas are operated at Nellis AFB as collection areas for wastes received from satellite accumulation points. These accumulation points manage 46 established waste streams generated on base.

A variety of activities on base, including aircraft maintenance and support, civil engineering, and printing operations, have been identified as primary contributors to hazardous waste streams. Numerous other shops add to hazardous waste streams, including Aerospace Ground Equipment, Aircraft Structural Maintenance (ASM), Fuels Management, Non-Destructive Inspection, Munitions and Armament Shops, In-Squadron Maintenance, the Wheel and Tire Shop, and others (e.g., avionics, egress systems, electrical, metals, pneudraulics, hydraulics, radio, jet engine, and structural maintenance). The greatest volumes of hazardous waste are generated from aircraft support functions. Routine activities conducted on the flightline generate paints containing lead-mercury-chromium, hazardous waste containers, and contaminated rags. Wastes derived from maintenance activities include petroleum, oils, and lubricants, paints and paint-related wastes such as thinners and strippers, batteries, contaminated spill absorbent, adhesives, sealers, solvents, fuel filters, photochemicals, ignitable wastes, and metals. Basic processes and waste

handling procedures for general aircraft maintenance activities are identified in the *Nellis AFB Hazardous Waste Management Plan 12* (Air Force 1997j).

ASBESTOS: Many buildings on base date from the 1940s through the 1980s; asbestos-containing materials have been identified in many of these facilities. An Asbestos Hazardous Survey and Assessment database has been compiled that provides information for each asbestos-containing building (Air Force 1994c). Renovation or demolition of on-base structures is reviewed by Civil Engineering personnel to ensure appropriate measures are taken to reduce potential exposure to, and release of, friable asbestos. Non-friable asbestos is not considered a hazardous material until it is removed or disturbed.

3.6 EARTH AND WATER RESOURCES

Earth resources consist of all soil and bedrock materials. This EIS focuses on soils and topography as the only aspects of earth resources potentially affecting or affected by on-going or proposed activities on Nellis AFB. Other aspects of earth resources -- mineral and energy deposits, unique landforms, and paleontologic resources -- are not relevant to this discussion since they either do not exist on base or would not be affected by current or proposed on-base actions.

Data used to describe baseline conditions included geologic, soil, and mineral resource literature obtained from the Air Force, U.S. Geological Survey (USGS), BLM, and University of Nevada (Nevada Bureau of Mines and Geology).

Water resources include surface water and groundwater. Lakes, rivers, and streams comprise surface water resources that are important for economic, ecological, recreational, and human health reasons. Groundwater is used for potable water consumption, agricultural irrigation, and industrial applications. Groundwater properties are often described in terms of depth to aquifer, aquifer or well capacity, water quality, and surrounding geologic composition. Attributes of water resources considered in the EIS include hydrologic setting, availability, use, quality (including protection zones), floodplains, flood hazard, and adjudicated claims to water rights for both surface and groundwater.

The ROI for earth and water resources includes the area encompassed by Nellis AFB. Within the ROI, this description focuses on specific areas subject to construction or ground disturbance as a result of the Proposed Action. The NAFR and NRC are not discussed in this section for either water or earth resources because the proposed activities for the F-22 would not alter current conditions in these areas (see section 2.5).

3.6.1 Earth Resources

Nellis AFB is located in the northern portion of the Las Vegas Basin in the southern part of the Las Vegas Valley. This area is characterized primarily by flat alluvial deposits with north-trending mountain ranges to the north and east. The elevation of Nellis AFB is about 2,000 feet above sea level. The ground surface over most of Nellis AFB is disturbed by man-made features, such as airfields, roads, and buildings. Nellis AFB is relatively flat. Over most of the base, including the vast majority of the developed areas, slopes are 1 percent or less.

Nellis AFB lies primarily on two types of soil, the Las Vegas - Destazo complex and the Las Vegas - Skyhaven complex (USDA 1985). These soils are very similar physically and chemically. Las Vegas soils comprise 60 percent of Nellis AFB soils and Skyhaven and Destazo soils together comprise 25 to 30 percent, leaving 10 to 15 percent McCarran - Grapevine complex, Weiser - Goodsprings complex, and Glencarb silt loam. The main soil types share the following attributes:

- moderately slow permeability;
- slight potential for water erosion;
- high potential for wind erosion; and
- a shallow hardpan layer that limits construction.

These attributes indicate that ground disturbance at Nellis AFB, such as would occur with construction, could lead to a high degree of wind erosion. Erosion from precipitation and runoff is rare due to soil characteristics and lack of slope on Nellis AFB.

3.6.2 Water Availability, Use, and Quality

The Sierra Nevada, stretching along Nevada's western border, interrupts the prevailing easterly flow of storm systems and the state's access to precipitation, resulting in a "rain shadow." The Las Vegas Valley extends in a northwest - southeast direction and drains southward through the Las Vegas Wash into Lake Mead. Nellis AFB lies in the northern portion of the Las Vegas Valley within the Colorado River Basin. Natural surface waters and perennial streams are nonexistent due to low precipitation, high evaporation, and low humidity. No 100-year floodplains occur within the developed portions of the base. With the exception of local thunderstorms intense enough at times to cause flash flooding, much of the warm weather precipitation is lost through evaporation and transpiration. The little precipitation that is captured is drawn into the valley's principal basin-fill aquifer, shallow aquifers, and the Colorado River.

Carbonate rock aquifers of the Death Valley and Colorado aquifer systems underlie Nellis AFB (USGS 1997). These systems are hydrologically connected to shallower alluvial aquifer systems composed of sand and gravels. The principal aquifer in the Las Vegas Valley hydrologic basin is naturally recharged by 30,000 to 35,000 acre-feet per year (AFY), mostly from the Spring Mountains on the west valley boundary. Recharge of the shallow aquifers is also occurring, primarily as a result of irrigation water percolating into the ground.

Surface water is sparse in Nevada. Typically, as much as 75 percent of Nevada's precipitation falls during the winter. Only the highest mountains average more than 10 inches of annual runoff (Moosburner 1986).

Surface water is transported to Nellis AFB by pipelines from Lake Mead. No perennial or ephemeral streams, natural lakes, or other open bodies of water, excluding manmade impoundments, are found on Nellis AFB. Low precipitation, a lack of slope, and the absence of perennial or ephemeral streams create a context where the potential for water erosion is rare.

Nevada's groundwater is typically found in unconsolidated deposits of sand, gravel, silt, and clay that partly fill the many basins. Most groundwater development is in basins where water is

readily obtained from shallow unconsolidated deposits and where well yields are more predictable than they are in the mountains.

Sources of groundwater are available from the principal alluvial-fill aquifer underlying the Las Vegas Valley. Wells are located in both the northwest part of the valley for the Las Vegas Valley Water District and in the northern end of the valley for North Las Vegas. Nellis AFB has groundwater rights provided by 17 permitted water wells, 13 on base and 4 off base.

Piped surface waters and groundwaters support base personnel and operations. These resources include water for drinking and sewage systems, fire utilities, landscape maintenance, and construction. Over 60 percent of current water use on Nellis AFB is for aircraft washing and maintenance.

Nellis AFB drinking water standards are established by the EPA under the Safe Drinking Water Act, also adopted by the State of Nevada. Drinking water quality for public supply systems is regulated by the Nevada Department of Health. Maximum contaminant levels have been established for various water quality constituents to protect against adverse health effects. All water sources for Nellis AFB meet EPA and State of Nevada standards.

3.7 BIOLOGICAL RESOURCES

Biological resources incorporate living, native or naturalized plant and animal species and the habitats within which they occur. Plant associations are referred to as vegetation and animal species are referred to as wildlife. Habitat can be defined as the resources and conditions present in an area that produces occupancy of a plant or animal (Hall *et al.* 1997). The analysis will focus on species or vegetation types that are important to the function of the ecosystem, are of special societal importance, or are protected under federal or state law or statute. For purposes of the impact analysis, these resources will be divided into four major categories: (1) vegetation, (2) wetlands, (3) wildlife, and (4) threatened, endangered, or sensitive species. Those categories are described as follows:

1) Vegetation includes all existing terrestrial plant communities with the exception of wetlands or threatened, endangered, or sensitive species. Vegetation communities of interest include salt desert shrub, southern desert shrub, northern desert shrub, and pinyon-juniper.

2) Wetlands are considered sensitive and protected by Section 404 of the Clean Water Act. They include jurisdictional and non-jurisdictional wetlands. Jurisdictional wetlands consist of those that meet the three criteria defined in the *Corps of Engineers Wetlands Delineation Manual* (Army 1987) and are under the jurisdiction of the U.S. Army Corps of Engineers. Non-jurisdictional wetlands include wetlands meeting only one or two of the three criteria. Wetlands are generally associated with drainages, stream channels, and water discharge areas (natural and man-made).

3) Wildlife includes all vertebrate animals (i.e., fish, amphibians, reptiles, birds, and mammals) with the exception of those identified as threatened, endangered, or sensitive species. Invertebrate species or species groups such as mollusks (e.g., snails) or insects are sometimes included.

4) Threatened, endangered, or sensitive species are defined as those plant and animal species listed as threatened, endangered, or proposed as such, by the USFWS and/or Nevada Division of Wildlife (NDOW). Preservation of sensitive biological resources is accomplished through many means, most notably the Endangered Species Act, which protects federally listed threatened and endangered plant and animal species. Federal species of concern, formerly Category 2 candidate species, are not protected by law; however, these species could become listed and, therefore, protected at any time. Considering these early in the planning process may avoid future conflicts that could otherwise develop. The State of Nevada also protects plant and animal species listed through the Nevada Revised Statutes and regulations set forth in the Nevada Administrative Code. Additionally, the Nevada Natural Heritage Program maintains a database of state species of concern, many of which are not afforded legal protection.

The ROIs for biological resources include Nellis AFB and all lands under the affected airspace associated with the F-22 beddown proposal. Two major areas have been identified: all areas directly affected by ground-disturbing activities and changes in noise contours on Nellis AFB and the NRC.

3.7.1 Nellis AFB

VEGETATION: Nellis AFB is located in the Mojave desertscrub biome, the smallest of the four North American warm-temperate desertland biomes. It is spatially and floristically intermediate between the Great Basin desertscrub and the Sonoran desertscrub. Winter rainfall predominates. The elevation range of the Mojave desertscrub biome is broader than that of the other desertscrub biomes, with roughly three-quarters of the biome lying between 2,000 and 4,000 feet. It is frequently referred to as "high desert" (Turner 1994b).

Most distinctions between desert biomes are based on the presence or absence of large, easily identified plant species. Main plant dominants of the Mojave desertscrub biome are creosote bush, all-scale, brittlebush, desert holly, and white burrobrush. Shadscale, blackbrush, yucca, and white bursage are also common (Turner 1994b).

The main base covers approximately 11,300 acres, 7,000 acres (62 percent) of which are undeveloped; the remaining area is either paved or contains structures. Native desertscrub vegetation is found in varying amounts in the developed and undeveloped areas of Nellis AFB, although native vegetation, when present, has generally been greatly disturbed. One of the least disturbed areas of desertscrub vegetation is found in Area II, located in the northeastern portion of the base. This area is dominated by the creosote bush-white bursage community (Air Force 1992c; Hazlett *et al.* 1997).

Approximately 1,000 acres of Nellis AFB are improved grounds, which are areas of turf grasses that require routine maintenance such as mowing, irrigating, and fertilizing. A wide variety of native and introduced, drought-tolerant deciduous trees and shrubs, evergreen trees and shrubs, perennials, ground covers, vines, and grasses have been planted throughout the base. They are contained mostly within and adjacent to developed areas at the base (Air Force 1997e).

WETLANDS: A 1:250,000 scale National Wetlands Inventory map was used for Nellis AFB because the standard 1:24,000 scale was not available (USFWS 1990). Recent field surveys have found that the only potential wetlands on Nellis AFB are the golf course ponds. U.S. Army Corps of Engineers personnel have determined that these man-made water sources are not subject to wetlands protection under the provisions of the Clean Water Act (Air Force 1997e). The remainder of the base is arid desert or urban development.

WILDLIFE: Due to its location adjacent to metropolitan Las Vegas and previous development and construction activities, Nellis AFB is primarily an urban environment with some relatively undisturbed lands lying to the east and north of the base. Wildlife species found on base are mostly limited to those that have adapted to high levels of human activity and disturbance.

Three general habitat types are present on the base: urban areas, open space recreation (e.g., golf course), and native desertscrub vegetation. Common bird species in the urban areas include house finch and house sparrow. Open spaces are frequented by American coot, horned lark, great-tailed grackle, and domestic geese and ducks. The areas with the most diverse wildlife are those containing native desertscrub vegetation. Area II comprises the most undisturbed native desertscrub habitat on base. Coyote, Gambel's quail, mourning dove, desert spiny lizard, and side-blotched lizard are common (Air Force 1997e).

Nellis AFB has an aggressive Bird Aircraft Strike Hazard program. Over the last ten years, no Class A or B mishaps due to bird-aircraft strikes have occurred around the base.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES: A total of 19 protected and sensitive species occur or potentially occur on Nellis AFB (see Appendix F, Table F-2). Only one species, the desert tortoise, is federally listed. It is listed as threatened by both the USFWS and the State of Nevada. The remaining 18 species, including 1 plant, 2 reptiles, 4 birds, and 11 bats, are federal species of concern (Air Force 1997a; USFWS 1997a).

The desert tortoise is the largest reptile in the arid southwestern U.S. Tortoises spend much of their lives in underground burrows they excavate to escape the harsh summer and winter desert conditions. They usually emerge in late winter or early spring and again in the fall to feed and mate, although they may be active during summer when temperatures are moderate. Desert tortoises are herbivorous, eating a wide variety of herbaceous vegetation, especially flowers of annual plants. Historically the tortoise occupied a variety of desert communities in southeastern California, southern Nevada, western and southern Arizona, southwestern Utah, and through Sonora and northern Sinaloa, Mexico. Today it can still be found in these areas, although the populations are fragmented and declining over most of its former range (Air Force 1994b).

In the 1970s, many biologists were concerned with the decline in desert tortoise populations. A long-lived animal with a low reproductive rate, the persistence of desert tortoise populations depends on the long-term survival of adults. The major cause of population declines appears to be high adult mortality due a number of factors including habitat loss, degradation, and fragmentation; direct take by humans (e.g., collection as pets, shooting, and motor vehicle collisions); disease; increased predation on juvenile tortoises by common ravens; and recent droughts (Air Force 1992b; Nowak et al. 1994). In 1980, the USFWS placed the Beaver Dam Slope, Utah, population on the federal list of threatened species, and by 1990, the entire Mojave Desert population was listed as threatened. In 1994, the *Desert Tortoise Recovery Plan* put forth guidelines for the establishment of critical habitat for the desert tortoise; three areas of critical habitat were proposed for Clark County (Clark County 1995a; Air Force 1997d).

Desert tortoises are expected to occur primarily in Mojave desertscrub habitat found on Nellis AFB and the South Range. On Nellis AFB, desert tortoises are not found in the Main Cantonment or Area III due to the widespread development in these areas. During a 1991 survey of 5,770 acres of Area II, 14 desert tortoises were observed. Section 7 consultations with the USFWS occurred in 1992 and 1993 prior to the development of a landfill site and sewer pipeline construction, respectively. The USFWS issued Biological Opinions for both these actions (Air Force 1997e).

Only one sensitive plant species, the California or Las Vegas bearpoppy, is found on Nellis AFB, (Hazlett *et al.* 1997; USFWS 1997a). It is currently listed as a federal species of concern, critically endangered by the State of Nevada, and rare by the Nevada Natural Heritage Program (see Appendix F, Table F-1). The USFWS considers protection of the Las Vegas bearpoppy as one of its highest priorities in Nevada. Species of concern are not protected under the Endangered Species Act; however, by protecting existing populations on public lands, including those found on Nellis AFB, the USFWS seeks to avoid listing the Las Vegas bearpoppy as threatened (Air Force 1997e).

Four populations of Las Vegas bearpoppy have been located on Nellis AFB: three populations in Area II and one population in Area III. In 1996, Area II had approximately 1,300 plants and Area III had the largest population with "thousands of plants." Because two of the four populations, including the Area III population, are exposed to habitat disturbance from human activities (e.g., motorcycling, bicycling, and horseback riding), current protective efforts are being evaluated by the Environmental Management office at Nellis AFB (Air Force 1997e).

The chuckwalla and banded Gila monster are both federal species of concern; the Gila monster is also protected by the State of Nevada. At Nellis AFB, chuckwallas have been confirmed by the presence of scat on the rocky hillsides of the eastern portion of Area II (Air Force 1997e). Chuckwallas inhabit rocky hillsides, talus slopes, and rock outcrops in areas dominated by creosote. Rocks and their associated crevices provide shelter and basking sites.

The Gila monster is found in Mojave desertscrub habitat characteristic of the undeveloped areas of Nellis AFB and the South Range. Gila monsters are capable of digging but they depend largely on natural crevices, desert woodrat nests, or animal burrows (e.g., those of the desert tortoise) for shelter. Winter ranges are generally in more elevated locations on rocky slopes or outcrops; summer ranges are located in adjacent lower valleys and bajadas.

Bats are found in all major vegetation communities of Nevada (Hall 1946). Within these communities, bats inhabit a wide variety of habitats from rocky canyons to riparian washes. The low-elevation creosote bush-white bursage community, characteristic of the Mojave Desert and southern Nevada, appears to support the most bat species; the higher-elevation Great Basin sagebrush-pinyon-juniper community supports the fewest (Air Force 1997a). Twenty species of bats potentially occur at Nellis AFB or on NAFR, twelve of which are considered species of concern by the USFWS. One species, the spotted bat, is listed as threatened by the NDOW (see Appendix F, Table F-2).

Only one Federal Bird Species of concern, the burrowing oil, has been found at Nellis AFB. Burrowing owls have been observed on and near Nellis AFB especially in the flat, previously disturbed areas found around the southern boundary of the base, including the concrete edges of flood control channels. They have been sighted along the south perimeter of Area I during construction activities adjacent to the golf course. In 1996, maintenance of a Clark County Regional Flood Control District channel within Area I disturbed two burrowing owls, and four artificial burrows were established in the southwest portion of Area I to comply with USFWS-recommended mitigation measures. Also in 1996, one adult and four young were seen in the southern corner of Area I, south of the golf course. Nearby construction was halted until the

young fledged. The black tern and white-faced ibis may occur at the golf course ponds only as rare transient migrants. The phainopepla occurs at the Desert Wells Annex, 4 miles west of Nellis AFB. None of these three species have been observed at Nellis AFB (Air Force 1997e).

3.7.2 Nellis Range Complex

VEGETATION: The NRC lies within the Basin and Range Physiographic Province, which is characterized by hundreds of long, narrow mountain ranges separated by broad alluvial valleys. It also lies within the hydrographic Great Basin, which is an area of internal drainage between the Rocky Mountains and the Sierra Nevada. Contained within the southern portion of the Great Basin lie two distinct biogeographic provinces: the Mojave Desert province and the Great Basin Desert province (DoD 1997). A biogeographic province is defined as a region that differs from another region primarily on the basis of the predominant vegetation and wildlife habitat types. The South Range encompasses an area that supports vegetation and habitat types characteristic of the Mojave Desert; the North Range and the majority of lands underlying MOA airspace encompass a transition area that supports vegetation and habitat types characteristic of both the Great Basin and Mojave Deserts (Air Force 1997e). The region can also be separated climatically into hot and cold deserts. The lower, hot Mojave Desert receives most of its precipitation as rain; the higher, cold Great Basin Desert receives most of its moisture as snow (MacMahon 1988).

In addition to the general vegetation of the lands underlying the NRC, the affected environment includes the North and South Range target areas, dominated by non-native grasses. Approximately 90,000 acres (about 3 percent of the NAFR) around target areas have been disturbed by military activities. Current NAFR fire-suppression activities include the use of firebreaks around targets to reduce the likelihood of fires.

Inventories of the North and South ranges have shown, at a coarse scale, a great diversity of vegetation. Almost all the vegetation types of both the Great Basin and Mojave Desert provinces occur, as well as vegetation characteristic of the Mojave-Great Basin transition (DoD 1997) (Figure 3.7-1). Because of the transition between the Mojave and Great Basin deserts and the diverse topographic relief, this region exhibits a unique diversity of plant and animal species.

The area roughly north of the 37th parallel is characterized by sagebrush and saltbush vegetation (Turner 1994a). Most of the precipitation, falling predominantly as snow, remains in the region until it is absorbed into the ground or evaporates; it is not transported out of the region.

In valley floors of the North Range and between 4,000 and 5,000 feet with pronounced cold-air drainages, the characteristic plant species include shadscale and fourwing saltbush in almost monotypic stands associated with annuals. The plant species found on valley floors and alluvial fans from 5,000 to 6,000 feet are dominated by dwarf shrubs but include shadscale associated with winterfat, Nevada ephedra, or Bailey greasewood. The salt-tolerant winterfat and greasewood are also found on valley floors with high salinity. Other species associated with the above series include fourwing saltbush, budsage, Indian ricegrass, and littleleaf horsebrush with the occasional Joshua tree or yellow rabbitbrush (DoD 1997). These principal scrub species are

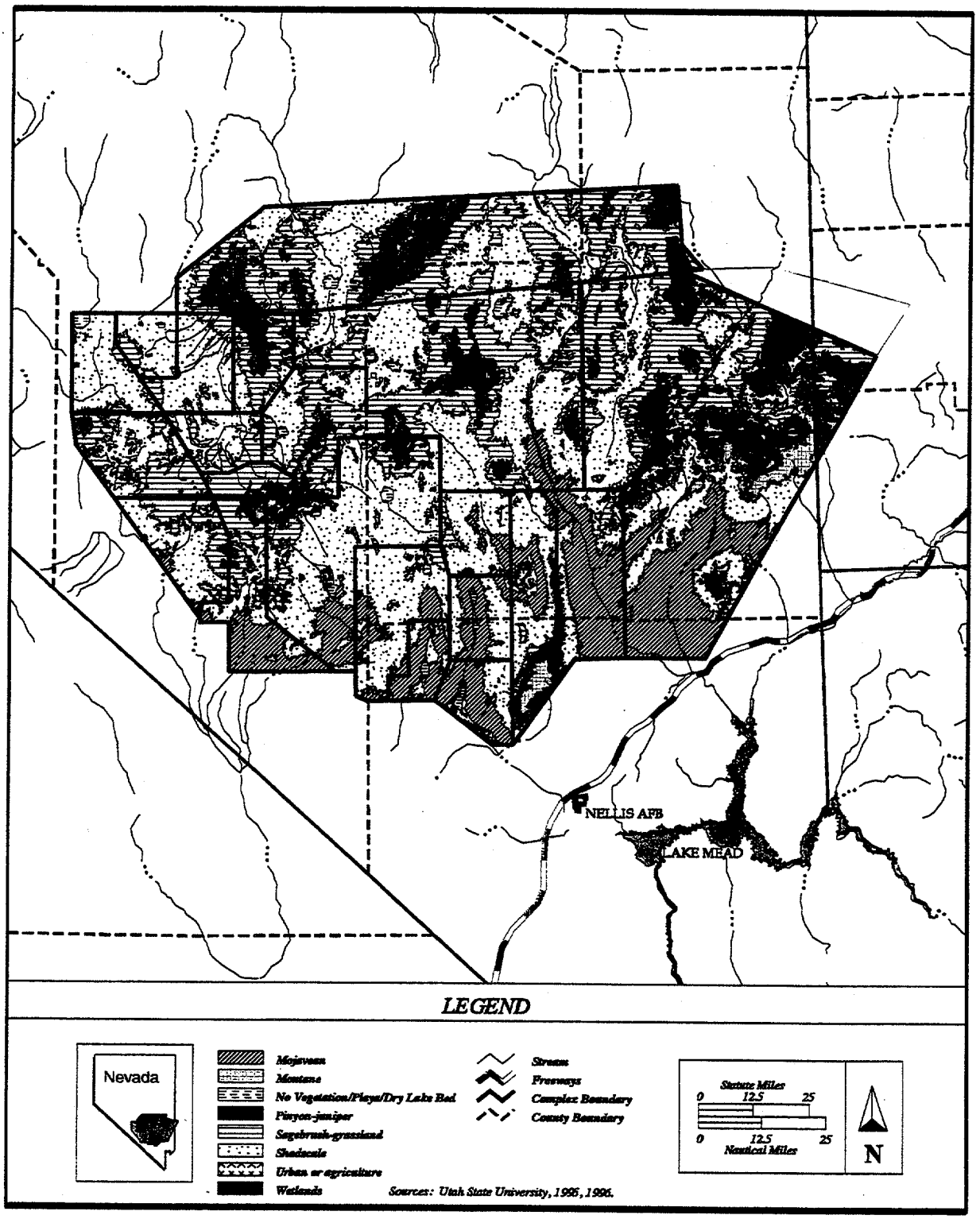


Figure 3.7-1. Dominant Vegetation Types within the Nellis Range Complex

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much-branched, non-sprouting, aromatic semishrubs with soft wood and evergreen leaves. They are mostly without spines. There are few cacti, either in numbers of individuals or species (Turner 1994a).

The characteristic plant series found on rolling uplands and montane slopes from 5,600 to 7,700 feet include black sagebrush, big sagebrush, with pinyon pine-Utah juniper occurring from 6,400 to 7,800 feet. Additional species occurring within these communities include squirreltail, Nevada ephedra, blue grama, and Indian ricegrass. Associated with springs and seeps are wiregrass, interior rose, Kentucky bluegrass, and desert gooseberry. At even higher elevations (7,400 to 8,800 feet) white fir and limber pine are dominant with associations of mountain maple, wax currant, big sagebrush, and mountain spray (DoD 1997).

The South Range lies within the northeastern portion of the Mojave Desert. Below approximately 4,000 feet, plant communities are dominated by creosote bush. The most common vegetation communities are creosote-white bursage and saltbush communities. At elevations above 4,000 feet they are replaced by communities transitional to Great Basin desertscrub (e.g., blackbrush) (Turner 1994b; DoD 1997).

Below 4,000 feet on valley floors and bajadas in the southern ranges (e.g., Three Lakes and Indian Springs valleys), creosote bush is the visually dominant shrub. It is associated with a variety of other shrubs depending on soil type and elevation. As in the North Range, fourwing saltbush and shadscale are characteristic at this elevation. Where soils are clayey and alkaline, as they are on playas at the lowest elevations, fourwing saltbush and shadscale dominate and are the characteristic species in the saltbush community.

At elevations from 4,000 to 5,000 feet on alluvial fans and valley bottoms the blackbrush community marks the transition between the Mojave and Great Basin deserts. Joshua tree, spiny menodora and Nevada ephedra are commonly associated with this community. Above 5,000 feet, the sagebrush-pinyon-juniper community is characteristic of the higher elevations of the Great Basin and Mojave deserts. Increased precipitation and lower temperatures at these elevations allow the development of this woodland type, consisting of trees less than 5 feet high. The dominant species include pinyon pine; big sagebrush in deeper soils; or black sagebrush in areas with shallow, rocky soils; and Utah juniper. Common subdominants in this woodland are rabbitbrush and joint fir (Air Force 1997d; DoD 1997).

WETLANDS: In 1996, a survey was conducted to characterize, describe, catalog, and delimit the extent of water resources within the range. The primary objectives of this survey were to characterize these water resources in terms of surface waters, saturated soils, value to wildlife, and current conditions, rather than conducting formal wetland delineations (Air Force 1997k). Over the approximately 3-million-acre NAFR, nearly all of the surface water resources are springs, seeps, pools, small streams, and the saturated soils they support. There is only one intermittent stream found on NAFR; no other naturally occurring rivers, ponds, or lakes are found (Air Force 1997k; USFWS 1995a, b).

The five man-made ponds on the North Range contain most of the available surface water on NAFR. Four of the five ponds (Tonopah Test Range, Strike Eagle, Cactus Flat, and Tolicha)

have been established for construction needs; the fifth (Rose Spring) was established to provide water for horses and wildlife (Air Force 1997k). On the South Range, surface waters are extremely limited and generally only accessible by helicopter. In the Pintwater Range, the major springs are Tim, Pintwater, and Crystal, with Tim Spring having the greatest volume of standing water (Air Force 1997k). Playas, dry lakes, and other seasonally or ephemerally wet areas were not systematically investigated during the 1996 wetland survey, but some are thought to be heavily used by waterfowl and other migratory birds in the spring (e.g., Mud Lake, Cactus Flat, Gold Flat on North Range; Three Lakes Valley and Indian Springs Valley on South Range) (Air Force 1997k).

MOA airspace overlies important and relatively extensive riparian and wetland habitats associated with the White and Muddy rivers and Meadow Valley Wash (Figure 3.7-2). Although extremely small in total area, riparian communities in the Great Basin/Mojave Desert region are critical centers of biodiversity and provide migration pathways for many species. More than 75 percent of the species in the region, including 80 percent of the birds, are strongly associated with riparian vegetation (Brussard *et al.* 1997).

Associated with the White River is Pahranagat Valley, which contains Pahranagat National Wildlife Refuge (NWR) with over 5,300 acres of marshes, open water, and native grass meadows and Key Pittman Wildlife Management Area (Figure 3.7-2) (USFWS 1995a; Northern Prairie Wildlife Research Center [NPWRC] 1997b). North of Pahranagat NWR, near the town of Hiko and along the White River, is the Key Pittman Wildlife Management Area, under the jurisdiction of NDOW. The 1,337 acres of high desert and marshes are managed primarily to provide food, cover, and habitat for waterfowl but to provide public use and recreation opportunities (Padillo 1998).

Located about 50 miles northeast of Las Vegas on the Muddy River is Moapa NWR. A tributary to the Colorado River system, the Muddy River receives much of its perennial flow of water from the numerous thermal springs in the Moapa Valley (USFWS 1997b).

WILDLIFE: Due to the presence of the Great Basin and Mojave deserts, the transition zone between them, and the desert springs and riparian areas of the region, there is a great diversity of habitat, which creates varied and locally abundant animal communities within the NRC. The range of wildlife supported by this great diversity of habitat and commonly found within the NRC includes over 30 species of reptiles, 60 species of mammals, and over 240 species of birds (see Appendix F).

Wildlife found in the area of the North Range includes a distinct fauna that is associated with the Great Basin desert scrub. A number of distinctive mammalian representatives follow the sagebrush communities of this biome: Townsend's ground squirrel, dark kangaroo mouse, and sagebrush vole. Other species such as the pale kangaroo mouse and chisel-toothed kangaroo rat prefer the saltbush communities and other desertscrub series. The Great Basin pocket mouse, Ord's kangaroo rat, and the montane vole are best represented at the higher altitudes. Common carnivores include badger, coyote, and bobcat. The more densely vegetated higher elevations

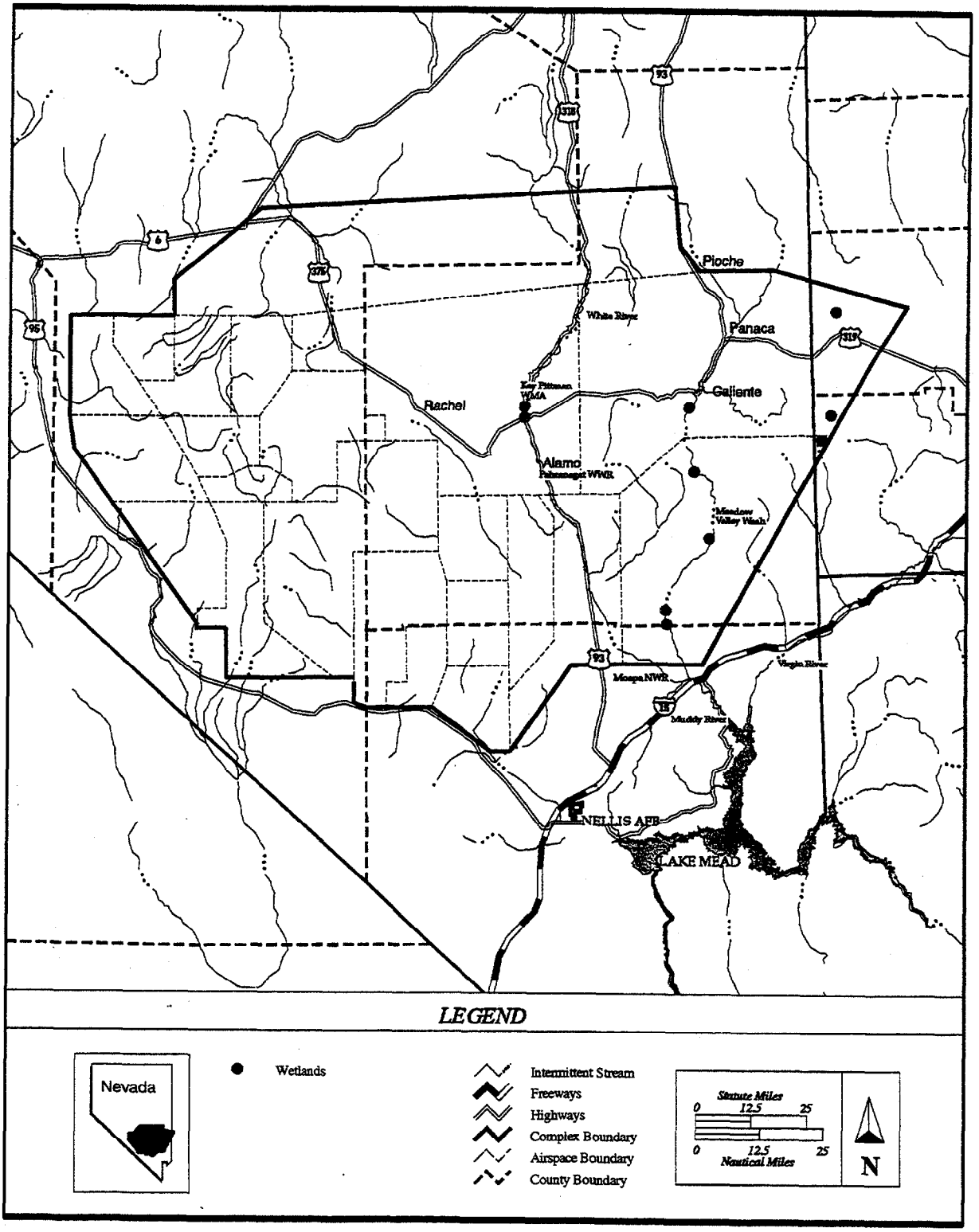

Figure 3.7-2. Nellis Range Complex Riparian and Wetland Habitats
Sources: Personal Communication, Cox 1997., Utah State University, 1995, 1996.

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support mountain lion and mule deer. Bats are common in the North Range but are restricted to areas with appropriate roost sites located near water. Species found on the North Range include California myotis, pipistrelle, and pallid bat (see Appendix F; Turner 1994a; Air Force 1997a).

Big game animals managed by NDOW and found on the ranges include mule deer, bighorn sheep, and pronghorn. Mule deer and bighorn sheep are generally found in the higher elevations, with bighorn associated with steep, rocky terrain and cliffs; pronghorn are generally associated with valleys and other flat, open grassland areas. Although uncommon, the three species may be found in the same area, usually at the edge of valleys. Estimated 1997 populations of pronghorn, bighorn sheep, and mule deer were 465, 1,030, and 3,090 individuals, respectively. Distributions of the three ungulates on the ranges and under MOA airspace are shown in Figure 3.7-3.

Wild horses and burros are protected under Public Law 92-195, the Wild Free-Roaming Horse and Burro Act of 1971, as amended (16 U.S.C. 1331-1340). Approximately 65 percent of the nation's 35,000 wild horses live in Nevada; about 1,239 were present in 1996 on the 394,500-acre Nevada Wild Horse Range (NWHR) located in the northeastern portion of the North Range (BLM 1997a) (see Figures 3.2-11 and 3.7-3). Through a cooperative agreement with Nellis AFB, the BLM is authorized to manage wild horses on the NWHR and to maintain the NAFR as a burro-free area (Air Force 1997e). Since wild horses heavily impact water and other natural resources on the North Range, an appropriate management level of 600 to 1,000 horses was established by the BLM (BLM 1996; Air Force 1997d, k). Achieving the appropriate management level will help maintain the wild horse population in a natural, ecological balance with the other resources and uses within the NWHR.

Due to cold winters, reptiles are not as well represented in the Great Basin portions of the North Range as in the warmer, Mojave desertscrub of the South Range. Common species include the sagebrush lizard, long-nosed leopard lizard, desert horned lizard, western whiptail, western fence lizard, gopher snake, and western rattlesnake. Amphibians on the North Range are restricted to areas near water and include the Great Basin spadefoot toad (see Appendix F; Jaeger 1957; Turner 1994a).

Birds common to the North Range include sage sparrow, sage thrasher, common raven, turkey vulture, and broad-tailed hummingbird. There are numerous raptor species, both resident and migratory, including both hawks and owls. In areas of pinyon-juniper, the pinyon jay, bushtit, and mountain chickadee are common. The most common warbler, especially in the pinyon-juniper belt, is the black-throated gray warbler (see Appendix F; Jaegar 1957; Turner 1994a). Bird diversity is especially apparent in the fall and spring during migration when bird species tend to follow the generally north-south mountain ranges and are attracted to the infrequent ponds and riparian areas (Air Force 1997b).

The South Range is primarily associated with Mojave desert scrub; however, at the higher elevations, Great Basin-associated habitats and the concomitant wildlife species discussed for the North Range are common.

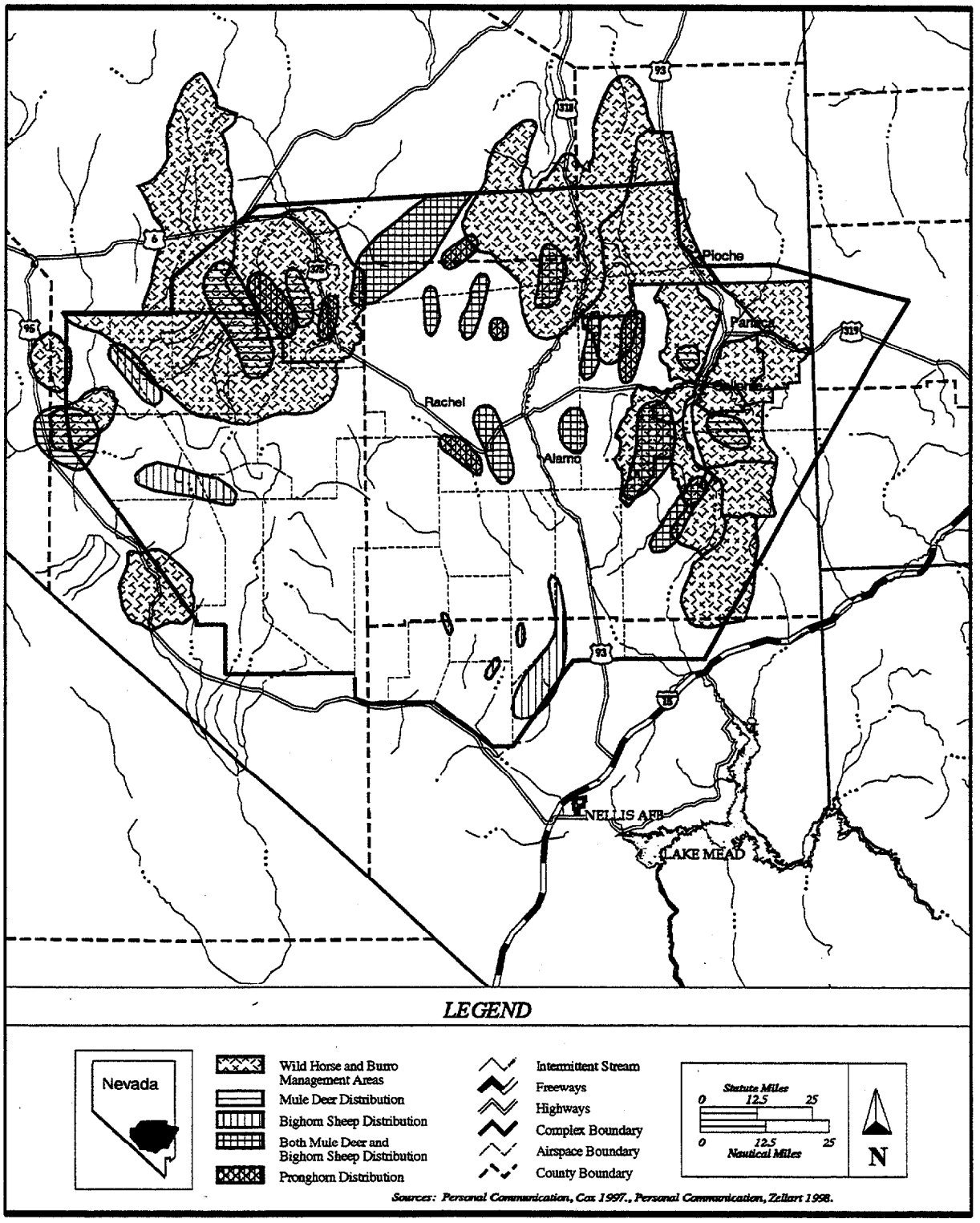

Figure 3.7-3. 1997 Pronghorn, Mule Deer, Bighorn Sheep Distribution and Wild Horse and Burro Management Areas

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Common mammals on the North Range are also common to the South Range. They include coyote, black-tailed jackrabbit, desert cottontail, and bobcat. The mountain lion, though uncommon, is found in the higher elevations. Rodents are especially prevalent in the Mojave desertscrub and include Merriam's kangaroo rat, little pocket mouse, white-tailed antelope squirrel, desert woodrat, southern grasshopper mouse, long-tailed pocket mouse, cactus mouse, and canyon mouse. The same species of bats that are found in the North Range are expected to be present in the South Range, again in areas where there is free-standing water (see Appendix F). Bighorn sheep, the only game animal found on the South Range, is found in the higher elevations of the Desert National Wildlife Range including the Pintwater, Desert, and Sheep ranges (see Figure 3.7-3). For further information, see the North Range discussion.

Birds common to the South Range include many of the same species found in the North Range including common raven, turkey vulture, red-tailed hawk, and sparrows. Birds more commonly associated with creosote scrub, but not found in the North Range, are greater roadrunner and lesser nighthawk. Species associated with riparian scrub habitat around springs include black-tailed gnatcatcher, phainopepla, and ash-throated flycatcher. Verdin are found along washes and the cactus wren is associated with stands of cholla cactus. Several migratory songbirds such as yellow-rumped warbler, Townsend's warbler, and orange-crowned warbler use the habitat surrounding the desert springs and open water during migration and occasionally for nesting, making this habitat a valuable resource in an otherwise dry and sparsely vegetated region (see Appendix F; Air Force 1997b).

Compared to the North Range, reptiles are better represented in the hotter, drier Mojave Desert. Common species include banded gecko, chuckwalla, desert iguana, zebratail lizard, long-nosed leopard lizard, desert spiny lizard, side-blotched lizard, desert collared lizard, western patchnose snake, western shovelnose snake, sidewinder, and speckled rattlesnake.

Since the lands underlying MOA airspace are predominantly Great Basin Desert, with some areas to the east of the South Range being Mojave Desert habitat, the previous discussion on the wildlife of the North Range and South Range is generally applicable to the area in and under the MOA airspace. In addition, a number of important wetland and riparian areas underlie MOA airspace, including (1) the Pahranagat Valley, containing the Pahranagat Valley NWR, the White River, and associated springs; (2) the Muddy River with the Moapa NWR; and (3) Meadow Valley Wash and its associated springs (see section 3.7.2, Wetlands, and Figure 3.7-2). The majority of the bird species listed in Appendix F are directly associated with these riparian areas. They include all of the waterfowl, wading birds, and many other species that use these areas during migration.

About 2,600 horses are also estimated to occur under MOA airspace. These herds compete with other animals for scarce resources such as water and salt desertscrub vegetation. Wild horses are concentrated around water sources and have severely impacted the vegetation for many miles around areas that provide accessible water (Air Force 1997e).

THREATENED, ENDANGERED, AND SENSITIVE SPECIES: Nine federally listed endangered or threatened species occur within the NRC. Six species are listed as endangered and three as

threatened. Seventy species are listed as species of concern by the USFWS. The State of Nevada lists seven endangered and two threatened species. An additional 38 species are afforded a degree of protection by the State of Nevada through the Nevada Revised Statutes and regulations set forth in the Nevada Administrative Code.

The federally threatened and state-listed desert tortoise is found on the southern portions of the South Range, the Desert National Wildlife Range, and NTS. Mormon Mesa, Nevada, which underlies the Desert MOA (Sally Corridor and Elgin) just east of the Desert National Wildlife Range boundary, has been designated as critical habitat for desert tortoise (USFWS 1994). A Biological Opinion regarding the terms for the use of lands jointly managed by NAFR and the Desert National Wildlife Range was issued by the USFWS in February 1997 (USFWS 1997c).

Two other reptile species, banded Gila monster and chuckwalla (discussed previously in section 3.7.1), are listed by the USFWS as species of concern. Only the chuckwalla has been found on NAFR and the South Range; both have been found under Desert MOA airspace (Air Force 1994b; Air Force 1997d).

The threatened Ute ladies'-tresses is the only federally listed plant known to occur within the NRC (Appendix F, Table F-1). It is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams and where the vegetation is relatively open and not overly dense, overgrown, or overgrazed (USFWS 1992b). Its only known occurrence is on private land near Panaca, Nevada (personal communication, Bair 1997).

Four species of plants listed by the State of Nevada as critically endangered occur or may occur on NRC. One is the aforementioned Ute ladies'-tresses. Two other species have been confirmed on NRC: Beatley milkvetch on the North Range and half-ring pod milkvetch on the South Range. The remaining critically endangered species, sunnyside elkweed, has not been confirmed within the NRC, but its occurrence is suspected (DoD 1997).

Located about 50 miles northeast of Las Vegas on the Muddy River is Moapa NWR. It was established to secure habitat for the endangered Moapa dace (USFWS 1997b). Just east of Pioche in the Pioche Hills lie a number of springs that support three sensitive native species of fish including the federally threatened Big Spring spinedace (BRRC 1997a).

Only two federally listed bird species occur within the NRC: the American peregrine falcon, listed as endangered, and the bald eagle, listed as threatened (see Appendix F, Table F-2). Neither are known to breed in the area; they are primarily spring and fall migrants and winter visitors. The bald eagle, which winters in the Pahranagat Valley and the Pahranagat NWR, is attracted to the marshes, ponds, and lakes along the riparian corridor of the White River. If and when bald eagles are on NAFR, they may be temporarily attracted to the small, ephemeral ponds, especially if waterfowl are present (Air Force 1997b).

The golden eagle is a year-round resident of NAFR (Air Force 1997b). Along with the bald eagle, this species is protected by the federal Eagle Protection Act of 1962. Large stick nests are built on cliff ledges, in large trees, and on power-line towers. In the Great Basin, black-tailed jackrabbits are their principal prey, which is heavily supplemented by ground squirrels and

carrion (e.g., roadkills and livestock carcasses). They have also been known to feed on adult and young pronghorn, deer, coyotes, bobcats, and foxes (Ryser 1985).

The mountain plover, a candidate proposed for listing as threatened or endangered, has the potential to occur within the NRC as a migrant, although its presence has not been confirmed. Sager (1996), in a review of the species, found no record of the species in Nevada.

No federally listed mammals are known to occur within the NRC although 14 species of concern (12 bats and 2 rodents) are found on both ranges or under MOA airspace (see Appendix F, Table F-2). Three bat species of special concern, long-legged myotis, fringed myotis, and Townsend's big-eared bat, have been detected on the North Range (Air Force 1997a). For further discussion of bats, see section 3.7.1. The kangaroo mouse and the vole occur only under Desert MOA airspace in the Pahranagat Valley.

Five species of fish are federally listed as threatened or endangered, and all occur under Desert MOA airspace, primarily along the White River and at Pahranagat and Moapa NWRs. The Pahranagat Valley supports three native endangered fish species. It also provides known or potential habitat for 23 other species (2 fishes, 2 snails, 2 aquatic beetles, 5 birds, and 12 mammals) that are currently of special concern though not presently candidates for listing under the Endangered Species Act (USFWS 1995a).

3.8 CULTURAL RESOURCES

Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered to be important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. Cultural resources are typically divided into three major categories: prehistoric and historic archaeological resources, architectural resources, and traditional cultural resources.

Prehistoric and historic archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., arrowheads, bottles). To archaeologists, prehistoric archaeological resources predate written records. In southern Nevada these resources range from isolated stone tools to rockshelters and petroglyphs. Historic archaeological resources in Nevada include mines and associated debris, railroads, trails, and dumps. The distinction between prehistoric and historic might be somewhat arbitrary since American Indian groups, while performing traditional activities, may still create artifacts and features that archaeologists may unintentionally label as prehistoric.

Architectural resources are standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. In Nevada all architectural resources are historic in age.

Traditional cultural resources are resources associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. In Nevada these resources are generally associated with modern American Indian groups. Traditional American Indian resources may include archaeological resources, locations of historic events, sacred areas, sources of raw material used to produce tools and sacred objects, traditional hunting or gathering areas, and native plants or animals. American Indians may consider these resources essential for the persistence of their traditional culture.

Under federal regulation, only significant cultural resources warrant consideration with regard to adverse impacts resulting from a federal undertaking. Significant archaeological, architectural, and traditional resources include those that are eligible or recommended as eligible for inclusion in the National Register of Historic Places (NRHP). The significance of prehistoric and historic archaeological resources and architectural resources must be evaluated according to NRHP eligibility criteria (36 CFR 60.4), in consultation with the State Historic Preservation Officer (SHPO). According to these criteria, "significance" is present in districts, sites, buildings, structures, and objects that:

a) are associated with events that have made a significant contribution to the broad patterns of history;

b) are associated with the lives of persons significant in the past;

c) embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; or

d) have yielded or may be likely to yield information important in prehistory or history.

An archaeological or architectural resource that is eligible to the NRHP is called a historic property. To be listed on or determined eligible for listing on the NRHP, a cultural resource must meet at least one of the above criteria and must also possess integrity. Integrity is defined as the authenticity of a resource's historic identity as evidenced by the survival of physical characteristics that existed during the historic or prehistoric occupation or use. The NRHP recognizes seven aspects or qualities that, in various combinations, define integrity: location, design, setting, materials, workmanship, feeling, and association. Integrity of location means that the cultural resource has not been moved. Integrity of design, materials, and workmanship means that the resource's original building materials, plan, shape, and design elements remain intact. Integrity of setting means that the surrounding landscape remains largely as it was during the resource's period of significance. Integrity of feeling and association means the resource retains a link to an earlier time and place and is able to evoke that era.

The determination of significance is made in consultation with the SHPO. Significant historic resources usually must be at least 50 years old; however, certain structures associated with more recent, exceptionally important historical events (e.g., the Cold War) also may be considered eligible for the NRHP. Archaeological isolates, because of their small size and limited information potential, are not considered eligible for the NRHP by the Nevada SHPO.

Certain categories of tangible American Indian resources, such as ancestral settlements or petroglyph and pictograph sites, may be protected through their eligibility to the NRHP. On the other hand, natural features and spiritual locations may not be addressed in historic preservation legislation if their historic use cannot be documented, if the resource does not have an integral relationship to traditional cultural practices and beliefs, if the present condition is such that the relationships no longer survive, if the resource's boundaries cannot be delineated, or if the resource does not meet NRHP criteria.

Even though a cultural resource may not be considered significant according to NRHP criteria, it may still have importance as a traditional resource to a particular tribe. In this case, traditional resources may be protected according to the consultation provisions of the Native American Graves and Repatriation Act if it contains a human burial or the American Indian Religious Freedom Act and Executive Order 13007, Indian Sacred Sites if it is important in religious rituals. (See Appendix A).

A single traditional resource may also be significant for more than one reason. For example, an outcrop of an unusual type of chert may be important to a tribe as a source of raw material for making tools, a source of medicine, a spiritual location, a link to the groups ethnic identity, a location to teach children about traditional beliefs and practices, and as a former living site.

The ROIs for the EIS include Nellis AFB and the NRC. In keeping with NEPA regulations, the level of detail involved in the examination and description of cultural resources was appropriate for the anticipated effect associated with each ROI. The Nellis AFB ROI includes all areas involving new construction, demolition, modification, or other potentially ground-disturbing activities. For the Nellis AFB ROI, the archaeological, architectural, and traditional resources contained on the base are discussed in detail. Discussions on resources within the NRC ROI emphasize resources that may be sensitive to noise or sonic booms. These resources include NRHP-listed properties, historic structures (especially historic mining structures), rock art sites, and traditional cultural resources.

Information on cultural resources was obtained from individual surveys and excavations at Nellis AFB and NAFR, the NRHP database, the *Cultural Resource Management Plan* for NAFR, reports from the Native American Interaction Program (NAIP) (including an on-going ethnographic study), general overviews and histories of the area, and discussions with Nellis AFB and BLM personnel on potentially noise-sensitive or sonic boom-sensitive resources.

In the *Native American Resource Document* (AIWS 1997) created for use with the Nellis Range Renewal LEIS, representatives of American Indian groups discussed traditional cultural resources on or near NAFR. The Native American Resource Document was prepared by representatives of the Southern Paiute, Western Shoshone and Owens Valley Paiute and Shoshone, as well as the Las Vegas Indian Center. They represent the Consolidated Group of Tribes and Organizations (CGTO), which is made up of the following tribes and official American Indian organizations (AIWS 1997):

- Southern Paiute
  - Kaibab Paiute Tribe, Arizona
  - Paiute Indian Tribes of Utah
  - Moapa Band of Paiutes, Nevada
  - Las Vegas Paiute Tribe, Nevada
  - Pahrump Paiute Tribe, Nevada
  - Chemehuevi Paiute Tribe, California
  - Colorado River Indian Tribes, Arizona
- Western Shoshone
  - Duckwater Shoshone Tribe, Nevada
  - Ely Shoshone Tribe, Nevada
  - Yomba Shoshone Tribe, Nevada
  - Timbisha Shoshone Tribe, California

- Owens Valley Paiute and Shoshone
  - Benton Paiute Tribe, California
  - Bishop Paiute Tribe, California
  - Big Pine Paiute Tribe, California
  - Lone Pine Paiute Tribe, California
  - Fort Independence Paiute Tribe, California
- Mojave
  - Fort Mojave Indian Tribe, Arizona
- Other Official Indian Organizations
  - Las Vegas Indian Center, Nevada

The Air Force is presently corresponding with Indian groups on the location of specific traditional cultural resources. American Indians have identified a number of sensitive areas throughout southern Nevada: "Cultural resources are not limited to archaeological or historical remains of native ancestors, but include all natural resources, as well as geological formations contained throughout the region ... [including] plants and animals ... natural landforms [that] mark locations that are significant for keeping the historic memory of American Indian people alive and for teaching children about their culture" (AIWS 1997).

A primary purpose of the NAIP is for the Air Force to establish working relationships with regional tribal members. It facilitates the Air Force's compliance with laws, regulations, executive orders, and DoD policy pertaining to American Indian rights concerning traditional cultural resources and archaeological resources located on Nellis lands, including the NAFR. It provides American Indians a forum to request access to certain resources and still allows the Air Force to consider mission safety and security requirements.

Anther purpose of the NAIP is to identify specific areas and locations to be designated for traditional cultural property protection. This would help the Air Force plan range management that considers the importance of the traditional cultural properties. The CGTO is concerned that sharing detailed traditional cultural resource information with anyone not of their community could expose the cultural resources to vandalism or other disturbances (AIWS 1997). The Air Force understands the importance of this information and is committed to confidentiality.

3.8.1 Nellis AFB

ARCHAEOLOGICAL RESOURCES: As of 1997, more than 6,937 acres on Nellis AFB had been surveyed for cultural resources (Air Force 1997i). These surveys included 100 percent of Area I, 66 percent of Area II, and 30 percent of Area III. No NRHP-eligible sites were found in either Area I or Area III. To date, six prehistoric sites and 16 historic sites in Area II have been

determined eligible for the NRHP (Air Force 1997i). The historic sites in Area II were incorporated into two districts: the Arrowhead Trail District and the Midnight/Moonlight Historic Mining District (Environmental Solutions 1995).

The areas north and east of Nellis AFB are open range and mountainous and are managed by the BLM. Areas to the south and west are developed. These areas have a low potential for containing prehistoric resources since they lack water, are covered with sand dunes, and would have possessed few food resources in the past. Approximately 10 percent of this area has been surveyed. A total of 20 prehistoric sites and 9 historic sites have been recorded (personal communication, K. Myhrer 1998). Although complete evaluations have not been made, all of the historic sites and approximately 25 percent of the prehistoric sites would likely be considered eligible.

ARCHITECTURAL RESOURCES: In 1988, Page and Turnbull, Inc. completed an inventory and evaluation of 10 World War II structures on Nellis AFB and Indian Springs Air Force Auxiliary Field. At that time, the only World War II structure evaluated as eligible for nomination to the NRHP was the original McCarran Field Air Terminal Building. The Nevada SHPO concurred with this evaluation and urged Nellis AFB to reconsider nominating the building to the NRHP (Air Force 1997i).

TRC Mariah Associates, Inc. completed an inventory of 194 Cold War-era cultural resources on Nellis AFB in 1994. Five structures were evaluated for nomination to the NRHP (Mariah Associates, Inc. 1994). Of these, the Maintenance Hangar and the Weapons School are considered as eligible for nomination to the NRHP.

TRADITIONAL RESOURCES: No known traditional resources, sacred areas, or traditional use areas have been identified on Nellis AFB. Nellis AFB is presently working with American Indian groups to identify these resources (personal communication, K. Myhrer 1998).

3.8.2 Nellis Range Complex

ARCHAEOLOGICAL RESOURCES: A number of archaeological surveys have been conducted on the NAFR section of the NRC. Approximately 5,000 archaeological resources have been recorded under the MOAs defining the limits of the airspace associated with NAFR. These consist of an estimated 600 within Clark County, 2,400 within Lincoln County, and 2,000 within Nye County. Within Clark County, only one of these archaeological sites is listed on the NRHP. In Lincoln County, two archaeological districts are listed on the NRHP. In Nye County, one NRHP site lies under the airspace (UNLV 1997). Most of the recorded archaeological sites have not been evaluated for NRHP eligibility.

Because most of the land within the NRC has not been surveyed for cultural resources, it is likely that tens of thousands of archaeological sites remain to be discovered. A significant portion of these undiscovered sites are probably eligible for nomination to the NRHP.

By 1991, 29 archaeological investigations had been completed on NAFR and the Indian Springs Air Force Auxiliary Field with approximately 2.3 percent of NAFR surveyed for cultural resources. During the fall and winter of 1997 and 1998, a sample survey of approximately 60,000 acres on the NAFR was conducted. The report is not yet available (personal communication, Helen Wells 1998). Excluding the most recent survey, 66,822 acres have been surveyed on NAFR. A total of 1,846 sites were recorded, but eligibility determinations for most of these are currently under review.

Historic archaeological sites associated with mining and ranching are found throughout the NRC. Seventy-six historic resources have been identified and recorded including ranching complexes and mining towns (U.S. Air Force, U.S. Navy, Department of the Interior 1991). Since mining and ranching were practiced throughout the NRC, similar Euroamerican sites would probably be found elsewhere. Other historic resources on the NRC include transportation and communications routes. A segment of the Las Vegas-Tonopah Railroad, built and used from 1907 to 1916, crosses the southern boundary of Indian Springs Air Force Auxiliary Field.

Archaeological resources are known to be located within the disturbed areas on NAFR, that is, those areas that are specifically subject to activities such as target practice, and the use and maintenance of facilities, roads, or utilities. Most target areas have not been surveyed for cultural resources. However, with a few exceptions, target areas on NAFR are often within dry lake beds where, due to a lack of vegetation and continued water erosion, archaeological resources are uncommon. Because target areas at NAFB have been used for many years, archaeological resources located within these areas have probably been destroyed, damaged, or strewn with unexploded ordnance that makes the data inaccessible to researchers.

ARCHITECTURAL RESOURCES: Hundreds of structures associated with the mining and ranching history of Nevada are found throughout the NRC. Over 50 mines and 15 mining districts, many with associated towns, were opened in what is now NAFR during the late 19th and early 20th centuries. Supersonic flight is currently restricted in the airspace above the historic towns of Hiko, Tempiute, Crystal Springs, Pioche, Bullionville, and Reveille.

TRADITIONAL CULTURAL RESOURCES: Traditional American Indian resources located on the NRC include traditionally used plants and animals, trails, and certain geographic areas. Types of resources that have been specifically identified in recent studies include rock art sites; power rocks and locations; medicine areas; landscape features such as specific peaks or ranges, hot springs, meadows, valleys, and caves; traditional-use plants (AIWS 1997); traditional-use animals such as hawks, eagles, insects, mountain lions, and deer; burial sites; gathering places for rabbit drives, dances, and ceremonies; traditional landscapes; and lithic raw material.

3.9 TRANSPORTATION

Transportation resources refer to the infrastructure and equipment required for the movement of people, raw materials, and manufactured goods in geographic space. Particular emphasis for this analysis is given to the road and rail networks. Airport facilities are discussed in section 3.1, Airspace. Transportation resources were analyzed on Nellis AFB only. Since no effect to transportation was expected due to overflights and noise, no further analysis of transportation resources in the NRC was conducted.

For transportation resources, ROI One includes the roadway network on Nellis AFB, and those roads likely to be used for base access. The primary components of the roadway network in the Nellis AFB area are depicted in Figure 3.9-1.

Nellis AFB is near several major highways. Regional access to the base is provided by Interstate 15 (I-15) via exits at Craig Road from the west, Las Vegas Boulevard from the north, and Nellis Boulevard to the south. From the base, I-15 may be reached via Craig Road or Las Vegas Boulevard; the Craig Road intersection with I-15 is the full interchange closest to the base, located approximately 2.5 miles west of the main gate. Cheyenne Avenue intersects I-15 approximately 4 miles west of the base and ends at the base's southwest boundary, near the base golf course.

To provide the measure of magnitude of transportation impacts on the Nellis AFB vicinity, a volume-to-capacity ratio for annual average daily traffic was analyzed. This measurement of roadway capacity and demand in the vicinity of Nellis AFB provides a general indication of the roadway's ability to accommodate travel demand. Volume-to-capacity, or V/C, ratios at or below 0.80 indicate the system has sufficient capacity to meet demand. V/C ratios of 0.80 to 0.99 indicate the system is operating in congestion and demands are exceeding the ability of the roadways to allow vehicles to move without undue delays. A 1.00 V/C ratio indicates major system failures and conditions where small disruptions to the flow of traffic can result in major delays.

Data from the Regional Transportation Commission 2000 Network show that approximately 4 miles of roads in the vicinity of Nellis AFB have a V/C ratio greater than 1.00; 2.5 miles have a V/C ratio of 0.91 to 1.00, 5 miles of roads have a V/C ratio of 0.81 to 0.90, and the remainder of roads in the vicinity of the base have a V/C ratio of less than 0.80.

The roads within Nellis AFB form a network independent from the surrounding vicinity. Mixed privately owned and government-owned vehicle traffic is permitted on most base streets. Government-owned vehicle-only areas include the flight line, perimeter road on the east side, and the motor pool and operations yards of the industrial areas.

The combination of Tyndall Avenue and Ellsworth Avenue form a primary arterial through the base from the West Gate to the North Gate. Fitzgerald Boulevard, the primary entrance to the

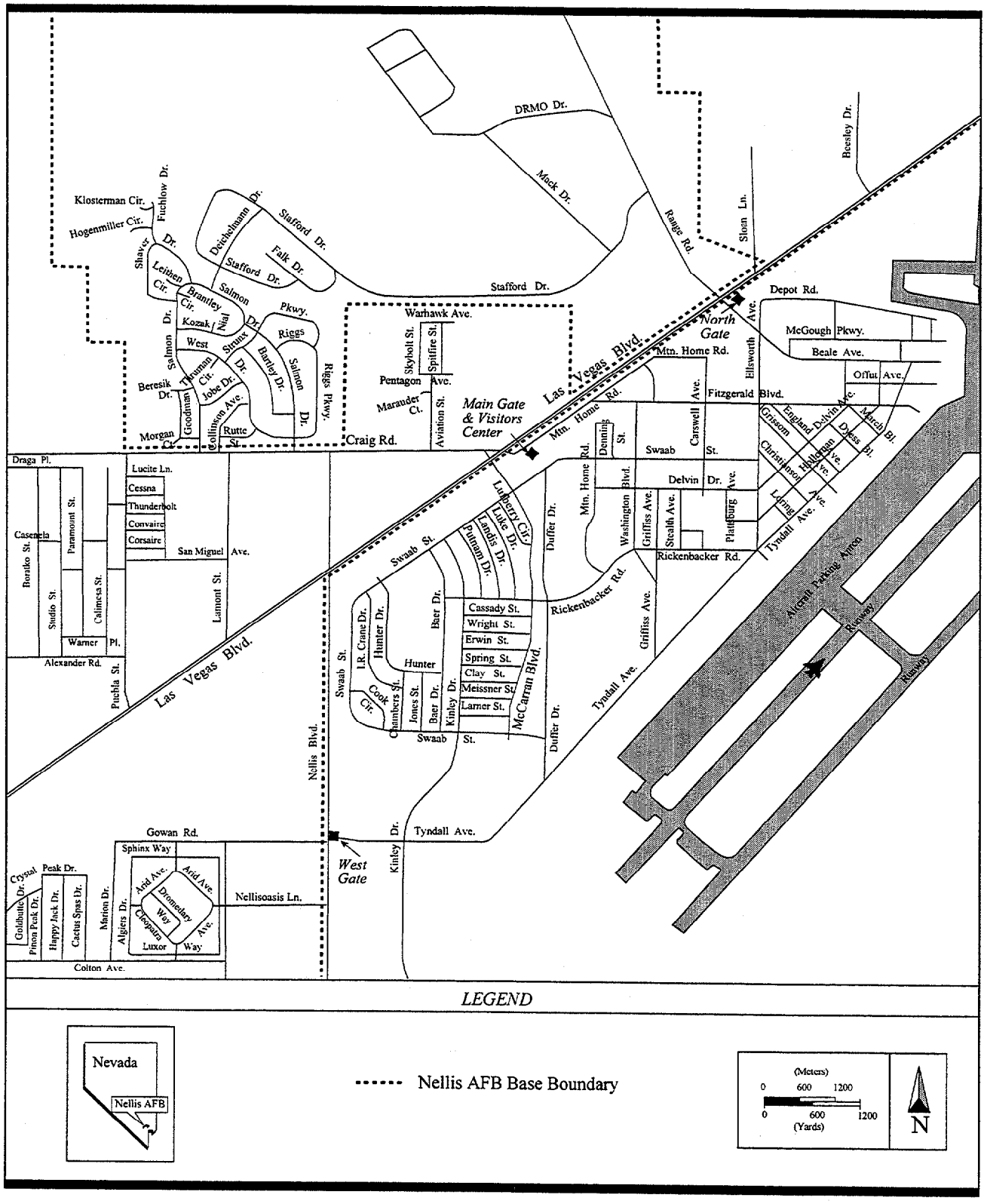

Figure 3.9-1. Transportation Network on Nellis AFB

base, serves as an arterial for collector streets: Washington Boulevard, Griffiss Avenue, Ellsworth Avenue, Kinley Drive, Rickenbacker, and Duffer Drive. The other base streets are local streets.

A review of the *1993 Nellis Air Force Base Traffic Study* (Air Force 1993) indicates five intersections of particular concern: the intersection of Beale and Ellsworth Avenues; Fitzgerald Boulevard, March Boulevard, and Delvin Drive intersection; Washington Boulevard and Fitzgerald Boulevard intersection; Ellsworth Avenue, Rickenbacker Road, and Tyndall Avenue intersection; and Tyndall Avenue Gate and Nellis Boulevard intersection.

Traffic counts were taken at these intersections at peak periods to establish base traffic demand. Data were used to evaluate and quantify existing traffic problems. Level of Service (LOS) criteria range from A to F. An LOS of A describes intersection operations with very low delay, while an LOS of F describes operations with delays in excess of 60 seconds per vehicle, which is considered to be unacceptable to most drivers. LOS D through F resulting in conditions below the minimum desirable design standard were considered adverse to transportation.

The study revealed that the intersection of Washington and Fitzgerald Boulevards near the Main Gate has an average LOS of C. Tyndall Avenue Gate and Nellis Boulevard intersection has the lowest LOS of the areas studied with an LOS of D (Hayes, Seay, Mattern, and Mattern, Inc. 1993). All other intersections achieved an LOS of A.

3.10 RECREATION AND VISUAL RESOURCES

For this EIS, recreation resources include primarily outdoor recreational activities that occur away from a participant's residence. This section addresses natural resources and man-made facilities that are designated or available for public recreational use in remote areas. The setting, activity, and other resources that influence affected recreation resources are also considered.

Visual resources are the natural (landforms, water bodies, vegetation) and man-made features (buildings, fences, signs) that give a particular environment its aesthetic characteristics. A visual impression of an area is derived from the type, physical arrangement, and contrast between these features. Although each viewer's perception may be slightly different, an overall landscape character can be assigned to an area, and impacts to that character can be assessed.

The ROIs for recreation consists of Nellis AFB and the NRC. The analysis examined the effects of noise on recreation use at recreation areas surrounding Nellis AFB and on lands underlying the NRC. The ROI for visual resources is the NRC. Visual resources were evaluated in relation to the impact of aircraft overflights.

Potential recreational opportunities and sites were determined through consultation with the BLM and other land management agencies. Visual resources management (VRM) guidelines were applied to ROI Two, in consultation with the BLM.

3.10.1 Nellis AFB

RECREATION RESOURCES: Recreational opportunities and facilities are an integral part of planning and development at all Air Force bases. At Nellis AFB, recreational facilities available to military personnel and their families include a variety of indoor and outdoor facilities. Indoor recreational facilities include a sports and fitness center, movie theater, bowling center, skills development center, automotive skills center, and a youth center. The base also provides full-service equipment rentals for on- and off-base recreational use. Outdoor recreational facilities, which occupy about 320 acres (3 percent of the total Nellis AFB land area), include two swimming pools, the High Desert Stables Equestrian Facility, Sunrise Vista Golf Course, tennis courts, the Rod and Gun Club, the family camping area, and athletic fields (see Figure 3.10-1).

Recreational opportunities are available in all three areas of the base, although most facilities (270 acres), including the golf course and swimming pools, are in Area I.

Recreational facilities near the base are at small neighborhood parks and schools. These facilities provide picnic areas and playing fields. A speedway is located along Las Vegas Boulevard in the vicinity of the base. Recreation programs are offered through both the cities of Las Vegas and North Las Vegas. Las Vegas Dunes Recreation Land is north of the base. This area provides for all-terrain vehicle riding and other motor sports.

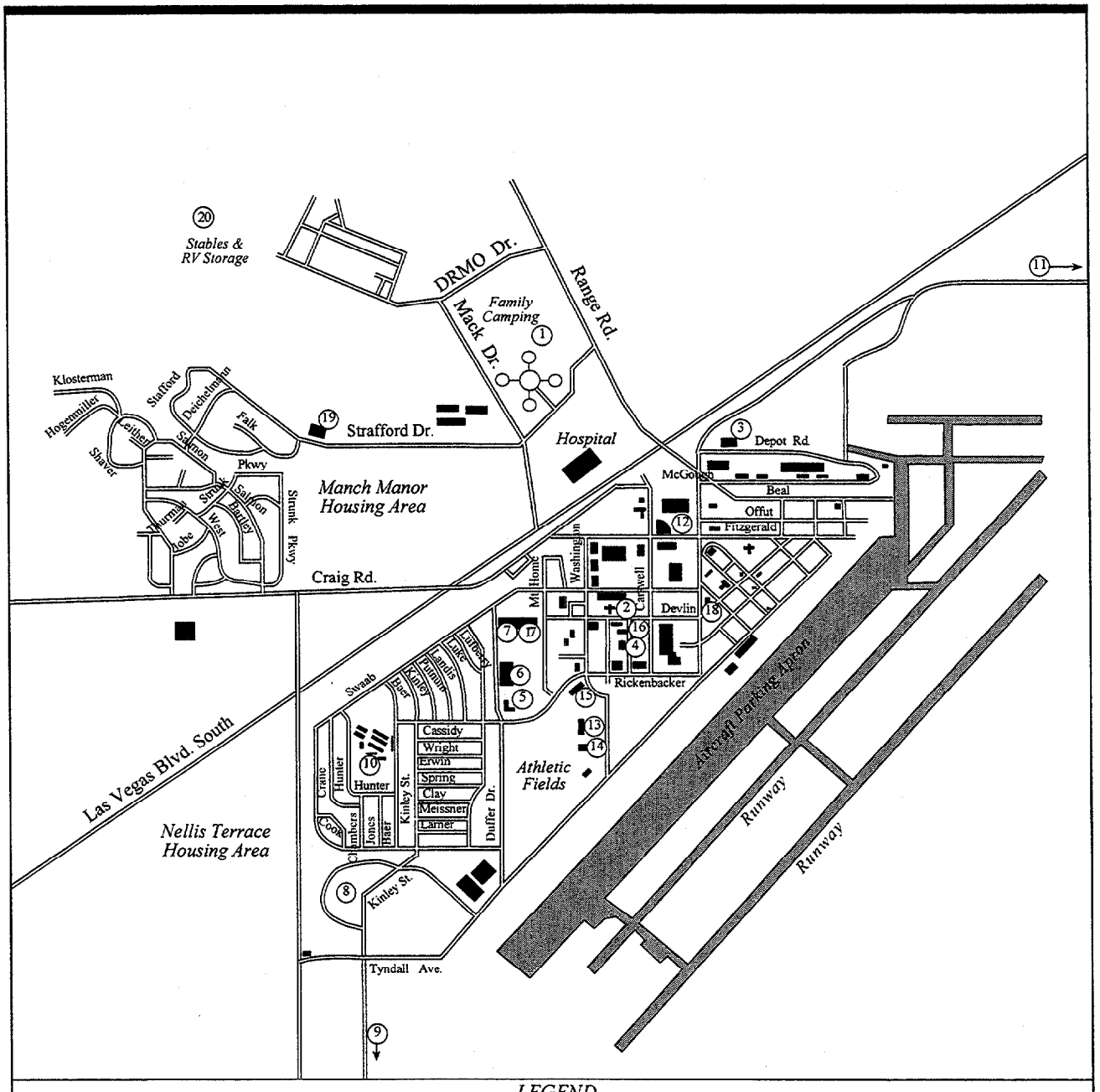

Figure 3.10-1. Recreation Areas on Nellis AFB

3.10.2 Nellis Range Complex

RECREATION: Most of the land beneath the NRC (ROI Two) that is open to public recreation is managed by the BLM for multiple use. Public access to NAFR is restricted. Very little recreation occurs there; hunting is the only recreation activity allowed, and only under permit conditions and existing MOUs. Hunting on NAFR is coordinated with the NDOW and USFWS.

Numerous broad valleys separate the north-south trending mountain ranges within and surrounding NAFR. The diverse landscape provides a variety of outdoor recreational opportunities ranging from hiking, camping, and nature viewing to off-road vehicle use, mining, and hunting. State parks, recreation areas, national forests, and wildlife refuges are also destinations for visitors.

NDOW manages game animals within the state. Bighorn sheep, elk, mule deer, antelope, and upland game (grouse, chukar, quail pheasant, dove, rabbits, etc.) are hunted throughout the ROI. Hunting also occurs within portions of the DNWR. A MOU between the Air Force and USFWS outlines the joint use and management of the area that overlaps NAFR and DNWR.

Due to the dispersed nature of primitive recreation, accurate recreation usage is difficult to measure. Many activities such as camping and hiking do not require special permits, so visitors often are not counted precisely. The BLM Caliente Field Office manages the majority of land under the associated airspace. The *Caliente Management Framework Plan* (BLM 1980) identified areas where recreation use is a concern due to unique or special attributes such as botanical, zoological, geological, and paleontological values. These areas are Ash Springs, Clover Creek, Gleason Canyon, Ella Mountain Summit, Panaca Charcoal Kilns-Panaca Summit, Oak Springs Summit, and Hancock Summit (BLM 1980) (Figure 3.10-2). The Tonopah Resource Area is under the northwest portion of the associated airspace. Recreation use for the entire Tonopah area was approximately 760,000 visits in 1996 (personal communication, Stewart 1997). Wilderness Study Areas are located throughout these resource areas. They also provide primitive recreational opportunities as discussed in section 3.2, Noise and Land Use.

Small portions of two national forests, Dixie and Humboldt, are located in ROI Two. Both offer picnicking, camping, and hiking in rugged mountainous terrain. Cathedral Gorge State Park, Beaver Dam State Park, and Echo Canyon State Recreation Area are located in the northeast portion of ROI Two (Figure 3.10-2). Each of these areas offers camping, picnicking, and hiking in a scenic location. Beaver Dam State Park and Echo Canyon State Recreation Area also offer fishing and water skiing. Table 3.10-1 provides visitor use information.

Other areas also attract visitors because of their distinctive attributes: the Key Pittman Wildlife Management Area, Pahranagat National Wildlife Refuge, White River Petroglyphs Site, and Leviathan Cave Geologic Area.

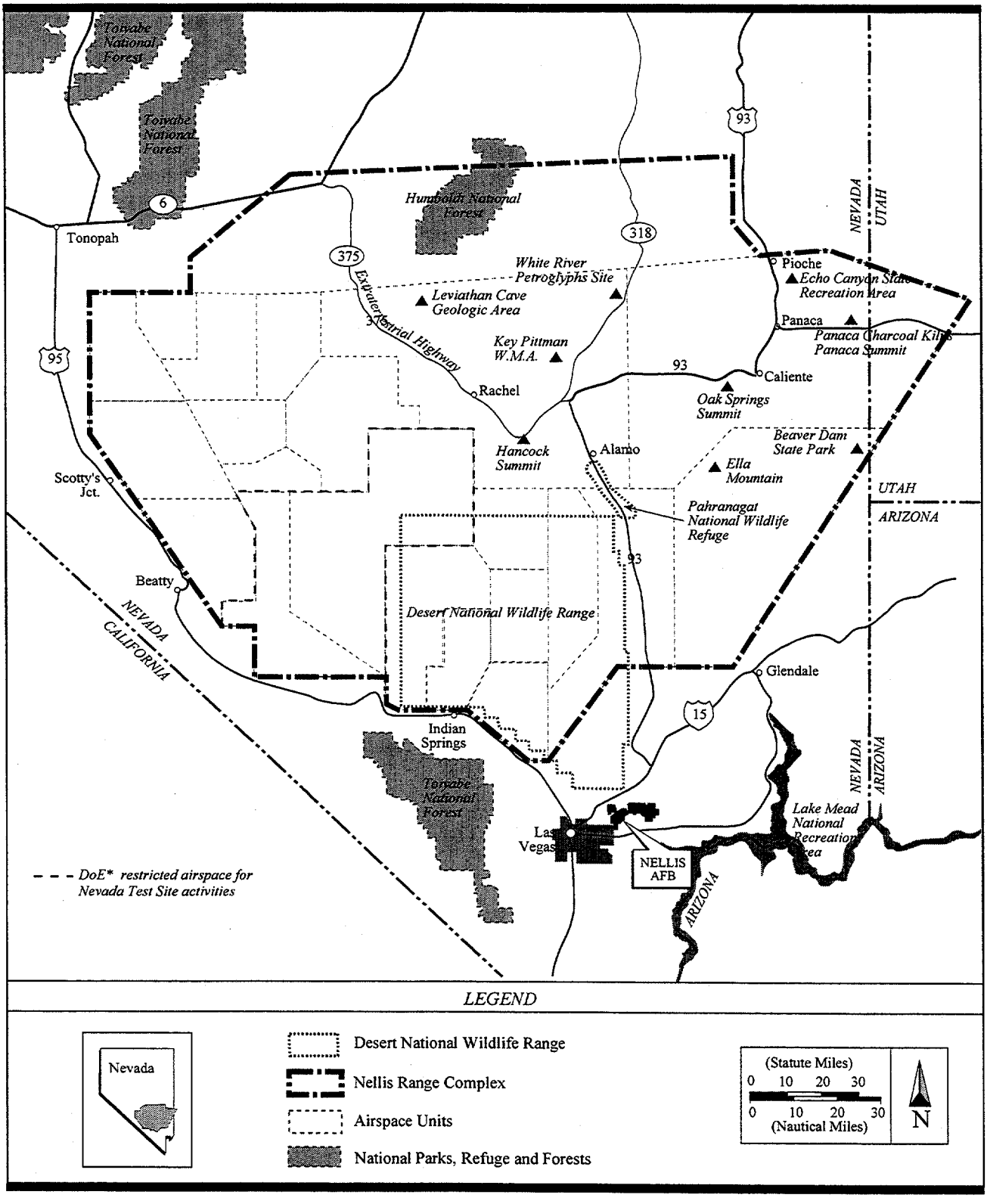

Figure 3.10-2. Recreation Sites and Areas within and Near the Nellis Range Complex

Table 3.10-1. Visitor Use Information

	Cathedral Gorge	*Echo Canyon*	*Beaver Dam*
Acreage	1,633	920	2,233
Peak Use Periods	April-Sept	April - Sept	May-Aug
Annual Visitors (1996)	42,617	53,447	6,926
Length of Stay	73% 1 day or less	75% 2 or more days	36% 1 day or less
Origin of visitors	46% in-state	92% in-state	95% in-state
Most Popular Activities	1. Hiking 2. Relaxing 3. Driving 4. Photography 5. Camping	1. Relaxing 2. Lake fishing 3. Hiking 4. Camping 5. Driving	1. Relaxing 2. Hiking 3. Lake fishing 4. Camping 5. Photography

Source: Personal communication, Weaver 1997

Ghost towns in the NRC, which are in various states of disrepair, also attract visitors. Usually these sites contain a few buildings or foundations of buildings. Some also have cemeteries, mine tailings, and other evidence of historic mining. Historic ghost towns and mining camps are also discussed in section 3.8, Cultural Resources.

VISUAL RESOURCES: ROI Two, located within the Basin and Range physiographic province, is characterized by flat valleys that provide broad views of distant mountain ranges. In the valleys, landforms consist of small hills, drainages, and volcanic rock formations. In the mountains, landforms include large alluvial fans, barren rock, and vegetation-covered mountainsides.

Within the broad valley areas there are several vegetation communities. The southern portion of the ROI is dominated by communities typical of the eastern Mojave Desert. Toward the northern portion of the ROI, communities transition to the Great Basin Desert. The mountain areas are predominantly coniferous forest (refer to section 3.7, Biological Resources, for a description of plant communities).

The few towns and rural communities that exist within ROI Two are typically associated with mining. Nellis AFB has established procedures for these areas to be avoided by military aircraft engaged in range-related training.

U.S. Highway 93 has been designated a scenic byway by the Nevada Department of Transportation. This highway offers views of desert wildlife, eroded mountainous terrain, and ghost towns.

In ratings of the visual character of an area, the shape, form, line, and color of the landscape all play an important roles. As stewards of the majority of land under much of ROI Two, the BLM uses the VRM classification system to identify the existing visual character of the landscape and define the allowable extent and type of modification to the landscape. The VRM classification system rates visual character from the most sensitive (VRM Class I) to the least sensitive (VRM Class IV).

There are no Class I areas within the ROI. The objective of the VRM Class II rating is to retain the existing character of the landscape. The level of development should be low and not draw the attention of the casual observer. Within ROI Two, areas identified as VRM Class II include those surrounding or adjacent to the Pahranagat Valley Wildlife Refuge, Clover Creek, Beaver Dam State Park, Big Hogback, Cathedral Gorge State Park, Highland Peak, Gleason Canyon, Echo Canyon State Park, Key Pittman Wildlife Management Area, and Wilderness Study Areas (BLM 1980) (refer to Figure 3.10-2). Other areas are identified as VRM Class III. These areas can be scenic but do not offer spectacular views or have a unique character. In these areas the objective is to partially retain the existing character of the landscape. Development is permitted but should not dominate the viewshed. VRM Class IV areas are found where the scenery is unspectacular and typical of the region. These are found in broad, flat areas where landforms are indistinct. Development in Class IV areas can dominate the viewshed but should blend with the surrounding area. A high degree of change is tolerated within VRM Class IV areas.

3.11 SOCIOECONOMICS

Socioeconomics is defined as the social and economic activities associated with the human environment, particularly population and economic activity. Human population is affected by regional birth and death rates as well as net migration in and out of the region. Economic activity typically includes employment, personal income, and industrial growth. Impacts on these two fundamental socioeconomic indicators can also influence other components such as housing availability and public services.

Socioeconomic data are presented at the county level in order to analyze baseline socioeconomic conditions in the context of county trends. Data have been collected from previously published documents issued by federal, state, and local agencies; from state and national databases (e.g., U.S. Bureau of Economic Analysis' *Regional Economic Information System*); from interviews with representatives from relevant agencies (e.g., the Clark County Chamber of Commerce); and from Nellis AFB (e.g., the base's Personnel Office).

Analyses of potential impacts to socioeconomic characteristics from implementation of the Proposed Action requires establishment of an ROI—a primary geographical area within which direct and secondary socioeconomic effects of the F-22 beddown would be noticed. Because direct socioeconomic effects associated with implementing the Proposed Action would occur in the immediate vicinity of Nellis AFB, the primary focus of this analysis is Clark County and the Las Vegas area.

3.11.1 Employment

Clark County employment sectors with the greatest number of jobs in 1995 included services, retail trade, government and government enterprises, and construction (Table 3.11-1). Government and government enterprises comprise federal civilian, military, and state- and local-government employment. The fastest growing employment sector in Clark County in 1995 was construction, which increased by more than 220 percent. Continued rapid growth in regional population (see section 3.11.3) caused this sustained growth in the construction industry (U.S. Bureau of Economic Analysis 1997).

In Fiscal Year 1996, 9,000 employees comprised the workforce at Nellis AFB. Of these employees, approximately 6,400 were appropriated-funds military personnel, 1,000 were appropriated-funds civilian personnel, 450 were non-appropriated-funds civilians, and 1,150 were other civilian (i.e., contract) employees. Also generating substantial economic activity are about 16,000 military retirees associated with Nellis AFB who receive and spend payrolls in the region (U.S. Bureau of Economic Analysis 1997). As one of the single largest government employers in the Clark County, Nellis AFB and its continuing operations represent a significant source of regional economic activity.

3.11.2 Earnings

In Clark County, wholesale trade comprises the highest paid employment sector, at $36,683 per employee. Earnings in the transportation and construction employment sectors are second ($36,621 per employee) and third ($35,958) highest in the county, respectively (Figure 3.11-1). Clark County's influence on statewide trends apparent in earnings trends for the same two employment sectors—transportation and construction—which are also the second and third highest paid in the state (U.S. Bureau of the Census 1997). Military employees receive average annual earnings of $24,761 (90.1 percent of the average earnings among all employment sectors in the county).

Table 3.11-1. Clark County Wage and Salary Employment (1980, 1990, & 1995)

Employment Sector	*1980*	*1990*	*1995*
Farm	419	406	302
Non-Farm	265,920	459,467	609,382
Agricultural Services, Forestry, Fisheries	1,313	3,909	5,996
Mining	589	819	1,189
Construction	16,312	40,549	52,437
Manufacturing	7,271	11,671	17,832
Transportation & Public Utilities	13,758	21,081	28,614
Wholesale Trade	6,548	14,216	18,743
Retail Trade	44,266	72,356	96,320
Finance, Insurance, Real Estate	20,410	35,154	43,200
Services	117,683	208,914	282,746
Government	37,770	50,798	62,305
Federal Civilian	4,893	6,957	7,900
Military	10,515	10,913	9,300
State and Local	22,362	32,928	45,105

Source: U.S. Bureau of Economic Analysis 1997.

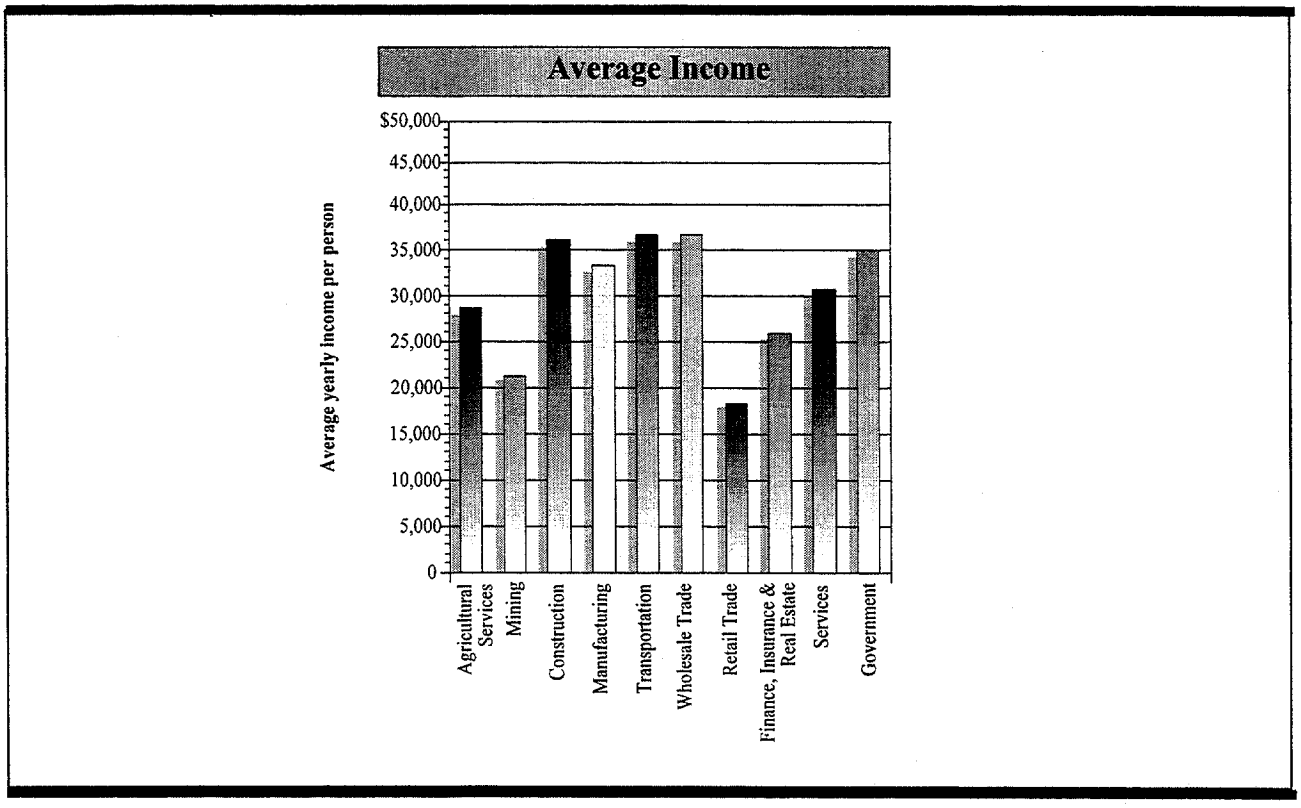

Figure 3.11-1. Average Yearly Earnings Per Person by Industrial Sector (1995)

Nellis AFB is a primary employer in Clark County, with total annual payroll expenditures of more than $555 million. Other Fiscal Year 1996 expenditures associated with activities at Nellis AFB included nearly $120 million in contracted services; of this total, more than half were awarded to businesses in the Las Vegas-Clark County region (Air Force 1996d).

3.11.3 Population

Clark County is the most populous of Nevada's 17 counties. Based on census data compiled over the past 15 years, it is the fastest growing metropolitan county in the U.S., having increased in population from about 469,000 people in 1980 to about 996,000 people in 1995, an increase of approximately 112 percent (U.S. Bureau of Economic Analysis 1997). As of July 1996, the population of Clark County was estimated to have grown to approximately 1,120,000 people (Clark County 1996b).

In 1996, approximately 3,800 personnel lived on Nellis AFB; approximately 6,100 personnel relied on off-base housing (Air Force 1996d). Based on the number of dependents typically associated with personnel at Nellis AFB (i.e., 2.02 dependents per staff member), more than 18,200 dependents are also estimated to live in the ROI, bringing total population associated

with the base to about 27,200 people. Assuming the number of dependents is evenly distributed among all personnel, the total off-base population associated with Nellis AFB would comprise approximately 18,500 people.

3.11.4 Housing

Since Clark County is one of the fastest growing counties in the U.S., this rapid population growth also includes a corresponding increase in the demand for affordable, quality housing in the region. The housing stock in Clark County increased 241 percent from approximately 93,000 units in 1970 to 317,000 units in 1990; at the same time, demand for housing only increased 227 percent, indicating a housing surplus (U.S. Bureau of the Census 1993).

Currently, housing on Nellis AFB is available in military family housing units, dormitories, and billeting facilities. A total of 1,212 units are available to Nellis AFB personnel and their families: 1,142 of these units are set aside for enlisted personnel and their dependents; the remaining 70 units are reserved for officers and their dependents. An additional 1,136 beds are available in dormitories. Billeting facilities at the base currently total 482 units; these comprise temporary units for families (60 units), visiting airmen's quarters (269 units), and visiting officers' quarters (153 units). Additional currently funded projects are scheduled to increase visiting airmen and officers quarters by another 286 units (Air Force 1996e).

3.11.5 Public Schools

Public school district boundaries in southern Nevada correspond with county boundaries (i.e., the Clark County School District includes all public schools located within the geopolitical boundaries of Clark County). As the overall population of the ROI continues to increase rapidly, there has been a corresponding increase in enrollment has affected public schools. As of 1996, about 167,000 students were enrolled in more than 180 public schools operating in Clark County (Clark County 1996a).

On-base educational facilities are limited to the Lomie G. Heard Elementary School, which is operated as part of Clark County School District. Lomie G. Heard Elementary can accommodate 900 students. A child development center also operates at the base and has sufficient capacity to accommodate about 550 children per day. School districts are compensated for each child of a military family that attends school off base.

3.11.6 Public Finance

Public finance is an important socioeconomic resource since it determines a county's ability to provide adequate services such as law enforcement, fire protection, and public school impact aid. The *general fund* is the most uniform administrative budgetary concept available to describe fiscal conditions. Clark County began Fiscal Year 1997 with an opening fund balance of $64 million and a total operating budget in excess of $550 million (Clark County 1996a).

3.12 ENVIRONMENTAL JUSTICE

In 1994, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, was issued to focus attention of federal agencies on human health and environmental conditions in minority and low-income communities and to ensure that disproportionately high and adverse human health or environmental effects on these communities are identified and addressed. To provide a thorough environmental justice evaluation, this section gives particular attention to the distribution of race and poverty status in areas potentially affected by implementation of the Proposed Action. Noise is the only response resource area that has been identified to have the potential to affect humans because it is the only area determined to have a potentially significant effect in this EIS. Consequently, no other resources will be examined. Upon signing Executive Order 12898, the President distributed the Order with a memorandum directing agencies to consider, where feasible, mitigation measures to address adverse effects on populations. The approach for performing the environmental justice analysis is in accordance with the *Interim Guide for Environmental Justice Analysis with the Environmental Impact Analysis Process* (Air Force 1997f).

Data used for the environmental justice analysis were collected from the *1990 Census of Population and Housing* (U.S. Bureau of the Census 1993). Although these data are now more than 7 years old, they represent the most complete, detailed, and accurate statistics available addressing population distribution and income. There are no indications that regional trends since 1990 have significantly altered general population characteristics.

The *region of comparison* (ROC) in environmental justice analysis is the smallest political unit encompassing the impact area. The ROC for this EIS includes Clark County for an analysis of impacts around Nellis AFB; and Clark, Lincoln, and Nye counties for an analysis of the political jurisdictions that lie under the NRC. For this analysis, minority and low-income populations are defined as follows:

Minority Populations: Persons of Hispanic origin of any race; blacks; American Indians, Eskimos, and Aleuts; and Asians or Pacific Islanders.

Low-Income Populations: Persons living below the poverty level, based on a total annual income of $12,674 for a family of four as reported in the 1990 census.

Estimates of these two population categories were based on data from the *1990 Census of Population and Housing*. Although the census does not report minority population as a class, it reports population by race and ethnic origin (Figure 3.12-1). These data were used to estimate minority populations potentially affected by the Proposed Action.

In metropolitan areas (e.g., Clark County), census tracts provide a "unit of measure" for socioeconomic data below the county and city level. In more rural areas (e.g., Lincoln and Nye counties), block numbering areas (BNAs) are the rough equivalent of census tracts. There are 120 census tracts in Clark County, four BNAs in Lincoln County, and five BNAs in Nye County.

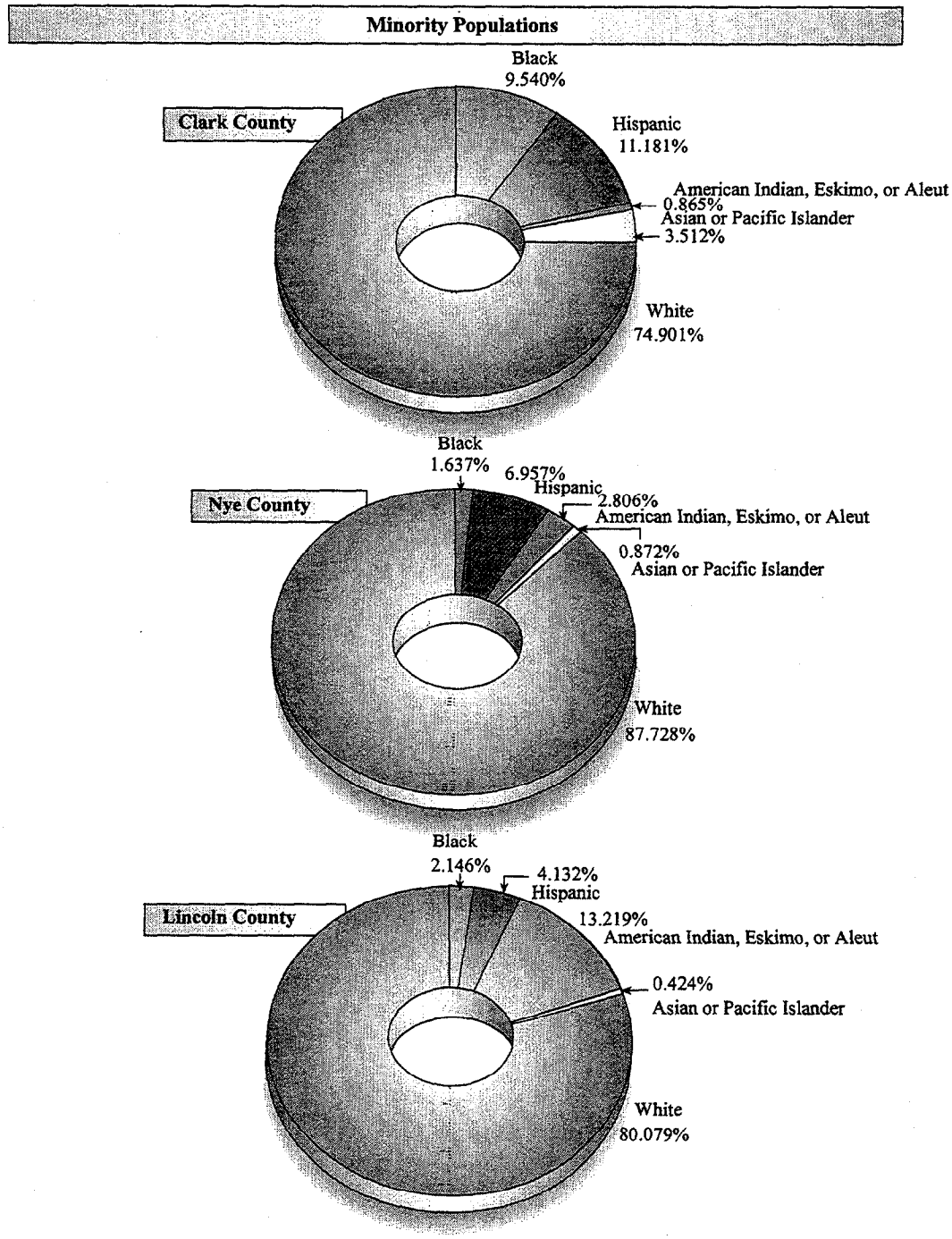

Figure 3.12-1. 1990 Population Distribution by Ethnicity (U.S. Census Bureau, 1993)

Census tracts were classified as minority or low-income if the percentage exceeded the percentage for the ROC. For minority tracts, the percentage exceeds 25 percent; for low-income census tracts, the percentage exceeds 11 percent. The number of people affected by the action was then determined by multiplying the total number of people in the census tract by the proportion of area of the tract affected, and then by the proportion of either minority or low-income inhabitants. If there was an adverse impact and it affected minority or low-income groups in a higher percentage than the ROC, it was considered to "disproportionately affect" minority and low-income populations.

3.12.1 Nellis AFB and Vicinity

Minority and low-income census tracts around Nellis AFB are presented in Figure 3.12-2. Although open land makes up the largest percentage of lands surrounding Nellis AFB, residential areas occur to the west. One community adjacent to Nellis AFB is Sunrise Manor. An unincorporated town, portions of Sunrise Manor are immediately west and south of Nellis AFB (see Figure 3.2-5). As of 1990, the town's population was approximately 115,000, larger than the incorporated cities of Henderson, North Las Vegas, and Boulder City; only the unincorporated town of Paradise and the City of Las Vegas were more heavily populated in Clark County. Census tracts for Sunrise Manor and for other areas near Nellis AFB have been classified as either minority or low-income using the criteria discussed above.

Areas in the vicinity of Nellis AFB currently affected by aircraft noise is discussed in detail in section 3.2. While no residential areas are located within clear zones associated with Nellis AFB, substantial tracts of residential land are located within APZs I and II and have been located within these areas for more than 10 years (see Figure 3.2-3 and Appendix D).

Over at least the last two decades, residential and other incompatible land uses have been permitted within areas adjacent to Nellis AFB though they are subjected to noise levels greater than 65 DNL. Clark County zoning ordinances have restricted land uses in this area (see Figure 3.2-6); however, encroachment by residential development continues to be a problem. These areas have also traditionally been occupied by a higher proportion of members of a minority group (from 26 to 31 percent of the population affected by noise levels greater than 65 DNL).

Approximately 22,800 people are estimated to be affected by current noise levels above 65 DNL. Out of those 22,800 people, about 5,900 (26 percent) are considered to be minorities, and 2,400 (11 percent) to have low incomes. The percentage of minority populations currently affected by noise exceeds the 25 percent minority average in Clark County as a whole. The 11 percent low-income composition around Nellis AFB is equal to the county average. Within the area zoned for noise above 65 DNL, 31 percent of the people belong to minority populations and 12 percent to low-income populations.

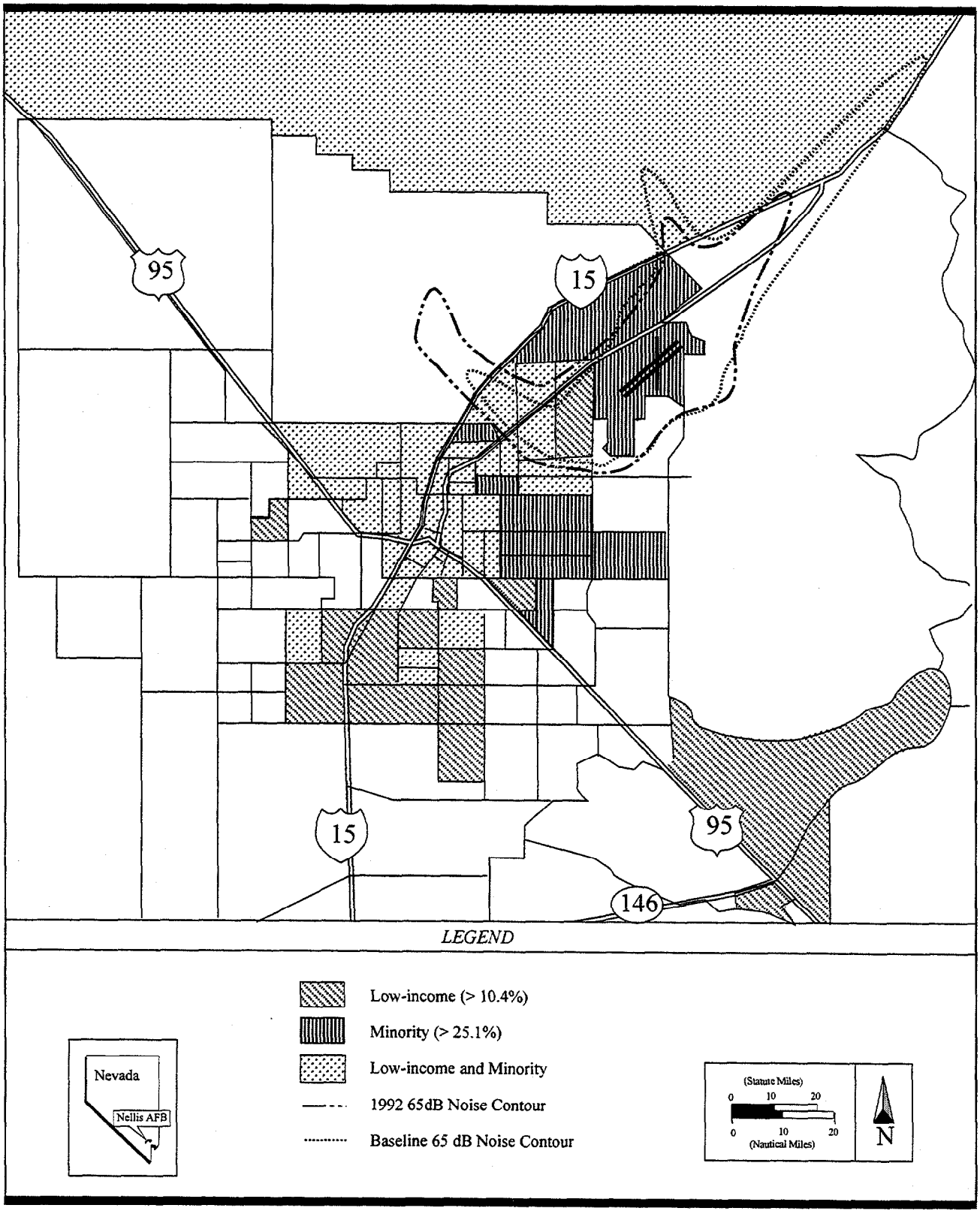

Figure 3.12-2. Census Tract/BNAs Disproportionate for Low-Income and Minority Populations

Minority and low-income groups in areas with baseline noise greater than 65 DNL are primarily found with noise levels between 65 and 70 DNL (Table 3.12-1); however, about 35 percent of the minority and low-income people are living in areas zoned for noise above 70 DNL.

Table 3.12-1. Minority and Low-Income Populations in Areas with Baseline Noise greater than 65 DNL

	Minority Population		*%*		*Low-Income Population*		*%*	
DNL	*Clark County*	*Baseline*	*Clark County*	*Baseline*	*Clark County*	*Baseline*	*Clark County*	*Baseline*
65-70	8,812	5,783	63	98	3,319	2,353	63	98
70-75	3,201	100	24	2	1,281	39	25	2
75-80	1,580	30	11	0	631	12	12	0
80-85	293	0	2	0	0	0	0	0
>85	0	0	0	0	0	0	0	0
TOTAL	13,886	5,913	100	100	5,231	2,404	100	100

3.12.2 Nellis Range Complex

A total of 63 census tracts and BNAs exceeded average minority or low-income population characteristics in the three-county region of comparison under the NRC. Figure 3.12-3 highlights census tracts within which averages for minority or low-income populations exceed those averages for the ROC.

In 1990, approximately 763,000 people lived in the three counties that comprise the ROC of that population; about 184,200 people (24 percent) were minorities and 79,100 people (10 percent) lived below the poverty level. Ethnic diversity increases with total population. In Clark County, 25 percent were minorities while 12 percent of Nye County's population and 20 percent of Lincoln County's population were minorities.

Poverty levels were the same (11 percent) for the two larger counties (Clark and Nye), while Lincoln County had a poverty level of 13 percent. According to the most recently published data, the poverty level in the U.S. is 13 percent, the same as in Lincoln County and 2 percent higher than in the other two counties in the ROC.

American Indian reservations are located throughout Nevada; however, none directly underlie airspace affected by the Proposed Action. Indian reservations in the three counties include the Duckwater Reservation in northeastern Nye County, the Yomba Reservation in northwestern Nye County, the Moapa Reservation in northeastern Clark County, the Fort Mojave Reservation and Trust Lands in southern Clark County, and the Las Vegas Colony in Clark County. The

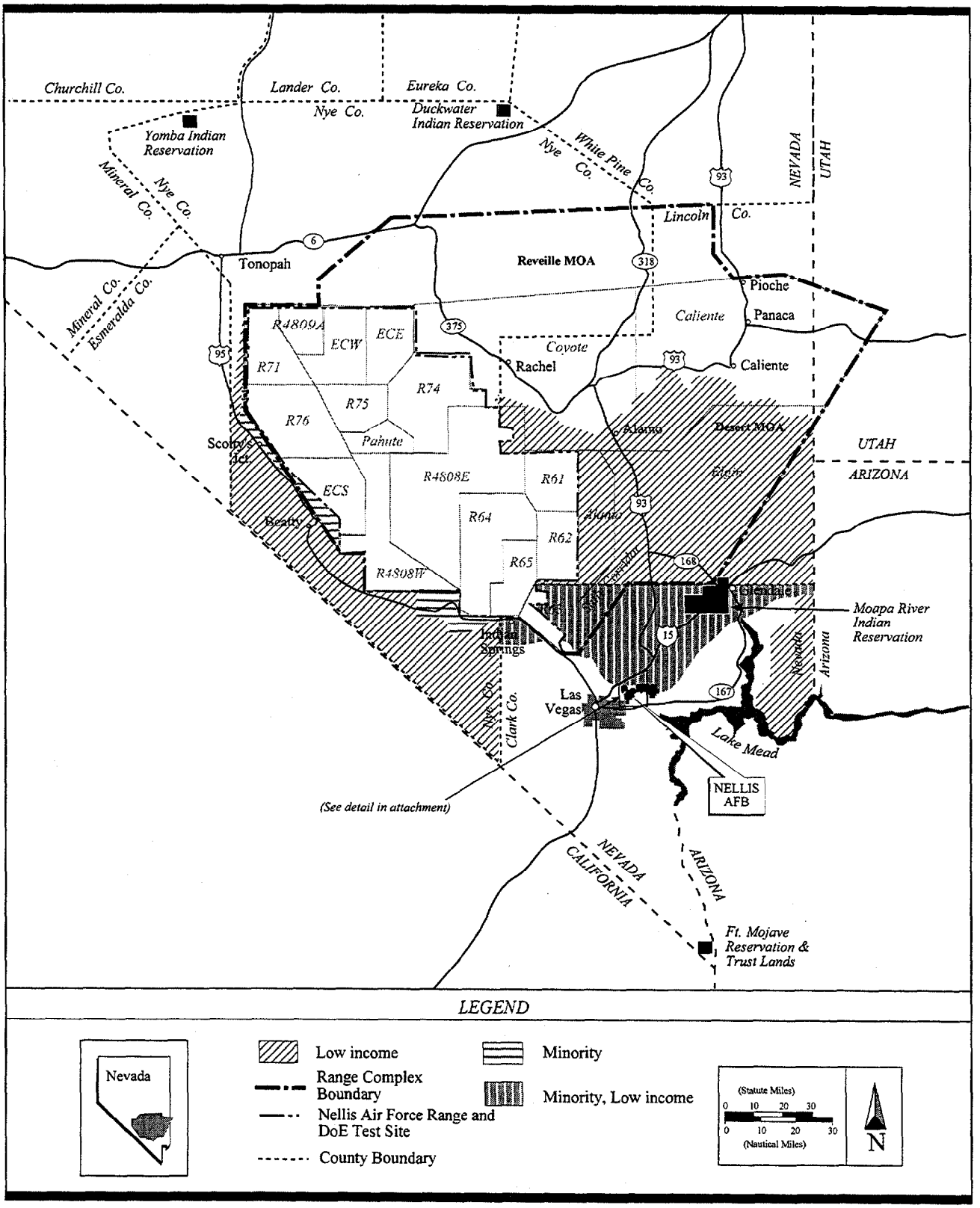

Figure 3.12-3. Census Tract/BNAs in Disproportionate for Low-Income and Minority Populations in Clark, Lincoln, and Nye Counties

populations associated with these reservations are included in the county populations provided previously. None of the reservations are located under the NRC, although the Moapa reservation is the closest. The Moapa Reservation, southeast of the Sally Corridor of the NRC, is 112 square miles in size. The population in 1990 was 375 and there were 112 housing units; 51 percent of its residents were living below the poverty level.

4.0 ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 presents the environmental consequences of the F-22 FDE program and WS beddown at Nellis AFB for each of the 12 resources discussed in Chapter 3. To define the consequences, this chapter overlays the project elements described in Chapter 2 onto the affected environment provided in Chapter 3. A comprehensive matrix comparing the No-Action Alternative and the Proposed Action by resource and the potential impacts is provided in Table 2.6-1. Cumulative effects of the F-22 beddown with other foreseeable future actions are presented in Chapter 5.

The proposed elements of the F-22 beddown would occur in phases over a nine year period. The environmental consequences would also occur incrementally, with fewer impacts early in the period when few aircraft and personnel would be present. At completion of the beddown, with all 17 aircraft and 367 personnel on base, the effects would be greater. The approach used for this impact analysis focuses almost solely on the impacts of the complete action with all project elements considered. One resource, Air Quality (section 4.3) assesses impacts at incremental stages of the proposed beddown. For Air Quality, each stage would result in different emission quantities that require comparison to federal and state standards.

4.1 AIRSPACE

The assessment of airspace use and management includes a discussion of how the No-Action and Proposed Action alternatives would affect air traffic within the airspace of Nellis AFB and the NRC ROIs. Since no modifications or additions are proposed for the current airspace structure in support of this Proposed Action, the impact analysis focuses on changes in airspace use that would result from the addition of nearly 8,900 annual F-22 airfield operations by fiscal year 2008. These sorties would increase current levels by about 13 percent without consideration of the F-15C replacement schedule, budget constraints, changes in the number of exercises or exercise participants, and other such factors that affect yearly cumulative sortie totals. Historic records indicate that total annual NRC use has ranged between 200,000 to 300,000 sortie-operations. See Appendix C for more detailed information on historic NRC sortie use.

The F-22 can be expected to operate within the same NRC airspace subdivisions and perform the same type of air-to-air combat missions as the F-15C. In addition, the F-22 will perform air-to-ground combat missions. The majority of F-22 flight operations would occur during the day at subsonic speeds and altitudes at or above 10,000 feet AGL. Historic range utilization records indicate that nearly one-third of the F-15C annual mission sorties are conducted within the Desert (Caliente, Coyote, and Elgin) and Reveille MOAs where air-to-air combat training maneuvers are performed. The other two-thirds are distributed among 17 subdivisions within restricted airspace where weapons and electronic warfare training is conducted. The average duration of an F-22 air-to-air or air-to-ground mission would be between 1 and 1.4 hours.

4.1.1 No-Action Alternative

Under this alternative, airspace use in the Nellis AFB terminal airspace and arrival and departure routes would remain the same as those described in section 3.1.1. The total number of operations (takeoffs and landings) at Nellis AFB is expected to remain generally the same as recent average levels (about 65,000-70,000) since no significant changes are expected in Air Warfare Center test and training flight mission activities in the foreseeable future. The No-Action Alternative would not change the configuration or management of Class B airspace.

Scheduling and use of the three NRC restricted areas and portions of R-4808N/S (DoE) (R-4806E/W, R-4807A/B, and R-4809) and the Desert and Revellie MOAs would continue as they currently are to support bombing, gunnery, and electronic warfare training, Red and Green Flag exercises, WS mission employment exercises, and other test and training activities. Appendices A and C describe the level of sortie-operations that have historically occurred within the individual MOAs and restricted area subdivisions, respectively. The No-Action Alternative would not change airspace boundaries. Scheduling and use of the Desert and Reveille MOAs would continue as they are currently in support of air-to-air training missions and the Air Combat Maneuvering Instrumentation (ACMI) arena. Appendix C describes the level of sortie-operations that have historically occurred within the individual MOA subdivisions. No changes

to the MOA boundaries or their overlying ATCAAs are anticipated under the No-Action Alternative.

This alternative would have no effect on the areas and altitudes authorized for supersonic flight within the NRC or on the number and frequency of supersonic sorties flown during air-to-air training or other operations where rapid evasion of a simulated threat is necessary. Supersonic flight would continue at the rate discussed in Chapters 2 and 3.

As discussed in section 3.1, Nellis AFB and the NRC are situated in an area that has had little effect on commercial and general aviation in the region. This is due primarily to the near-direct routing provided by Federal Airways and Jet Routes for instrument flight rules traffic and the visual routes commonly flown by visual flight rules traffic between most airports through this region. No changes are currently planned for the Airway/Jet Route structure surrounding the NRC. Although commercial and general aviation are expected to increase by 54 and 17 percent, respectively, by 2015 (Nevada Department of Transportation 1995), such increases would not be affected by Nellis AFB and NRC operations, which are expected to remain at current levels. The interaction of Nellis AFB operations and airspace management with state and federal agencies provides avenues for discussing any airspace matters.

4.1.2 Proposed Action

NELLIS AFB

The proposed F-22 beddown would have no effect on the use and management of the Class B airspace surrounding Nellis AFB. This lack of effect is particularly evident in comparisons of operational increases that could result from the Proposed Action with historic operational levels. Large fluctuations in range use over the years have had a corresponding effect on the number of airfield operations conducted. With a nearly 120,000 difference in airfield operations between the low and high years since 1987, the addition of 8,944 F-22 operations at Nellis AFB (a 13% increase) to the recent levels of 65,000 to 70,000 would represent about 40 percent of historic peak operational levels. This increase does not consider reductions or fluctuations that may occur between year groups as a result of budget impacts; aircraft realignments; and changes in the number, composition, and duration of the different exercises. The proposed beddown would not require any modification to the current terminal airspace structure or operational procedures.

The F-22 would not require any changes to the departure and arrival route structures discussed in section 3.1.1. These routes were established based on terrain and obstacle clearance, civil air traffic routes and available airspace, and navigational aid coverage, as well as on aircraft operational characteristics similar to those of the F-22.

NELLIS RANGE COMPLEX

Proposed F-22 activities would not alter the current structure, management, and total use of the NRC restricted areas and MOAs. Varying range operations through the years have resulted in

cumulative total annual use ranging between 200,000 and 300,000 sortie-operations. The F-22 would fly mission profiles within the R-4807A/B tactical and electronic battlefield arena similar to those flown by F-15Cs though generally at higher altitudes. Most training activities would occur throughout the R-4807A/B and R4809 (as shown in Table 2.3-4). The F-22 would primarily use the Caliente, Coyote, and northern Elgin subdivisions of the Desert and Reveille MOAs for air-to-air combat training and staging for range battlefield operations.

The F-22 would not require any changes to the areas currently approved for supersonic operations. See section 4.2 for further discussion of the supersonic noise profile and potential effects associated with the F-22.

CIVIL AND COMMERCIAL AVIATION AIRSPACE USE: The Proposed Action would have no impact on civil and commercial aviation airspace use since the F-22 would be operating within the same flight parameters currently used for Nellis AFB terminal and NRC airspace. As discussed in section 3.1.2, civil air traffic operations at the local airports, on the Federal Airways and Jet Routes, and along those highways commonly used as visual references by visual flight rules aircraft are sufficiently clear of and unaffected by Nellis AFB and NRC operations. These operations and the F-22 beddown would not affect future commercial and general aviation growth in Nevada. Ongoing interaction between Nellis AFB and state and federal agencies helps ensure compatibility of military and commercial/civil aviation in the region of influence.

4.2 NOISE AND LAND USE

Proposed additional airfield operations by F-22s would change the shape and extent of the area affected by aircraft noise around Nellis AFB. This section describes the nature of the changes in the noise environment as a result of projected F-22 airfield operations. It also presents a comparison of the projected noise environment relative to baseline and past (i.e., 1981 and 1992) noise conditions. Past conditions provide a context for understanding the trends and variations in the way aircraft noise affects Nellis AFB and its vicinity. Analysis of potential impacts to land use overlays projected noise conditions onto existing land uses and the regulations governing land use in the area. Specifically, the analysis focuses on the compatibility of projected noise levels and Clark County's land use zones.

Within the NRC, F-22s would operate within the same airspace subdivisions and perform similar types of flying activities as F-15Cs have for many years. F-22s would, however, predominantly fly above 10,000 feet AGL. Total activity within the NRC by all aircraft including the F-22s would remain within the historic range of 200,000 to 300,000 sortie-operations annually. Using the same methods as employed to define baseline subsonic and supersonic noise levels, the analysis presented in this section examines how inclusion of F-22 sortie-operations would affect noise conditions within the NRC. The analysis compares baseline noise levels to projected noise levels and uses this comparison to evaluate the Proposed Action's potential effects on land uses within the NRC.

4.2.1 No-Action Alternative

Under the No-Action Alternative, the proposed beddown of F-22 aircraft at Nellis AFB would not occur. Implementation of the No-Action Alternative would not change noise levels from baseline conditions and would create no specific impacts to land use in the vicinity of the base or on the NRC.

4.2.2 Proposed Action

NELLIS AFB

NOISE MODELING: F-22 noise data from overflights was collected by the Air Force Research Laboratory (personal communication, AFRL 1999). These data demonstrate that the F-18 noise profile represents an appropriate surrogate for F-22 noise. Using these surrogate data, proposed F-22 airfield operations at the base were modeled using NOISEMAP (Version 6.5) to generate noise levels (DNL). The analysis assessed the airfield operations anticipated with complete beddown of all 17 F-22 aircraft plus baseline operations for all other aircraft. The resulting noise values were then expressed as contours and compared to the contours associated with the baseline noise environment.

NOISE ENVIRONMENT: Under the Proposed Action, the area affected by noise levels of 65 DNL or greater would increase by approximately 8,700 acres relative to baseline conditions (Table 4.2-1 and Figure 4.2-1). Roughly 60 percent of the total increase would apply to open, undeveloped lands northeast of the base. The great majority of these unzoned lands are managed by federal agencies. The remaining 40 percent would cover developed areas southwest and west of the base.

The affected area would remain generally consistent with the pattern of noise around the base for the past 20 years. About 99 percent of the total affected land either overlaps with locations previously exposed to equivalent noise levels or covers open undeveloped lands northeast of the base. The remaining 1 percent extends beyond Clark County's A-E65 zone. No location would be subject to an increase of more than 2 dB relative to baseline (the updated 1997 noise study) conditions.

Compared to 1992 and 1981 noise levels, approximately 7,600 and 1,900, respectively, more acres would be affected by projected noise. Almost all of this additional acreage would lay north and northwest of Nellis AFB and consist of open lands managed by the BLM. In the developed lands southwest and west of the base, more area was affected by higher noise levels in 1992 (Figure 4.2-2). For example, the 65 DNL contour in 1992 extended more than 3 miles beyond the limits of the projected 65 DNL contour. A similar pattern applies to the other noise contours in this area.

Table 4.2-1. Comparison of Past, Baseline, and Proposed Acreage under Noise Contours in the Vicinity of the Nellis AFB Airfield

	NOISE CONTOUR					
	65-70 DNL	*70-75 DNL*	*75-80 DNL*	*80-85 DNL*	*>85 DNL*	*Total*
1981 Acreage[1]	11,736	5,766	2,587	1,290	N/A	21,379
1992 Acreage[1]	9,217	4,309	1,613	493	N/A	15,632
Baseline Acreage[1]	9,621	3,400	1,082	391	20	14,514
Projected Acreage[1]	13,940	6,620	2,004	598	90	23,252
Change: baseline to projected	4,319	3,220	922	201	70	8,738
Increase (%)	45	95	85	53	350	60

[1] Nellis AFB acreage excluded

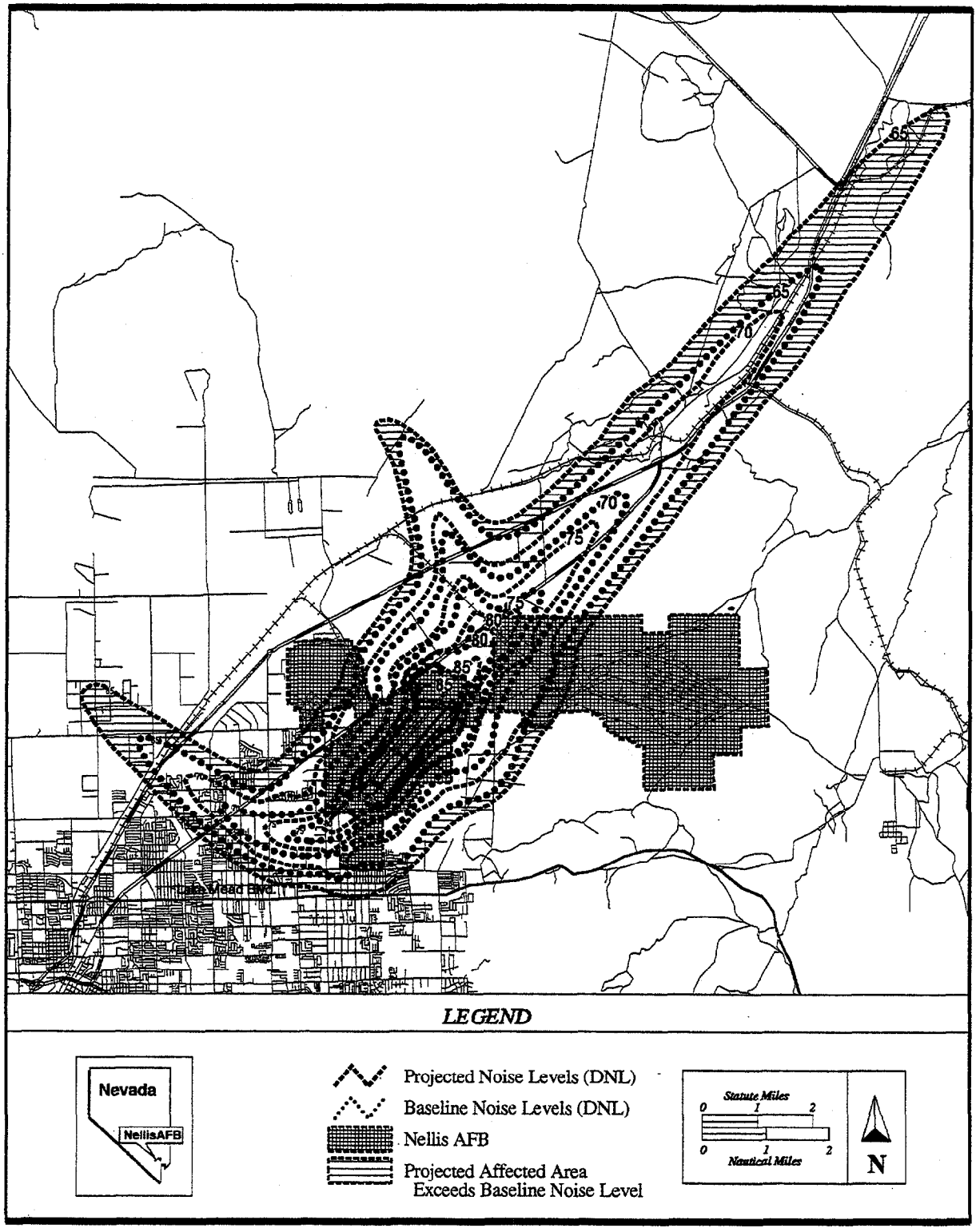

Figure 4.2-1. Baseline and Projected Noise Levels at Nellis AFB

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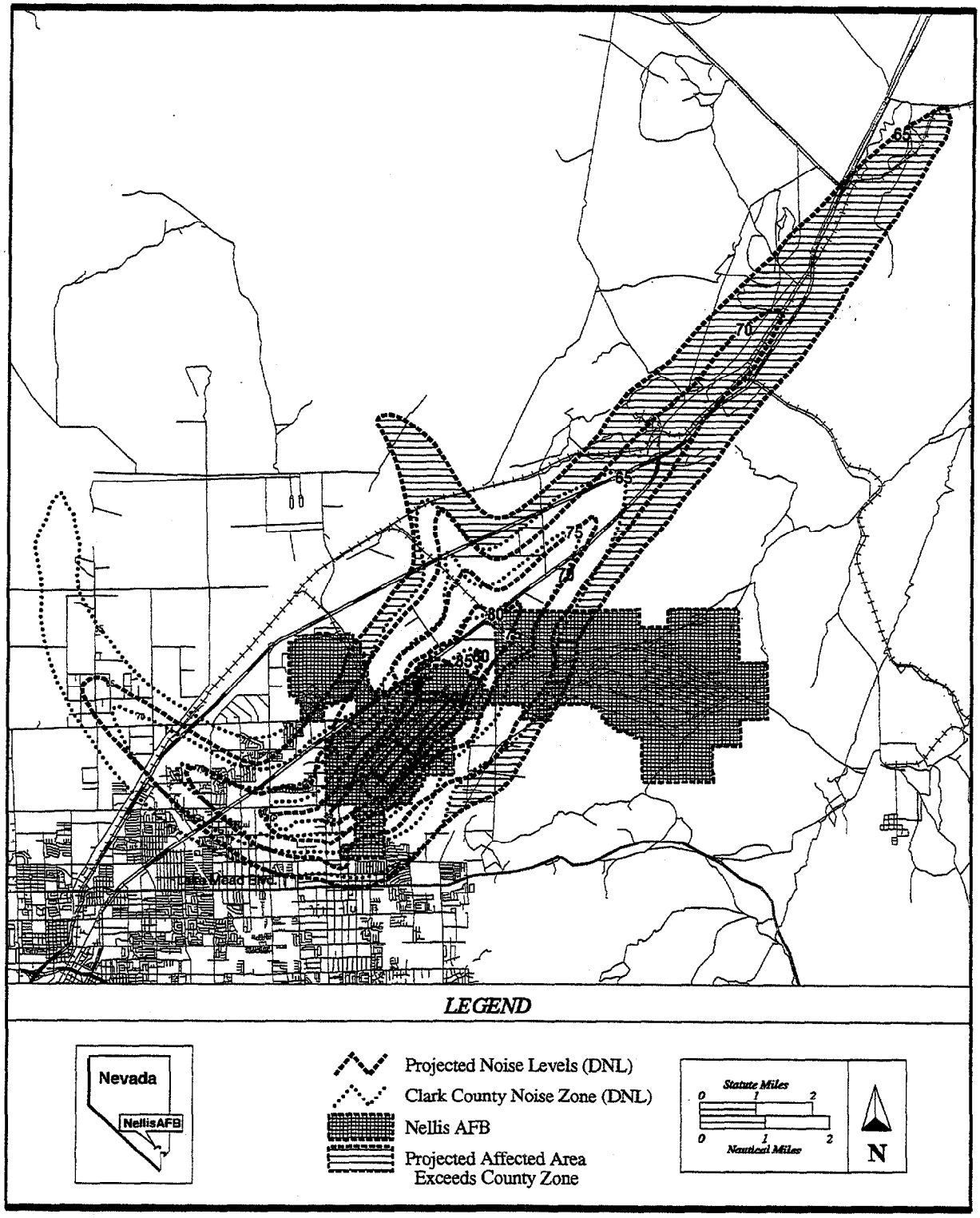

Figure 4.2-2. Projected F-22 Noise Levels and Clark County Noise Zones

/net/polaris/oahu/f22/plots/figures/noisefigs3.aml 04/02/99

ON-BASE LAND USE: Land use on base would not be negatively impacted by the proposed aircraft beddown. Based on the analysis of proposed aircraft operations, Area I and portions of Areas II and III would be exposed to DNL noise levels of 65 dB or greater. These proposed noise levels are consistent with both past and baseline noise levels on base.

The Proposed Action calls for the construction of new on-base facilities (refer to Figure 2.3-2). These proposed facilities would be sited on previously disturbed land with similar land uses and would be consistent with the present land use and the *Nellis AFB Comprehensive Plan*.

OFF-BASE LAND USE: The Proposed Action would not be expected to alter land ownership or land use in the area surrounding Nellis AFB. Comparison of baseline noise conditions to projected noise conditions shows that the affected area would increase (Figures 4.2-3 and 4.2-4, Table 4.2-2) for each land use category. Despite the increase in noise levels over these areas, the effect of this change would be reduced for several reasons:

- most (85 percent) of the increase in affected acreage would apply to open, undeveloped lands;
- the lands would be subject to increases of 2 dB or less; and
- the lands are located within areas already zoned for the noise levels or previously exposed to similar noise levels.

Table 4.2-2. Comparison of Land Uses Affected By Baseline and Projected Noise Levels

Land Use Category	*Acres within Clark County Zones*[1]	*Baseline Acres Affected by 65 DNL or Greater*[1]	*Projected Acres Affected by 65 DNL or Greate*[1]	*Projected Increase from Baseline*
Commercial	1,473	1,239	1,363	124
Industrial	435	226	371	145
Open/Public	11,595	12,204	19,875	7,671
Recreational	72	58	70	12
Residential	2,058	788	1,573	785
TOTAL	15,633	14,514	23,252	8,738

1. Nellis AFB excluded from total acres.

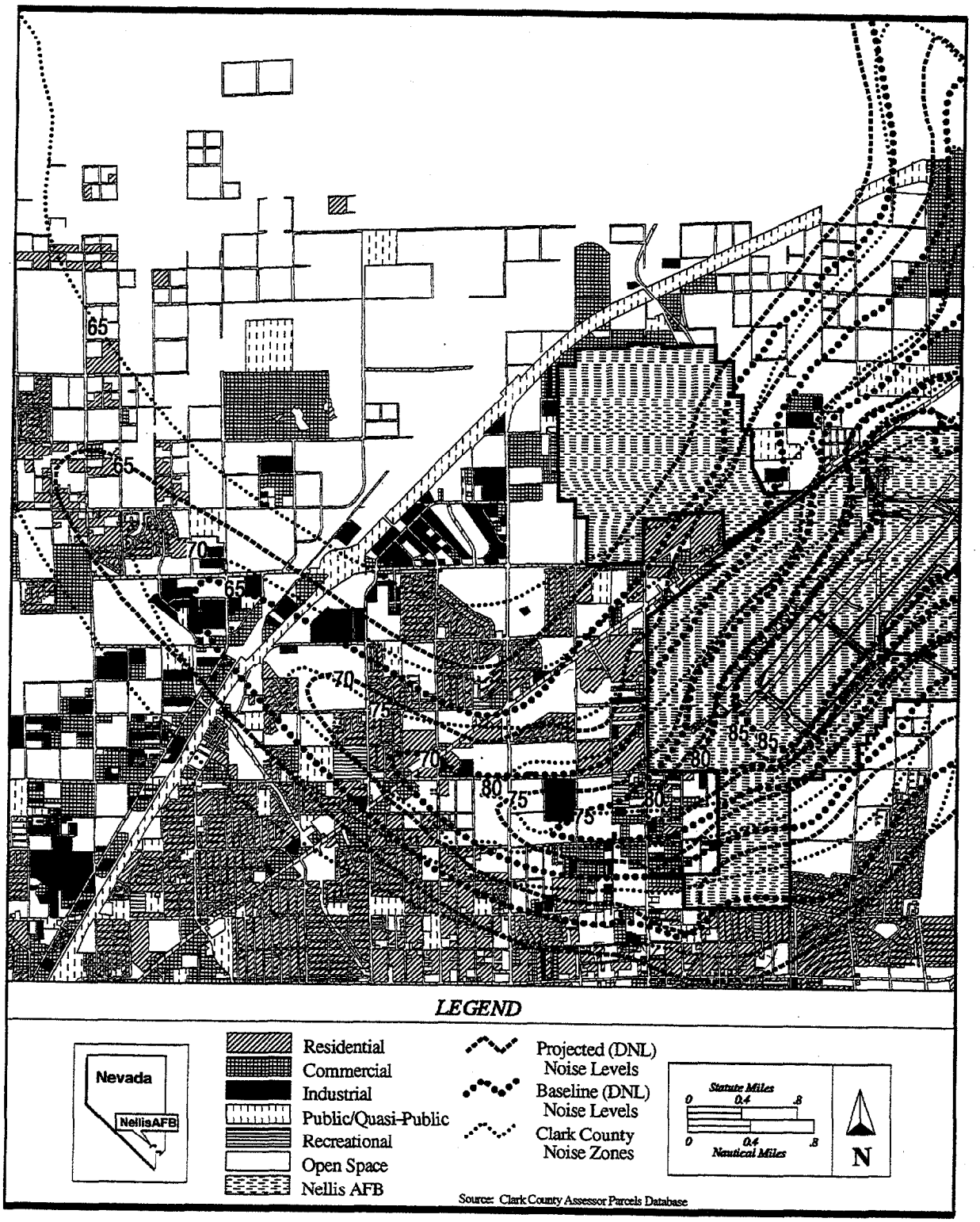

Figure 4.2-3. Land Use and Noise Levels - South and West of Nellis AFB

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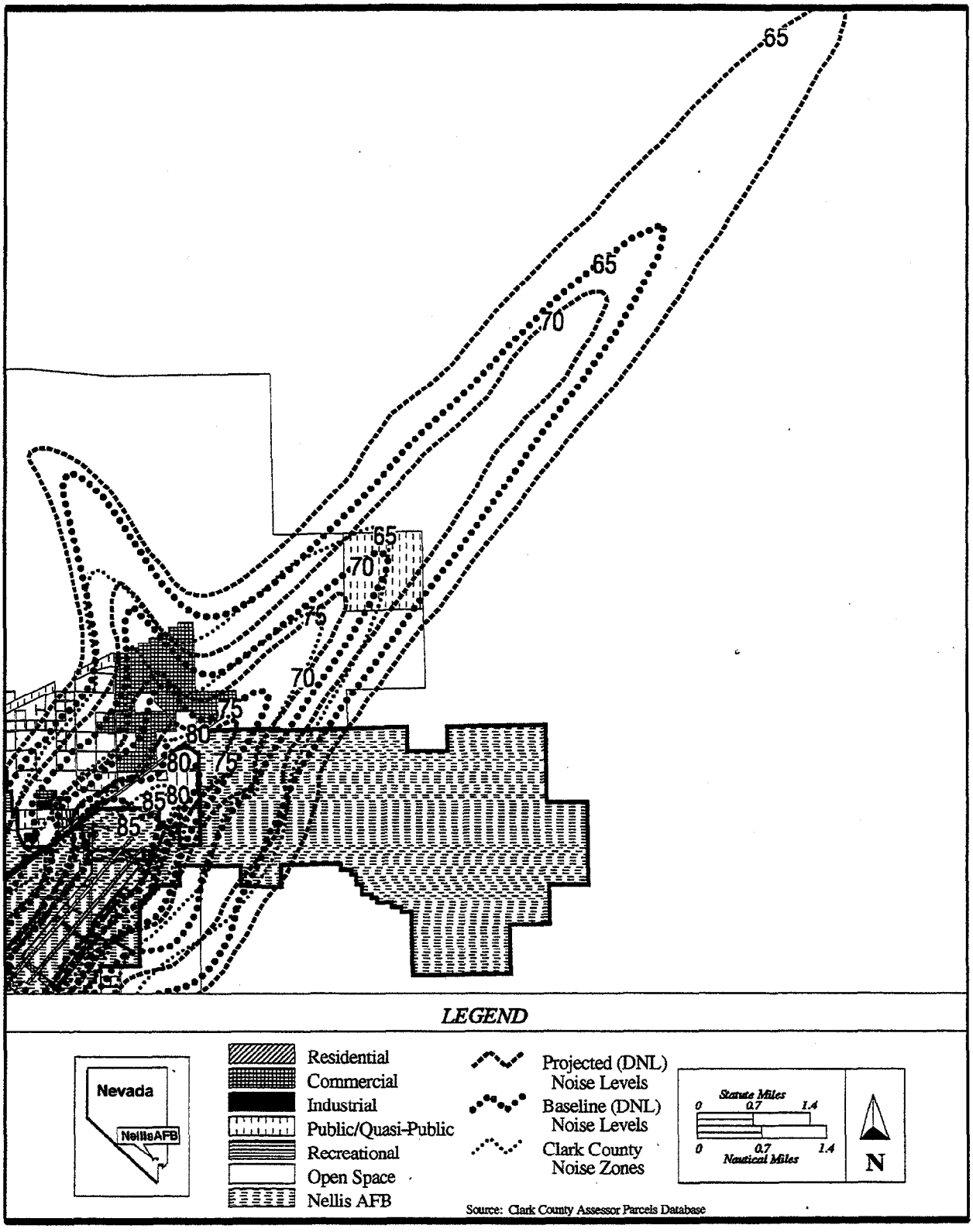

Figure 4.2-4. Land Use and Noise Levels - Northeast of Nellis AFB

/net/pulau/oahu/f22/plots/figures/noisefig6.aml 04/02/99

Land Use Regulations and Projected Conditions. Noise from the proposed beddown would affect less commercial, industrial, recreational and residential lands than encompassed by the 1996 Clark County noise zones (Table 4.2-3). The Proposed Action would, however, affect approximately 8,300 acres more open lands than are included in the county noise zones.

Table 4.2-3. Land Use within Projected Noise Levels around Nellis AFB (in acres)[1]

	PROJECTED NOISE CONTOURS (DNL)							CLARK COUNTY ZONES	
Land-Use Category	*65-70*	*70-75*	*75-80*	*80-85*	*>85*	*Total Projected Acres*	*Tota l (%)*	*Total 1992 Acres*	*Total (%)*
Commercial	263	568	496	36	0	1,363	6	1,473	9
Industrial	221	89	53	8	0	371	2	435	3
Open/Public	12,262	5,552	1,426	545	90	19,875	85	11,595	63
Recreational	38	17	15	0	0	70	<1	72	1
Residential	1,156	394	14	9	0	1,573	7	2,058	13
TOTAL	13,940	620	2,004	598	90	23,252	100	15,633	100

[1] Excludes Nellis AFB

Commercial and industrial land uses within the affected area would continue to be consistent with the Clark County regulations. Relative to baseline conditions, the amount of commercial and industrial land uses affected by noise levels of 65 DNL or greater would increase by 269 acres (Table 4.2-2). Less than 50 acres of this total would fall outside the area zoned by the county for these noise levels. These land uses would be exposed to 65–70 DNL which HUD considers compatible with commercial and industrial activities (refer to Table 3.2-3). In addition, these areas would experience an imperceptible increase in noise of less than 1 dB.

Approximately 85 percent of the lands affected by projected noise levels would consist of open, undeveloped land. Almost all of these lands lie northeast of the base and are used for grazing under the management of the BLM. Although the area affected by noise extends beyond the limits of the county zones, the projected noise levels would not be inconsistent with either the actual land use or the principles behind Clark County's regulations.

Projected noise levels of 65 DNL or greater would encompass about 12 acres more of recreational land use than under baseline conditions. All of these lands are included within the Clark County zones. The Proposed Action would expose approximately 15 acres of recreational land to 75-80 DNL and none to higher noise levels. This land is currently zoned for 80 DNL or greater.

Projected aircraft noise would also affect residential land uses south and west of Nellis AFB. Residential land use within Clark County noise zones A-E70 through A-E 80 are already inconsistent with the county regulations. Roughly 790 acres more residential lands would be subject to noise levels of 65 DNL or greater than under baseline. Except for 200 acres, all of these lands fall within areas already exposed to these noise levels. This would not result in a significant impact to land use, including the 200 acres, for three reasons. First, the change in noise levels resulting from the proposed beddown would be 2 dB or less. Second, basic construction practices for these residences would attenuate noise, reducing indoor noise levels to 45-50 DNL. Third, these lands have been previously exposed to similar or higher noise levels between 1981 and 1992.

Affected Population and Annoyance. The projected noise of 65 DNL or greater could affect about 38,000 people (Table 4.2-4). Almost 15,000 people more would be affected than under baseline conditions. The total population living within areas zoned for noise levels of 65 DNL or greater is approximately 45,000.

Table 4.2-4. Baseline and Projected Affected Population and Annoyance

Noise DNL	*Percentage of People Potentially Highly Annoyed*[1]	*Baseline Population Affected*[2]	*Baseline Number of People Potentially Highly*	*Projected Population Affected*[2]	*Projected Number of People Highly Annoyed*[2]	*Population within Clark County Zones*[2]
65-70	12	21,276	2,553	27,556	3,307	26,005
70-75	22	1,404	309	10,074	2,216	11,482
75-80	37	121	45	30	11	6,357
80-85	54	0	0	90	48	764
>85	70	0	0	0	0	0
TOTAL		22,801	2,907	37,750[1]	5,582	44,608

[1] Percent reflects low end of noise level range.

[2] Nellis AFB excluded.

A total of approximately 5,600 people could be highly annoyed by noise from the proposed beddown. This could comprise an increase of 2,700 people over baseline. People within these areas are already exposed to noise levels within 2 dB of projected levels.

Sensitive Receptors. Six schools, churches, and parks lie within areas where baseline noise is greater than 65 DNL. Under the Proposed Action, 15 additional noise-sensitive receptors would be affected (Figure 4.2-5 and Table 4.2-5). The increase in projected noise levels would be less than 2 dB for all receptors, and the change in noise would not be perceptible to people.

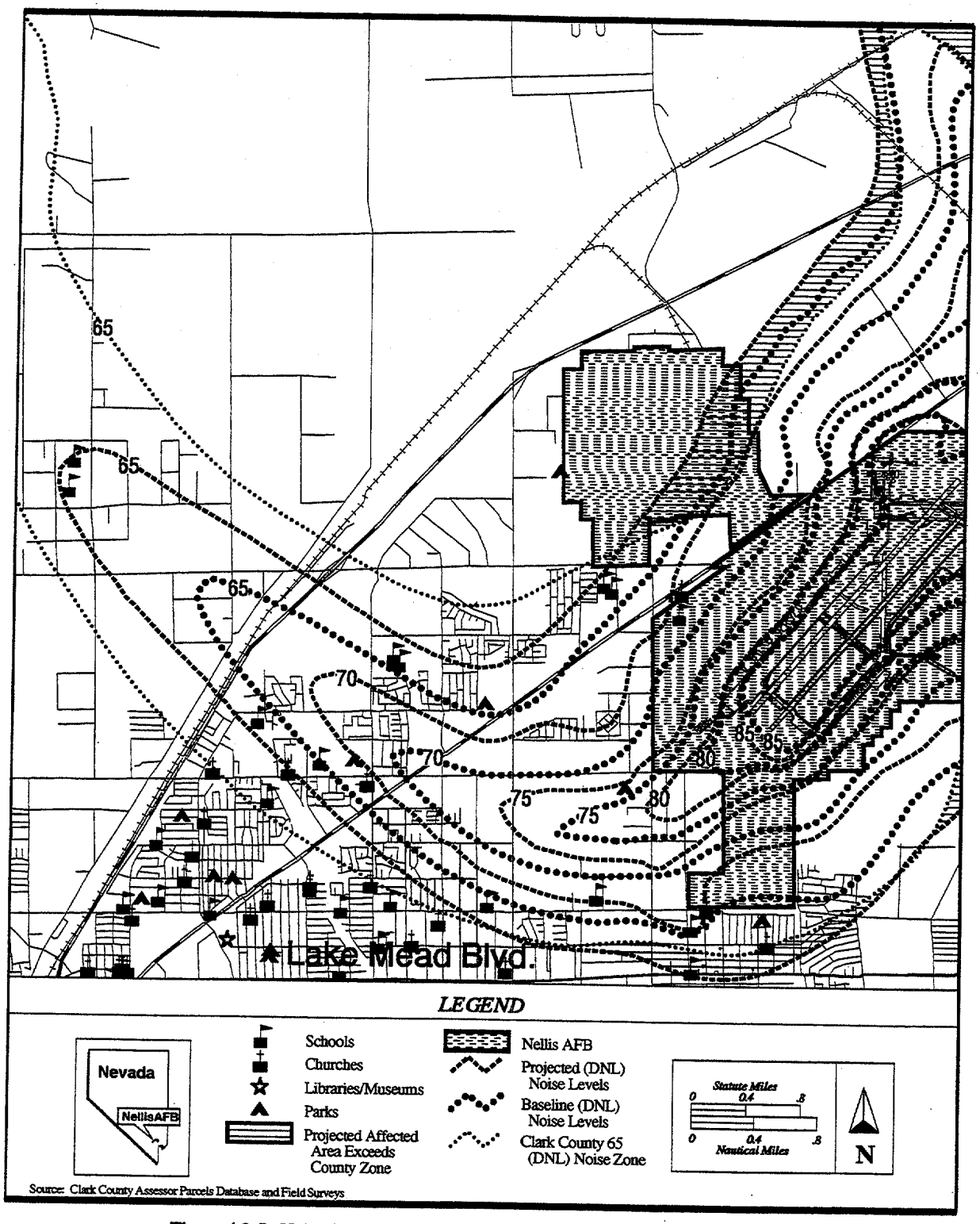

Figure 4.2-5. Noise-Sensitive Receptors and Noise Levels around Nellis AFB

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Table 4.2-5. Noise-Sensitive Receptors within Baseline[1] and Projected Noise Contours[1]

Noise	*65-70 DNL*		*70-75 DNL*		*75-80 DNL*		*80-85 DNL*		*>85 DNL*	
Receptor	Baseline	Projected	Baseline	Projected	Baseline	Projected	Baseline	Projected	Baseline	Projected
Schools	2	11[3]	0	1[6]	0	0	0	0	0	0
Churches	2	3[4]	0	1[7]	0	0	0	0	0	0
Parks	1	3[5]	1	0	0	1[8]	0	0	0	0
TOTAL	5	17	1	2	0	1	0	0	0	0

[1] Actual noise levels, not Clark County zones

[2] Excludes Nellis AFB

[3] Cheyenne Campus Community College High School, Cox Elementary, Craig Elementary, Elizondo Elementary, Lowman Elementary, Manch Elementary, Martin Luther King Jr. Elementary, Mojave High School, Mountain View Elementary, Tate Elementary, Woolley Elementary

[4] Frontier Community Baptist Church, St. Michaels Orthodox, Salvation Army

[5] Alexander Villas, Cheyenne Sports Complex, Sunrise Park and Recreation Center

[6] Von Toble Middle School

[7] Palestine Baptist Church

[8] Nellis Meadows

Noise Abatement Procedures. Nellis AFB already employs measures to reduce aircraft noise effects and would continue them under the Proposed Action. In the 1992 AICUZ report (Air Force 1992a), Air Force responsibilities for flight activities include the following: flight safety, noise abatement, and participation in the land-use planning process. These measures are detailed in Section 3.2. To reduce noise around Nellis AFB, the Air Force has restricted and would continue restrict nighttime flying activities. Flights would be routed to have the least effect on populated areas changes in flight altitude would be employed. These procedures would remain in effect under the proposed beddown.

The Air Force would continue to participate in land-use discussions with governmental parties and make recommendations to city and county planning and zoning organizations on the types of land uses that are compatible.

NELLIS RANGE COMPLEX

NOISE MODELING: Assessment of the effect of F-22 sortie-operations on noise within the NRC involved incorporating surrogate noise data and flight profiles for the F-22 with the baseline data for all other aircraft. The same models (MR_NMAP and BOOMAP) were used to model subsonic and supersonic noise in the affected airspace. Operations within subdivisions of the airspace were distributed according to the pattern of use of F-15Cs.

NOISE ENVIRONMENT: Table 4.2-6 shows SELs for subsonic noise for several aircraft, including the F-22. They are the same data as shown in Table 3.2-9 but with the F-22 projections added. Current data indicated that F-22 noise levels (SELs) would be higher at altitudes below 5,000 feet AGL than most other aircraft commonly using the NRC. Given that most F-22 flight activity would occur above 10,000 feet AGL, no noticeable difference is expected. Table 4.2-7 and Figure 4.2-6 show L_{dnmr} for the 21 airspace units described in section 3.2. Projected noise levels would not measurably differ from baseline conditions. Two factors account for this lack of change. First, the sortie-operations projected for the F-22 would represent 13 and 9 percent of total sortie-operations in the NRC under low- and high-use conditions, respectively. Second, the F-22s would operate predominantly (89 percent) at altitudes above 10,000 feet AGL. At these altitudes, neither the noise level nor the startle effect would be noticeably different from existing conditions.

Table 4.2-6. Sound Exposure Levels (SEL) in dB at Various Altitudes in the NRC*

	ALTITUDE IN FEET ABOVE GROUND LEVEL						
Aircraft Type	*300*	*500*	*1,000*	*2,000*	*5,000*	*10,000*	*20,000*
B-1B	115	112	107	101	92	82	69
F-15C	116	112	107	101	90	80	65
F-16	106	103	98	91	81	70	56
A-10	99	95	89	82	72	63	53
C-130	99	96	91	85	77	69	61
F-22**	118	114	108	102	92	83	73

* Level flight, steady high-speed conditions
** Projected based on F-18 aircraft

During air combat maneuvering, the F-22 is estimated to be supersonic approximately 10 percent of the time. Figure 4.2-7 and Table 4.2-8 show CDNL for the Proposed Action. Airspace units not shown are subject to CDNL of less than 45 dB or not authorized for supersonic flight. Sonic boom levels and frequency of occurrence would be slightly higher than baseline conditions. Coyote and Elgin would experience the largest change, with a 1-3 CDNL increase and 4 to 6 additional sonic booms per month. All other affected airspace would be subject to increases of less than 1 CDNL and less than 1 sonic boom per month. Combined subsonic and supersonic noise is present in Table 4.2-9. Combined noise would increase at most by 1 DNL. In most areas, noise would not increase at all.

LAND USE AND MANAGEMENT: Under the Proposed Action, land status and land-use patterns within the NRC would not be altered. Since land uses in this area have remained the same for many years and have been exposed to aircraft operations since the formation of Nellis AFB in 1940s, the changes in use associated with the proposed beddown have a negligible potential to impact land use. Furthermore, subsonic noise levels would not change under the Proposed Action.

Table 4.2-7. Baseline and Projected Subsonic Noise Levels in the Nellis Range Complex

	200,000 SORTIE-OPERATIONS		300,000 SORTIE-OPERATIONS	
Airspace	*Baseline* L_{dnmr}	*Projected* L_{dnmr}	*Baseline* L_{dnmr}	*Projected* L_{dnmr}
Caliente	54	54	56	56
Coyote	57	57	59	59
Elgin	46	46	47	47
Reveille	54	54	56	56
R61	53	53	55	55
R62	53	53	55	55
R63	53	53	55	55
R64	53	53	55	55
R65	53	53	55	55
Alamo	53	53	55	55
EC South	52	52	54	54
Pahute Mesa	53	53	54	54
R71	53	53	55	55
R74	60	60	62	62
R75	61	61	63	63
R76	58	58	60	60
R4808W[1]	46	46	47	47
R4808E[1]	<45	<45	<45	<45
R4809A	49	49	51	51
EC East	55	55	57	57
EC West	56	56	57	57

[1] Not part of NRC airspace; DoE airspace over the NTS

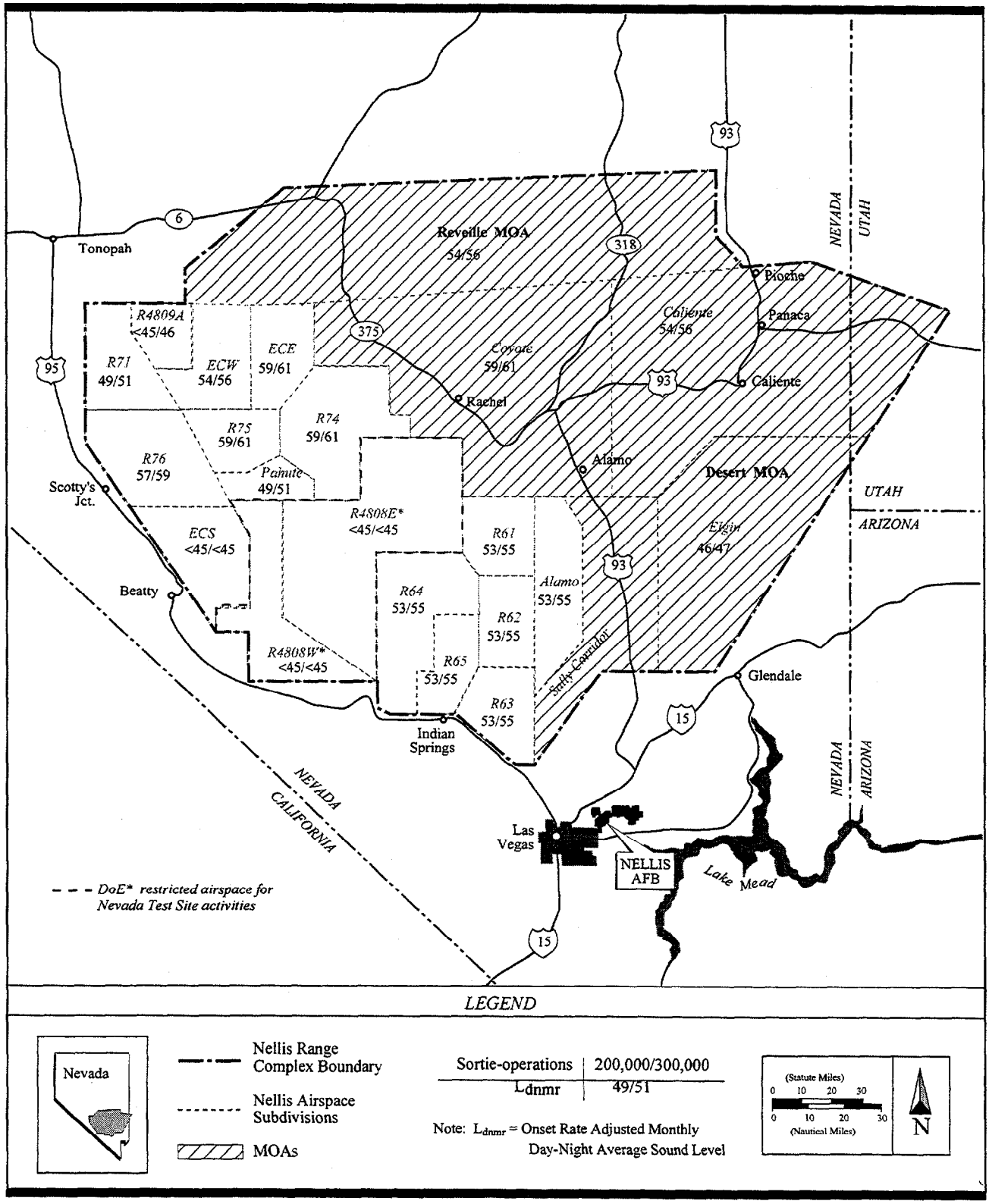

Figure 4.2-6. Proposed Noise Levels within the Nellis Range Complex

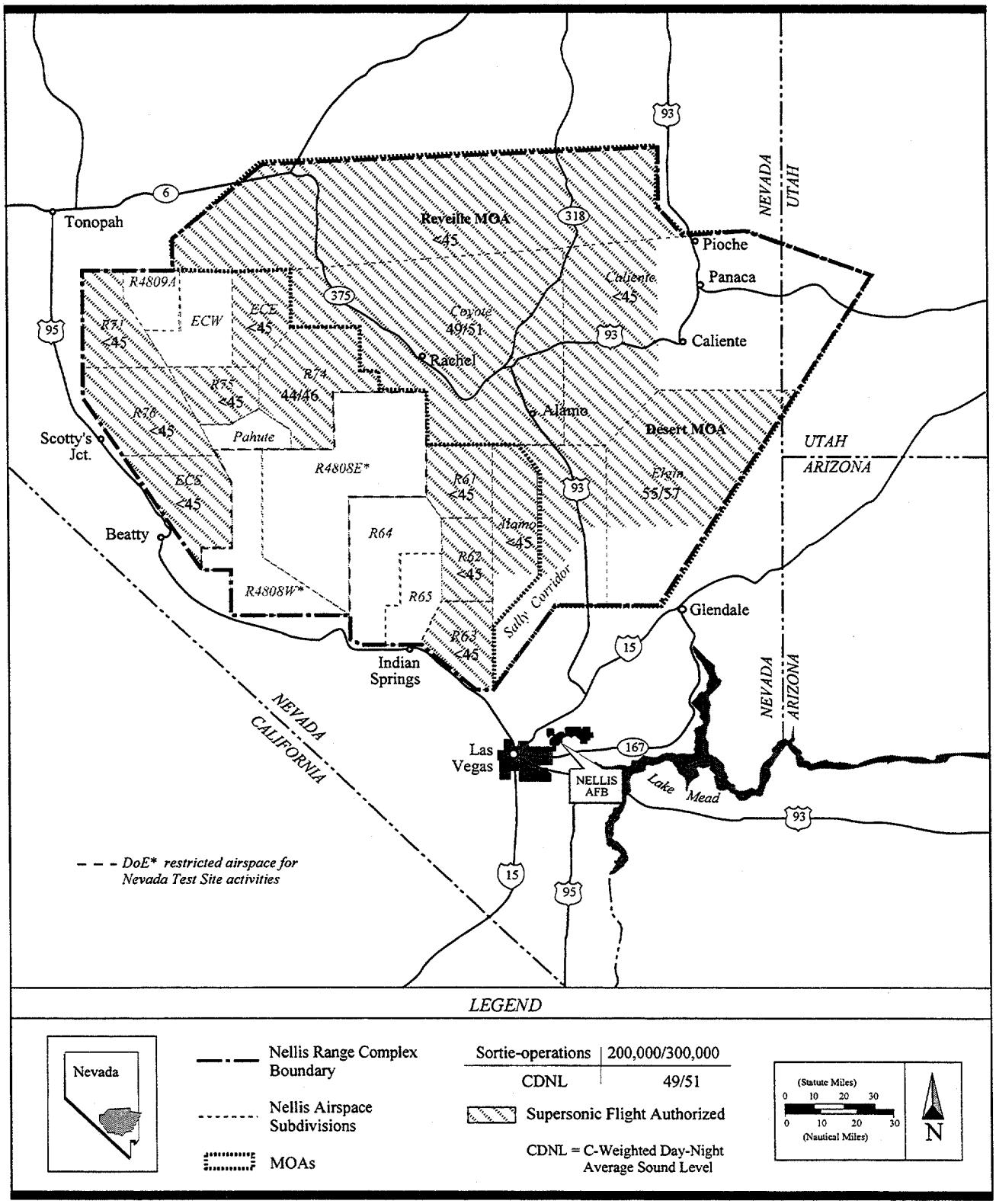

Figure 4.2-7. Proposed Action Sonic Boom Levels within Nellis the Range Complex

Table 4.2-8. Projected Sonic Boom Levels and Frequency under the Proposed Action

	200,000 SORTIE-OPERATIONS				300,000 SORTIE-OPERATIONS			
	Baseline		*Projected*		*Baseline*		*Projected*	
Airspace	*CDNL*	*Booms per Month*	*CDNL*	*Booms per Month*	*CDNL*	*Booms per Month*	*CDNL*	*Booms per Month*
Elgin	54	20	55	24	56	30	57	35
Coyote	48	4	51	10	50	7	52	12
Reveille	<45	<2	45	2	<45	<2	45	2
EC East*	<45	<2	45	2	<45	<2	46	2
R74*	<45	<2	45	2	<45	<2	46	2
* Restricted access								

Table 4.2-9. Combined DNL and CDNL[1] Noise Levels under Baseline and Proposed Action

	200,000 SORTIE-OPERATIONS		300,000 SORTIE-OPERATIONS	
Airspace	*Baseline DNL*	*Projected DNL*	*Baseline DNL*	*Projected DNL*
Elgin	58	59	60	60
Coyote	58	59	60	60
R74	60	60	62	62
Reveille	54	54	56	57
EC West	56	56	57	58

[1] L_{dnmr} equivalents for CDNL calculated by correlating CDNL values to Schultz Curve (see Appendix D).

Increases in supersonic flight activity would result in a minimal increase in the number of sonic booms experienced at ground level. Increases in sonic booms in Range 74 would not affect land use because the area is already restricted from public access. Since the increase in sonic booms beneath portions of the Desert MOA are minimal, and since the intensity of booms reaching the ground would be similar to the intensity under existing conditions, impacts to land use resulting from sonic boom exposure would be insignificant.

Similarly, management plans for the lands underlying the NRC should not require amendment. Current land management plans and practices recognize the military activities associated with NAFR. The nature and extent of those activities will not be altered substantially under the Proposed Action.

Potential effects to special-use areas such as the DNWR are of particular concern to the public. As presented above, noise levels over these areas will not change.

4.3 AIR QUALITY

Emission of air pollutants into the Nellis AFB ROI would increase under implementation of the Proposed Action. These increases would remain below *de minimis* levels and would not delay attainment of the National Ambient Air Quality Standards (NAAQS). Potential sources of emissions include facility construction, maintenance activities, vehicle and diesel-powered electric generator operations, vehicle travel, and aircraft operations. Aside from aircraft emissions, the primary pollutants from other operations would be exhausts from ground-based internal combustion engines and fugitive dust. Overall aircraft operations within the NRC would remain within the current range (200,000 to 300,000 sortie-operations per year), and F-22 aircraft operations would not cause total emissions and air quality to vary significantly from the current range.

Criteria to determine the significance of these changes are based on federal, state, and local air pollution standards and regulations. The changes would be significant if the emissions from the Proposed Action alternative (1) increase ambient pollution concentrations from below to above any NAAQS, (2) contribute to an existing violation of any NAAQS, (3) impair visibility within federally mandated Prevention of Significant Deterioration (PSD) Class I areas, or (4) result in non-conformance with the Clean Air Act or any State Implementation Plan.

4.3.1 No-Action Alternative

Under the No-Action Alternative, none of the construction activities, personnel relocations, or aircraft operations proposed for the F-22 aircraft beddown would occur at Nellis AFB, and no proposed F-22 aircraft operations would occur in NRC airspace. Air pollutant emissions would remain unchanged from baseline conditions under the No-Action Alternative.

4.3.2 Proposed Action

NELLIS AFB

Changes in air emissions at Nellis AFB as a result of the Proposed Action were calculated using the same methods and types of input used to determine baseline emissions. All ground-based emission sources associated with the Proposed Action were assessed, including construction of facilities, vehicle travel by new personnel, maintenance, testing, refueling, and emissions from ground equipment supporting the F-22. Emissions associated with airfield operations accounted for taxi, takeoffs, and landings by F-22 within the Nellis AFB airfield environment. The methods for calculating the air quality analysis are presented in detail in Appendix E.

Emissions were calculated for aircraft operations associated with the F-22, including power setting, minutes at taxi/idle, takeoff, climbout, and approach. CO, NO_x, PM_{10}, and SO_x, were obtained from the Special Project Office for the F-22 aircraft (personal communication, Captain R. Reed 1998, 1999). VOC rates were derived from the Aircraft Engine Emissions Factors for

the F119 engine (Air Force 1978), an existing, related, high-performance engine with a combustion system similar to the production engine for the F-22 (personal communication, M. Wade 1998).

Since the Proposed Action is scheduled to take several years, emissions impacts were calculated for each year leading up to completion of the aircraft beddown. Table 4.3-1 provides a summary

Table 4.3-1. Estimated Additional Annual Emissions for F-22 at Nellis AFB under the Proposed Action (Tons/Year)

Calendar Year	*CO*	*NO_X*	*VOC*	*SO_X*	*PM_{10}*
2000	6	27	1	2	5[1]
2001	<1	<1	<1	<1	<1
2002	32	17	4	1	2
2003	42	59	6	3	3
2004	42	59	6	3	3
2005	44	67	6	4	4
2006	42	59	6	3	3
2007	53	60	11	4	3
2008+	89	124	13	7	6

[1] Some variation in construction dates may occur. The PM_{10} estimated emissions from construction at 2008 represent the maximum amount under the Proposed Action. Aircraft emissions are based on 1,878 annual sorties in 2002; 2,140 annual sorties in 2003-2007; and 4,472 annual sorties in 2008.

of the annual additional emissions estimated to occur through 2008 as a result of the F-22 beddown. CO and PM_{10} emissions are especially important because Las Vegas Metropolitan Area and Clark County are not in attainment for these criteria pollutants.

Fluctuations in annual emissions would occur as various phases of the Proposed Action would be completed. Short-term increases in air emissions would result primarily from construction activities and vehicle commuting associated with construction personnel. Long-term increases in emissions would result from commuting by permanently assigned personnel, aircraft operations, and facility space heating. All new point sources of emissions such as hangars or other buildings would be subject to existing permitting requirements. The base air emissions inventories would require updates to reflect new point sources of emissions. Modifications to the current basewide Title V Permit would be required if equipment other than mobile aircraft maintenance equipment was added or replaced. No modification to the Title V Permit is required for changes or additions to mobile equipment used to maintain or service aircraft on the ground. However,

Clark County air quality operating permits for individual pieces of equipment would have to be modified for any change to that equipment. Nellis AFB would apply for all modifications to the Title V Permit and the Clark County air quality operating permits after finalization of equipment needs.

Beddown of the F-22 and its associated actions would result in an overall increase in emissions at Nellis AFB (Table 4.3-2). NO_X would increase by the greatest percentage (19 percent) due to the nature of the F-22 engine. PM_{10} would increase by 11 percent. Increases for all other criteria pollutants would be less than 4 percent. Beddown of the F-22 would increase Nellis AFB's contribution to the overall CO budget for the Las Vegas Metropolitan Area from 2.1 to 2.2 percent. To put this change in perspective, the total annual CO emissions for the F-22 beddown in 2008 would represent only about 0.1 percent of the annual CO budget for the Las Vegas Metropolitan Area. In 2008, all PM_{10} emissions from Nellis AFB would represent 0.068 percent of the 1995 Las Vegas Valley total, an increase of 0.006 percent over baseline. Emissions associated with F-22 construction projects in 2000 would be expected to account for less than 0.057 percent of all PM_{10} emissions in the Las Vegas Metropolitan Area.

Table 4.3-2. Summary of Projected Total Emissions at Nellis AFB (Tons/Year)

	CO	*NO_X*	*VOC*	*SO_X*	*PM_{10}*
Baseline Total	2,644	659	533	372	54
F-22 Projected 2008+	89	124	13	7	6
Post-2008 Total	2,733	783	546	379	60
Percent Change	3.4%	19.1%	2.4%	1.9%	11.1%

Compliance with the Final Conformity Rule is presumed if the emissions associated with a federal action like the F-22 beddown are below the relevant *de minimis* threshold and are regionally insignificant. Since Clark County is designated by the EPA as being in serious nonattainment for CO and PM_{10} the *de minimis* levels are 100 and 70 tons per year, respectively. Regional significance thresholds for CO and PM_{10} in Clark County are higher than the *de minimis* thresholds. None of the activities associated with the Proposed Action exceeds the CO or PM_{10} *de minimis* or regional significance thresholds. Maximum PM_{10} emissions would be 6 tons per year in 2008, or 64 tons below *de minimis*; in all other years, PM_{10} emissions would range from less than 1 ton per year to 5 tons. Differences in the proposed construction program account for this variation. Maximum CO emissions would be 89 tons per year, or 11 tons below the *de minimis* threshold. Neither CO nor PM_{10} emissions associated with the Proposed Action would contribute to exceedences or delay achieving attainment in Clark County or exceed regional significance; a conformity determination is not required.

NELLIS RANGE COMPLEX

Total operational activities in the NRC would not differ from those now occurring in the NRC. Under the Proposed Action, F-22 aircraft would conduct approximately 26,000 sortie-operations in the NRC per year after 2007. These F-22 activities would represent 13 percent of total sortie-operations in low-use years (200,000 sortie-operations per year) and 9 percent of total sortie-operations in high-use years (300,000 sortie-operations per year). Since the Air Force anticipates that the F-22 would operate like the existing F-15Cs in the NRC, the distribution of total sortie-operations among the various airspace units would match that of the F-15Cs.

Because the total sortie-operations in the NRC would not change, inclusion of sortie-operations by F-22s would not noticeably alter the emissions for any pollutant. Table 4.3-3 presents the estimated quantities (tons per year) of emissions that the 26,000 F-22 sortie-operations would generate in the different airspace units comprising the NRC. Overall, air quality conditions would remain very similar to those found now, although variations could occur in the totals of different criteria pollutants. Such variation would depend on the total number of sortie-operations and mix of aircraft using the NRC in a given year. Variation in mix and number of aircraft occurs consistently within the NRC so emissions also vary accordingly. Inclusion of F-22 activities would represent just another part of this variation.

Table 4.3-3. Estimated F-22 Aircraft Emissions in Nellis Range Complex Airspace (Tons/Year)

	Desert MOA	*Reveille MOA*	*R-4806*	*R-4807*	*R-4809*	*R-4808*[1]	*Total NRC*
CO	0.80	0.80	0.61	2.73	0.22	0.44	5.60
NO_X	167.60	34.60	22.60	60.15	4.71	19.64	309.30
VOC	0.20	0.04	0.21	0.15	0.01	0.02	0.63
SO_X	5.10	1.10	0.68	3.69	0.14	0.60	11.31
PM_{10}	1.70	0.40	0.24	1.27	0.05	0.21	2.17

[1] NTS airspace managed by DoE; used for aircraft transit only.

Table 4.3-4 shows that the F-22 would tend to contribute a higher percentage of NO_X and SO_X; these increases are due to engine design. The percentage contribution of the F-22 would decrease as total sortie-operations in the NRC increased towards 300,000. For example, F-22 SO_X emissions under the 300,000 sortie-operation scenario would represent a 4.6 percent lower contribution to the total SO_X emissions than those under a 200,000 sortie-operation scenario. Total emissions for the NRC, including those by the F-22, would continue to be distributed throughout a volume of air of 13,000 cubic miles resulting in low criteria pollutant concentrations (refer to Table 3.3-6). Air quality effects associated with total NRC aircraft operations would continue to be insignificant.

Table 4.3-4. Estimated F-22 Contribution to Total Nellis Range Complex Emissions

	NRC Total Emissions (Tons/Year) 200,000 Sortie-Operations	*% Contribution F-22*	*NRC Total Emissions (Tons/Year) 300,000 Sortie-Operations*	*% Contribution F-22*
CO	110.5	5.6%	165.6	3.4%
NO_x	2083.1	14.9%	3124.4	9.9%
VOC	15.0	4.2%	24.3	2.6%
SO_x	81.8	13.8%	122.5	9.2%
PM_{10}	35.0	6.2%	52.8	4.1%

Use of the NRC by F-22s would not result in exceedences of NAAQS or PSD increments. No measurable changes to ground-level pollutant concentrations (refer to Table 3.3-6) would be anticipated for two reasons. First, F-22 sortie-operations would fall within the 200,000 to 300,000 total sortie-operations in the NRC. Second, the F-22 would spend 89 percent of its flight time at 10,000 feet AGL or higher and less than 8 percent of its flight time below the mixing height of 5,000 feet AGL.

No impairment of visibility in PSD Class I areas would occur as a result of the F-22 beddown. Criteria to determine significant impacts on visibility within Class I areas usually apply to stationary emission sources; mobile sources are generally exempt from permit review. The negligible potential for F-22s to contribute to already minimal pollutant concentrations indicates that the Proposed Action would not impair visibility. Smokeless engines in the aircraft and the F-22's dominant use of altitudes above 10,000 feet AGL make the possibility of visible atmospheric discoloration extremely remote. The Class I area nearest to the NRC is Zion National Park, approximately 37 miles east of the NRC. Emissions from aircraft would quickly disperse and would not be expected to affect visual range from a reference point 37 miles away. Therefore, impacts on visibility from the alternative within Class I areas close to the NRC would be insignificant.

4.4 SAFETY

This section evaluates the Proposed Action to determine its potential to affect safety risks to military personnel, the public, and property. Fire and ground safety are assessed for the potential to increase risk, as well as for the Air Force's capability to manage that risk by limiting exposure, responding to emergencies, and suppressing fires. Analysis of aircraft flight risks correlates projected Class A mishaps and bird-aircraft strike hazards with current use of the airspace to consider the magnitude of the change in risk associated with the proposal. Projected changes to uses and handling requirements of explosives are compared with current uses and practices. If a unique situation is anticipated to develop as a result of the Proposed Action, the capability to manage that situation is assessed. Finally, when the changes in risk arising from the Proposed Action are considered individually and collectively, assessments can be made about the adequacy of disaster response planning and the need for new or modified procedures and requirements that may become necessary.

4.4.1 No-Action Alternative

Under the No-Action Alternative, operations on the base and throughout the NRC would be unchanged from current conditions. Ground, flight, and ordnance safety considerations associated with current operations, as discussed in section 3.4, would remain unchanged.

Current operations and training activities on Nellis AFB and within the NRC do not pose a significant safety risk to the public, military personnel, or property. Since these conditions would not change under the No-Action Alternative, it would not result in significant impacts.

4.4.2 Proposed Action

Under the Proposed Action, the beddown of F-22s for FDE program and WS alters some of the conditions regarding safety both on base and within the NRC. However, none of these changes would significantly degrade safety conditions in either ROI. The beddown and operations of the F-22 would not influence current safety conditions or procedures.

NELLIS AFB

OPERATIONS AND MAINTENANCE: Operations and maintenance activities conducted on Nellis AFB would continue to be performed in accordance with all applicable safety directives. There are no specific aspects of F-22 operations or maintenance that would create any unique or extraordinary safety issues.

As part of the F-22 beddown, some new facilities would be constructed, and other, older facilities would be demolished. New facilities would include buildings on the flightline to support F-22 operations and maintenance, additional munitions support facilities, and a new dormitory. No unique construction practices or materials would be required. During

construction, standard industrial safety standards and best management practices would be followed. No unusual ground safety risks would be expected to arise from these activities.

FIRE AND CRASH RESPONSE: Fire and crash response would continue to be provided by Air Force fire departments. If new response procedures are required for unique materials used in the construction of the F-22, they would be developed after the production mode F-22 is finalized. Under the Proposed Action, fire fighters would be fully trained and appropriately equipped for crash and rescue response.

AIRCRAFT MISHAPS: Historically, when new military aircraft first enter the inventory, the accident rate is higher. However, it is impossible to predict the potential mishap level. Historical trends do, however, show that mishaps of all types decrease the more an aircraft is flown. Over time, operations and maintenance personnel learn more about the aircraft's capabilities and limitations. Some of this experience has already been gained for the F-22.

By the time the proposed F-22 operations at Nellis AFB begin, the initial OT&E phase of the aircraft's integration into the operational force will have progressed substantially. Significant knowledge will have been gained about the aircraft's safest flight regime. At Nellis AFB, only highly experienced fighter pilots support the FDE phase and develop tactics at the WS. Their activities will provide additional data about the aircraft's safe operating parameters and further minimize flight risks. As the programs proceed from 2002 onward, the potential for mishaps would likely decrease to low levels comparable to other fighter aircraft. Since the F-22 design incorporates the most modern technology, knowledge is constantly being gained about the safe operating envelope of the aircraft, and it will be flown by the most experienced pilots, the F-22 will operate as safely as, or more safely than, other aircraft in the Air Force inventory. The majority of flight operations would be conducted over remote areas, where population densities are very low. In the unlikely event that an aircraft accident occurs, it would not subject people or property on the ground to undue risk.

BIRD-AIRCRAFT STRIKE HAZARDS: A total of 135 bird-aircraft strikes have been documented for Nellis AFB over a 10-year period. Implementing the Proposed Action would not alter this low rate. Two factors support this conclusion: (1) the F-22 would operate like all other fighters that have used Nellis AFB and rarely encounter bird-aircraft strikes and (2) no aspect of the Proposed Action would increase concentrations of birds on or near the base.

MUNITIONS USE AND HANDLING: On Nellis AFB, a new munitions maintenance and storage facility would be constructed to support JDAM storage. This facility would be designed and approved for JDAM maintenance and storage. No requirements for safety waivers associated with their use are anticipated. The Proposed Action would not require development of new safety arcs nor would it change arming and dearming locations.

NELLIS RANGE COMPLEX

FIRE RISK AND MANAGEMENT: Within the NRC, current procedures to minimize ground safety risks associated with air-to-air and air-to-ground training would continue. Operations and maintenance activities on NAFR would continue to be conducted according to current processes and procedures. All actions would be accomplished by technically qualified personnel and would be conducted in accordance with applicable Air Force safety requirements, approved technical data, and Air Force Occupational, Safety, and Health standards.

Since the use of NAFR would not appreciably change and the overall levels of ordnance and flare use would remain within average yearly variations, there is no anticipated increase in fire risk. The end of this safety section details fire risks associated with the proposed use of flares by F-22s. Planned disaster response actions and range fire suppression capabilities have proven adequate in the past and would likely be adequate in the future. The land areas surrounding training ranges ensure public protection by restricting presence in the safety areas associated with laser use, emitters, and targets supporting air-to-ground ordnance delivery.

SONIC BOOMS: Although the number of booms would be expected to increase (see section 4.2), resulting overpressures would remain well below levels that would create health risks to people or any other safety risks to structures on the ground.

AIRCRAFT MISHAPS: A range of expected maximum and minimum sortie-operations were considered to assess aircraft mishaps under current operations. The greatest indicated risk is associated with use of MOA airspace (Desert MOA). Throughout the MOA airspace, statistical projections indicate the probability of a Class A mishap once every 2 years. However, when the level of use is considered, this equates to a probability of a mishap of only 0.00003 percent per year. Risks associated with aircraft mishaps for aircraft currently using the airspace are anticipated to remain relatively unchanged. The mishap rate and risk of mishaps for a new aircraft like the F-22 may be higher in its early years, but would be expected to decrease through time to lower levels matching those of other fighter aircraft. As more information about the operating characteristics of the aircraft is gained, the probability and risk of a pilot exceeding its safe operating regime is minimized. Given this historic pattern reflecting decreased risk over time, F-22 operations in the NRC would not pose significant safety risks.

BIRD-AIRCRAFT STRIKE HAZARDS: Since 1985, there have been ten documented strikes in the NRC: one was a Class B mishap, three were Class C mishaps, and the other six strikes caused little or no damage. Risk associated with bird-aircraft strikes is expected to remain low under the Proposed Action. The F-22 would fly above 10,000 feet AGL 89 percent of the time. This is well above the altitude (3,000 feet AGL) where 95 percent of bird-aircraft strikes occur.

ORDNANCE USE AND HANDLING: Use of live and training ordnance would continue on NAFR. Training activities would also continue to employ chaff and flares. The F-22 will also be capable of delivering the JDAM or equivalent. By 2008, the JDAMs or other similar ordnance used with

the F-22 would represent about 3 to 5 percent of the total ordnance used on NAFR. Only trained and qualified personnel would handle ordnance in accordance with all explosive safety standards and detailed published technical data.

The overall type and amount of total ordnance expended would continue at current levels. Added tonnage of ordnance contributed by the F-22 would be less than the normal annual variation on NAFR. Weapons employment procedures are detailed in AFI 13-212, Volume 2/NAFB Supplement. Operational constraints pertaining to use of specific delivery tactics, ordnance type, or aircraft headings are developed to mitigate any potentially unsafe condition and ensure that ordnance remains within the applicable safety footprint.

No degradation of public safety is expected from release of ordnance by F-22s since there is no public access near target areas. Weapons safety footprints for ordnance delivery by F-22s are currently under development. These footprints will define safety and operational requirements for F-22 ordnance delivery to ensure all ordnance comes to rest within the approved ranges within NAFR.

CHAFF AND FLARES: Under the Proposed Action, 36,000 bundles of chaff and 8,000 flares would be released annually by F-22s, contributing about 9 percent of the total chaff and about 8 percent of the total flare use for the NRC. Since the total amount or type of flares and chaff in the NRC would not increase under the Proposed Action, no change to baseline conditions would be expected.

As described in section 3.4, Safety, available information and studies (Air Force 1997c) indicate chaff poses no health risk to humans or wildlife, affects soils and vegetation negligibly, and is unlikely to impact aesthetics. Assuming a conservative average of 3 million fibers per chaff bundle and an even distribution throughout the NRC, annual F-22 use of chaff would contribute one fiber per approximately 240 square feet. This density would be greater under NAFR airspace, which the F-22 would use the most, but it would still remain quite low and unnoticeable.

The F-22 would release flares as part of the FDE and WS sortie-operations, but this activity would not affect safety, fire risk, or natural resources. Minimum flare release altitude for the F-22 would be 700 feet AGL over the numbered and electronic combat ranges of NAFR and 5,000 feet AGL in the MOAs. While the actual burn time of the flares expected to be used by the F-22 is classified, the minimum release altitude of 700 feet AGL is designed to allow the flares to burn out completely at least 100 feet above the ground (Air Force 1997c). The release altitude in the MOAs provides an additional buffer against burning material contacting the ground. However, 89 percent of F-22 flight activities and flare releases would occur at 10,000 feet AGL or higher. Since flare releases would commonly be more than 13 times the minimum-release altitude, the potential for burning material contacting the ground would be negligible.

In the unlikely event of an inadvertent release of a flare below the minimum altitude, the risk of a wildfire would remain minimal. As described in section 3.4.2, the probability of a fire starting

from a single ignition source such as a flare is extremely low, even with the right fuel, wind, and vegetation conditions.

Flares and flare residues, as detailed in section 3.4.2, do not pose a health risk to humans or animals because they are not likely to be ingested and the quantities involved are negligible. The extremely small quantities of flare residues also have little potential to affect soil or water.

4.5 HAZARDOUS MATERIALS AND WASTE

The qualitative and quantitative assessment of impacts from hazardous materials and waste focuses on how and to what degree the alternatives affect hazardous materials use and management, hazardous waste generation and management, and waste disposal. A substantial increase in the quantity or toxicity of hazardous substances used or generated is considered a potentially significant impact. Reduced quantities and types of hazardous substances would be considered a beneficial impact. If the quantity of hazardous substances used or generated did not change, then there would be no impact.

A comparative analysis of existing and proposed hazardous materials and waste management practices was performed to evaluate impacts. Hazardous waste generation records were reviewed to determine the magnitude of anticipated increases in hazardous waste generation based on historic levels, existing management practices, and storage capacity.

Since changes associated with the Proposed Action in the NAFR and NRC would not affect hazardous materials and waste (section 2.5), only potential impacts on Nellis AFB are discussed. Fire and medical teams responding to F-22 crashes on the ranges would be fully trained in handling the expected resulting hazardous waste and materials. All hazardous material and waste would be removed from the mishap site by trained teams and properly disposed of according to the techniques established by the F-22 Special Projects Office.

4.5.1 No-Action Alternative

Under the No-Action Alternative, Nellis AFB personnel would continue to use hazardous materials in the same manner and quantity as they currently do. The types and amounts of hazardous waste generated would continue without change under this alternative. Existing procedures for the centralized management, procurement, handling, storage, issuing, and disposal of hazardous materials used on base would remain unchanged. Spill prevention, control, and countermeasures plans would not require updating.

The No-Action Alternative includes no specific plans to alter or demolish asbestos-containing buildings. Normal modifications and repairs to such buildings would likely occur as at present. Any asbestos-containing materials encountered during these efforts would be handled under existing rules to reduce exposure to, and release of, friable asbestos.

4.5.2 Proposed Action

HAZARDOUS MATERIALS AND HAZARDOUS WASTE GENERATION: The hazardous materials and waste associated with the F-22 program would not significantly impact installation management programs. Management protocols for hazardous substances related to the F-22 would follow existing regulations and procedures. If any new waste streams are identified after the production

model of the F-22 is finalized, the appropriate transportation, storage, and disposal procedures would be implemented and Nellis AFB's RCRA Part B permit would be modified as necessary.

The F-22 hazardous materials (HAZMAT) program would consist of the following processes: identification and tracking, materials evaluation and materials decision, reporting and documentation, and information dissemination. The HAZMAT program would minimize the quantity and types of hazardous materials associated with the F-22. Ozone-depleting substances would be eliminated. Fire protection systems associated with the F-22 would use HFC 125 for fire zones. The use of cadmium would be minimized. Other substances such as volatile organic compounds, isocyanates, and chrome would be present in coatings, but sanding and overcoating are expected to occur less frequently than with other aircraft. Efforts would continue to minimize the use of methyl ethyl ketone (a toxic solvent) and methylene dianiline (used in adhesives).

The most commonly used hazardous materials on the F-22 flight line would include jet and motor fuels, other types of petroleum products, paints, thinners, adhesives, cleaners, lead-acid batteries, hydraulic fluids, and non-halogenated solvents.

Maintenance activities associated with the F-22 would include Aircraft Structural Maintenance, which includes structural repair, corrosion control, and composite repair; aircraft avionics, electrical system, radar, wheel and tire repair; jet engine, fueling system, structural and navigational/communication repairs; and aircraft washdown. Materials used during these activities would include primers, topcoats, various coatings, solvents, sealants, epoxies, solder, paint and epoxy strippers, adhesives, refrigerants, coolants, hydraulic fluids, cleaners, lubricants, and degreasers.

Other planned maintenance operations would involve minor maintenance for vehicles and equipment associated with the F-22 program. These operations would not differ from those currently performed for vehicles and equipment associated with other aircraft types at Nellis AFB. Petroleum, oil, and lubricants, as well as other substances required for minor maintenance activities, would be stored temporarily at approved accumulation points within the maintenance facility. Substances used for, or resulting from, minor maintenance activities would be stored in small quantities at each facility. Diesel fuel for support vehicles would be stored in existing aboveground storage tanks, and appropriate spill prevention and containment strategies would continue to be implemented. In addition, a spill prevention, control, and countermeasures plan would be implemented, and appropriate spill response equipment would be located on site.

Since complete and specific data for the F-22 are not yet available, quantitative assessment of the potential increase in hazardous waste generation associated with the F-22 mission requires use of surrogate data for similar aircraft. Estimated increases in hazardous waste generation are based on waste generation data for the F-15C, a comparably sized, twin-engine fighter.

Estimates show that about 70 percent of the hazardous waste generated by the F-22 would be derived from six processes: Aircraft Structural Maintenance, aerospace ground equipment

maintenance, in-squadron maintenance, munitions maintenance, propulsion and test cell, and supply fuels management. Less notable contributions to overall waste generation would come from additional maintenance activities, such as avionics, tire and wheel shops, and the structural sheet metal shop.

Estimated waste generation by specific activity is summarized in Table 4.5-1. After full implementation of the Proposed Action in 2008, F-22 maintenance would generate about 4,000 pounds of RCRA hazardous waste per year (856 pounds per year x 17 aircraft). This total would represent less than a 3 percent increase in total hazardous waste relative to current conditions. No new types of waste streams are anticipated, and this increase would not effect current hazardous waste management protocols or generator status. Nevertheless, if any new waste streams are identified for either classified or non-classified hazardous wastes and materials after the production model of the F-22 is finalized, the appropriate transportation, storage, and disposal procedures would be developed, and Nellis AFB's RCRA Part B permit would be modified as necessary. Through recycling and pollution prevention, hazardous waste at Nellis AFB has declined and will continue to decline. These procedures would be applied to waste streams from the F-22.

Table 4.5-1. Estimated Hazardous Waste Generation (pounds/year/aircraft)

Maintenance Activity	*Pounds*
Aircraft Structural Maintenance	111
Aerospace Ground Equipment	200
In-Squadron Maintenance	368
Munitions Maintenance	40
Propulsion and Test Cell	80
Supply Fuels Management	57
TOTAL	856

Construction and maintenance activities associated with the Proposed Action would require the use of hazardous substances such as petroleum, oil, and lubricants. During construction, use of these substances for fueling and equipment maintenance would have the potential for minor spills and releases. Use of best construction practices would reduce this potential to an insignificant level.

Specialized training for handling and disposal of wastes would be available for any personnel associated with the Proposed Action that may come in contact with these materials. In addition, a *Storm Water Pollution Prevention Plan* (Air Force 1998) prepared by Nellis AFB personnel

provides methods for the reduction or elimination of pollution in local groundwater sources, if any hazardous materials are inadvertently released.

Adherence to all requirements for hazardous materials storage and use, as well as temporary storage of hazardous wastes, would be monitored under the Air Force's Environmental Compliance Assessment Management Program.

ASBESTOS: Asbestos may be encountered as structures are remodeled or demolished to accommodate new F-22 support facilities. The Air Force currently practices to remove exposed friable asbestos and manages other asbestos-containing materials in place, depending on the potential threat to human health. Friable asbestos, if encountered, would be removed and disposed of in a local asbestos-permitted landfill.

4.6 EARTH AND WATER RESOURCES

Analysis of the potential impacts to earth resources employs the following steps: identifying locations where the actions may directly or indirectly affect earth resources; defining the nature of the affected earth resource; and evaluating the degree to which the characteristics, abundance, or value of the resource would be altered, depleted, or degraded.

In terms of water resources, no aspect of current operations at Nellis AFB affects either hydrologic setting or water sources; this would not change under the Proposed Action. Therefore, this analysis focuses on potential effects on water use, availability, and quality.

Since changes associated with the Proposed Action in the NRC, including NAFR, would not affect any undisturbed earth or water resources (refer to section 2.5), this section discusses only potential impacts on Nellis AFB.

4.6.1 No-Action Alternative

Implementation of the No-Action alternative would result in no change in activities at Nellis AFB. As a result, no change in topography or soil erosion would occur. Furthermore, no change in water uses, availability, or quality would be expected. Therefore, no impact to surface water or groundwater would occur if the No-Action Alternative were implemented.

4.6.2 Proposed Action at Nellis AFB

EARTH RESOURCES: The potential for impacts from the Proposed Action on Nellis AFB would be associated with construction of new facilities and, to a lesser degree, alteration of existing facilities. Soil loss and erosion could potentially take place, but, as described below, the impact caused by soil loss and erosion would be negligible.

Site grading associated with construction of the flightline, munitions, and dormitory facilities would be the primary activity with the potential to affect earth resources. Grading for new facilities would cause loss of some disturbed groundcover, which would increase the potential for soil erosion. However, several factors indicate that erosion and soil loss would be negligible. First, the area affected would be only 4.0 acres within the developed portion of Nellis AFB. Roughly 39 percent of the proposed construction would replace existing buildings. Second, construction activities would take place over 7 years and range from about 4,200 to 91,030 square feet in any single year, limiting the total area exposed to erosion at any one time. Third, low precipitation (8 inches per year) and low runoff (0.2-2.1 inches per year), combined with the flat topography of the base, would substantially reduce the potential for erosion. Lastly, Air Force requirements to employ standard construction practices (e.g., soil stockpiling and watering) would further limit both wind and water erosion. Based on these factors, construction grading would not measurably degrade soil resources through erosion or loss. Similarly, fugitive dust would be limited (see section 4.3, Air Quality).

WATER AVAILABILITY, USE, AND QUALITY: Under the Proposed Action, construction activities and personnel increases are not expected to appreciably affect the surface waters at Nellis AFB or in the surrounding areas. Surface water for Nellis AFB is transported via pipelines from Lake Mead. Sources of groundwater are available from the principal alluvial-fill aquifer underlying the Las Vegas Valley. Although proposed changes in operations and personnel would increase the use of water, the increase in personnel would be only about 4 percent, and on-base construction would be temporary and use little water. Use of water for F-22 program activities, including personnel, is likewise expected to be limited, and its affect on the availability of groundwater at Nellis AFB or in the surrounding areas would be minimal.

Use of water for the proposed F-22 programs would not significantly affect availability of surface water or groundwater at Nellis AFB or elsewhere in the area. Full implementation of the F-22 programs in 2008 would result in use of approximately 400 to 500 AFY, which is well within Nellis AFBs water allocation and will not require Nellis AFB to seek additional water rights.

Projected on-base construction would disturb existing groundcover, but the potential for soil loss, erosion, and sedimentation would be temporary and limited in scope. Required use of best management practices would further reduce this impact. Because no perennial or ephemeral streams, natural lakes, or other open bodies of water are present at Nellis AFB, no sediments would be introduced into surface waters.

The Proposed Action includes paving and construction of buildings with impermeable surfacing. During construction at Nellis AFB, soils would temporarily be compacted, which would impede drainage and reduce water infiltration. In other areas, such activities could increase runoff volumes and could alter current hydrological processes. However, the base lacks significant open water bodies and the area altered would be 4.0 acres. Since no surface water resources of consequence are located on base and the newly impenetrable surfaces would be less than 0.04 percent of the total base, implementation of the Proposed Action would not significantly impact surface water. Existing spill prevention, control, and countermeasure plans would protect surface water sources during construction and use of facilities, so the potential for on- or off-base surface water quality to be affected would be negligible.

Construction and paving associated with the Proposed Action would result in slightly fewer acres available to facilitate groundwater recharge, but the impact would be negligible given the low average annual precipitation and the lack of year-round surface water on base. Infiltration historically has been a minimal source of recharge.

No floodplains have been identified on base. Since the existing potential for flooding on Nellis AFB is minimal, the Proposed Action would not increase flood hazards on the base.

4.7 BIOLOGICAL RESOURCES

Determination of the significance of potential impacts to biological resources is based on (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource, (2) the proportion of the resource that would be affected relative to its occurrence in the region, (3) the sensitivity of the resource to proposed activities, and (4) the duration of ecological ramifications. Impacts to biological resources are significant if species or habitats of high concern are adversely affected over relatively large areas or disturbances reduce population size or distribution of a species of high concern. No significant impacts to biological resources would result by implementing the Proposed Action.

This section analyzes the potential for direct or indirect impacts to biological resources from implementation of the Proposed Action. Direct impacts would be associated with the proposed construction and operations of facilities at Nellis AFB, and direct and indirect impacts could result from the proposed operation of the F-22 over the NRC.

4.7.1 No-Action Alternative

Under the No-Action Alternative, there would be no change to current baseline conditions. No new construction or testing and training operations would occur; therefore, there would be no impact to biological resources.

4.7.2 Proposed Action

NELLIS AFB

VEGETATION: The Proposed Action, requiring the construction of new facilities and the demolition of older facilities, would be restricted to six previously disturbed areas on Nellis AFB. Since construction activities, structural modifications, and demolition associated with the Proposed Action would occur in previously disturbed areas that currently support no sensitive plant species or wetlands, there would be no significant impacts on vegetation at Nellis AFB.

WETLANDS: No designated wetlands or areas exhibiting wetland characteristics exist on or near the proposed areas of construction; therefore, implementation of the Proposed Action would have no impact on wetlands.

WILDLIFE: Since the proposed facilities construction and modifications would occur on previously developed areas that are predominantly graded or paved, proposed construction activities would not have significant impacts on terrestrial wildlife.

Projected noise levels with the addition of the F-22 at Nellis AFB are similar to current baseline noise levels (see section 4.2, Noise and Land Use). Wildlife would not be adversely affected.

Bird-aircraft strikes have not historically presented an operational constraint to Nellis AFB. In the course of over 700,000 airfield operations between January 1985 and October 1996, there

have been a total of 135 bird-aircraft strikes (none of these Class A or B mishaps) involving Nellis AFB aircraft within the immediate vicinity of the base (see section 3.4, Safety). Since the Proposed Action would only increase base operations by 13 percent and Nellis AFB has a successful and aggressive Bird Airstrike Hazard program, a significant increase in bird-aircraft strikes around Nellis AFB is unlikely.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES: Only the federally listed desert tortoise, listed as threatened by both the USFWS and NDOW, exists on Nellis AFB. Surveys conducted in 1992 found a small population in the northeastern portion of Area II. Current plans are to locate the munitions facilities in previously disturbed sites within the fenced munitions storage area, near similar facilities. A previous USFWS opinion (USFWS 1992a) regarding the potential current or future impacts to the desert tortoise population states the level of impact was "...not likely to appreciably reduce the likelihood of survival and recovery of the Mojave population of the desert tortoise in the wild..." The USFWS issued reasonable and prudent measures, including implementing terms and conditions designed to minimize incidental take in Areas I, II, and III. According to 50 CFR Section 402.16, any new Air Force action that may affect the desert tortoise in Area II, not considered in previous biological opinions, would require reinitiation of consultation with the USFWS. Nellis AFB would avoid impacts to the tortoise due to construction activities. Since projected noise levels (see section 4.2, Noise and Land Use) would diverge little from current levels, the desert tortoise would not be adversely affected by noise associated with the Proposed Action.

The California bearpoppy, currently listed as a species of concern, is located in Areas II and III on Nellis AFB. Construction activities would be restricted to previously disturbed areas and would not impact this species. Other federal species of concern, chuckwalla, banded gila monster, 11 species of bats, and 4 species of birds, would not be affected by the Proposed Action.

NELLIS RANGE COMPLEX

VEGETATION: Potential impacts to vegetation resources were evaluated for both direct and indirect effects as a result of fire; ordnance delivery, recovery, and removal; and maintenance of targets.

The use of flares and ordnance delivery may occasionally result in accidental fires that adversely affect vegetation and wildlife habitat by removing plant cover (short-term effect) or altering the plant community (long-term effect). Removal of vegetation can also lead to increased erosion and sedimentation that can cause long-term environmental change. The level and extent of effects on biological resources are site specific and depend on factors such as type of plant community (i.e., adaptation to fire), season, and frequency of fires.

Range areas occasionally have fires, either caused by munitions spotting charges or, in rare cases, flares. Techniques used to keep fires from spreading include placing fire breaks around targets, on-site fire spotting, and fire suppression crews (Air Force 1997d). An MOU exists between Nellis AFB and BLM, which establishes basic procedures and responsibilities for fire prevention, reporting, and fire suppression and management (Nellis AFB and BLM 1987).

Existing operational restrictions (altitude restrictions, fire rating restrictions, flare types permitted) are greater in training areas (i.e., MOAs) over non-DoD land. Restrictions at NRC set a 5,000-feet AGL minimum-release altitude in MOAs overlying public land (Air Force 1997e). With the current restrictions and guidelines for flare use over MOAs, the chance of fires is extremely rare; therefore, impacts to areas underlying MOA airspace due to flare use would not be significant.

The most prevalent procedures currently used to reduce fire risk from flares are suspension of flare use during periods of high fire risk and restricting the release altitude of flares. Suspension of the use of flares during high-risk periods is an effective procedure to reduce fires (Air Force 1997c). Although four to five fires occur on NAFR every year caused by ordnance, flares, or other sources, they tend to be small and contained within the target areas, which are generally devoid of vegetation or have fire breaks around them. Therefore, impacts to vegetation on the ranges and under the MOAs would be short term and minimal.

Under the Proposed Action, F-22s would use existing target areas on NAFR for ordnance delivery and training; no new roads, targets, or facilities will be built. Since flight activities do not result in any ground disturbance, habitat underlying the Desert and Reveille MOAs would not be impacted.

WETLANDS: Wetlands in the North and South ranges are composed of springs and seeps, and the pools, small streams, and saturated soils they support; there is only one intermittent creek found on either range. Due to the dispersed nature of these resources and the lack of any ground-disturbing activities (e.g., ordnance use) at or near any wetland area, impacts to wetlands would not be significant. Since the lands underlying the Desert and Reveille MOAs would not be subjected to any ground-disturbing activities, wetlands found there would not be affected by the Proposed Action.

WILDLIFE: Potential impacts to wildlife were evaluated for both direct and indirect effects as a result of fire, ordinance delivery, recovery and removal; maintenance of targets; fires; and noise. For a discussion of bird-aircraft strike hazards, see sections 3.4 and 4.4.

There is a possibility that flare use and ordnance delivery may start accidental fires. Impacts to wildlife due to fire would be due to habitat disturbance, similar to those described for vegetation; these impacts would be short term and not significant. Fires would be less likely to occur in MOAs because ordnance delivery, the predominant cause of military-related fires, would not occur.

Under the Proposed Action, F-22s would use existing target areas on NAFR for ordnance delivery and training; no new roads, targets, or facilities would be built. Lands underlying the Desert and Reveille MOAs would not be subject to any ground-disturbing activities. Because there would be no new ground-disturbing activities from implementation of the Proposed Action, impacts to wildlife habitat would not occur.

The greatest impact to wildlife from aircraft overflights is from the visual effect of the approaching aircraft and the concomitant subsonic noise. Most reactions by wildlife to visual

stimuli occur in response to overflights below 1,000 AGL (Lamp 1989; Bowles 1995). No major visual impact is expected from F-22 overflights since 94 percent of the operations would take place at altitudes above 1,000 feet AGL and 90 percent would occur above 10,000 feet. Those operations that would take place at altitudes below 1,000 feet AGL would be restricted to target areas on both ranges.

Studies on the effects of noise on wildlife have been predominantly conducted on mammals and birds. Studies on subsonic aircraft disturbances of ungulates (e.g., pronghorn, bighorn sheep, elk, and mule deer), in both laboratory and field conditions, have shown that effects are transient and of short duration and suggest that the animals habituate to the sounds (Workman *et al.* 1992; Krausman *et al.* 1993, 1998; Weisenberger *et al.* 1996). Similarly, the impacts to raptors and other birds (e.g., waterfowl, grebes) from aircraft low-level flights were found to be brief and insignificant and not detrimental to reproductive success (Smith *et al.* 1988; Lamp 1989; Ellis *et al.* 1991; Grubb and Bowerman 1997). Consequently, changes to the number and types of overflights are not expected to significantly impact wildlife or wildlife populations.

Subsonic noise levels and overflights associated with the Proposed Action over the entire NRC are similar to those for baseline conditions (see sections 3.2 and 4.2, Noise and Land Use) and are within normally acceptable criteria. Since there is essentially no change, the Proposed Action would not result in significant impacts to wildlife from subsonic noise.

Supersonic operations would take place within currently authorized areas of the NRC. Only in Elgin, Coyote, and R-74 airspace units did projected noise levels for supersonic flight operations exceed 45 CDNL. In these three areas, the number of sonic booms expected to reach the ground would increase a maximum of six per month, for a total of between 10 and 35 per month.

Studies of the effects of supersonic noise on birds and mammals have suggested that animals tend to habituate to sonic booms and that long term effects are not adverse. Captive and free-ranging ungulates exhibited a startle response and increased heart rates upon initial exposure to a sonic boom and decreased response with succeeding exposures (Workman *et al.* 1992). In raptors, Ellis *et al.* (1991) found that peregrine and prairie falcons' responses to simulated sonic booms were often minimal and never associated with reproductive failure. Typically, birds quickly resumed normal activities within a few seconds following a sonic boom. While the falcons were noticeably alarmed by the sonic booms, the negative responses were brief and not detrimental to reproductive success during the course of the study. Sonic boom levels and frequency of occurrence are slightly higher than baseline levels (see section 4.2, Noise and Land Use); therefore, potential impacts to wildlife from sonic booms would not be significant.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES: No federally listed plant species are known to occur on the ranges. Some populations of sensitive plant species are found on the ranges, but not within existing target areas. Other listed plant species, such as Beatley milkvetch, half-ring pod milkvetch, Ute ladies'-tresses, and sunnyside elkweed are known or suspected to occur on the NRC, but are not found on the NAFR. Existing threats to populations of sensitive plant species on the ranges include ordnance delivery and the use of flares (see section 4.7.2). Threats to these plant populations are minimal, since ordnance delivery activities are restricted to existing target areas; therefore, impacts to sensitive plant species found on the ranges would not be significant.

According to the USFWS Biological Opinion that reviewed the potential impacts to desert tortoise populations on Ranges 62, 63, and 64, "...current weapons testing and training is not likely to jeopardize the continued existence of the desert tortoise, and is not likely to destroy or adversely modify designated critical habitat." The USFWS issued a number of reasonable and prudent measures, with their implementing terms and conditions, which are designed to minimize incidental take that might otherwise result from current weapons testing and training (USFWS 1997a).

Impacts due to fire on threatened and endangered species and sensitive wildlife species, both on NAFR and NRC, would be minimal, since the chance of fires caused by flares or munitions is extremely low.

The only federally listed species occurring on the ranges that may be affected by noise is the desert tortoise. Studies on the effects of subsonic noise on desert tortoises have found impacts to be insignificant (Bowles *et al.* 1996). Subsonic noise levels associated with the Proposed Action are similar to those under baseline conditions (see sections 3.2 and 4.2, Noise and Land Use). Since there is essentially no change, the Proposed Action would not result in significant impacts to special status species from subsonic noise. Supersonic flight would not occur in airspace over desert tortoise populations.

As with other wildlife found under MOAs, the greatest effect of military overflights on special status species is from the visual effect of the aircraft and its associated noise. Visual impacts are not expected to be significant because most MOA operations would take place at altitudes above 1,000 feet AGL, which is higher than the level at which wildlife react to visual stimuli (Lamp 1989; Bowles 1995).

The impacts of noise from aircraft overflights on special status species are expected to be the same as those discussed for wildlife. Winter populations of bald eagles are found on Pahranagat NWR under the Desert MOA. Pahranagat NWR and other noise-sensitive habitats underlying MOA airspace, including Desert NWR and Key Pittman Wildlife Management Area, have overflights restricted to 2,000 feet AGL and supersonic overflights restricted to 5,000 feet AGL. Pahranagat NWR is further avoided by 1 NM (Air Force, Navy, and DOI 1981). Transient, migrating peregrine falcons may be present in low numbers within the NRC, but the impacts to these individuals from noise are not expected to be significant.

Overall, there would be no significant effect on special status species because aircraft operations and noise levels would not substantially increase over existing levels. Most of the additional operations would occur at high altitudes, therefore, these operations would not take place in areas with concentrations of noise-sensitive endangered species.

4.8 CULTURAL RESOURCES

The methodology for identifying, evaluating, and mitigating impacts to cultural resources has been established through federal laws and regulations including the National Historic Preservation Act, the Archaeological Resource Protection Act, the Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act. This process requires identifying significant cultural resources potentially affected by an action, determining the effect of that action, and implementing measures to avoid, reduce, or otherwise mitigate those effects.

A project affects a significant resource when it alters the property's characteristics, including relevant features of its environment or use, that qualify it as significant according to the National Register of Historic Places (NRHP) criteria. Effects may include the following:

- Physical destruction, damage, or alteration of all or part of the resources;
- Alteration of the character of the surrounding environment that contributes to the resource's qualifications for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the resource or alter its setting; and
- Neglect of the resource resulting in its deterioration or destruction.

Potential impacts are assessed by (1) identifying project activities that could directly or indirectly affect significant resources; (2) identifying the known or expected significant resources in areas of potential effect; and (3) determining whether a project activity would have no effect, no adverse effect, or an adverse effect on significant resources (36 CFR 800.9).

General sources of impacts to archaeological, architectural, and traditional resources from the Proposed Action may include the following:

- Ground disturbance from construction or modification to facilities.
- Noise, vibrations, and visual impacts from construction and air and ground operations.

Impacts to traditional cultural resources can be determined only through consultation with the affected American Indian groups. However, physical disturbance to prehistoric archaeological sites (especially rock art sites), disturbance to traditionally used plant and animal resources, and increased noise over sacred or traditional use areas have often been cited by American Indians as significant impacts. Consultation with American Indian groups was conducted through the Native American Interaction Program (NAIP) by Nellis AFB in accordance with the *Presidential Memorandum on Government-to-Government Relations with Native American Tribal Governments*; Executive Order 13084, *Consultation and Coordination with Indian Tribal*

Governments; *DoD Policy on American Indian and Native Alaskan Consultation* (1998); and Executive Order 13007, *Sacred Indian Sites*.

4.8.1 No-Action Alternative

Under this alternative, no new construction, building modifications, additional target use, or increased noise or sonic booms would occur. The effect on the environment would be unchanged relative to baseline. Therefore, this alternative would have no impacts to archaeological, architectural, or traditional resources.

4.8.2 Proposed Action

NELLIS AFB

ARCHAEOLOGICAL RESOURCES. Building construction activities could affect cultural resources; however, new construction is proposed within already disturbed sections of Areas I and II, and effects to archaeological resources due to construction is unlikely. All of Area I and 66 percent of Area II have been surveyed for archaeological resources. A total of 66 archaeological sites have been recorded and 22 of these, including six prehistoric and two historic districts all within Area II, are considered eligible to the NRHP. If the new construction is placed in areas that are developed or previously disturbed or within areas previously surveyed that do not contain archaeological sites, then no impact to archaeological resources is expected. Under the Proposed Action, new construction is proposed for disturbed areas within the Munitions Area in Area II. The Munitions Area has never been surveyed for cultural resources. When new construction is placed in unsurveyed areas or areas known to contain archaeological resources, then Section 106 consultation and survey to identify archaeological remains would be conducted. Nellis AFB would avoid disturbing significant cultural resources of possible.

In addition to construction and demolition on base, the addition of 17 F-22 aircraft would expand the areas adjacent to Nellis AFB subject to noise equal to or above 65 dB. The effects of noise on archaeological resources may be related to setting. Noise that affects setting may be caused by construction and maintenance of facilities and by machinery or vehicles. Aircraft noise and overflights can also affect setting. To be adversely affected, the setting of a resource must be an integral part of the characteristics that qualify the resource for listing on, or eligibility for, the NRHP. Because of modern development, this characteristic is often not the case for significant cultural resources, especially in urban or semi-urban environments. Even in rural areas, noise intrusions from vehicles, farm machinery, and off-road machines may create a noise environment that is probably inconsistent with the original setting of the property.

If the audible and visible aspects of the setting are fundamental to the resource's significance, then the nature and magnitude of potential impact from audible or visual intrusions on that setting can be evaluated. Intrusions sufficient to alter the setting can adversely affect the resource. The nature and magnitude of the impacts depend upon the characteristics of the affected cultural resource, the amount by which the sound level exceeds baseline noise levels, the other types of

noise sources in the vicinity of the cultural resource, and the frequency with which people visit the resource.

The area adjacent to Nellis AFB is currently used for grazing or development, and it contains two major highways. There are over 20 prehistoric sites and portions of several historic transportation sites known to occur here, including the Arrowhead Trail. Fourteen of these resources are potentially significant. Additional noise is unlikely to adversely affect archaeological resources in this area or the existing setting.

ARCHITECTURAL RESOURCES. None of the buildings subject to demolition or modification are considered significant cultural resources. Therefore, construction activities would not have an adverse effect on architectural resources on Nellis AFB. Since no historic structures are located near construction areas, and they are unlikely to be affected by vibrations and noise. Historic structures are also unlikely to be affected by noise and vibrations by overflights. Noise levels (SEL) for the F-22 would not exceed 110 dB.

Studies have established that damage to structures from subsonic noise-related vibration, even historic buildings, requires high decibel levels generated at close proximity to the structure and in a low frequency range (Battis 1983, 1988; USFS 1992). Aircraft must generate at least 120 dB at a distance of no more than 150 feet to potentially damage structures (Battis 1988).

A study by Wyle Laboratories (Sutherland 1990) indicated that a large, high-speed aircraft flying directly over a building had less than a 0.3 percent chance of damaging fragile structures such as wooden buildings. The probability of an aircraft operating at 200 feet AGL at 540 knots true airspeed directly over such a structure is extremely unlikely to cause damage. Operations at higher elevations would have a lower potential for causing damage since on-the-ground noise levels decrease as the aircraft rises. Structures offset from the flight track have an even lower probability of being affected by low-flying aircraft. Since 90 percent of the F-22 sortie-operations would be conducted over 10,000 feet AGL, damage to structures from either noise or vibrations is unlikely.

TRADITIONAL CULTURAL RESOURCES. Noise could potentially affect traditional cultural resources in a variety of ways (AIWS 1997). For example, traditional ceremonies and rituals by members of tribes included in the Consolidated Group of Tribes and Organizations (CGTO) often depend on isolation, solitude, and silence. An aircraft flying overhead, even at very high altitudes, may be deemed an intrusion by members of the CGTO. Overflights and vehicle traffic can be disruptive for American Indians engaged in ceremonial activities, sometimes preventing these activities from being conducted in certain locations.

Traditional resources are not known to exist in this area, but if they do exist, it is unlikely that adverse effects due to the noise increases would result, given the previously developed nature of the area. During discussions with American Indian groups on the effect of noise increases around Nellis AFB due to the Proposed Action, no concerns were expressed.

NELLIS RANGE COMPLEX

ARCHAEOLOGICAL RESOURCES. Ordnance delivery would take place on existing target complexes on the NAFR under the Proposed Action. Similar ordnance is being used at these target areas, and delivery of additional ordnance by F-22 aircraft would not increase disturbed areas near targets. F-22 use of ordnance on existing targets would be unlikely to adversely affect significant cultural resources.

ARCHITECTURAL RESOURCES AND TRADITIONAL CULTURAL RESOURCES. Subsonic noise would not increase within the NRC as a result of the Proposed Action. Therefore, no effect to cultural resources is expected from increased subsonic noise associated with the beddown of F-22 aircraft at Nellis AFB.

It is possible for sonic booms to adversely affect some cultural resources. Individual sonic booms vary considerably. The average boom pressure on the ground is 1 pound per square foot (psf). Overpressures on the order of 2 psf would break approximately 75 panes per million. Maximum overpressures of even 6 psf have an extremely low potential to damage structures or displace rocks (Battis 1983). Therefore, while there is some potential for sonic booms to break windows in historic buildings, there is very low potential for structural damage to architectural resources or for displacement and breakage of the components of most archaeological resources.

Supersonic noise levels would increase by 1 to 3 dB (CDNL) under the Proposed Action in R-74, Elgin, and Coyote airspace. Frequency of sonic booms expected with the F-22 would also increase 4 to 6 per month in NRC airspace approved for supersonic flight. Supersonic flight is restricted over Pahute Mesa, Caliente, R4808, and Highway 168 in the southeastern section of the Desert MOA (see Figure 2.2-7) and this restriction will remain unchanged for the Proposed Action. Potential effects from sonic booms include audible intrusions to traditional resources and vibration effects to historic structures and rock art sites. There is very low potential for structural damage to architectural resources due to sonic booms. Therefore, no adverse effects to architectural resources are expected due to an increase in supersonic noise levels or frequency of sonic booms. An increase in sonic boom frequency could adversely affect traditional use or sacred areas by creating an audible intrusion to the setting; however, previous consultations have not elicited concerns. Continuing consultation with American Indian groups would continue through the NAIP to identify areas of concern and to determine the extent of effects to these resources.

Potential effects to cultural resources from chaff are primarily related to visual impacts to resources where setting is the primary significance criteria. These resources may include rural historic landscapes or traditional or sacred areas. The effects to cultural resources from the use of flares is usually associated with the secondary effects of fire. The probability of flares causing fires is usually related to the chances of unexpended flares reaching the ground, the chances of flames igniting vegetation, and the chances of the fire spreading (Air Force 1997c). Chaff and flares would continued to be used as described in section 4.4. This continued use would have a negligible, if any, effect on cultural resources.

4.9 TRANSPORTATION

Since transportation resources should be affected only by on-base construction and increased personnel, the transportation analysis focuses on Nellis AFB road network, including those roads which access the base.

4.9.1 No-Action Alternative

Under the No-Action Alternative, transportation activity would continue at the current levels, and jurisdiction of roads would remain unchanged. Implementation of the No-Action Alternative would create no specific impacts to transportation.

4.9.2 Proposed Action

The Proposed Action could affect transportation due to an increase in personnel and planned on-base construction activities. Construction activities, planned for three locations on Nellis AFB, are scheduled to occur during three phases over an eight-year period. These activities may result in temporary delays and creation of alternative traffic patterns. Due to the temporary nature of the construction, the staggered completion schedule, and the relative dispersal of the locations, no significant impacts are anticipated.

Off-base transportation and traffic in the vicinity of Nellis AFB could be affected by the Proposed Action. In fiscal year 2002, 172 additional personnel are anticipated. Each person would live off base; therefore, average daily traffic would increase on access roads into the base. During the first quarter of fiscal year 2007, 195 new personnel are anticipated; 84 of these individuals would be housed on base in the new dormitory facility. Of the remaining 111 individuals who would reside off base, a limited number may participate in car pooling and ride-sharing, and people would be accessing the base at different times because their work schedules would vary. The resulting minimal increased traffic caused by additional personnel would represent a negligible effect on the volume-to-capacity (V/C) ratio.

One intersection within the Nellis AFB transportation network, Tyndall Avenue gate and Nellis Boulevard, is rated below the minimum desirable design standard. Increased vehicular activity associated with the proposed addition in personnel could further degrade this condition. Long-range base plans indicate that the Tyndall Avenue gate will be widened. Completion of this plan would help to alleviate the congestion.

4.10 RECREATION AND VISUAL RESOURCES

Potential issues and concerns regarding recreation and visual resources arising from the Proposed Action include an increase in noise, overcrowding of recreation facilities on base, and degradation of the visual environment.

The methodology for determining impacts on recreation resources focuses on (1) determining existing users, (2) determining the noise and visual impacts on recreational use due to a change in sortie-operations on the NRC and airfield operations at Nellis AFB, and (3) determining the effects to recreation of increased personnel on base.

The methodology for determining impacts to visual resources involves review of the visual resources management (VRM) guidelines used by the BLM. Where VRM is not used, scenic or specifically designated areas are identified and the effects of the Proposed Action on the visual quality are assessed.

4.10.1 No-Action Alternative

Under the No-Action Alternative, no increase in base personnel would occur. Access to and availability of recreational resources would remain unchanged. Military aircraft would continue to use the NRC, noise would not increase, and visual resources would remain unchanged. Therefore, under this alternative, no impacts to recreation are expected.

4.10.2 Proposed Action

NELLIS AFB

RECREATION: As a result of the Proposed Action, use of on-base facilities by personnel could increase. Recreational activities and sports leagues are evaluated annually. Influxes of personnel are common on the base due to the large number of temporarily assigned personnel. Therefore, an increase in base personnel as a result of the Proposed Action would not adversely affect recreation activities on base.

Recreation is not expected to be affected by noise resulting from the proposed aircraft operations. Noise levels on base range upwards from 65 DNL (see section 4.2, Noise and Land Use). These noise levels are consistent with the existing base noise environment.

One local park lies within the 70 dB noise contour (see Figure 4.2-4). This noise level is considered an acceptable level in accordance with current Clark County regulations. Projected noise increases associated with the F-22 would place this park within the 75 dB contour. However, the location of the park near current 75 dB levels indicates a change of less than 2 dB, which is not considered significant. Three other parks would fall within the 65 dB contour, which is within acceptable levels. Twelve schools and four churches also fall within areas with

noise levels up to 75 DNL. Changes in noise levels for these facilities do not exceed 2 dB and are not significant.

NELLIS RANGE COMPLEX

RECREATION: Public access to NAFR is restricted; few recreational activities occur there. Hunting is the only recreational activity allowed on NAFR. Only under permit conditions and existing MOUs are recreational visits allowed. Because the Proposed Action does not require a change in access for hunting nor does it change the amount of land available, this activity is not expected to change. Hunting on the range would continue to be coordinated with the NDOW and USFWS. Because access would not be restricted on the outlying areas of NAFR, no impact is expected to these areas. The legislative EIS for the NAPR Withdrawal Renewal proposes to allow public use of small portions at the boundary of the NAFR. F-22 operational would not affect the use of these areas.

Noise levels vary from 45 L_{dnmr} to 61 L_{dnmr} over NAFR (refer to Table 4.2-7). Much of the airspace associated with NAFR is located over DoD or DoE controlled land with restricted recreational use. Underneath the NRC, an impact to recreational use is not expected since subsonic noise levels would not perceptibly change.

Average supersonic exposures would probably increase as a result of the Proposed Action. Under the Elgin airspace, the average number of sonic booms would increase by about 20 percent from 20 to 24 booms per month. Under the Coyote airspace, the average number of sonic booms would increase from 4 to 10 booms per month (see Table 4.2-8). There are a number of recreation areas under these MOAs (see Figure 3.10-2), including Key Pittman Wilderness Management Area, White River Petroglyphs site, Beaver Dam State Park, and Ella Mountain. These sonic booms could be perceived as annoying to visitors in a wilderness setting. Due to the subjective nature of annoyance from noise disturbance and because the area is currently subject to sonic booms, some visitors would not be annoyed by the increase. Recreation visitors in developed areas would probably not be affected, because these areas tend to have higher ambient noise levels. In all other MOAs and restricted airspace except for R-74, the frequency of sonic booms is expected to remain the same as under current conditions. Since no recreation is permitted in this area, no impact to recreation is expected.

VISUAL: Impacts from aircraft overflights on the visual environment are difficult to quantify. This difficulty stems from the inability to separate visual impacts from the noise of the overflight. Aircraft overflights are usually noticed because of accompanying noise. Aircraft emissions would not be expected to impair visual quality (section 3.3).

Military aircraft overflights are transitory. The nature of the impact depends on the sensitivity of the resource, the distance from which the aircraft is viewed, and the length of time it is visible. Altitude relative to the viewer also plays a key role in determining impacts. Eyes are typically drawn to the horizon than to the area overhead; people are, less likely to notice aircraft at higher altitudes. Within highly vegetated mountainous areas, views would tend to be screened or

extremely brief. In such areas, the lower the altitude the aircraft flies, the more likely that views of passing aircraft are screened.

The most visually sensitive areas in the NRC include state parks and wildlife refuges (VRM Class II areas). Where the terrain is hilly or undulating, views of aircraft are brief. In areas of flat terrain, the views can be expansive, and military aircraft can be detected. On the open desert, where vegetation is low and visibility unimpaired, the visual effects of low-flying aircraft may also affect the sense of solitude and naturalness for individuals seeking a primitive recreational experience. Since total flight activity in the NRC would not change (see section 2.3), F-22 use would not add to potential visual effects from aircraft flight. F-22 activities would likely be less noticeable because of the higher operational altitudes.

4.11 SOCIOECONOMICS

Analyses of potential impacts to socioeconomic resources performed for this EIS considered both economic and social characteristics of the affected region. These characteristics include the size and demographic composition of the population; employment, income, and other general economic indicators; and population-related resources such as housing and public schools.

Assessment began with a determination of the economic impact of current operations at Nellis AFB presented in section 3.11. Data used to summarize current conditions were obtained primarily from an Economic Resource Impact Statement (ERIS), which included a detailed, categorical breakdown of personnel levels at the base, including payroll disbursements and expenditures in the region (e.g., for contracted service providers, etc.). Assessment of the base's current socioeconomic impact on the ROI enables the most accurate projections possible of impacts to affected indicators that could be realized upon implementation of the Proposed Action.

Two resources originally thought to have the potential to be adversely impacted were housing and public services. Analysis of the housing sector involved examination of the proposed personnel increase as it would impact regional housing supply (e.g., determining whether sufficient—and suitable—vacancies occur on base and in regional housing markets to accommodate increased personnel levels and associated dependents). Assessment of impacts to public services (e.g., availability of sufficient quantity and quality of utilities, fire and police protection, and educational facilities) involved correspondence with purveyors of such services.

4.11.1 No-Action Alternative

Under the No-Action Alternatives, there would be no beddown of F-22 aircraft at Nellis AFB. Implementation of this alternative would not affect the socioeconomic resources and opportunities associated with Nellis AFB or Clark County.

4.11.2 Proposed Action

EMPLOYMENT: Employment growth in Clark County has outpaced most statistical areas in the U.S. (refer to Table 3.11-1). In Clark County between 1980 and 1995, total non-farm employment increased by 129 percent. By comparison, nationwide non-farm employment increased by 32 percent over the same period (U.S. Department of Commerce 1997).

In Fiscal Year 1996, approximately 9,000 employees comprised the workforce at Nellis AFB. As one of the largest government employers in the ROI, Nellis AFB and its continuing operations represent a significant source of regional economic activity. While not significant in the context of regional economic activity, the addition of 367 jobs to employment at Nellis AFB, combined with indirect employment opportunities created by increased demand for goods and services, would beneficially impact employment in the ROI.

EARNINGS: Nellis AFB is a primary employer in the region, with total annual payroll expenditures of more than $555 million; military employees in Clark County receive average

annual earnings of about $25,000. Based on this average, the 367 new employees at Nellis AFB associated with the Proposed Action would generate a total of approximately $9.1 million in payroll disbursements in the ROI, beneficially impacting regional economic characteristics.

POPULATION: On average, each projected staff member is anticipated to have two dependents. The proposed increase of 367 personnel would yield approximately 1,100 new residents within the ROI (Table 4.11-1). This number would represent a 4.1 percent increase in the total population directly associated with the base and a 0.09 percent increase in Clark County's total population. Such an increase would not have a significant impact on local or regional population or place noticeably significant additional demands on affected community services, utilities, or housing.

Table 4.11-1. Comparison of Existing and Projected Staff and Dependents at Nellis AFB

	Staff	*Dependents*	*Total*
Existing	9,024	18,228	27,252
Projected	9,391	18,970	28,361
Difference	+367	+742	+1,109

HOUSING: Construction has been one of the fastest growing employment sectors in the ROI over the past 15 years. Much of this growth is attributable to rapid population growth and corresponding increased demand for affordable, quality housing in the region. This growth in the regional housing supply is projected to continue; therefore, sufficient and suitable (e.g., new) off-base housing would be available to personnel associated with the Proposed Action.

Currently, housing on base is available in military family housing units, dormitories, and billeting facilities. A total of 1,212 units are available to Nellis AFB personnel and their families. An additional 1,136 beds are available in dormitories, and billeting facilities at the base currently total 482 units. Currently funded projects are scheduled to increase quarters for visiting airmen and officers by another 286 units. The on-base housing supply combined with the expanding off-base supply and proposed dormitory construction on base would be sufficient (and inherently suitable) to accommodate personnel changes associated with the Proposed Action.

PUBLIC SCHOOLS: As of 1996, a total of about 166,700 students were enrolled in Clark County schools. The Air Force estimates that approximately 350 additional children would attend public schools in Clark County under the Proposed Action. These schools would continue to receive federal impact aid in lieu of taxes for each child attending school off base. These students would be phased in over several years, and the increase would be negligible compared to the rapid growth of Clark County. Current facilities in operation in the county and on base can accommodate new students added to the ROI's population upon implementation of the Proposed Action.

PUBLIC FINANCE: Because the Proposed Action would have a negligible effect on affected counties' operating budgets and general funds, no significant impact with regard to their ability to provide adequate services would be expected to result from its implementation.

4.12 ENVIRONMENTAL JUSTICE

As directed by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, this analysis addresses potential disproportionately high and adverse human health or environmental effects on these populations.

The existence of disproportionately high and adverse impacts depends on impacts identified for each of the individual resources (e.g., noise, air quality, water resources, and hazardous materials and wastes). If implementation of the Proposed Action were to have potentially significant effects on people for any other particular resource, then it would be necessary to examine those impacts in terms of their potential to adversely and disproportionately affect minority or low-income communities. Section 3.12 determined that noise was the only resource with such potential.

4.12.1 No-Action Alternative

Because there would be no change from existing conditions under the No-Action Alternative, there would be no environmental justice issues.

4.12.2 Proposed Action

NELLIS AFB

Low-income and minority populations in the residential areas associated with Sunrise Manor and other unincorporated communities near Nellis AFB would bear a disproportionately greater share of noise impacts than the population as a whole in the surrounding community. Portions of Sunrise Manor west and south of Nellis AFB (see Figure 3.2-5) would be subject to increased noise of 2 dB or less above levels currently experienced, but this would occur in areas zoned for noise above 65 DNL. The beddown of the F-22 aircraft would not result in a shift in location or change in shape of affected clear zones or APZs. No significant impact with regard to safety would result from the Proposed Action.

Currently, noise levels affect 26 percent of minority populations (Figure 4.12-1). This would increase by 1 percent to 27 percent under the Proposed Action. The minority population in the community is 25 percent, so this means minority populations already receive a disproportionately greater effect from noise under current operations. Most affected minority members live in areas with noise between 65 and 70 DNL, although the Proposed Action would increase the percentage affected by noise greater than 70 DNL to 26 percent (Table 4.12-1). Minority members potentially annoyed could increase from about 844 to 1,646 (Table 4.12-2). Noise increases would also affect low-income populations. Eleven percent of the people currently affected by noise greater than 65 DNL are considered to belong to low-income groups. This level increases to 19 percent for the Proposed Action. Under the Proposed Action, the number of low-income people affected by noise greater than 65 DNL would increase by 4,641 people (Table 4.12-3). This is 8 percent higher than the 11 percent of the community's population that is considered low-income, and, therefore, represents a disproportionately higher effect on that population.

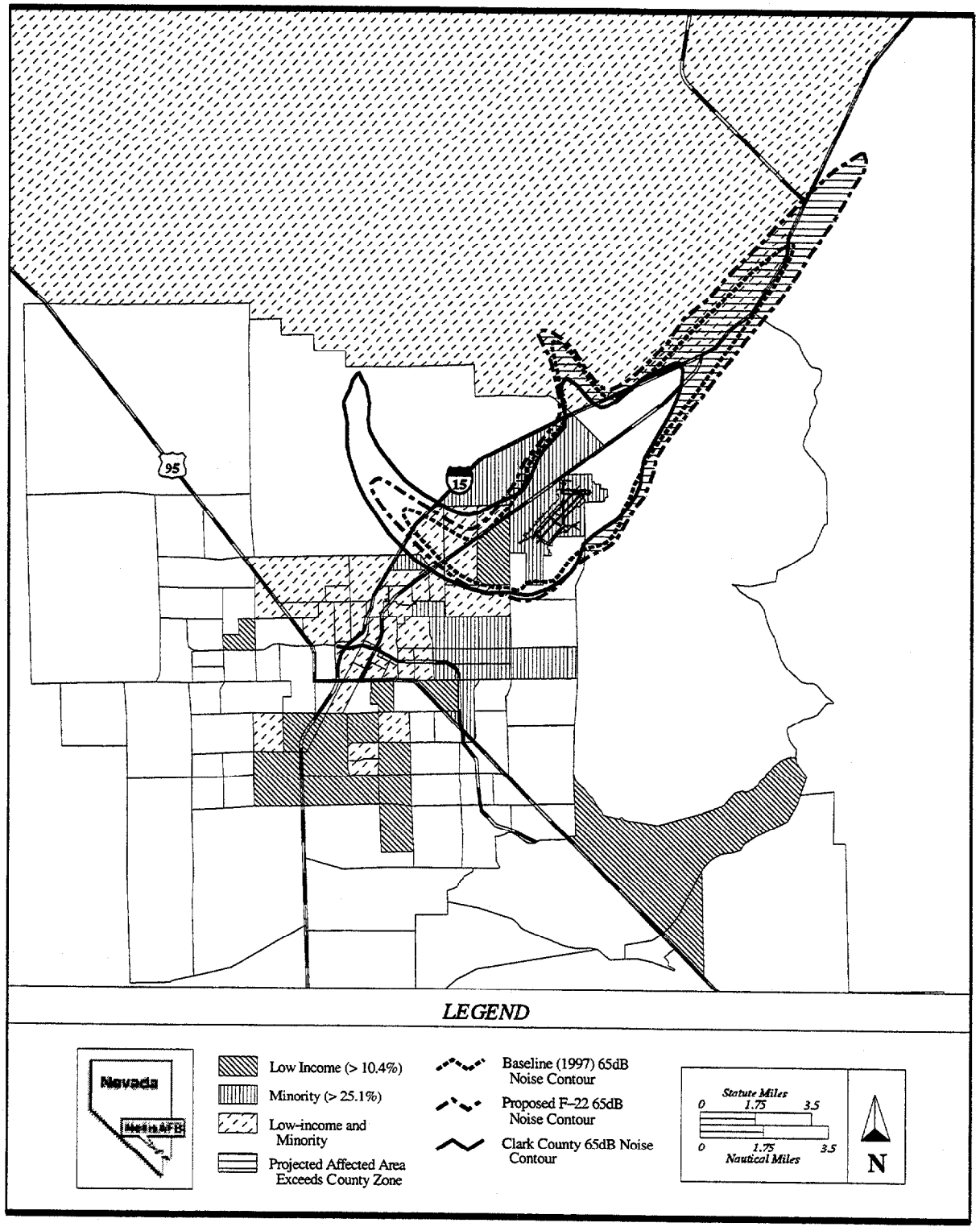

Figure 4.12-1. Proposed Noise Contours and Low-Income and Minority Census Tracts

/net/pulau/oahu/f22/plots/figures/noisefigs9.aml

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Table 4.12-1. Minority Populations Affected by Noise Levels Greater than or Equal to 65 DNL

	Minority	*%*	*Non-Minority*	*%*	*Total County Population*
Clark County Total Population[1]	281,120	25	838,88	75	1,120,000
	Minority	*%*	*Non-Minority*	*%*	*Total Affected*
Clark County Zoning ≥65 DNL	13,886	31	30,722	69	44,608
Baseline Noise Levels ≥65 DNL	5,913	26	16,888	74	22,801
Projected Noise Levels ≥65 DNL	10,050	27	27,700	73	37,750
Difference Projected - Baseline	+4,137	+1	+10,812	-1	+14,949
Difference Projected – Zoned	-3,836	-4	-3,022	+4	-6,858

1. Total population based on 1996 estimate from Clark County Department of Comprehensive Planning.

Table 4.12-2. Annoyance and Minority Populations in Areas with Noise Greater than 65 DNL

DNL	*Clark County Zoning Population*	*%*	*Baseline Population*	*%*	*% HA[1]*	*Population Potential HA*	*Projected Population*	*%*	*% HA[1]*	*Population HA*
65-70	8,812	63	5,783	98	14	810	7,432	74	14	1,041
70-75	3,201	24	100	2	23	23	2,605	26	23	599
75-80	1,580	11	30	0	37	11	3	0	37	1
80-85	293	2	0	0	53	0	9	0	53	5
>85	0	0	0	0	69	0	0	0	69	0
TOTAL	13,886	100	5,913	100		844	10,050	100		1,646

[1] Percent Highly Annoyed (HA) based on Schulz curve

Table 4.12-3. Effects of Noise Levels around Nellis AFB on Low-Income Populations

	Low-Income	*%*	*Non Low-Income*	*%*	*Total County Population*
Clark County Total Population[1]	123,200	11	996,800	89	1,120,000
	Low-Income	*%*	*Non Low-Income*	*%*	*Total Affected*
Clark County Zoning ≥65 DNL	5,231	12	39,377	88	44,608
Baseline Noise Levels ≥65 DNL	2,404	11	20,397	89	22,801
Projected Noise Levels ≥65 DNL	7,045	19	30,705	81	37,750
Difference Projected - Baseline	4,641	+8	10,308	-8	14,949
Difference Projected - Zoned	+1,814	+7	-8,672	-7	-6,858

1. Total population based on 1996 estimate from Clark County Department of Comprehensive Planning.

The Proposed Action would extend into areas with higher than average minority and low-income populations because a higher percentage of minorities and people with low-incomes live adjacent to Nellis AFB. The noise levels associated with the Proposed Action are within areas already zoned for noise levels above 65 DNL and are in predominantly minority or low-income areas. The 203 acres of projected noise outside the zoned region, south of Nellis AFB and the areas to the north and east are not in areas with a disproportionate number of minority or low-income groups.

ONGOING MEASURES TO REDUCE EFFECTS. Zoning regulations currently require all residential construction within areas affected by noise levels of 65 DNL or greater to include noise attenuation features. Noise attenuation from current standard construction practices can reduce indoor noise by 20 dB or more. The Air Force will continue to work with Clark County and other local officials to support enforcement of existing zoning ordinances and to assess the adequacy of noise abatement measures. If changes are found to be needed to address noise conditions, the Air Force will assist local officials who seek to establish or modify noise attenuation measures. The Air Force will also continue to employ noise abatement procedures around the base including expedited climb-outs for all aircraft and restrictions on the time and the direction of flight activities.

NELLIS RANGE COMPLEX

The Proposed Action's only effect that could have an adverse impact on minority and low-income populations is noise above 65 DNL. No change would occur to subsonic noise levels under the Proposed Action. A 1 to 3 CDNL increase would occur due to supersonic operations in the Elgin and Coyote airspace areas, but the combined subsonic and supersonic noise level would still be less than 65 DNL (see Table 4.2-9). Although Elgin has been identified as a low-income area, Coyote overlies neither low-income nor minority tracts. No disproportionate increase in noise over low-income or minority tracts would occur under the Proposed Action.

AMERICAN INDIAN RESERVATIONS

No American Indian reservations directly underlie airspace affected by the Proposed Action. There would be no disproportionate impacts to American Indian populations.

5.0 CUMULATIVE EFFECTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.0 CUMULATIVE EFFECTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

5.1 CUMULATIVE EFFECTS

This section provides (1) a definition of cumulative effects; (2) a description of past, present, and foreseeable actions relevant to cumulative effects; (3) an assessment of how the Proposed Action would impact with other actions; and (4) an evaluation of cumulative effects potentially resulting from these interactions.

5.1.1 Definition of Cumulative Effects

Council on Environmental Quality (CEQ) regulations stipulate that the cumulative effects analysis within an EIS should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR 1508.7). Recent CEQ guidance in *Considering Cumulative Effects* (CEQ 1997) affirms this requirement, stating that the first steps in assessing cumulative effects involve defining the scope of the other actions and their interrelationship with the Proposed Action. The scope must consider geographic and temporal overlaps among the Proposed Action and other actions. It must also evaluate the nature of interactions among these actions.

Cumulative effects are most likely to arise when a relationship or synergism exists between a proposed action and other actions expected to occur at the same time or in a similar location. Actions overlapping with or close to the Proposed Action would be expected to have more potential for a relationship than actions that are more geographically separated. Actions that coincide, even partially, in time would tend to offer a higher potential for cumulative effects.

To identify cumulative effects the analysis needs to address three fundamental questions: (1) Does a relationship exist such that elements of the Proposed Action might interact with elements of past, present, or reasonably foreseeable actions? (2) If one or more of the elements of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action? and (3) If such a relationship exists, then does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

5.1.2 Scope of Cumulative Effects Analysis

The scope of the cumulative effects analysis involves both the geographic extent of the effects and the time frame in which the effects could be expected to occur. For this F-22 beddown EIS, two ROIs delimit the geographic extent of the cumulative effects analysis. ROI One includes

Nellis AFB and its vicinity, including Las Vegas and its associated airspace. ROI Two defines the horizontal boundaries of the NRC and the vertical boundaries of its overlying airspace. Examination of other actions not occurring within or adjacent to one or both of these ROIs reveals that they lack the necessary interactions to result in cumulative effects.

The time frame for cumulative effects centers around the timing of the Proposed Action. For the beddown itself, the time frame extends from 2000, when construction would begin, through 2008, when the last F-22s would arrive at Nellis AFB. The effects of implementing the FDE program and WS would continue beyond 2008 because new aircraft commonly remain in the inventory for 25 years or more. Actions occurring beyond the end of the beddown, other than the beddown and its operations or the continued use of Nellis AFB and the NRC, are not reasonably foreseeable and cannot be considered under cumulative effects.

Past actions within the two ROIs relate predominantly to activities on and use of Nellis AFB and the NRC. Under the No-Action Alternative, the current environmental conditions of these two areas underwent analysis in this EIS. Since those conditions represent the result of long-term use occurring at Nellis AFB and in the NRC, analysis of the No-Action Alternative has considered those past and present effects engendered by the operation and use of the base and range complex. The Legislative EIS for the withdrawal renewal also addresses the effects of the use of NAFR.

The FDE program and WS EIS also has assessed the interactions, or synergistic effects, of individual elements of the proposed F-22 beddown under each resource (sections 4.1 through 4.12). For example, analyses considered the combined effects of construction, increased vehicle use, and aircraft operations on the air quality within ROI One (section 4.3).

Another factor influencing the scope of cumulative effects analysis involves identification and consideration of other actions. Beyond determining that the geographic scope and time frame for the actions interrelate with the Proposed Action, the analysis employs the measure of "reasonably foreseeable" to include or exclude other actions. For the purposes of this analysis, public documents prepared by federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions. Scoping also can provide insight into such actions, but no comment received at scoping for this EIS identified other such actions. Documents used to define other actions included notices of intent for EISs and Environmental Assessments, management plans, land-use plans, other NEPA studies, and economic and demographic projections.

5.1.3 Cumulative Effects of Reasonably Foreseeable Actions

Actions potentially relating to the cumulative effects for the proposed F-22 beddown could include those of the Department of Defense, Department of Energy, Department of the Interior, and local counties. The following outlines these actions and assesses their relationship to the proposed beddown. The amount of detail available about the actions varies, so this assessment

can only present the degree of specificity supported by available information on both the actions and their potential effects.

DEPARTMENT OF DEFENSE ACTIONS

Three DoD actions, one ongoing and two proposed, overlap with the proposed F-22 beddown in terms of location and timing. The ongoing action consists of use of existing MTRs that partially lie within NRC airspace. The Proposed Actions include conducting Initial OT&E for the F-22 at Edwards AFB, California, and renewing the NAFR land withdrawal under Public Law 99-606.

EXISTING MTRS: DoD has established several different MTRs within or adjacent to the NRC airspace that may or may not be flown in conjunction with NRC missions. An MTR consists of airspace corridors created for military flight training at airspeeds in excess of 250 knots and below 10,000 feet MSL. Designed to support low-level training requirements while minimizing disturbances to people and property, MTRs commonly avoid airports, towns, wildlife refuges, and other noise-sensitive locales. MTRs that transit or enter NRC airspace include segments that allow flight as low as 100 feet AGL, but normally flights occur between 500 and 1,000 feet AGL. Two types of MTRs exist: instrument routes (IRs) and visual routes (VRs).

Because portions of these MTRs overlap with NRC airspace in which the F-22s would fly, the potential for cumulative effects exists. It is expected that use of these MTRs would continue into the foreseeable future, coinciding with the time frame in which the F-22 would operate in the NRC. However, use of the MTRs constitutes an existing activity. The additive effects of current MTR use and proposed F-22 sortie-operations are assessed under the analysis of the Proposed Action. Since the F-22 beddown does not propose to add sortie-operations on specific MTRs, the beddown would not influence the type or quantity of use of the MTRs, nor would MTR use affect the beddown.

F-22 INITIAL OT&E AT EDWARDS AFB, CALIFORNIA: Edwards AFB is a primary weapons system and aircraft testing facility for the Air Force. The Air Force proposes to conduct Initial OT&E for the F-22 at Edwards AFB between 2002 and 2003. An EA evaluating the proposed Initial OT&E activities, in preparation now, and is expected to be published in mid 1999. Results of the Initial OT&E program determines whether the F-22 meets initial operational capability criteria before the program proceeds to full-rate production. To fulfill the needs of these programs, the Air Force would conduct flight operations in airspace and over ranges that provide realistic challenges. In preparation for and as part of the Initial OT&E program, the Air Force proposes to fly approximately 500 sorties within the NRC airspace from spring 2002 through spring 2003. Of these sorties, about half would focus on pilot training, whereas the remainder would represent flight tests. All flight operations would adhere to existing airspace restrictions applicable to the NRC, but the airspace would be used to its full extent. Each of the flight-test sorties would likely involve a supersonic event; some may occur at 3,000 feet AGL within R-4807A airspace, whereas the remainder would be at altitudes of 5,000 feet AGL or higher.

To support the test efforts, chase aircraft (e.g., F-16s), refueling tankers, and Airborne Warning and Control System aircraft would fly in the NRC. These aircraft would generate a total of about 2,300 additional *sorties* within the NRC. Although not specified in the proposal, *sortie-operations* in the NRC over the approximate 18-month period of the action would total about 16,500 for all aircraft, with the F-22s contributing approximately 5,300 sortie-operations. All of these sortie-operations are included within the 200,000 to 300,000 range of sortie-operations within the NRC. The cumulative effects of the total sortie-operations are encompassed within analyses in Chapter 4.

NAFR LAND WITHDRAWAL RENEWAL: Under Public Law 99-606, the Secretary of the Military Service is required to determine the need for continued exclusive military use of NAFR and prepare appropriate environmental analyses. This effort is currently underway in the form of a Final Legislative EIS, *Renewal of the Nellis Air Force Range Land Withdrawal*, published in March 1999. The purpose of the land withdrawal renewal for NAFR is to continue to provide a safe and secure location that permits testing of high performance weapons systems and tactics and supports realistic training for military personnel to meet nationally directed missions. Continuance of exclusive DoD use of NAFR would support the full spectrum of training for military operations. A decision to not renew the land withdrawal for NAFR would likely eliminate the air-to-ground training ranges, instrumentation, and other facilities that make it important and unique. Such a decision would not eliminate the overlying airspace, but without the ground-based facilities, the spectrum of aircraft operations conducted in the airspace would diminish significantly. The land would revert to the BLM.

The Air Force's decision to beddown the F-22 and congressional decisions regarding continuing the withdrawal for NAFR represent independent actions resulting in separate decisions. The decision to beddown the F-22s at Nellis AFB for the FDE program and WS would not dictate a decision to renew the land withdrawal. As presented in the range renewal Legislative EIS and this EIS, the NAFR supports numerous important functions and activities for the military including major exercises and FDE program and WS for many aircraft. The activities proposed for the F-22 at NAFR would not increase total use of the range or NRC. Flight activities at NAFR for the F-22 would represent between 9 and 13 percent of the total use of the range. Ordnance use by the F-22s would comprise less than 1 percent of total weapons delivery activities. Therefore, there would be no cumulative impacts.

DEPARTMENT OF ENERGY ACTIONS

The DoE recently completed an evaluation of potential site-wide impacts of future development of the Nevada Test Site (NTS) and other associated sites in Nevada. This evaluation included analysis of four development alternatives (current operations, discontinued operations, expanded operations, alternative uses) with respect to its five major programs (defense, waste management, environmental restoration, non-defense research and development, and work for others). The framework for an NTS resource management plan was also presented in the site-wide EIS. The *Record of Decision* identified expanded use of the NTS pending other DoE decisions. If fully implemented, this decision would result in a multipurpose, multi-program use

of lands withdrawn by DoE, although much of the NTS would remain in exclusive use. DoE will pursue diversification of interagency, private industry, and public education use while meeting the mission requirements of the NTS and other Nevada sites.

Site characterization studies at the Yucca Mountain in Nye County are ongoing and designed to determine whether the site is suitable for the storage and isolation of high-level radioactive materials and spent nuclear fuel. DOE anticipates making a recommendation in 2001 to the President on the suitability of the Yucca Mountain site for this purpose. If suitable, following Nuclear Regulatory Commission review and approval, construction could be completed and operations could commence by 2010.

The DOE proposes that low-level nuclear waste (LLW) be transported from a number of DOE/NV-approved LLW generators to a disposal site located on the NTS utilizing rail and truck transportation modes and an intermodal transfer facility. The use of rail and truck modes and alternative routes could reduce radiological risk, improve safety, and reduce costs for transporting LLW from generator sites to the NTS. LLW would be shipped via rail to an intermodal facility near the NTS where the cargo would be transferred to trucks for delivery to waste disposal sites at the NTS. The proposed action and alternatives address routes that would avoid the Las Vegas Valley and Hoover Dam.

Locations for the proposed intermodal facility are (1) an existing intermodal facility in Barstow, California operated by the Burlington Northern Santa Fe Railroad, (2) a facility proposed by the City of Caliente, Nevada (at either of two potential locations), and (3) an existing intermodal facility at the rail terminal of the Yermo Annex operated by the U.S. Army in Yermo, California.

Although these actions occur on lands underlying NRC airspace, they are independent of the proposed F-22 beddown and use of that airspace. Decisions concerning the NTS and Yucca Mountain would not influence decisions regarding the F-22. Furthermore, use of the overlying airspace by the F-22 would not contribute to the effects of the activities at the NTS or Yucca Mountain. For these reasons, there would be no cumulative impacts.

DEPARTMENT OF INTERIOR ACTIONS

BUREAU OF LAND MANAGEMENT: The Stateline Resource Area (now part of the Las Vegas District) comprises approximately 3.7 million acres of public land in Clark and Nye counties. The resource area is bordered by the Caliente Resource Area, USFWS Desert National Wildlife Range (DNWR), NAFR, and NTS. In the *Stateline Resource Management Plan* (BLM 1992b), the BLM's preferred alternative, Alternative D, provided for multiple-use of public lands, permits maximum flexibility in the disposal of lands, and protects the desert tortoise.

The Tonopah Resource Area (now divided between the Las Vegas and Ely districts) includes approximately 6.1 million acres of land in Nye and Esmeralda counties. *The Tonopah Resource Management Plan* (BLM 1994) and EIS addressed issues including wild horse and burro

management, special management areas, off-highway vehicle use, management of released wilderness study areas, utility corridor routing, and locatable and fluid minerals.

The BLM's decisions in these resource areas are not related to the F-22 beddown. The F-22 is a continuation of aircraft activity within the NRC and will not change the nature of airspace use. Therefore, there are no cumulative impacts.

U.S. FISH AND WILDLIFE SERVICE: The USFWS withdrawal of the DNWR continues the limited access and single use of these lands and is not expected to increase the area of disturbance. Management of the DNWR resources, including occasional species introductions and restricted hunting, would continue. The decision to renew the withdrawal of the DNWR, as well as its effects on the environment, are unrelated to the proposed F-22 beddown. No aspect of the renewal would alter or add to the types of operations conducted in the airspace overlying the DNWR, even with the addition of the F-22s. As indicated in section 2.2 and throughout Chapter 4 of this EIS, beddown of the F-22s at Nellis AFB and their use of the NRC would not change the amount or nature of overflights of the DNWR. For these reasons, no interaction exists between the two actions and the DNWR renewal is not included in the analysis of cumulative effects.

LOCAL ACTIONS

While not involving specific actions, planning and anticipated growth in local cities as well as Clark, Nye, and Lincoln counties in Nevada represent factors worthy of consideration for cumulative effects when combined with the proposed F-22 beddown. Nellis AFB, Las Vegas, and a portion of the NRC lie within Clark County, whereas Nye and Lincoln counties encompass the majority of the NRC.

As discussed in Section 3.11, census data and other information indicate that Clark County exhibited the greatest growth in population within the U.S. over the last 15 years. From 1980 through 1996, population increased 112 percent; estimates for 1996 place the county population at 1.2 million people. This amount exceeds that anticipated in the *Regional Transportation Plan for Clark County* (Regional Transportation Commission 1994), which anticipated that Clark County's population would increase to approximately 1.2 to 1.4 million people by 2005.

Key economic and development forces that influence future private activities and the character of Nye County and its communities include federal activities at the NTS and NAFR, mining and tourist activity, migration and commuting patterns, and the local service sector activity. Population projections for Nye County (Nye County Board of Commissioners 1993) indicate an average annual growth of 4.6 percent from 1990 to 2010. However, economic growth in the Las Vegas Valley and the availability of low cost land and housing in the Pahrump area of Nye County would support this population increase. This area is expected to grow at approximately 7.6 percent per year during the same period. Nye County anticipates this growth will convert approximately 2,000 acres of undeveloped land to urban uses by 2005. Based on demographic

projections prepared as part of this document, the population of Lincoln County is forecast to increase from 3,727 in 1996 to 4,552 in 2026.

For socioeconomics, the original ROI for the F-22 beddown included Clark, Nye, and Lincoln counties. Analysis in section 4.11, Socioeconomics, however, establishes that population growth and its accompanying impacts resulting from the F-22 beddown would occur only within Clark County and the Las Vegas area. Thus, the lack of a geographic overlap of the growth in Nye and Lincoln counties and the effects of the F-22 beddown confirm that no interaction exists and there are no cumulative impacts.

5.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA requires that environmental analysis include identification of "...any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented." Irreversible and irretrievable resource commitments are related to the use of nonrenewable resource and the effects that the uses of these resources would have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

For the Proposed Action, most resource commitments are neither irreversible nor irretrievable. Most impacts are short term and temporary or longer lasting but negligible. Those limited resources that may involve a possible irreversible or irretrievable commitment under the Proposed Action are discussed below.

Facilities construction and maintenance for F-22 support and increased personnel would require consumption of limited quantities of aggregate, steel, concrete, petroleum, oil, and lubricants. Construction would occur on previously disturbed areas or locations lacking native habitat, so no irreversible loss of habitat and wildlife would result. Similarly, construction on base would avoid significant cultural resources. While construction of new facilities would incur some soil disturbance and loss, use of best management practices would localize and minimize soil loss.

The proposed F-22 beddown would require fuels used by aircraft and surface vehicles. The 4,500 additional sorties from Nellis AFB would use fuel use for as long as the FDE program and WS continued. Surface vehicles supporting F-22 maintenance and operations would also use fuel, oil, and lubricants.

Personal vehicle use by the additional staff proposed to support the F-22 beddown would consume fuel, oil, and lubricants. The amount of these materials used would not likely exceed that currently used by these same individuals and their families. The Proposed Action would not increase consumption of these resources.

Use of ordnance would cause negligible ground disturbance, soil exposure, and erosion. Areas affected by use of F-22 ordnance consist of existing targets, so new disturbance would be unlikely. In addition, quantities of steel and other materials used in construction of munitions and targets would be committed under the Proposed Action. For the F-22, the amounts of these materials would be minimal, representing approximately 3 to 5 percent of the annual ordnance delivery activities at NAFR. The effects on targets would not be changed.

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6.0 REFERENCES

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P.O. Box 306
Caliente, NV 89008

Lincoln County Library-Pioche
15 Main Street
Pioche, NV 89043

Nevada State Library and Archives
Federal; Publications
100 North Stewart Street
Carson City NV 89701-4285

North Las Vegas Library District
2300 Civic Center Dr. North
Las Vegas, NV 89030

Pahrump Community Library
2101 E. Calvada Blvd.
Pahrump, NV 89041

Tonopah Public Library
171 Central
Tonopah, NV 89049

University of Nevada/Las Vegas
James Dickinson Library
Government Publications
4505 Maryland Parkway
Las Vegas, NV 89154-7013

Washington County Library
50 S. Main Street
St. George, UT 84770

White Pine County Public Library
950 Campton
Ely, NV 89301

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APPENDIX A
LAWS, REGULATIONS, AND GUIDELINES

RELEVANT FEDERAL STATE AND LOCAL STATUTES, REGULATIONS AND GUIDELINES

Air Force Instruction (AFI) 11-206 prohibits Air Force pilots from intentionally allowing any object to be dropped from an aircraft, except in an emergency, without prior approval. Approval is only given when the dropped object will not create a hazard to people.

AFI 11-214 and Air Combat Command Supplement 1 (February 1997) delineates procedures for chaff and flare employment and prescribes a minimum flare employment altitude of 2,000 feet above ground level (AGL) over non-government-owned or controlled areas.

AFI 13-201 establishes practices to decrease disturbances from flight operations and protect the public from the hazards and effects associated with flight operations.

AFI 13-212 Vol. 1, Vol. 2, Vol. 3 establishes procedures for the planning, construction, design, operation, and maintenance of weapons ranges and outlines procedures governing weapons range use of chaff and flares.

AFI 10-601 describes how to develop and process Air Force mission needs and operational requirements that may result in Air Force appropriations funding. It describes how to prepare, validate, and approve Mission Need Statements (MNS), Operational Requirements Documents (ORD), and Cost and Operational Effectiveness Analysis (COEA).

AFI 32-2001 defines the requirements for Air Force installation fire protection programs, including equipment, response times, and training.

AFI 32-7061 (Environmental Impact Analysis Process) is the Air Force implementation of the procedural provisions of the NEPA and CEQ regulations.

AFI 91-301 contains Air Force occupational safety, fire prevention, and health regulations governing a wide range of activities and procedures associated with safety in the workplace.

AFI 99-102 implements the Air Force's Test and Evaluation Policy. It describes planning, conducting, and reporting cost-effective Operational Testing and Evaluations to support acquisition and sustainment program decisions and actions throughout a system's life cycle.

Air Force Manual 91-201 regulates and provides procedures for explosives safety and handling. Defines criteria for quantity distances, clear zones, and facilities associated with ordnance.

American Indian Religious Freedom Act (1978), 42 USC section 1996 states that it is the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religious freedom, including but not limited to access to sites, use and possession of sacred objects, and worship through ceremonial and traditional rites.

BLM Manual Chapter 6840, U.S.D.I. Bureau of Land Management is the BLM's policy to conserve threatened and endangered species and ecosystems they depend upon primarily by prescribing management for conservation of lands these species inhabit. Similarly, it is policy to manage candidate species and their habitats to ensure that their actions do not contribute to the need to list any candidate species as threatened or endangered. It is also the policy to carry out management plans for the conservation of state-listed plants and animals. The State Director is to develop policies that will assist the state in achieving their management objectives for those species.

BLM Recreation Opportunity Spectrum (1986) provides a framework to assess and manage the recreation resource of an area.

BLM Visual Resource Management Policy and Guidelines for Lands under Wilderness Review guides assessment and documentation for BLM lands under wilderness review.

Clean Air Act (42 USC section 7401), as amended in August 1977 and November 1990, dictates that the National Ambient Air Quality Standards (NAAQS) must be maintained nationwide. The Act delegates authority to state and local agencies to enforce the NAAQS and to establish air quality standards and regulations of their own. Section 169A states that a national goal is to prevent any further impairment of visibility within federally mandated Class I areas from man-made sources of air pollution.

The United States Environmental Protection Agency Final Conformity Rule, 40 CFR 93 subpart B (for federal agencies) and 40 CRF51 subpart W (for state requirements), implements Section 176 (c) of the Clean Air Act, as amended in 42 U.S.C. 7506 (c). The Final Conformity Rule requires all federal agencies to ensure that any agency activity conforms to an approved State or Federal Implementation plan. Conformity means compliance for attaining or maintaining the NAAQS. Specifically, this means federal activity will 1) not cause a new violation of existing NAAQS; 2: not contribute to an increase in the frequency or severity of violations of existing NAAQS; or 3) not delay the timely attainment of any NAAQS milestones or attainment.

Clean Water Act of 1977, 33 USC section 1251 et seq. requires any point source waste that discharges into waters of the United States to have a National Pollutant Discharge Elimination System (NPDES) permit. Section 404 of this act regulates development in streams and wetlands and requires a permit from the U.S. Army Corps of Engineers prior to such activities.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and the Superfund Amendments and Reauthorization Act (SARA) of 1986 provide liability and compensation for cleanup and emergency response from hazardous substances discharged into the environment and the cleanup of hazardous disposal sites.

Department of Defense Directive Number 3200.11 grants the DoD permission to build and maintain Major Range and Test Facility Bases (MRTFB) to conduct testing and evaluations (T&E). Examples of T&E programs allowed by this directive are developmental T&E, operational T&E, live-fire T&E, and modeling and simulation activities. Private and commercial entities are permitted to use the MRTFB as long as there is not an increase in cost to the DoD.

Department of Defense American Indian and Alaska Native Policy was formally issued by the Secretary of Defense on October 20, 1998. The policy supports tribal self-governance and government-to-

government relations with the Federal government. It specifies that DoD will meet its trust responsibilities to tribes and will address tribal concerns related to protected tribal resources, tribal rights, and Indian lands. The policy also addresses procedures for building stable and enduring relationships with tribes. The principle and practice of meaningful consultation and communication with tribes will be fully integrated down to staff offices at the installation level. The policy also recognizes and respects the significance tribes ascribe to certain natural resources and properties of traditional or customary religious or cultural importance.

Endangered Species Act of 1973, 16 USC section 1531 et seq., as amended, protects proposed and listed threatened or endangered species. Formal consultation with the U.S. Fish and Wildlife Service is required under Section 7 of the act for federal projects and all other projects that require federal permits (e.g., U.S. Army Corps of Engineers permits) where such actions could directly or indirectly affect any proposed or listed species.

Executive Order 12088, Federal Compliance with Pollution Control Standards (1978) requires the head of each executive agency to be responsible for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution, including noise pollution, with respect to federal facilities and activities under the control of the agency.

Executive Order 12372 (Intergovernmental Review of Federal Programs) directs federal agencies to "make efforts to accommodate state and local elected officials' concerns with proposed . . . direct federal development." The executive order requires federal agencies to provide state and local officials the opportunity to comment on actions that could affect their jurisdictions, using state-established consultation processes when possible.

Executive Order 12898 (Environmental Justice) directs federal agencies to achieve environmental justice by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations in the United States and its territories and possessions.

Executive Order 13007 (Sacred Sites, 1996) directs agencies responsible for managing federal lands to, "(1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites."

Executive Order 13084 (Consultation and Coordination with Indian Tribal Governments, 1998) states, among other things:

- In formulating policies significantly or uniquely affecting Indian tribal governments, agencies shall be guided to the extent permitted by law, by principles of respect of Indian tribal self-government and sovereignty, for tribal treaty and other rights, and for responsibilities arising from the unique legal relationship between the Federal government and Indian tribal governments.
- Each agency shall have an effective process to permit elected officials and other representatives of Indian tribal governments to provide meaningful and timely input in the development of regulatory policies on matters significantly or uniquely affecting their communities.

Federal Aviation Act of 1958 created the Federal Aviation Administration (FAA) and charged the FAA Administrator with ensuring the safety of aircraft and the efficient utilization of the National Airspace System, within the jurisdiction of the United States.

Federal Aviation Regulation Part 73 (1975) defines special use airspace and prescribes the requirements for the use of that airspace.

Federal Aviation Regulation Part 91 (1990) describes the rules governing the operation of aircraft within the United States.

Federal Interagency Committee on Urban Noise (1980) defines noise levels for various land uses and may result in areas that will not qualify for federal mortgage insurance. Additional sections allow for noise attenuation measures that are often required for Department of Housing and Urban Development approval.

Hazardous and Solid Waste Amendments (HSWA) of 1984 significantly expanded the scope and requirements of Resource Conservation and Recovery Act (RCRA) and mandated the underground storage tank regulations.

Memorandum for the Heads of Executive Departments and Agencies regarding Government-to-Government Relations with Native American Tribal Governments directs each executive department and agency to operate within a government-to-government relationship with federally recognized tribal government; consult with tribal governments prior to taking actions affecting such governments; and assess the impact of plans, projects, programs and activities on tribal trust resources and assure that tribal rights are considered during consideration of such plans, projects, and programs.

Migratory Bird Treaty Act of 1972, 16 USC sections 703 through 711 protects migratory waterfowl and all seabirds by limiting the transportation, importation, killing, or possession of those birds.

National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190, 42 U.S.C. 4347, as amended) requires federal agencies to take the environmental consequences of proposed actions into consideration in their decision making process. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions.

National Historic Preservation Act of 1966 establishes National Register of Historic Places; defines Section 106 process requiring federal agencies to consider effects of an action on cultural resources on or eligible for the National Register.

National Wildlife Refuge System Administration Act provides for the acquisition, designation administration, use, and protection of lands administered by the Secretary of the Interior for the conservation of fish and wildlife, including those threatened with extinction.

Nevada Air Quality Statues (NEV. REV. STAT. 445.401-445.601) establish the state air pollution control program and grant the State Environmental Commission to set air quality standards, emission control requirements, and rules and regulations to prevent, abate, and control air pollution.

Nevada Water Pollution Control Act of 1973 (NEV. REV. STAT. 455.131-445.354) implements provisions of the Clean Water Act and regulates pollution sources of surface and groundwater; oversees construction, modification, and operation of sewage systems, and water treatment plants; and monitors distribution of drinking water supplies. The law applies to all waters, situated wholly or partly within or bordering on the state, including lakes, ponds, marshes, wells, springs, and irrigation and drainage systems. The Water Pollution Control Act established programs for executing the permit authority delegated to the state under both the Clean Water Act (permits) and Safe Drinking Water Act (groundwater protection).

Occupational Safety and Health Administration (OSHA) Asbestos Standard (29CFR 1926.58) lists federal requirements during construction activities for handling and removal of asbestos from equipment and building structures.

Protection of Historic and Cultural Properties, 36 CFR section 800 (1986) provides an explicit set of procedures for federal agencies to meet their obligations under the National Historic Preservation Act and Executive Order 11593.

Recreation Management, 43 CFR 8300 series "sets forth procedure and practices for the management and use of public lands for specific kinds of public recreation activities, resource conditions, outdoor recreation occupancy, and resource development." Guidelines are also provided regarding access to public lands and limitations on travel across public lands.

Resource Conservation and Recovery Act (RCRA) of 1976 regulates storage, transportation, treatment, and disposal of hazardous waste that could adversely affect the environment.

Solid Waste Disposal Act (SWDA) and Amendments of 1980 amends RCRA with additional regulation of energy and materials conservation and the establishment of a National Advisory Council.

Wilderness Act of 1964 requires a wilderness review of roadless areas to determine suitability for designation by Congress as a Wilderness Area.

APPENDIX B
PUBLIC PARTICIPATION AND CONSULTATION SUMMARY

PUBLIC PARTICIPATION AND CONSULTATION SUMMARY

1.0 INTRODUCTION

This document presents a summary of the public participation efforts associated with the F-22 aircraft follow-on Operational Test and Evaluation and Weapons School permanent beddown at Nellis AFB. Many opportunities have been and will be available for public participation in the F-22 Beddown environmental impact analysis process (EIAP). These include the following:

- scoping sessions and comment period;
- agency notification and consultation; and
- public hearings and comment period.

2.0 SCOPING PROCESS

The scoping period for the F-22 beddown EIAP began when the Notice of Intent was published in the *Federal Register* on August 11, 1997. The closing date for the scoping period was set for September 30, 1997. Although the receipt of public comments is most useful during the early stage of the EIAP, the Air Force stated during the scoping sessions that they would welcome comments throughout the EIS analysis and preparation process.

The Air Force's intent during the scoping process was to provide the greatest level of opportunity for government agencies, special interest groups, and the general public to learn about the Air Force's proposal and to offer several ways for those interested to express their concerns regarding the proposal. Newspaper advertisements (Attachment A) announcing the scoping sessions were place in local newspapers on these dates:

- *Tonopah Times-Bonanza and Goldfield News*: August 21
- *Lincoln County Record*, Caliente: August 21
- *Las Vegas Review-Journal*: August 11 and August 22
- *The Daily Spectrum*, St. George, Utah: August 22

A press release was sent to other regional papers and public service announcements provided to area radio stations. These efforts were undertaken to disseminate information about the proposal to the public living in the region potentially impacted by the proposal.

The scoping sessions used a combination of "open house" and formal testimony. This created a comfortable atmosphere for attendees—one in which participants could speak individually to Air Force representatives but also have their concerns officially placed on the record. During the sessions, attendees were encouraged to ask questions and provide input.

At the front door of every scoping session location, Air Force representatives greeted attendees. A "sign-in" table was placed here, and attendees were asked to write their name and address on a registration sheet. At this time, attendees were given three fact sheets (Attachment B), then directed into the presentation room. Two mounted displays were developed to enhance public understanding of the proposed beddown of F-22 aircraft at Nellis AFB:

- Proposed construction and renovation activities and personnel additions; and
- Nellis AFB and Nellis Range Complex environs, as well as airspace use.

Attendees were encouraged to examine these displays and to ask any questions they had regarding the information presented. The displays illustrated information regarding the construction, personnel, and flight activities proposed at Nellis AFB and on the number and location of F-22 flight operations proposed for the Nellis Range Complex. Air Force personnel and Air Force Center for Environmental Excellence (AFCEE) representatives encouraged attendees to examine the displays and ask questions. They were also encouraged to formulate and submit scoping comments.

There were three methods available for public comment during the scoping sessions; attendees could (1) give verbal testimony to a court reporter, (2) submit written comments (comment forms were made available), and (3) mail in letters or email comments.

Scoping sessions were held in 3 locations in southern Nevada to support the F-22 beddown proposal. The schedule for the scoping sessions and attendance are presented in Table 1.

Table 1
Schedule of Sessions and Attendance

Date	*Location*	*Attendance*
Wednesday, August 26, 1997	Convention Center 301 Brougher Tonopah, NV	6
Thursday, August 27, 1997	Dell H. Robison Middle School 825 Marion Drive Las Vegas, NV	13
Friday, August 28, 1997	Youth Center Highway 93N Caliente, NV	3

Written and verbal comments received from the general public, interest groups, and government agencies during the comment period were reviewed to summarize the scope of comments and attendance. This review was documented and included in a Scoping Summary Report distributed to applicable Air Force personnel to identify issues to be addressed in the draft environmental impact statement (EIS). The report was based on all verbal and written comments submitted through September 30, 1997. In total, seven verbal comments were recorded during the scoping meetings and 13 (12 letters and 1 email) were received by end of the scoping period.

3.0 INTERAGENCY-INTERGOVERNMENTAL COOPERATION FOR ENVIRONMENTAL PLANNING (IICEP)

As part of the environmental impact analysis process, consultation and correspondence was performed with several state and federal agencies. That correspondence included the following:

U.S. Fish and Wildlife Service (USFWS):

Memorandum from AFCEE to USFWS, State Supervisor, Reno Office, August 8, 1997

Nevada Department of Wildlife (NDOW)

Memorandum from AFCEE to NDOW, State Office, August 8, 1997

Nevada State Historic Preservation Officer (SHPO)

Memorandum from AFCEE to SHPO, August 8, 1997

Native American Interaction Program

Memorandum from Nellis AFB on August 8, 1997, to:

Paiute Indian Tribes of Utah
Pahrump Paiute Tribe
Benton Paiute Indian Tribe
Kaibab Band of Southern Paiutes
Bishop Paiute Indian Tribe
Moapa Paiute Indian Tribe
Las Vegas Paiute Colony
Big Pine Paiute Tribe of the Owens Valley
Lone Pine Paiute Shoshone Tribe
Yomba Shoshone Tribe
Duckwater Shoshone Tribe
Ely Shoshone Indian Tribe
Timbisha Shoshone Tribe
Fort Independence Indian Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe
Fort Mojave Tribe
Las Vegas Indian Center

Copies of the correspondence are presented at the end of this appendix (Attachment D).

4.0 PUBLIC HEARINGS AND COMMENTS

The public comment period for the F-22 Beddown Draft EIS will begin when the Notice of Availability is published in the *Federal Register* (anticipated June 1999). The public comment period will extend for 45 days from that date.

Advertisements announcing the hearings will be placed in same local newspapers used to announce the scoping meetings (see above). Public service announcements will be aired on regional radio stations.

The proposed format for the public hearings combines the formal hearing approach with the open house format. Prior to formal public testimony, a brief summary of the environmental process and the F-22 Beddown proposal will be presented by Air Force personnel. In addition, displays will be staffed by Air Force personnel to answer any questions the public may have regarding the proposal.

It is anticipated that public hearing attendees will again be greeted by Air Force representatives at the door where the "sign-in" table will be located. Attendees will be asked to write their name and address on the registration sheet. If they choose to testify, they will be asked to complete a speaker card with this same information. They will also be offered fact sheets and any other relevant written materials.

Two methods of commenting will be available for people attending the public hearings:

1. verbal testimony recorded by a court reporter and/or

2. written comments, either brought with them or completing a comment form provided by the Air Force.

The Air Force plans hearings in three locations: Tonopah, Las Vegas, and Caliente, Nevada.

5.0 CONCLUSION

The public participation opportunities for the F-22 Beddown EIAP were designed to fulfill the requirements of NEPA. The Air Force's intent was to ensure that any interested public was given the opportunity to review the information, ask questions, discuss concerns, and provide comments.

ATTACHMENT A

Notice of Intent

The Notice of Intent was published in the *Federal Register* on August 11, 1997. Initially, the project title was "F-22 Aircraft Follow-on Operational Testing and Evaluation and Weapons School Permanent Beddown". At the end of 1998 the project title was changed to "F-22 Aircraft Force Development Evaluation and Weapons School Beddown" to reflect a change in Air Force terminology for specific testing within the Operational Testing and Evaluation program. Force Development Evaluation tests and evaluates the aircraft and its systems, explores new flight techniques, and develops tactics. The number of aircraft, personnel, or structural additions and modifications did not change since public scoping meetings in August 1997.

NOTICE OF INTENT
TO PREPARE ENVIRONMENTAL IMPACT STATEMENT
FOR F-22 AIRCRAFT FOLLOW-ON OPERATIONAL TESTING AND EVALUATION AND WEAPONS SCHOOL PERMANENT BEDDOWN AT NELLIS AFB, NEVADA

The United States Air Force (Air Force) is issuing this notice to advise the public of its intent to prepare an Environmental Impact Statement (EIS) to assess the potential environmental impacts of a proposal to station F-22 Tactical Fighter Aircraft at Nellis AFB, NV. A total of 17 F-22 aircraft would be permanently based in phases at Nellis AFB between the years 2002 and 2010. The aircraft, to be assigned to the Operational Test and Evaluation and USAF Weapons School programs at Nellis AFB, would use the Nellis AFB Range Complex and associated airspace for the purposes of fully testing and evaluating F-22 operational capabilities and to provide training to Air Force pilots. The proposed action entails facility construction activities on Nellis AFB over a 6 year period starting in FY 1999. Approximately 370 personnel would be added to the installation between FY 2001 and 2009. Because of the unique nature of the Air Force's Fighter Weapons School at Nellis AFB, only the proposed action and the no-action alternative have been identified. If feasible alternatives are developed as part of the scoping process, they will be included in the draft EIS document. The data in this EIS will be considered in making the beddown decision and documented in the Air Force's Record of Decision addressing the proposal. A separate EIS currently being conducted by the Air Force to address Nellis Range Renewal issues, will include potential cumulative impacts of F-22 flying operations resulting from this proposed action.

The Air Force intends to hold three public scoping meetings to be held on the following dates and times at the indicated locations:

1. Convention Center, 301 Brougher, Tonopah, NV, August 26, 1997, 7:00 PM

2. Dell H. Robison Middle School, 825 Marion Drive, Las Vegas, NV, August 27, 1997, 7:00 PM

3. Youth Center, Highway 93N, Caliente, NV, August 28, 1997, 7:00 PM

These meetings are the first step in soliciting public and government agency comments on the proposed action. Comments provided at these meetings and throughout the scoping process should focus on the merits of the proposal, alternatives, and the nature and scope of environmental issues and other concerns that need to be assessed in the EIS. During the meetings, the Air Force will describe the proposed action and no-action alternative, define the process involved in preparing the EIS, and outline the opportunities for public involvement in the process. The scoping period for the F-22 Permanent Beddown at Nellis AFB EIS, will extend through September 30, 1997.

Written and oral comments will be accepted at the scoping meetings and at any time during the scoping period for the F-22 Beddown Nellis AFB EIS. To ensure the Air Force has sufficient time to consider public input in the preparation of the Draft EIS, comments should be submitted to the address below by September 30, 1997:

F-22 Aircraft Beddown, Nellis AFB, NV, EIS
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363
Phone: (210) 536-6544
FAX (210) 536-3890

ATTACHMENT B

Newspaper Advertisement

EIS Scoping Meetings for the F-22 Beddown at Nellis AFB

The US Air Force is issuing this notice to advise the public of its intent to prepare an Environmental Impact Statement (EIS) to assess the potential environmental impacts of a proposal to station F-22 Tactical Fighter Aircraft at Nellis AFB, NV. A total of 17 F-22 aircraft would be permanently based in phases at Nellis AFB between the years 2002 and 2010. The data in this EIS will be considered in making the beddown decision and documented in the Air Force's Record of Decision addressing the proposal. A separate EIS currently being conducted by the Air Force to address Nellis AF Range Renewal issues, will include potential cumulative impacts of F-22 flying operations resulting from this proposed action. The Air Force intends to hold three public scoping meetings at 7:00pm on the following dates at the

- Convention Center, 301 Brougher, Tonopah, Tues., Aug 26
- Dell H. Robison Middle School, 825 Marion Drive, Las Vegas, Wed., Aug 27
- Youth Center, Highway 93N, Caliente, Thurs., Aug 28

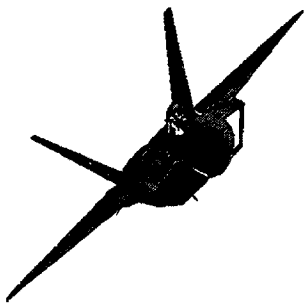
These meetings are the first step in soliciting public and government agency comments on the proposed action. Comments provided at these meetings and throughout the scoping process should focus on the merits of the proposal, alternatives, and the nature and scope of environmental issues and other concerns that need to be assessed in the EIS. During the meetings, the Air Force will describe the proposed action and no-action alternative, define the process involved in preparing the EIS, and outline the opportunities for public involvement in the process. The scoping period for the F-22 Beddown at Nellis AFB EIS, extends through September 30, 1997. Written and oral comments will be accepted at the scoping meetings and during the scoping period. To ensure the Air Force has sufficient time to consider public input in the preparation of the Draft EIS, scoping comments should be submitted by September 30, 1997 to:

F-22 Beddown at Nellis AFB EIS
HA AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363
Phone: (210) 536-6544
Fax: (210) 536-3890

Las Vegas Sun, August 22, 1997, Page 4B

ATTACHMENT C

Fact Sheets



F-22 Beddown at Nellis AFB EIS

FACTSHEET

Nellis AFB, NV

August 1997

The F-22 at Nellis AFB

As one of the first steps toward full integration of the technologically advanced F-22 Raptors into the United States' complement of fighters, the Air Force is proposing to base 17 of these sophisticated aircraft at Nellis AFB. The Air Force proposes to test and evaluate the F-22 at the Nellis Air Force Range Complex in order to ensure it meets its potential as the world's premier fighter jet. F-22s at Nellis AFB would also be used for advanced combat training at the long-established U.S. Air Force Weapons School where thousands of aircrews have received Ph.D.-level instruction in their weapons systems. Graduates of the F-22 Weapons School Division would be the experts in their units for the employment of the Air Force's newest air superiority fighter.

F-22: The Next Generation Fighter Aircraft

Although the Cold War has ended, the changing and sometimes volatile situations throughout the world have resulted in broader, more varied, and unpredictable combat situations. This is best illustrated by the varied roles the U.S. military has played in Haiti, Kuwait, Iraq, Turkey, Bosnia, and various countries across the continent of Africa. In any major regional conflict, U.S. air forces need to be flexible, adaptable, and have the capability to quickly achieve air dominance to ensure the safety and survival of both U.S. ground and air forces. An aircraft that can fly fast, undetected, far into enemy territory, and deliver an array of weaponry that can neutralize the opposition is one that can ensure this air dominance. Air superiority provides freedom *from* attack and freedom *to* attack. The F-22 achieves this air dominance through its stealth, speed, maneuverability, and weaponry.

The F-22 is integral to the complement of Air Force aircraft. Currently, other countries have fighter jets with technology and capabilities that are equal to, if not surpassing many existing U.S. aircraft. Advances in surface-to-air missiles (SAMs) and air-to-air missiles make many of the U.S. fighter aircraft more vulnerable to detection and possible destruction than ever before. The F-22 surpasses both the F-15 and F-16 in speed and maneuverability. Its advanced weaponry delivery systems and instrumentation allow it to fly undetected, far into enemy territory and deliver ordnance eliminating enemy targets in advance of ground and other air forces. This next-generation aircraft is sophisticated, responsive, flexible, and extremely difficult to detect. The F-22 ensures that the U.S. will sustain its air superiority well into the 21st century.

F-22 Beddown at Nellis AFB EIS (continued)

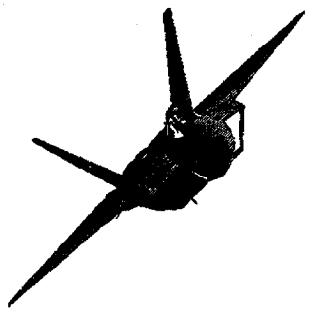
Nellis AFB and Nellis Air Force Range Complex: The Best Choice for the F-22

The choice of Nellis AFB and Nellis Air Force Range Complex is ideal because the base already has the facilities and airspace needed to test and evaluate, as well as conduct aircrew weapons training for this next generation aircraft. The Nellis AFB Air Warfare Center has the facilities, personnel, and understanding of new aircraft found no where else in the United States. In addition, the Nellis Air Force Range Complex and associated airspace, for years, have been used for testing and training and were designed to allow for a variety of testing and training elements, including supersonic flying. The addition of F-22 aircraft will only compliment these testing, evaluation, and training missions already found at Nellis AFB, Air Warfare Center and the Nellis Air Force Range Complex.

The Proposed Action

The Air Force proposes to base, in phases, 17 F-22 tactical fighter aircraft at Nellis AFB, between 2002 and 2010. The aircraft would be assigned to the Operational, Test, and Evaluation (OT& E) and Weapons School Programs at Nellis AFB. Flight activities would occur in current Nellis AFB and Nellis Air Force Range Complex airspace.

The majority of flight operations would take place during the day at subsonic speeds and at altitudes of 10,000 feet or more above ground level. By the year 2010, an estimated 4,500 testing and training flights per year would take place. These flight activities represent an increase of about 3 percent over current operations. To maintain the aircraft and accommodate the approximate addition of 370 personnel needed to support F-22 activities, some construction and remodeling of several buildings may occur at the Base.



NEPA and the F-22 at Nellis AFB

FACTSHEET

Nellis AFB, NV

August 1997

The National Environmental Policy Act (NEPA) is the umbrella law under which the Air Force, like other federal agencies, conducts analyses to determine and consider the effects of proposed training, construction, or other activities on the environment. The Air Force, therefore, is preparing an Environmental Impact Statement (EIS) on its proposal to base 17 F-22 aircraft at Nellis AFB. The aircraft would be used for further test and evaluation and for training of Air Force pilots. This action would take place in three phases over an eight-year period, with the first aircraft arriving in 2002 and the last in 2010. The action would involve flight activities in the existing Nellis Air Force Range Complex airspace. Nellis AFB has almost all the facilities needed for the F-22, so this proposal includes only limited on-base construction.

The EIS will examine the potential environmental impacts of basing F-22 aircraft at Nellis AFB and their use of the Nellis Range Complex. It will evaluate the effects this proposal might have on a wide variety of existing environmental resources. As the lead agency, the Air Force will prepare the EIS and consult with the State of Nevada, Native American tribal representatives, and federal agencies.

This NEPA process is important because it: (1) considers and presents, in a scientifically objective manner, the potential impacts of the proposed action; (2) provides this information to help public officials make decisions that are based on an understanding of these environmental consequences; and (3) discloses the full extent of the action and its environmental consequences to the public.

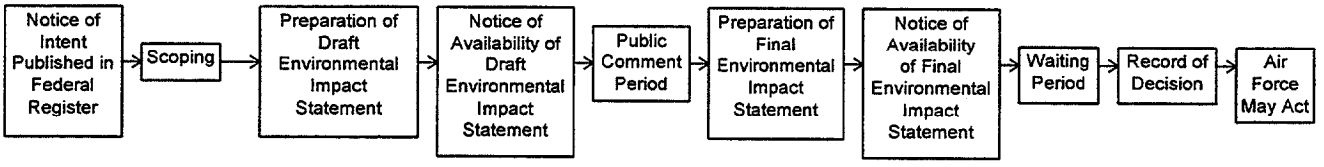
The F-22 EIS and the Public

In preparing this EIS, the Air Force will offer extensive opportunities for public involvement. Scoping sessions are the first opportunity for public involvement and are intended to solicit public input into the scope of the EIS as well as identify the issues and topics it should address. Scoping sessions are being held in three southern Nevada locations from August 26 through 28, 1997: Caliente, Las Vegas, and Tonopah. These locations were selected in an effort to reach the public that might be most affected by the proposed action.

After receiving input during these scoping sessions, the Air Force will prepare a Draft EIS and circulate it for public review and comment. At present, the Air Force anticipates that the Draft EIS will be released in the Spring of 1998. The public will have the opportunity to request a copy of the Draft EIS or a copy will also be available at public facilities such as libraries, city halls, community centers, as well as federal, state, and local government agencies. The public review and comment period for the Draft EIS will last 45 days. During this time period public hearings will be held to provide an opportunity for the public to evaluate the proposal and the adequacy of the Draft EIS.

NEPA and the F-22 at Nellis AFB (continued)

All comments received during this period will be addressed in the Final EIS and provided to the decision makers for consideration. A copy of the Final EIS will be published (anticipated late Summer 1998) and made available to the public. After allowing 30 days for public review of the Final EIS, the Air Force will publish a Record of Decision (ROD). The ROD will specify the alternative selected, how it will be implemented, and any mitigation measures that will be employed to reduce environmental impacts.



Components of the EIS

The EIS will include four main components

- A definition of the *Purpose and Need* for the proposed actions. This will explain the requirements that led to the proposal to base 17 aircraft at Nellis AFB and the reason the proposal is being pursued.

- A description of the *Proposed Action and Alternatives*, detailing the nature and scope of the proposal including on-base construction, aircraft flight activities, and personnel increases. This section also examines alternatives, such as No-Action (basing of F-22s at Nellis AFB).

- A presentation of the *Affected Environment* under its current conditions, to provide a baseline against which the potential impacts of the proposal can be assessed. The sources of this information will include the abundant, existing resource studies, analyses, and inventories performed by the Air Force and other federal, state, and local agencies concerning the Nellis area and vicinity.

- An analysis of the *Environmental Consequences* of the proposed action of basing 17 aircraft at Nellis. This component will characterize the potential impacts associated with the proposed action and alternatives so that they can be taken into consideration by the Air Force and the cooperating agencies in their decision-making processes.

Resources Considered in the EIS

As required by NEPA, this EIS will use multi-disciplinary analysis designed to provide a comprehensive view of the proposal's effects on the environment. The range of topics to be addressed will be refined by the scoping process, but will include at least the following areas:

Air Quality
Air Safety
Noise
Wetlands and Floodplains
Threatened and Endangered Species
Fish and Wildlife
Cultural and Native American Resources
Soils and Minerals
Water Resources
Land Use and Transportation
Socioeconomic Resources and Environmental Justice
Visual and Recreational Resources

NEPA and the F-22 at Nellis AFB (continued)

Milestones in the F-22 EIS Process:

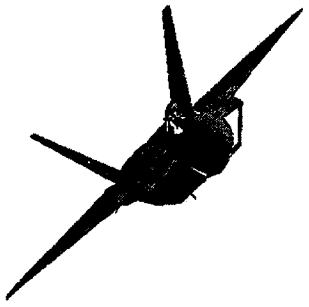
Public Scoping	Summer 1997
Draft EIS Published	Spring 1998
Public Comment Period on Draft EIS	Spring-Summer 1998
Final EIS Published	Late Summer 1998
ROD	Fall 1998

For those who wish to submit written comments during the scoping period (until September 30, 1997), please send them in care of:

F-22 Beddown at Nellis AFB EIS
Mr. Timothy Knapp
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363.
Phone (210) 536-6544
FAX (210) 536-3890

For more information about Nellis AFB and issues surrounding the proposed F-22 Beddown, please contact:

Mike Estrada
AWC/PA
4370 N. Washington, Suite 223
Nellis AFB, NV 89191-7078
Phone (702) 652-6552
Fax (702) 652-9838



F-22 Beddown at Nellis AFB

FACTSHEET

Nellis AFB, NV

August 1997

F-22 Raptor

Mission

The F-22 is an air-superiority fighter with the capability to effectively and precisely target and neutralize enemy aircraft. From the beginning of a battle, the F-22's first objective is to establish air superiority by clearing the skies of enemy aircraft and protecting U.S. aircraft and ground forces.

Features

The F-22 uses the latest in technology and materials to produce an aircraft with a low radar signature, high maneuverability, and exceptional engine performance. Knowledge gained from proven weapon systems—such as the F-15, F-16, and F-117A—formed the foundation for F-22 weapon and ordnance delivery capabilities.

Stealth: A combination of improved radar capability, visibility, and weapons provides the F-22 pilot with the ability to see the enemy first and destroy opposing targets. The F-22 possesses a sophisticated electronics package that allows the pilot to track, identify, and shoot enemy threats before they are able to detect the F-22.

Low radar profile: Technological advances in materials and equipment provide the F-22 with the ability to fly undetected into enemy territory while at the same time precisely targeting enemy aircraft and identifying ground threats such as surface-to-air missiles.

Supersonic speeds: The F-22 engines produce more thrust than any other current fighter engine. This allows the aircraft to cruise at supersonic speeds without using an afterburner. For this reason, the F-22 uses less fuel, provides more responsive maneuvering, and offers less opportunity for enemy detection.

Increased maneuverability: The F-22 has been aerodynamically designed with the ability to outmaneuver any current or projected aircraft. This ensures the F-22's air superiority for flying great distances, deep into enemy airspace, at both medium and high altitudes while at the same time delivering its lethal fire-power.

Weapons: The F-22 is capable of carrying existing and planned air-to-air weapons. In addition, it will carry the newest air-to-ground munitions, such as the Joint Direct Attack Munitions (JDAMs) and other ground-attack weapons.

F-22 Beddown at Nellis AFB (continued)

Development of the F-22

The F-22 emerged in the early 1980s when the Air Force recognized the need for a next-generation fighter aircraft. By 1984, the Air Force had defined the requirements for the F-22 (originally known as the Advanced Tactical Fighter) including supersonic flight without afterburner. A competition was held that included a 54-month demonstration/validation program whereby two prototype aircraft were designed, developed, and constructed for flight testing. This demonstration/valuation was completed in December 1990 and the prototype aircraft flown at Edwards AFB in October 1991. From this competition, the engineering and manufacturing development contract was awarded to the team of Lockheed Martin-Boeing. Pratt & Whitney engines accompanied this aircraft design. The final design of the aircraft was approved by the Air Force in 1995. The first prototypes were assembled in Lockheed's California facility and made their maiden flights there, since that time aircraft assembly operations have moved to Marietta, Georgia.

F-22 Facts

Crew:	F-22A, one crewperson; F-22B, two crewpersons
Engines:	Two Pratt & Whitney F119-PW-100 engines
Speed:	Maximum speed Mach 2
Armament:	Air-to-Air and Air-to-Ground Weapons
Wing Span:	Approximately 44 feet across
Fuselage and tail:	Approximately 65 feet long and 16 feet high
Weight:	Maximum take-off, 58,000 pounds; empty, about 30,000 pounds
Material:	42% Titanium, 35% composite, and 23% aluminum, steel, and other materials
Builder:	Boeing and Lockheed Martin Corporation

ATTACHMENT D

IICEP Letters

FORT MOJAVE INDIAN TRIBE

NORA HELTON - Chairperson
LLEWELLYN BARRACKMAN - Vice Chairman
MELBA GUERRERO - Secretary
DRUSILLA WARD - Member • GAYLE JENKINS - Member
IRIS SCERATO - Member • LELAND MCCORD - Member

500 MERRIMAN AVENUE, NEEDLES, CA 92363
(760) 326-4591 • FAX (760) 326-2468

000001

EMN-

August 18,1997

Mr. Keith Myhrer, C.R.M.
99 ABW/EM
4349 Duffer Drive, Suite 1601
Nellis AFB, NV. 89191-7007

RE: F-22 Proposal

Dear Mr. Myhrer,

The Fort Mojave Indian Tribe acknowledges the need to maintain air superiority, with advanced technologies. Based on the information provided in your recent correspondence, the Tribe does not object to the proposed project.

However, please provide a copy of the draft E.I.S once it is prepared, so our staff can determine potential impact to the Tribe. Send copies to R. Martin Bailey, at the address listed above.

Sincerely,

Nora Helton, Chairperson
Fort Mojave Indian Tribe

Copy: R. Martin Bailey

nellis.doc

RECEIVED
AUG 2 5 1997

000002

Nevada Natural Heritage Program

Department of Conservation and Natural Resources
1550 East College Parkway, Suite 145 • Carson City, Nevada 89706-7921
(702) 687-4245

19 August 1997

Tim Knapp, Project Manager
F-22 Aircraft Beddown, Nellis AFB, NV, EIS
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363

Dear Mr. Knapp:

Our program maintains a comprehensive database on sensitive species throughout the state of Nevada. We have recently added considerably to our data systems, emphasizing information in southern Nevada, as part of the Clark County multiple species planning effort.

We believe that these data will be an integral part of your EIS and look forward to working with you on this project.

Sincerely,

Glenn H. Clemmer
Program Manager

Enclosures

000007

United States Department of the Interior

FISH AND WILDLIFE SERVICE

DESERT NATIONAL WILDLIFE RANGE
1500 N DECATUR BLVD
LAS VEGAS, NEVADA 89108
(702) 646-3401

September 10, 1997

Mr. Tim Knapp, Project Manager
F-22 Aircraft Beddown,—Nellis AFB, NV, EIS
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363

Subject: Environmental Impact Statement (EIS) for the F-22 Follow-On Operational Testing and Evaluation and Weapons School Beddown, Nellis AFB, Nevada.

Dear Mr. Knapp:

We received your request for a variety of information in August, regarding the F-22 proposal at Nellis AFB, and are responding with the following comments.

First, all of the information you seek with respect to Federal or State listed species, candidate species, species of concern and potential conflicts within Nellis AFB - range and area of influence (MOA), can be found at one source... Nellis AFB, in their Environmental Management group, as they have already addressed these areas in the preparation of their withdrawal renewal process.

With respect to other appropriate comments, we would like to add, for the record, that Nellis Range overlays approximately 836,000 acres of Desert National Wildlife Range for which, an operation Memorandum of Understanding between the Air Force (Nellis) and the U.S. Fish and Wildlife Service (Desert NWR) exists, which governs Air Force operations within this area. Two additional National Wildlife Refuges exist (one within the Nellis MOA, and one adjacent to it) which are considered in Nellis' AFR and AFI documents for pilots and range uses. All of these National Wildlife Refuges have altitude and flight restrictions in-effect.

In your letter you mentioned that up to 17 sorties per day are anticipated. Nellis currently indicates their training arenas and schedules are "booked solid", so with this in mind, we might ask where you propose to put an additional flight wing?

Sincerely,

Ken Voget

Ken Voget, Project Leader
Desert Refuge Complex Office
Las Vegas, Nevada

United States Department of the Interior 000008

BUREAU OF LAND MANAGEMENT
Cedar City District Office
176 East DL Sargent Drive
Cedar City, Utah 84720
Telephone (801) 586-2401

In Reply Refer To:
UT-040

September 15, 1997

Mr. Tim Knapp
F-22 Aircraft Beddown, Nellis AFB, NV, EIS
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363

Dear Mr. Knapp:

Thank you for the opportunity to comment on the proposed EIS regarding the Follow-On Operational Testing and Evaluation and Weapons School Beddown of the F-22 Tactical Fighter Aircraft at Nellis Air Force Base. The Cedar City District of the Bureau of Land Management administers much of the land in southwestern Utah. Some of this area is within the Nellis Range Complex as shown on the map attached to your scoping letter.

We have aircraft related to fire suppression which fly seasonally in the area. We are assuming that the Letter of Agreement concerning Interagency Airspace Coordination between the BLM in Nevada and the 57th Operations Group and the 99th Range Group, Nellis AFB would be adhered to for the F-22 operations.

There are an increasing number of hangglider and paraglider operators which launch from Frisco Peak, northeast of the Nellis Range Complex (T. 26 S, R. 13W). Most of these recreationists fly to the north, but their safety should be considered in any low altitude flights.

Please contact me at (801) 865-3082 if you need further information.

Sincerely,

Gina Ginouves

Gina Ginouves
Acting District Manager

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
NEVADA STATE OFFICE
4600 KIETZKE LANE, SUITE 125C
RENO, NEVADA 89502-5055

September 23, 1997
File Nos. AF 2-4
1-5-97-SP-344

Mr. Tim Knapp
Project Manager
F-22 Aircraft Beddown
3207 North Road
Brooks AFB, Texas 78235-5363

Dear Mr. Knapp:

Subject: Notice to Prepare an Environmental Impact Statement for F-22 Beddown at Nellis Air Force Base, Nevada (ER# 97/0476).

We have reviewed the notice of intent for the preparation of an environmental impact statement (EIS) for the proposed F-22 Aircraft Follow-on Operational Testing and Evaluation and Weapons School Permanent Beddown at Nellis Air Force Base (AFB), Nevada. The proposal consists of stationing a total of 17 F-22 aircraft at Nellis AFB between the years 2002 and 2010. The Operational Test and Evaluation and U.S. Air Force Weapons School would use the Nellis AFB and the Nellis Range Complex and associated airspace to test and evaluate the operational capabilities of the F-22 aircraft. The aircraft would also be used to provide training to Air Force pilots. The proposed action includes a 6-year period of limited construction and remodeling of facilities at Nellis AFB, Nevada, starting Fiscal Year (FY) 1999. Approximately 370 personnel would be added to Nellis AFB between FY 2001 and FY 2009. Our comments and recommendations regarding issues to be addressed in the EIS are provided below.

Threatened, Endangered, and Candidate Species

We are responding to the U.S. Air Force's request for information on federally listed endangered, threatened, candidate, and proposed species which may occur in the vicinity of Nellis AFB and Nellis Range Complex. Our response will be sent under separate cover. If you have questions regarding this list, please contact Janet Bair at (702) 784-5227 (File No. 1-5 97-SP-344).

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Mr. Tim Knapp

File Nos. AF-2-4
1-5 97-SP-344

We recommend the EIS address any impacts to federally listed endangered, threatened, candidate, and proposed species as well as any species of concern to the Fish and Wildlife Service which may be affected by the F-22 beddown. Species of concern have no protection under the Endangered Species Act of 1973, as amended. However, their consideration early in the planning process may avoid future conflicts that could otherwise develop.

Wildlife Populations and Habitat

Positive and negative impacts, either direct, indirect, or cumulative, to wildlife and their habitats should be identified for each alternative. Areas with sensitive resources such as unique plant community types, wetland and riparian communities, raptor nest sites, winter and summer range for bighorn sheep, caves and abandoned mine shafts, and wildlife corridors should be examined. Descriptions of habitats should include both qualitative and quantitative information.

Negative impacts that should be addressed include, but are not limited to, destruction or alteration of breeding, nesting, cover, and foraging habitat for wildlife. Impacts resulting from facilities construction and access roads should be considered. Negative impacts to wildlife populations and wildlife habitats from air to ground ordnance releases should also be identified.

Impacts to wildlife from overflights within Nellis AFB and the Nellis Range Complex should be addressed. The EIS should address impacts of noise from overflights on wildlife, especially in those areas with known populations of birds, reptiles, and large mammals. We are concerned that noise from low-altitude flights as well as noise impacts along heavily used aircraft flight corridors may cause undue stress on wildlife populations. Impacts to the desert tortoise from low altitude flights and aircraft noise should be identified. It should also be determined if wildlife species in flight areas avoid suitable habitats because of flight noise. Some bird species are believed to underutilize suitable habitats because of low-altitude flights and may be completely driven off by frequent aircraft activity (Gladwin et al. 1988). Low-altitude flights may trigger fright/flight responses in ungulates (Gladwin et al. 1988). Impacts to bighorn sheep should be addressed, especially during calving season.

Under the Migratory Bird Treaty Act (15 U.S.C. 701-718h), active nests (nests with eggs or young) of migratory birds may not be harmed, nor may migratory birds be killed. We recommend all land-clearing activities associated with facilities construction be conducted outside of the avian breeding season. If this is not feasible, we recommend a qualified biologist survey the construction zone prior to land-clearing activities. If active nests are located, a protective buffer should be identified (the size depending on the requirements

of the species) and the entire area avoided to prevent destruction or disturbance to the nests until they are no longer active. Land clearing could take place, however, if no active nests are found.

We also have an interest in wetland and riparian ecosystems. Wetland and riparian communities should be identified within the project area, and it should be determined whether the project may include discharge of dredged or fill materials into waters of the United States, including wetlands. Such discharge is regulated by the U.S. Army Corps of Engineers (Corps) pursuant to section 404 of the Clean Water Act. We recommend the applicant contact the Corps' Reno Field Office, C. Clifton Young Federal Building, 300 Booth Street, Room 2103, Reno, Nevada, 89509, (702) 784-5304, regarding the possible need for a permit. If wetlands or waters of the United States cannot be avoided and will be filled or excavated, we recommend you contact our office. We can assist in developing mitigation and/or compensation for wildlife habitat losses.

Water Quality/Hazardous Materials

Impacts, if any, to water quality from each alternative should be addressed. This should include a discussion of impacts to surface and ground water. Potential impacts of hazardous materials on water quality should be discussed, as well response procedures if an accident involving these materials occurs.

All hazardous materials used or produced on the site should be identified. Potential impacts of these materials on fish and wildlife should be discussed. Transportation routes for hazardous materials should be identified. Any surface waters, endangered and threatened species, and species of concern occurring along these routes should be noted. The location and qualifications of personnel and equipment which would respond to transportation accidents involving hazardous materials should be identified.

Mitigation/Compensation for Impacts

We recommend the project proponent develop measures to avoid, reduce, or compensate for direct and indirect habitat losses and other negative impacts to fish and wildlife resources that would result from this project. Compensation for temporal loss of fish and wildlife resources, habitat fragmentation, and other impacts could include reclamation of other Federal lands disturbed by past activities, placement of monies into a fund for restoration, or enhancement of other disturbed areas. The EIS should discuss mitigation/compensation measures in detail.

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Mr. Tim Knapp

File Nos. AF-2-4
1-5 97-SP-344

Besides providing comments on the draft and final environmental document, we may comment on any public notice issued by the Corps for a permit pursuant to section 404 of the Clean Water Act for discharge of dredged or fill material into wetlands or waters of the United States. We may also comment on any public notice issued for a permit from the Nevada Division of Environmental Protection.

We appreciate the opportunity to provide scoping comments on this project. If you have any questions, please contact James Harvey or Mary Jo Elpers at (702) 784-5227.

Sincerely,

Chester C. Buchanan
Acting State Supervisor

cc:
District Manager, Nevada Division of Wildlife, Las Vegas, Nevada
Chief, Nevada Field Office, U.S. Army Corps Of Engineers, Reno, Nevada
Director, Office of Environmental Policy and Compliance, U.S. Department of the Interior, Washington, D.C.
Chief, Branch of Federal Activities, U.S. Fish and Wildlife Service, Arlington, Virginia
Refuge Manager, Desert National Wildlife Refuge Complex, Las Vegas, Nevada
Assistant Regional Director, Interior Basins Ecoregion, Fish and Wildlife Service, Portland, Oregon
Assistant Regional Director, Klamath and California Ecoregions, Fish and Wildlife Service, Portland, Oregon. (Attn: Merle Richmond)

000010

Mr. Tim Knapp

File Nos. AF-2-4
1-5 97-SP-344

References:

Gladwin, D.N., D.A Asherin, and K.M. Manci. 1987. Effects of aircraft noise and sonic booms on fish and wildlife: results if a survey of U.S. Fish and Wildlife Service Endangered Species and Ecological Services Field Offices, Refuges, Hatcheries, and Research Centers, NERC-88/30. U.S. Fish and Wildlife Service, National Research Center, Fort Collins, CO. 24 pp.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
NEVADA STATE OFFICE
4600 KIETZKE LANE, SUITE 125C
RENO, NEVADA 89502-5055

September 30, 1997
File No. 1-5-97-SP-344

Mr. Tim Knapp
F-22 Aircraft Beddown, Nellis Air Force Base,
Nevada, Environmental Impact Statement
HQ AFCEE/ECP
3207 North Road
Brook Air Force Base, Texas 78235-5363

Dear Mr. Knapp:

Subject: Species List for Nellis Air Force Base and Range/Airspace Complex, Clark, Lincoln, and Nye Counties, Nevada

In response to your letter to Ralph Morgenweck, Regional Director, U.S. Fish and Wildlife Service, Region 6, forwarded to this office on August 28, 1997, enclosed is a list of endangered, threatened, and candidate species which may occur in the subject areas (Enclosure A). This fulfills the requirement of the Fish and Wildlife Service to provide information on listed species pursuant to section 7(c) of the Endangered Species Act of 1973, as amended. Section 7 implementing regulations [50 CFR § 402.12(C)] require that after 90 days, the Federal agency must verify the current accuracy of a species list with the Service.

For your consideration, a list of other species of concern to the Service that may occur in the project areas is enclosed. The Service has used information from the State and other private interests to assess the conservation needs and status of these species. Further biological research and field study are needed to resolve their conservation status. One potential benefit of considering these other species of concern is that by exploring alternatives early in the planning process, it may be possible to provide long-term conservation benefits for these species and avoid future conflicts that could otherwise develop. We recommend that you contact the Nevada Natural Heritage Program [1550 East College Parkway, Suite 145, Carson City, Nevada 89710, (702) 687-4245] and the appropriate regional office of the Nevada Division of Wildlife, as well as other local, State, and Federal agencies for data on distribution and conservation needs for these and other species of concern.

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Please reference File No. 1-5-97-SP-344 in future correspondence concerning this species list. If you have any questions, please contact Janet Bair at (702) 784-5227.

Sincerely,

Allen R. Hyatt

for Robert D. Williams
State Supervisor

Enclosure

ENCLOSURE A

ENDANGERED, THREATENED, AND CANDIDATE SPECIES,
AND SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE

NELLIS AIR FORCE RANGE AND AIRSPACE COMPLEX
CLARK, LINCOLN, AND NYE COUNTIES, NEVADA

File Number: 1-5-97-SP-344
List 1 of 2
(September 23, 1997)

Birds		
T	Bald eagle	*Haliaeetus leucocephalus*
C	Mountain plover	*Charadrius montanus*
Fishes		
E	White River springfish	*Crenichthys baileyi baileyi*
E	Hiko White River springfish	*Crenichthys baileyi grandis*
E	Pahranagat roundtail chub	*Gila robusta jordani*
E	Moapa dace	*Moapa coriacea*
T	Big Spring spinedace	*Lepidomeda mollispinis pratensis*
Reptile		
T	Desert tortoise	*Gopherus agassizii*
Plant		
T	Ute ladies' tresses	*Spiranthes diluvialis*
C	Clokey's eggvetch	*Astragalus oophorus* var. *clokeyanus*

E - Endangered, T - Threatened, C - Candidate

Species of Concern

Mammals	
Pygmy rabbit	*Brachylagus idahoensis*
Spotted bat	*Euderma maculatum*
Greater western mastiff bat	*Eumops perotis californicus*
Allen's big-eared bat	*Idionycteris phyllotis*
California leaf-nosed bat	*Macrotus californicus*
Desert Valley kangaroo mouse	*Microdipodops megacephalus albiventor*
Pahranagat Valley montane vole	*Microtus montanus fucosus*
Small-footed myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Long-legged myotis	*Myotis volans*
Big free-tailed bat	*Nyctinomops macrotis*
Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*
Birds	
Northern goshawk	*Accipiter gentilis*
Western burrowing owl	*Athene cunicularia hypugea*
Black tern	*Chlidonias niger*

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Least bittern	*Ixobrychus exilis hesperis*
Ferruginous hawk	*Buteo regalis*
White-faced ibis	*Plegadis chihi*
Fishes	
Meadow Valley Wash desert sucker	*Catostomus clarki* ssp.
Moapa White River springfish	*Crenichthys baileyi moapae*
Virgin River chub	*Gila seminuda*
Moapa speckled dace	*Rhinichthys osculus moapae*
Meadow Valley Wash speckled dace	*Rhinichthys osculus* ssp.
Pahranagat speckled dace	*Rhinichthys osculus velifer*
Reptile	
Chuckwalla	*Sauromalus obesus*
Invertebrates	
Pahranagat pebblesnail	*Fluminicola merriami*
Moapa Warm Spring riffle beetle	*Stenelmis moapa*
Grated tryonia	*Tryonia clathrata*
Plants	
Merriam bearpoppy	*Arctomecon merriami*
Sheep Mountain milkvetch	*Astragalus amphioxys* var. *musimonum*
Beatley milkvetch	*Astragalus beatleyae*
Eastwood's milkweed	*Asclepias eastwoodiana*
Needle Mountains milkvetch	*Astragalus eurylobus*
Black woolypod	*Astragalus funereus*
Gilman milkvetch	*Astragalus gilmanii*
Halfring milkvetch	*Astragalus mohavensis* var. *hemigyrus*
Long-calyx milkvetch	*Astragalus oophorus* var. *lonchocalyx*
Cane Spring evening primrose	*Camissonia megalantha*
Remote rabbitbrush	*Chrysothamnus eremobius*
Welsh cryptantha	*Cryptantha welshii*
Sanicle biscuitroot	*Cymopterus ripleyi* var. *saniculoides*
Nevada willowherb	*Epilobium nevadense*
Sheep fleabane	*Erigeron ovinus*
Pahute green gentian	*Frasera pahutensis*
Kingston bedstraw	*Galium hilendiae* ssp. *kingstonense*
Maguire bitterroot	*Lewisia maguirei*
Nevada dune penstemon	*Penstemon arenarius*
Pahute Mesa beardtongue	*Penstemon pahutensis*
Bashful beardtongue	*Penstemon pudicus*
Beatley phacelia	*Phacelia beatleyae*
Parish phacelia	*Phacelia parishii*
Pygmy poreleaf	*Porophyllum pygmaeum*
Schlesser pincushion	*Sclerocactus schlesseri*

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THREATENED SPECIES AND SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE

NELLIS AIR FORCE BASE, CLARK COUNTY, NEVADA

File Number: 1-5-97-SP-344
List 2 of 2
(September 19, 1997)

Threatened Species

Reptile	
Desert tortoise	*Gopherus agassizii*

Species of Concern

Mammals	
Spotted bat	*Euderma maculatum*
Greater western mastiff-bat	*Eumops perotis californicus*
Allen's big-eared bat	*Idionycteris phyllotis*
California leaf-nosed bat	*Macrotus californicus*
Small-footed myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Long-legged myotis	*Myotis volans*
Yuma myotis	*Myotis yumanensis*
Big free-tailed bat	*Nyctinomops macrotis*
Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*
Birds	
Western burrowing owl	*Athene cunicularia hypugea*
Black tern	*Chlidonias niger*
Least bittern	*Ixobrychus exilis hesperis*
White-faced ibis	*Plegadis chihi*
Reptiles	
Banded Gila monster	*Heloderma suspectum cinctum*
Chuckwalla	*Sauromalus obesus*
Plants	
California bearpoppy	*Arctomecon californica*
Las Vegas cryptantha*	*Cryptantha insolita*

*Believed extinct

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS AIR FORCE BASE TEXAS

TO: State Historical Preservation Office

FROM: HQ AFCEE/ECP
3207 North Road
Brooks AFB TX 78235-5363

SUBJECT: Environmental Impact Statement (EIS) for the F-22 Follow-On Operational Testing and Evaluation and Weapons School Beddown, Nellis AFB, Nevada

The United States Air Force (Air Force) is in the process of preparing an Environmental Impact Statement (EIS) to assess the potential environmental impacts of a proposal to station (i.e., beddown) F-22 Tactical Fighter Aircraft permanently at Nellis Air Force Base (AFB), NV. In accordance with Executive Order 12372, Intergovernmental Review of Federal Programs, and in order to initiate Section 106 consultation, the Air Force is requesting your input on this proposal. The information in the EIS will be considered in making the determination for the Air Force's Record of Decision. The target date for completing the EIS is September 1998.

The F-22, an air dominance fighter aircraft is designed to ensure that the United States maintains air superiority well into the next century. The Air Force proposes to base, in phases, 17 F-22 aircraft at Nellis AFB between 2002 and 2010. It is estimated that six of the F-22s would be assigned to the Operational Test and Evaluation program at Nellis AFB for the purposes of conducting the next stage of testing and evaluating the operational capabilities of the aircraft. The remaining 11 aircraft would be assigned to the USAF Weapons School at the base to provide training in this next generation fighter aircraft to Air Force pilots. Flight activities would occur in current Nellis AFB and Nellis Range Complex airspace.

The proposed beddown could potentially affect two areas. The first location is the Nellis AFB installation in Las Vegas Valley where the aircraft would be based and at which they would take-off and land. To maintain the aircraft and accommodate approximately 370 additional personnel, limited construction and remodeling of buildings would occur at the base. The second area is the Nellis Range Complex and associated airspace (Attachment 1, Map), which has been used continuously by the military for many years to conduct activities similar to those envisioned for the F-22. Approximately six sorties (i.e., training flights) per day would be flown in this airspace after the initial beddown of aircraft in 2002. When the beddown is complete in 2010, an estimated 17 sorties per day will be flown by F-22. In total, the F-22s would result in a 2 to 3 percent increase in flight activities in the airspace. Existing targets in the western portion

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of the Nellis Range Complex would be used for the few annual training missions involving air-to-ground ordnance releases. Consequently, no new surface disturbance would occur as a result of the flying/training activity and beddown.

We are beginning the process of gathering information concerning previous archaeological and historical studies at Nellis AFB and its Range/Airspace Complex. This process will continue over the next several months. We would appreciate your help in retrieving this information and with the analysis of necessary future actions concerning protection of the cultural resources within the affected environment of the Proposed Action and potential alternatives. We would also like to receive information on any concerns relating to cultural resources you may have associated with this project.

We would appreciate receiving any comments or information within 30 calendar days of receipt of this letter. Responses should be sent directly to:

Mr. Tim Knapp, Project Manager
F-22 Aircraft Beddown, Nellis AFB, NV, EIS
HQ AFCEE/ECP
3207 North Road
Brooks AFB, TX 78235-5363

For your information, we will also conduct three scoping meetings to outline the F-22 beddown proposal and solicit input from the general public, government agencies, and other interested parties. The dates, times, and locations for these meetings are shown in Attachment 2. Their purpose is to explain the proposed action and a No-Action alternative, describe the process involved in preparing the EIS, and obtain information on potential issues that need to be addressed in the EIS. You are also invited to participate in these meetings.

Your cooperation and input into this planning process will be greatly appreciated. Additional information on the project can be provided to you by Mr. Knapp, at (210) 536-6544 or via E-mail at tknapp@afceeb1.brooks.af.mil.

William A. Myers

WILLIAM A. MYERS, AICP
Chief, Environmental Planning Division
Environmental Conservation & Planning Directorate

Attachments:
1. Map of Area of Potential Effect
2. Scoping Schedule

APPENDIX C
THE ANALYSIS OF HISTORICAL AIRCRAFT SORTIE DATA AND THE PROJECTION OF A RANGE OF FUTURE AIRCRAFT OPERATIONS AT THE NELLIS RANGE COMPLEX

ANALYSIS OF HISTORICAL AIRCRAFT SORTIE DATA AND PROJECTION OF A RANGE OF FUTURE AIRCRAFT OPERATIONS AT THE NELLIS RANGE COMPLEX

INTRODUCTION

Aircraft operations over the Nellis Air Force Range (NAFR) and within the Nellis Range Complex (NRC) have historically varied, depending on many factors including international events, congressional funding, training needs, and operational test and evaluation requirements. It is anticipated that future aircraft operations would be expected to vary in response to this wide range of factors. Various organizations within the Air Force also maintain independent records of aircraft operations within the NRC to support their needs and requirements. The Air Force conducted a detailed, comprehensive review of aircraft operations within the NRC from 1991 through 1995 (the 2001 Utilization Study) to support this EIS.

An independent evaluation of the various records of aircraft operation within the NRC covering annual operations outside of the years covered by the 2001 Utilization Study was completed in order to support the F-22 EIS and the NAFR Withdrawal LEIS and to develop a basis for projections of annual sorties by aircraft by airspace subdivision. This appendix summarizes this evaluation and includes descriptions of the data reviewed, a display of the data collected and analyzed, a process for normalizing the available data, a methodology for distributing aircraft sorties over the NRC, and a projection of the range of yearly NRC aircraft operations (for a projected low-use year and a high-use year).

REVIEW OF EXISTING SORTIE DATA

Several different sources of aircraft sortie data were collected and reviewed in an effort to establish a consistent summary of NRC use since 1983. Because of administrative limitations on how long operational records are maintained, it was necessary to examine both historical records from various Air Force organizations and environmental reports for documentation on past NRC use. Table 1 summarizes the sortie data from several sources.

Since the existing sortie data were collected for the specific purposes of the individual organizations, there are differences and inconsistencies among the various data sets. Differences between the data sets can be attributed to the following:

- Specific purposes and requirements of the tracking organization can lead to different methods of sortie counting. For example, data shown in Table 1 under "Other Sources" (obtained from past environmental assessments and from 57th FW operational data) reflect the number of complex-wide range sortie missions, for which one mission into the NRC is counted as one sortie, rather than counting each operation within each NRC airspace subdivision. For the other organizations identified in Table 1, the sorties were counted once for *each* of the airspace subdivisions flown during a single mission into the NRC. This difference in methodology accounts for the higher numbers shown for the 2001 Utilization Study, Range Group Scheduling, the HQ-AFSA/XATF RAPCON records and the 99th OSG History. (Range Group Scheduling is also the source of the 99th OSG history records.)

Table 1. Summary of Annual NRC Sortie Data 1983-1997

Year	*2001 Utilization Study*	*Range Group Scheduling*	*Air Traffic Activity HQ AFSA/XATF RAPCON*	*99th OSG History Records*	*Other Sources*
1983					65,866 FY(1)
1984					71,122 FY(1)
1985					69,524 FY(1)
1986				200,089 CY	69,279 FY(1)
1987			360,758 CY		69,771 FY(1) 241,019 FY(2)
1988			319,741 CY	199,734 FY	196,824 FY(2)
1989			334,449 CY	259,289 FY	
1990			311,258 CY	208,424 CY	
1991	*268,511 CY	251,808 FY	248,893 CY	(same as Range Scheduling data)	
1992	*236,905 CY	259,185 FY	255,106 CY	"	
1993	*239,682 CY	213,413 FY	240,402 CY	"	
1994	*222,627 CY	198,490 FY		"	*64,993 CY(3)
1995	*230,573 CY	**181,014 FY	242,116 CY	"	*61,165 CY(3)
1996		***186,233 FY	207,293 CY	"	*66,843 CY(3)
1997		****255,025 FY			*24,419 CY(3)

Notes: 1. Final Environmental Assessment, R-4807 Expansion, May 1989
2. 1989 Airspace Management Briefing
3. Sortie data provided by 57th FW Operations (Complex wide)
* Data set is available by aircraft type.
** Partial fiscal year – data were not available for August and September 1995.
*** Partial fiscal year – data were not available for October 1995.
**** Range Scheduling began tracking four additional subdivisions (Pahute Mesa, R-4808 E&W, and R4809A)

- Some data sets are reported by calendar year (CY) while others are reported by fiscal year (FY), as indicated in the table. This fact can account for significant differences in yearly totals if a Red Flag, other large force exercises or changes in operations tempo occurred during the October-December quarter.

- Aircraft realignments, unit activation/deactivations, reductions in force and flying hours, budget constraints, and other such actions since the late 1980s have affected the number and type of aircraft using the NRC. The number of Flag exercises and participants has declined in recent years. Deactivation of the 474th TFW resulted in removal of 66 F-16s from Nellis. Other realignments included beddown of 5 F-15Es, conversion from 20 F-5s to 18 F-16s, relocation of F-117s to Holloman AFB, and relocation of F-4Gs to Nellis and their subsequent deactivation. The TAC and SAC merger, use of more precision guided weapons, and other considerations have also changed the composition of mission packages.

- The number of subdivisions tracked may vary depending upon the organization (e.g., Range Group Scheduling). Further, since airspace subdivisions may be established or disbanded at the convenience of the Air Force (i.e., without formal coordination with the FAA or other agencies) the number and location of internal boundaries of subdivisions and may change over time.

- The years for which sortie data were available differed among the various data sources.

Because of the above differences, the 2001 Utilization Study and the Range Group Scheduling data sets were found to be the only sources sufficiently consistent and comprehensive for estimating NRC airspace use for the purposes of the EIS. However, there are several differences in how these two sources accounted for the NRC sorties:

- The 2001 Utilization Study was prepared as a special effort for calendar years 1991-1995 and was based on extensive research of different range data sources and organizational records to determine sorties flown by aircraft type. The data accounted for 21 NRC airspace subdivisions that included the north and south range areas, 4 MOA sectors, as well as Pahute Mesa, R-4808 E, R-4808 W, and R-4809A. Sorties were counted once for each of the airspace subdivisions flown during a range mission. An estimate of the number of subdivisions flown during a Red Flag mission was made in the study. Red Flag (RF) factors of zero, one, five or ten were applied for each Red Flag participant depending upon aircraft type. No distribution of sorties by airspace subdivision was made for Red Flag participants. Some specific details on how the 2001 Utilization Study data were assembled are not available, but information from the other sources helped to validate the general reliability of the 2001 Utilization Study data. Table 2 summarizes the 2001 Utilization Study data. The complete 2001 Utilization Study data tables are presented in Tables 8 through 12.

- The Range Group Scheduling office tracked and reported use of the NRC by accounting for *actual* sorties flown by organization by fiscal year within 17 of the 21 airspace subdivisions prior to October 1996. (No aircraft type data was available.) The four airspace subdivisions (Pahute Mesa, R-4808E, R-4808W, and R-4809A) were not tracked until October 1996.

Starting in August 1997, tracked R-4808E and R-4808W as one subdivision. Flying organizations provide daily updates to the office that reflect sorties flown during the previous day's range schedule. While these data are reliable, they only track military test and training sorties and do not include civil/commercial flights. Further, Red Flag and Green Flag organizations list extensive use of 11 to 14 airspace subdivisions and moderate annual use of up to four additional subdivisions from 1995 through 1997 (See Tables 13, 23 and 36). An additional data anomaly to be considered is the lack of data for August, September, and October 1995 and the omission of this data from the FY95 and FY96 totals which results in the total for CY 1995 being significantly lower than other years. Table 3 present Range Group Scheduling data by calendar year for 1995 through 1997. Following "normalization" of assumptions (to account for the differences in the subdivisions and aircraft types covered) this data would correspond with 2001 Utilization Study calendar year data. (Data for years before 1995 were no longer on file).

The Range Scheduling data for 1995 through 1997 are organized by military organization and are used to document how airspace subdivisions were used by each organization. Once an aircraft leaves Nellis AFB-controlled airspace, Range Scheduling charges the organization for airspace subdivisions reserved. The airspace subdivisions are then recorded. If an aircraft actually uses fewer subdivisions, the change is not registered in Range records. This could explain why the 2001 Utilization Study elected to use what constitutes an average of 10 airspace subdivisions for most large force exercise aircraft. (Range Scheduling lists 11-14 sortie-operations for airspace subdivisions with heavy use and up to 18 subdivisions affected per Flag aircraft). Breakout by aircraft types by airspace subdivision is not provided by Range Scheduling. The type of aircraft flown per organization is not readily available from historical records. This is especially the case where the "organization" is Red Flag.

NORMALIZED RESULTS

No single data source or combination of sources currently available contain sufficient detail to comprehensively construct an accurate accounting of past NRC use by aircraft type and by airspace subdivision as presented in the 2001 Utilization Study. This is primarily due to the administrative limitations on the length of time records are maintained and because tracking requirements by any one organization do not fully account for all range users by aircraft type and by airspace subdivision. In addition, it is not likely that previous data needs or requests had required the compilation of range use data as was accomplished for the 2001 Utilization Study.

In an effort to evaluate the most recent NRC use data (for 1995 through 1997), the Range Group Scheduling monthly data were normalized so that the data could be compared with data in the 2001 Utilization Study. The results are presented in Table 4.

Table 2. NRC Sortie Data CY91-95 by Subdivision — 2001 Utilization Study						
Subdivision	*1991*	*1992*	*1993*	*1994*	*1995*	*Average*
Desert MOA						
Caliente	12,782	11,969	14,110	14,120	11,372	12,871
Coyote	7,789	7,933	8,039	7,837	6,292	7,578
Elgin	13,862	10,610	11,350	10,023	8,775	10,924
Reveille MOA	8,106	8,133	7,577	7,583	6,060	7,492
R 4806						
R61	4,105	3,740	4,911	3,704	3,660	4,024
R62	5,504	5,194	6,383	5,195	5,281	5,511
R63	4,430	4,280	6,491	5,487	5,538	5,245
R64	7,474	7,149	8,531	6,687	6,718	7,312
R65	7,113	6,019	7,858	6,448	6,814	6,850
Alamo	4,685	4,380	5,415	4,742	4,294	4,703
R 4807						
EC South	7,744	5,311	5,686	4,771	6,478	5,998
Pahute Mesa	5,983	5,470	5,287	5,063	5,981	5,557
R71	8,464	5,493	4,687	4,499	6,953	6,019
R74	7,314	6,886	6,649	6,572	9,583	7,401
R75	7,648	6,853	6,240	6,044	9,977	7,352
R76	10,922	8,950	7,751	6,617	8,247	8,497
R 4808						
R4808E	4,988	4,987	5,126	4,328	4,910	4,868
R4808W	5,961	5,438	5,965	5,420	6,400	5,837
R4809A	2,321	2,321	2,321	1,821	2,905	2,338
EC East	6,826	5,503	5,712	6,308	6,479	6,166
EC West	9,509	7,179	7,849	7,379	7,536	7,890
Subtotal[1]	153,530	133,798	143,938	130,648	140,253	140,433
Red Flag Total	114,981	103,107	95,744	91,979	90,320	99,226
Grand Total	**268,511**	**236,905**	**239,682**	**222,627**	**230,573**	**239,660**

Note: 1. Subtotal of sorties in the above subdivisions.

Table 3. NRC Sortie Data CY95-97 by Subdivision -- Range Group Scheduling

Subdivision	*Partial CY 95*[1]	*Partial CY 96*[2]	*CY 97*
Desert MOA			
Caliente	15,978	21,841	18,221
Coyote	13,642	17,890	13,882
Elgin	13,480	20,066	14,534
Reveille MOA	13,444	17,265	13,734
R 4806			
R61	3,701	4,537	4,266
R62	3,108	4,809	4,357
R63	3,227	4,930	4,160
R64	3,079	4,640	4,223
R65	4,092	5,936	5,179
Alamo	4,075	5,378	4,275
R 4807			
R71	12,843	16,955	13,460
R74	13,131	17,492	13,610
R75	13,367	17,591	13,490
R76	13,060	17,326	13,644
EC South	12,788	17,067	13,556
Pahute Mesa[2]		5,157	13,157
R 4808			
R4808E[2]		479	5,804
R4808W[2]		5,145	8,208
R4809A[2]		4,721	12,863
EC East	13,312	17,577	13,590
EC West	13,242	17,446	13,520
Total	**169,569**	**244,248**	**221,733**

Notes: 1. Partial CY 95 Data not available for August, September and October.
2. Partial CY 96 Data collected in October, November & December only for R4808E, R4808W, Pahute Mesa, R4809A

Table 4. Normalized NRC Monthly Sortie Data CY95-97 by Subdivision — Range Group Scheduling (Page 1 of 2)

Subdivision	*1995*[1]	*1996*[2]	*1997*[3]	*Average*
Desert MOA				
Caliente	15,978	21,841	18,221	
Coyote	13,642	17,890	13,882	
Elgin	13,480	20,066	14,534	
Reveille MOA	13,444	17,265	13,734	
R 4806				
R61	3,701	4,537	4,266	
R62	3,108	4,809	4,357	
R63	3,227	4,930	4,160	
R64	3,079	4,640	4,223	
R65	4,092	5,936	5,179	
Alamo	4,075	5,378	4,275	
R 4807				
R71	12,843	16,955	13,460	
R74	13,131	17,492	13,610	
R75	13,367	17,591	13,490	
R76	13,060	17,326	13,644	
EC South	12,788	17,067	13,556	
Pahute Mesa	0	5,157	13,157	
R 4808				
R4808E	0	479	5,804	
R4808W	0	5,145	8,208	
R4809A	0	4,721	12,863	
EC East	13,312	17,577	13,590	
EC West	13,242	17,446	13,520	
MOAs, 60 & 70 Ranges	169,569	228,746	181,701	
4808, 4809 & PM	0	15,502	40,032	
Subtotal	169,569	244,248	221,733	

Table 4. Normalized NRC Monthly Sortie Data CY95-97 by Subdivision — Range Group Scheduling (Page 2 of 2)

Subdivision	*1995*[1]	*1996*[2]	*1997*[3]	*Average*
Adjustments				
MOAs, 60 & 70 Ranges	0	0	0	
Aug, Sept & Oct [4]	56,523	0	0	
R4808, 4809 & PM [5]	47,090	38,645	0	
Military Aircraft				
MOAs, 60 & 70 Ranges	226,092	228,746	181,701	212,180
R4808, 4809 & PM	47,090	54,147	40,032	47,090
Military Aircraft	273,182	282,893	221,733	259,269
Civilian/Commercial [6]	19,161	19,161	19,161	19,161
Grand Total CY	292,343	302,054	240,894	278,430

Notes: 1. Partial CY 95 data. Data not available for August, September and October 1995 and no data available for R 4808E and 4808W, R4809 and Pahute Mesa.
2. Partial CY 96 data. Data for R 4808E and 4808W, R4809 and Pahute Mesa collected in October, November & December 1996 only.
3. Full CY 97 data.
4. Prorated from 1995 annual total for nine months.
5. CY 95 value for R4808, R4809 and Pahute Mesa is average of 96 and 97 data. CY 96 value is increased by 75% of the average 96 and 97 data.
6. B-737, Cessna and Small Props — Average from 2001 Utilization Study (CY 91-95).

The normalization procedure involved the following adjustments:

For CY 95:

- Data were not available for August, September and October. The data for the rest of year was presumed to be representative for these three months. The annual total was therefore prorated based on the nine months of available data.
- Data for subdivisions R-4808 E, R-4808-W and R-4809 and Pahute Mesa were not available. An estimate of the military sorties for these subdivisions was calculated by averaging the sorties for these subdivisions for CY96 and CY97.
- Civilian and commercial flights were estimated from the 2001 Utilization Study (average of 5 years) to be 19,161 per year.

For CY 96:

- Data for subdivisions R-4808 E, R-4808-W and R-4809 and Pahute Mesa were prorated from three months to a full year. Since there were three Red Flag exercises during the year, this proration was reduced by the number of Red Flag sorties associated with these subdivisions for one Red Flag exercise (approximately 7,860 sorties).
- Civilian and commercial flights were estimated from the 2001 Utilization Study (average of 5 years) to be 19,161 per year.

For CY 97:

- Civilian and commercial flights were estimated from the 2001 Utilization Study (average of 5 years) to be 19,161 per year.

PROJECTIONS OF FUTURE AIRCRAFT OPERATIONS AND DISTRIBUTION METHODOLOGY

Based primarily on an examination of the 2001 Utilization Study data and the Range Group Scheduling office data, a range of from 200,000 to 300,000 subdivision sorties per year, including Flag operations, is considered a reasonable, bracketing range of sorties for the purposes of this EIS.

A method was developed for creating a distribution of aircraft over the 21 airspace subdivisions of the NRC. This distribution then permits calculating the number of sorties by aircraft type by airspace subdivision for a given total number of sorties. The procedure is as follows:

- As a starting point, the CY 95 distribution from the 2001 Utilization Study was used because it represents the most complete data set available for the numbers of sorties by aircraft type and by airspace subdivision. (An annual total of 230,573 sorties were identified in this study). See Table 12.

- Because of the retirement of certain aircraft types, a revised table was created in which the F-111 sorties were added to the F-15 sorties to simulate the replacement of F-111s by F-15Es. Likewise the F-4 sorties were added to the F-16 sorties as the transfer of the SEAD mission of F-4s was moved to F-16s.

- Ratios of the number of each aircraft type in each airspace subdivision to the total number of sorties were calculated.

- For the Red Flag aircraft, for which no airspace subdivision use by aircraft type data was provided in the 2001 Utilization Study, a distribution was developed for each aircraft type depending upon its Red Flag factor given in the 2001 Utilization Study. See Table 5. As above, ratios of the number of each Red Flag aircraft type in each airspace subdivision were calculated.

- The above distributions were then applied to the total numbers of non-Red Flag and Red Flag aircraft separately to produce tables of aircraft type by airspace subdivision.

- The non-Red Flag and Red Flag sortie distributions tables are then added to form the combined sortie distribution table for a given total number of sorties.

The application of the above distribution methodology for these low and high limits result in Tables 6 and 7, respectively. These tables present the calendar year number of sorties into each airspace subdivision by aircraft type, using the modified CY 95 distribution based on 2001 Utilization Study data.

Table 5. Red Flag Sortie Distribution by Airspace Subdivision

Subdivision	Red Flag Factor 1	5	10
	Percentage Distribution		
Desert MOA			
Caliente	100%	40%	15%
Coyote	0%	20%	10%
Elgin	0%	20%	5%
Reveille MOA	0%	20%	10%
R 4806			
R61	0%	0%	0%
R62	0%	0%	0%
R63	0%	0%	0%
R64	0%	0%	0%
R65	0%	0%	0%
Alamo	0%	0%	0%
R4807			
EC South	0%	0%	1%
Pahute Mesa	0%	0%	0%
R 71	0%	0%	5%
R 74	0%	0%	17%
R 75	0%	0%	13%
R 76	0%	0%	13%
R 4808			
R 4808W	0%	0%	6%
R 4808E	0%	0%	0%
R 4809			
EC East	0%	0%	3%
EC West	0%	0%	2%
Total	100%	100%	100%

Table 6. Projected NRC Distribution by Aircraft Type and Subdivision -- 200,000 Sorties Annually

		AV-8	A-10	B-1	B-2	B-52	C-130	C-141	E-3	EA-6B	F-14
Desert MOA											
	Caliente	138	69	541	10	93	836	101	162	471	311
	Coyote	104	83	377	7	69	419	50	1	235	175
	Elgin	120	92	194	3	46	417	50	2	236	151
Reveille MOA		102	71	381	7	67	419	50	1	235	170
R 4806											
	R61	79	988	7	2	23	4				2
	R62	97	1,156	7	2	23	4				2
	R63	19	1,139	7		21	7				2
	R64	78	1,164	7	2	23	5				1
	R65	81	1,187	7	2	23	8				1
	Alamo	97	1,148	5	2	23	5				1
R4807											
	EC South	27	526	67	1	24	1				53
	Pahute Mesa	22	149	36	1	15	1				42
	R 71	66	517	197	3	46				1	109
	R 74	150	123	603	13	97	1		1		274
	R 75	132	212	472	10	80	1				222
	R 76	126	559	462	9	80	1			1	222
R 4808											
	R 4808W	73	189	229	5	39	2				120
	R 4808E					3					
R 4809			2								
	EC East	42	134	143	4	35	1				80
	EC West	45	149	105	2	28	1		1		66
Total		1,598	9,659	3,848	84	854	2,133	252	167	1,179	2,002

		F-15	F-16	F-18	F-111	F-117	KC-10	KC-135	Mirage	mall Prop	Tornado	Helos	Other	Airspace Subunit Total	Airspace Total
Desert MOA															49,884
	Caliente	6,803	11,232	948		26	26	883	333	54	5	250	127	23,420	
	Coyote	3,995	6,819	533		16	13	444	225	26	45	225	81	13,943	
	Elgin	3,716	6,214	484		9	13	443	111	26	3	128	62	12,521	
Reveille MOA		4,002	6,668	530		17	13	443	225	31	47	181	82	13,746	13,724
R 4806															28,021
	R61	562	1,314	29		2		2		1		158	2	3,175	
	R62	716	1,488	38		2		3		1		173	868	4,581	
	R63	774	1,716	37		3		1				211	868	4,804	
	R64	641	1,505	40		2		1				188	2,171	5,827	
	R65	654	2,856	36		2		2		8		177	868	5,910	
	Alamo	716	1,504	45		2		2				176		3,725	
R4807															75,999
	EC South	1,250	3,214	125		3		3	25	2	46	85	885	6,334	
	Pahute Mesa	1,421	2,849	128				1				70	455	5,188	
	R 71	2,111	4,806	286		9		3	114		43	62	1,234	9,607	
	R 74	5,699	9,732	782		28		2	380	347	46	954	1,239	20,470	
	R 75	4,790	8,473	642		21		2	291	347	41	947	1,267	17,951	
	R 76	3,894	7,914	605		22		3	291	347	46	104	1,763	16,450	
R 4808															14,101
	R 4808W	2,724	5,019	340		10		3	133		4	76	875	9,842	
	R 4808E	435	434								41	1,174	2,172	4,259	
R 4809		163	266							347		441	1,301	2,520	18,252
	EC East	2,303	4,198	239		5		2	69	347	46	97	19	7,765	
	EC West	1,961	3,893	198		3		1	47	2	46	100	1,321	7,967	
Total		**49,329**	**92,116**	**6,065**		**182**	**65**	**2,244**	**2,244**	**1,885**	**460**	**5,977**	**17,659**	**200,000**	**200,000**

Table 7. Projected NRC Distribution by Aircraft Type and Subdivision – 300,000 Sorties Annually

		AV-8	A-10	B-1	B-2	B-52	C-130	C-141	E-3	EA-6B	F-14
Desert MOA											
	Caliente	207	103	813	16	140	1,254	151	243	707	466
	Coyote	156	125	566	10	104	628	75	1	353	263
	Elgin	179	139	291	5	70	626	75	3	354	226
Reveille MOA		154	107	571	10	100	628	75	1	353	255
R 4806											
	R61	118	1,483	10	3	34	7				3
	R62	146	1,736	10	3	34	7				3
	R63	29	1,708	10		31	10				3
	R64	117	1,476	10	3	34	8				1
	R65	121	1,780	10	3	34	12				1
	Alamo	146	1,721	8	3	34	8				1
R4807											
	EC South	41	788	100	1	36	1				79
	Pahute Mesa	33	224	53	1	22	1				62
	R 71	99	776	296	5	68				1	164
	R 74	225	184	905	19	145	1		1		410
	R 75	198	318	708	15	119	1				334
	R 76	189	839	693	14	121	1			1	334
R 4808											
	R 4808W	110	284	343	8	58	3				181
	R 4808E					4					
R 4809			3								
	EC East	63	201	215	6	53	1				120
	EC West	67	224	158	3	41	1		1		98
Total		2,398	14,489	5,772	126	1,282	3,199	377	251	1,768	3,004

		F-15	F-16	F-18	F-117	KC-10	KC-135	Mirage	mall Prop	Tornado	Helos	Other	Airspace Subunit Total	Airspace Total
Desert MOA														74,826
	Caliente	10,204	16,849	1,421	40	39	1,325	500	81	8	374	190	35,130	
	Coyote	5,992	10,228	800	25	20	666	337	39	68	337	121	20,915	
	Elgin	5,574	9,320	725	14	20	665	167	39	5	193	92	18,782	
Reveille MOA		6,003	10,002	975	26	20	665	337	47	70	272	122	20,613	20,613
R 4806														42,032
	R61	843	1,971	44	3		3		1		237	3	4,762	
	R62	1,075	2,233	57	3		4		1		259	1,302	6,871	
	R63	1,161	2,574	56	4		1				316	1,302	7,206	
	R64	962	2,257	60	3		1				282	3,257	8,741	
	R65	981	4,285	55	3		3		12		265	1,302	8,866	
	Alamo	1,073	2,256	68	3		3				264		5,587	
R4807														113,999
	EC South	1,874	4,822	187	4		4	37	3	69	128	1,327	9,501	
	Pahute Mesa	2,131	4,274	191			1				105	682	7,782	
	R 71	3,166	7,209	429	14		4	170		65	92	1,851	14,410	
	R 74	5,848	14,598	1,173	42		3	570	520	69	1,431	1,858	30,704	
	R 75	7,185	12,709	962	32		3	437	520	61	1,421	1,901	26,926	
	R 76	5,841	11,871	908	33		4	437	520	69	156	2,644	24,675	
R 4808														21,152
	R 4808W	4,087	7,528	511	15		4	200		7	114	1,313	14,763	
	R 4808E	653	651							61	1,762	3,258	6,388	
R 4809		245	399						520		661	1,952	3,780	27,378
	EC East	3,454	6,297	359	7		3	104	520	69	146	29	11,648	
	EC West	2,941	5,840	296	5		1	71	3	69	150	1,982	11,951	
Total		73,994	138,174	9,097	273	98	3,361	3,366	2,827	690	8,966	26,488	300,000	300,000

Table 8. NRC CY91 Sortie Data by Aircraft Type and Subdivision -- 2001 Utilization Study

	A-4	A-6	A-7	AV-8	A-10	B-1	B-2	B-52	C-12	C-130	C-141	C-160	CESSNA	E-3	EA-6	F-4
Alamo		13	26	84	1,004		11	1		1						152
Caliente	4	47	47	76	66	54	50	316	1						4	129
Coyote	3	38	26	50	44	58	62	329		1					2	49
ECE		14		4	18	50	62	329		1					2	626
ECS		8	1	6	345			243		150			5		4	1,342
ECW		12			38	50	53	329	8						4	653
Elgin	4	39	21	30	175			118							2	188
Pahute Mesa		16	24	70	44	9	12	195					12		3	16
R4808E						50	50	110	450	500						
R4808W		16		38	42	5	12	259		300			25		4	537
R4809A									250	500						
R61		4	18	56	836		12	1					12			148
R62		13	26	84	1,020		12	1					12			148
R63		12	29	36	554			1		2						108
R64		1	16	84	1,168		12			500						152
R65			56	84	1,075		12			500			12			148
Reveille	3	34	33	50	28	52	50	214		1			14		4	24
R71		8	10		464	3	1	248	4	11			4		4	1,435
R74		18	28	86	44	61	62	331	250	1					4	58
R75		18	16	48	77	59	62	331	250	1			3		4	727
R76	14	11		6	334	68	50	338	254	500			16		4	1,351
Subtotal:	*28*	*322*	*377*	*892*	*7,376*	*519*	*585*	*3,694*	*1,467*	*2,969*	*0*	*0*	*115*		*45*	*7,991*
RF Sorties:	0	88	141	473	631	77	0	335	0	396	30	25	0	231	46	377
RF Factor:	10	10	10	10	10	10	10	10	5	5	5	5	5	1	5	10
RF Total:	*0*	*880*	*1,410*	*4,730*	*6,310*	*770*	*0*	*3,350*	*0*	*1,980*	*150*	*125*	*0*	*231*	*230*	*3,770*

Nellis Range Complex Utilization - 1991

	F-5	F-14	F-15	F-16	F-18	F-86	F-111	F-117	HELO	KC-10	KC-135	OV-10	RF-4	T-38	U-2	Other	Total
Alamo	4	70	638	1,946	92	4	56	92	159					15		321	*4,685*
Caliente	20	206	3,478	4,184	310		114	3,180	147	3	23		207	129		7	*12,782*
Coyote	4	64	1,187	1,302	130		219	3,254	223		17		210	82		439	*7,789*
ECE		4	609	677	92		207	3,333	150		17		211	36		384	*6,826*
ECS		4	150	532	72		158	3,258	61		17		239	70		1,079	*7,744*
ECW			1,221	1,313	77		199	3,305	164		17		209	74		1,783	*9,509*
Elgin	42	152	3,769	5,528	298	3	54	3,158	154		4		5	144		16	*13,862*
Pahute Mesa		20	367	498	80		154	3,275	18		15		205	68		882	*5,983*
R4808E			500	500			50	1	101							2,676	*4,988*
R4808W		4	178	335	80		99	2,427	11		17		167	64		1,341	*5,961*
R4809A									71							1,500	*2,321*
R61	4	70	562	1,751	85	5	52	67	20				1	17		388	*4,105*
R62	4	71	620	1,865	93	6	60	67	70				1	16		1,319	*5,504*
R63		75	633	1,614	55	2	164	3	128				1	7		1,006	*4,430*
R64		70	561	1,634	71	3	53	64	148				1	16		2,920	*7,474*
R65		70	584	2,868	64	4	73	67	188				11	16		1,281	*7,113*
Reveille		54	1,091	1,156	134		198	4,238	35		8		208	209		268	*8,106*
R71			181	612	104		122	4,227	15		17		253	184		557	*8,464*
R74		32	568	680	112		217	3,393	128		17		211	72		941	*7,314*
R75		20	394	587	100		217	3,523	38		17		211	74		871	*7,648*
R76			210	630	76		207	3,910	87		17		217	135		2,487	*10,922*
Subtotal:	*78*	*986*	*17,501*	*30,212*	*2,125*	*27*	*2,673*	*44,842*	*2,116*	*3*	*203*		*2,568*	*1,428*	*0*	*22,466*	*153,530*
RF Sorties:		0	2,731	4,393	245	0	799	0	0	0	361	163	571	0	22	0	
RF Factor:	10	10	10	10	10	10	10	10	5	5	5	10	10	10	10	5	
RF Total:	*0*	*0*	*27,310*	*43,930*	*2,450*	*0*	*7,990*	*0*	*0*	*0*	*1,805*	*1,630*	*5,710*	*0*	*220*	*0*	*114,981*
															Grand Total:		*268,511*

Table 9. NRC CY92 Sortie Data by Aircraft Type and Subdivision -- 2001 Utilization Study

	A-4	A-6	A-7	AV-8	A-10	B-1	B-2	B-52		C-12	C-130	C-141	CESSNA	DOE	E-3	EA-6	F-4	F-5
Alamo		6	2	6	1,184		34	3			9			3			3	22
Caliente	26	108	131		67	57	50	182			25	2		1		9	18	4
Coyote	24	79	102		105	61	84	188			14			3		3	21	42
ECE	8	22	5		121	53	84	152			9		1	1		5	81	6
ECS					332	6		82			154		3	3			451	
ECW		20			141	52	51	152			7		23	1		3	102	
Elgin	0	64	57	1	134			3			18					6	2	
Pahute Mesa	2	28	88	4	113	9	32	46			6		4				8	33
R4808E						50	50	110		450	500			1				
R4808W		32		4	124	5	32	94			304	6	3	1			81	11
R4809A										250	500							
R61		12	2		948		34	3			1			1				6
R62		16	2		1,170		34	3			2		1	1			2	22
R63		14	15		797			3			2			1			2	
R64		18			1,224		34	3			505		1	1			4	
R65		10	40		1,105		34	3			500		3	1			2	
Reveille	26	105	100		28	64	51	188		2	22		1			4	15	47
R71		31			358	9		111			1					7	499	44
R74	12	38	84		113	64	82	188		250	8		1			5	12	39
R75	2	57	64		166	67	85	183		251	6		7	2		5	106	39
R76		53		4	445	79	50	191		250	510		3			5	506	68
Subtotal:	*100*	*713*	*692*	*19*	*8,675*	*576*	*821*	*1,888*		*1,453*	*3,103*	*8*	*51*	*21*		*52*	*1,915*	*383*
RF Sorties:					492	188		230			716	18	251		227	157	281	
RF Factor:	10	10	10	10	10	10	10	10	5	5	5	5	5	5	1	5	10	10
RF Total:					*4,920*	*1,880*	*0*	*2,300*	*0*	*0*	*3,580*	*90*	*1,255*	*0*	*227*	*785*	*2,810*	*0*

Nellis Range Complex Utilization - 1992

	F-14	F-15	F-16	F-18	F-86	F-111	F-117	HELO	KC-10	KC-135	M2000	RF-4	T-34	T-38	ornado	U-2	Other	Total
Alamo	82	637	1,563	179	3	81		329				4	6	12	9		203	*4,380*
Caliente	213	3,440	3,692	926		118	2,415	291	4	9	12	97		43		1	28	*11,969*
Coyote	87	1,589	1,641	435		147	2,399	397		4		93	17	17		1	380	*7,933*
ECE	51	720	927	81		93	2,551	133				92		17		1	289	*5,503*
ECS	7	236	519	8		105	2,096	50				138	1	17		1	1,102	*5,311*
ECW	24	796	1,190	27		88	2,502	106				91		17		1	1,785	*7,179*
Elgin	152	2,794	3,790	875	2	37	2,265	317	2		6			65	2	1	17	*10,610*
Pahute Mesa	56	665	710	204		145	2,388	6				82	13	14		1	813	*5,470*
R4808E		500	500					101								1	2,724	*4,987*
R4808W	54	380	485	138		59	2,232	4				64	2	14		1	1,308	*5,438*
R4809A								71									1,500	*2,321*
R61	84	566	1,490	82	3	66		49					8	16	9	1	359	*3,740*
R62	84	620	1,562	175	3	66		124				2	11	16	9	1	1,268	*5,194*
R63	84	616	1,492	60	2	65	5	86					4	10	7	1	1,014	*4,280*
R64	84	580	1,516	32	3	67		187						12	9	1	2,868	*7,149*
R65	84	568	1,927	32	3	63		86						12	9	1	1,536	*6,019*
Reveille	93	1,606	1,599	483		145	2,957	155				150	7	65		1	219	*8,133*
R71	22	241	560	169		76	2,491	50				147	19	63		1	594	*5,493*
R74	79	889	857	291		139	2,581	116		2		91	15	17		1	912	*6,886*
R75	75	709	882	300		129	2,583	130		2		138	6	19		1	839	*6,853*
R76	20	352	773	296		117	2,648	163		1		189	24	53		1	2,149	*8,950*
Subtotal:	*1,435*	*18,504*	*27,675*	*4,793*	*19*	*1,806*	*32,113*	*2,951*	*6*	*18*	*18*	*1,378*	*133*	*499*	*54*	*19*	*21,907*	*133,798*
RF Sorties:	95	2,254	3,615	193		584	57	9		636	201	332			837	25	46	
RF Factor:	10	10	10	10	10	10	10	5	5	5	10	10	5	10	10	5	10	
RF Total:	*950*	*22,540*	*36,150*	*1,930*	*0*	*5,840*	*570*	*45*	*0*	*3,180*	*2,010*	*3,320*	*0*	*0*	*8,370*	*125*	*230*	*103,107*
																	Grand Total:	*236,905*

Table 10. NRC CY93 Sortie Data by Aircraft Type and Subdivision -- 2001 Utilization Study

	A-4	A-6	A-10	AT-38	B-1	B-2	B-52	C-12	C-130	C-141	E-3	EA-6B	EF-111	F-1
Alamo	8	2	1,305	2		62	9	1	23					
Caliente	18	55	44	20	60	50	80		1					9
Coyote	7	41	44	9	56	113	80		1					8
ECE		24	143		55	106	76		1					8
ECS		1	608		3	14	23	12	152					8
ECW		24	169		55	76	74		1					8
Elgin	17		42	16	6	1	13	1	1					
Pahute Mesa	2	24	175		2	62	19		1					10
R4808E					50	61	50	450	500					
R4808W	2	24	199		2	62	12		302					8
R4809A								250	500					
R61	4		1,100	2		64	6	2	19					
R62	9		1,317	2		58	9	2	23					
R63	9		1,448	10			9	2	521					
R64	5		1,341	2		60	7	2	525					
R65	5		1,359	2		35	7		26					
Reveille	23	32	22	9	56	66	73		1					10
R71			538	1	5	13	32	1	1					8
R74	2	36	101	9	55	113	83	250	1					8
R75		24	201		54	105	81	251	1					8
R76			599		58	64	86	251	500					8
Subtotal:	*111*	*287*	*10,755*	*84*	*517*	*1,185*	*829*	*1,475*	*3,101*	*0*	*0*	*0*	*0*	*101*
RF Sorties:		88	616		157		235		462	166	189	149	193	92
RF Factor:		10	10	10	10	10	10	5	5	5	1	5	5	10
RF Total:		*880*	*6,160*	*0*	*1,570*	*0*	*2,350*	*0*	*4,620*	*830*	*189*	*745*	*965*	*920*

Nellis Range Complex Utilization - 1993

	F-4	F-14	F-15	F-16	F-18	F-111	F-117	KC-10	KC-135	RF-4	ornado	Helos	Other	U-2	Total
Alamo	165	23	1,111	2,070	24	54	1			4		92	459		*5,415*
Caliente	389	313	5,055	6,810	819	121	6	2	8	156	8	26	68	1	*14,110*
Coyote	240	138	2,349	3,184	665	135	1			163	8	160	643	2	*8,039*
ECE	364	135	1,115	2,199	516	140				156	8	146	525	3	*5,712*
ECS	470	59	747	1,415	122	86			5	149	10	533	1,274	3	*5,686*
ECW	399	123	1,615	2,301	513	141				155	8	167	2,026	2	*7,849*
Elgin	382	209	3,972	6,196	313	40	7			9	2	55	65	3	*11,350*
Pahute Mesa	329	124	1,000	1,716	526	87				152	8	24	1,033	3	*5,287*
R4808E			500	501		50						100	2,854		*5,126*
R4808W	300	115	998	1,674	496	61				145	8	29	1,535	1	*5,965*
R4809A												71	1,500		*2,321*
R61	120	30	932	1,956	16	26	1			3		19	611		*4,911*
R62	161	30	1,095	2,032	26	52	1			2		96	1,468		*6,383*
R63	149	18	1,023	2,039	13	51	7			2		118	1,072		*6,491*
R64	148	30	1,025	1,987	24	36	1			2		216	3,120		*8,531*
R65	165	30	1,095	3,714	24	47	1			2		193	1,153		*7,858*
Reveille	203	150	2,309	3,142	669	165	1		1	152	8	128	365	2	*7,577*
R71	556	58	802	1,420	212	93	1		5	156	8	39	742	4	*4,687*
R74	265	129	1,315	2,084	592	132	1			155	8	137	1,177	4	*6,649*
R75	396	129	1,157	1,942	560	149				155	8	45	978	4	*6,240*
R76	569	68	870	1,560	420	147			5	158	10	56	2,326	4	*7,751*
Subtotal:	*5,770*	*1,911*	*30,085*	*49,942*	*6,550*	*1,813*	*29*	*2*	*24*	*1,876*	*102*	*2,450*	*25,004*	*36*	*143,938*
RF Sorties:	123	181	1,879	3,210	498	851	70		597	44	464	160	64	26	
RF Factor:	10	10	10	10	10	10	10	5	5	10	10	5	5	5	
RF Total:	*1,230*	*1,810*	*18,790*	*32,100*	*4,980*	*8,510*	*700*	*0*	*2,985*	*440*	*4,640*	*800*	*320*	*130*	*95,744*
													Grand Total:		*239,682*

Table 11. NRC CY94 Sortie Data by Aircraft Type and Subdivision -- 2001 Utilization Study

	A-4	A-6	AV-8	A-10	B-1	B-2	B-52	C-5	C-12	C-130	C-141	E-2	E-3	EA-6B	EF-111
Alamo				1,838		16	16			5				4	
Caliente	4		84	126	72	50	88		8	11				8	16
Coyote			76	51	72	65	82		6	6				3	15
ECE			76	169	66	66	82		3	2				2	15
ECS				569	9	4	19		1	1					
ECW			34	210	66	55	81		3						
Elgin	4		2	166	15		31		7	8				6	18
Pahute Mesa			76	238	7	16	19		1	2					17
R4808E					50	54	50		451						
R4808W			76	268	7	16	12			2					15
R4809A									250						
R61				1,170		16	16		1	4				4	
R62				1,340		17	17		1	6				4	
R63				1,226			22		1	5				4	
R64	1			1,378		16	15	1		4				4	
R65				1,374		13	15	1	1	19	3			4	
Reveille			78	49	74	52	80			11				7	
R71				568	10	3	20		2	4					
R74			76	135	54	66	81		253	2				3	15
R75			58	229	69	66	94		250	2				1	15
R76				582	61	53	90		250	3				1	
Subtotal:	*9*	*0*	*636*	*11,686*	*632*	*644*	*930*	*2*	*1,489*	*97*	*3*	*0*	*0*	*55*	*120*
RFSorties	0	161	218	433	212	0	143	9	0	463	33	25	184	241	110
RF Factor		10	10	10	10	10	10	5	5	5	5	1	1	5	5
RF Total:		*1,610*	*2,180*	*4,330*	*2,120*	*0*	*1,430*	*45*	*0*	*2,315*	*165*	*25*	*184*	*1,205*	*550*

Nellis Range Complex Utilization - 1994

	F-1	F-4	F-14	F-15	F-16	F-18	F-111	F-117	KC-10	KC-135	RF-4	T-38	ornado	Helos	Other	U-2	Total
Alamo		127	13	680	1,668	63	60	30				1		211	2	8	*4,742*
Caliente		372	255	5,167	6,405	1,084	163	2	3	8	51	14	12	98	10	9	*14,120*
Coyote		302	106	2,661	3,157	785	149	1	2	4	49	2	16	207	9	11	*7,837*
ECE		529	63	1,890	2,391	549	139	4		4	48		16	174	4	16	*6,308*
ECS		775	8	706	1,363	172	69			3	48		16	3	1,000	5	*4,771*
ECW		581	10	1,811	2,106	528	123	4		2	49		16	184	1,502	14	*7,379*
Elgin		355	196	3,594	4,850	566	66	2	3		3	14		100	12	5	*10,023*
Pahute Mesa		502	28	1,331	1,621	536	69			2	49		10	37	502		*5,063*
R4808E				500	500		50							173	2,500		*4,328*
R4808W		471	26	1,253	1,560	468	69			2	49		2	116	1,000	8	*5,420*
R4809A														71	1,500		*1,821*
R61		90	9	553	1,611	48	52	1						128	1		*3,704*
R62		117	13	635	1,666	56	52	29				1		241	1,000		*5,195*
R63		182	10	768	1,886	59	95	30				1		198	1,000		*5,487*
R64		107	11	619	1,580	47	52	1						348	2,503		*6,687*
R65		150	9	680	2,791	53	77	1						256	1,001		*6,448*
Reveille		153	107	2,669	3,217	806	148	1	2	6	53		16	26	9	19	*7,583*
R71		807	28	745	1,377	202	90	4		4	52		16	49	502	16	*4,499*
R74		368	89	1,723	2,285	616	136	4		6	49		16	73	507	15	*6,572*
R75		590	37	1,477	1,806	554	127	4		6	49		16	76	503	15	*6,044*
R76		798	20	795	1,429	203	137	4		7	49		16	103	2,000	16	*6,617*
Subtotal:	*0*	*7,376*	*1,038*	*30,257*	*45,269*	*7,395*	*1,923*	*122*	*10*	*54*	*598*	*33*	*168*	*2,872*	*17,067*	*157*	*130,648*
RF Sorties	314	263	79	1,990	2,870	269	479	46	0	585	0	0	911	73	64	0	
RF Factor	10	10	10	10	10	10	10	10	5	5	10	10	10	5	5	5	
RF Total:	*3,140*	*2,630*	*790*	*19,900*	*28,700*	*2,690*	*4,790*	*460*	*0*	*2,925*	*0*	*0*	*9,110*	*365*	*320*	*0*	*91,979*
																Grand Total:	*222,627*

Table 12. NRC CY95 Sortie Data by Aircraft Type and Subdivision -- 2001 Utilization Study

	AV-8	A-10	B-1	B-2	B-52	C-130	C-141	E-3	EA-6B	EF-111	F-4	F-14
Alamo	112	1,323	6	2	26	6					161	1
Caliente	21	66	53		34	2		2	1	7	714	136
Coyote	28	87	54		31	2		1		10	975	54
ECE	21	152	51	2	26	1				10	1,220	48
ECS	22	605	39		23	1				7	1,627	46
ECW	33	170	45	1	22	1		1		10	1,374	46
Elgin	92	102	33		29			2	1	1	624	100
Pahute Mesa	25	172	41	1	17	1				12	1,092	48
R4808E					3							
R4808W	29	213	35	1	15	2				9	1,107	50
R4809A		2									62	
R61	91	1,140	8	2	26	5					146	2
R62	112	1,334	8	2	26	5					157	2
R63	22	1,313	8		24	8					152	2
R64	90	1,342	8	2	26	6					159	1
R65	93	1,368	8	2	26	9					147	1
Reveille	26	73	58		28	2		1		10	856	48
R71	30	592	37		28				1	9	1,641	52
R74	17	126	48	1	28	1		1		10	1,023	64
R75	33	233	49	1	28	1				11	1,306	64
R76	26	633	37		29	1			1	9	1,672	64
Subtotal:	*923*	*11,046*	*626*	*17*	*495*	*54*	*0*	*8*	*4*	*115*	*16,215*	*829*
	92	9	381	8	49	481	58	185	271	31	335	148
RF Factor	10	10	10	10	10	5	5	1	5	5	10	10
RF Total:	*920*	*90*	*3,810*	*80*	*490*	*2,405*	*290*	*185*	*1,355*	*155*	*3,350*	*1,480*

Nellis Range Complex Utilization - 1995

	F-15	F-16	F-18	F-111	F-117	KC-10	KC-135	Mirage	all Pro	ornado	Helos	Other	Total
Alamo	777	1,573	52	48	2		2				203		*4,294*
Caliente	4,016	5,700	419	105	2				4	6	68	16	*11,372*
Coyote	2,029	2,529	166	90			3	3	1	52	149	28	*6,292*
ECE	1,815	2,313	141	87			2	3	400	53	112	22	*6,479*
ECS	1,130	1,643	99	56	1		3	3	2	53	98	1,020	*6,478*
ECW	1,663	2,243	138	92			1	3	2	53	115	1,523	*7,536*
Elgin	3,002	4,361	333	43	1		2		1	4	38	6	*8,775*
Pahute Mesa	1,575	2,193	147	51			1				81	524	*5,981*
R4808E	502	500								47	1,354	2,504	*4,910*
R4808W	1,592	2,065	123	54			3			5	88	1,009	*6,400*
R4809A	185	245		3					400		508	1,500	*2,905*
R61	616	1,369	34	32	2		2		1		182	2	*3,660*
R62	786	1,559	44	40	2		3		1		199	1,001	*5,281*
R63	818	1,826	43	74	3		1				243	1,001	*5,538*
R64	708	1,576	46	31	2		1				217	2,503	*6,718*
R65	723	3,146	42	31	2		2		9		204	1,001	*6,814*
Reveille	2,048	2,474	162	79	1		2	3	7	54	99	29	*6,060*
R71	1,116	1,721	105	70	1		3	3		50	71	1,423	*6,953*
R74	2,259	2,790	138	91			2	3	400	53	1,100	1,428	*9,583*
R75	2,210	2,798	156	82			2	3	400	47	1,092	1,461	*9,977*
R76	1,191	1,788	114	70	1		3	3	400	53	120	2,032	*8,247*
Subtotal:	*30,761*	*46,412*	*2,502*	*1,229*	*20*	*0*	*38*	*27*	*2,028*	*530*	*6,341*	*20,033*	*140,253*
	1,912	4,022	449	549	19	15	509	256	29		110	65	
RF Factor	10	10	10	10	10	5	5	10	5	10	5	5	
RF Total:	*19,120*	*40,220*	*4,490*	*5,490*	*190*	*75*	*2,545*	*2,560*	*145*	*0*	*550*	*325*	*90,320*
												Grand Total:	*230,573*

Table 13. NRC Partial CY95 Sortie Data by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	77	876	2,698	138		286	4,075
Caliente	251	1,508	5,945	4,786	2,935	553	15,978
Coyote	471	1,503	3,407	4,786	2,935	540	13,642
Elgin	321	1,361	4,963	3,337	2,874	624	13,480
Reveille	372	1,328	3,499	4,785	2,932	528	13,444
R61	65	696	2,581	138		221	3,701
R62	75	885	1,887			261	3,108
R63	70	1,055	1,842	1		259	3,227
R64	73	835	1,890			281	3,079
R65	67	746	2,999	2		278	4,092
R71	1,011	1,117	2,633	4,683	2,932	467	12,843
R74	510	1,321	3,236	4,683	2,932	449	13,131
R75	712	1,372	3,184	4,683	2,928	488	13,367
R76	1,001	1,289	2,643	4,683	2,932	512	13,060
EC East	669	1,350	3,235	4,683	2,932	443	13,312
EC West	783	1,312	3,087	4,684	2,932	444	13,242
EC South	1,035	1,170	2,689	4,683	2,932	279	12,788
Total	7,563	19,724	52,418	50,755	32,196	6,913	169,569

1) Data not available for August, September and October

Table 14. NRC Sortie Data January 95 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	8	76	131	138		22	375
Caliente	13	108	295	1,150		26	1,592
Coyote	55	134	10	1,150		33	1,382
Elgin	27	136	463	395		19	1,040
Reveille	28	144	14	1,149		30	1,365
R61	8	66	122	138		9	343
R62	6	77	134			21	238
R63	2	106	123			19	250
R64	5	78	137			6	226
R65	6	34	379			9	428
R71	220	128	44	1,142		9	1,543
R74	70	139	4	1,142		10	1,365
R75	134	163	8	1,142		21	1,468
R76	202	123	52	1,142		18	1,537
EC East	136	131	8	1,142		16	1,433
EC West	170	117	8	1,142		13	1,450
EC South	220	128	44	1,142		6	1,540
Total	1,310	1,888	1,976	12,114		287	17,575

Table 15. NRC Sortie Data February 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	2	126	156			19	303
Caliente	42	89	707	1,193		38	2,069
Coyote	112	186	41	1,193		37	1,569
Elgin	52	92	853	788		7	1,792
Reveille	106	181	28	1,193		35	1,543
R61	1	114	132			17	264
R62	2	127	158			19	306
R63	2	152	166			29	349
R64	2	122	168			20	312
R65	1	102	368	1		19	491
R71	138	149	24	1,193		37	1,541
R74	104	132	50	1,193		32	1,511
R75	156	106	12	1,193		67	1,534
R76	138	159	28	1,193		37	1,555
EC East	136	150	28	1,193		31	1,538
EC West	154	131	12	1,193		31	1,521
EC South	138	161	24	1,193		40	1,556
Total	1,286	2,279	2,955	12,719		515	19,754

Table 16. NRC Sortie Data March 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	20	106	241			25	392
Caliente	30	114	793		1,917	48	2,902
Coyote	65	172	203		1,917	35	2,392
Elgin	55	111	754		1,856	52	2,828
Reveille	52	138	225		1,914	11	2,340
R61	19	92	239			12	362
R62	20	102	250			22	394
R63	19	158	200			33	410
R64	19	95	287			16	417
R65	19	91	507			9	626
R71	126	187	175		1,914	6	2,408
R74	70	142	212		1,914	14	2,352
R75	108	184	218		1,914	14	2,438
R76	116	237	180		1,914	20	2,467
EC East	94	162	218		1,914		2,388
EC West	114	126	230		1,914		2,384
EC South	118	210	210		1,914	8	2,460
Total	1,064	2,427	5,142		21,002	325	29,960

Table 17. NRC Sortie Data April 95 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	20	74	333			9	436
Caliente	33	238	410		1,018	201	1,900
Coyote	46	155	226		1,018	195	1,640
Elgin	45	231	428		1,018	197	1,919
Reveille	38	134	240		1,018	183	1,613
R61	14	43	336			8	401
R62	20	63	334			9	426
R63	20	83	340			31	474
R64	20	61	340			31	452
R65	22	70	401			33	526
R71	103	158	174		1,018	159	1,612
R74	52	146	219		1,018	170	1,605
R75	84	152	251		1,014	164	1,665
R76	107	153	167		1,018	173	1,618
EC East	74	152	231		1,018	177	1,652
EC West	96	136	202		1,018	170	1,622
EC South	107	157	163		1,018	165	1,610
Total	901	2,206	4,795		11,194	2,075	21,171

Table 18. NRC Sortie Data May 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	10	101	247			71	429
Caliente	47	312	909			8	1,276
Coyote	39	262	822			2	1,125
Elgin	55	186	255			42	538
Reveille	20	238	831			7	1,096
R61	10	87	213			69	379
R62	10	91	248			70	419
R63	10	111	250			73	444
R64	10	84	242			70	406
R65	10	89	266			71	436
R71	90	115	365			1	571
R74	46	216	778			2	1,042
R75	56	219	744			0	1,019
R76	95	132	367			1	595
EC East	58	209	752			2	1,021
EC West	68	266	697			3	1,034
EC South	102	118	352			2	574
Total	736	2,836	8,338			494	12,404

Table 19. NRC Sortie Data June 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		108	579			103	790
Caliente	34	249	767	479		150	1,679
Coyote	47	217	549	479		147	1,439
Elgin	29	126	686	393		230	1,464
Reveille	43	203	568	479		153	1,446
R61		71	552			87	710
R62		118	211			92	421
R63		112	235			13	360
R64		107	180			94	381
R65		117	238			93	448
R71	73	113	504	479		156	1,325
R74	55	211	533	479		142	1,420
R75	54	205	499	479		138	1,375
R76	70	126	492	479		161	1,328
EC East	51	203	535	479		142	1,410
EC West	51	195	559	479		142	1,426
EC South	70	118	490	479		12	1,169
Total	577	2,599	8,177	5,183		2,055	18,591

Table 20. NRC Sortie Data July 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	9	36	176			28	249
Caliente	11	83	410	1,964		64	2,532
Coyote	48	269	10	1,964		39	2,330
Elgin	15	93	531	1,761		42	2,442
Reveille	26	207	10	1,964		59	2,266
R61	9	30	136			17	192
R62	9	28	164			17	218
R63	9	32	163	1		42	247
R64	9	30	168			16	223
R65	9	32	171	1		41	254
R71	67	164		1,869		46	2,146
R74	50	239		1,869		38	2,196
R75	54	239		1,869		42	2,204
R76	71	233		1,869		48	2,221
EC East	54	239		1,869		36	2,198
EC West	54	239		1,870		46	2,209
EC South	71	169		1,869		32	2,141
Total	575	2,362	1,939	20,739		653	26,268

Table 21. NRC Sortie Data November 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	4	171	324			8	507
Caliente	32	191	973			17	1,213
Coyote	8	53	907			50	1,018
Elgin	34	267	318			34	653
Reveille	8	39	944			49	1,040
R61		127	338			1	466
R62	4	160	342			10	516
R63	4	179	316			18	517
R64	4	167	328			1	500
R65		142	403			2	547
R71	106	72	767			36	981
R74	8	54	847			36	945
R75	14	62	857			39	972
R76	114	72	769			40	995
EC East	14	60	870			36	980
EC West	30	58	850			36	974
EC South	116	60	757			14	947
Total	500	1,934	10,910			427	13,771

Table 22. NRC Sortie Data December 95 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	4	78	511			1	594
Caliente	9	124	681			1	815
Coyote	51	55	639			2	747
Elgin	9	119	675			1	804
Reveille	51	44	639			1	735
R61	4	66	513			1	584
R62	4	119	46			1	170
R63	4	122	49			1	176
R64	4	91	40			27	162
R65		69	266			1	336
R71	88	31	580			17	716
R74	55	42	593			5	695
R75	52	42	595			3	692
R76	88	54	588			14	744
EC East	52	44	593			3	692
EC West	46	44	529			3	622
EC South	93	49	649			0	791
Total	614	1,193	8,186			82	10,075

Table 23. NRC CY96 Sortie Data by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	4	1,094	3,180	494	1	605	5,378
Caliente	59	2,222	7,169	8,168	2,406	1,817	21,841
Coyote	114	1,422	4,142	8,226	2,494	1,492	17,890
Elgin	63	2,116	6,586	7,284	2,494	1,523	20,066
Reveille	118	1,334	4,203	7,710	2,488	1,412	17,265
R61	8	917	3,045			567	4,537
R62	8	1,034	3,169			598	4,809
R63	8	1,327	2,906			689	4,930
R64	8	904	3,153	2		573	4,640
R65	8	972	4,308	3		645	5,936
R71	202	958	3,850	8,254	2,494	1,197	16,955
R74	126	1,228	4,055	8,254	2,494	1,335	17,492
R75	140	1,207	4,147	8,254	2,494	1,349	17,591
R76	204	1,024	4,085	8,254	2,494	1,265	17,326
EC East	146	1,233	4,109	8,254	2,494	1,341	17,577
EC West	140	1,212	3,991	8,254	2,494	1,355	17,446
EC South	206	968	4,159	8,254	2,494	986	17,067
R4808E[2]		10	469				479
R4808W[2]		185	1,670	2,661		629	5,145
Pah. Mesa[2]		184	1,676	2,661		636	5,157
R4809A[2]		150	1,502	2,539		530	4,721
Total	1,562	21,701	75,574	97,526	27,341	20,544	244,248

Data collected in October, November & December only
For R4808E, R4808W, Pahute Mesa, R4809A

Table 24. NRC Sortie Data January 96 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		148	153			12	313
Caliente	19	160	446	1,932		38	2,595
Coyote	46	56	24	1,903		18	2,047
Elgin	19	184	556	1,658		19	2,436
Reveille	62	34	16	1,933		19	2,064
R61	4	141	132			14	291
R62	4	164	146			15	329
R63	4	164	78			20	266
R64	4	138	144			22	308
R65	4	111	377			18	510
R71	98	49	26	1,933		7	2,113
R74	62	44	24	1,933		11	2,074
R75	70	30	24	1,933		28	2,085
R76	98	49	28	1,933		28	2,136
EC East	70	40	24	1,933		9	2,076
EC West	70	32	24	1,933		15	2,074
EC South	98	49	28	1,933		9	2,117
Total	732	1,593	2,250	20,957		302	25,834

Table 25. NRC Sortie Data February 96 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo	4	93	132			20	249
Caliente	22	217	633	886		15	1,773
Coyote	24	65	243	886		17	1,235
Elgin	20	226	680	183		18	1,127
Reveille	20	55	242	886		9	1,212
R61	4	87	117			17	225
R62	4	93	125			17	239
R63	4	140	111			21	276
R64	4	88	147			21	260
R65	4	78	382	1		23	488
R71	76	57	42	886		18	1,079
R74	28	60	231	886		8	1,213
R75	50	32	237	886		6	1,211
R76	76	55	131	886		38	1,186
EC East	40	60	237	886		10	1,233
EC West	50	24	140	886		8	1,108
EC South	78	53	126	886		6	1,149
Total	508	1,483	3,956	9,044		272	15,263

Table 26. NRC Sortie Data March 96 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		118	203			39	360
Caliente	18	207	524		1,621	117	2,487
Coyote	44	51	173		1,621	107	1,996
Elgin	24	266	607		1,621	102	2,620
Reveille	36	57	167		1,615	80	1,955
R61		116	176			25	317
R62		134	200			28	362
R63		144	236			29	409
R64		116	198			27	341
R65		124	275			29	428
R71	28	96	87		1,621	93	1,925
R74	36	47	172		1,621	100	1,976
R75	20	67	158		1,621	73	1,939
R76	30	98	117		1,621	74	1,940
EC East	36	50	169		1,621	96	1,972
EC West	20	69	149		1,621	98	1,957
EC South	30	86	165		1,621	61	1,963
Total	322	1,846	3,776		17,825	1,178	24,947

Table 27. NRC Sortie Data April 96 by Organization and Subdivision– Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		88	348		1	61	498
Caliente		289	642		785	99	1,815
Coyote		162	488		873	71	1,594
Elgin		214	628		873	101	1,816
Reveille		162	516		873	72	1,623
R61		81	332			53	466
R62		97	336			55	488
R63		111	328			49	488
R64		88	314			56	458
R65		99	386			59	544
R71		150	611		873	68	1,702
R74		156	486		873	66	1,581
R75		156	551		873	63	1,643
R76		148	604		873	72	1,697
EC East		146	516		873	66	1,601
EC West		146	516		873	60	1,595
EC South		148	597		873	74	1,692
Total		2,441	8,199		9,516	1,145	21,301

Table 28. NRC Sortie Data May 96 by Organization and Subdivision – Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		71	294			52	417
Caliente		286	936			205	1,427
Coyote		196	780			191	1,167
Elgin		239	493			97	829
Reveille		184	742			192	1,118
R61		55	281			51	387
R62		72	282			47	401
R63		81	258			71	410
R64		61	292			32	385
R65		70	324			49	443
R71		117	716			191	1,024
R74		117	716			189	1,022
R75		115	736			191	1,042
R76		115	735			195	1,045
EC East		113	731			177	1,021
EC West		115	729			195	1,039
EC South		114	747			196	1,057
Total		2,121	9,792			2,321	14,234

Table 29. NRC Sortie Data June 96 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		47	588			5	640
Caliente		165	765			6	936
Coyote		112	571			8	691
Elgin		154	773			7	934
Reveille		112	600			5	717
R61		16	570			4	590
R62		47	588			6	641
R63		54	585			38	677
R64		37	587			5	629
R65		32	604			6	642
R71		18	568			4	590
R74		18	568			4	590
R75		18	568			3	589
R76		19	568			4	591
EC East		34	568			4	606
EC West		32	568			5	605
EC South		18	568				586
Total		933	10,207			114	11,254

Table 30. NRC Sortie Data July 96 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		142	237			3	382
Caliente		228	434	2,230		45	2,937
Coyote		325	1	2,230		46	2,602
Elgin		160	501	2,232		28	2,921
Reveille		297		2,230		44	2,571
R61		122	264			3	389
R62		108	281			3	392
R63		167	236			28	431
R64		103	257			3	363
R65		116	308			6	430
R71		101	13	2,230		29	2,373
R74		324	1	2,230		30	2,585
R75		324	1	2,230		44	2,599
R76		105	23	2,230		36	2,394
EC East		336	1	2,230		46	2,613
EC West		326	1	2,230		47	2,604
EC South		123	25	2,230			2,378
Total		3,407	2,584	24,532		441	30,964

Table 31. NRC Sortie Data August 96 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		110	186	494		39	829
Caliente		85	623	453		417	1,578
Coyote		213	54	544		268	1,079
Elgin		55	661	544		401	1,661
Reveille		199	102			258	559
R61		109	179			38	326
R62		111	175			46	332
R63		170	158			56	384
R64		85	190			36	311
R65		100	279			62	441
R71		131	37	544		164	876
R74		219	47	544		242	1,052
R75		221	47	544		250	1,062
R76		164	33	544		186	927
EC East		220	47	544		258	1,069
EC West		222	47	544		247	1,060
EC South		130	33	544		42	749
Total		2,544	2,898	5,843		3,010	14,295

Table 32. NRC Sortie Data September 96 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		53	74			68	195
Caliente		133	298			28	459
Coyote		74	138			38	250
Elgin		120	266			31	417
Reveille		70	140			22	232
R61		26	75			63	164
R62		35	75			69	179
R63		81	74			83	238
R64		37	75			64	176
R65		29	138			95	262
R71		65	142			19	226
R74		66	138			22	226
R75		61	138			27	226
R76		65	150			25	240
EC East		66	146			27	239
EC West		66	136			22	224
EC South		67	150			12	229
Total		1,114	2,353			715	4,182

Table 33. NRC Sortie Data October 96 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		119	238			104	461
Caliente		154	578	1,673		424	2,829
Coyote		24	457	1,669		339	2,489
Elgin		185	433	1,673		351	2,642
Reveille		22	466	1,669		326	2,483
R61		79	231			100	410
R62		97	248			105	450
R63		113	228			117	458
R64		92	235			97	424
R65		121	287			85	493
R71		28	429	1,669		287	2,413
R74		22	463	1,669		320	2,474
R75		30	462	1,669		320	2,481
R76		62	422	1,669		285	2,438
EC East		30	453	1,669		316	2,468
EC West		30	467	1,669		317	2,483
EC South		30	457	1,669		267	2,423
R4808E		8					8
R4808W		30	473	1,669		301	2,473
Pah. Mesa		29	467	1,669		300	2,465
R4809A		26	420	1,669		237	2,352
Total		1,331	7,914	23,374		4,998	37,617

Table 34. NRC Sortie Data November 96 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		77	234			200	511
Caliente		155	678	994		400	2,227
Coyote		41	606	994		382	2,023
Elgin		165	389	994		341	1,889
Reveille		41	610	992		378	2,021
R61		72	190			195	457
R62		51	220			201	472
R63		79	201			171	451
R64		47	201	2		195	445
R65		70	293	2		186	551
R71		41	638	992		310	1,981
R74		41	612	992		336	1,981
R75		41	623	992		337	1,993
R76		37	648	992		315	1,992
EC East		33	612	992		325	1,962
EC West		41	614	992		334	1,981
EC South		39	656	992		312	1,999
R4808E		2					2
R4808W		41	608	992		321	1,962
Pah. Mesa		41	608	992		329	1,970
R4809A		43	568	870		286	1,767
Total		1,198	9,809	13,776		5,854	30,637

Table 35. NRC Sortie Data December 96 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		28	493			2	523
Caliente		143	612			23	778
Coyote		103	607			7	717
Elgin		148	599			27	774
Reveille		101	602			7	710
R61		13	498			4	515
R62		25	493			6	524
R63		23	413			6	442
R64		12	513			15	540
R65		22	655			27	704
R71		105	541			7	653
R74		114	597			7	718
R75		112	602			7	721
R76		107	626			7	740
EC East		105	605			7	717
EC West		109	600			7	716
EC South		111	607			7	725
R4808E		0	469			0	469
R4808W		114	589			7	710
Pah. Mesa		114	601			7	722
R4809A		81	514			7	602
Total		1,690	11,836			194	13,720

Table 36. NRC CY97 Summary and Monthly Sortie Data by Organization-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		570	2,801	59		845	4,275
Caliente		2,230	6,796	2,658	2,775	3,762	18,221
Coyote		2,089	3,646	2,658	2,775	2,714	13,882
Elgin		1,965	6,758	106	2,775	2,930	14,534
Reveille		2,116	3,542	2,658	2,779	2,639	13,734
R61		537	2,697	250		782	4,266
R62		564	2,862	121		810	4,357
R63		779	2,301			1,080	4,160
R64		515	2,743			965	4,223
R65		470	3,706			1,003	5,179
R71		2,161	3,475	2,658	2,763	2,403	13,460
R74		2,076	3,530	2,658	2,763	2,583	13,610
R75		1,990	3,570	2,658	2,763	2,509	13,490
R76		2,100	3,562	2,541	2,763	2,678	13,644
EC East		2,076	3,488	2,658	2,763	2,605	13,590
EC West		2,055	3,491	2,658	2,763	2,553	13,520
EC South		2,091	3,540	2,658	2,763	2,504	13,556
R4808E[(2)]		452	2,237	2,091		1,024	5,804
R4808W[(2)]		1,601	1,588	963	2,775	1,281	8,208
Pah. Mesa[(2)]		1,963	3,476	2,655	2,650	2,413	13,157
R4809A[(2)]		2,073	3,205	2,658	2,763	2,164	12,863
Total		32,473	73,014	35,366	38,633	42,247	221,733

Table 37. NRC Sortie Data January 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		64	181			64	309
Caliente		192	524			94	810
Coyote		199	75			200	474
Elgin		109	569			10	688
Reveille		218	57			225	500
R61		61	148			38	247
R62		64	174			70	308
R63		102	109			51	262
R64		59	154			78	291
R65		51	352			65	468
R71		205	49			118	372
R74		198	45			235	478
R75		202	45			246	493
R76		200	61			282	543
EC East		204	45			237	486
EC West		205	45			208	458
EC South		206	45			184	435
R4808E		3					3
R4808W		182	49			116	347
Pahute Mesa		185	57			184	426
R4809A		197	25			109	331
Total		3106	2809			2814	8729

Table 38. NRC Sortie Data February 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		23	123			50	196
Caliente		343	417		1317	479	2,556
Coyote		437	58		1317	226	2,038
Elgin		237	525		1317	389	2,468
Reveille		410	66		1317	254	2,047
R61		23	115			44	182
R62		23	121			48	192
R63		58	74			206	338
R64		42	112			105	259
R65		31	313			69	413
R71		403	42		1305	229	1,979
R74		409	26		1305	223	1,963
R75		401	40		1305	241	1,987
R76		403	42		1305	242	1,992
EC East		404	40		1305	242	1,991
EC West		402	36		1305	235	1,978
EC South		395	44		1305	243	1,987
R4808E		3					3
R4808W		403	34		1317	236	1,990
Pahute Mesa		357	34		1305	230	1,926
R4809A		398	20		1305	192	1,915
Total		5605	2282		18330	4183	30400

Table 39. NRC Sortie Data March 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		42	212			79	333
Caliente		476	358		1458	405	2,697
Coyote		391	156		1458	136	2,141
Elgin		400	503		1458	445	2,806
Reveille		435	113		1462	114	2,124
R61		37	198			80	315
R62		39	198			81	318
R63		57	129			87	273
R64		47	193			83	323
R65		27	419			91	537
R71		418	139		1458	100	2,115
R74		430	105		1458	99	2,092
R75		370	193		1458	107	2,128
R76		424	168		1458	109	2,159
EC East		428	131		1458	100	2,117
EC West		420	142		1458	100	2,120
EC South		424	170		1458	90	2,142
R4808E		7					7
R4808W		418	123		1458	78	2,077
Pahute Mesa		416	125		1345	83	1,969
R4809A		419	99		1458	70	2,046
Total		6125	3874		20303	2537	32839

Table 40. NRC Sortie Data April 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		13	99			76	188
Caliente		289	436			378	1,103
Coyote		333	309			270	912
Elgin		266	376			245	887
Reveille		328	314			237	879
R61		13	90			69	172
R62		13	100			77	190
R63		52	89			127	268
R64		9	102			119	230
R65		12	136			151	299
R71		337	365			243	945
R74		325	337			265	927
R75		301	383			268	952
R76		326	372			273	971
EC East		334	344			255	933
EC West		324	343			251	918
EC South		328	372			265	965
R4808E						3	3
R4808W		329	329			251	909
Pahute Mesa		299	346			258	903
R4809A		332	303			202	837
Total		4563	5545			4283	14391

Table 41. NRC Sortie Data May 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		77	157			170	404
Caliente		138	664			784	1,586
Coyote		102	591			663	1,356
Elgin		161	447			619	1,227
Reveille		96	589			658	1,343
R61		78	165			168	411
R62		81	153			139	373
R63		107	78			88	273
R64		67	151			153	371
R65		57	126			91	274
R71		76	435			570	1,081
R74		87	573			665	1,325
R75		72	437			515	1,024
R76		72	439			596	1,107
EC East		75	435			612	1,122
EC West		72	435			606	1,113
EC South		72	431			587	1,090
R4808E						5	5
R4808W		70	433			567	1,070
Pahute Mesa		72	445			537	1,054
R4809A		72	390			558	1,020
Total		1704	7574			9351	18629

Table 42. NRC Sortie Data June 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		37	465			52	554
Caliente		156	823			72	1,051
Coyote		75	588			66	729
Elgin		150	834			68	1,052
Reveille		75	574			47	696
R61		35	463			49	547
R62		38	547			49	634
R63		62	527			94	683
R64		32	524			52	608
R65		37	533			78	648
R71		105	584			62	751
R74		75	584			48	707
R75		75	582			56	713
R76		74	586			67	727
EC East		75	583			65	723
EC West		75	583			64	722
EC South		76	586			64	726
R4808E			482			1	483
R4808W		75	574			13	662
Pahute Mesa		75	582			54	711
R4809A		106	582			13	701
Total		1508	12186			1134	14828

Table 43. NRC Sortie Data July 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		72	263	59	0	39	433
Caliente		104	471	963	0	62	1,600
Coyote		123	54	963	0	57	1,197
Elgin		139	594	106	0	58	897
Reveille		115	48	963	0	32	1,158
R61		68	242	250	0	37	597
R62		60	254	121	0	40	475
R63		85	176	0	0	59	320
R64		38	233	0	0	40	311
R65		32	187	0	0	66	285
R71		123	50	963	0	30	1,166
R74		123	46	963	0	27	1,159
R75		121	46	963	0	24	1,154
R76		123	50	846	0	33	1,052
EC East		123	46	963	0	31	1,163
EC West		123	46	963	0	31	1,163
EC South		123	50	963	0	20	1,156
R4808E		12	0	396	0	0	408
R4808W		124	46	963	0	20	1,153
Pahute Mesa		123	56	963	0	22	1,164
R4809A		116	46	963	0	29	1,154
Total	0	2070	3004	13334	0	757	19165

Table 44. NRC Sortie Data August 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		116	331	0	0	66	513
Caliente		35	560	1695	0	203	2,493
Coyote		62	92	1695	0	99	1,948
Elgin		84	775	0	0	177	1,036
Reveille		60	87	1695	0	73	1,915
R61		104	292	0	0	55	451
R62		115	329	0	0	66	510
R63		116	258	0	0	69	443
R64		82	290	0	0	54	426
R65		94	265	0	0	65	424
R71		68	85	1695	0	66	1,914
R74		50	96	1695	0	63	1,904
R75		56	84	1695	0	59	1,894
R76		68	89	1695	0	60	1,912
EC East		56	108	1695	0	61	1,920
EC West		56	101	1695	0	61	1,913
EC South		66	89	1695	0	44	1,894
R4808E		46	72	1695	0	34	1,847
R4808W							0
Pahute Mesa		50	91	1692	0	57	1,890
R4809A		60	78	1695	0	41	1,874
Total	0	1,444	4,172	22,032	0	1,473	29,121

Table 45. NRC Sortie Data September 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		14	77	0	0	21	112
Caliente		55	482	0	0	310	847
Coyote		17	110	0	0	91	218
Elgin		64	409	0	0	245	718
Reveille		17	102	0	0	89	208
R61		11	71	0	0	25	107
R62		17	74	0	0	31	122
R63		31	51	0	0	72	154
R64		24	70	0	0	33	127
R65		17	96	0	0	45	158
R71		16	82	0	0	92	190
R74		22	106	0	0	65	193
R75		22	106	0	0	99	227
R76		16	98	0	0	97	211
EC East		15	116	0	0	97	228
EC West		16	106	0	0	99	221
EC South		16	98	0	0	93	207
R4808E		22	98	0	0	86	206
R4808W				0	0		0
Pahute Mesa		22	98	0	0	88	208
R4809A		16	98	0	0	87	201
Total	0	450	2548	0	0	1865	4863

Table 46. NRC Sortie Data October 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		64	158	0	0	117	339
Caliente		244	614	0	0	390	1,248
Coyote		126	375	0	0	306	807
Elgin		160	500	0	0	285	945
Reveille		128	365	0	0	302	795
R61		59	186	0	0	106	351
R62		66	190	0	0	108	364
R63		71	153	0	0	90	314
R64		66	209	0	0	124	399
R65		66	225	0	0	134	425
R71		151	400	0	0	294	845
R74		122	365	0	0	302	789
R75		130	412	0	0	297	839
R76		136	412	0	0	298	846
EC East		125	401	0	0	309	835
EC West		125	405	0	0	307	837
EC South		133	411	0	0	302	846
R4808E		134	369	0	0	302	805
R4808W				0	0		0
Pahute Mesa		130	405	0	0	305	840
R4809A		143	351	0	0	284	778
Total	0	2,379	6,906	0	0	4,962	14,247

Table 47. NRC Sortie Data November 97 by Organization and Subdivision-- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		19	96	0	0	110	225
Caliente		100	576	0	0	568	1,244
Coyote		87	506	0	0	583	1,176
Elgin		111	384	0	0	372	867
Reveille		88	507	0	0	592	1,187
R61		16	92	0	0	111	219
R62		16	87	0	0	100	203
R63		26	72	0	0	115	213
R64		20	76	0	0	118	214
R65		21	223	0	0	108	352
R71		96	510	0	0	582	1,188
R74		90	513	0	0	576	1,179
R75		90	510	0	0	579	1,179
R76		96	510	0	0	584	1,190
EC East		90	506	0	0	579	1,175
EC West		90	516	0	0	572	1,178
EC South		94	510	0	0	576	1,180
R4808E		90	508	0	0	581	1,179
R4808W				0	0		0
Pahute Mesa		90	505	0	0	586	1,181
R4809A		89	485	0	0	569	1,143
Total	0	1,419	7,692	0	0	8,561	17,672

Table 48. NRC Sortie Data December 97 by Organization and Subdivision -- Range Group Scheduling

	Scheduling Organization						
Subdivision	561st	422th	57th	Red Flag	Green Flag	Other	Total
Alamo		29	639	0	0	1	669
Caliente		98	871	0	0	17	986
Coyote		137	732	0	0	17	886
Elgin		84	842	0	0	17	943
Reveille		146	720	0	0	16	882
R61		32	635	0	0	0	667
R62		32	635	0	0	1	668
R63		12	585	0	0	22	619
R64		29	629	0	0	6	664
R65		25	831	0	0	40	896
R71		163	734	0	0	17	914
R74		145	734	0	0	15	894
R75		150	732	0	0	18	900
R76		162	735	0	0	37	934
EC East		147	733	0	0	17	897
EC West		147	733	0	0	19	899
EC South		158	734	0	0	36	928
R4808E		135	708	0	0	12	855
R4808W				0	0		0
Pahute Mesa		144	732	0	0	9	885
R4809A		125	728	0	0	10	863
Total	0	2,100	14,422	0	0	327	16,849

APPENDIX D
AIRCRAFT NOISE ANALYSIS

AIRCRAFT NOISE ANALYSIS

Noise is generally described as unwanted sound. Unwanted sound can be based on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (community annoyance). Noise analysis thus requires a combination of physical measurement of sound, physical and physiological effects, plus psycho- and socioacoustic effects.

Section 1 of this Appendix describes how sound is measured, and summarizes noise impact in terms of community acceptability and land use compatibility. Section 2 gives detailed descriptions of the effects of noise which lead to the impact guidelines presented in Section 1. Section 3 provides a description of the specific methods used to predict aircraft noise.

1.0 NOISE DESCRIPTORS AND IMPACT

Aircraft operating in the Nellis Range complex generate two types of sound. One is "subsonic" noise, which is continuous sound generated by the aircraft's engines and also by air flowing over the aircraft itself. The other is sonic booms, which are transient impulsive sounds generated during supersonic flight. These are quantified in different ways.

Section 1.1 describes the quantities which are used to describe sound. Section 1.2 describes the specific noise metrics used for noise impact analysis. Section 1.3 describes how environmental impact and land use compatibility are judged in terms of these quantities.

1.1 QUANTIFYING SOUND

Measurement and perception of sound involves two basic physical characteristics: amplitude and frequency. Amplitude is a measure of the strength of the sound and is directly measured in terms of the pressure of a sound wave. Because sound pressure varies in time, various types of pressure averages are usually used. Frequency, commonly perceived as pitch, is the number of times per second the sound causes air molecules to oscillate. Frequency is measured in units of cycles per second, or Hertz (Hz).

Amplitude. The loudest sounds the human ear can comfortably hear have acoustic energy one trillion times the acoustic energy of sounds the ear can barely detect. Because of this vast range, attempts to represent sound amplitude by pressure are generally unwieldy. Sound is therefore usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as a sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Because of the logarithmic nature of the decibel scale, sounds levels do not add and subtract directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

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

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels behaves differently than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that combination of decibel values consists of first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

The difference in dB between two sounds represents the ratio of the amplitudes of those two sounds. Because human senses tend to be proportional (i.e., detect whether one sound is twice as big as another) rather than absolute (i.e., detect whether one sound is a given number of pressure units bigger than another), the decibel scale correlates well with human response.

Under laboratory conditions, differences in sound level of 1 dB can be detected by the human ear. In the community, the smallest change in average noise level which can be detected is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud sounds and for quieter sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity but only a 50 percent decrease in perceived loudness because of the nonlinear response of the human ear (similar to most human senses).

Frequency. The normal human ear can hear frequencies from about 20 Hz to about 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. When measuring community response to noise, it is common to adjust the frequency content of the measured sound to correspond to the frequency sensitivity of the human ear. This adjustment is called A-weighting (ANSI 1988). Sound levels that have been so adjusted are referred to as A-weighted sound levels. The amplitude of A-weighted sound levels is measured in dB. It is common for some noise analysts to denote the unit of A-weighted sounds by dBA or dB(A). As long as the use of A-weighting is understood, there is no difference between dB, dBA or dB(A). It is only important that the use of A-weighting be made clear. In this study, sound levels are reported in dB and are A-weighted unless otherwise specified.

A-weighting is appropriate for continuous sounds, which are perceived by the ear. Impulsive sounds, such as sonic booms, are perceived by more than just the ear. When experienced indoors, there can be secondary noise from rattling of the building. Vibrations may also be felt. C-weighting (ANSI 1988) is applied to such sounds. This is a frequency weighting that is flat over the range of human hearing (about 20 Hz to 20,000 Hz) and rolls off above and below that range. In this study, C-weighted sound levels are used for the assessment of sonic booms and other impulsive sounds. As with A-weighting, the unit is dB, but dBC or dB(C) are sometimes used. In this study, sound levels are reported in dB, and C-weighting is specified as necessary.

Time Averaging. Sound pressure of a continuous sound varies greatly with time, so it is customary to deal with sound levels that represent averages over time. Levels presented as instantaneous (i.e., as might be read from the dial of a sound level meter), are based on averages of sound energy over either 1/8 second (fast) or one second (slow). The formal definitions of fast and slow levels are somewhat complex, with details that are important to the makers and users of instrumentation. They may, however, be

thought of as levels corresponding to the root-mean-square sound pressure measured over the 1/8-second or 1-second periods.

The most common uses of the fast or slow sound level in environmental analysis is in the discussion of the maximum sound level that occurs from the action, and in discussions of typical sound levels. Figure D-1 is a chart of A-weighted sound levels from typical sounds. Some (air conditioner, vacuum cleaner) are continuous sounds whose levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle passby. Some (urban daytime, urban nighttime) are averages over some extended period. A variety of noise metrics have been developed to describe noise over different time periods. These are described in Section 1.2.

1.2 NOISE METRICS

1.2.1 Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is usually abbreviated by ALM, L_{max} or L_{Amax}. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities.

1.2.2 Peak Sound Level

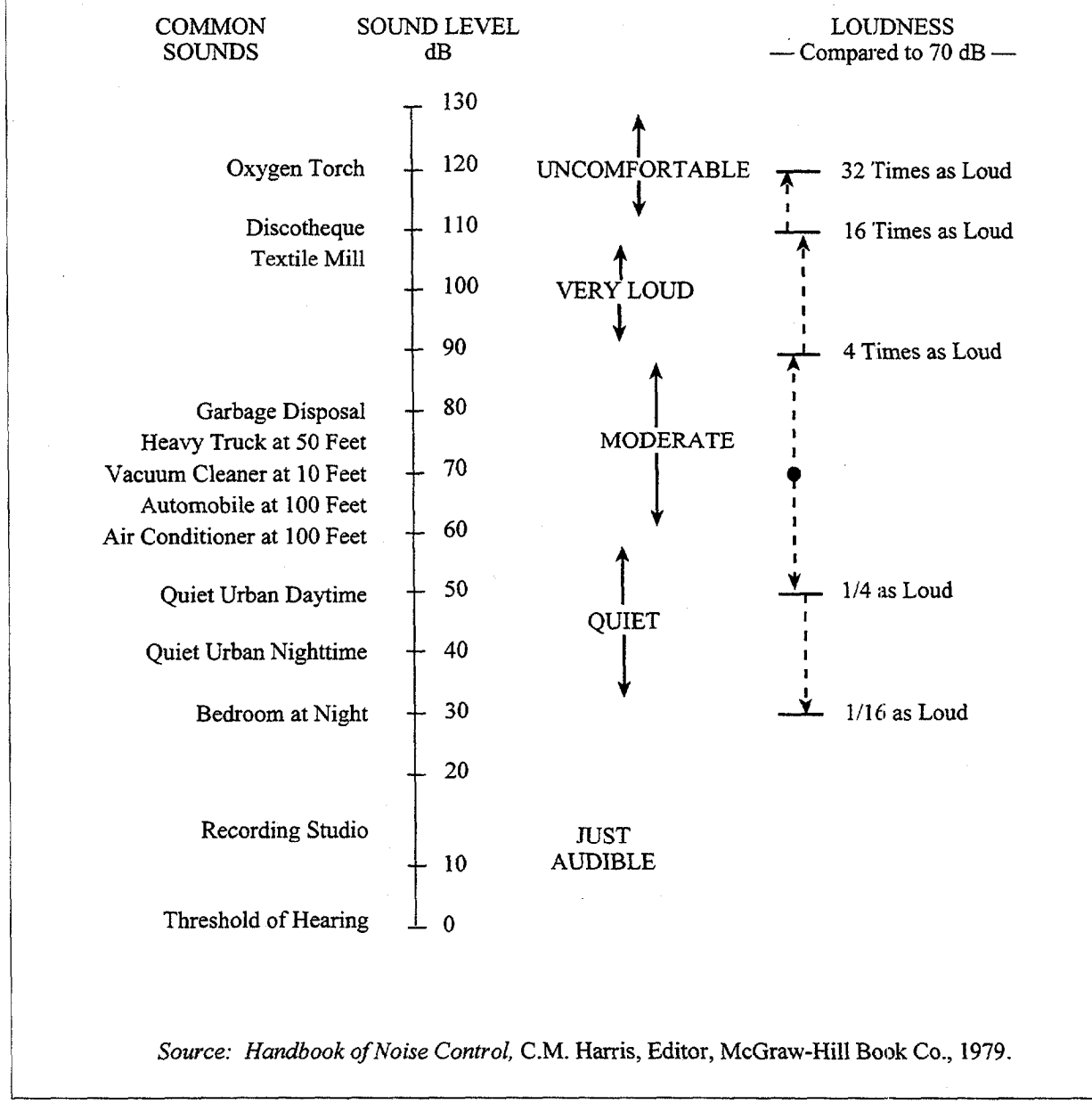
For impulsive sounds, the true instantaneous sound pressure is of interest. For sonic booms, this is the peak pressure of the shock wave, as described in Section 3.2 of this Appendix. This pressure is usually presented in physical units of pounds per square foot. Sometimes it is represented on the decibel scale, with symbol L_{pk}. Peak sound levels do not use either A or C weighting.

1.2.3 Sound Exposure Level

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

Sound exposure level is a composite metric which represents both the intensity of a sound and its duration. Mathematically, the mean square sound pressure is computed over the duration of the event, then multiplied by the duration in seconds, and the resultant product is turned into a sound level. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that Sound Exposure Level measures this impact much more reliably than just the maximum sound level.

Because the sound exposure level and the maximum sound level are both used to describe single events, there is sometimes confusion between the two, so the specific metric used should be clearly stated.



Source: Handbook of Noise Control, C.M. Harris, Editor, McGraw-Hill Book Co., 1979.

Figure D-1. Typical A-Weighted Sound Levels of Common Sounds

Sound Exposure Level can be computed for C-weighted levels (appropriate for impulsive sounds), and the results denoted CSEL or L_{CE}. SEL for A-weighted sound is sometimes denoted ASEL. Within this study, SEL is used for A-weighted sounds and CSEL for C-weighted.

1.2.4 Equivalent Sound Level

For longer periods of time, total sound is represented by the equivalent continuous sound pressure level (L_{eq}). L_{eq} is the average sound level over some time period (often an hour or a day, but any explicit time span can be specified), with the averaging being done on the same energy basis as used for SEL. SEL and L_{eq} are closely related, differing by (a) whether they are applied over a specific time period or over an event, and (b) whether the duration of the event is included or divided out.

Just as SEL has proven to be a good measure of the noise impact of a single event, L_{eq} has been established to be a good measure of the impact of a series of events during a given time period. Also, while L_{eq} is defined as an average, it is effectively a sum over that time period and is thus a measure of the cumulative impact of noise.

1.2.5 Day-Night Average Sound Level

Noise tends to be more intrusive at night than during the day. This effect is accounted for by applying a 10-dB penalty to events that occur after 10 PM and before 7 AM. If L_{eq} is computed over a 24-hour period with this nighttime penalty applied, the result is the day-night average sound level (DNL or L_{dn}). DNL is the community noise metric recommended by the U.S. Environmental Protection Agency (USEPA 1972) and has been adopted by most federal agencies (FICON 1992). It has been well established that DNL correlates well with community response to noise (Schultz 1978; Finegold *et al.* 1994). This correlation is presented in Section 1.3.

While DNL carries the nomenclature "average," it incorporates all of the noise at a given location. For this reason, DNL is often referred to as a "cumulative" metric. It accounts for the total, or cumulative, noise impact.

It was noted earlier that, for impulsive sounds, C-weighting is more appropriate than A-weighting. The day-night average sound level can be computed for C-weighted noise, and is denoted CDNL or L_{Cdn}. This procedure has been standardized, and impact interpretive criteria similar to those for DNL have been developed (CHABA 1981).

1.2.6 Onset-Adjusted Monthly Day-Night Average Sound Level

Aircraft operations in military airspaces such as the Nellis Range Complex generate a noise environment somewhat different from other community noise environments. Overflight are sporadic, occurring at random times and varying from day to day and week to week. This situation differs from most community noise environments, in which noise tends to be continuous or patterned. Individual military overflight events also differ from typical community noise events: noise from a low-altitude, high-airspeed flyover can have a rather sudden onset.

To represent these differences, the conventional Day-Night Average Sound Level metric is adjusted to account for the "surprise" effect of the sudden onset of aircraft noise events on humans (Plotkin *et al.*

1987; Stusnick *et al.* 1992; Stusnick *et al.* 1993). For aircraft exhibiting a rate of increase in sound level (called onset rate) of from 15 to 150 dB per second, an adjustment or penalty ranging from 0to 11 dB is added to the normal Sound Exposure Level. Onset rates above 150 dB per second require a 11 dB penalty, while onset rates below 15 dB per second require no adjustment. The Day-Night Average Sound Level is then determined in the same manner as for conventional aircraft noise events and is designated as Onset-Rate Adjusted Day-Night Average Sound Level (abbreviated L_{dnmr}). Because of the irregular occurrences of aircraft operations, the number of average daily operations is determined by using the calendar month with the highest number of operations. The monthly average is denoted L_{dnmr}.

1.3 NOISE IMPACT

1.3.1 Community Reaction

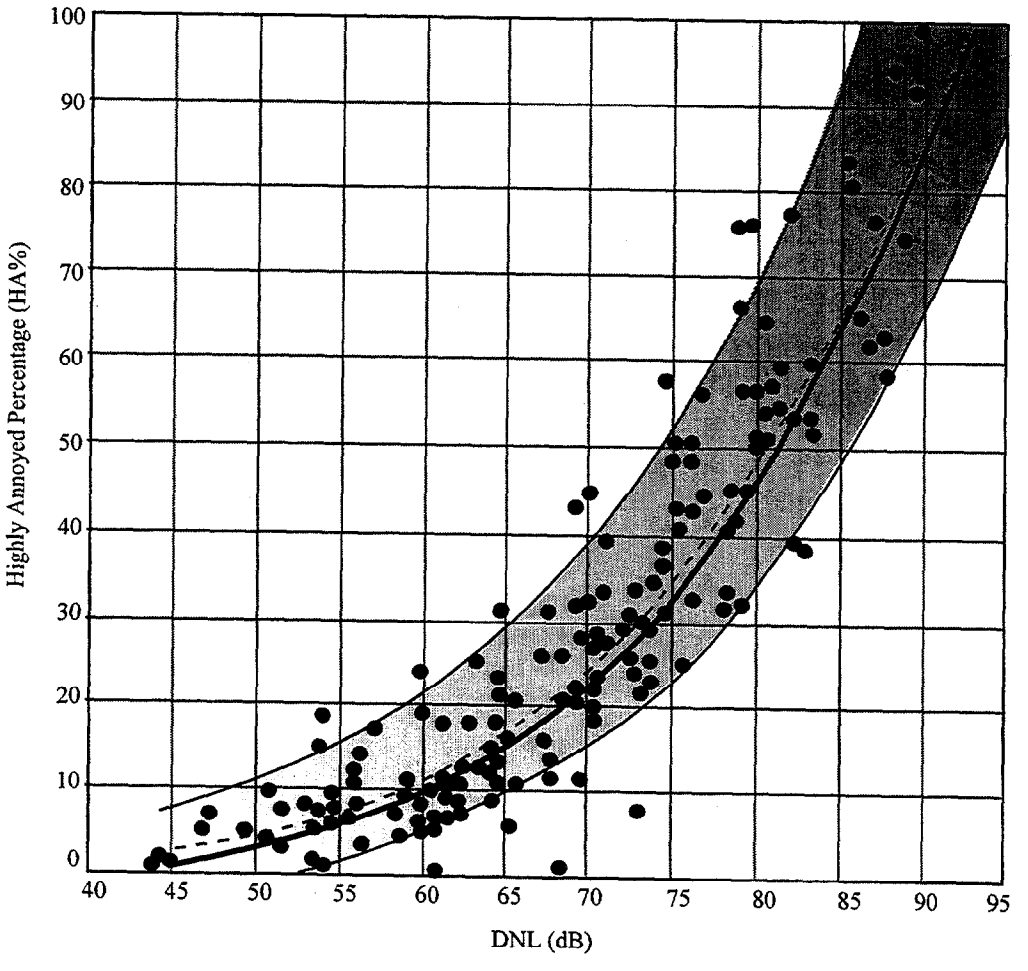
Studies of community annoyance to numerous types of environmental noise show that DNL correlates well with impact. Schultz (1978) showed a consistent relationship between DNL and annoyance. Figure D-2 shows Shultz's original curve fit. This result shows that there is a remarkable consistency in results of attitudinal surveys which relate the percentages of groups of people who express various degrees of annoyance when exposed to different Day-Night Average Sound Levels.

A more recent study has reaffirmed this relationship (Fidell *et al.* 1991). Figure D-3 (FICON 1992) shows an updated form of the curve fit (Finegold *et al.* 1994) in comparison with the original. The updated fit, which does not differ substantially from the original, is the current preferred form. In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors which influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using Day-Night Average Sound Level.

As noted earlier for Sound Exposure Level, Day-Night Average Sound Level does not represent the sound level heard at any particular time, but rather represents the total sound exposure. It accounts for the sound level of individual noise events, the duration of those events, and the number of events. Its use is endorsed by the scientific community (ANSI 1980; ANSI 1988; USEPA 1972; FICUN 1980; FICON 1992).

While DNL is the best metric for quantitatively assessing cumulative noise impact, it does not lend itself to intuitive interpretation by non-experts. Accordingly, it is common for environmental noise analyses to include other metrics for illustrative purposes. A general indication of the noise environment can be presented by noting the maximum sound levels which can occur and the number of times per day noise events will be loud enough to be heard. Use of other metrics as supplements to DNL has been endorsed by federal agencies (FICON 1992).

The Schultz curve is generally applied to annual average DNL. In section 1.2.6, L_{dnmr} was described and presented as being appropriate for quantifying noise in military airspaces. In the current study, the Schultz curve is used with L_{dnmr} as the noise metric. L_{dnmr} is always equal to or greater than DNL, so impact is generally higher than would have been predicted if the onset rate and busiest-month adjustments were not accounted for.



Source: Schultz, 1978.

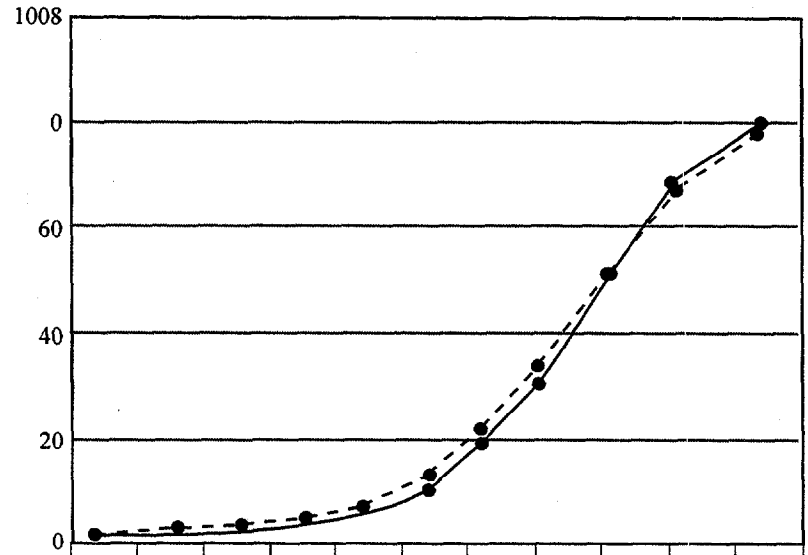
LEGEND

- - - %HA = 0.8553 L_{dn} - 0.0401 L_{dn}^2 + 0.00047 L_{dn}^3

All 161 Data Points Given Equal Weight

All Surveys Given Equal Weight

Figure D-2. Community Surveys of Noise Annoyance



Day-Night Average Sound Level in dB	40	45	50	55	60	65	70	75	80	85	90
Calculated % HA Points: USAF	0.41	0.83	1.66	3.31	6.48	12.3	22.1	36.5	53.7	70.2	82.6
SCHULTZ	0.58	1.11	2.12	4.03	7.52	13.6	23.3	37.1	53.3	68.8	81

LEGEND

USAF (Finegold *et al.* 1992) DATA 400 POINTS
%HA = 100/[1 + EXP (11.13 - 0.141 LDN)]

SCHULTZ DATA 161 POINTS
%HA = 100/[1 + EXP (10.43 - 0.132 LDN)]

HA = Highly Annoyed

Figure D-3. Response of Communities to Noise; Comparison of Original (Schultz 1978) and Current (Finegold et al. 1994) Curve Fits

Sonic boom exposure is measured by C-weighting, with the corresponding cumulative metric being CDNL. Correlation between CDNL and annoyance has been established, based on community reaction to impulsive sounds (CHABA 1981). Values of the C-weighted equivalent to the Schultz curve are different than that of the Schultz curve itself. Table D-1 shows the relation between annoyance, DNL and CDNL.

Table D-1. Relation Between Annoyance, DNL and CDNL

CDNL	*% Highly Annoyed*	*DNL*
48	2	50
52	4	55
57	8	60
61	14	65
65	23	70
69	35	75

There are several points of interest in the noise-annoyance relation. The first is DNL of 65 dB. This is a level most commonly used for noise planning purposes, and represents a compromise between community impact and the need for activities like aviation which do cause noise. Areas exposed to DNL above 65 dB are generally not considered suitable for residential use. The second is DNL of 55 dB, which was identified by EPA as a level below which there is effectively no adverse impact (USEPA 1972). The third is DNL of 75 dB. This is the lowest level at which adverse health effects could be credible (USEPA 1972). The very high annoyance levels make such areas unsuitable for residential land use.

Interpretation of CDNL from impulsive noise is accomplished by using the CDNL versus annoyance values in Table D-1. CDNL can be interpreted in terms of an "equivalent annoyance" DNL, e.g., CDNL of 52, 61, and 69 dB are equivalent to DNL of 55, 65 and 75 dB, respectively. If both continuous and impulsive noise occur in the same area, impacts are assessed separately for each.

1.3.2. Land Use Compatibility

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is the Day-Night Average Sound Level or Onset-Rate Adjusted Day-Night Average Sound Level for military overflights. Impulsive noise can be assessed by relating CDNL to an "equivalent annoyance" DNL, as outlined in section 1.3.1.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published guidelines (FICUN 1980) relating Day-Night Average Sound Levels to compatible land uses. This committee was composed of representatives from the United States Departments of Defense, Transportation, and Housing and Urban Development; the Environmental Protection Agency; and the Veterans Administration. Since the

issuance of these guidelines, federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, the Department of Defense and the Federal Aviation Administration (FAA) adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. The FAA included the committee's guidelines in the Federal Aviation Regulations (USDOT 1984). These guidelines are reprinted in Table D-2, along with the explanatory notes included in the regulation. Although these guidelines are not mandatory (note the footnote "*" in the table), they provide the best means for determining noise impact in airport communities. In general, residential land uses normally are not compatible with outdoor Day-Night Average Sound Levels (DNL values) above 65 dB, and the extent of land areas and populations exposed to DNL of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases, where noise change exceeds 3dB, the 1992 FICON indicates the 60dB DNL may be a more appropriate incompatibility level for densely populated areas.

2.0 NOISE EFFECTS

The discussion in section 1.3 presents the global effect of noise on communities. The following sections describe particular noise effects.

2.1 HEARING LOSS

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period. Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4,000 Hz, after a 40-year exposure) suggests a time-average sound level of 70 dB over a 24-hour period (USEPA 1972). Since it is unlikely that airport neighbors will remain outside their homes 24 hours per day for extended periods of time, there is little possibility of hearing loss below a Day-Night Average Sound Level of 75 dB, and this level is extremely conservative.

2.2 NONAUDITORY HEALTH EFFECTS

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have not been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on 22–24 January 1990 in Washington, D.C., which states the following: "The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day). At the International Congress (1988) on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous.

Table D-2. Land-Use Compatibility With Yearly Day-Night Average Sound Levels

Land Use	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoria, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware, and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

* The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.

KEY TO TABLE D-2

SLUCM = Standard Land-Use Coding Manual.
Y (YES) = Land Use and related structures compatible without restrictions.
N (No) = Land Use and related structures are not compatible and should be prohibited.
NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35 = Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

NOTES FOR TABLE D-2

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential 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 and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
(2) Measures to achieve NLR 25 dB 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.
(3) Measures to achieve NLR 30 dB 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 35 dB 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) Land-use compatible provided special sound reinforcement systems are installed.
(6) Residential buildings require an NLR of 25.
(7) Residential buildings require an NLR of 30.
(8) Residential buildings not permitted.

Consequently, it can be concluded that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place (von Gierke 1990; parenthetical wording added for clarification).

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

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

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

A recent review of health effects, prepared by a Committee of the Health Council of The Netherlands (CHCN 1996) reviewed currently available published information on this topic. They concluded that the threshold for possible long-term health effects was a 16-hour (0600 to 2200) L_{eq} of 70 dB. Projecting this to 24 hours and applying the 10 dB nighttime penalty used with DNL, this corresponds to DNL of about 75 dB. The study also affirmed the risk threshold for hearing loss, as discussed earlier.

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

2.3 ANNOYANCE

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the U.S. Environmental Protection Agency as any negative subjective reaction on the part of an individual or group (USEPA 1972). As noted in the discussion of Day-Night Average Sound Level above, community annoyance is best measured by that metric.

Because the EPA Levels Document (USEPA 1972) identified DNL of 55 dB as "...requisite to protect public health and welfare with an adequate margin of safety," it is commonly assumed that 55 dB should be adopted as a criterion for community noise analysis. From a noise exposure perspective, that would be an ideal selection. However, financial and technical resources are generally not available to achieve that goal. Most agencies have identified DNL of 65 dB as a criterion which protects those most impacted by noise, and which can often be achieved on a practical basis (FICON 1992). This corresponds to about 13 percent of the exposed population being highly annoyed.

Although DNL of 65 dB is widely used as a benchmark for significant noise impact, and is often an acceptable compromise, it is not a statutory limit and it is appropriate to consider other thresholds in particular cases.

In this EIS, no specific threshold is used. The noise in the ROIs are evaluated on the basis of the information presented in this appendix and in the body of the EIS. Particular attention is given to the ideal 55 dB identified by EPA.

Community annoyance from sonic booms is based on CDNL, as discussed in Section 1.3. Particular effects often cited for sonic booms include startle and task interference. These effects are implicitly included in the "equivalent annoyance" CDNL values in Table D-1, since those were developed from actual community noise impact.

2.4 SPEECH INTERFERENCE

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that the use of the Sound Exposure Level metric will measure speech interference successfully, and that a Sound Exposure Level exceeding 65 dB will begin to interfere with speech communication.

2.5 SLEEP INTERFERENCE

Sleep interference is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

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

An analysis sponsored by the U.S. Air Force summarized 21 published studies concerning the effects of noise on sleep (Pearsons *et al.* 1989). The analysis concluded that a lack of reliable in-home studies, combined with large differences among the results from the various laboratory studies, did not permit development of an acceptably accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced. None of the laboratory studies were of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions. A recent extensive study of sleep interference in people's own homes (Ollerhead 1992) showed very little disturbance from aircraft noise.

There is some controversy associated with the recent studies, so a conservative approach should be taken in judging sleep interference. Based on older data, the U.S. Environmental Protection Agency identified an indoor Day-Night Average Sound Level of 45 dB as necessary to protect against sleep interference

(USEPA 1972). Assuming a very conservative structural noise insulation of 20 dB for typical dwelling units, this corresponds to an outdoor Day-Night Average Sound Level of 65 dB as minimizing sleep interference.

A 1984 publication reviewed the probability of arousal or behavioral awakening in terms of Sound Exposure Level (Kryter 1984). Figure D-4, extracted from Figure 10.37 of Kryter (1984), indicates that an indoor Sound Exposure Level of 65 dB or lower should awaken less than 5 percent of those exposed. These results do not include any habituation over time by sleeping subjects. Nevertheless, this provides a reasonable guideline for assessing sleep interference and corresponds to similar guidance for speech interference, as noted above.

2.6 NOISE EFFECTS ON DOMESTIC ANIMALS AND WILDLIFE

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

There are available many scientific studies regarding the effects of noise on wildlife and some anecdotal reports of wildlife "flight" due to noise. Few of these studies or reports include any reliable measures of the actual noise levels involved. However, in the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research Council has proposed that protective noise criteria for animals be taken to be the same as for humans (NRC NAS 1977).

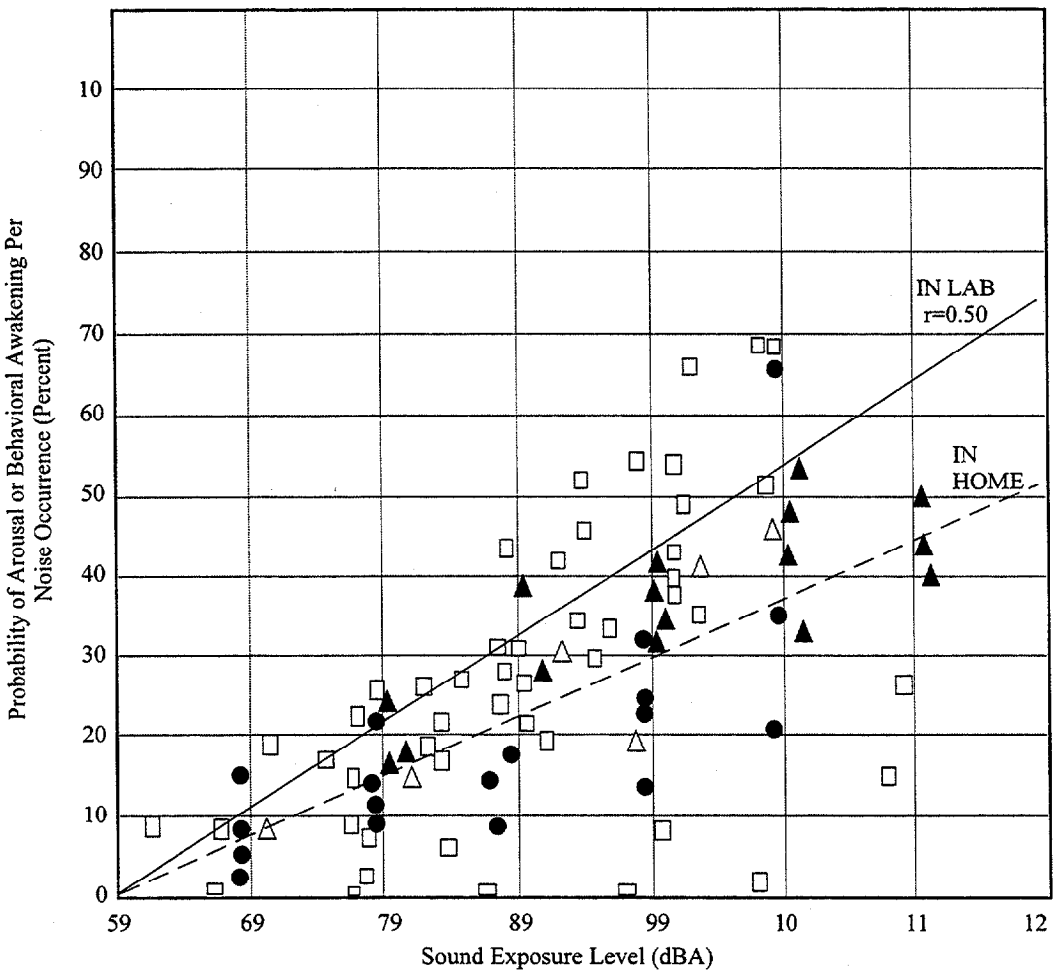
2.7 NOISE EFFECTS ON STRUCTURES

2.7.1 Subsonic Aircraft Noise

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of the excitation of structural component resonance. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (NRC NAS 1977).

A recent study, directed specifically at low-altitude, high-speed aircraft showed that there is little probability of structural damage from such operations (Sutherland 1989). One finding in that study is that sound levels at damaging frequencies (e.g., 30 Hz for window breakage or 15 to 25 Hz for whole-house response) are rarely above 130 dB.

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle," of objects within the dwelling, such as hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne



LEGEND

- Laboratory Studies, Variety of Noises, Lukas
- Steady State (In Home)
- Transient (In Home)
- Truck Noise, Laboratory Study, Thiesen
  Transformer, Transmission Line, Window Air Conditioner, and Distant Traffic Noise, Horonjeff, *e*

Figure D-4. Probability of Arousal or Behavioral Awakening in Terms of Sound Exposure Level

noise, causing homeowners to fear of breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally incompatible with residential land use. Thus assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

2.7.2 Sonic Boom

Sonic booms are commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table D-3 summarizes the threshold of damage that might be expected at various overpressures. There is a large degree of variability in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. While glass can suffer damage at low overpressures, as shown in Table D-3, laboratory tests of glass (White 1972) have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms. In general, structural damage from sonic booms should be expected only for overpressures above 10 psf.

2.8 NOISE EFFECTS ON TERRAIN

Members of the public often perceive that noise from low-flying aircraft can cause avalanches or landslides by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

2.9 NOISE EFFECTS ON HISTORICAL AND ARCHAEOLOGICAL SITES

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

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

As noted above for the noise effects of noise-induced vibrations of normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

Table D-3. Possible Damage to Structures From Sonic Booms

Sonic Boom Overpressure Nominal (psf)	*Type of Damage*	*Item Affected*
0.5 - 2	Cracks in plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
	Cracks in glass	Rarely shattered; either partial or extension of existing.
	Damage to roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, e.g., large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("Party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Source: Haber and Nakaki 1989

3.0 NOISE MODELING

3.1 SUBSONIC AIRCRAFT NOISE

An aircraft in subsonic flight generally emits noise from two sources: the engines and flow noise around the airframe. Noise generation mechanisms are complex, and in practical models the noise sources must be based on measured data. The Air Force has developed a series of computer models and aircraft noise data bases for this purpose. The models include NOISEMAP (Moulton 1992) for noise around airbases, ROUTEMAP (Lucas and Plotkin 1988) for noise associated with low-level training routes, and MR_NMAP (Lucas and Calamia 1996) for use in MOAs and ranges. These models use the NOISEFILE database developed by the Air Force. NOISEFILE data includes SEL and L_{Amax} as a function of speed and power setting for aircraft in straight flight.

Noise from an individual aircraft is a time-varying continuous sound. It is first audible as the aircraft approaches, increases to a maximum when the aircraft is near its closest point, then diminishes as it departs. The noise depends on the speed and power setting of the aircraft, and its trajectory. The models noted above divide the trajectory into segments whose noise can be computed from the data in NOISEFILE. The contributions from these segments are summed.

MR_NMAP was used to compute noise levels in the Nellis Range Complex. The primary noise metric computed by MR_NMAP was L_{dnmr} averaged over each airspace. The program was also used to compute the number of times per day that SEL of 65 dB would be exceeded at any given location in the range complex. Supporting routines from NOISEMAP were used to calculate SEL and L_{Amax} for various flight altitudes and lateral offsets from a ground receiver position.

3.2 SONIC BOOM

When an aircraft moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave which disperses rapidly. At supersonic speeds, the aircraft is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at the ground, a sonic boom consists of two shock waves (one associated with the forward part of the aircraft, the other with the rear part) of approximately equal strength and (for fighter aircraft) separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them have the appearance of a capital letter "N," so a sonic boom pressure wave is usually called an "N-wave."

The ground pattern of a sonic boom depends on the size, shape, speed, and trajectory of the aircraft. The Air Force's PCBoom3 computer program (Plotkin 1996) can be used to compute sonic boom for a given single event. Supersonic operations at Nellis are associated with air-to-air activity, however, which can best be described statistically. Accordingly, cumulative sonic boom impact (CDNL) was computed using the Air Force's BooMap model (Frampton *et al.* 1993). This is based on measurements of sonic booms, together with analysis of tracking data, four major field studies. BooMap provides CDNL in a supersonic air combat arena, plus the average number of booms per day which would be heard at any given location.

4.0 AICUZ OVERVIEW

4.1 INTRODUCTION

The Air Installation Compatible Use Zone (AICUZ) Program is a Department of Defense (DoD) planning program which was developed in response to growing incompatible urban development (encroachment) around military airfields. The Air Force AICUZ program policy is to promote land use compatibility through participation in local, regional, state, and federal land use planning control and coordination processes.

Most Air Force installations were built in the 1940s and early 1950s and in relatively remote areas. Since then, urban growth has extended toward the boundaries of many of these installations. Problems result when complaints over the effects of aircraft operations (e.g., noise, low overflight, etc.) lead to operational changes which negatively impact the flying mission. Incompatible encroachment has been a contributor to the cessation of flying mission and base closures at installations such as Lowery AFB in Colorado, Chanute AFB in Illinois, and Laredo AFB in Texas. As communities grow and expand, it is only natural that they become more interested in orderly development. This should include adequate provisions to protect the Air Force facilities which are an integral part of the communities physical and economic structure.

The Air Force has been successful in encouraging the adoption of enabling legislation for planning compatible development around airfields in Arizona, Texas, and Alabama. Other states such as California have adopted legislation after recognizing the need to protect all airfields from encroachment. The Air Force encourages the adoption of state-enabling legislation for this purpose, and will cooperate with the appropriate authorities regarding its implementation.

4.2 PROGRAM OBJECTIVES

The AICUZ program has two objectives:

- assist local, regional, state, and federal officials in protecting and promoting the public health, safety, and welfare by promoting compatible development within the AICUZ area of influence and

- protect Air Force operational capability from the effects of land use which are incompatible with aircraft operations.

The AICUZ study must be consistent with current land use planning principles and procedures as well as current techniques in noise assessment methodology. Also, it must adequately describe current air operations and procedures and provide recommendations for compatible land use development based on nationally recognized standards. In some cases, projections for future air operations are included in the AICUZ study if the community requests it. The inclusion of future projections in the AICUZ must avoid releasing new information scheduled to be released through the Environmental Impact Analysis Process (EIAP). If future projections are planned to be included, approval from the MAJCOM/CE is required. The AICUZ should relate to state laws, enabling legislation, and local economic and political conditions. The AICUZ is not an end in itself but rather one of many land use determinants used by local planners and decisionmakers. The AICUZ study must have a factual and rational basis.

4.3 REGULATORY BASIS

Several documents provide the regulatory basis for the AICUZ program:

- DoD Instruction (DoDI) 4165.57 established and requires the military departments to develop, implement, and maintain an AICUZ program for installations with flying operations. This DoDI:

  1. sets forth DoD policy on achieving compatible use of public and private lands in the vicinity of military airfields;

  2. defines (a) required restrictions on the uses and heights of obstructions in the vicinity of air installations to provide for safety of flight and to assure that people and facilities are not concentrated in areas susceptible to aircraft accidents and (b) desirable restrictions on land use to assure its compatibility with the characteristics, including noise, of air installations operations;

  3. describes the procedures by which AICUZ may be defined; and

  4. provides policy on the extent of government interest in real property within those zones which may be retained or acquired to protect the operational capability of active military airfields (subject in each case to the availability of required authorizations and appropriations).

- The General Services Administration (GSA), Federal Management Circular (FMC) 75-2 entitled "Compatible Land Uses at Federal Airfields" requires federal agencies, that operate airfields to work with local, regional, state, and other federal officials on compatible land use planning. It requires other federal agencies to ensure their programs serve and foster compatible land use according to plans (such as AICUZ) developed by the federal agency operating on airfield. It requires HUD, VA, FHA and other Federal agencies to implement the AICUZ program as they are able under their mandate.

- AFI 32-7063, "Air Installation Compatible Use Zone (AICUZ) Program" sets forth the policy, responsibilities, and requirements of the program. Topics covered include program objectives, responsibilities, land use compatibility guidelines, and AICUZ studies and updating.

- AFJM 32-8008 (formerly AFM 86-14), "Airfield and Heliport Planning Criteria" provides standardized criteria for all DoD service components for planning and developing the layout of runways, taxiways aprons, and related facilities for airfields and heliports. It provides criteria for establishing planes and surfaces of navigational airspace surrounding the airfields and heliports for the purpose of controlling potential obstructions to aircraft operations.

- AFMAN 32-7067 (formerly AFM 19-10), "Planning in the Noise Environment" is a Tri-Service manual which discusses noise characteristics, noise sources, effects of noise, noise monitoring, tools for noise analysis and reducing noise conflicts.

- AFI 13-201, "Air Force Airspace Management" establishes practices to decrease disturbances from flight operations that might cause adverse public reaction, and provides flying unit commanders with general guidance for dealing with local problems. This instruction sets forth the AICUZ responsibilities of the flying operation organizations at Air Force installations.

4.4 EVOLUTION OF THE AICUZ PROGRAM

The military services, particularly the Air Force, have been advocates of noise planning for a long time. Many aspects of the noise program presently used for civilian airports have their roots in the Air Force's experiences. As early as 1957, the Air Force began establishing procedures for estimating noise exposure and gauging community reaction to aircraft operations. By 1964, the Air Force was working on the relationship between land use planning and aircraft noise. Even at that early time, the Air Force recognized the need to address noise from a land use planning perspective. The Air Force's major concern is the threat posed to the flying mission at an installation as a result of incompatible development.

The late 1960s and early 1970s marked the beginning of the environmental movement. Emphasis on incorporating environmental concerns into the planning process was of major concern to the U.S. Government. Notable events included Air Force research on sonic boom exposure in the 1960s, FAA civilian aircraft certification in 1969, the National Environmental Policy Act in 1969, and the Noise Control Act in 1972. These efforts only increased the awareness of the military on noise planning issues and provided the basis for institutionalizing its programs.

In 1971, the Greenbelt concept was initiated by the Air Force to address the growing problem of incompatible development around airfields (encroachment). The idea behind "Greenbelt" was to establish a buffer zone around the installation through the purchase of property. For obvious budgetary considerations, this concept proved to be economically infeasible.

4.4.1 Noise Description

The AICUZ study was first implemented by the Air Force in 1973. The Air Force adopted the NOISEMAP computer program to describe noise impacts created by aircraft operations. NOISEMAP is one of two EPA-approved programs, the other being the Integrated Noise Model (INM), used by the FAA for civilian airports. The Air Force continues to improve the NOISEMAP program.

The next significant event in the development of the military noise program was the 1974 EPA designation of the noise descriptor "DNL," or Day-Night Average Sound Level. In that year, the EPA Administrator, under authority in the Noise Control Act of 1972, recommended federal agencies adopt the DNL noise descriptor system. The Air Force and EPA agreed upon an implementation procedure by which all future AICUZ studies would be prepared in DNL.

The development of DNL was an important milestone in the AICUZ program. It provides a single descriptor for the noise level. This reduced confusion, increased credibility, and allowed for comparative research efforts on the effects of noise.

Published AICUZ studies for Nellis AFB for 1981 and 1992 are shown in figures D-5 and D-6.

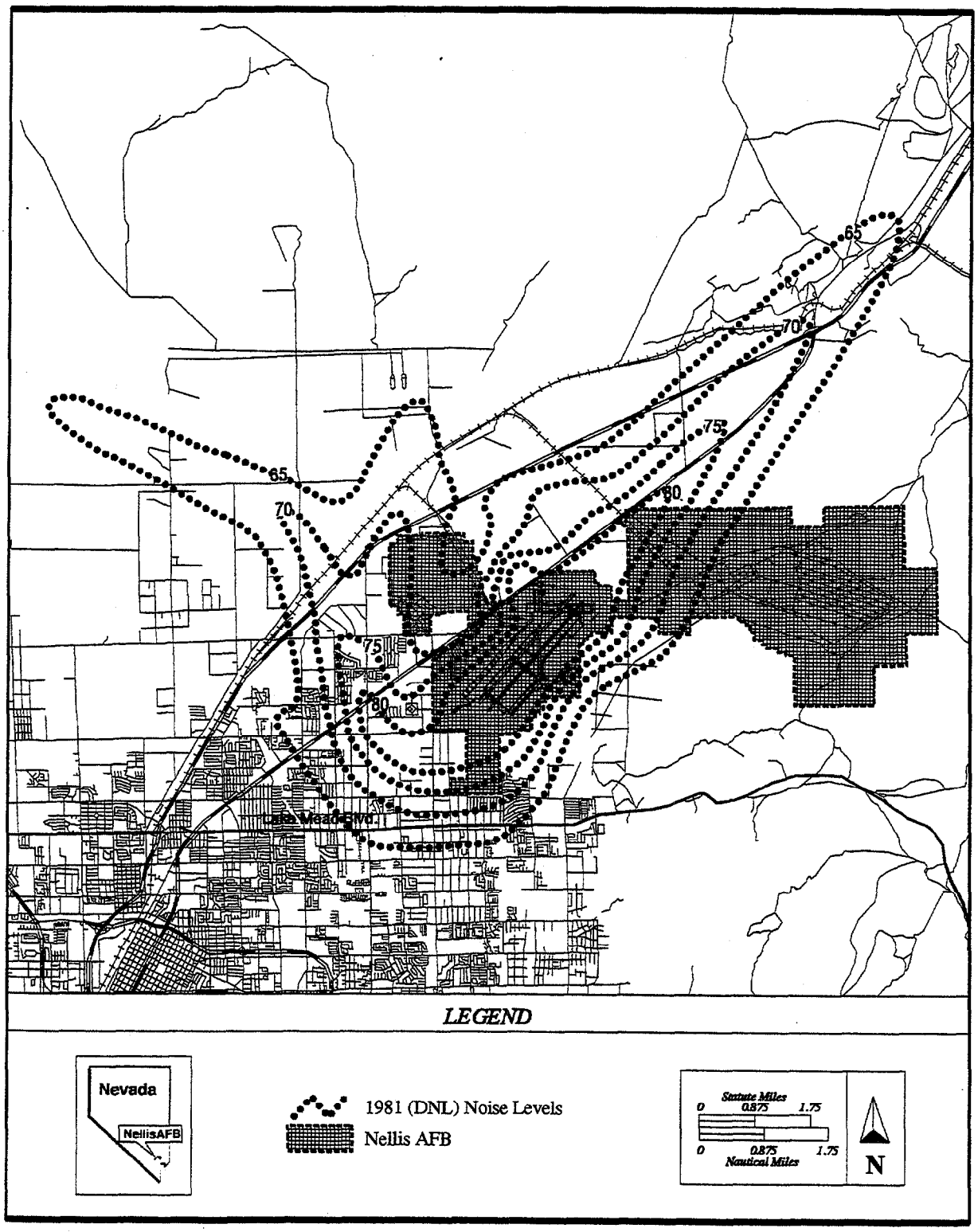


Figure D-5. 1981 Noise Levels in the Vicinity of Nellis AFB

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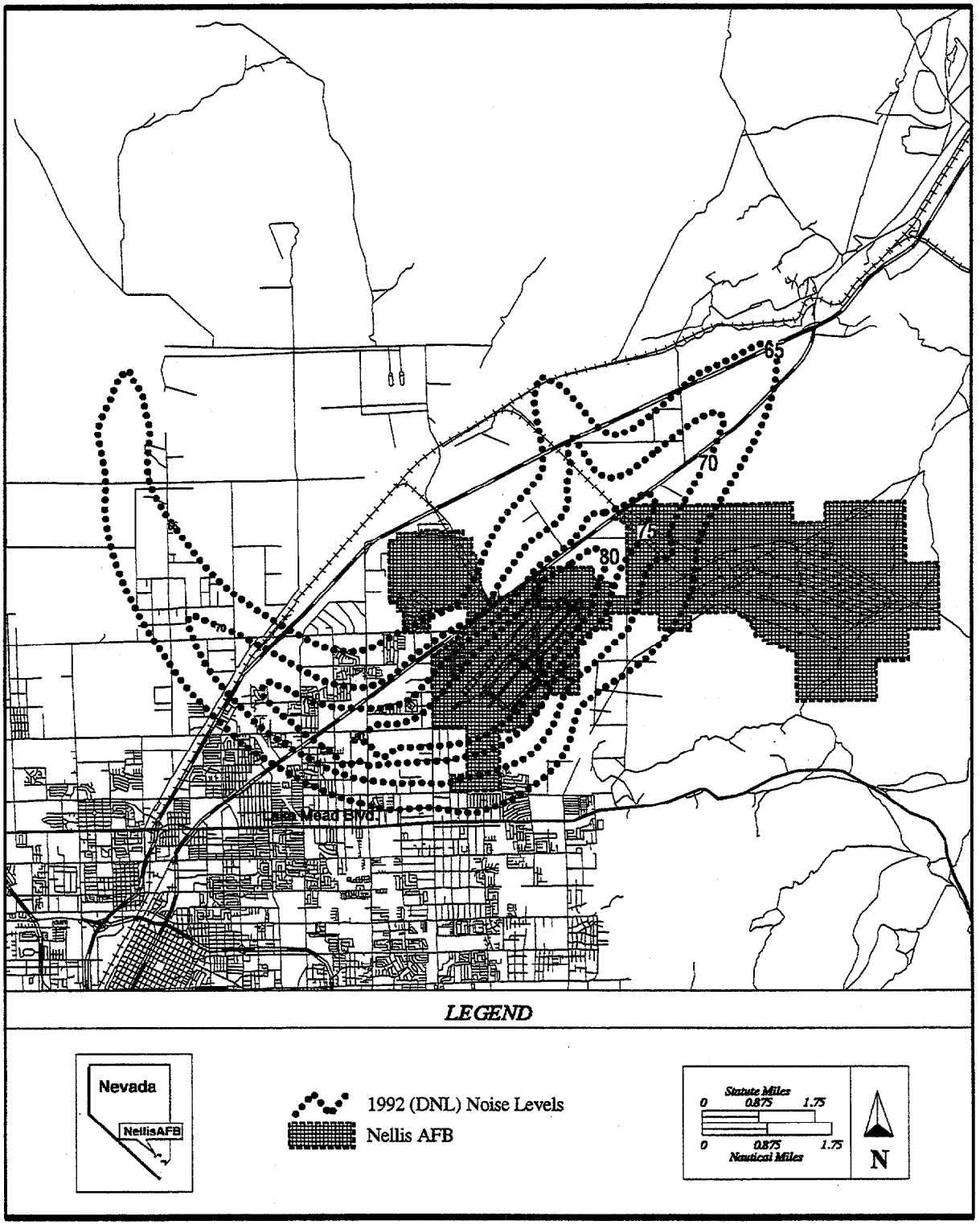

Figure D-6. 1992 Noise Levels in the Vicinity of Nellis AFB

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4.4.2 Height Restrictions

Another aspect of the AICUZ program, which is paralleled in the civilian community, is the height obstruction criteria. U.S. standard instrument approach and departure procedures (Joint Air Force, Navy, Army, and FAA Criteria Handbook – AFM 55-9) prescribes flight path area and vertical clearances from terrain and manmade obstructions. The restrictions limit the height of buildings and other structures in the vicinity of the airfield to ensure the safety of pilots, aircraft and individuals and structures on the ground. AFJM 32-8008 provides more details on the height restriction criteria.

4.4.3 Accident Potential Zones

Accident Potential Zones (APZs) are one aspect of the AICUZ program where military application differs from civilian airfields. An analysis of aircraft accidents within 10 nautical miles of an airfield for the period of 1968-1972 led to defining areas of high accident potential known as the Clear Zone (CZ), Accident Potential Zone I (APZ I), and Accident Potential Zone II (APZ II). The majority of these accidents (62%) occurred either on or adjacent to the airfield or within the CZ, while only about 8% occurred in APZ I and 5% in APZ II. It was concluded that the CZ warranted special attention due to the high incident of accident potential that severely limited acceptable land uses. The Air Force has spent approximately $65 million to acquire real property interests within the clear zones. The percentages of accidents within the two APZs are such that while purchase is not necessary, some type of land use control is essential. The Air Force recommendation is to limit the number of people exposed through selective land use planning.

4.4.4 Land Use Guidelines

Most complaints are related to noise generated by aircraft operations. Noise around an airport is a fact of life, however, as aircraft operations increase the noise exposure increases and complaints increase with demands for noise reductions. In most cases, noise reduction is accomplished by restricting airfield or aircraft operations.

The Federal Interagency Committee on Noise (FICON), published "Guidelines for Considering Noise in Land Use Planning and Control" in June 1980. The committee, now called FICAN (Federal Interagency Committee on Aircraft Noise) is made up of representatives from federal departments that include Transportation, Defense, Environmental Protection Agency, Veterans Administration, and Housing and Urban Development. The purpose of these guidelines is to encourage the best land use, consistent with community planning objectives, while minimizing exposure to excessive noise levels.

4.4.5 Noise Reduction Efforts

Military and civilian noise planning efforts have benefited from mutual interest and efforts. One area is research and development. Developing quieter engines for the KC-135, for example, came about through commercial efforts to reduce fuel costs and noise impacts of the Boeing 707. Other efforts have gone into developing engine test facilities, or hush houses, where engines can run at full power with dramatically reduced noise effects to the surrounding environment. Noise abatement procedures are also practiced in Air Force flight scheduling and aircraft operating procedures. Modification to flight tracks, imposition of quiet hours, and use of preferential runways are all techniques used by both the military and civilian

airfields to reduce noise. At most installations, Air Force noise reduction efforts have been used to their maximum degree, and land use planning and controls are the answer for further protection of the community.

4.4.6 Conclusion

In summary, the difference between noise concerns for the military and the civilian sector continue to become less. The exchange of technical noise information and assistance is needed to address and solve similar problems. Requests from the civilian side to jointly use military airfields are increasing. The Air Force presently has several joint use airfields. Air National Guard and Air Force Reserve units operate from several major airports in the country. There are also large scale joint service operations that include activities at civilian airports. Therefore, both civilian and military airfield operators need to understand each other's mission requirements and their implication with regard to noise and land use planning.

The overall goal of the Air Force AICUZ program is to reduce people's exposure to high levels of aircraft noise and accident potential through compatible land use controls adopted by the local communities. To this end, the Air Force initiated a program to assist local communities in implementing AICUZ recommendations. This program is called the Joint Land Use Study (JLUS) program. Meanwhile, the Air Force must continue to provide the public with current information which will assist them in making prudent land use decisions and mutually work together to resolve the problems of growth and encroachment. Attachment 5 provides a list of policy letters and guidance's that apply to AICUZ program.

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APPENDIX E
AIR QUALITY ANALYSIS

AIR QUALITY ANALYSIS

The air quality analysis examined impacts from air emissions associated with the Proposed Action. As part of the analysis, emissions generated from construction, aircraft operation, aerospace ground equipment (AGE), motor vehicles, and other area (nonmobile) sources were examined for carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_X), volatile organic compounds (VOCs), and particulate matter (PM_{10}). Clark County is currently in serious nonattainment for CO and PM_{10}.

Nellis Air Force Base

CONSTRUCTION EMISSIONS: Construction activities would generate both combustive emissions from heavy equipment use and fugitive dust from ground-disturbing activities. Fugitive dust would be generated during construction activities associated with building construction and modification. These emissions would be greatest during site clearing and grading activities. Uncontrolled fugitive dust (particulate matter) emissions from ground-disturbing activities are emitted at a rate of 1.2 tons of total suspended particulate (TSP) per acre per month (EPA 1995). The PM_{10}, which is TSP less than 10 microns in size, is approximately 50 percent of the TSP.

Construction for the Proposed Action would disturb approximately 4 acres between 2000 and 2008 (see Table 2.3-2). In 2000 five buildings would be constructed or modified for a total of 88,600 square feet or 2 acres. An additional acre of disturbed land around the building sites was added to the construction acreage. The model assumed 30 working days a month with an average project duration of 3 months. The following formula: [1.2 tons (.50) x 3 acres x 3 months] derived 5.4 tons, the amount of PM_{10} for calendar year 2000, the year with the largest number of scheduled construction activities. These temporary emissions would produce short-term elevated PM_{10} concentrations that would fall off rapidly with distance from the source. Construction would also take place in 2002 (.17 acres) and 2005 (.91 acre).

Combustive emissions from equipment exhaust were estimated by developing a profile of typical daily construction equipment for the months of construction activities. The equipment included a mix of heavy trucks, light trucks, graders, loaders, and tractors. Analysis of the construction vehicles was performed using Mobile 5a. Mobile 5a is an U.S. EPA-approved, regulatory on-road mobile-source emissions model. The model calculates vehicle emissions factors using input data such as fuel usage and distance of travel for a mix of general vehicle types (i.e., light trucks, cars).

AIRCRAFT OPERATIONS: Emissions were calculated for aircraft operations associated with the F-22, including power setting, minutes at taxi/idle, takeoff, climbout, and approach. CO, NO_X, PM_{10} and SO_X were obtained from the Special Project Office for the F-22 aircraft (personal communication, Captain Robert Reed 1998, 1999). VOC rates were derived from the Aircraft Engine Emissions Factors for the F119 engine (Air Force 1978), an existing, related, high-performance engine with a combustion system similar to the production engine for the F-22 (personal communication, M. Wade 1998). A daily average of 17.25 take-offs and landings were assumed based on the 4,472 annual sorties for 17 F-22 aircraft. Calculations were based on landings and takeoffs and flights up to 5,000 feet AGL. The total tons per

year of CO, NO_X, SO_X, VOC, and PM_{10} were proportioned in other years based on the beddown of 6 aircraft in fiscal year 2002, 8 in 2003, and 17 in 2008.

VEHICLE EMISSIONS: Vehicle emissions were obtained through the use of vehicle daily trip generation for the Proposed Action and the use of Mobile 5a. The commute of personnel living off base to Nellis AFB (average daily trip) was assumed to be 10 miles round-trip (five miles each way), since abundant residential areas occur close to Nellis AFB. After the completion of the dormitory in 2005, it is assumed that 84 of the additional personnel at Nellis AFB (172 people in 2002 and 195 people in 2007) would live on base. Vehicle emissions results also include government and privately owned vehicle miles travelled on base. On-base travel on Nellis AFB averages 153 vehicle miles travelled (vmt) per person per year.

AEROSPACE GROUND EQUIPMENT: AGE is maintenance equipment associated with the particular aircraft. It includes heaters, compressors, coolers, lifts, and other miscellaneous equipment. A list of the AGE associated with the F-22 aircraft was obtained from the F-22 Special Management Office and emissions were calculated using updated sources from the Nellis AFB Air Emissions Inventory (Radian 1995) Emissions in tons from AGE per year were calculated using the Air Quality Assessment Model (Air Force 1976).

OTHER AREA SOURCES: Other area (nonmobile) sources included facility space heating, residential space heating, and refueling emissions (including fuel evaporation and R-9 refueling truck emissions). AP-42 (EPA 1995) provided the analysis results.

Nellis Range Complex (NRC)

Total annual emissions associated with aircraft activity in NRC were calculated based on scenarios reflecting the range of 200,000 or 300,000 annual sortie-operations. As with the aircraft emissions calculations for the base, aircraft emissions estimates for the NRC were based on aircraft operation summaries developed to support noise analyses. Aircraft activity in NRC airspace is described in terms of annual sortie-operations, typical engine power settings, and typical altitude distributions for a given aircraft type. Emission factors for aircraft were derived primarily from calculation methods for Air Pollutant Emission Criteria Inventories (Air Force 1978). The analysis determined the contribution of the F-22 aircraft to the total emissions of aircraft within the range of 200,000 to 300,000 annual sortie-operations. Tables 4.3-3 and 4.3-4 summarize the results of the analysis.

The computerized Multiple Aircraft Instantaneous Line Source (MAILS) dispersion model (Leibsch 1992) was used to assess concentrations of ground-level pollutants resulting from aircraft flight activities. Using data from overall sortie-operations in the NRC, a conservative scenario of low-altitude flight activities over an NRC range was used. The scenario involved a total of 60 fighter, bomber, and transport aircraft flying 500 feet AGL and passing the same point on the ground within one hour. This scenario would apply under use levels of 200,000 to 300,000 sortie-operations in the NRC. The mixing height was set at 5,000 feet in accordance with regional meteorological conditions. Emission concentrations calculated for a 1-hour period were scaled to represent maximum use in 3-, 8-, 24-hour and annual periods. Resulting pollutant concentrations were compared to the NAAQS and PSD standards to determine if exceedences would occur.

Results

The results of the emission calculations for the years 2000 to 2008 for the area around Nellis AFB are presented in Table E-1. The table shows the emissions for a specific pollutant (CO, NO_X, SO_X, VOC, and PM_{10}) using the following categories:

- Construction and Construction Equipment
- Aircraft Operations and Aerospace Ground Equipment
- Motor Vehicles
- Other Area Sources

Based on the underlying assumption of a daily average of 17.25 takeoffs and landings in the fully operating program of 4,472 sorties and 17 F-22 aircraft, the maximum annual emissions of CO and PM_{10} are well below the *de minimus* levels for the general conformity rule. The maximum amount of CO, NO_X, SO_X, PM_{10}, and VOC emissions associated with the Proposed Action occurs in 2008 with the full contingent of 17 F-22s at Nellis AFB. The Proposed Action would add 88.5 tons of CO per year in 2008, below the *de minimis* level of 100 tons, and 6 tons of PM_{10}. PM_{10} emissions are well below the *de minimis* level of 70 tons per year. Both CO and PM_{10} are below regional significance for Clark County.

The air quality analysis for the NRC examined the contribution of F-22 aircraft emissions within the 21 airspace units for a range of 200,000 to 300,000 sortie-operations. The F-22 would annually contribute between 0.03 and 1.4 tons of CO emissions, 6 to 300 tons of NO_X, 0.01 to 0.67 tons of VOCs, 0.19 to 9.5 tons of SO_X, and 0.2 and 2.6 tons of PM_{10}. Total emissions for the NRC, including those by the F-22, would continue to be distributed throughout a volume of air of 13,000 cubic miles resulting in low criteria pollutant concentrations. Air quality effects associated with total NRC aircraft operations would continue to be insignificant.

Table E-l. Air Quality Analysis for the F-22 Beddown (Page 1 of 3)

2000	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	5.80	26.69	1.78	1.26	5.4
Aircraft Operations and AGE	0.00	0.00	0.00	0.00	0.00
Motor Vehicles	0.00	0.00	0.00	0.00	0.00
Other Area Sources	0.12	0.28	0.00	0.00	0.00
Total	**5.92**	**26.97**	**1.78**	**1.26**	**5.40**

Table E-l. Air Quality Analysis for the F-22 Beddown (Page 2 of 3)

2001	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	0.00	0.00	0.00	0.00	0.00
Motor Vehicles	0.00	0.00	0.00	0.00	0.00
Other Area Sources	0.12	0.28	0.00	0.00	0.00
Total	**0.12**	**0.28**	**0.00**	**0.00**	**0.00**

2002[1]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.33	1.54	0.10	0.08	0.31
Aircraft Operations and AGE	23.98	14.28	0.77	0.40	1.71
Motor Vehicles	6.71	0.67	0.04	0.80	0.05
Other Area Sources	0.70	0.58	0.10	2.48	0.30
Total	**31.72**	**17.07**	**1.01**	**3.76**	**2.37**

2003[2]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	31.97	57.12	3.09	1.62	2.28
Motor Vehicles	8.90	0.88	0.06	1.03	0.06
Other Area Sources	0.89	0.67	0.14	3.31	0.40
Total	**41.76**	**58.67**	**3.29**	**5.96**	**2.74**

2004[2]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	31.97	57.12	3.09	1.62	2.28
Motor Vehicles	8.86	0.87	0.06	1.02	0.06
Other Area Sources	0.89	0.67	0.14	3.31	0.40
Total	**41.72**	**58.66**	**3.29**	**5.95**	**2.74**

1. 6 aircraft and 1,578 sorties
2. 8 aircraft and 2,140 sorties

Table E-l. Air Quality Analysis for the F-22 Beddown (Page 3 of 3)

2005[2]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	1.77	8.11	0.54	0.52	1.64
Aircraft Operations and AGE	31.97	57.12	3.09	1.62	2.28
Motor Vehicles	8.84	0.86	0.06	1.00	0.06
Other Area Sources	0.92	0.75	0.14	3.31	0.40
Total	**43.50**	**66.84**	**3.83**	**6.45**	**4.38**

2006[2]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	31.97	57.12	3.09	1.62	2.28
Motor Vehicles	8.82	0.86	0.06	0.99	0.06
Other Area Sources	0.92	0.75	0.14	3.31	0.40
Total	**41.71**	**58.73**	**3.29**	**5.92**	**2.74**

2007[2]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	31.97	57.12	3.09	1.62	2.28
Motor Vehicles	18.80	1.82	0.12	2.08	0.12
Other Area Sources	1.78	1.17	0.30	7.06	0.85
Total	**52.55**	**60.11**	**3.51**	**10.76**	**3.25**

2008[3]	*CO*	*NO_x*	*SO_x*	*VOC (Hc)*	*PM_{10}*
Construction and Equipment	0.00	0.00	0.00	0.00	0.00
Aircraft Operations and AGE	67.94	121.38	6.57	3.43	4.84
Motor Vehicles	18.80	1.82	0.12	2.08	0.12
Other Area Sources	1.78	1.17	0.30	7.06	0.85
Total	**88.42**	**124.37**	**6.99**	**12.57**	**5.81**

2. 8 aircraft; 2,140 annual sorties
3. 17 aircraft; 4,472 annual sorties

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APPENDIX F
BIOLOGICAL RESOURCES SUPPORT DATA

Table F-1. Protected and Sensitive Plant Species Known to Occur on Nellis AFB and NAFR (Page 1 of 4)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*NNHP and TNC ranking*[1]	*Distribution*
Found on Nellis AFB					
Las Vegas bearpoppy	*Arctomecon californica*	SOC	CE	G3S3	Clark County; Nellis AFB (areas II and III)
Found on NAFR					
Ackerman milkvetch	*Astragalus ackermanii*	SOC		G2S2	Clark and Lincoln counties; Desert NWR and S Range, NAFR (Sheep and Pintwater ranges)
Amargosa Penstemon	*Penstemon fruticiformis* ssp. *Amargosae*	SOC		G3T2S2	Western Clark and southern Nye counties, unconfirmed on NAFR.
Bashful beardtongue	*Penstemon pudicus*	SOC		G1S1	Nye County; N Range (Kawich Range).
Beatley milkvetch	*Astragalus beatleyae*	SOC	CE	G2S2	Nye County; N Range, NAFR (Pahute Mesa) and Nevada Test Site (NTS, Halfpint Range).
Beatley phacelia (scorpion plant)	*Phacelia beatleyae*	SOC		G2S2	Lincoln and Nye counties; Desert NWR, S Range, NAFR (Halfpint Range).
Black woolypod	*Astragalus funereus*	SOC		G2S2	Clark, Lincoln, and Nye counties; N and S ranges, NAFR (Yucca Mt. and Halfpint Range).
Blaine pincushion cactus	*Sclerocactus blainei*	SOC	CY	G1S1	Nye County; N Range, NAFR.
Cane Spring evening primrose	*Camissonia megalantha*	SOC		G2S2	Lincoln and Nye counties; NTS, NAFR (Halfpint Range) and N Range (Kawich Range).
Charleston ground-daisy	*Townsendia jonesii* var. *tumulosa*	SOC		G2T2S2	Clark County; Desert NWR.
Clokey eggvetch	*Astragalus oophorus* var. *clokeyanus*	SOC		G2S2	Clark and Nye counties; N Range, NAFR (Belted Range) and NTS.
Clokey greasewood	*Glossopetalon clokeyi*	SOC		G1S1	Clark County, unconfirmed on NAFR.
Clokey mountain sage	*Salvia dorrii* var. *clokeyi*	SOC		G5T2S2	Clark County; under MOA airspace (Desert NWR, Sheep Range), unconfirmed on NAFR but occurrence suspected.

Table F-1. Protected and Sensitive Plant Species Known to Occur on Nellis AFB and NAFR (Page 2 of 4)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*NNHP and TNC ranking*[1]	*Distribution*
Found on NAFR					
Clokey paintbrush	*Castilleja martinii* var. *clokeyi*	SOC		G3T2S2	Nye County, presumed to occur elsewhere, on NAFR.
Currant milkvetch	*Astragalus uncialis*	SOC		G2S1	Northeastern Nye County, unconfirmed on NAFR or MOA airspace.
Currant Summit clover	*Trifolium andinum* var. *podocephalum*	SOC		G3T1S1	Unconfirmed on NAFR (other data unavailable).
Eastwood milkweed	*Asclepias eastwoodiana*	SOC		G2S2	Nye County; reported on NAFR (Tonopah Test Range [DoE 1996]).
Gilman milkvetch	*Astragalus gilmanii*	SOC		G3S1	Lincoln County; N Range, NAFR (Groom and Tikaboo ranges.
Half-ring pod milkvetch	*Astragalus mohavensis* var. *hemigyrus*	SOC	CE	G3T2S2	Clark and Lincoln counties; S Range, NAFR (Desert, E Desert, Pintwater ranges).
Holmgren smelowskia	*Smelowskia holmgrenii*	SOC			Northern Nye, unconfirmed on NAFR or MOA airspace.
Kingston bedstraw	*Galium hilendiae* ssp. *kingstonense*	SOC		G4QT2S2	Clark and Nye counties; N Range, NAFR (Belted and Eleana ranges).
Long-calyx milkvetch	*Astragalus oophorus* var. *lonchocalyx*	SOC		G4T1S1	Lincoln County, N. Wilson Creek Range but unconfirmed on NAFR or MOA airspace.
Maguire biscuitroot	*Lewisia maguirei*	SOC		G1S1	Northeastern Nye County, MOA airspace (Cherry Creek summit in Quinn Canyon Range).
Meadow Valley sandwort	*Arenaria stenomeres*			G1S1	Clark and Lincoln counties, under MOA airspace (Las Vegas Range, S. Meadow Valley Mts.).
Merriam's bearpoppy	*Arctomecon merriami*	SOC		G3S2	Lincoln, Nye, and Clark counties; S Range, NAFR (Spotted, Pintwater, Desert, and E Desert ranges, Ranger and De Lamar mtns., and Three Lakes Valley).
Mojave sweetpea	*Lathyrus hitchcockianus*			G2S2	Nye County, on NTS but not known from NAFR or related overflight areas.
Nachlinger catchfly	*Silene nachlingerae*	SOC		G2S2	Reported as occurring on NAFR.
Nevada dune penstemon	*Penstemon arenarius*	SOC		G2S2	Nye, Mineral, and Churchill counties, occurs south of Tolicha Peak near NAFR boundary.

Table F-1. Protected and Sensitive Plant Species Known to Occur on Nellis AFB and NAFR (Page 3 of 4)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*NNHP and TNC ranking*[1]	*Distribution*
Found on NAFR					
Nevada willowherb	*Epilobium nevadense*	SOC		G2S2	Clark County, Spring Mountains, unconfirmed on NAFR.
Pahute green gentian	*Frasera pahutensis*	SOC		G2S2	Nye County, SE rim of Pahute Mesa on NTS, reportedly occurs on NAFR.
Pahute Mesa beardtongue	*Penstemon pahutensis*	SOC		G2S2	Clark, Lincoln and Nye counties, on NAFR (Pahute Mesa), Stonewall Mountain.
Parish's phacelia	*Phacelia parishii*	SOC		G2S2	Clark, Lincoln, and Nye counties; Desert NWR and S Range, NAFR (Indian Springs and Three Lakes valleys).
Peck Station milkvetch	*Astragalus eurylobus*	SOC		G2S2	Lincoln County, under MOA airspace (vicinity of Peck Station).
Pygmy pore leaf	*Porophyllum pygmaeum*	SOC		G1S1	Clark and Lincoln counties; S Range, NAFR (Desert and E Desert ranges).
Remote milkvetch	*Astragalus remotus*	SOC		G1S1	Clark County, Spring Mountains and Bird Spring Range, unconfirmed on NAFR.
Remote rabbitbrush	*Chrysothamnus eremobius*	SOC		G1S1	Clark County; S Range, NAFR (Pintwater Range).
Rollins clover	*Trifolium rollinsii*	SOC		G4T2S2	Nye County, Toiyabe Range, unconfirmed on NAFR.
Rosy bicolored penstemon	*Penstemon bicolor* ssp. *roseus*	SOC		G2T2S2	Clark County, Dry Lake Valley but unconfirmed on NAFR or Desert MOA.
Sanicle biscuitroot	*Cymopterus ripleyi* var. *saniculoides*	SOC		G1S1	Lincoln and Nye counties; N Range, NAFR (Pahute Mesa, Groom, Eleana, Halfpint, and Belted ranges).
Schlesser pincushion	*Sclerocactus schlesseri*	SOC		G1S1	Distribution unavailable, unconfirmed on NAFR.
Sheep fleabane	*Erigeron ovinus*	SOC		G1S1	Clark and Lincoln counties; N Range, NAFR (Groom Range) and under MOA airspace (Irish Mt).
Sheep range milkvetch	*Astragalus amphioxys var. musimonum*	SOC		G5T2S2	Clark and Lincoln counties; under MOA airspace (Sheep Range) and S Range, NAFR (Desert and E Desert ranges).
Sunnyside green gentian	*Frasera gypsicola*	SOC		G2S2	Northeastern Nye County, unconfirmed on NAFR or MOA airspace.

Table F-1. Protected and Sensitive Plant Species Known to Occur on Nellis AFB and NAFR (Page 4 of 4)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*NNHP and TNC ranking*[1]	*Distribution*
Found on NAFR					
Tufted globe mallow	*Sphaeralcea caespitosa*	SOC		G3S2	Northeastern Nye County, unconfirmed on NAFR or MOA airspace.
Utah spikeweed	*Selaginella utahensis*	SOC		G2S2	Clark County, unconfirmed on NAFR or in MOA airspace.
Waxflower	*Jamesia tetrapetala*	SOC		G2S2	Lincoln and Nye counties; under MOA airspace (Highland Range), unconfirmed on NAFR but occurrence suspected.
Welsh's cat's-eye	*Cryptantha welshii*	SOC		G1S1	Distribution unavailable; unconfirmed on NAFR.

Sources: Mozingo and Williams 1980; Hazlett *et al.* 1988; Morefield and Knight 1991; Morefield 1995; DoE 1996; BRRC 1997a; DoD 1997; NNHP 1997; Air Force 1997d, b; USFWS 1997b,c; USFWS 1998.

Notes: 1. Status and ranking:

Federal: E = Endangered - in danger of extinction in all or significant portions of their ranges;
T = Threatened - likely to be classified as endangered in the foreseeable future if present trends continue;
SOC = Species of Concern, formerly Category 2 candidate species - of management concern due to restricted distribution or habitat disturbance;
C = Candidate species - species for which there is sufficient information on their biological status and threats to propose them as Endangered or Threatened.

State: CE = Critically Endangered - species threatened with extinction, whose survival requires assistance because of overexploitation, disease, or other factors or because their habitat is threatened with destruction, drastic modification, or severe curtailment (NRS 527.260-.300);
CY = Cactus and Yucca - succulent taxa that are protected statewide (NRS 527.060-.120).

Nevada Natural Heritage Program and The Nature Conservancy ranking system:

G Global rank indicator, based on worldwide distribution at the species level;
T Global trinomial rank indicator, based on worldwide distribution at the infraspecific level;
S State rank indicator, based on distribution within Nevada at the lowest taxonomic level;
1 Critically imperiled due to extreme rarity, imminent threats, or biological factors;
2 Imperiled due to rarity or other demonstrable factors;
3 Rare and local throughout its range, or with very restricted range, or otherwise vulnerable to extinction;
4 Apparently secure, though frequently quite rare in parts of its range, especially at its periphery;
H Of historical occurrence, not now known but could be rediscovered;
Q Taxonomic status uncertain.

Table F-2. Protected and Sensitive Animal Species Known or with Potential to Occur on Nellis AFB, NAFR, and under MOA Airspace (page 1 of 5)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*Occurrence*
Invertebrates				
Grated tryonia	*Tryonia clathrata*	SOC		Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Moapa Warm Spring riffle beetle	*Stenelmis calida moapa*	SOC		Desert MOA (Sally Corridor: Pahranagat Valley)
Pahranagat pebblesnail	*Fluminicola merriami*	SOC		Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Fishes				
Big Spring spinedace	*Lepidomeda mollispinis pratensis*	T	SP	Desert MOA (Caliente E: Pioche Hills)
Hiko White River springfish	*Crenichthys bayleyi grandis*	E	SP	Desert MOA (Coyote Bravo and Charlie: Pahranagat Valley)
Meadow Valley Wash desert sucker	*Catostomus clarki* ssp.	SOC	SP	Desert MOA (Caliente E: Cedar Range, Pioche Hills); Desert MOA (Elgin: Clover Mts.)
Meadow Valley Wash speckled dace	*Rhinichthys osculus* ssp.	SOC		Desert MOA (Caliente E: Cedar Range, Pioche Hills); Desert MOA (Elgin: Clover Mts.)
Moapa dace	*Moapa coriacea*	E	E	Desert MOA (Elgin: Moapa NWR)
Moapa speckled dace	*Rhinichthys osculus moapae*	SOC	SP	Desert MOA (Elgin: Moapa NWR)
Moapa White River springfish	*Crenichthys bayleyi moapae*	SOC	SP	Desert MOA (Elgin: Moapa NWR)
Mormon White River springfish	*Crenichthys baileyi thermophilus*	SOC		Under MOA airspace, in White River-Pahranagat Valley, Lincoln Co.
Pahranagat roundtail chub	*Gila robusta jordani*	E	E	Desert MOA (Coyote Bravo: Pahranagat Valley)
Pahranagat speckled dace	*Rhinichthys osculus velifer*	SOC	SP	Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)

Table F-2. Protected and Sensitive Animal Species Known or with Potential to Occur on Nellis AFB, NAFR, and under MOA Airspace (page 2 of 5)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*Occurrence*
Fishes (cont'd.)				
Pahrump killifish	*Empetrichthys latos*	E	CE	Under MOA airspace at Corn Creek Springs, Clark Co.
White River springfish	*Crenichthys bayleyi bayleyi*	E	SP	Desert MOA (Coyote Bravo: Pahranagat Valley)
Reptiles				
Banded Gila monster	*Heloderma suspectum cinctum*	SOC	SP	Nellis AFB; Desert MOA (Sally Corridor, Arrow Canyon Range); Desert MOA (Elgin: Clover Mts.)
Chuckwalla	*Sauromalus obesus*	SOC		Nellis AFB; Desert MOA (Elgin: Meadow Valley and Mormon Mts.); Desert MOA (Sally Corridor: Sheep Range); S Range: R-4806E (Sheep Range)
Desert tortoise	*Gopherus agassizi*	T	T	Nellis AFB; S Range: southern part of Desert NWR in Mojave desertscrub; NTS
Mammals				
Allen's big-eared bat	*Idionycteris phyllotis*	SOC		Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Big free-tailed bat	*Nyctinomops macrotis*	SOC		Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
California leaf-nosed bat	*Macrotus californicus*	SOC		Nellis AFB; NRC
Cave myotis	*Myotis velifer brevis*	SOC		Reaches northern limit in southern Clark County; not known or expected on NAFR
Desert Valley kangaroo mouse	*Microdipodops megacephalus albiventer*	SOC		Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Fringed myotis	*Myotis thysanodes*	SOC		Nellis AFB; N Range, EC East: R-4807A (Kawich Range); Reveille MOA (Kawich Range); N Range: R-4807A, -4807B, -4808W, TPECR (Pahute Mesa); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Greater western mastiff bat	*Eumops perotis californicus*	SOC		Nellis AFB; NRC

Table F-2. Protected and Sensitive Animal Species Known or with Potential to Occur on Nellis AFB, NAFR, and under MOA Airspace (page 3 of 5)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*Occurrence*
Mammals (cont'd.)				
Hidden Forest Uinta chipmunk	*Eutamias umbrinus nevadensis*	SOC		Sheep Mountains – Hidden Forest at 7,700-8,500 feet, overflown by MOA airspace
Long-eared myotis	*Myotis evotis*	SOC		Nellis AFB; N Range, EC East: R-4807A (Kawich Range); Reveille MOA (Kawich Range); N Range: R-4807A, -4807B, -4808W, TPECR (Pahute Mesa); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Long-legged myotis	*Myotis volans*	SOC		Nellis AFB; N Range: R-4808E (Groom Range); Desert MOA (Coyote Charlie: Irish Mt.); N Range, EC East: R-4807A (Kawich Range); Reveille MOA (Kawich Range); N Range: R-4807A, -4807B, -4808W, TPECR (Pahute Mesa); Desert MOA (Sally Corridor: Sheep Range); S Range: R-4806E (Sheep Range); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Pahranagat Valley montane vole	*Microtus montanus fucosus*	SOC		Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Pygmy rabbit	*Brachylagus idahoensis*	SOC	SP	Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Small-footed myotis	*Myotis ciliolabrum*	SOC		Nellis AFB; N Range:R-4807A,B (Belted Range); N Range: R-4808E (Groom Range); Desert MOA (Sally Corridor: Sheep Range; S Range: R-4806E (Sheep Range); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Spotted bat	*Euderma maculatum*	SOC	T	Nellis AFB; N Range: R-4807A, -4807B, -4808W, TPECR (Pahute Mesa); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Townsend's big-eared bat	*Plecotus townsendii*	SOC		Nellis AFB; N Range, EC East: R-4807A (Kawich Range); Reveille MOA (Kawich Range); Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley); NTS
Western small-footed myotis	*Myotis ciliolabrum*	SOC		Observed on the NTS and potentially occurs on NAFR

Table F-2. Protected and Sensitive Animal Species Known or with Potential to Occur on Nellis AFB, NAFR, and under MOA Airspace (page 4 of 5)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*Occurrence*
Mammals (cont'd.)				
Yuma myotis	*Myotis yumanensis*	SOC		Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Birds				
American kestrel	*Falco sparverius*	none	SP	N Range:R-4807A,B (Belted Range)
Bald eagle	*Haliaeetus leucocephalus*	T, EPA	E	Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley), Migrant and winter visitor especially to Pahranagat Valley; NTS
Barn owl	*Tyto alba*	none	SP	NRC
Black tern	*Chlidonias niger*	SOC	SP	Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Burrowing owl	*Athene cunicularia*	SOC	P	A spring and fall migrant and breeder on NAFR
Common nighthawk	*Chordeiles minor*		SP	NRC
Cooper's hawk	*Accipiter cooperii*		SP	NRC
Ferruginous hawk	*Buteo regalis*	SOC	SP	Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Flammulated owl	*Otus flammeolus*		SP	NRC
Golden eagle	*Aquila chrysaetos*	EPA	SP	Reveille MOA (Fairview Range)
Great horned owl	*Bubo virginianus*		SP	NRC
Least bittern	*Ixobrychus exilis hesperis*	SOC	SP	Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
Lesser nighthawk	*Chordieles acutipennis*		SP	NRC
Long-eared owl	*Asio otus*		SP	NRC
Mountain plover	*Charadrius montanus*	C	SP	R; NTS
Northern goshawk	*Accipiter gentilis*	SOC	SP	NRC

Table F-2. Protected and Sensitive Animal Species Known or with Potential to Occur on Nellis AFB, NAFR, and under MOA Airspace (page 5 of 5)

Common Name	*Scientific Name*	*Federal Status*[1]	*State Status*[1]	*Occurrence*
Birds (cont'd.)				
Northern harrier	*Circus cyaneus*		SP	NRC
Osprey	*Pandion haliaetus*		SP	NRC
Peregrine falcon	*Falco peregrinus anatum*	E	SP	Spring and fall migrant through NRC
Phainopepla	*Phainopepla nitens*		SP	Nellis AFB; NRC
Prairie falcon	*Falco mexicanus*		SP	NRC
Red-tailed hawk	*Buteo jamaicensis*		SP	NRC
Rough-legged hawk	*Buteo lagopus*		SP	NRC
Sharp-shinned hawk	*Accipiter striatus*		SP	NRC
Short-eared owl	*Asio flammeus*		SP	NRC
Swainson's hawk	*Buteo swainsoni*		SP	NRC
Turkey vulture	*Cathartes aura*		SP	NRC
Western burrowing owl	*Athene cunicularia hypugea*	SOC	SP	Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)
White-faced ibis	*Plegadis chihi*	SOC	SP	Nellis AFB; Desert MOA (Sally Corridor and Coyote Bravo: Pahranagat Valley)

Sources: DoE 1996; BRRC 1997a, b; NDOW 1997; NNHP 1997; USFWS 1995c, 1997b.

Notes: 1. Federal: E = Endangered - in danger of extinction in all or significant portions of their ranges;
T = Threatened - likely to be classified as endangered in the foreseeable future if present trends continue;
SOC = Species of Concern, formerly Category 2 candidate species - of management concern due to their restricted distribution or presence of habitat disturbance;
C = Candidate species - species for which there is sufficient information on their biological status and threats to propose them as Endangered or Threatened;
EPA = Eagle Protection Act.

State: SP = Species protected under NRS 501.
E = Endangered - in danger of extinction in all or significant portions of their ranges;
T = Threatened - likely to be classified as endangered in the foreseeable future if present trends continue.

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 1 of 13)	
Common Name	*Scientific Name*
Amphibians	
Arizona toad	*Bufo microscaphus*
Great Plains toad	*Bufo cognatus*
Leopard frog	*Rana pipiens*
Red-spotted toad	*Bufo punctatus*
Great Basin spadefoot toad	*Spea intermontana*
Western toad	*Bufo boreas*
Woodhouse's toad	*Bufo woodhousii*
Reptiles	
Banded Gila monster*	*Heloderma suspectum cinctum*
Chuckwalla*	*Sauromalus obesus*
Coachwhip	*Masticophis flagellum*
Common kingsnake	*Lampropeltis getula*
Desert collared lizard	*Crotophytus insularis*
Desert horned lizard	*Phrynosoma platyrhinos*
Desert iguana	*Dipsosaurus dorsalis*
Desert night lizard	*Xantusia vigilis*
Desert spiny lizard	*Sceloporus magister*
Desert tortoise*	*Gopherus agassizi*
Gilbert's skink	*Eumeces gilberti*
Glossy snake	*Arizona elegans*
Gopher snake	*Pituophis melanoleucus*
Ground snake	*Sonora semiannulata*
Longnose leopard lizard	*Gambelia wislizenii*
Long-nosed snake	*Rhinocheilus lecontei*
Night snake	*Hypsiglena torquata*
Ringneck snake	*Diadophis punctatus*
Sagebrush lizard	*Sceloporus graciousus*
Side-blotched lizard	*Uta stansburiana*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 2 of 13)	
Common Name	*Scientific Name*
Reptiles (cont.)	
Sidewinder	*Crotalus cerastes*
Southwestern blackhead snake	*Tantilla hobartsmithi*
Speckled rattlesnake	*Crotalus mitchelli*
Spotted leaf-nosed snake	*Phyllorhynchus decurtatus*
Striped whipsnake	*Masticophis taeniatus*
Western banded gecko	*Coleonyx variegatus*
Western fence lizard	*Sceloporus occidentalis*
Western patchnose snake	*Salvadora hexalepis*
Western rattlesnake	*Crotalus viridus*
Western shovelnose snake	*Chionactis occipitalis*
Western whiptail	*Cnemidophorus tigris*
Zebra-tailed lizard	*Callisaurus draconoides*
Mammals	
Allen's big-eared bat*	*Idionycteris phyllotis*
Badger	*Taxidea taxus*
Big brown bat	*Eptesicus fuscus*
Big free-tailed bat*	*Nyctinomops macrotis*
Bighorn sheep	*Ovis canadensis*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Botta's pocket gopher	*Thomomys bottae*
Brush mouse	*Peromyscus boylii*
Bushy-tailed wood rat	*Neotoma cinerea*
Cactus mouse	*Peromyscus eremicus*
California leaf-nosed bat*	*Macrotus californicus*
California myotis	*Myotis californicus*
Canyon mouse	*Peromyscus crinitus*
Chisel-toothed kangaroo rat	*Dipodomys microps*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 3 of 13)	
Common Name	*Scientific Name*
Mammals (cont.)	
Cliff chipmunk	*Tamias dorsalis*
Coyote	*Canis latrans*
Dark kangaroo mouse	*Microdipodops megacephalus*
Deer mouse	*Peromyscus maniculatus*
Desert cottontail	*Sylvilagus auduboni*
Desert kangaroo rat	*Dipodomys deserti*
Desert Valley kangaroo mouse*	*Microdipodops megacephalus albiventer*
Desert woodrat	*Neotoma lepida*
Fringed myotis*	*Myotis thysanodes*
Gray fox	*Urocyon cinereoargenteus*
Great Basin pocket mouse	*Perognathus parvus*
Greater western mastiff bat*	*Eumops perotis californicus*
Hoary bat	*Lasiurus cinereus*
House mouse	*Mus musculus*
Kit fox	*Vulpes velox*
Least chipmunk	*Tamias minimus*
Little pocket mouse	*Perognathus longimembris*
Long-eared myotis*	*Myotis evotis*
Long-legged myotis*	*Myotis volans*
Long-tailed pocket mouse	*Chaetodipus formosus*
Long-tailed vole	*Microtus longicaudus*
Long-tailed weasel	*Mustela frenata*
Merriam's kangaroo rat	*Dipodomys merriami*
Mexican free-tailed bat	*Tadarida brasiliensis*
Montane vole	*Microtus montanus*
Mountain cottontail	*Sylvilagus nuttallii*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 4 of 13)	
Common Name	*Scientific Name*
Mammals (cont.)	
Northern grasshopper mouse	*Onychomys leucogaster*
Ord's kangaroo rat	*Dipodomys ordii*
Pahranagat Valley montane vole*	*Microtus montanus fucosus*
Pale kangaroo mouse	*Microdipodops pallidus*
Pale Townsend's big-eared bat*	*Corynorhinus townsendii pallescens*
Pallid bat	*Antrozous pallidus*
Panamint chipmunk	*Tamias panamintinus*
PiZon mouse	*Peromyscus truei*
Porcupine	*Erethizon dorsatum*
Pronghorn	*Antilocapra americana*
Pygmy rabbit*	*Brachylagus idahoensis*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Ringtail	*Bassariscus astutus*
River otter	*Lutra canadensis*
Rock squirrel	*Spermophilus variegatus*
Sagebrush vole	*Lemmiscus curtatus*
Small-footed myotis*	*Myotis ciliolabrum*
Southern grasshopper mouse	*Onychomys torridus*
Spotted bat*	*Euderma maculatum*
Spotted skunk	*Spilogale gracilis*
Townsend's ground squirrel	*Spermophilus townsendii*
Western harvest mouse	*Reithrodontomys megalotis*
Western pipistrelle	*Pipistrellus hesperus*
White-tailed antelope squirrel	*Ammospermophilus leucurus*
Wild burro	*Equus asinus*
Wild horse	*Equus caballus*
Yuma myotis*	*Myotis yumanensis*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 5 of 13)	
Common Name	*Scientific Name*
Birds	
Abert's towhee	*Pipilo aberti*
American avocet	*Recurvirostra americana*
American bittern	*Botaurus lentiginosus*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American dipper	*Cinclus mexicanus*
American goldfinch	*Carduelis tristis*
American kestrel*	*Falco sparverius*
American pipit	*Anthus rubescens*
American redstart	*Setophaga ruticilla*
American robin	*Turdus migratorius*
American white pelican	*Pelecanus erythrorhynchos*
American wigeon	*Anas americana*
Ash-throated flycatcher	*Myiarchus cinerascens*
Bald eagle*	*Haliaeetus leucocephalus*
Band-tailed pigeon	*Columba fasciata*
Bank swallow	*Riparia riparia*
Barn owl*	*Tyto alba*
Barn swallow	*Hirundo rustica*
Bell's vireo	*Vireo bellii*
Belted kingfisher	*Ceryle alcyon*
Bendire's thrasher	*Toxostoma bendirei*
Bewick's wren	*Thryomanes bewickii*
Black chinned hummingbird	*Archilochus alexandri*
Black phoebe	*Sayornis nigricans*
Black tern*	*Chlidonias niger*
Black-capped chickadee	*Parus atricapillus*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 6 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Black-crowned night heron	*Nycticorax nycticorax*
Black-headed grosbeak	*Pheucticus melanocephalus*
Black-necked stilt	*Himantopus mexicanus*
Black-tailed gnatcatcher	*Polioptila melanura*
Black-throated gray warbler	*Dendroica nigrescens*
Black-throated sparrow	*Amphispiza bilineata*
Blue grosbeak	*Guiraca caerulea*
Blue grouse	*Dendragapus obscurus*
Blue-winged teal	*Anas discors*
Blue-gray gnatcatcher	*Polioptila caerulea*
Bonaparte's gull	*Larus philadelphia*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer's sparrow	*Spizella breweri*
Broad-tailed hummingbird	*Selasphorus platycercus*
Brown creeper	*Certhia americana*
Brown-headed cowbird	*Molothrus ater*
Bufflehead	*Bucephala albeola*
Bullock's oriole	*Icterus bullockii*
Burrowing owl	*Athene cunicularia*
Bushtit	*Psaltriparus minimus*
Cactus wren	*Campylorhynchus brunneicapillus*
California gull	*Larus californicus*
Calliope hummingbird	*Stellula calliope*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Canyon wren	*Caltherpes mexicanus*
Caspian tern	*Sterna caspia*
Cassin's finch	*Carpodacus cassinii*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 7 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Cedar waxwing	*Bombycilla cedrorum*
Chestnut-collared longspur	*Calcarius ornatus*
Chipping sparrow	*Spizella passerina*
Chukar	*Alectoris chukar*
Cinnamon teal	*Anas cyanoptera*
Clark's grebe	*Aechmophorus clarkii*
Clark's nutcracker	*Nucifraga columbiana*
Cliff swallow	*Hirundo pyrrhonota*
Common goldeneye	*Bucephala clangula*
Common loon	*Gavia immer*
Common merganser	*Mergus merganser*
Common moorhen	*Gallinula chloropus*
Common nighthawk*	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Common raven	*Corvus corax*
Common snipe	*Gallinago gallinago*
Common yellowthroat	*Geothlypis trichas*
Cooper's hawk*	*Accipiter cooperii*
Costa's hummingbird	*Calypte costae*
Dark-eyed junco	*Junco hyemalis*
Double crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Dusky flycatcher	*Empidonax oberholseri*
Eared grebe	*Podiceps nigricollis*
Eastern kingbird	*Tyrannus tyrannus*
European starling	*Sturnus vulgaris* |
Evening grosbeak	*Coccothraustes vespertinus*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 8 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Ferruginous hawk*	*Buteo regalis*
Flammulated owl*	*Otus flammeolus*
Forster's tern	*Sterna forsteri*
Fox sparrow	*Passerella iliaca*
Gadwall	*Anas strepera*
Gambel's quail	*Callipepla gambellii*
Golden eagle*	*Aquila chrysaetos*
Golden-crowned kinglet	*Regulus satrapa*
Grace's warbler	*Dendroica graciae*
Gray flycatcher	*Empidonax wrightii*
Gray vireo	*Vireo vicinior*
Great Blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Great horned owl*	*Bubo virginianus*
Great tailed grackle	*Quiscalus mexicanus*
Greater roadrunner	*Geococcyx californianus*
Greater yellowlegs	*Tringa melanoleuca*
Green-tailed towhee	*Pipilo chlorurus*
Green-winged teal	*Anas crecca*
Hairy woodpecker	*Picoides villosus*
Hammond's flycatcher	*Empidonax hammondii*
Hermit thrush	*Catharus guttatus*
Hooded oriole	*Icterus cucullatus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 9 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Hutton's vireo	*Vireo huttoni*
Indigo bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Ladder-backed woodpecker	*Picoides scalaris*
Lapland longspur	*Calcarius lapponicus*
Lark bunting	*Calamospiza melanocorys*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Le Conte's thrasher	*Toxostoma lecontei*
Least bittern*	*Ixobrychus exilis hesperis*
Least sandpiper	*Calidris minutilla*
Lesser goldfinch	*Carduelis psaltria*
Lesser nighthawk*	*Chordieles acutipennis*
Lesser scaup	*Aythya affinis*
Lesser yellowlegs	*Tringa flavipes*
Lewis' woodpecker	*Melanerpes lewis*
Lincoln's sparrow	*Melospiza lincolnii*
Loggerhead shrike	*Lanius ludovicianus*
Long-billed curlew	*Numenius americanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Long-eared owl*	*Asio otus*
Lucy's warbler	*Vermivora luciae*
MacGillivray's warbler	*Oporornis tolmiei*
Mallard	*Anas platyrhynchos*
Marbled godwit	*Limosa fedoa*
Marsh wren	*Cistothorus palustris*
Merlin	*Falco columbarius*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 10 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Mountain bluebird	*Sialia currucoides*
Mountain chickadee	*Parus gambeli*
Mountain plover*	*Charadrius montanus*
Mountain quail	*Oreortyz pictus*
Mourning dove	*Zenaida macroura*
Nashville warbler	*Vermivora ruficapilla*
Northern flicker	*Colaptes auratus*
Northern goshawk*	*Accipiter gentilis*
Northern harrier*	*Circus cyaneus*
Northern mockingbird	*Mimus polyglottos*
Northern pintail	*Anas acuta*
Northern pygmy owl	*Glaucidium gnoma*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Northern saw whet owl	*Aegolius acadicus*
Northern shoveler	*Anas clypeata*
Northern waterthrush	*Seiurus noveboracensis*
Olive-sided flycatcher	*Contopus borealis*
Orange-crowned warbler	*Vermivora celata*
Osprey *	*Pandion haliaetus*
Peregrine falcon*	*Falco peregrinus anatum*
Phainopepla*	*Phainopepla nitens*
Pied billed grebe	*Podilymbus podiceps*
Pine siskin	*Carduelis pinus*
Pinyon jay	*Gymnorhinus cyanocephalus*
Plain titmouse	*Parus inornatus*
Prairie falcon*	*Falco mexicanus*
Pygmy nuthatch	*Sitta pygmaea*
Red crossbill	*Loxia curvirostra*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 11 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Red-breasted merganser	*Mergus serrator*
Red-breasted nuthatch	*Sitta canadensis*
Red-breasted sapsucker	*Sphyrapicus ruber*
Redhead	*Aythya americana*
Red-naped sapsucker	*Sphyrapicus nuchalis*
Red-necked phalarope	*Phalaropus lobatus*
Red-tailed hawk*	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked duck	*Aythya collaris*
Ring-necked pheasant	*Phasianus colchicus*
Rock dove	*Columba livia*
Rock wren	*Salpinctes obsoletus*
Rough-legged hawk*	*Buteo lagopus*
Ruby-crowned kinglet	*Regulus calendula*
Ruddy duck	*Oxyura jamaicensis*
Rufous hummingbird	*Selasphorus rufus*
Rufous-sided towhee	*Pipilo erythrophtalmus*
Sage sparrow	*Amphispiza belli*
Sage thrasher	*Oreoscoptes montanus*
Sandhill crane	*Grus canadensis*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Scott's oriole	*Icterus parisorum*
Semipalmated plover	*Charadrius semipalmatus*
Sharp-shinned hawk*	*Accipiter striatus*
Short-eared owl*	*Asio flammeus*
Snow goose	*Chen caerulescens*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 12 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Snowy egret	*Egretta thula*
Solitary sandpiper	*Tringa solitaria*
Solitary vireo	*Vireo solitarius*
Song sparrow	*Melospiza melodia*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularia*
Steller's jay	*Cyanocitta stelleri*
Swainson's hawk*	*Buteo swainsoni*
Swainson's thrush	*Catharus ustulatus*
Swamp sparrow	*Melospiza georgiana*
Townsend's solitaire	*Myadestes townsendi*
Townsend's warbler	*Dendroica townsendi*
Tree swallow	*Tachycineta bicolor*
Tundra swan	*Cygnus columbianus*
Turkey vulture*	*Cathartes aura*
Varied thrush	*Ixoreus naevius*
Vaux's swift	*Chaetura vauxi*
Veery	*Catharus fuscescens*
Verdin	*Auriparus flaviceps*
Vermilion flycatcher	*Pyrocephalus rubinus*
Vesper sparrow	*Pooecetes gramineus*
Violet-green swallow	*Tachycineta thalassina*
Virginia rail	*Rallus limicola*
Virginia's warbler	*Vermivora virginiae*
Warbling vireo	*Vireo gilvus*
Western bluebird	*Sialia mexicana*
Western burrowing owl*	*Athene cunicularia hypugea*
Western grebe	*Aechmophorus occidentalis*

Table F-3. Wildlife Species Known or with Potential to Occur on Nellis AFB, Nellis AFR, and under MOA Airspace (Page 13 of 13)	
Common Name	*Scientific Name*
Birds (cont.)	
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
Western sandpiper	*Calidris mauri*
Western screech owl	*Otus kennicottii*
Western scrub jay	*Aphelocoma californica*
Western tanager	*Piranga ludoviciana*
Western wood pewee	*Contopus sordidulus*
White-faced ibis*	*Plegadis chihi*
White-breasted nuthatch	*Sitta carolinensis*
White-crowned sparrow	*Zonotrichia leucophrys*
White-faced ibis	*Plegadis chihi*
White-throated sparrow	*Zonotrichia albicollis*
White-throated swift	*Aeronautes saxatalis*
Willet	*Catoptrophorus semipalmatus*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Willow flycatcher	*Empidonax traillii*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's warbler	*Wilsonia pusilla*
Winter wren	*Troglodytes troglodytes*
Wood duck	*Aix sponsa*
Yellow bellied sapsucker	*Sphyrapicus varius*
Yellow warbler	*Dendroica petechia*
Yellow-billed cuckoo	*Coccyzus americanus*
Yellow-breasted chat	*Icteria virens*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Dendroica coronata*

Sources: Hall 1946; Burt and Grossenheider 1976; Stebbins 1985; Jones et al. 1992; Air Force 1994b; DoE 1996; BRRC 1997a, b; Collins 1997; Jenkins 1997; NDOW 1997; NNHP 1997; NPWRC 1997a, b; Air Force 1997d; USFWS 1995c, 1997b.

Note: * = Sensitive species, see Table 3.8-2.

LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Air Combat Command
ACEC	Areas of Critical Environmental Concern
AFB	Air Force Base
AFI	Air Force Instruction
AFY	Acre-feet per year
AGE	Areospace Ground Equipment
AGL	Above ground level
AICUZ	Air Installation Compatible Use Zone
Air Force	U.S. Air Force
APZ	Accident Potential Zone
ASM	Aircraft Structural Maintenance
ATCAA	Air Traffic Control Assigned Airspace
AWACS	Airborne Warning and Control System
BASH	Bird-Aircraft Strike Hazard
BLM	Bureau of Land Management
BNA	Block numbering area
CDNL	C-Weighted Day-Night Sound Level
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGTO	Consolidated Group of Tribes and Organizations
CO	Carbon monoxide
CY	Calendar year
dB	Decibel
DNL	Day-Night Average Sound Level
DNWR	Desert National Wildlife Range
DoD	Department of Defense
DoE	Department of Energy
DoI	Department of the Interior
EC	Electronic combat
ECE	Electronic Combat East
ECR	Electronic combat ranges
ECS	Electronic Combat South
ECW	Electronic Combat West
EIAP	Environmental impact analysis process
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERIS	Economic Resource Impact Statement
FAA	Federal Aviation Administration
FDE	Force Development Evaluation
FICON	Federal Interagency Committee on Noise
FLPMA	Federal Land Policy and Management Act
FY	Fiscal year
GPS	Global Positioning System
HAZMAT	Hazardous materials
HQ ACC	Headquarters Air Combat Command
HUD	Department of Housing and Urban Development
I-15	Interstate 15
IICEP	Intergovernmental/Interagency Coordination of Environmental Planning
IOT&E	Initial Operations Test & Evaluating
IR	Instrument route
JDAM	Joint Direct Attack Munitions
KCAS	Knots Calibrated Airspeed
L	Sound level
Ldnmr	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
LEIS	Legislative Environmental Impact Statement
LLW	Low-level nuclear waste
Lmax	Maximum sound level
LOLA	Live ordnance loading area
LOS	Level of Service
MAILS	Multiple Aircraft Instantaneous Line Source
mm	Millimeter
MLWA	Military Lands Withdrawal Act
MOA	Military Operations Area
MOU	Memorandum of Understanding
MR_NMAP	MOA-Route NoiseMAP
MSL	Mean sea level
MTR	Military training route
NAAQS	National Ambient Air Quality Standards
NAFR	Nellis Air Force Range
NAIP	Native American Interaction Program
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Division of Wildlife
NEPA	National Environmental Policy Act
NM	Nautical mile
NO_X	Nitrogen oxide
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	Nellis Range Complex
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NWHR	Nevada Wild Horse Range
NWR	National Wildlife Refuge
OT&E	Operational Test and Evaluation
Pb	Lead
PCB	Polychlorinated Biphenyls
PLO	Public Land Order
PM_{10}	Particulate matter equal to or less than 10 microns in diameter
ppm	Parts per million
PSD	Prevention of Significant Deterioration
psf	Pounds per square foot
RCRA	Resource Conservation and Recovery Act
RFMDS	Red Flag Measurement and Debriefing System
RMP	Resource Management Plan
ROC	Region of Comparison
ROD	Record of Decision
ROI	Region of Influence
SEL	Sound exposure level
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SO_X	Sulfur oxide
TPECR	Tolicha Peak Electronic Combat Range
TSP	Total Suspended Partical
TTR	Tonopah Test Range
U.S.C.	United States Code
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
V/C	Volume to capacity
vmt	Vehicle miles traveled
VOC	Volatile organic compound
VR	Visual route
VRM	Visual resources management
WHMA	Wild Horse Management Area
WS	Weapons School
WSA	Wilderness Study Area