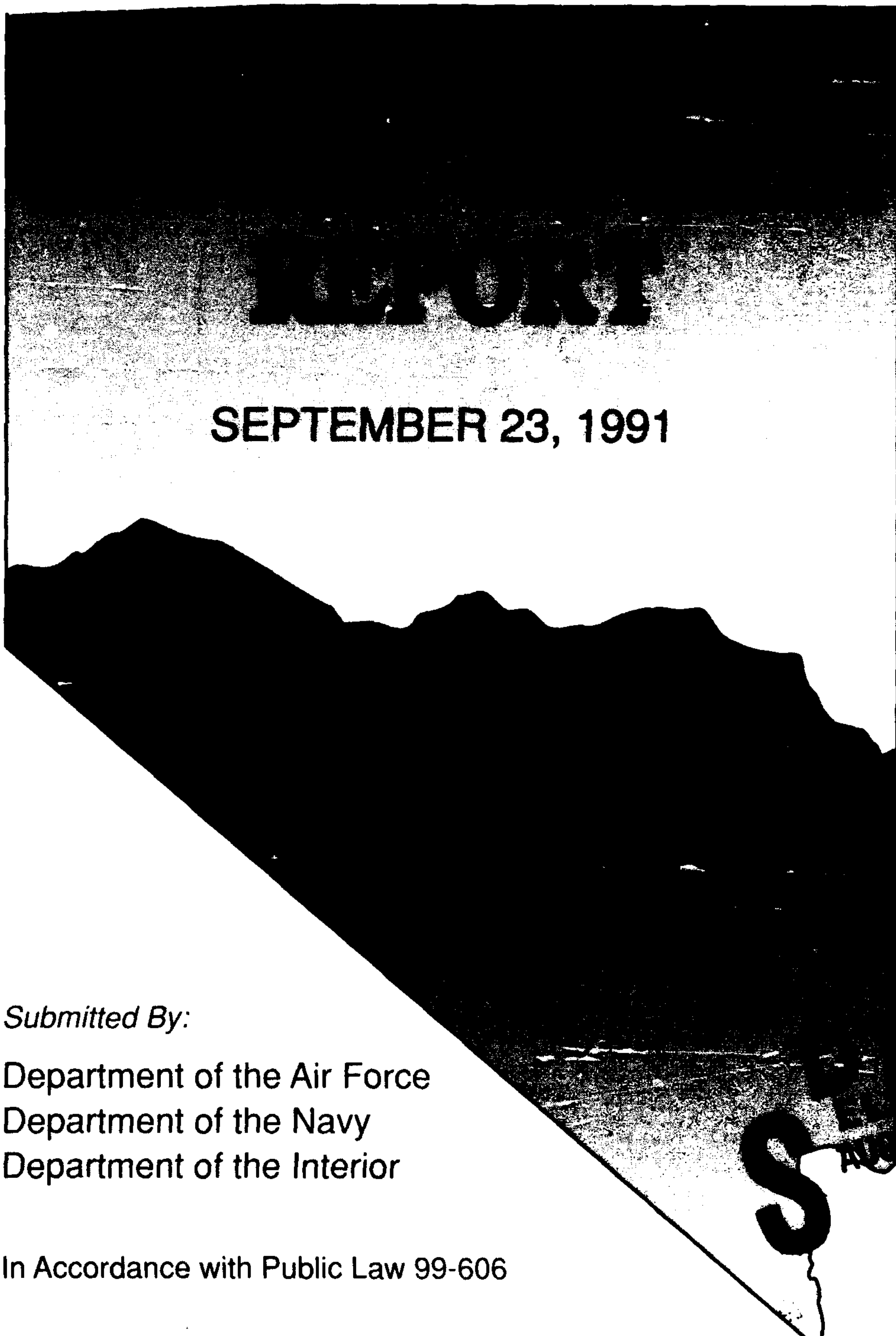

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SEPTEMBER 23, 1991

Submitted By:

Department of the Air Force
Department of the Navy
Department of the Interior

In Accordance with Public Law 99-606

SPECIAL NEVADA REPORT

Cooperating Agencies:

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Department of Energy

Prepared By:

Science Applications International Corporation
Desert Research Institute

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PREFACE

Attached is the Special Nevada Report for your reference and use. The report is required by the Military Lands Withdrawal Act of 1986 and contains a description of current and proposed defense-related activities in the State of Nevada, an analysis of their impacts, and possible actions that could be taken to mitigate those impacts. The report was prepared jointly by the Departments of the Air Force, Navy, and Interior.

A tremendous effort was devoted to the preparation of this report. Some 1,200 documents were collected, reviewed, and analyzed by professionals in diverse fields from many organizations and agencies. The report was based on the best data available in the existing literature.

The Department of Defense has a great investment in Nevada, and the state benefits from DOD's presence. In 1988, over six percent of the total employment in the state and $1.4 billion of the gross regional product in Nevada could be attributed to defense-related activities. Not only is 14% of all DOD land in the state, but over $650 million has been invested in facilities in the state which represents a current replacement cost over $2,000,000,000.

Changes in the federal budget and the ongoing base closure process will continue to affect DOD resources. This creates uncertainty about the practicality of implementing some possible mitigation measures. Consequently, a cooperative effort will be needed in the future to insure the most effective use of available resources.

The Department of Defense is committed to being a good neighbor in the State of Nevada. The DOE places a high priority on environmental compliance and protection, and on minimizing adverse impacts caused by its activities. By continuing to take a proactive approach, we can protect both our environment and our national security mission.

Copies of this report are available through the National Technical Information Service or the Defense Technical Information Center. Inquiries concerning this report should be sent to the United States Air Force, Tactical Fighter Weapons Center, Office of Public Affairs (TFWC/PA), Nellis AFB, NV 89191-5000.

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LIST OF ACRONYMS

AAA	anti-aircraft artillery
AAF	Army Airfield
ACEC	Area of Critical Environmental Concern
ACMI	Air Combat Maneuvering Instrumentation
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AEHA	Army Environmental Hygiene Agency
AF	acre-feet
AFAF	Air Force Auxiliary Field
AFB	Air Force Base
AFOSH	Air Force Occupational Safety and Health
AFR	Air Force Regulation
AFY	acre-feet per year
AGL	above ground level
AICUZ	Air Installations Compatible Use Zones
AIRFA	American Indian Religious Freedoms Act
AMCR	Army Material Command Regulation
ANG	Air National Guard
ANSI	American National Standards Institute
APZ	Accident Potential Zone
AR	Aerial Refueling Route
ARML	Aerospace Medical Research Laboratory
ARTCC	Air Route Traffic Control Center
ATCAA	Air Traffic Control Assigned Airspace
BEIR	Biological Effects of Ionizing Radiation
BLM	Bureau of Land Management
BMI	Basic Management Incorporated
BREN	Base Reactor Experiment-Nevada
BTU	British Thermal Unit
BUREC	Bureau of Reclamation
CAA	Clean Air Act
CCSD	Clark County Sanitation District
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CEQ	Council on Environmental Quality
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
CLSC	Combat Logistic Supply Center
CNTS	Central Nevada Test Site
CO	carbon monoxide

LIST OF ACRONYMS
(Continued)

COE	Corps of Engineers
CP-1	Control Point-1
CVW	Carrier Air Wing
CRC	Colorado River Commission
dB	decibel
DAR	Defense Access Road
DNA	Defense Nuclear Agency
DNWR	Desert National Wildlife Range
DOD	Department of Defense
DOE	Department of Energy
DOE/NV	Department of Energy, Nevada Operations Office
DOT	Department of Transportation
DOI	Department of the Interior
DRI	Desert Research Institute
DRMO	Defense Reutilization and Marketing Office
EA	Environmental Assessment
EIS	Environmental Impact Statement
EC	Electronic Combat
ECAMP	Environmental Compliance Assessment and Management Program
ECM	Electronic Countermeasures
EMSL	Environmental Monitoring Systems Laboratory
EMT	emergency medical technician
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
EQPC	Environmental Quality Program Coordinator
ERDA	U.S. Energy Research and Development Administration
ES&H	Environmental, Safety, and Health
ESQD	Explosive Safety Quantity-Distance
EW	Electronic Warfare
EWR	Electronic Warfare Range
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FCF	functional check flight
FD	fire department
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FL	Flight Level

LIST OF ACRONYMS
(Continued)

FLPMA	Federal Land Policy and Management Act
FOD	foreign object damage
FONSI	Finding of No Significant Impact
FRTC	Fallon Range Training Complex
FSS	Flight Service Station
FWS	Fighter Weapons School
FWW	Fighter Weapons Wing
FY	fiscal year
GNP	gross national product
GPI	gross personal income
GRP	gross regional product
gpd/ft	gallons per day per foot
gpm	gallons per minute
GWEN	Ground Wave Emergency Network
HAZMAT	hazardous materials
HWAAP	Hawthorne Army Ammunition Plant
IBP	International Biological Program
ICG	Intergovernmental Coordinating Group
ICD	intrusion/imitative communications deception
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
IICEP	Interagency/Intergovernmental Coordination for Environmental Planning
INM	Integrated Noise Model
IR	Instrument Military Training Route
IRP	Installation Restoration Program
ISAFAF	Indian Springs Air Force Auxiliary Field
kt	kiloton
KVA	kilovolt amp
LF	low frequency
LANL	Los Alamos National Laboratory
LANTIRN	Low Altitude Navigation and Targeting Infrared for Night System
LATN	Low Altitude Tactical Navigation
L_{Cdn}	C-Weighted Day-Night Sound Level
L_{dn}	Day-Night Sound Level

LIST OF ACRONYMS
(Continued)

L_{dnmr}	Onset Rate Adjusted Monthly Day-Night Average Sound Level
LLF	Low-Level Flight
LLNL	Lawrence Livermore National Laboratory
LP	liquid petroleum
MARSA	Military Assumes Responsibility for Separation of Aircraft
MCL	maximum contaminant level
MCP	Military Construction Program
mgd	million gallons per day
mg/l	milligrams per liter
MOA	Military Operations Area
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSL	mean sea level
MTMC	Military Traffic Management Command
MTR	Military Training Route
MWMU	Mixed Waste Management Unit
M-X	Missile Experimental
NAAQS	National Ambient Air Quality Standards
NAEG	Nevada Applied Ecology Group
NAFB	Nellis Air Force Base
NAFR	Nellis Air Force Range
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NATCF	Nellis Air Traffic Control Facility
NAVAIR	Naval Air Systems Command
NBAA	National Business Aircraft Association
NDBS	no drop bomb scoring
NDEP	Nevada Division of Environmental Protection
NDHPA	Nevada Division of Historic Preservation and Archaeology
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NEESA	Naval Energy and Environmental Support Activity
NFMA	National Forest Management Act
NM	nautical miles
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen

LIST OF ACRONYMS
(Continued)

NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRDS	Nuclear Rocket Development Station
NS	Noise Sensitive
NTS	Nevada Test Site
NWR	National Wildlife Refuge and/or Range
OCAP	Operating Criteria and Procedures
ORNL	Oak Ridge National Laboratory
ORV	off-road vehicle
OSHA	Occupational Safety and Health Act
OSE	Office of the State Engineer
OSW	Operations Support Wing
PA	Preliminary Assessment
PCB	polychlorinated biphenyl
PDI	personal disposable income
PIC	Planning Information Corporation
PILT	payment in lieu of taxes
PM	particulate matter
ppb	parts per billion
ppm	parts per million
psf	pounds per square foot
PWD	Public Works Department
RADEX	radiation exclusion
RAICUZ	Range Air Installations Compatible Use Zones
RASS	Range Air Surveillance System
RCRA	Resource Conservation and Recovery Act
RCTC	Reserve Component Training Center
RDX	cyclotrimethylene-trinitramine
REECo	Reynolds Electrical and Engineering Co., Inc.
REMI	Regional Economic Models, Inc.
RF	radio frequency
RFR	radio frequency radiation
RI/FS	remedial investigation/feasibility study
RNA	Research Natural Area
ROI	Region of Influence
RWMS	Radioactive Waste Management Site
ROW	Right-of-Way

LIST OF ACRONYMS
(Continued)

SAC	Strategic Air Command
SAIC	Science Applications International Corporation
SAM	surface-to-air missile
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCS	Soil Conservation Service
SCP	Spill Contingency Plan
SDWA	Safe Drinking Water Act
SEL	sound exposure level
SEL_c	C-weighted sound exposure level
SFA	Supersonic Flight Area
SHPO	State Historical Preservation Office
SNL	Sandia National Laboratories
SNM	Special Nuclear Material
SNR	Special Nevada Report
SNWS	Southern Nevada Water System
SPCC	Spill Prevention, Control and Countermeasures Plan
SR	Slow Speed Low-Altitude Route
SUA	Special Use Airspace
TAC	Tactical Air Command
TACTS	Tactical Aircrew Combat Training System
TCA	Terminal Control Area
TCID	Truckee-Carson Irrigation District
TDS	total dissolved solids
TDY	temporary duty
TECR	Tonopah Electronic Combat Range
TFS	Tactical Fighter Squadron
TFTS	Tactical Fighter Training Squadron
TFW	Tactical Fighter Wing
TFWC	Tactical Fighter Weapons Center
TIADS	Tactical Integrated Air Defense System
TIS	tracking instrumentation subsystem
TNC	The Nature Conservancy
TNT	trinitrotoluene
TPECR	Tolicha Peak Electronic Combat Range
TRG	Tactical Reconnaissance Group
TRU	transuranic
TSD	treatment, storage, or disposal
TTR	Tonopah Test Range
TWS	track-while-scan
UNLV	University of Nevada, Las Vegas
USAF/BMO	United States Air Force Ballistic Missile Office

LIST OF ACRONYMS
(Continued)

USFS	United States Forest Service
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UTTR	Utah Test and Training Range
VFD	Volunteer Fire Department
VFR	Visual Flight Rules
VR	Visual Military Training Route
WADF	Western Area Demilitarization Facility
WIPP	Waste Isolation Pilot Plant
WISS	Weapons Impact Scoring Set
WMA	Wildlife Management Area
WSA	Wilderness Study Area
WSNSO	Weather Service Nuclear Support Office
WSMR	White Sands Missile Range

CHAPTER 1

INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

The Special Nevada Report does not assess defense-related activities in Nevada in the context of overall national interest. However, Nevada's assets represent the premier combat flying training areas for the Department of Defense (DOD) nation-wide. The mission of Nellis Air Force Base (AFB) and Naval Air Station (NAS), Fallon are critical to our national security. Both of these installations are unique, in that they are one of a kind, providing current state-of-the-art training in modern air combat, knowledge of enemy aircraft capabilities, and sound tactics essential to fly, fight, and win. The missions of the Tactical Fighter Weapons Center, Nellis AFB provide joint training for all Air Force fighter units and combat-realistic Red Flag exercises. NAS Fallon provides the key training for all Carrier Air Wings. At NAS Fallon, units with different aircraft and home stations are integrated into a combat force prior to deployment on board an aircraft carrier. There are no other facilities where this training could be conducted within the United States. Essential to the successful and realistic training of combat pilots at these installations, are the range and airspace complexes vital for a realistic combat environment. In modern air warfare, high-speed, low-level flight is essential for survival. The recent overwhelming victory in Desert Storm is a direct result of the contribution made by the training our pilots received at NAS Fallon and Nellis AFB complexes. This was without a doubt, one of the most significant victories in modern warfare whose outcome was in large part determined by air power, at a savings of many American, as well as Coalition Forces, lives. Additionally, Hawthorne Army Ammunition Plant, the largest conventional munitions plant in the free world, played a key role in supporting all Services involved in Desert Storm. We need to stand ready for any future conflicts by assuring that these national assets remain available to maintain our combat readiness. The lives of young Americans who defend the nation depend on Nevada's training complexes.

This report is submitted to Congress by the Secretary of the Air Force, the Secretary of the Navy, and the Secretary of the Interior pursuant to Section 6 of the Military Lands Withdrawal Act of 1986 (Public Law 99-606). It contains an analysis and evaluation of the effects on public health and safety resulting from DOD and Department of Energy (DOE) military and defense-related uses on withdrawn public lands in the State of Nevada and in airspace overlying the State. This report describes the cumulative impacts of those activities on public and private property in Nevada and on plants, fish and wildlife, cultural, historic, scientific, recreational, wilderness and other resources of the public lands of Nevada. An analysis and evaluation of possible measures to mitigate the cumulative effects of the withdrawal of lands and the use of airspace in Nevada for defense-related purposes was conducted, and those considered practical are listed.

1.2 GEOGRAPHIC AND TEMPORAL SCOPE

1.2.1 LANDS WITHDRAWN FOR DEFENSE-RELATED MISSIONS

Figure 1.1 shows the locations of all existing public lands withdrawn for defense-related uses in Nevada, the lands acquired for defense-related uses which are contiguous to those withdrawn lands, and lands proposed to be withdrawn for defense-related uses. Figure 1.2 shows the locations of public lands envisioned to be withdrawn in Nevada for defense-related uses. The defense-related uses associated with existing acquired lands contiguous to withdrawn lands and each of the existing, proposed, and envisioned land withdrawals are described in Chapters 2 through 7. Also described in those chapters is the geographic scope of those lands.

Certain lands are excluded from the geographic scope of the Special Nevada Report analysis. Specifically, the Yucca Mountain Site Characterization Project (YMP) is not addressed in the Special Nevada Report for the following reasons: (1) users of the potential repository would be predominately non-defense related sources, (2) funding for the YMP is derived from predominately non-defense related sources, and (3) voluminous analysis has been and will continue to be conducted on all phases of the YMP. Further, Right-of-way lands, administered by the Bureau of Land Management, that are used by defense-related activities, or lands that have been leased or acquired by defense-related activities which are not adjacent to withdrawn lands are also excluded. The economic and environmental influence of these rights-of-way and acquired or leased lands are considered in the overall resource evaluation of the defense activities examined.

Acreage used by DOD and DOE in Nevada is listed in Table 1-1. That table also lists the acreage of public lands proposed and envisioned to be withdrawn for defense-related uses. At present, approximately 4,145,039 acres of public land are withdrawn for defense-related uses in Nevada. That is approximately 5.9 percent of the total land area in Nevada. Proposals exist to return approximately 6,100 acres of land currently withdrawn in Nevada for defense-related purposes to public use. Proposals also exist to withdraw approximately 188,723 additional acres of public land. The 586,000 acre proposed Hawthorne Reserve Component Training Center (RCTC) is not being actively pursued at this time. It is envisioned that approximately 202,000 additional acres will need to be withdrawn for defense-related uses in the future. If all proposed and envisioned land withdrawals were to occur, approximately 6.4 percent of the total land area in Nevada would be withdrawn for defense-related uses. Approximately 13.3 percent of all DOD lands are in the State of Nevada. This equals about 4.7 percent of the total land area in the state (refer to Tables 8-1 and 8-2). The estimated value of real property facilities on this land is in excess of two billion dollars.

The Bureau of Land Management (BLM) was charged under the Federal Land Policy and Management Act of 1976 to conduct a review of all existing withdrawals nationwide to determine if they were being used for the purpose for which they were withdrawn. These reviews have been completed for existing withdrawals at NAS Fallon and the Nevada Test Site (NTS) and conclude these withdrawals are being used for purposes defined in the original withdrawal. The withdrawal for the Nellis Range was renewed by Congress in 1986

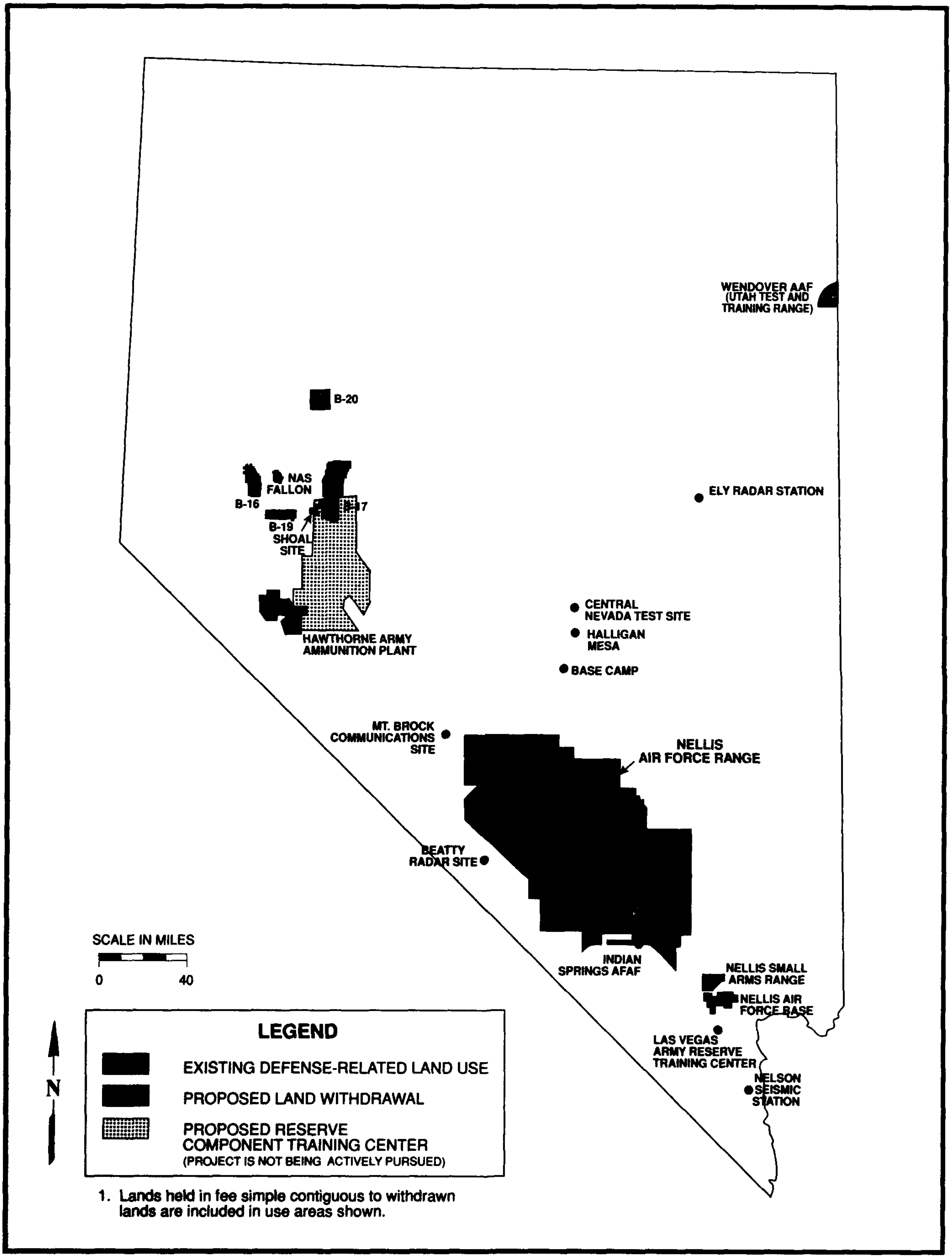


FIGURE 1.1 EXISTING AND PROPOSED DEFENSE-RELATED LAND USES/WITHDRAWALS IN NEVADA

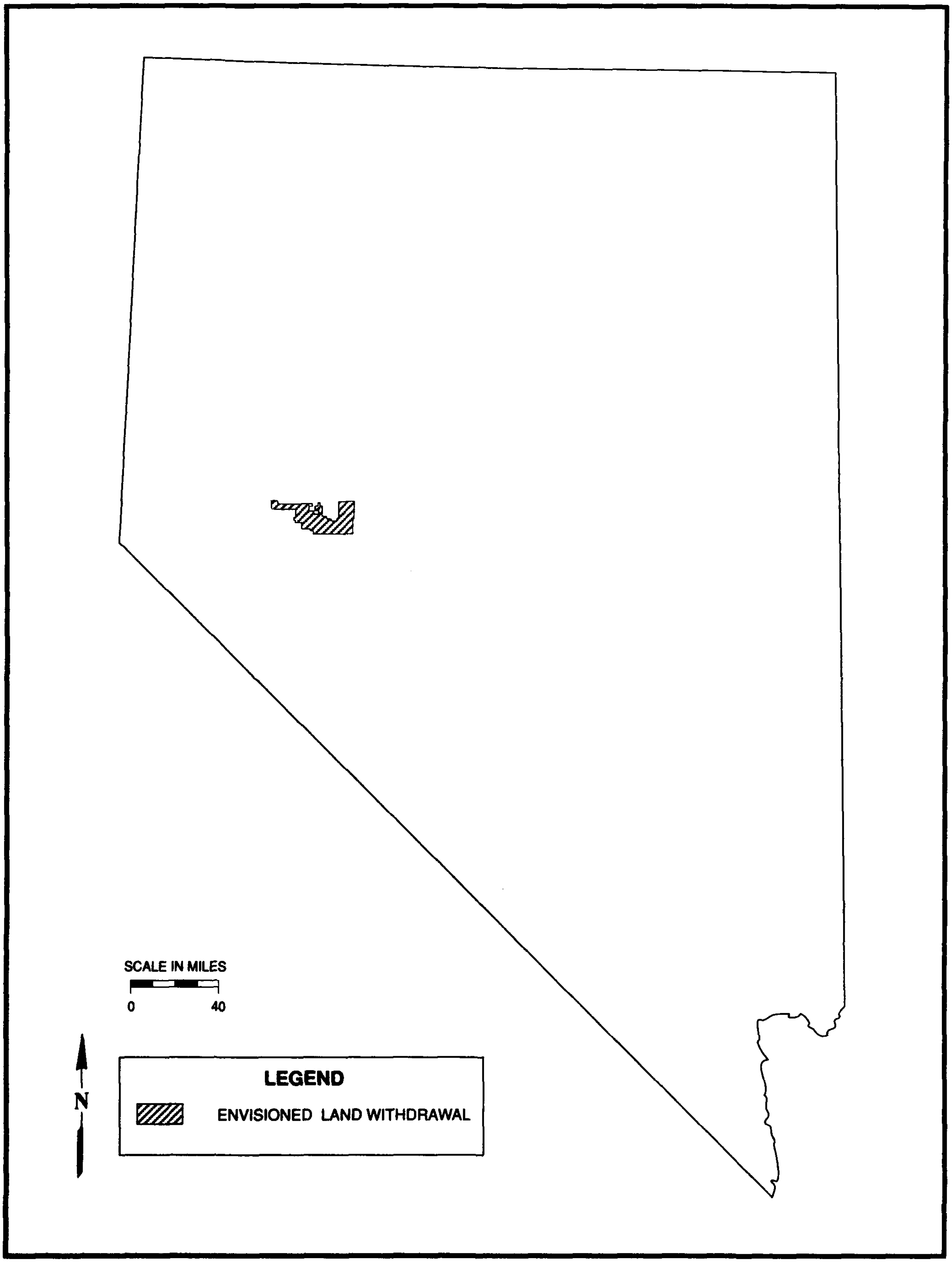


FIGURE 1.2 ENVISIONED LAND WITHDRAWALS IN NEVADA

Table 1-1. Acreage Used in Nevada for Defense-Related Purposes.

	Existing Acreage	Percent of Land in Nevada[1]	Proposed (P) and Envisioned (E) Changes
Nellis			
Nellis Air Force Base	11,193		
Nellis Small Arms Range	10,760		-5,789(P)
Nellis Air Force Range (including Indian Springs Auxiliary Airfield)	3,035,326		
TOTAL	3,057,279	4.32	
Fallon			
NAS Fallon	7,982		+400(P)
NAS Fallon Range Training Complex	97,041		+188,323(P) +202,000(E)
TOTAL	105,023	0.15	
Hawthorne			
Hawthorne Army Ammunition Plant	147,431		
TOTAL	147,431	0.21	
DOE			
Nevada Test Site	814,528		
Central Nevada Test Site	2,560		
Nelson Seismic Station	2.5		
Mt. Brock Communication Site	11.3		
Project Shoal Site	2,560		
TOTAL	819,661.8	1.16	
Other			
Beatty Radar Site	19		-19(P)
Ely Radar Site	10		
Halligan Mesa/Base Camp	600		
Wendover Range	15,010		-321(E)
Las Vegas Army Reserve Training Center	5		
Proposed Hawthorne Reserve Component Training Center	0	0	+586,000(P)[2][3]
TOTAL	15,644	0.02	
TOTAL	4,145,039	5.86%	+384,594 0.53%[4]

[1] Total acreage in Nevada equals 70,745,600 acres.

[2] Acreage for Alternative A of Proposed Action; Acreage for Alternative B of Proposed Action is 500,000 acres.

[3] The 586,000 acre Proposed Hawthorne Reserve Component Training Center project is not being actively pursued at this time; acreage shown (+586,000) is not included in Proposed (P) and Envisioned (E) changes TOTAL column.

[4] Percent change resulting from proposed and envisioned actions.

and was therefore, not subject to the review process. The BLM is currently conducting a withdrawal review of the 147,431 acre Hawthorne Army Ammunition Plant (HWAAP) withdrawal with an expected completion date of 1991.

1.2.2 AIRSPACE UTILIZED FOR DEFENSE-RELATED USES

Airspace utilized for defense-related uses in Nevada includes special use airspace (SUA), military training routes (MTRs), slow speed low altitude training routes (SRs), low altitude training navigation (LATN) areas, and aerial refueling routes (ARs). These airspace areas are categorized by the types of activities that occur within each area and the potential hazard those operations may represent to aircraft which are not taking part in those operations. Hazardous military activities (aerial bombing and gunnery, artillery firing, etc.) are confined to restricted areas, and, until 1975, non-hazardous activities were generally unrestricted. Since 1975, airspace for non-hazardous military flight activities such as military operations areas (MOAs) and, since 1978, MTRs have been identified on aeronautical charts to alert military and civil aircraft not participating in those activities of the areas where such activities occur. The underlying rationale for those airspace designations is to promote aviation safety for all users of the National Airspace System. The designation of restricted areas is considered "rule-making" by the Federal Aviation Administration (FAA) which requires publication of notices of proposed designations of restricted areas in the Federal Register to afford the public the opportunity to review the proposals and comment on them prior to their establishment. MOAs, MTRs, ARs, and Air Traffic Control Assigned Airspace (ATCAA) areas are established without resort to the "rule-making" procedure. If the designation of airspace will affect the public domain, the FAA may, however, require public notification of the intent to designate such areas and require informal public meetings to afford the public an opportunity to comment on the proposed action prior to FAA approval. Environmental Assessments (EAs) or Environmental Impact Statements (EISs) must be prepared pursuant to the National Environmental Policy Act (NEPA) prior to the establishment of airspace if the floor of the proposed SUA is below 3,000 feet above ground level (AGL), if supersonic flight is to be conducted within the airspace in question, or if there is any potential impact on the environment.

Figure 1.3 illustrates the different categories of SUA and other airspace areas. The vertical and horizontal dimensions of this airspace vary because each individual area is specifically configured to accommodate the type of missions flown within that airspace. As shown in Figure 1.3, combinations of different categories of airspace may be contained within one another. That is the situation with regard to airspace associated with NAS Fallon and Nellis AFB. Configuring the SUA and other airspace areas with such combinations minimizes, to the extent feasible, the degree to which civil aviation is inconvenienced by defense-related use of airspace.

Figure 1.4 shows the location of the airspace used and proposed to be used for defense-related purposes over Nevada. MTRs and ARs are not shown on Figure 1.4, but they are discussed in Chapter 7. The location of airspace over Nevada which is envisioned to be designated for defense-related uses is shown in Figure 1.5. Approximately 36 percent of the state is overlain by either restricted airspace or military operating areas. Two-thirds

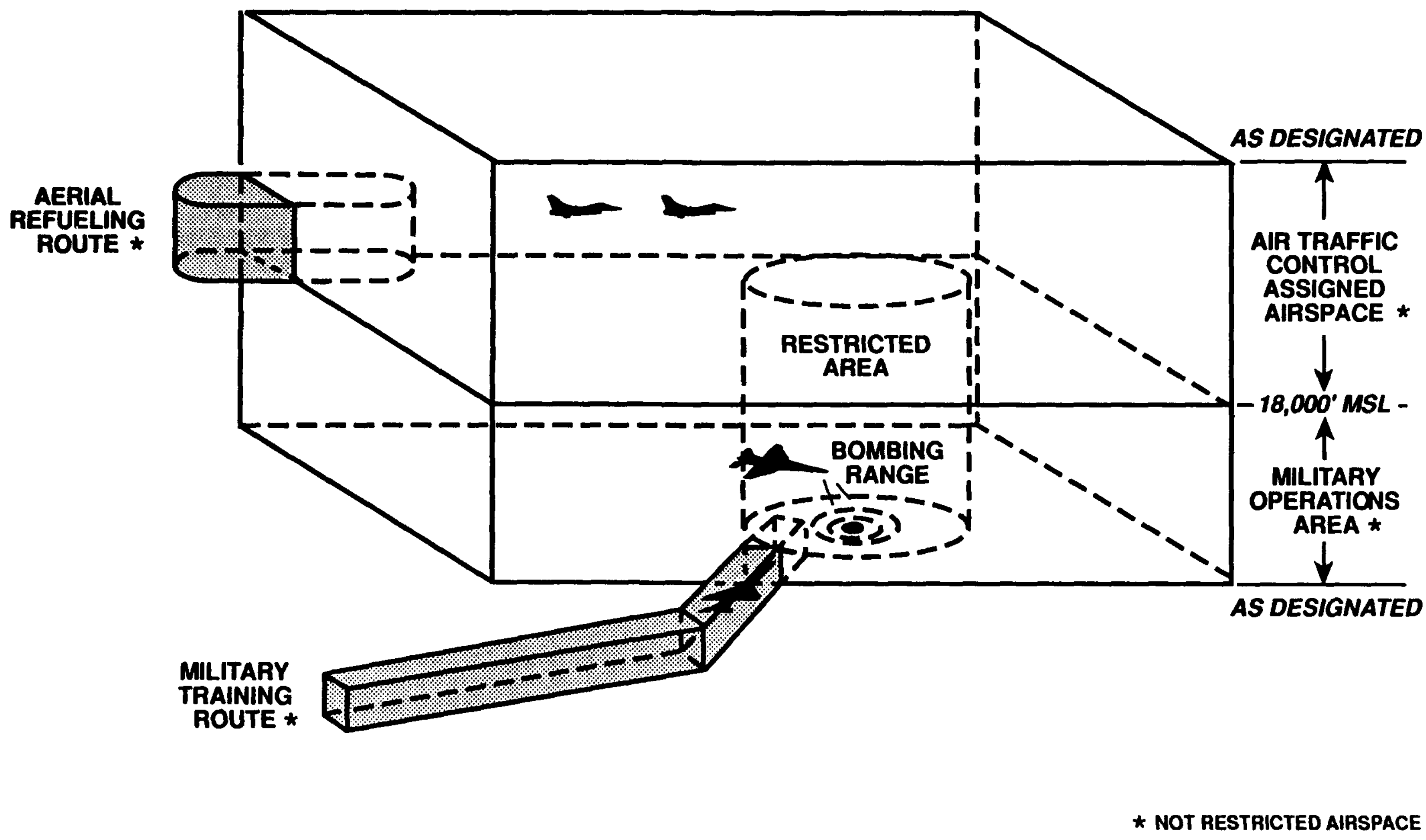
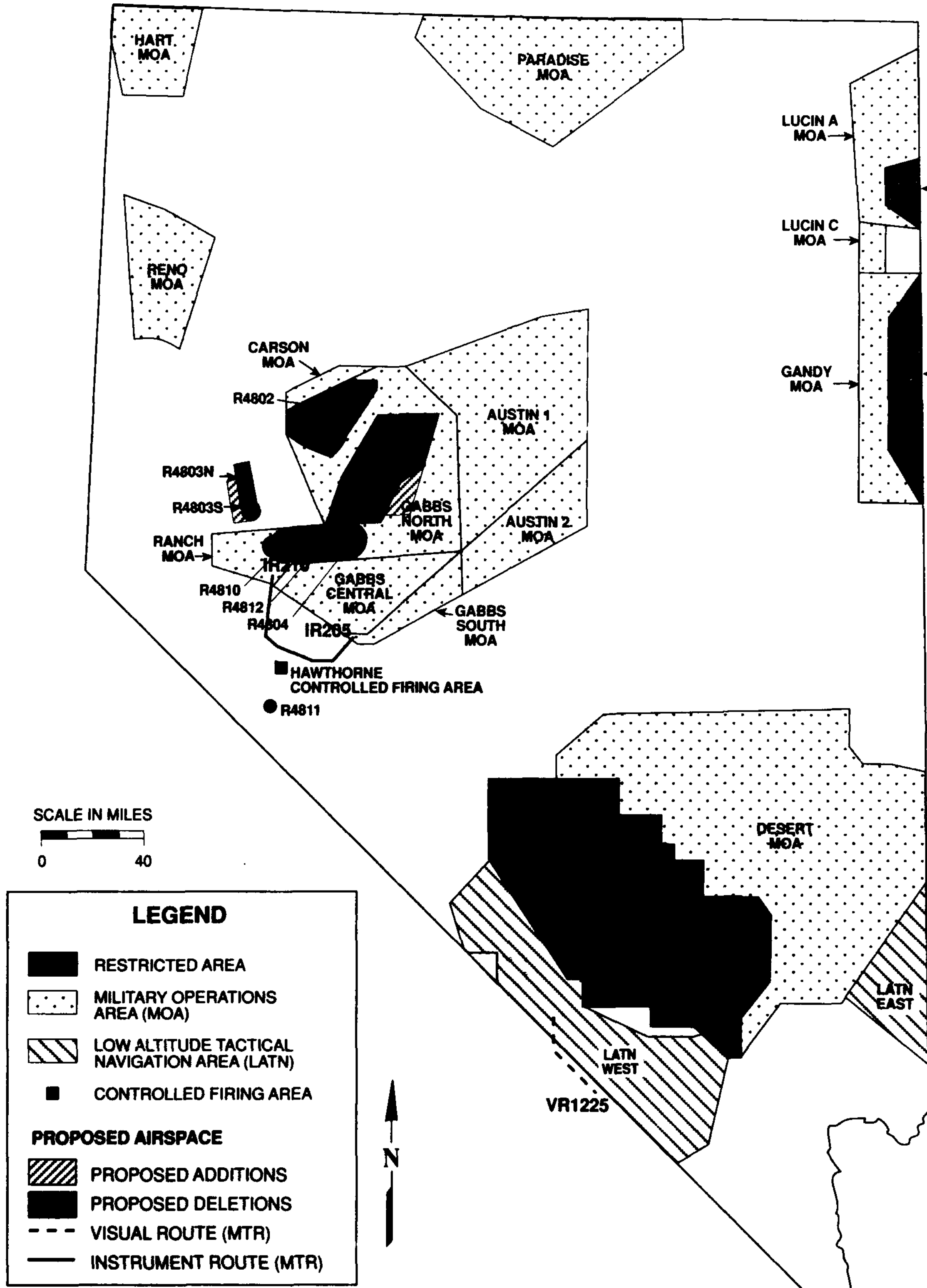


FIGURE 1.3 EXAMPLE OF AIRSPACE CONFIGURATION DESIGNATED FOR DEFENSE-RELATED USES



1. Special Use Airspace is not in use at all times.
2. Non-participating civil and military VFR aircraft may utilize MOAs/LATNs at any time.

FIGURE 1.4 EXISTING AND PROPOSED AIRSPACE OVER NEVADA USED FOR DEFENSE-RELATED PURPOSES

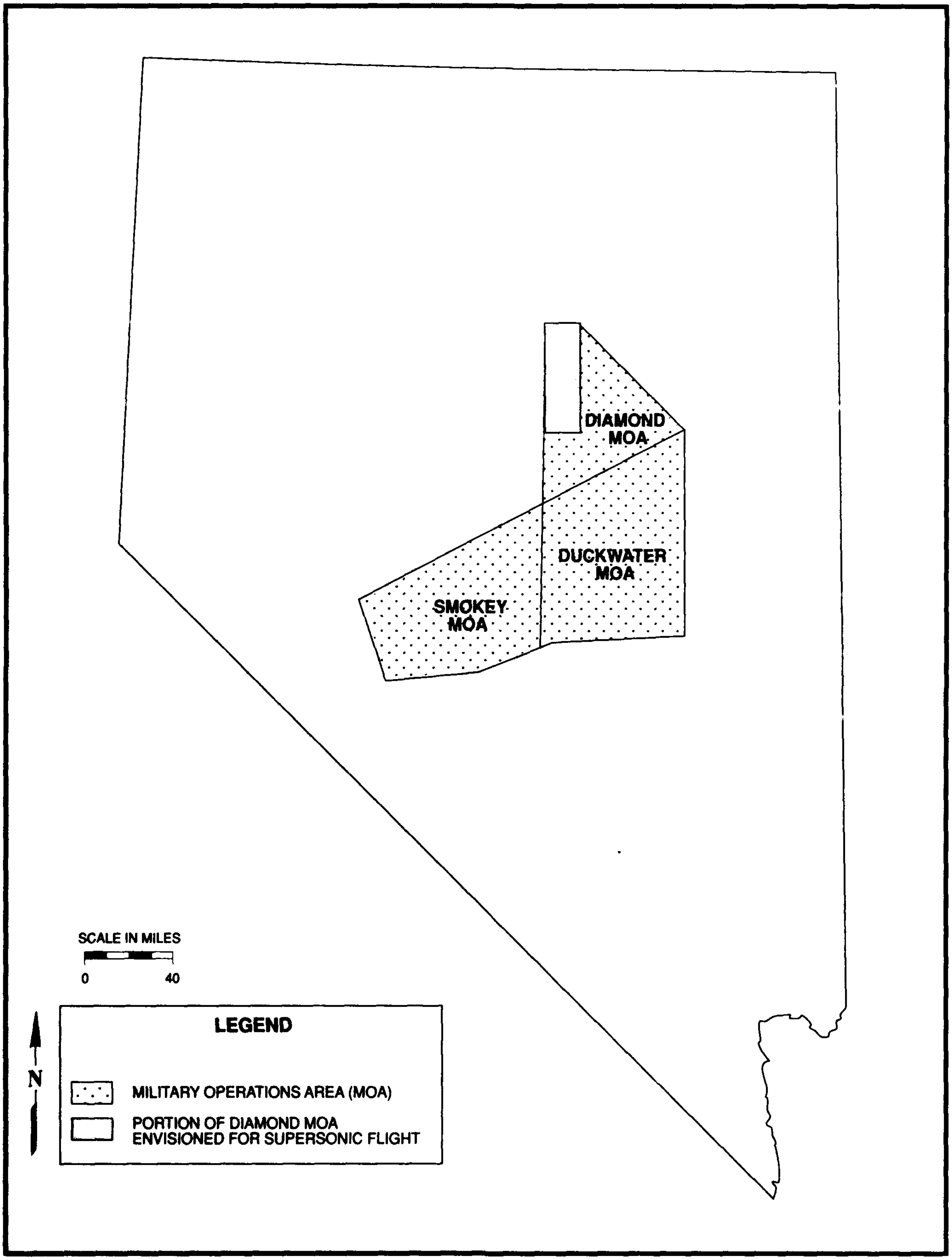


FIGURE 1.5 LOCATIONS OF AIRSPACE OVER NEVADA ENVISIONED FOR DEFENSE-RELATED PURPOSES

of the defense-related airspace in Nevada is available at all times for concurrent use by DOD aircraft and civilian aircraft which are flying under visual flight rules (VFR). There are an estimated 10,000 non-military users of the Fallon and Nellis MOAs. The specific missions associated with the various airspace areas in Nevada are described in Chapters 2 through 7.

1.2.3 TEMPORAL SCOPE

Two periods of time were used as the points of reference in analyzing the effects of defense-related uses in airspace over and on lands withdrawn in Nevada. Existing effects were evaluated for calendar year 1988, unless otherwise indicated; and the effects of continued, proposed, and envisioned defense-related uses are evaluated for calendar year 2000. The year 2000 is one year prior to the expiration of the withdrawal of lands under P.L. 99-606 and was selected for reference to future withdrawals and activities. The same methods for identifying the effects of defense-related uses were employed for both time periods. For the year 2000 evaluation, the intensity of activity was scaled from current operations to provide future, projected levels of activities unless details of proposed activities were available. The accuracy of the projections for calendar year 2000 is of course subject to changing world conditions. The level of activity at any military installation in Nevada at any given time is dependent upon the DOD force structure at that time and the existing world threat scenarios. Where land or airspace changes are proposed or envisioned, the level of activities for year 2000 is assumed to be of equal intensity across all contiguous land or airspace areas unless otherwise indicated by the controlling agency.

1.3 SOURCES OF INFORMATION

1.3.1 GENERAL

The Reference Section following Chapter 9 lists the references cited throughout this report. Information used to prepare this report was provided from records of and sources in the Navy, Air Force, Army, National Guard, BLM, and DOE. It was also derived from documents that were obtained from other Federal agencies and from the State of Nevada, county, local, and university sources. No field investigations were conducted to obtain additional information for this report.

1.3.2 INSTALLATION RESTORATION PROGRAMS

Significant sources of information regarding the location and distribution of non-hazardous, hazardous, and toxic contaminants are the documents produced under the DOD and DOE Installation Restoration Programs (IRPs). These programs were developed in response to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The IRPs identify all potential hazardous and/or toxic waste sites and characterize those sites found to be of potential concern. Following characterization, those sites that are found to present a public health or resource concern are scheduled for design and implementation of remediation programs. Potentially contaminated sites identified in these programs are referred to as IRP Sites.

1.4 METHODS OF ANALYSIS

This section describes general methods of analysis that were used to evaluate effects resulting from defense-related activities in Nevada on public health and safety and on public and private property, plants, fish and wildlife resources, cultural and historical resources, scientific resources, recreational resources, wilderness resources, mineral and energy resources, and water resources. General assumptions related to the analyses are also specified in this section. More detailed discussions, as appropriate, are contained in Chapters 2 through 7.

1.4.1 EFFECTS ON PUBLIC HEALTH AND SAFETY

1.4.1.1 Ground Motion

Ground motion results from underground explosions that are part of the nuclear weapons testing program of DOE at the NTS. Weapon yield limits of 150 kilotons (kt) of equivalent explosive yield have been in effect since the Threshold Test Ban Treaty of 1976. Ground motion effects depend on the explosive yield of the device and the distance between a given location and the underground test. Population centers in proximity to the testing areas (approximately 31 miles or less) were evaluated for potential effects to low-rise structures. Las Vegas is the only regional population center that has structures of sufficient dimension which required consideration beyond a distance of 31 miles from the NTS.

Ground motion at the various communities resulting from the underground explosions was estimated from published ground motion regression equations that include weapon yield and the distance between the source of the ground motion and the receiver (structure). Structures founded on rock were distinguished from structures founded on alluvium (Source: Vortman, 1979). Minimal source-receiver distances and maximum yield (150 kt) were used to estimate ground motions. Comparisons of predicted motions were made to instances of documented damage where possible.

1.4.1.2 Air Quality

Following requirements set out in the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS). There are primary air quality standards which are designed to protect public health and safety, and there are secondary air quality standards which are designed to protect the public welfare from any known or anticipated adverse effects of an air pollutant. Those standards are listed in Table 1-2. Air quality at a given location is described by the concentration of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions.

The State of Nevada has established state ambient air quality standards which, but for three exceptions, are identical to NAAQS (Table 1-2). There is currently no State standard comparable to NAAQS for inhalable particulates (PM_{10}), but one is expected to be established in the near future. In addition, there are State standards for hydrogen sulfide (112 $\mu g/m^3$ or 0.08 ppm) and for visibility (maintenance of prevailing visibility of greater than 30 miles) (Source: Nevada Bureau of Air Quality, 1987-1988 Trend Report, 1989) which have no counterpart at the Federal level. The State standards for hydrogen sulfide and visibility are met in the areas which this report addresses (Source: Nevada Bureau of Air Quality, 1987-1988 Trend Report, 1989). They are, therefore, not the subject of further analysis or discussion. In addition, to ensure the clarity of this report, the discussion of the analysis will focus on pollutant concentrations in comparison to NAAQS. It should, however, be kept in mind that the analysis applies equally well to the Nevada Ambient Air Quality Standards.

Table 1-2. National Ambient Air Quality Standards (NAAQS).

Pollutant	Averaging Time	Primary Standard[4] ($\mu g/m^3$)	Secondary Standard[4] ($\mu g/m^3$)
Total Suspended Particulates	Annual[1]	75	60
	24-hour	260	150
Inhalable Particulates	Annual[2]	50	50
	24-hour	150	150
Sulfur Dioxide	Annual[2]	80	N/A[3]
	24-hour	365	N/A
	3-hour	N/A	1,300
Carbon Monoxide	8-hour	10,000	N/A
	1-hour	40,000	N/A
Ozone	1-hour	235	235
Nitrogen Dioxide	Annual[2]	100	100
Lead	3-month	1.5	1.5

(1) Annual Geometric Mean
(2) Annual Arithmetic Mean
(3) Not Applicable
(4) Micrograms per cubic meter

The principal method to determine the significance of emission inventories emitted from DOD and DOE operations was to compare ambient air quality concentrations to the applicable NAAQS. To accomplish that comparison, air emissions inventories were compiled for each facility or operation for which data were available. For facilities or operations where emissions data were incomplete or unavailable, the type and frequency of emission-gathering activities were evaluated to provide a reference for comparison to other facilities where the emission inventory was better defined. If the facility was located in an area of Nevada where ambient air quality does not currently meet NAAQS, then the facility's effect on air quality was examined by comparing the facility emission inventory to the emission inventory for that basin. Areas of Nevada which do not currently meet NAAQS are shown in Figure 1.6. The only area of concern for this report that does not currently meet NAAQS is the Las Vegas Valley which does not meet NAAQS for carbon monoxide and particulate matter. If the facility was located in an area where the ambient air quality is better than NAAQS, then it was concluded that activities at the installation did not decrease air quality below acceptable levels.

Under the CAA, as amended in August 1977, emissions from military aircraft are excluded from regulation. However, for purposes of this report, emissions from military aircraft were estimated based on known emission levels for individual aircraft to evaluate their effect on air quality. For emission sources such as aircraft traveling in MOAs or on MTRs where emissions are dispersed over a large area, the aircraft sortie rates and flight profiles were used to calculate exhaust emissions while each aircraft was using the airspace. The total estimated emissions within a given airspace volume were summed, and that sum was used to calculate the volume concentration for each pollutant for a typical day of use. The resulting homogeneous concentrations were used as an estimate of ground-level pollution below the given volume of airspace and were compared to the applicable NAAQS.

A conservative (i.e., health protective), somewhat better than worst-case, approach was used to estimate the effect of aircraft emissions on ambient air quality. All aircraft emissions within a given unit of airspace were assumed to be contained within the lateral dimensions of that airspace and within a vertical dimension equal to the mean afternoon mixing height of 8,000 feet AGL. By dividing the mass of pollutants estimated to be emitted by aircraft on a typical day by the volume of airspace, an estimated typical daily concentration was calculated for each pollutant emitted by aircraft. Those results were compared to the allowable concentration for each pollutant as established in NAAQS.

The air quality analysis presented in this report is based on the CAA, as amended in 1977. The CAA was extensively amended very recently (November, 1990), but it is not expected that the changes will affect the conclusions of this report. According to the latest information (Clean Air Report, Inside EPA, Oct. 25 & Nov. 8, 1990), the focus of the reauthorized CAA is on air toxics, acid rain, mobile sources, reduction in ozone-depleting chemicals, and ozone non-attainment in urban areas. The provisions establishing the NAAQS in the CAA, which are the focal point of the analysis in this report, are essentially unchanged. In addition, it will take a considerable length of time for EPA to develop the regulations to implement the new provisions in the amended CAA.

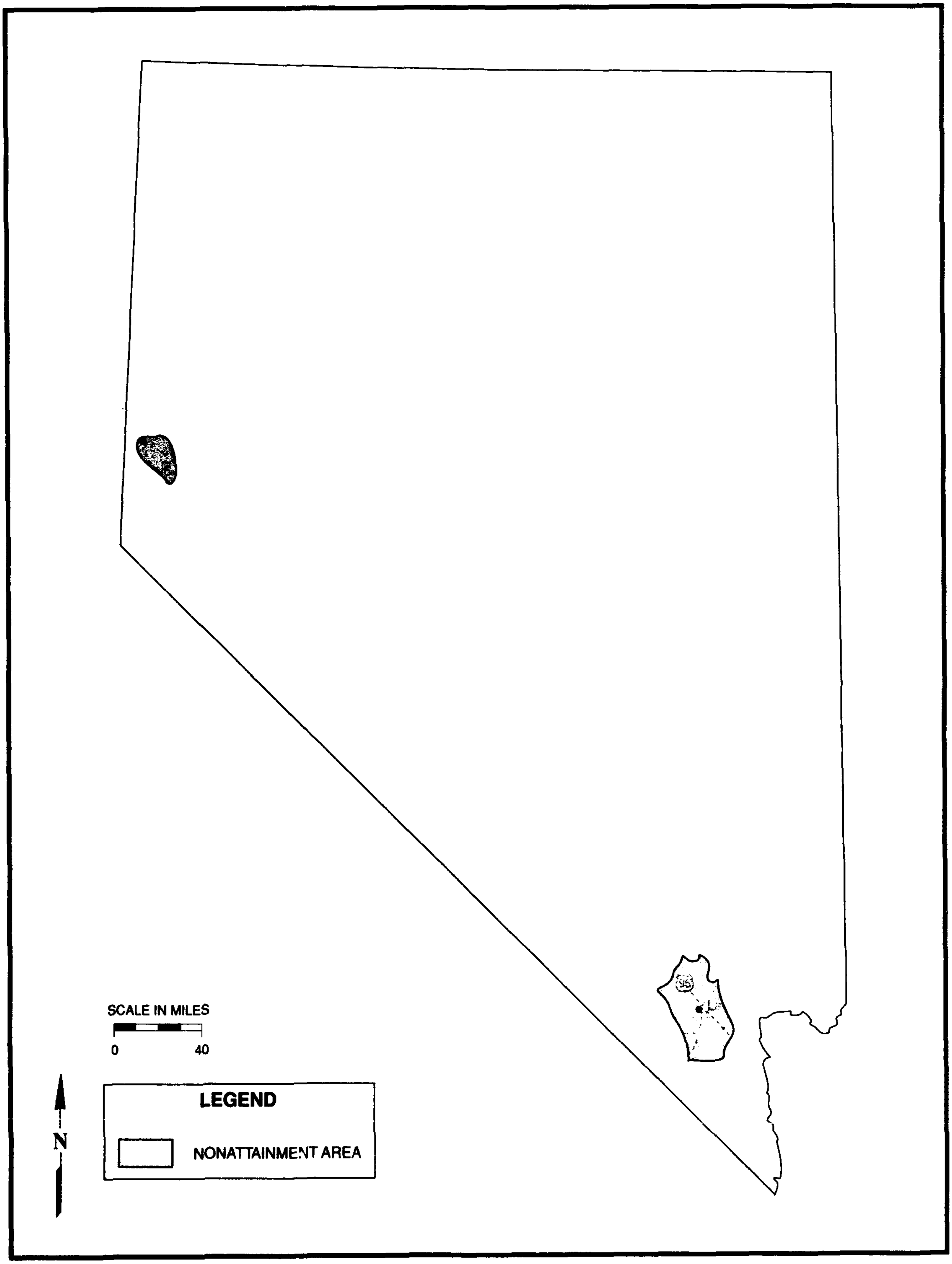


FIGURE 1.6 AIR BASINS IN NEVADA CURRENTLY NOT IN ATTAINMENT OF NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

1.4.1.3 Water Quality and Flood Hazard

In evaluating the effects of waste water treatment and disposal and hazardous and toxic materials storage, disposal, and spills on public health and safety, locations of all known potential sites were identified and evaluated in the context of local surface and ground water use and quality. Records of the Nevada Division of Environmental Protection (NDEP) were reviewed to determine whether violations of relevant laws or regulations had occurred and if so, what remedial actions had been accomplished. The potential for transport of hazardous and toxic materials off withdrawn lands by surface flooding was examined. In each instance the public health and safety implication of disposal, storage, and use was evaluated in terms of current water quality and environmental and health standards.

For flood hazards the major watersheds originating on withdrawn lands or those watersheds that have been altered by defense-related uses were identified. An assessment was conducted of the potential for floods from those watersheds to endanger public safety off the withdrawn lands. Where applicable, regional hydrology models were used to qualitatively estimate the hazard.

1.4.1.4 Ionizing Radiation

To analyze the potential effects of ionizing radiation from DOE activities associated with the NTS and Tonopah Test Range (TTR), assessments of risks were developed based on the National Academy of Science Biological Effects of Ionizing Radiation risk factors. Estimates of the potential radiation doses due to the use or possible release of radioactive material were developed from existing published reports. Those estimates included routine operations and abnormal events. To assess the risks from potential releases, estimates were made of the type and quantity of radioactive material and frequency of release events. Those risks are provided in the form of radiation doses and potential risk of cancer, other somatic effects, and genetic effects. The analyses also reflect the recognition of doses that are below the level of regulatory concern.

1.4.1.5 Non-Ionizing Radiation

Non-ionizing radiation consists of lasers and electromagnetic sources such as radar. Technical data, locations of use, and regulations were reviewed to determine safe distances and potential receptors. Where human receptors were located at less than safe distances, the probability and effects of inadvertent exposure were evaluated.

1.4.1.6 Solid and Hazardous Waste

Inventories of hazardous waste streams currently generated by operations at each withdrawal along with a description of current disposal practices were developed. Analyses of the potential effects from solid and hazardous waste operations were based on the degree of compliance with appropriate environmental regulations as indicated by recent inspection reports by Federal or State of Nevada regulatory agencies.

1.4.1.7 Noise and Sonic Boom

Methods used for evaluation of aircraft noise and sonic boom effects on public health and safety included use of the A-weighted sound-level metric for general and subsonic aircraft noise levels and the C-weighted sound-level metric for impulsive sounds including sonic boom. These measures are further quantified in terms of cumulative noise exposure by means of the day-night average sound level which accounts for the greater sensitivity of people to noise occurring during nighttime periods (10 p.m. to 7 a.m.). These day-night average sound level metrics are denoted, respectively, as L_{dn} for general and subsonic aircraft noise and L_{Cdn} for sonic boom and impulsive sounds. These metrics represent the average 24-hour noise exposures (with a 10 dB nighttime penalty) occurring during an annual period. A modified L_{dn} metric has been developed by the Air Force as appropriate to assess noise from MTR operations. This interim metric, designated L_{dnmr}, incorporates allowances for the sporadic use of MTRs and the unique sudden onset-rate characteristics of low altitude flight noise experienced under MTRs (a penalty of up to 5 dB) and assesses the average 24-hour noise exposure over the busiest calendar month. The 10 dB nighttime penalty is also incorporated. This metric was used to quantify noise level exposures along MTRs.

The relationships between these noise exposure metrics (initially L_{dn} and L_{Cdn}) and the percentage of people expected to be highly annoyed were formalized by the Committee on Hearing, Bioacoustics and Biomechanics of the National Research Council (Source: CHABA, 1981) as illustrated in Figure 1.7. The L_{dnmr} metric relationship to annoyance can be represented by that shown for L_{dn} in Figure 1.7, the additive corrections for unique subjective effects being incorporated within the L_{dnmr} metric. Figure 1.7 shows the percentage of people that would be expected to be "highly annoyed" when subjected to a specific level of noise or sonic boom, quantified in L_{dn}, L_{dnmr}, or L_{Cdn}, as appropriate. This method is used extensively to estimate the number of people in each exposed area that would be expected to be in a "highly annoyed" category. This consistent method of evaluating human reaction by means of "highly annoyed populations" has a uniformity of usage in almost all government-developed documentation and can, where necessary, be cross-referenced to other human reactions, such as complaints (Source: U.S. Air Force, LEEV, 1978).

The NOISEMAP (for generalized noise levels), ROUTEMAP (for noise levels along MTRs), and the Oceana Model (for sonic boom) are the models which were used in determining the exposures associated with aircraft noise and sonic boom. References to average single event sonic boom levels are based on actual measured data obtained by the Navy and Air Force, respectively. Also used was the PEAKEST Army model for predicting impulsive noise levels from gunnery, missiles, bombs, and blasts.

Measurement and prediction of sonic boom overpressures is currently a developing technology. In 1980, the Air Force conducted a supersonic flight study at the Warning Area 72 (W-72), commonly called the Oceana MOA. The empirical model provided the first capability to predict space-average noise levels from supersonic flight operations. In 1989, the Air Force conducted a study at the White Sands Missile Range (WSMR) to validate the Oceana Model. Validation was accomplished by comparing recorded boom levels to those

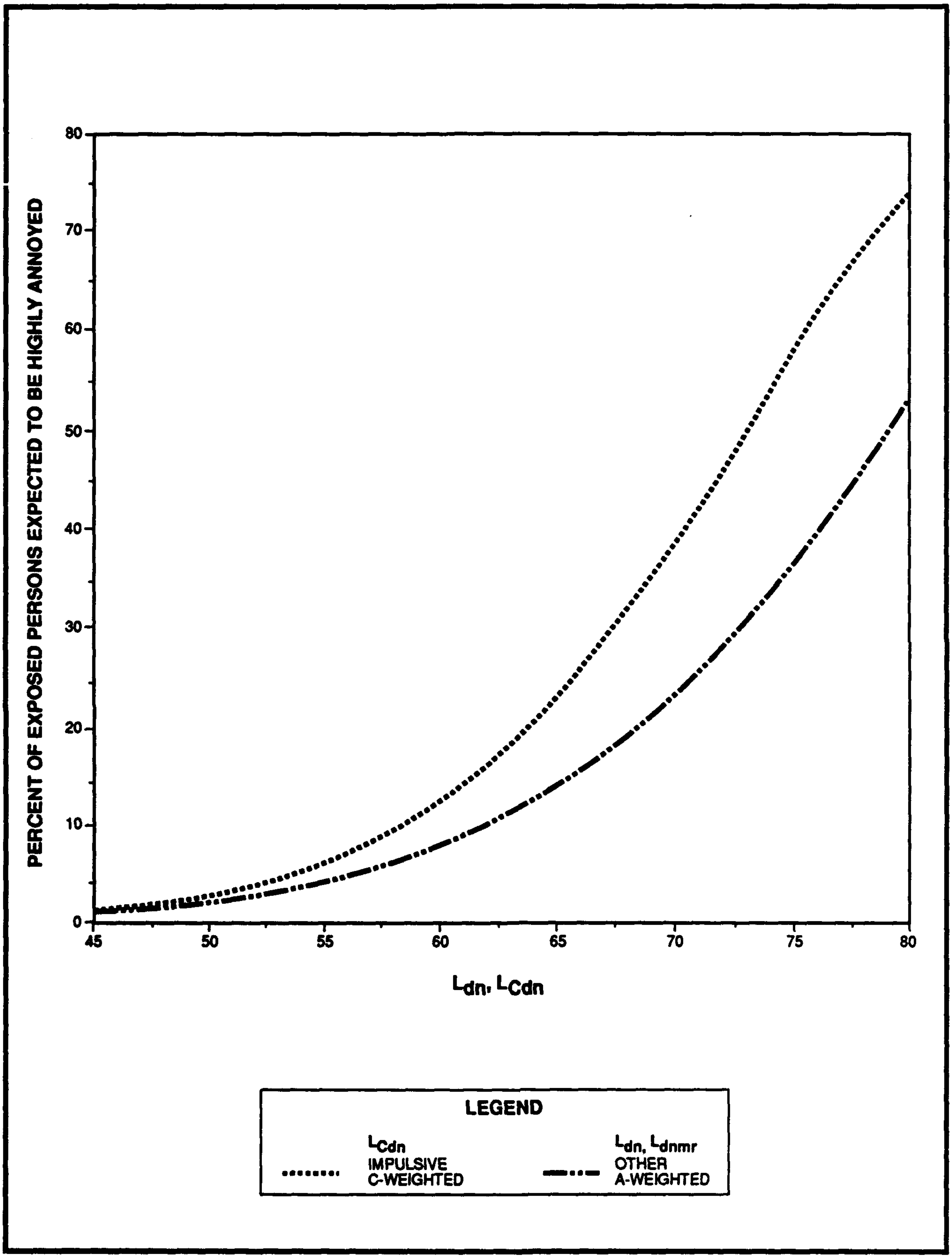


FIGURE 1.7 RECOMMENDED RELATIONSHIP FOR PREDICTING COMMUNITY RESPONSE TO HIGH ENERGY IMPULSIVE AND OTHER SOUNDS (SOURCE: CHABA, 1981)

predicted by the model. The WSMR data indicates that the Oceana Model over-predicts noise levels by about 10 decibels. In order to present predicted noise impacts according to the best available technology, both the Oceana and WSMR models will be used to show maximum, minimum and average overpressures that can be expected from supersonic flight operations.

It is possible but highly improbable that higher overpressures than that shown by the Oceana Model could occur. It is believed that the noise environment is close to that predicted by the WSMR refinement. This position is supported by the real-time monitoring data at NAS Fallon. The Air Force is continuing research efforts to refine sonic boom modeling capability and has already initiated contractual steps to conduct a site-specific analysis on the Nellis Range in the near future.

It is recognized that sudden occurrences of high noise levels and sonic boom occurrences can induce reactions other than annoyance to humans. There is, however, insufficient research at present to predict such effects in a quantitative manner for analysis of conditions in Nevada or elsewhere. Impacts such as startle, sleep disturbance and effects on wildlife are therefore possible under subsonic flight paths and airspace authorized for supersonic flight. Such airspaces are therefore located, as much as is possible, above land areas with low population densities and to minimize other impacts.

1.4.1.8 Facility Accidents

The effects of facility accidents evaluated in this report included the potential results of explosions at ammunition storage areas, fires involving large quantities of hazardous materials, and major fuel spills. To assess the potential effects from those accidents, locations of potential major accident sites (e.g., ammunition storage bunkers, fuel tank farms) and their proximity to public areas were identified. Facility designs and operating procedures developed to prevent and mitigate accidents at those facilities were reviewed. Qualitative evaluations were developed based on historical mishap data and evidence of compliance with applicable safety directives.

1.4.1.9 Aircraft Mishaps

The evaluation of the safety-related effects on the people and environment of Nevada from aircraft mishaps was based on an analysis of flight paths, sortie rates, historical mishap rates, location of people and property, historical rates of injury/death, and DOD regulations and policies that address aircraft-related safety procedures. Areas historically showing the greatest number of mishaps were investigated in detail. The area affected by a mishap was assumed to be eight acres which is approximately the size of the area affected by a crash of a heavy bomber.

1.4.1.10 Objects Dropped from Aircraft

In evaluating the potential for safety-related affects on the people and environment of Nevada from objects dropped from aircraft, the analysis was based on flight paths, sortie rates, historical rates of objects (including, when available, armaments) falling from aircraft, the location of people and property, historical rates of injury/death, and DOD regulations and policies that address aircraft-related safety procedures. A quantitative estimate of the probability of the people and environment of Nevada being affected by objects dropped from aircraft was made for areas where people reside. That quantitative estimate was compared to other risks to determine if people and property are being exposed to higher risk, due to defense-related use of airspace in Nevada, than would otherwise occur.

The area affected by a dropped object, (e.g., a bolt) was assumed to be 10 square feet. The area affected by a 2,000-pound explosive bomb, which would be the worst case, was assumed to be about 3.9 square miles (2,496 acres) (Source: Tybrin Corporation, 1988). The probability of injury or death due to objects dropped from aircraft also depends in part on the population and building densities in the vicinity of the airfield, areas adjacent to the ranges, and under air transit routes. Population density was also considered in determining the probability of objects dropped from aircraft affecting public health and safety. The effect of undetonated ordnance impacting or lying off-range in Nevada was described in qualitative terms because no known injury or death has occurred in Nevada due to undetonated ordnance impacting or lying off-range.

1.4.1.11 Transportation of Hazardous Materials

The effects on public health and safety resulting from transporting hazardous or toxic substances for defense-related purposes in Nevada are addressed at the statewide level in Chapter 8. When evaluating the effect on public health and safety from the transportation of hazardous or toxic substances in connection with defense-related activities in Nevada, major shipments of hazardous materials (HAZMAT) were defined as shipments that are required by the U.S. Department of Transportation (DOT) to display a vehicle placard which warns that a dangerous quantity of HAZMAT is contained within the vehicle. Such placards are required for trucks and railroad cars. The most dangerous HAZMAT require a placard when any amount is transported. These materials include the following: Class A explosive, Class B explosive, poison A, flammable solid (water reactive material), radioactive material, uranium hexaflouride (fissile), and uranium hexaflouride (low-specific activity) (Source: Transportation Regulations, 49 CFR, Part 173). Less dangerous HAZMAT require a placard when the shipment exceeds 1,000 pounds. Aircraft and pipelines do not require placards.

A three-step process was used in determining the effect on public health and safety resulting from the transportation of HAZMAT. First, flow rates for transportation of HAZMAT into, out of, and through Nevada were developed. The basic information with regard to flow rates in Nevada was obtained from the Commodity Report, 1988, prepared by the Nevada Department of Transportation (NDOT) (Source: NDOT, 1988). Information as to the types of HAZMAT transported in connection with defense-related activities was based on records of the installations which are the subject of this report. Flow rates in tons per day were categorized according to the type of HAZMAT, transportation mode, and route used. The State of Nevada had previously conducted a HAZMAT flow analysis for highways in which HAZMAT were classified into nine categories based on the United Nations Classification System (Source: NDOT, 1988b). The same classifications were used in preparing the analysis for this report. Those classifications are Class 1 (explosives), Class

2 (gases), Class 3 (flammable liquids), Class 4 (flammable solids, spontaneously combustible materials, and materials dangerous when wet), Class 5 (oxidizers and organic peroxides), Class 6 (poisonous and etiologic materials), Class 7 (radioactive materials), Class 8 (corrosives), and Class 9 (miscellaneous HAZMAT).

Second, the number of transportation accidents and incidents involving HAZMAT had to be determined. For purposes of this report, incidents were defined as events that involve actual or suspected release of HAZMAT, regardless of whether an accident occurred. A data base was developed by obtaining information from Federal, State of Nevada, private, and professional association sources on accidents by mode, location, severity, carrier, shipper (entity requesting shipment), causal information, and other relevant data.

Third, an analysis was performed to determine whether HAZMAT-related accidents (incidents and accidents) in Nevada occurring during transportation of HAZMAT in connection with defense-related activities in Nevada comprised a disproportionate percentage of all HAZMAT accidents in Nevada. That was accomplished by comparing the percentage of HAZMAT shipments in Nevada which are defense-related to the percentage of HAZMAT accidents occurring in Nevada which involve defense-related shipments.

The primary statutory authority governing HAZMAT transportation is the Hazardous Materials Transportation Act, which is implemented and enforced by DOT. Regulations implementing that Act are published in 49 CFR Parts 171-178. The Military Traffic Management Command (MTMC) controls the selection of carriers to transport HAZMAT for DOD activities. MTMC has adopted the regulations of DOT. Additionally, MTMC requires HAZMAT carriers to have a lower citation and accident rate than that required by DOT to retain licensing status, a vehicle inspection program, a driver training program, and a minimum of $5 million in liability insurance coverage. MTMC maintains an undercover surveillance program to monitor the carriers that are selected. DOE HAZMAT are transported by carriers that are certified by DOT for the required type of transportation. In addition, DOE has adopted the MTMC regulations; and DOE requires carriers to have performed well on previous work, to maintain complete and accurate freight records, and to have been responsive to DOE guidance and procedures.

Some limitations of the analysis warrant discussion. Complete HAZMAT flow rates are not readily available for rail transportation because the Interstate Commerce Commission only conducts a one percent sampling of freight movement. Furthermore, data were not available which would allow a determination of what portion of the total HAZMAT flow rate in Nevada requires placarding. Consequently, the entire flow rate of HAZMAT was used as the base.

The DOT data base used for that analysis contains only a portion of accidents and incidents. This could be due to some degree of non-reporting and/or non-transfer of reports to the data base. Furthermore, to be included in that data base, an accident must result in at least one of the following conditions: $50,000.00 or more in property damage, death, injury requiring hospitalization, evacuation of the public for one hour or longer, or arterial highway closure for one hour or longer. Thus, the data base is limited to the most severe accidents.

1.4.1.12 Chaff and Flares

Chaff and flares are countermeasure devices utilized by military aircraft for both offensive and defensive purposes.

Chaff consists of fine filaments of fiberglass with an aluminum coating. When released from an aircraft as a "burst," chaff becomes a large diffuse radar-reflecting cloud that obscures the aircraft from ground or airborne radar. The purpose of such a radar screen is to allow an attacking aircraft to evade the radar positioning and target acquisition of either ground or airborne opponents.

Flares, when released or propelled from an aircraft, burn with intense heat. The intended effect of flare is to provide an intense infra-red source for heat-seeking weapons, drawing them away from the aircraft. Flares are also used to illuminate targets at night. More complete descriptions of chaff and flares are contained in the Glossary.

Potential effects of chaff and flares were assessed by reviewing their composition, usage rates, potential pathways for effects, and historical mishaps. Potential chaff effects include inhalation and ingestion, as well as interference with civilian aircraft navigation aids, communication systems, and transmission lines. Potential effects from flares include range fires and personnel injury due to flares. Chaff and the vast majority of flare use is limited to the Nellis AFB Range and NAS Fallon Range Training Complex (FRTC). Therefore, discussion is limited to Chapters 2 and 3 for Nellis AFB and NAS Fallon, respectively.

1.4.2 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

The analysis of the effects of defense-related uses in airspace over and on withdrawn public lands in Nevada on public and private property focused on the socioeconomic effects. That analysis assumes one can isolate the direct and indirect contributions of the defense-related uses to the local and State economy. Economic effects of defense-related use of airspace were assumed to be coincident with its associated installation.

An economic-demographic model entitled Regional Economics Models, Inc. (REMI) (Sources: DOE, Office of Civilian Radioactive Waste Management, 1988; Treyz and Stevens, 1985) was used to identify the economic and demographic effects resulting from defense-related activities in Nevada. The direct employment or procurement associated with that land use was the basic element in the identification of total effects and was the primary input into the modelling process. Direct employment and procurement data for 1988 were used. The assumptions of direct employment underlying the projections for the year 2000 are subject to changing world conditions. The level of operations at any defense-related activity in Nevada during a given time is dependent upon the DOD force structure at that time and the existing world threat scenarios.

Indirect employment and total population estimates and forecasts were based on multiple assumptions that were part of the model. Assumptions incorporated into the model include the structure of the Nevada economy, how employment is related to population, age structure of the associated population, and ratios of financial measures to population. It was further assumed that many of the underlying assumptions such as household size, birth rates, and employment-to-population ratios change over time. Further, alternative use scenarios were assumed for the analysis of the effects in the year 2000. Those forecasts were based on historic land uses within the Nevada rural counties in which there is withdrawn land.

Economic simulations were performed for the years 1988 and 2000. They included the current, proposed, and envisioned land withdrawals and use of airspace and their associated economic activity. The employment and procurement data associated with each economically related group of land withdrawals and airspace such as Nellis AFB, its ranges, auxiliary airfields, and other activities were removed from the model; and the economy was simulated without those activities. The difference between the results with and without Nellis AFB is the estimated net economic effect of that group of withdrawals and airspace. That was the only analysis used for the year 1988 economic simulation. The year 2000 economic simulation used to determine the net effect on the economy was composed of two parts. One was simply the difference between the forecast of the defense-related activity for the year 2000 and the same forecast without the economic components expected for the activity in year 2000. The second was more speculative and took into account the fact that land has alternative uses. The difference between the net value of the land withdrawal activities and the net value of the alternative uses was interpreted as the effect of the withdrawal on the economy given alternative land uses. Economic activities that were assumed alternative land uses in rural areas (Churchill, Mineral, Nye, and Lincoln counties) were grazing and mining since they contribute substantially more to the local economy than other potential alternative uses such as outdoor recreation. Generalized activity substitutions derived from the experience of past military base closures were assumed to be reasonable alternative land uses for the urban environment associated with Nellis AFB.

Socioeconomic effects result primarily from the activities associated with four installations. They are Nellis AFB, NAS Fallon, Hawthorne Army Ammunition Plant (HWAAP), and the NTS. The economic, population, housing, community services, public finance, and land use effects from those land withdrawals and airspace uses are concentrated in the local area proximate to each of those activities. Economic and population-related effects of the other land withdrawals represent a small percentage of the relevant local economy. As a result, the effects on public and private property resulting from those other land withdrawals are not set forth separately but are instead incorporated in the analysis of the cumulative effects on the State of Nevada.

The economic effects for local regions of influence were translated into demographic effects using REMI and spreadsheet analysis. Assessment of effects on community services included public services such as education, health care, police, and fire protection. Public finance considerations included the direct provision of funds to specific public agencies by a withdrawal sponsor and associated population-related effects on public fiscal resources and expenditures. A comparison of direct and population-related fiscal considerations is presented for public fiscal resources and expenditures. As a result of employment at defense-related activities, residents of Nevada who own their own homes or rent property in the civilian communities pay property taxes directly or through rent payments and pay sales, motor vehicle, fuel, and other taxes on goods purchased from businesses located in the cities, towns, and counties. Community service inventories and public fiscal activities were assumed to represent local standards for the activities. That assumption determined the ratios of service staffing level to population and fiscal measure to population for the spreadsheet analysis. Attribution of a portion of the total fiscal measure or service staffing level to an activity on withdrawn land is based upon a revenue, cost, or staffing averaging approach which is proportional to direct employment by that activity.

No quantitative or qualitative field investigations related to social effects were undertaken for this report. However, document analysis of existing studies, public meeting transcripts, contact records of discussions conducted during data collection for other resource area studies, as well as publications and news articles regarding defense-related activities in Nevada provide qualitative information regarding current attitudes and lifestyles of Nevada residents. The review of these documents was inductive in that the cumulative effects described in Section 8.3.8 were derived from patterns developed from this available body of literature.

1.4.3 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

Analyses of effects on plants, fish, and wildlife resources resulting from defense-related uses in airspace over and on withdrawn public lands in the State of Nevada were based on data derived from published sources, from the files of wildlife and land management agencies, and from information provided by the Nevada Natural Heritage Program data base. No primary data collection (field investigation) was performed.

DOD has conducted wildlife monitoring and DOD and DOE have conducted numerous studies on the effects of defense-related activities on wildlife in Nevada. A substantial number of similar studies have been conducted by other parties. Analysis was based, in part, on studies documenting effects of human activities on wildlife. In making that analysis, effects from recognized human-caused disturbances to plants and wildlife population which are likely to be associated with defense-related activities (e.g., road construction, off-road vehicle use in desert lands, and noise) were considered. Documents prepared in compliance with NEPA for proposed activities on public lands withdrawn for defense-related purposes in Nevada were examined for information regarding impacts on wildlife. Positive effects on fish and wildlife resulting from the withdrawal of public lands were also considered.

Based on available species range maps, 18 threatened and endangered species, 23 raptors (birds of prey), and 17 game and other species are considered in the analysis. Those species are listed in Table 1-3. Ranges of wildlife species used in that analysis were derived from published literature and files maintained by BLM, the Nevada Department of Wildlife (NDOW), and the U.S. Fish and Wildlife Service (USFWS). The location of raptor and waterfowl migration routes and fish and waterfowl habitat was also examined. It was assumed that the effects on wildlife resulting from defense-related uses in airspace over and

Table 1-3. Species Considered in the Analysis of the Effects of Defense-Related Activities on Wildlife in Nevada.

Common Name	Scientific Name
THREATENED AND ENDANGERED SPECIES	
Endangered	
American bald eagle	*Haliaeetus leucocephalus*
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*
Ash Meadows pupfish	*Cyprinodon nevadensis mionectes*
Cui-ui	*Chasmistes cujus*
Devils Hole pupfish	*Cyprinodon diabolis*
Hiko White River springfish	*Crenichthys baileyi grandis*
Moapa dace	*Moapa coraicea*
Pahrump poolfish	*Empetrichthys latos*
Peregrine falcon	*Falco peregrinus*
Warm Springs pupfish	*Cyprinodon nevadensis pectoralis*
White River spinedace	*Lepidomeda albivallis*
White River springfish	*Crenichthys baileyi baileyi*
Threatened	
Ash Meadows naucorid	*Ambrysus amargosus*
Big Spring spinedace	*Lepidomeda mollisinis pratensis*
Desert dace	*Eremichthys acros*
Desert tortoise	*Xerobates agassizzi*
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*
Railroad Valley springfish	*Crenichthys nevadae*
RAPTORS[1]	
Turkey vulture	*Cathartes aura*
Northern goshawk	*Accipiter gentilis*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo swainsoni*
Rough-legged hawk	*Buteo lagopus*
Ferruginous hawk	*Buteo regalis*
Golden eagle	*Aquila chrysaetos*
Northern harrier	*Circus cyaneus*
Osprey	*Pandion haliaetus*
Prairie falcon	*Falco mexicanus*

Table 1-3. Species Considered in the Analysis of the Effects of Defense-Related Activities on Wildlife in Nevada (continued).

Common Name	Scientific Name
Merlin	*Falco columbarius*
American kestrel	*Falco sparverius*
Barn owl	*Tyto alba*
Western screech owl	*Otus kennicottii*
Flammulated owl	*Otus flammeolus*
Great-horned owl	*Bubo virginianus*
Burrowing owl	*Athene cunicularia*
Northern pygmy owl	*Glaucidium gnoma*
Long-eared owl	*Asio otus*
Short-eared owl	*Asio flammeus*
Northern saw-whet owl	*Aegolius acadicus*
GAME AND OTHER SELECTED SPECIES[2]	
Elk	*Cervus canadensis*
Mule deer	*Odocoileus hemionus*
Pronghorn antelope	*Antilocapra americana*
Mountain lion	*Felis concolor*
Desert bighorn sheep	*Ovis canadensis*
Wild horse	*Equis caballus*
Burro	*Equis asinus*
Kit fox	*Vulpes macrotis*
Red fox	*Vulpes fulva*
Gray fox	*Urocyon cinereoargenteus*
California quail	*Callipepla californica*
Gambel's quail	*Callipepla gambelii*
Scaled quail	*Callipepla squamata*
Mountain quail	*Oreortyx pictus*
Sage grouse	*Centrocercus urophasianus*
Blue grouse	*Dendragaphus obscurus*
Chukar	*Alectoris chukar*

(1) Raptor migratory routes were also considered in the analysis.
(2) Waterfowl and shorebird habitats, migratory flyways, and fishable waters were also considered in the analysis.

on withdrawn public lands in Nevada would primarily result from the overlap of wildlife habitat and populations with the locations where defense-related activities occur. Potential effects were determined, in part, by calculating the proportion of the Nevada range of each species listed in Table 1-3 that exists within defense-related public land withdrawals and beneath airspace used for defense-related missions. Maps of existing, proposed, and envisioned defense-related public land withdrawals, MOAs, and MTRs and distribution for each species were digitized. The extent of overlap with each defense-related withdrawal and each defense-related airspace area was determined for each species. That overlap was converted to the percentage of the range existing within Nevada of each species listed in Table 1-3. The overlap analysis provided a limited estimate of the status of wildlife distributions in Nevada and resulted in a limited characterization of the effects of defense-related activities on wildlife populations.

The effects of defense-related activities on wildlife may not be limited to areas within identified boundaries of public land withdrawals. Wildlife can be affected by many off-withdrawal activities as a result of increased human population. Any presence of the human population in rural Nevada, defense-related or otherwise, may be expected to affect wildlife by the potential for vehicle/wildlife collisions, poaching, increased water requirements for municipalities causing a decrease in water available for habitat management, and additional sewage treatment facilities. Some of those effects were included in the analysis where appropriate.

1.4.4 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

The impacts of defense-related activities on cultural resources in Nevada depend on the nature of those cultural resources, the extent and intensity of various land disturbing activities, the nature and efficiency of management policies and procedures, and the extent to which potential impacts have been mitigated through alternative courses of action, project modification, or data recovery.

Section 110 of the National Historic Preservation Act requires federal agencies to establish a program to locate, inventory, and nominate all properties that appear to qualify for inclusion in the National Register of Historic Places. Pursuant to Section 106 of the National Historic Preservation Act (NHPA) and other legislation, federal regulations (36 CFR Part 800) outline procedures that, if followed, will minimize the potential for adverse impacts on significant historic and cultural properties. These procedures, to be followed in consultation with the State Historic Preservation Office (SHPO) and, when appropriate, the Advisory Council on Historic Preservation (ACHP), define how Federal agencies are to assess and mitigate the impacts of their actions on cultural resources. According to 36 CFR 800.3(a) an "undertaking shall be considered to have an effect whenever any condition of the undertaking causes or may cause any change, beneficial or adverse, in the quality of the historical, architectural, archaeological, or cultural characteristics that qualify the property to meet the criteria of the National Register." That would include damage from land use and vandalism. Memoranda of Agreements and Programmatic Agreements may be initiated between a Federal Agency, State Historic Preservation Office, and Advisory Council on Historic Preservation that outline the agreed upon steps that will be taken during an undertaking to minimize the potential for adverse effects.

The American Indian Religious Freedom Act (AIRFA) of 1978 establishes that it "shall be 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 religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects and the freedom of worship through ceremonials and traditional rites." The Act gives Federal agencies the responsibility to evaluate their policies and procedures with the aim of protecting Indian religious freedom, to consult with Indian groups, specifically traditional leaders, in the course of this review, and to make such changes in policy and procedure as are necessary to preserve Indian religious cultural rights and practices. Based on Section 1(b)(2) and 2(1) of the NHPA, the ACHP has issued guidelines ("Draft Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review") that incorporate AIRFA requirements under Section 106 review.

The adequacy of information concerning the nature of cultural resources depends on the extent to which cultural resources have been identified and reported through field surveys and overviews. The use of existing data without the benefit of field checks and the limited extent to which historic properties have been identified through overviews and surveys on defense-related lands may not permit an understanding of the full extent of effects. Consequently, a higher percentage of properties may have been affected by defense related activities and programs than is presented in this document.

In the State of Nevada formal records describing the context, nature, and known condition of identified cultural resources are maintained at several locations including the Nevada State Museum, the Museum of National History at the University of Nevada, Las Vegas, the various Federal agencies (U.S. Forest Service, BLM, and USFWS) responsible for land management, the various DOD and DOE agencies, and various contractors conducting field surveys and overviews. For the SNR, this information was amassed through DOD and DOE materials and through record searches conducted at the Nevada State Museum, the Desert Research Institute (DRI), and the Museum of Natural History at the University of Nevada, Las Vegas. Record searches were not conducted at other localities.

Occasionally there were discrepancies between the number of sites in any one particular area documented during the search of site records, and the number of sites said to have been recorded in those areas through various surveys. In those cases, the number of sites used for analysis was the number of sites that could be documented by site records. If surveys and overviews had not been conducted in advance of defense-related activities, it was not possible to determine or precisely estimate the number and nature of the cultural resources potentially affected by those actions.

The information concerning the nature, extent, and intensity of the various land disturbing activities on existing, proposed and envisioned land withdrawals was obtained from DOD and DOE materials. This information, presented in Chapters 2 through 5, was not sufficient for quantification. DOD and DOE materials also contained information concerning existing and proposed policies and procedures for the management of cultural resources. DOE material contains information concerning project modifications, courses of action, and data recovery programs used to mitigate potential effects. DOD has procedurally mitigated potential effects through a policy of avoidance.

Professional archaeologists typically examine cultural resources for existing impacts when they are recorded. This information is coded on the filed site records. These records do not usually contain information regarding the source of impacts. Impacts may be due to various activities including natural weathering, seismic activity, previous historic activity, vandalism, and neglect. For the SNR it was assumed, unless otherwise noted, that existing impacts to cultural resources are due to past defense-related activities because land withdrawal for military purposes greatly preceded most cultural resource surveys.

Whether a cultural resource is or is not eligible for the listing in the National Register of Historic Places depends on the opinion of the Federal agency made in consultation with the State Historic Preservation Officer and confirmed by the Keeper of the National Register, National Park Service. In most cases, adequate information concerning the eligibility of the recorded cultural resources was not contained in the defense-related agencies' documentation. Professional archaeologists typically make recommendations concerning the eligibility of the cultural resources for nomination to the National Register on the site records. Eligibility as discussed in this report reflects the opinion of the archaeologists as noted on the site form and not a formal determination of eligibility by the Federal agencies.

In this report the word impacts is used in discussing cultural resources, rather than effects because of the language of P.L. 99-606.

1.4.5 EFFECTS ON SCIENTIFIC RESOURCES

During the course of the analyses associated with each public land withdrawal, unique or important attributes of scientific resources were identified. In part, the scope of the scientific resource is determined more by what is not known than by what is known. For each of the scientific disciplines and natural and cultural resources, that knowledge varies significantly among the several land withdrawals. The basic assumption in identification of scientific resources is that sparsity or absence of information or data related to important resources or natural processes represents the opportunity to expand scientific knowledge and understanding. Effects on scientific resources are only evaluated in Chapter 8, Section 8.6.

1.4.6 EFFECTS ON RECREATIONAL RESOURCES

Substantial disagreement exists on what constitutes unacceptable effects on outdoor recreation opportunity settings, given that levels of acceptability depend on the values and desires of the person making the judgement. The recreation opportunity setting is "the combination of physical, biological, management, and social conditions that give value to a place" (Harrison et al., 1980). Noise in recreation settings is a factor of concern to outdoor recreation managers. A widely accepted methodology for determining noise impacts is outlined in Predicting Impact of Noise on Recreationists, (Harrison et al., 1980). That methodology is based on the recognition that while sound is a physical phenomenon that can be measured, noise is an interpretation that the magnitude of a sound has reached disturbing levels. No absolute standards define what those thresholds are. Yet empirical studies indicate that there are common concepts about what constitutes adverse acoustical impacts in certain settings, as indicated in the following discussion.

According to this methodology, "noise is considered just as inappropriate in a modern campground as in a remote wilderness. The difficulty, however, is that . . . definitions of noise are a function of more than just loudness; some types of sounds are perceived as noise regardless of the loudness. For example, even the faint sound of a vehicle might constitute a noise in a wilderness, while in a developed modern campground the same sound might not be noticed" (Source: Harrison et al., 1980).

This focus on background settings is the basis of this methodology for estimating impacts on recreationists. It is based on a framework of four types of recreation opportunities:

Modern Opportunities:

The sounds here are loud relative to the full range of recreation opportunities. A variety of both mechanical and nonmechanical sounds is acceptable at levels close to that found in urban residential environments.

Semi-modern Opportunities:

The sounds here may have the same sources as in modern opportunity areas. But the loudness, repetitiveness, and duration of the sounds are noticeably less.

Semi-primitive Opportunities:

The sounds here are primarily natural. Human-related sounds occur less often than in the semi-modern category, last for a short period of time, and are infrequent during the night.

Primitive Opportunities:

The sounds here are generally not human-related. They are primarily natural, background sounds (such as wind or water). In those areas that are the most primitive, both mechanical and unnatural, nonmechanical sounds are disturbing (Source: Harrison et al., 1980).

The four types of recreation opportunity categories were used to classify Nevada's recreation areas (Section 8.7.2). For example, modern opportunities included urban parks, jet skiing areas, and off-road vehicle sites (i.e., areas where noise is an accepted component of the recreation use of the area). Similarly, semi-modern opportunities included small, rurally situated parks or campgrounds along main highways, where external and internal noises are expected from traffic, day-use picnickers or from organized group functions. Semi-primitive opportunities included fishing lakes or streams and developed campgrounds in more remote locations. Primitive opportunities logically encompassed all wilderness, designated or otherwise, and also included primitive campgrounds located in very remote areas, for example, in some of the National Forests or BLM Extensive Recreation Management Areas.

The 1987 Statewide Comprehensive Outdoor Recreation Plan produced by the Nevada Division of State Parks and based on information provided by the BLM was used to evaluate the effects of defense-related activities on recreation resources beneath airspace and on public lands withdrawn in Nevada. Environmental impact statements (EISs), environmental assessments (EAs), land resource management plans for the specific land withdrawals, and other DOD/DOE records were also used. Map overlays were developed to examine recreation areas that are located on withdrawn lands and that are located beneath airspace used for defense-related missions.

Recreation resources considered in this report are primarily areas that are officially owned, managed, or otherwise recognized by Federal, State, or county government. Recreation areas located in urban areas were not analyzed. Wilderness areas, which are used for recreation, and the BLM Extensive Recreation Management Areas, which encompass large portions of the State, were also considered in the analysis.

Other than a study performed by the NDOW in the area of NAS Fallon, data which scientifically identify and examine effects of defense-related activities on recreation resources in Nevada were unavailable. Because of that limitation, the recreation analysis focused on determining the amounts of recreation resources located on the withdrawals or beneath the defense-related airspace. The objective of the analysis was to determine the extent to which defense-related activities co-exist with recreation resources in Nevada and attempt to determine the extent to which that co-existence may affect the quality of those resources.

Two categories of effects on recreation resources were analyzed: 1) the effects of land withdrawals and any resultant restrictions or access denials on recreation uses of these resources; and 2) the effects of defense-related overflight on recreation resources. The analysis of effects of the current, proposed, and envisioned withdrawals on the availability of recreation resources was based on a comparison of the availability of such resources on non-withdrawn lands to that on withdrawn land. Restrictions, permit systems, and closures were considered as limiting access to recreation resources. The effects resulting from withdrawal of lands were also evaluated by determining the potential recreation features of the withdrawals and determining the effect that the withdrawal of those lands has on the recreation potential in Nevada.

The effects of defense-related overflight of recreation lands were evaluated by mapping the primary recreation features in Nevada and determining if defense-related airspace is present over those areas. The analysis assumed that noise emanating from defense-related use of airspace above recreation areas, regardless of duration, frequency, or noise level, was a distraction to a portion of recreationists. The analysis also assumed that some users consider unpopulated and undisturbed expanses of Nevada's landscape, including the BLM Extensive Recreation Management Areas and USFS Management Areas, part of its natural appeal. However, it is also recognized that some people will not be annoyed by aircraft noise.

The recreation analysis considers visitor use data for State Parks, USFS Management Areas and campgrounds, National Wildlife Refuges, Wildlife Management Areas, National Parks, BLM Recreation Areas, and "other" areas. Additionally, a non-quantitative analysis was conducted to assign each recreation site to the 4 categories of recreation opportunities, described in the publication Predicting Impact of Noise on Recreationists, (Source: Harrison et al., 1980). This analysis, the results of which are provided in Section 8.7, provides an indication of the primary recreation opportunities available in each park setting. An effort was made to rank park sites with the highest probabilities for noise disturbance, based on number of monthly overflights of each area and the potential for supersonic operations above the area.

1.4.7 EFFECTS ON WILDERNESS RESOURCES

The wilderness resources on public lands in Nevada are determined and managed by the three primary federal land management agencies in the State: the U.S. Bureau of Land Management, Forest Service and Fish and Wildlife Service. These agencies follow established federal policy and regulations in evaluating areas for wilderness designation. Wilderness resources in Nevada are shown in Figure 1.8.

The Wilderness Act (Public Law 88-577, 88th Congress, S.4, September 3, 1964) defined wilderness as follows:

> Sec. 2. (c) A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human inhabitation, which is protected and managed so as to preserve its natural conditions and which: 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

The term "solitude" was not defined in the Act and has become a subject of controversy. Opportunities for solitude are an important aspect of the wilderness resource. An absence of man-made noise contributes to solitude. Low-level military overflights can intrude on solitude, but those intrusions do not destroy wilderness aspects of the area. Over the majority of the wilderness resources, those intrusions are momentary. Accordingly, low-level military overflights do not preclude the designation of wilderness areas by Congress.

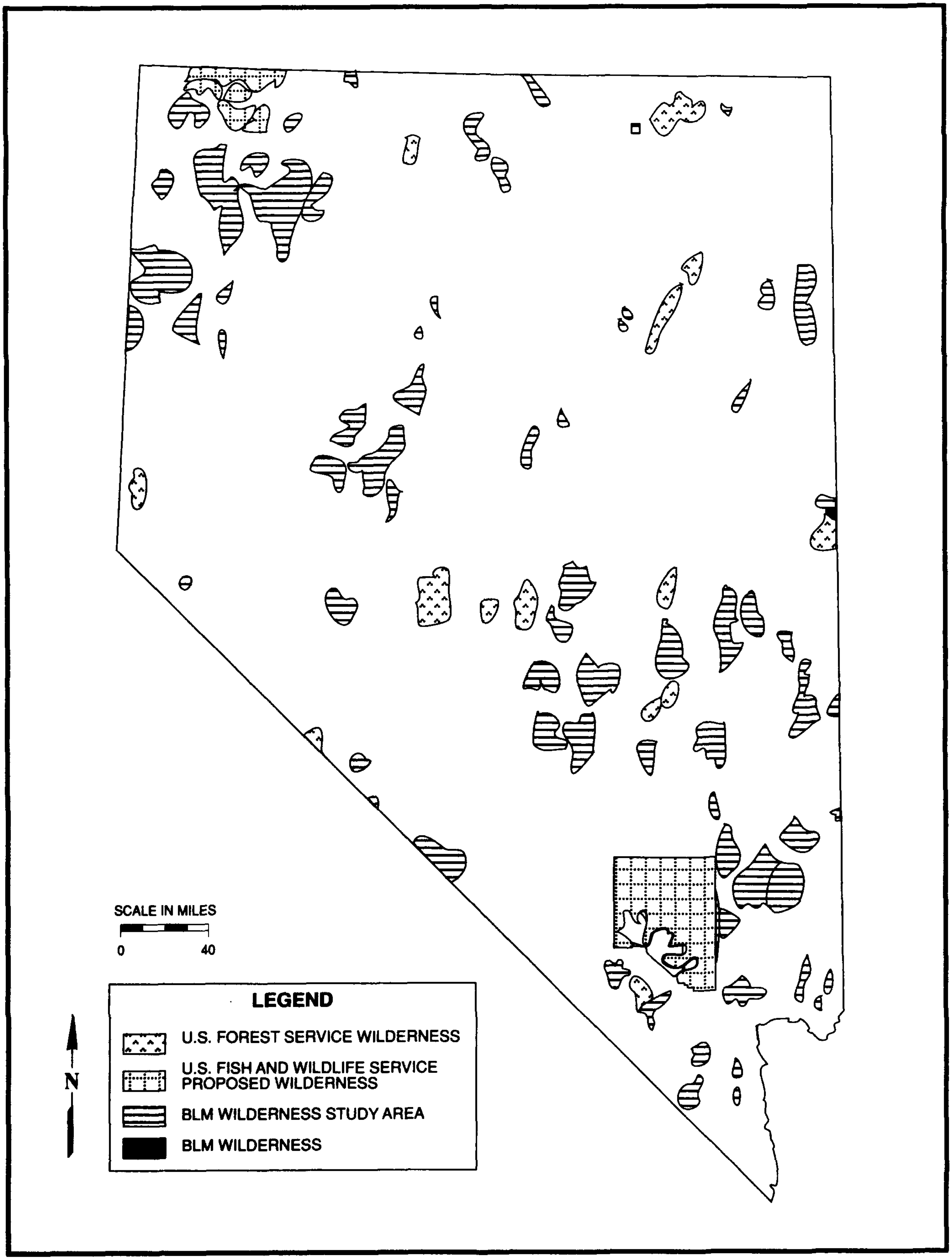


FIGURE 1.8 WILDERNESS RESOURCES IN NEVADA

Federal lands withdrawn from the public domain for military and defense-related purposes prior to the Federal Land Policy and Management Act of 1976 (FLPMA) are exempt from wilderness evaluation.

Section 603 of the FLPMA directed the BLM to report to Congress through the Secretary of the Interior and the President, on the public lands recommended for inclusion in the National Wilderness Preservation System. To accomplish this task, the BLM conducted inventories and evaluations of public lands under its jurisdiction to determine roadless areas which may have wilderness characteristics. Wilderness inventories were conducted throughout Nevada within each BLM resource management area to identify Wilderness Study Areas (WSAs) meeting the minimum criteria established in Section 2 of the Wilderness Act for wilderness consideration. In total, 102 distinct wilderness study areas, encompassing nearly 5 million acres, were identified during the BLM Intensive Wilderness Inventory.

Wilderness EISs were prepared as a result of the Statewide Inventory and list various alternatives for each of the WSAs including the BLM Preferred Alternative. This Alternative, however, does not necessarily indicate the ultimate designation of the WSAs. In fact, congressional wilderness proposals often result in designation of more wilderness acreage than that recommended by the Federal land management agencies.

Recommendations made in the final EISs will be reviewed by the Bureau of Land Management Director and the Secretary of the Interior, who will make a recommendation to the President of the United States. The President has up to two years to make his final recommendation to Congress, which has sole authority to designate an area as wilderness. Until Congress decides whether to designate an area as wilderness, the WSAs will be managed as "de facto wilderness," in accordance with the BLM's Interim Management Policy and Guidelines for Lands Under Wilderness Review. Suitability recommendations for Nevada are to be reported to the President by October 21, 1991, and to Congress by October 21, 1993. If the recommended lands are designated as wilderness by Congress, these areas would be managed in accordance with the Wilderness Act of 1964 and the BLM's Wilderness Management Policy September, 1981 (Source: BLM, 1981).

Wilderness resources on Forest Service (USFS) lands have been extensively evaluated since the passage of the 1964 Wilderness Act. Until December, 1989, the 64,667 acre USFS Jarbidge Wilderness Area was the only designated wilderness area in the State. The USFS preferred alternative of only 409,900 acres was rejected by Congress. Legislation to designate as wilderness areas 733,400 acres of USFS lands in 14 separate areas was signed into law by the President of the United States in December 1989. Designation of USFS Wilderness also resulted in the co-designation of an 8,000 acre BLM wilderness area contiguous with the USFS Mt. Moriah Wilderness Area.

Recommendations for wilderness areas in the National Wildlife Refuge System in the State of Nevada have been made by the Secretary of the Interior and are pending approval by the President of the United States. There are currently three wilderness proposals, totaling more than 1.7 million ac., within National Wildlife Refuges and Ranges in Nevada. National Park Service (NPS) wilderness reviews, to date, have resulted in wilderness proposals for one NPS unit in Nevada: Death Valley National Monument. Lake Mead National Recreation Area and Great Basin National Park do not have wilderness proposals, although suitable lands do exist in each of these units.

Information about wilderness resources in Nevada was obtained from the wilderness proposals and EISs produced by the BLM, USFS, and USFWS and from EISs, EAs, and land resource management plans specific to public lands withdrawn for defense-related purposes. In many instances wilderness resources on withdrawn lands are not identifiable because the land was withdrawn prior to the effective date of laws requiring wilderness evaluation.

Potential effects of defense-related activities on wilderness resources in Nevada were categorized into: 1) the effects on public lands withdrawn for defense-related purposes which were thus considered generally inaccessible; and 2) the effects of defense-related use of airspace over wilderness resources. Wilderness areas, proposed wilderness areas, and WSAs were transferred onto a base map of Nevada. Other maps which illustrated the location and extent of each of the defense-related land withdrawals, supersonic use areas, and other airspace areas were overlaid on the base map. Examination of the overlays provided an assessment of the spatial overlap of wilderness resources and defense-related existing, proposed, and envisioned land withdrawals and special use airspace areas. Those data were examined to determine the extent to which defense-related activities may affect wilderness resources in the State of Nevada.

The analysis of effects to wilderness resources was based in part on two recent surveys of wilderness managers. One involved 50 Park and Forest Service managers. Military operations, mainly overflights, were ranked as the most common threat to wilderness areas (Source: Peine et al 1989). Another survey of 540 wilderness managers was conducted by the General Accounting Office. According to the study, noise was found to be the most common off-site problem. Noise from low-level military flights was noted as a problem at several of the wilderness areas surveyed (Source: U.S. GAO, 1989).

1.4.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

The mineral resources included in the evaluation of the effects of defense-related uses in the airspace over and on the public lands withdrawn in Nevada on mineral and energy resources were base and precious metals, uranium, industrial minerals, and gem stones. Energy resources included oil and gas, types of hydrocarbons, and geothermal resources. Hydropower was not included in the assessment because none of the lands withdrawn in Nevada have sufficient potential to generate hydroelectric power. Similarly, coal was not included in the assessment because the identified coal prospects and deposits in Nevada (outside the Goose Creek coal field in extreme northeastern Nevada) are minor occurrences that lie outside of the withdrawn lands (Source: Brady, 1983).

The method used to assess the mineral and energy-resource potential of military withdrawals in Nevada is widely referred to as the 'mineral deposit models' approach (Source: Ovenshine, 1986). In brief, this method requires the resource assessor to compare the geology of the area being assessed to the known attributes of hundreds of mineral-deposit models described by Cox and Singer (1986). If enough similarities exist between a single deposit model and the area being assessed, the assessor may conclude that the area is favorable, or has potential, for deposits of that model type. Of course, several types of deposit models could be applied to the area being assessed if it contained enough attributes of each deposit model. A favorable or 'permissive' terrain for a specific deposit type is defined as an area underlain by rocks of a type and age that have hosted those ore deposits in other areas. If enough data are available for the area being assessed, estimates can be made of the number of deposits that could be present in the permissive terrains. One of the chief benefits of the 'mineral deposit models' approach is reproducibility; the chances should be high that two geologists assessing the same area and using the same models would arrive at nearly the same conclusions.

The assessment of base- and precious-metals potential conducted for the Special Nevada Report used data from a study of the entire state of Nevada currently being conducted by the U.S. Geological Survey (USGS) and the Nevada Bureau of Mines and Geology (NBMG) (Source: Cox and others, 1989). For that study, regional geological, geophysical, geochemical, and mineral-occurrence data are being compiled, bedrock geology is being estimated in areas of shallow alluvial cover, and the geologic units present are being grouped into geologic terrains that are permissive or favorable for various types of mineral deposits (see preceding discussion of 'mineral deposit models'). Unfortunately the USGS/NBMG study has not progressed to the point where direct data can be used for the assessment of all military lands in Nevada. Enough data and interpretations have been compiled, however, for use in the Special Nevada Report for parts of the Nellis Ranges, the Nevada Test Site, Fallon NAS and Ranges, and the Hawthorne AAP.

Most defense-related land withdrawals are closed to mining and mineral leasing. However, geothermal leasing can occur on parts of NAS Fallon and HWAAP. Oil and gas leasing can occur on HWAAP. None has occurred to date. NAS Fallon is actively considering geothermal leasing for parts of the Station. Portions of the proposed and envisioned land withdrawals for NAS Fallon are expected to be managed for commercial mining. Nevertheless, because most of the lands withdrawn for defense-related purposes are closed to commercial mining activities, the evaluation was based on the assumption that all defense-related lands in Nevada are closed to commercial mining. The mineral and energy resource potential of public lands lying beneath SUA and other airspace areas which are open to mining and mineral leasing were not considered to be affected by defense-related uses of the airspace.

1.4.9 EFFECTS ON WATER RESOURCES

The evaluation of the effects of defense-related activities on water resources in Nevada focused primarily on the land withdrawals because any potential additional water resources on those lands is currently undevelopable and because activities on those lands may consume water and may have the potential to contaminate water resources. The status of water rights for various uses was examined for each withdrawal. In addition to the land withdrawals, the water rights associated with acquired lands on NAS Fallon and in Dixie Valley were examined.

Evaluation of effects on water resources was based on hydrographic basins as defined by the Office of the Nevada State Engineer. The hydrographic basins that are wholly or partly included within each withdrawal were identified. For each of the identified basins, information was compiled on the following: 1) the available water resources, 2) current status of water rights, 3) current and future defense-related water use, 4) ground water contamination, and 5) effects of water development. The basic approach to evaluating effects was based on development of hydrologic budgets for each of the areas considered.

The information and data for the analysis were derived from several sources. First, DOD and DOE documents were examined for information and data regarding water consumption, water contamination, water rights, and potential new sources of water associated with the withdrawals. Second, publicly available documents pertaining to water resources on the withdrawn lands were obtained from the University of Nevada System libraries and other sources. Third, additional information and data were obtained by site visits and discussions with knowledgeable individuals in county and State government. Information on water rights was compiled by SNR project personnel at the Office of the Nevada State Engineer. Those data were reduced and analyzed by project personnel using assumptions consistent with those used by the Office of the State Engineer (OSE). However, because the data were not compiled and analyzed by OSE personnel, that office does not certify the results.

Three basic assumptions were employed in the analysis of the effects on water resources. The first was that the available reconnaissance-level assessments of water resource potential of the hydrographic basins related to the land withdrawals accurately reflected the available water resources. Second, it was assumed that all State water rights applications for which permits were issued will be perfected. Third, it was assumed that if a defense-related activity had the potential to impair a water resource, it had in fact impaired that resource. Other less significant assumptions were made in analyzing the effects of specific land withdrawals. Those are identified and discussed when they occur.

A limitation to the analyses presented in Chapters 2 through 8 is the unquantified nature of water rights associated with the Doctrine of Federal Reserved Water Rights. That Doctrine has developed through a substantial body of Federal case law that defines but does not quantify a Federal right to use the amount of water necessary to accomplish the purpose for which a withdrawal or Federal reservation was made, subject to water rights that existed at the time of withdrawal (Source: Bird and Cochran, 1979). Because those rights are not quantified, uncertainty exists regarding the amount of water that may be allocated and managed under the State's water law within some hydrographic basins.

1.5 ORGANIZATION OF THE SPECIAL NEVADA REPORT

This report is organized into 9 chapters. Immediately prior to Chapter 1 is a list of acronyms used in this report. Chapter 1 has been an introduction and overview of the scope and methods used to determine the effects of defense-related uses in airspace over and on withdrawn and contiguous acquired lands in Nevada on public health and safety and eight categories of resources. Chapters 2 through 7 identify the effects of defense-related uses in geographic areas of Nevada land from withdrawals or use of airspace areas and the effects potentially resulting from proposed and envisioned changes in withdrawals and airspace. Chapter 8 identifies those cumulative effects throughout the State of Nevada. Chapter 9 presents a summary of the effects identified in this report and the evaluated possible mitigation measures that could minimize those effects throughout the State. Chapter 9 is followed by a glossary of terms used in this report and by a list of the references cited in this report.

CHAPTER 2

NELLIS AIR FORCE BASE, NELLIS AIR FORCE RANGE, AND ASSOCIATED USE OF AIRSPACE

2.1 EXISTING, PROPOSED, AND ENVISIONED ACTIVITIES

2.1.1 OVERVIEW OF EXISTING ACTIVITIES

Nellis Air Force Base (AFB) has been used for flight operations since 1929. Until 1940 the field consisted of dirt runways, a few buildings, and related utilities. In 1941, the City of Las Vegas purchased and improved the field for use in training civilian pilots. Later that year, the field was offered to the Army Air Corps for use as a gunnery school. Air-to-air gunnery training was started in 1942 and concentrated on training B-17 gunners. Early in 1945, B-29 gunnery and B-24 copilot training replaced the B-17 program. Later that year, the base was deactivated. It was reactivated in 1949 as the host of the Air Training Command's 3595th Pilot Training Wing for advanced single-engine training. A U.S. Air Force Aircraft Flexible Gunnery School was also established at the base in 1949. Its mission was to train instructors in all phases of fighter gunnery, rocketry, and dive bombing. Eventually, this effort became the core of the Nellis AFB program (Source: U.S. Air Force, TFWC, 1988b).

On October 29, 1940, President Roosevelt established the Las Vegas Bombing and Gunnery Range, now called Nellis Air Force Range (NAFR). From 1940 until 1959, co-use of portions of the NAFR was granted to cattlemen and miners.

A training camp was established in 1942 at Indian Springs, Nevada, to facilitate air-to-air gunnery training for aircrews. The camp was redesignated as Indian Springs Auxiliary Air Field on April 1, 1964. This airfield is now designated Indian Springs Air Force Auxiliary Field (AFAF), and provides support and maintenance for the NAFR Complex (Source: DOI/BLM, 1981).

Nellis AFB was transferred from Air Training Command to Tactical Air Command (TAC) in 1956. TAC reorganized the base in 1966 and established the Tactical Fighter Weapons Center (TFWC). At the same time, the Fighter Weapons School (FWS) was transformed into the 4525th Fighter Weapons Wing (FWW), later changed to the 57th FWW (Source: U.S. Air Force, TFWC, 1988b).

A portion of the Desert National Wildlife Range (DNWR), which was established in 1936 for the protection and preservation of desert bighorn sheep, is within the NAFR. In order to provide for the protection of bighorn sheep and wild horses, the Air Force, U.S. Fish and Wildlife Service (USFWS), and U.S. Bureau of Land Management (BLM) entered into Memoranda of Understanding (MOUs) in 1951 and 1962. The MOUs have been updated and amended, as necessary, to ensure proper management by the respective agencies.

Public Land Orders transferred portions of the NAFR to the Atomic Energy Commission (AEC), which later became the U.S. Department of Energy (DOE), for the development of the Nevada Test Site (NTS). Pahute Mesa was delegated to DOE through a Memorandum of Understanding (MOU) with the Air Force for the testing of nuclear weapons. In addition, the Air Force permitted 336,665 acres in November 1956 to the Albuquerque Operations Office of the DOE, for use as a fully-instrumented ballistic test range. This area is now referred to as the Tonopah Test Range (TTR) (Source: DOI/BLM, Final EIS, 1981). Activities on the TTR that are related to the mission of Nellis AFB are discussed in this chapter; activities on the TTR that are related to the mission of the DOE are discussed in Chapter 5.

There are several airspace areas overlying or adjacent to the NAFR that are identified for defense-related use. These areas support diversified aircrew training and weapons testing missions. This airspace consists of four Restricted Areas, the Desert Military Operations Area (MOA), with overlying Air Traffic Controlled Assigned Airspace (ATCAA), two Low Altitude Tactical Navigation (LATN) areas, and three Aerial Refueling Routes (ARs). There are also 29 individually designated Military Training Routes (MTRs) that either transit or provide low-level entry to or exit from the NAFR Complex.

2.1.2 LOCATION OF EXISTING ACTIVITIES

2.1.2.1 Land Withdrawals

The locations of Nellis AFB, the Small Arms Range, Indian Springs AFAF, and the NAFR (including the TTR) are shown on Figure 2.1. The total land area occupied by Nellis AFB and its training range complex is more than 3 million acres (Source: U.S. Air Force, TFWC, 1988e).

Nellis AFB is located approximately 8 miles northeast of the City of Las Vegas, in Clark County, and consists of three areas encompassing about 11,200 acres. The main base (Area I) is located east of U.S. Highway 93. Area II, which was formerly known as Lake Mead Base, is located northeast of the main base. Area III is located to the west of U.S. Highway 93.

The Small Arms Range is located approximately 3 miles north of the base and encompasses 10,760 acres.

Indian Springs AFAF is located approximately 45 miles northwest of Las Vegas and encompasses approximately 2,300 acres. This airfield was originally used in 1942 in conjunction with air-to-air combat training by the Army. It became a part of TAC in 1961 and has evolved as an operational and maintenance support airfield for the NAFR.

The NAFR occupies 3,035,326 acres of land between Tonopah and Las Vegas, Nevada, and is divided into the North and South ranges. The North Range includes the TTR (approximately 336,665 acres) and the Tonopah Electronic Combat Range (TECR), which are used jointly by the 37th Tactical Fighter Wing (TFW) and the DOE. DOE-

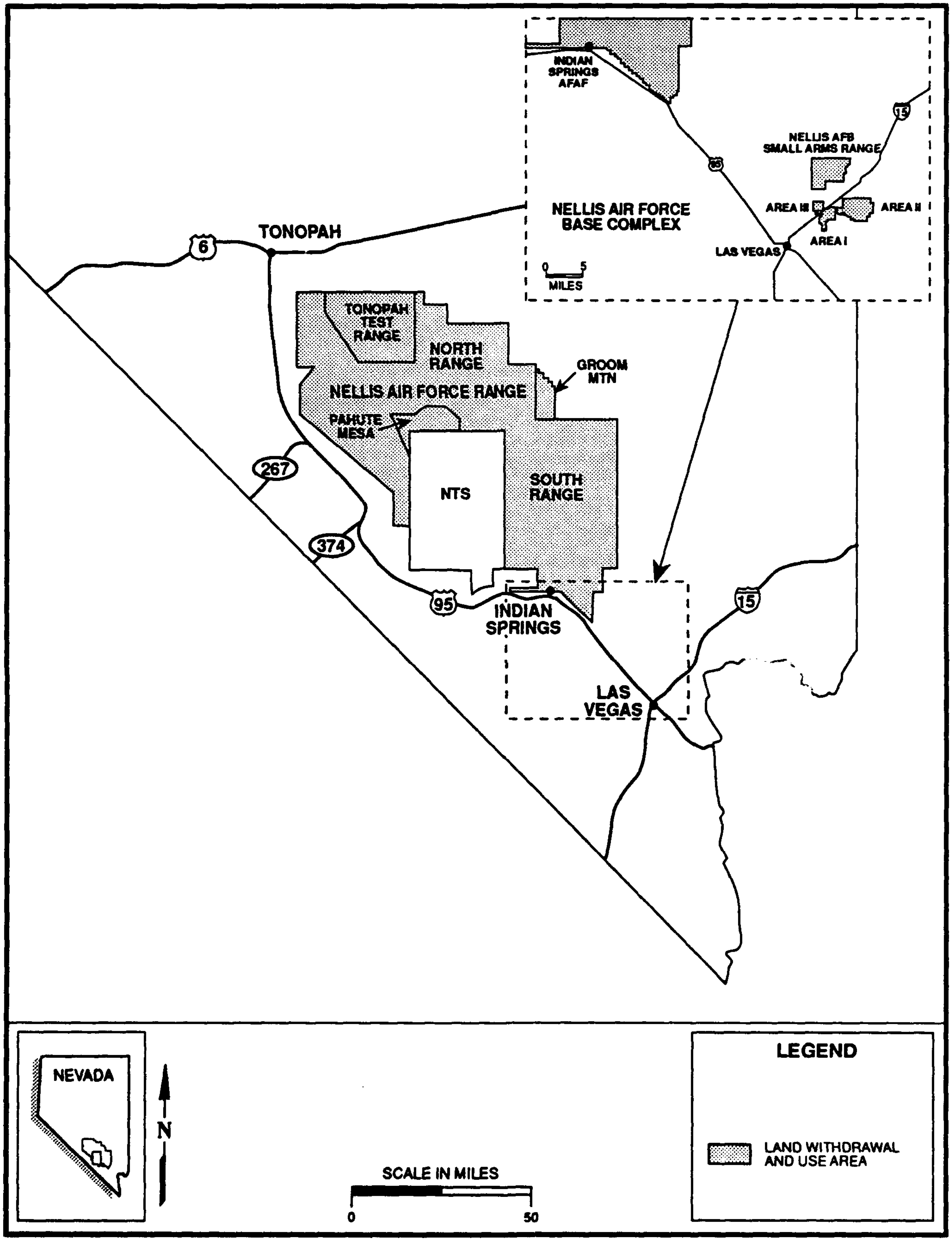


FIGURE 2.1 LAND WITHDRAWALS AND USE AREAS ASSOCIATED WITH THE NELLIS AFB MISSION

related activities and employment in support of the 37th TFW are discussed in Chapter 5. Pahute Mesa is discussed in Chapter 5. The South Range encompasses 826,000 acres of the Desert National Wildlife Range area of 1.5 million acres.

2.1.2.2 Airspace

Airspace associated with the NAFR is shown on Figure 2.2; greater detail of the airspace configuration is shown on Figure 2.3. Airspace control over portions of the Restricted Areas and all of the Desert MOA has been delegated to the Nellis Air Traffic Control Facility (NATCF) by the Federal Aviation Administration (FAA) Air Route Traffic Control Centers serving the surrounding airspace. The NATCF controls the entry and exit of military aircraft in this airspace while the Range Control Center monitors mission activities within this airspace. Because activities in Restricted Areas can be hazardous, non-participating aircraft are restricted from this airspace except when released by the controlling agency for joint use. The NATCF may release and authorize use of R-4806, R-4806E, and R-4807 for non-participating aircraft when not required for defense-related activities. R-4808 and R-4809 are managed by the DOE and are never authorized for joint use by civil aircraft.

The Desert MOA comprises the eastern half and northern portion of the airspace associated with the NAFR. The training conducted within the Desert MOA consists of high speed operations, including abrupt aircraft maneuvers and supersonic flight at or above 5,000 feet above ground level (AGL). An Air Combat Maneuvering Instrumentation (ACMI) area is located in the southern portion of the Desert MOA and provides a real-time monitoring of combat training activities. The MOA designates an area where military aircraft are exempted from the provisions of Federal Aviation Regulation 91.71, which normally restricts abrupt aircraft maneuvers or acrobatics within Federal airways and control zones. The FAA has granted a waiver for non-transponder operations for special designated missions in the Desert MOA. These operations are conducted under the stringent requirements that such aircraft are closely monitored by air traffic control through use of computer generated targets, traffic advisories are provided to all participating and non-participating aircraft, and an increased buffer is maintained within the boundaries of the MOA. The Desert MOA is active during daylight hours Monday through Saturday and at other times by Notice to Airmen (NOTAM).

Even though military aircraft are scheduled for flight activity within the MOA, civil aircraft flying under Visual Flight Rules (VFR) can fly through the area. In addition, both military and civil aircraft under Instrument Flight Rules (IFR) may be cleared through the MOA by NATCF, if separation can be provided. All scheduled military aircraft operate under "Military Assumes Responsibility for Separation of Aircraft" (MARSA) conditions wherein the military is responsible for separation between military aircraft in the Air Traffic Control System.

The LATN areas are unrestricted airspace used intermittently by the military. These areas allow A-10 aircraft to practice random tactical navigation and formations between 100

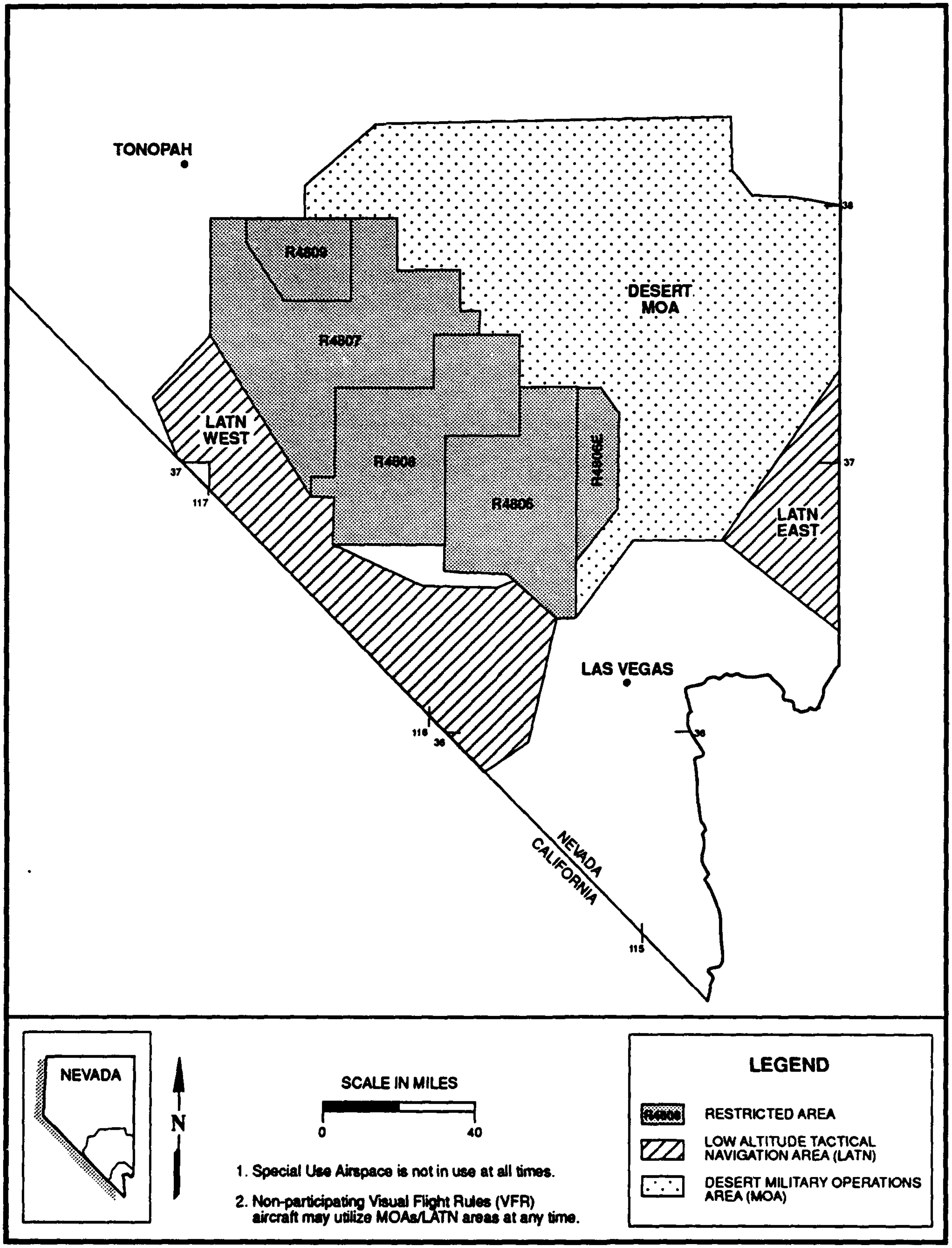


FIGURE 2.2 AIRSPACE ASSOCIATED WITH NELLIS AFB MISSION

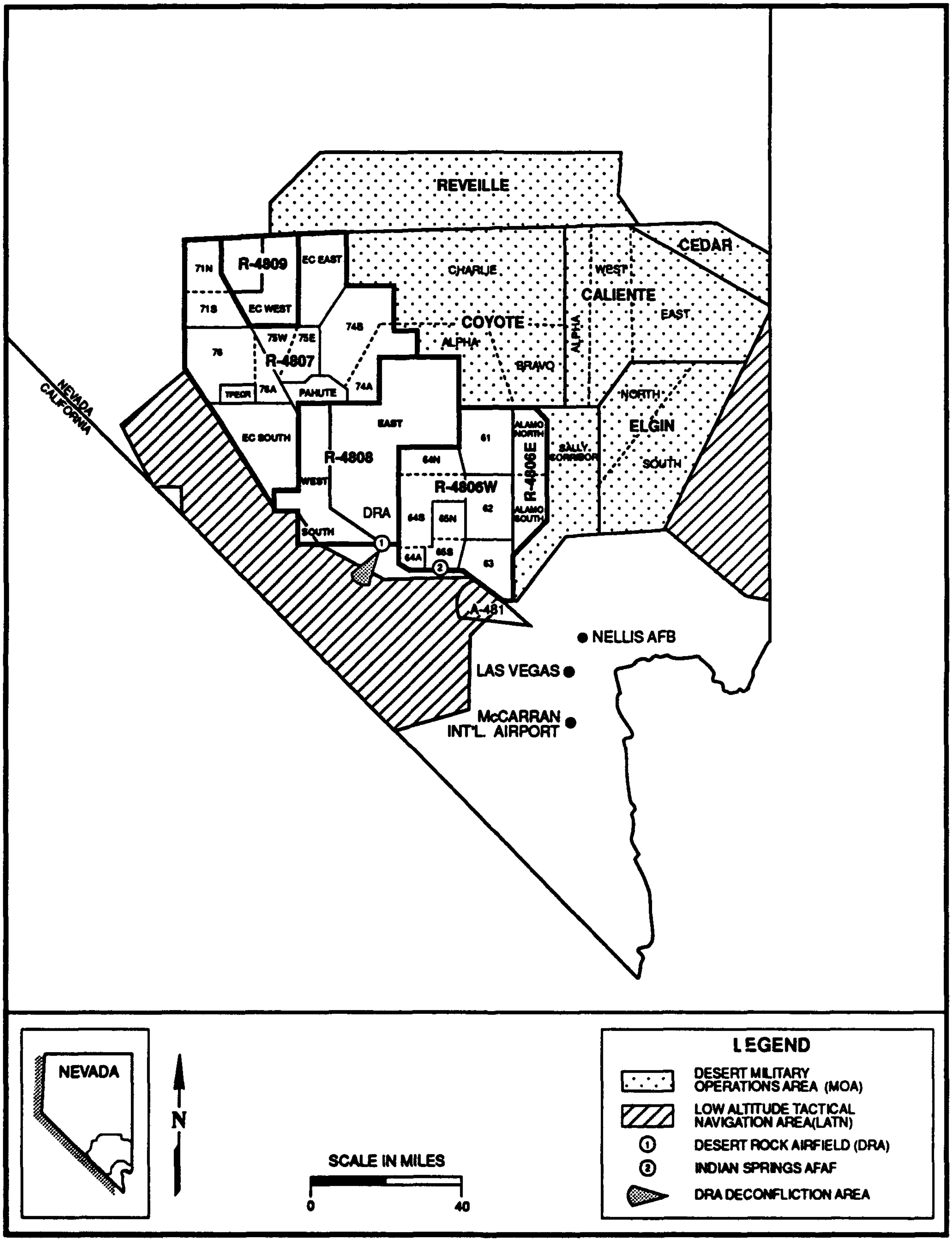


FIGURE 2.3 NELLIS AIR FORCE RANGE COMPLEX

and 1,500 feet AGL, at airspeeds at or below 250 knots. These areas are normally used when no airspace is available for this type of training within the NAFR Complex (Source: U.S. Air Force, TFWC, 1988d).

There are 29 MTRs and 3 ARs located within or at the boundaries of airspace associated with the NAFR. Several of these MTRs overlap or are reversals of each other. Generally, MTRs are established below 10,000 feet mean sea level (MSL) for operations at speeds in excess of 250 knots. However, some MTR segments may be at higher altitudes due to terrain, or climb and descent requirements. There are IFR military training routes (IRs) and VFR military training routes (VRs). The normal width of an IR from the centerline is 5 miles and 5 to 10 miles for VRs, although some segments of these routes may be as narrow as 2 miles and as wide as 20 miles. MTRs and ARs are discussed in Chapter 7.

There are several other types of designated airspace around the Nellis AFB/Las Vegas area. The following are brief descriptions of these types.

Alert Area 481 (A-481) extends from Nellis AFB westward to advise civil aviation of high-density military operations transiting between the base and the NAFR. The Alert Area begins at 7,000 feet MSL and extends to a ceiling of 19,000 feet MSL.

Indian Springs Airport Traffic Area encompasses a five statute mile radius of the airfield from the surface to 3,000 feet AGL within which aircraft are provided air traffic control services by the Indian Springs tower. The tower can advise civil aircraft of military aircraft operations occurring at Indian Springs.

Desert Rock Airfield is an uncontrolled airfield operated by the DOE, located approximately 65 miles northwest of Las Vegas along U.S. Highway 95. Traffic is normally light. Periodic flights are conducted using aircraft that vary from a general aviation single-engine aircraft to multi-engine jet aircraft. A fan shaped deconfliction area extends southwesterly for 10 nautical miles (NM) from the Desert Rock airfield. This area extends from the surface to 7,500 feet MSL within 3.75 NM of the airport and 4,000 to 7,500 feet MSL between 3.75 and 10 NM. The purpose of the area is to separate DOE airport operations from Nellis flights.

Las Vegas Terminal Control Area (TCA) encompasses Nellis AFB and McCarran International Airport. All aircraft operating within the TCA must be in contact with an air traffic control facility. In the northern portion of the TCA, air traffic control services are provided by Nellis Approach Control. The southern portion is controlled by Las Vegas Approach Control (Source: U.S. Air Force, TFWC, 1988d).

2.1.3 MISSION AND FACILITY DESCRIPTIONS

2.1.3.1 Mission

The TFWC at Nellis AFB conducts a multitude of activities to ensure Tactical Air Forces worldwide maintain skilled instructors, knowledge of the enemy, technical expertise, effective equipment, and sound tactics. The TFWC also provides a well-instrumented range and airbase to support training and testing programs.

The Nellis AFB mission is accomplished through the use of an array of aircraft types including the A-10, F-15, and F-16. Nellis provides training for composite strike forces that include every type of combat and combat-support aircraft in the Air Force inventory, along with air and ground units of the Army, Navy, and Marines. Training is also provided for air units from the North Atlantic Treaty Organization and other U.S. allies.

Two major components comprise the TFWC: the 57th FWW and the 554th Operations Support Wing (OSW). A third organization assigned to Nellis AFB is the 37th TFW, which operates F-117A and AT-38A aircraft from the TTR airfield. The 37th TFW reports to Headquarters, 12th Air Force at Bergstrom AFB, Austin, Texas. A fourth unit assigned to Nellis AFB is the Air Warrior mission, which was relocated from George AFB (California) in January 1990. The Air Warrior unit operates in California airspace in support of the Army National Training Center at Ft. Irwin (California). As such, the unit is not considered further in this report.

The mission of the 57th FWW is to support the TFWC in serving the worldwide tactical air forces by providing advanced training in the employment of tactical fighter aircraft and weapons, conducting operational testing and tactics development, and performing aerial demonstrations. To accomplish its diverse but related missions, the 57th FWW is organized into the following seven components.

Fighter Weapons School conducts instructor courses for selected A-10, F-15, F-16, and F-111 aircrews and air weapons controllers.

Tactics and Test group performs operational testing and tactics development for fighter aircraft and weapons; and contributes to FWS tactical employment manuals and other documents pertaining to tactical fighter aircraft.

4440th Tactical Fighter Training Group provides the management and support structure for conducting realistic combat training exercises involving tactical fighter units.

Maintenance provides aircraft, weapons, and equipment to support the flying activities of the TFWC.

4513th Adversary Threat Training Group provides host base intelligence support, operates a hands-on training facility with Soviet-built equipment, and conducts tactical intelligence courses.

USAF Air Demonstration Squadron (Thunderbirds) performs precision aerial demonstrations throughout the world.

The mission of the 554th OSW is to provide major base logistics and support functions for Nellis AFB and Indian Springs AFAF. These functions include:

- supply	- morale, welfare, and recreation
- transportation	- resource plans
- real estate	- environmental and contract planning
- base security	- industrial engineering
- personnel	- civil engineering
- food service	- disaster preparedness
- billeting	- family housing
- judge advocate	- fire protection
- medical	- social actions

The OSW, through the 554th Range Group, develops, operates, and maintains all range facilities and threat simulators to satisfy Department of Defense (DOD) and TAC requirements for a combat-like operational environment.

The 37th TFW has operated from the TTR since 1979 employing its air-to-ground mission. The 37th TFW is composed of two combat-coded squadrons, the 415th and the 416th Tactical Fighter Squadrons (TFS), and one training-coded squadron, the 417th Tactical Fighter Training Squadron (TFTS). The 37th TFW uses F-117A aircraft and in the near future will have 56 aircraft assigned. There are also 9 AT-38 aircraft assigned to the 37th TFW.

In fiscal year (FY) 87, which runs from October 1 to September 30, approximately 60,000 sorties were flown in the NAFR complex. A sortie consists of one aircraft mission from takeoff to landing. In FY 88, that number decreased to about 50,000 sorties. The total number of operations (landings, takeoffs, and practice approaches) for FY 88 at Nellis AFB was 170,000 (Source: U.S. Air Force, HQ TAC, 1988b).

The mission of Indian Springs AFAF is to recover aircraft with emergencies or hung ordnance, and to support maintenance and operations on the NAFR. The airfield can accommodate up to 24 deployed aircraft. The Thunderbirds use airspace around Indian Springs AFAF to practice and perfect aerial maneuvers. The average number of daily operations was approximately 270 departures and arrivals during the period January through March 1986. Of these operations, 61 percent were F-16 aircraft (41 percent by Thunderbirds, 20 percent by other F-16 activity); 26 percent were UH-1 helicopter activity; approximately 10 percent were A-10 and A-7 aircraft; and various other operations comprised approximately 3 percent.

2.1.3.2 Facilities

There are more than 1,777 buildings at Nellis AFB. Facilities include numerous aircraft hangars, maintenance, operational, training and storage facilities; 1,471 military family housing units, 2,911 enlisted dormitory spaces, and about 156 bachelor officers' quarters; commissary, base exchange, and 45 recreational facilities; a 35-bed hospital; 3

dining halls, and over 22 other personnel support facilities (Source: U.S. Air Force, TFWC, 1987).

The primary pavement facilities at Nellis AFB consist of two parallel NE-SW runways, a large aircraft parking apron with taxiways extending the length of the runways, three warm-up pads and connecting taxiways. The westernmost runway (Runway 03L/21R) is 10,119 feet long and 200 feet wide. The easternmost primary instrument runway (Runway 03R/21L) is 10,051 feet long and 150 feet wide. Both runways have 1,000 feet overruns at each end with arresting barriers. The NATCF uses seven FAA radars and two Air Force radar sites to control the airspace associated with the NAFR (Source: U.S. Air Force, 1985).

Area II has a weapons storage area, a small cantonment area, and a Professional Military Education facility. It also has some industrial activities, to include the 820th Civil Engineering Squadron (Red Horse), and a recently added Federal Prison Camp. The Prison makes use of existing facilities and will accommodate up to 300 inmates with a staff of approximately 75 security personnel. Nellis AFB Area III has additional housing, recreational areas, and industrial activities (Source: U.S. Air Force, 1985).

Facilities at Indian Springs AFAF include 145,296 square feet of administrative and industrial space, 79 family housing units, 28 mobile home spaces, permanent quarters for 90 single airmen, and ancillary facilities. There are three runways at Indian Springs AFAF, two of which are inactive (Source: DOI/BLM, 1981).

A mission realignment, beginning in 1985, began to transfer the military personnel from Indian Springs AFAF, deactivate the 4460th Helicopter Squadron, and prepare for large-scale deployment operations. During FY 86 and FY 87, more than $3 million was spent at Indian Springs AFAF to ready the base for limited deployments. In FY 88, the main runway was resurfaced and extended to 9,000 feet, the existing control tower was replaced with a new 7-story structure, and storage capacity for petroleum, oil, and lubricants was increased to 150,000 gallons. In the FY 89-91 period, additional billeting and hangar space is planned, as well as the construction of a permanent munitions storage area. The goal of these activities is for Indian Springs AFAF to support a squadron-sized deployment (Source: U.S. Air Force, TFWC, 1988e).

Operating as part of the North Range of the NAFR, three Electronic Combat (EC) ranges provide a user selectable, low-to-high electronic threat environment. These EC ranges are:

> Tonopah Electronic Combat Range (TECR). The TECR is the main, manned threat simulator range and has simulated electronic threats that include surface-to-air missile (SAM) sites with numerous anti-aircraft artillery (AAA) fire control radars to simulate a realistic array of signals. The threats are located in as realistic a configuration as possible (given the proximity to live bombing ranges) to simulate enemy air defense arrays. The presence of acquisition radars adds to the realism of the environment and provides data for command and control of the integrated air defense system.

Tolicha Peak Electronic Combat Range (TPECR). The TPECR contains long- and short-range strategic threat systems and associated point defense systems, along with appropriate acquisition and ground-controlled intercept radars. The TPECR simulates the defense of the deep interdiction and offensive counter air targets. The TPECR is a smaller range than the TECR and has less capability, but it plays an important role in all the major exercises conducted on the North Ranges.

EC South. This range contains a limited number of electronic threat simulators representing both missiles and AAA, and provides a separate area for tactics development and training in the use of anti-radiation missiles against electronic threats. The EC South Range is not tied into the integrated air defense system of the TECR and TPECR and, therefore, does not provide as realistic a simulation of the enemy air defense system. However, using EC South is much simpler and does not require elaborate planning.

The North Range contains four unmanned weapons delivery areas in addition to the TECR, the TPECR, and EC South. All four subranges consist mainly of tactical-type targets representing airfields, SAM sites, truck convoys, missile storage sites, artillery companies, and other targets. The type of weapons authorized for delivery depends upon the target selected.

The TTR, located on the North Range of the NAFR, is operated for the DOE by Sandia National Laboratories. DOE activities on the TTR are discussed in Chapter 5. Facilities of the 37th TFW are located primarily on two parcels of land of approximately 1,530 total acres. Support activities are provided by two DOE contractors. These activities support operations of a single runway airfield, associated facilities, and a personnel housing area. The housing complex consists of dormitories, a cafeteria, recreational facilities, a fire station, and administrative offices. The major construction at the TTR for the 37th TFW began in 1979 and continued into early 1990. During this period, runway extensions, aprons and taxiways, hangars, support facilities, and dormitories were constructed at a cost of slightly over $100 million. There are now 176 permanent operational buildings, 69 permanent dormitories, and 36 temporary dormitories at the TTR. The dormitories contain more than 500 rooms. Including the Chevron dormitories, there are 4,075 available bedspaces.

The South Range consists of five weapons delivery areas. These areas include two manned subranges and three unmanned subranges. There are also three air-to-air Dart subranges.

2.1.4 INFRASTRUCTURE

The main fire station at Nellis AFB is located near the aircraft parking apron. Another station is located in Area II of the base (Source: U.S. Air Force, TFWC, 1988b). There are long-standing community support agreements with the cities of Las Vegas, North Las Vegas, Henderson, Boulder City, Clark County, and the BLM for additional fire suppression capabilities. A new agreement is being negotiated with the Nevada Division of Forestry (Source: U.S. Air Force, 1985).

Fire protection on the NAFR is the responsibility of the BLM. In the event of a range fire, personnel and equipment are provided by several agencies including Sandia National Laboratories, BLM, the range civilian operations and maintenance contractor, and the Indian Springs AFAF Fire Department.

Electrical power for Nellis AFB is provided by the Nevada Power Company (Source: U.S. Air Force, 1985). Electric power for the NAFR is supplied by the Nevada Power Company, Valley Electric Association, Sierra Pacific Power Company, and Lincoln County Power District No. 1. There are four utility systems on the TTR, and Valley Electric Association provides power in the southwest portion of the North Range. Some public utilities are routed along the southwest border of the South Range and provide service to Indian Springs AFAF and the South Range area (Source: DOI/BLM, Final EIS, 1981). Electric power on the NAFR is supplemented by locally generated (diesel generators) power throughout the complex.

Four large above-ground JP-4 tanks with capacities ranging from 420,000 to 840,000 gallons comprise the main fuel storage area at Nellis AFB. These tanks are located in Area III, and are supplied by a direct pipeline from the CAL-NEV (contractor for supplying JP-4 fuel) tank farm. There are 16 other above-ground tanks (capacities less than 660 gallons) and 108 underground tanks containing JP-4, diesel fuel, fuel oil, etc., throughout the base (Source: U.S. Air Force, 1989a).

The inventory of fuel storage tanks at Indian Springs AFAF includes five above-ground JP-4 tanks (all less than 1,000 gallon capacity), one 200,000 gallon above-ground JP-4 storage tank, and 27 heating oil tanks with capacities from 500 to 4,000 gallons. Four of the heating oil tanks are below ground. Additionally, there is one 20,000 gallon storage tank for gasoline and one 20,000 gallon tank for diesel fuel (Source: Col R. Johnson, Chief of Supply, Nellis AFB, personal communication, 1990).

Fuel storage at the TPECR consists of one 10,000 gallon tank for gasoline and two 15,000 gallon tanks for diesel fuel.

Bulk fuel storage at the TTR occurs in a fully diked tank farm of six tanks. Total fuel storage is approximately 264,300 gallons of DF-1 diesel fuel and 1,200,000 gallons of JP-4 jet fuel. DF-1 fuel is transported by truck to 74 underground storage tanks for heating fuel purposes, and is also delivered to 2 service stations (one 10,000-gallon tank and two 10,000-gallon tanks). Unleaded motor gas is contained in five 10,000-gallon tanks. A range-compound area on the TTR has one 15,000 gallon tank for gasoline, two 10,000 gallon tanks for diesel fuel, and one 10,000 gallon tank for JP-4. Most DF-1 tanks are of fiberglass construction. JP-4 fuel is transferred from the bulk storage area to the runway vicinity via an underground pipeline that has an impressed current cathodic protection system. All JP-4 and DF-1 fuels are trucked onto the TTR. JP-4 is trucked from Nellis AFB and DF-1 is obtained from suppliers in Las Vegas.

There are numerous 100 and 500 gallon tanks at Nellis AFB, Indian Springs AFAF, and on the NAFR for auxiliary power generators.

2.1.5 PROPOSED AND ENVISIONED CHANGES

2.1.5.1 Land Withdrawals

There is no anticipated change in ownership, control, or boundaries of Areas I, II, and III of Nellis AFB. There is an ongoing effort to reduce the Small Arms Range from the existing 10,760 acres to approximately 4,800 acres, returning the remainder to the BLM. The range would still be used as a pistol range with a "black-powder" club target area.

Indian Springs AFAF will continue to serve as an emergency aircraft recovery base for aircraft using the NAFR; to provide a primary weather divert base for Nellis AFB; and to provide support to DOE operations. Additionally, TAC Headquarters proposes to conduct deployments of up to 24 aircraft during Red Flag/Green Flag exercises and do approximately six "quick turns" (integrated combat turns) per exercise day at Indian Springs AFAF. A boundary change may occur to a small portion of Indian Springs AFAF. Action is underway to eliminate the buildings in the 92.59-acre family housing area. Ownership of the land could depend on who obtains the buildings. One option is to remove the buildings, restore the land, and return it to the BLM.

There are no anticipated changes to the existing boundaries or use of the NAFR. As national defense requirements change, however, programs may be modified or deleted, or new programs may be developed.

It has been proposed to move the 37th TFW and Detachment 1 of the 57th FWW and their aircraft from the TTR to Holloman AFB, New Mexico in the spring of 1992. This proposed change would result in the elimination of F-117A flight operations currently conducted out of the TTR. There are no plans for changes in land ownership or associated airspace at the TTR or the NAFR as a result of the relocation of the 37th TFW.

The 66th Air Rescue Squadron will be assigned to Nellis in early 1991. This unit will consist of 4 MH-6OG helicopters and 118 personnel to support the Air Force search and rescue mission.

2.1.5.2 Airspace

There were approximately 60,000 sorties (one aircraft mission from takeoff to landing) flown on the NAFR complex in FY 89. In the year 2000, this number is projected to increase approximately 20 percent, to more than 72,000 sorties (Source: U.S. Air Force, TFWC, 1989). Total operations (takeoffs, landings, practice approaches) at Nellis AFB are projected to be more than 200,000 in the year 2000.

VR-1225 is proposed to be altered and two new exit points added (Figure 2.4). The proposed changes are required for F-15 and F-16 aircraft to enter the NAFR Restricted Areas when using Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) equipment. Relocation of the VR is designed to route air traffic away from people living in the Pahrump Valley. Extending the time of use to 24 hours provides the capability to test

Southwest Gas Corporation supplies natural gas to Nellis AFB.

Sewage from Area I of Nellis AFB is discharged into the Clark County Sanitation District system. Area II is serviced by an Imhoff tank treatment system with outfall into two sewage lagoons. A portion of Area II waste water is serviced by septic tanks. A base sanitary landfill is located on a 20-acre site in the southeastern area of the main base, just south of the golf course. The estimated remaining capacity of this landfill is approximately three years. An adjacent 9-acre site will provide an additional nine years of sanitary landfill operations (Source: U.S. Air Force, 1985).

The lagoon treatment system supporting the activities of the 37th TFW at the TTR consists of a 12.8 acre stabilization lined pond followed by two 1.9 acre evaporation percolation basins. The system is designed for an average 30-day flow of 0.269 mgd, adequate to serve a full time equivalent population of 2,500.

Solid waste removal from Nellis AFB and Indian Springs AFAF is provided by Silver State Disposal Company. Solid waste from the NAFR is disposed in the Beatty landfill for TPECR, and the TTR sanitary landfill for TECR. The 150-acre landfill site at Indian Springs AFAF is used for disposal of construction and target residue (Source: DOI/BLM, 1981).

A large inventory of military ordnance is maintained at Nellis AFB and large quantities of explosive and inert/training munitions are expended on the NAFR annually. This material is subject to deterioration and obsolescence, and constitutes an additional hazardous material source.

Water wells at Nellis AFB tap valley-fill aquifers. The static water level ranges from 69 feet to 121 feet below the surface. Well yields average 412 gallons per minute (gpm) and range from 250 gpm to 970 gpm. Nellis AFB also receives Colorado River water through the Southern Nevada Water System. The Nellis AFB annual allocation from this system is 4,000 acre-feet.

Nellis AFB currently has a 4-million gallon above-ground water storage capacity distributed among several tanks and linked to well pumps via pipelines. There is one 3-million gallon tank in Area III.

Potable water for support of the 37th TFW at TTR comes primarily from four wells drawing from water levels 100 feet to 400 feet below the surface. Use of this water does not exceed 380 acre-feet per year. The airfield support activities at the TTR include a 110,000-gallon water storage tank to serve the housing complex and two 250,000-gallon storage tanks serving the operations and maintenance areas.

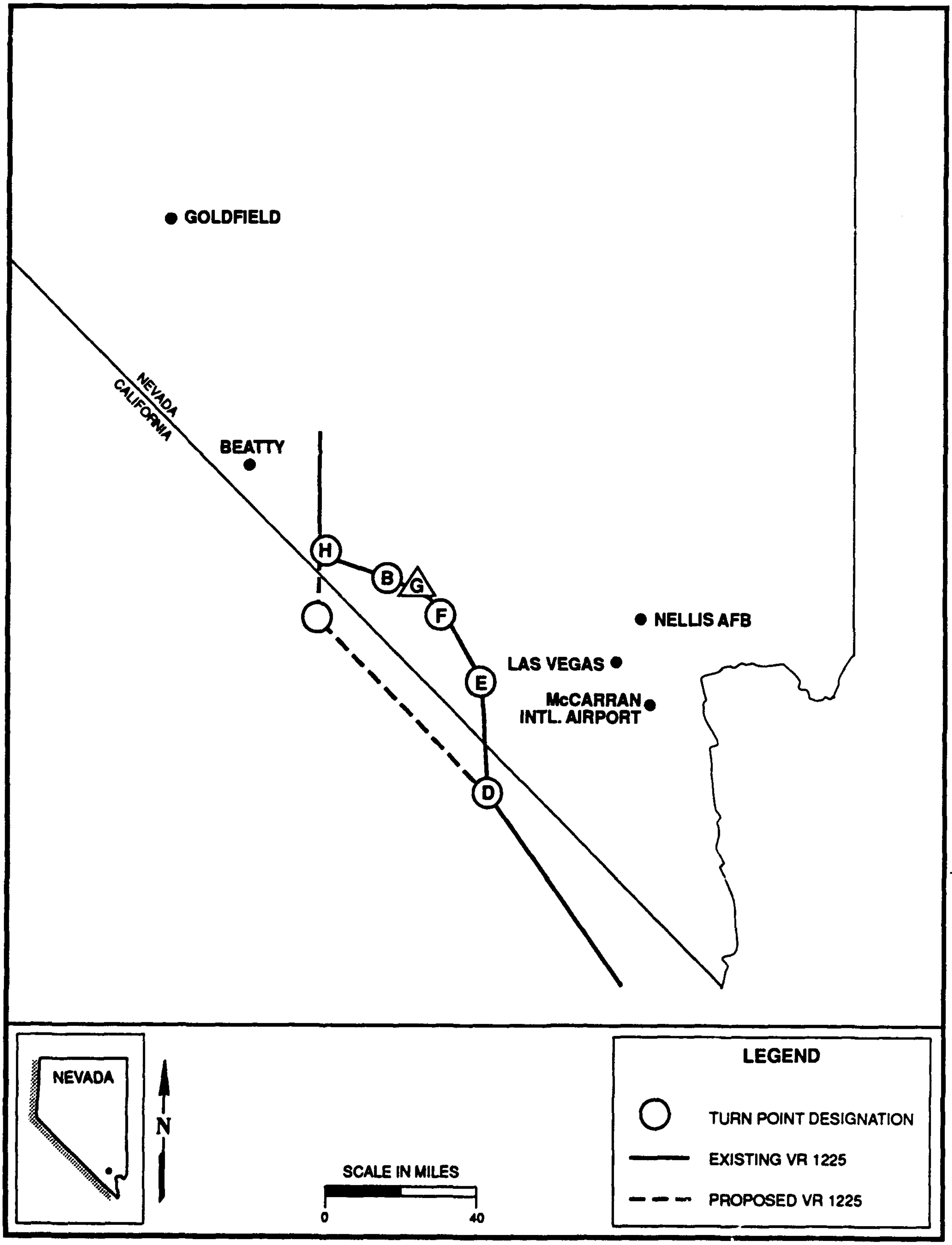


FIGURE 2.4 PROPOSED CHANGES IN AIRSPACE ASSOCIATED WITH THE NELLIS AFB MISSION

and evaluate new weapons systems and provide night aircrew training under simulated combat conditions (Source: U.S. Air Force, 1989f).

Other proposed changes in airspace include the following. The floor of IR-286 is proposed to be lowered from 500 feet AGL to 100 feet AGL between points D and F, and alternate exit G is proposed to be extended six miles. The airspace boundary between Restricted Areas R-4808 and R-4807 is proposed to be moved approximately 8 miles east in order to provide participating military aircraft increased accessibility to EW ranges within R-4807. Pahute Mesa is proposed to be redesignated R-4807B to enable separate airspace scheduling for the Pahute Mesa area and to facilitate joint use by civil aircraft of most of R-4807 when not in use by the military.

2.1.5.3 Facilities

Construction related to Nellis AFB and the NAFR is ongoing. The Military Construction Program (MCP) is a multi-year program that tracks major construction and property improvements in the current year and the following five years. An example of a multi-phased MCP is the Nellis AFB Eastside Development, which included property acquisition, a multi-phase, multi-year construction program of facilities on both existing Nellis AFB property and on newly purchased property, and construction of the Aerial Measurements Operation facility (to be operated by DOE). The Nellis AFB Eastside Development Project also includes a parallel taxiway, 22 revetments, a parking apron, arm/de-arm pads, and other support facilities. Procurement of properties and construction began in FY 87 and could continue through FY 93 (Sources: DRI, 1985a; U.S. Air Force, TFWC, 1990).

Proposed or envisioned facilities include the following. Construction of the LANTIRN Support Facility will provide a 1,400 square-foot building to maintain and store LANTIRN equipment (Source: U.S. Air Force, HQ TAC/URS Consultants, 1988b). LANTIRN is a radar system that enables aircrews to perform at night using the same flying techniques and tactics currently used in daylight operations, even under adverse weather conditions. Construction of a civil engineering complex is underway and a supply complex is anticipated in the early 1990's. A 350 to 500 room Red Flag visitor quarters, scheduled for construction sometime between FY 90/91 depending on private-sector funding or MCP funding (Source: URS Corporation, 1987), would be used to house visitors during Red Flag exercises. Phase II construction of the Base Civil Engineering (BCE) complex is scheduled for FY 92. A joint Air Force and Veterans Administration hospital is also planned for Nellis AFB.

2.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from land withdrawals and airspace associated with the missions or activities of Nellis AFB and the NAFR. Sources of potential effects and analysis of effects on public health and safety are identified.

2.2.1 GROUND MOTION

Activities related to Nellis AFB, the NAFR, and associated airspace do not result in significant ground motion.

2.2.2 AIR QUALITY

Construction and operation of facilities at the Nellis AFB and on the NAFR are conducted in compliance with the rules and regulations of the Nevada Division of Environmental Protection (NDEP) and the Clark County Health District-Air Pollution Control Division.

2.2.2.1 Sources of Potential Effects

Nellis AFB

Air emissions from the Nellis AFB complex originate from the following sources and activities: aircraft flight operations, aircraft ground maintenance operations, aerospace ground equipment operations, surface coating operations, fire training exercises, motor vehicle operations, fuel storage and refueling, and heating and power production. Table 2-1 summarizes the 1986 emission estimates for these sources (Source: U.S. Air Force, Nellis AFB, undated). There have not been any substantial changes in facility operations since this emission inventory was compiled; thus, these estimates are representative of the current emission inventory.

Air emissions from flight operations and ancillary activities were forecasted for the year 2000 and are also summarized in Table 2-1. These projections assume that air pollution sources directly associated with flight operations would increase at the same rate as the number of sorties (20 percent increase), and that other base operations that generate air emissions would increase at a rate less than the increase in sorties. These assumptions are conservative since cleaner-burning engines, improvements in emission control technology, and additional emission control requirements are likely to result in less of an emission increase than is projected for year 2000.

Nellis Air Force Range

Surface activities on the NAFR that result in the release of air pollutants include ground facilities at the Indian Springs AFAF, and various ground activity, ordnance delivery, and weapons firing on the North and South ranges, including the TTR.

Air emissions from ground facilities at Indian Springs AFAF result primarily from aircraft ground maintenance operations, motor vehicle operations, and fuel storage and refueling (Source: DRI, 1987). A specific emission inventory is not available for Indian Springs AFAF; emissions were estimated to be less than five percent of the corresponding source emissions at the Nellis AFB, on the basis of the respective sortie rates.

Table 2-1. Air Emission Estimates for the Nellis AFB Complex (tons/year) (1986 and 2000)[1].

Source	Year (P/F)[2]	CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]
Aircraft Flight Operations	P	2,274.4	627.9	345.3	21.3	66.3
	F	2,729.3	753.5	414.4	25.6	79.6
Aircraft Ground Maintenance Operations	P	74.5	23.4	53.0	1.2	6.4
	F	89.3	28.2	63.6	1.4	7.7
Aerospace Ground Equipment Operations	P	68.9	21.4	10.6	6.9	1.2
	F	82.7	25.7	12.7	8.4	1.4
Surface Coating Operations	P	0.0	97.7	0.0	0.0	0.0
	F	0.0	112.4	0.0	0.0	0.0
Fire Training Exercises	P	5.4	4.5	0.0	1.2	0.0
	F	6.0	5.0	0.0	1.3	0.0
Motor Vehicle Operations	P	668.0	101.3	119.3	26.3	18.5
	F	734.8	111.4	131.2	29.0	20.4
Fuel Storage and Refueling	P	0.0	391.4	0.0	0.0	0.0
	F	0.0	450.2	0.0	0.0	0.0
Heating and Power Production	P	4.0	0.8	16.5	0.4	0.1
	F	4.4	1.0	18.2	0.4	0.1
TOTAL	P	3,095.2	1,268.4	544.7	57.3	92.5
	F	3,646.5	1,487.4	640.1	66.1	109.2

(1) 1986 estimates assumed for present
(2) P = Present; F = Future (Year 2000)
(3) Carbon Monoxide
(4) Hydrocarbons
(5) Oxides of Nitrogen
(6) Particulate Matter
(7) Oxides of Sulfur

Source: U.S. Air Force, Nellis AFB, 1986

Air emissions from range operations result from range maintenance, ordnance drops, and weapons testing (Source: DOI/BLM, 1981). Detailed emission inventories for these activities are not available, but the magnitude of the emissions can be estimated by examining the frequency of activity. Range maintenance consists primarily of portable target placement, target maintenance, and periodic sweeps for unexploded ordnance. Vehicle travel on unpaved roads during this activity results in fugitive dust (particulate matter), estimated to be 100 tons/year (Source: DOI/BLM, 1981). Exhaust emissions from the maintenance vehicles are not quantified, but the annual emission rates are much less than the fugitive dust emission rate.

Ordnance delivery rates for NAFR are estimated to be 6,000 tons per year of inert/training ordnance, and 1,000 tons/year explosive ordnance (Source: U.S. Air Force, Nellis AFB, 1977). The air pollution effect of the inert/training ordnance is a small amount of fugitive dust generated upon impact. Explosive ordnance generates fugitive dust upon impact and detonation, and also releases gaseous emissions. The gaseous emissions are carbon monoxide and unburned hydrocarbons; the formation of nitrogen oxides is suppressed by the deficiency of oxygen in the chemical reaction. Using an emission factor from the EPA Compilation of Air Pollutant Emission Factors (Source: EPA, 1980) for trinitrotoluene (TNT), which is typically the main charge in artillery projectiles and mortar rounds, the annual explosive ordnance (1,000 tons) results in the release of 362 tons of carbon monoxide and 10 tons of hydrocarbons.

An estimated 20 percent increase in sortie activities in the year 2000 will result in a nearly equal increase of the directly-related activities such as ground operations at Indian Springs AFAF, range maintenance activities, and ordnance delivery rates. Air pollution emissions from those sources are expected to increase at the same 20 percent rate, although cleaner-burning engines and improved emission control technology may result in a lower rate of emissions increase.

Nellis Airspace

Air emissions in airspace associated with the NAFR result from aircraft activities during a variety of training exercises. These aircraft emissions are dispersed over large areas, thereby reducing the localized air quality effect. Based on the sortie rates and aircraft mix for each area (Sources: DOI/BLM, 1979; U.S. Air Force, Nellis AFB, undated; U.S. Air Force, HQ TAC, 1988b) and the engine emission profile for each aircraft type (Source: U.S. Air Force, HQ AFESC/RDVS, 1985), an emission inventory was developed for aircraft operations in NAFR-related airspace. This inventory is summarized in Table 2-2.

A growth of 20 percent in sortie activity is projected by the year 2000. The aircraft mix is expected to change slightly as a result of increased use of F-15 and F-16 aircraft. Applying these changes to the emission scenario results in the projections shown in Table 2-2 for the year 2000.

Table 2-2. Summary of Aircraft Exhaust Emissions and Estimated Ambient Air Quality Impacts (Concentrations) for Nellis AFB Operations.

Airspace	Year (P/F)[2]	Emission Rate (tons/year) CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]	Daily Concentration ($\mu g/m^3$)[1] CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]
R-4806	P	260.8	8.2	1,469.4	24.7	60.4	0.077	0.002	0.435	0.007	0.018
	F	119.2	9.8	2,302.7	32.7	81.4	0.035	0.003	0.682	0.010	0.024
R-4807/9	P	486.9	15.3	2,742.9	46.1	112.6	0.093	0.003	0.523	0.009	0.021
	F	221.8	18.3	4,285.6	60.8	151.5	0.042	0.003	0.817	0.011	0.029
Desert MOA	P	869.5	27.3	4,898.0	82.4	201.2	0.054	0.002	0.305	0.005	0.012
	F	397.2	32.8	7,675.6	108.9	271.4	0.025	0.002	0.478	0.007	0.017
E LATN	P	2.5	0.1	12.2	0.0	1.0	0.001	0.000	0.005	0.000	0.000
	F	3.0	0.2	14.6	0.1	1.2	0.001	0.000	0.006	0.000	0.000
W LATN	P	6.1	0.3	29.6	0.1	2.5	0.001	0.000	0.006	0.000	0.000
	F	7.3	0.4	35.5	0.1	2.9	0.001	0.000	0.007	0.000	0.000
Primary NAAQS ($\mu g/m^3$, from Table 1-3) presented here for comparison purposes[8]							10,000[9]	N/A[10]	100[11]	50[12]	365[12]

(1) Micrograms per cubic meter
(2) P = Present; F = Future
(3) Carbon Monoxide
(4) Hydrocarbons
(5) Oxides of Nitrogen
(6) Particulate Matter
(7) Oxides of Sulfur
(8) Estimated air quality effects (daily concentration) from Nellis AFB operations cannot be directly compared with the NAAQS because an ambient background concentration must be added to the Nellis AFB effects, and the averaging periods are not the same for all pollutants. However, the NAAQS can be used to assess the relative magnitude of air quality effects.
(9) 8-hour average.
(10) N/A = There is no NAAQS for HC.
(11) Annual average.
(12) 24-hour average.

Flight operations at Indian Springs AFAF consist primarily of emergency recovery of aircraft, practice approaches, temporary aircraft deployments, and occasional use as a weather divert base for Nellis AFB. Air emissions from these activities are included in the analysis of Nellis airspace emissions.

2.2.2.2 Analysis of Effects

The EPA has established National Ambient Air Quality Standards (NAAQS) at levels that are designed to protect public health and safety with an adequate margin of safety. The Las Vegas area does not currently meet the NAAQS for carbon monoxide (CO) and particulate matter (PM). The principal contributors to non-attainment are automobile exhaust (for CO) and land disturbance resulting in wind-blown dust (for PM). Air emissions for Nellis AFB (Table 2-1) comprise a small percentage of the Las Vegas area emission inventory (Source: URS Corporation, 1987). For example, the Nellis AFB emission rate for NO_X (544.7 tons/year) shown in Table 2-1 represents only about 4 percent of the 14,000 tons/year of NO_X emitted by all sources in the Las Vegas Valley (Source: U.S. Air Force, HQ TAC, 1988b).

The "1985 Annual Reasonable Further Progress Report for the Las Vegas Valley" concludes that, for CO, the existing strategy of control measures for automobile traffic flow, ridesharing, and tailpipe emission reductions will be sufficient to reach attainment of the NAAQS for CO in the urban area. Control of PM is being addressed through fugitive dust suppression measures on temporary parking lots, roads, and construction sites. Emissions from the Nellis AFB complex were not identified as significant impediments to attaining the NAAQS in the Las Vegas Valley. Furthermore, all Nellis AFB facilities are in compliance with their air emissions permits (Source: David Lee, Clark County Health Department, Air Pollution Control Division, personal communication, 1990).

The NAFR is located in an area of Nevada that meets the NAAQS for all pollutants. The small amount of pollutants emitted are distributed over a large area, thereby contributing to smaller concentrations. As a result, air emissions from the range operations are not adversely affecting public health and safety in the area.

A conservative approach has been used to estimate the effect of aircraft emissions on ambient air quality. All aircraft emissions within a given airspace are assumed to be contained within the lateral dimensions of the airspace and within a vertical dimension equal to the mean afternoon mixing height of approximately 8,000 feet AGL. By dividing the mass of pollutants emitted on a typical day (annual estimates presented in Table 2-2 converted to daily estimates) by the volume of the airspace, a typical daily concentration can be calculated for each pollutant. The results, also shown in Table 2-2 indicate that no pollutant contributes more than approximately 0.05 percent of the allowable concentration, indicating minimal air quality effect associated with the airspace activities.

2.2.3 WATER QUALITY AND FLOOD HAZARD

Water-related risks to public health and safety can result from two sources. First, a risk can result from contamination of ground water or surface water resources that are used for human consumption or for contact purposes, such as bathing or recreation. Second, flood events can create public safety problems including water resource contamination, property damage, injury, or fatalities. Surface water runoff at less than flood stage can also transport contaminants to publicly accessible environments.

2.2.3.1 Sources of Potential Effects

Nellis AFB and Small Arms Range

Installation Restoration Program (IRP) activities have been active in the identification and characterization of contamination at the facilities (Sources: CH2M Hill, 1982; Dames and Moore, 1985; Montgomery, 1989). The locations of IRP sites and base production wells are shown on Figure 2.5. Potential contaminant sources (IRP sites) include underground storage tanks, landfills, spills, fire training areas, low-level radioactive waste disposal areas and ordnance deactivation and disposal areas. Additionally, waste water is generated in Areas I, II, and III of Nellis AFB.

Various contaminants (halocarbons, hydrocarbons, phenols, pesticides, nitrates, and metals) have been detected in the soils and ground water. However, none of the contaminants have been detected above Federal drinking water standards in the base production wells.

Flood hazards result from flash floods generated by precipitation in the Las Vegas Range and in the northern part of the Sunrise-Frenchman Mountains. Floods from the Las Vegas Range may cross the Small Arms Range or the base, while flood flows from the Sunrise-Frenchman Mountains may cross Area II or portions of Area I.

Nellis Air Force Range

The potential sources of contaminants, some of them hazardous and toxic wastes, on the NAFR include approximately 46 ordnance disposal pits, 12 trash/landfills, an abandoned mine shaft, several air-to-ground live ordnance target ranges, and an approximate 3,500 gallon gasoline leak. The chemical compounds and materials in these sites that potentially affect public health and safety include nitrates, trinitrotoluene, ammonium picrate, cyclotrimethylene-trinitramine, sodium sulfide, sodium hydroxide, cyanide, dimethyl hydrazide, nitric acid, solvents, batteries, petroleum products, lead and acid, and a variety of organic and inorganic products of chemical reactions and combustion. Waste water is also produced at various locations on the ranges. No measurements have been taken to verify any contamination exists on the NAFR.

Indian Springs AFAF

IRP investigations characterized and identified seven potential sources of contamination at Indian Springs AFAF (Sources: CH2M Hill, 1982; J.M. Montgomery, 1989). The IRP sites initially identified included landfills and waste disposal areas, a sewage treatment area, a fire training pit, an aircraft washdown area, and an oil spreading site. Initial screening eliminated four areas from further consideration, and thus only three sites were subjected to more investigation (the former landfill, sewage treatment area and fire training pit). The locations of these sites are indicated on Figure 2.5.

Various contaminants (petroleum, hydrocarbons, and antimony) were detected in the soils at discrete locations. Analytes detected in monitoring well samples were typical of background levels (relative to monitoring and production wells in the area) (Source: Montgomery, 1989).

Public hazards from floods on Indian Springs Air Force Auxiliary Field (ISAFAF) are not a concern, since the drainage is from public lands south of ISAFAF across the facility and onto withdrawn land.

2.2.3.2 Analysis of Effects

Nellis AFB and Small Arms Range

Ground Water Quality. The IRP studies investigated sources of contamination from past releases in conjunction with the shallow and artesian ground water systems. Soil and ground water samples were collected and analyzed to assess the nature and extent of contamination at the source areas. Consideration of the analytical results in relation to receptors, pathways, and toxicological profiles form the basis of a risk assessment to determine the current and potential future impacts of contaminants on public health and the environment. (Based on the risk assessment, there is no adverse health risk associated with the soil ingestion/inhalation. However, based on fate and transport modeling and risk assessment analysis, there is potential for adverse health risk to ground water at several of the sites if no remedial action is taken [Source: Montgomery, 1989]). Organic and inorganic contaminants were detected in the shallow monitoring wells and base production wells (Sources: Dames and Moore, 1985; Montgomery, 1989). Tetrachloroethane, nitrate and sulfate have exceeded the Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act (SDWA) but only in the shallow monitoring wells, not the deeper production wells supplying drinking water for the base. In addition, there are two POL leak/spill areas where free and dissolved product has reached the shallow ground water system. Elevated nitrates and sulfates were detected in shallow wells south of the base (Sources: Kaufmann, 1976; CH2M Hill, 1982). Potential sources of these contaminants are leachate and migration from the former base sewage treatment plant percolation ponds or domestic septic tank leachate in the vicinity of the wells.

NDEP has issued a Resource Conservation and Recovery Act (RCRA) hazardous waste permit to Nellis AFB. A condition to this permit requires that the IRP process be integrated with the requirements of a RCRA Facility Investigation (RFI). The IRP remedial investigation/feasibility study (RI/FS), which follows the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) process, and the RFI are similar. However, the RFI specifically regards the edge of the contaminated site as the point of compliance whereas the RI/FS typically addresses the nearest receptor under current and future use scenarios as the point of compliance. The permit condition was applied due to the NDEP's need to uphold State law which is designed to protect ground

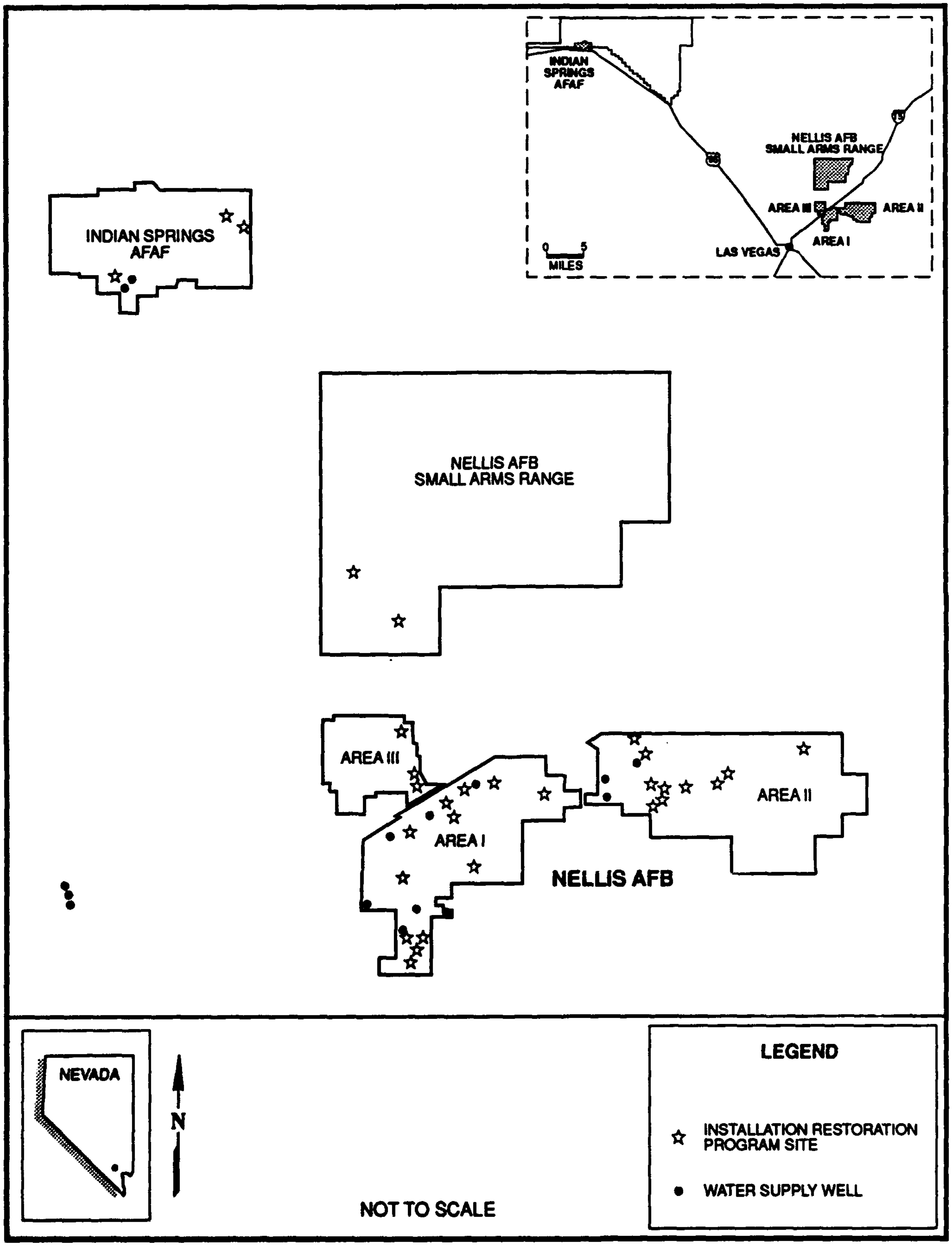


FIGURE 2.5 LOCATION OF NELLIS AFB, SMALL ARMS RANGE, AND INDIAN SPRINGS AFAF GROUNDWATER WELLS AND INSTALLATION RESTORATION PROGRAM SITES

water for future users. In response to these permit conditions, Nellis AFB developed a "RCRA Facility Investigation Plan" and an "IRP/RFI Integration Report". These actions have brought Nellis AFB and NDEP into substantial agreement on substantive issues. Dialogue between the two agencies will continue during implementation of the study and remediation activities.

By year 2000, as the Las Vegas Valley water supplies become fully utilized, the potential for ground water contamination will represent a more serious public health risk. However, if appropriate remedial actions are taken at the contamination sources, future public health concerns will be minimized.

Floods and Surface Water Runoff. There are four issues related to flooding and surface water runoff: 1) the potential effect of Nellis AFB and its drainage facilities on off-site public health and safety; 2) the potential for the transport of surface contaminants to areas where they may endanger public health and safety; 3) the potential for uncovering, transport, and dispersal of buried contaminants to areas where they may either impair a public water supply or endanger public health and safety; and 4) the transport of surface ordnance materials off-site with the potential to either impair a public water supply or endanger public health and safety. Each of these issues are addressed below.

First, Nellis AFB is located on coalescing alluvial fans originating in the Las Vegas Range to the north of the facility. The topography of the land to the north of the base and of the base itself results in drainage across the area that is generally from the north to the southeast (Source: Montgomery, 1989). The combination of Area I of the base, and of the highways to the north of Nellis AFB, Interstate 15, and Las Vegas Boulevard North, has resulted in the diversion and concentration of the natural water flow. Development of Area I of Nellis AFB has increased the amount of impermeable area (runways, aprons, streets, buildings, etc.). Improvements in Area II have also increased the amount of impermeable area. Watersheds on the north and east side of the base, including Area I and Area II, can generate 100-year peak flood flows of approximately 7,150 cubic feet per second (Source: Montgomery, 1989). Watersheds to the north and west that include parts of the NAFR, the Small Arms Range, and base housing in Area III can generate peak flood flows of approximately 6,270 cubic feet per second.

The potential effects of Nellis AFB on downstream public health and safety cannot be quantitatively assessed with existing studies. As population increases in the Las Vegas Valley, the need to control damaging floods will increase. A previous study recommended the construction of dikes, channels, and other flood control facilities on Nellis AFB to control flood waters and protect downstream public health and safety (Source: Montgomery, 1989). The lack of a master drainage plan for Nellis AFB precludes the development of an accurate assessment of flood conditions and their potential effect on public health and safety.

Second, the potential for transport of contaminants from Nellis AFB due to flooding or surface runoff cannot be determined with existing studies. Nevertheless, given the extensive runway and apron areas, the use of petroleum products, and the use of solvents at Nellis AFB, there is a potential for effects on downstream public health and safety.

Third, there are a number of sites in Area I where potentially hazardous or toxic wastes are potentially buried (Source: Dames and Moore, 1985). There is a small potential for these wastes to be uncovered, transported, and dispersed. However, the extent of this potential cannot be determined with existing studies.

Fourth, there is a potential for contaminants and unexploded ordnance to be transported by surface water from the Small Arms Range. There is a potential for transport of contaminants from the facilities located in the northeastern portion of Nellis AFB. The extent of this potential, which could result from construction of artificial barriers or diversions that alter the natural flow of surface water, cannot be determined with existing studies. The lack of a master drainage plan for Nellis AFB precludes firm conclusions regarding these issues.

Waste Water Treatment and Disposal. Waste water generated in Area I of Nellis AFB is collected and discharged to Clark County Sanitation District waste water treatment plants, and thus constitutes no danger to either a public water supply or public health and safety. The waste water generated in Area II is treated in an on-base sewage treatment plant consisting of an Imhoff tank followed by discharge to two 50 feet by 200 feet clay-lined lagoons. Sludge from the Imhoff tanks is air dried and is currently disposed of in the Clark County Sanitary Landfill. Waste water treatment and disposal at Nellis AFB does not have an effect on public health and safety.

Nellis Air Force Range

The NAFR encompasses approximately three million acres and includes all or parts of 24 different hydrographic basins and the associated mountain ranges. Through Memoranda of Understanding, the TTR and Pahute Mesa are under the jurisdiction of the DOE, which is addressed in Chapter 5.

Approximately 1,000 tons of explosive ordnance are dropped annually on the NAFR (Source: U.S. Air Force, Nellis AFB, 1977). No studies or sampling programs have been done to define the quantity and distribution of chemical explosion by-products. Since 1971, residual ordnance components (e.g., bomb fragments, rocket casings, flare casings), inert or live ordnance residuals and practice bombs, have been gathered and disposed of routinely in shallow on-site pits. Destroyed target materials (e.g., lumber, tanks, trucks, jeeps) have been collected and disposed of in impromptu landfills on the NAFR. There are approximately 46 explosive ordnance disposal (EOD) pits and 12 target/trash landfills on the NAFR. One mine shaft has also been used for disposal of waste materials.

Ground Water Quality. The quantities of materials and the chemical nature of those materials in the various disposal sites are unknown. The residuals from explosive ordnance disposal are expected to contain chemical compounds related to the explosives and pyrotechnics in those devises. Some of these compounds and elements are hazardous or toxic. Constituents that might be included are identified in Sec. 2.2.3.1.

The various landfills and mine shaft contain wood and metal, various paint products and solvents, batteries, and petroleum products. There was also an approximate 3,500 gallon gasoline leak from an underground tank at the Tolicha Peak range support facility. The tank has been replaced and the site is identified in the NAFR IRP.

The target zones, some of which are on alluvial fans and playas, may have accumulations of detonation products from various chemical explosives. There are no data on the specific products or their concentrations.

If there is ground water contamination on the NAFR it does not currently have an effect on public health or safety, nor would effects be likely to occur by the year 2000, because the NAFR is a controlled access area. There is no legal opportunity for public contact with potentially harmful substances. To date the only water supplies on the NAFR have been developed for use by range personnel, and there is no evidence that those supplies have been contaminated. Existing contamination might, however, preclude development of ground water reservoirs at some future time. The first phases of the IRP and the Preliminary Assessment have been completed and the Site Investigation (PA/SI) is currently planned. The results of these investigations will be made public and after approval by appropriate regulatory agencies, appropriate remediation will be initiated. Current planning schedules are for clean-up work, if required, to start in 1992. Nellis AFB will work with the NDEP in implementation of this IRP program and any follow-on remediation efforts.

Floods and Surface Water Runoff. On the NAFR, there are three watersheds that have the potential to endanger public health and safety due to flooding. These watersheds are Thirsty Canyon, Beatty Wash, and Black Canyon. Using regional peak flood flow equations developed for the Southern Nevada area (Source: Squires and Young, 1983), the 100-year peak flows from the Thirsty Canyon drainage was estimated to be approximately 10,300 cubic feet per second; the peak flow from the Beatty Wash drainage was estimated to be approximately 5,000 cubic feet per second from the drainage area on the withdrawn land; and the peak flow from the Black Canyon drainage was estimated to be approximately 6,000 cubic feet per second. The U.S. Department of Defense has made no known alterations in these drainages that would significantly increase peak flood flows above those that would be expected if the drainages were not withdrawn lands. Presumably, past activities have not resulted in surface contamination that would create a potential to transport or disperse contaminants beyond the boundaries of the withdrawn lands. This potential, however, cannot be determined with existing studies.

Waste Water Treatment and Disposal. The existing waste water treatment lagoons at the TTR are oversized for the population being served. The result is that no overflow occurs to the associated evaporation/percolation ponds. This 12.8 acre facility is currently experiencing some minor septic problems and causing objectionable odors. DOE is in the process of connecting Sandia facilities to the sewer and has proposed construction of an intermediary dike. This dike would create a two-pond system to handle existing flows. Removal of the 37th TFW from the TTR would reduce significantly (by 80 percent) the inflow to the lagoon system. It is doubtful that the system would function properly at such a low inflow rate. To ensure proper waste treatment, additional dikes or a new smaller waste treatment lagoon will be required. The existing lagoon leaks more rapidly than it had been designed for.

Indian Springs AFAF

Ground Water Quality. The IRP studies have focused on three potential contaminant sources with the collection and analysis of soil and monitoring well samples (Source: Montgomery, 1989). No significant contamination was detected in ground water. Soil samples at the fire training area exhibited concentrations of total petroleum hydrocarbons above recommended standards. Based on the results of the risk assessment, there is no adverse health risk associated with ingestion/inhalation of soil. The environmental fate and transport analysis indicated that antimony from the sewage treatment area and a constituent of petroleum hydrocarbon (n-hexane) from the fire training area could reach ground water in 10 to 30 years. However, since there are no downgradient drinking water receptors, there is no adverse public health risk.

Floods and Surface Water Runoff. Indian Springs AFAF is located on the north side of U.S. Highway 95, downslope from the town of Indian Springs. The watershed drainage in this area is from the south to the north (Source: Montgomery, 1989). Therefore, there is no danger that any surface contaminants on Indian Springs AFAF would be transported and dispersed by surface water to areas where they may impair either a public water supply or public health and safety.

2.2.4 IONIZING RADIATION

Nuclear materials at Nellis AFB, in the form of depleted uranium ammunition, are controlled as specified in the terms and conditions of the USAF Radioactive Material Permit issued under the USAF Master Materials License and as specified in 10 CFR Part 20. Since the material is also stored as ammunition, additional requirements must be met (i.e., storage in a bunker and accountability requirements for munitions). This radioactively benign material is dispersed on the NAFR as a result of testing. The conditions of the Radioactive Material Permit require an annual inventory balance, to include munitions that have been fired.

2.2.4.1 Sources of Potential Effects

Nellis AFB has a USAF Radioactive Material Permit to receive and possess up to 77,000 pounds of depleted uranium (Permit No. 42-23539-OIAF). This material is in the form of depleted uranium ammunition and is stored in ammunition bunkers on Nellis AFB.

2.2.4.2 Analysis of Effects

Because of the nature of depleted uranium, the basic control procedures outlined in appropriate technical orders are sufficient for the Nellis AFB operation. The hazard from depleted uranium is primarily chemical toxicity, not radioactivity. No potential, credible effects relating to the radioactive hazards of this material have been identified. Thus, there is no effect on public health and safety due to radiation. No change in potential effects from Nellis AFB are projected to occur by the year 2000.

2.2.5 NON-IONIZING RADIATION

Electromagnetic radiation hazards discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible (light) radiation. Systems producing RF/microwave radiation include radio and television transmitters, microwave ovens, radar systems, microwave communication systems, sterilization systems used for medical supplies, welding equipment, and medical equipment. Except for radar systems, these sources are not considered further in this section because of their very low potential health hazard to the public due to low emission levels, location, or stringent emission controls.

Laser radiation effects discussed in this section refer only to those effects that can potentially affect the general public. Lasers are used for target designation and air-to-ground ranging by the military. These devices are not considered lethal but are capable of delivering sufficient energy or power in the beam of light to damage the retina of the human eye. Laser devices are, however, used only on designated laser target ranges; and at the NAFR the potential for harm to the public is extremely remote.

2.2.5.1 Sources of Potential Effects

Nellis AFB uses RFR emitters extensively in radar and communication systems both on the base and in the range complex. Electronic Combat (EC) ranges are used to train pilots in state-of-the-art electronic warfare. A variety of systems are used including those that mimic surface-to-air missiles, ground-jamming systems, and early-warning radar. Radar systems located on the aircraft are used to target and attack these ground-based systems.

The threat simulators used on the North Range of the NAFR include early warning/height finder simulators, surface-to-air missile simulators, anti-aircraft artillery simulators, unmanned threat emitters, radar jammers, and intrusion/imitative communications deception (ICD) systems (Source: U.S. Air Force, 554th Range Group, 1987). A microwave communications system is also used. Microwave relay links are located at Cedar Peak, Angel Peak, Tolicha Peak, and Highland Peak.

Electromagnetic activities on the TTR include tracking radar, telemetry receiving and recording equipment, and extensive radio communications systems.

The TFWC maintains a Frequency Management Office to obtain clearance authorizations for the operation of Electronic Countermeasures (ECM) on the NAFR. Frequency management and the control of electronic emission interference are regulated by Air Force Regulation 55-44.

Lasers have been approved for use in association with the TFWC and the Desert MOA. The laser system primarily used is LANTIRN, which stands for Low Altitude Navigation and Targeting Infrared for Night. This system enables aircrews to train at night with the same techniques used during daylight.

2.2.5.2 Analysis of Effects

The radar systems used on the aircraft pose no hazard to the public due to the aircraft's altitude, the energy levels used by the equipment, and the speed of the aircraft. Given these factors, the duration of any possible RFR exposure is very small, if such exposure were to occur.

None of the electromagnetic systems used at the threat sites pose a hazard to the public or environment; all radar systems are of relatively low power (Source: SNL, 1985). No hazard exists for the public or the environment due to these operations (Source: U.S. Air Force, HQ SAC, 1988). Electromagnetic interference may occur to civilian aircraft flying through the Desert MOA or near the EC ranges. Nellis AFB has frequency management procedures to minimize this problem (Source: U.S. Air Force, 554th Range Group, 1987). No changes are anticipated by the year 2000.

Laser use at Nellis AFB and the NAFR is subject to the requirements of Air Force Occupational Safety and Health (AFOSH) Standard 161-10, Health Hazards Control for Laser Radiation. This standard is based on the recommendations of the American National Standards Institute (ANSI Z136.1-1980 (1986)) and was established to prevent possible harmful effects to personnel and the public resulting from exposure to laser radiation at all Air Force facilities and ranges.

AFOSH 161-10 includes the following procedures in addition to those described in Section 8.1 of ANSI Z136.1-1980 (1986). The laser device is activated only on established laser targets in Department of Defense land; special tests or deviations from this procedure require safety analysis and approval. Two-way communication between the test vehicle and the range controlling agency is required. Laser operations are not conducted with standing water or ice in the immediate target area to prevent reflection of the beam outside the cleared range. Test-crew members, all test personnel, and any visitors who may be at risk use appropriate glasses, goggles, or visors when lasing a reflective target. Weapon system operators are trained in the laser hazards of the equipment and the control measures to prevent injury during training or operational-laser tests. Range access roads are cleared and secured, and signs are displayed at designated checkpoints where lasing operations are scheduled.

An analysis of airspace requirements for the LANTIRN system has been performed and airspace requirements for safe operation have been determined (Source: U.S. Air Force, 1988b). Additional lasers must meet the requirements of AFOSH 161-10 and a hazard analysis must be made prior to use.

Given these procedures, no effect on public health and safety is expected to result from the use of lasers at Nellis AFB and its associated ranges now or by the year 2000.

2.2.6 SOLID AND HAZARDOUS WASTE

2.2.6.1 Sources of Potential Effects

Nellis AFB is a large-quantity solid and hazardous waste generator (Sources: Hazardous Materials Technical Center, 1988; Guitierrez-Palmenberg, 1988) and is subject to regulatory requirements of the Resource Conservation and Recovery Act (RCRA). Hazardous wastes (other than explosives) are managed in accordance with the procedures specified in Nellis AFB Hazardous Waste Management Plan (Plan 12), dated July, 1989.

In 1986, Nellis AFB generated about 53,150 pounds of hazardous waste. In 1987, the total amount generated was almost 47,000 pounds. About 60 percent of the hazardous wastes generated at Nellis AFB results from painting and corrosion control activities. The paint and corrosion control shop waste is a mixture of polyurethane paint, lacquer, paint strippers and thinners, and cleaning solvents. Approximately 4,000 gallons of paint and corrosion control wastes were disposed of through the local Defense Reutilization and Marketing Office (DRMO) in 1987.

Approximately 30 percent of the waste generated is composed of waste solvents and strippers. Approximately 2,000 gallons of such waste were disposed of through the DRMO in 1987.

Other hazardous wastes generated on an infrequent basis include mercury from various instruments, mercury batteries, lithium batteries, and explosives.

Several activities on the NAFR generate small quantities of hazardous waste and recyclable petroleum products. Most of these activities are located at Indian Springs AFAF. Wastes generated at Indian Springs AFAF are delivered to Nellis AFB for handling under the Nellis Hazardous Waste Management Plan.

All hazardous wastes generated by the 37th TFW at the TTR are regulated under the EPA Notification of Hazardous Waste Activity Permit. The wastes are collected and stored at a 90-day Hazardous Waste Accumulation Facility which is regulated under 40 CFR Part 262 (Standards Applicable to Generators of Hazardous Wastes). All wastes (other than JP-4 contaminated soil) are being shipped from this facility to a licensed Treatment, Storage, and Disposal facility. In June 1990, the NDEP approved a remediation plan for the cleanup of fuel contaminated at the 37th TFW fire training pit on the TTR. Cleanup will resume in the near future.

2.2.6.2 Analysis of Effects

Full implementation of the Nellis AFB Hazardous Waste Management Plan, and the procedures and conditions outlined in the RCRA Part B Permit Applications for the DRMO storage facility and the EOD area will ensure that hazardous wastes are handled and disposed in an environmentally acceptable manner. The Hazardous Waste Management Program at Nellis AFB is routinely audited by the EPA, the NDEP, and U.S. Air Force environmental experts.

A comprehensive assessment (Source: U.S. Air Force, 1989a) was conducted in March 1989 in accordance with the Environmental Compliance Assessment and Management Program developed by the U.S. Air Force. The assessment indicated that overall compliance with applicable hazardous waste regulations at the DRMO hazardous waste storage facility, the EOD thermal treatment facility, and the designated 90-day accumulation point was excellent. Five major deficiencies were identified at other facilities on Nellis AFB. Three of these deficiencies involved contamination of large quantities of otherwise non-hazardous waste liquids, another involved shipments of silver for recycling without a manifest, and one concerned unauthorized deposition of full drums of unknown contents and origin at two locations on the base.

Nellis AFB was inspected twice by the EPA in 1987. In February 1987, three minor administrative violations were recorded. In November 1987, the EPA with a State of Nevada inspector in attendance noted several administrative violations regarding training and lack of proper communication equipment in the accumulation area. A follow-up inspection was conducted in July 1988 by the NDEP. All of the violations noted in the November 1987 audit had been corrected. Another inspection by State of Nevada officials was conducted in May 1988, during which no discrepancies were observed at Nellis AFB, although several waste storage violations were noted at Indian Springs AFAF.

While the deficiencies identified in the audits indicate that full compliance with applicable hazardous waste regulations has not been achieved, an aggressive hazardous waste management program exists at Nellis AFB. The Base Environmental Protection Committee, consisting of the leadership of major organizations and tenant units on the installation, oversees response to environmental compliance concerns, and the chairman tracks all open agenda items until they are resolved. Continued emphasis on the compliance program will ensure that hazardous and toxic wastes generated by activities associated with Nellis AFB and the NAFR do not affect public safety and health. This includes storage and expenditure of depleted uranium munitions. Continued use of the Nellis AFB DRMO by Indian Springs AFAF precludes any effect on public health or safety from these operations. No change is anticipated by the year 2000.

An Environmental Compliance Assessment and Management Program (ECAMP) audit of the 37th TFW was done at the TTR in April 1990. The hazardous waste program was found to be well managed. Four minor regulatory deficiencies were noted and one major deficiency, the cleanup at the fire training pit, was observed. The TTR also has a current Spill Prevention and Response Plan and a current Hazardous Waste Management Plan (both dated 2 July 90). Continued progress in resolving these deficiencies coupled with current management practices will ensure there are not public health and safety effects by the year 2000.

2.2.7 NOISE AND SONIC BOOM

2.2.7.1 Sources of Potential Effects

Nellis AFB

The primary source of noise in the vicinity of Nellis AFB is aircraft operations into and out of the base. Nellis AFB received 149 aircraft-disturbance complaints in 1987, 158 complaints in 1988, and 192 complaints in 1989. In 1987, 68 percent of the complaints were from the Las Vegas area and 32 percent from rural areas. In 1988, 34 percent of the complaints were received from the Las Vegas area and 66 percent from rural areas (Source: U.S. Air Force, TFWC, 1989). In 1989, the percentage of complaints from the Las Vegas area was 42 percent while 58 percent was from the rural areas.

The noise impacts of Nellis AFB operations were addressed in a 1981 Air Installations Compatible Use Zones (AICUZ) study (Source: U.S. Air Force, Nellis AFB, 1981) and in a 1988 environmental assessment of aircraft realignments at Nellis AFB (Source: U.S. Air Force, HQ TAC/URS Consultants, 1988). The AICUZ study reported that noise around the base was dominated by flight operations. Engine noise from ground run-up operations contributed very little to the overall noise levels. Typical daily flight operations at Nellis AFB consist of about 750 takeoffs and landings (Source: U.S. Air Force, HQ TAC/URS Consultants, 1988) by F-16 (50 percent), F-15 (10 percent), F-5 (18 percent) and F-4 (5 percent) fighter aircraft. Projections for the year 2000 are for total operations to increase by 20 percent, but the noisier F-4 and F-5 aircraft will be replaced by a greater number of operations by F-16 and F-15 aircraft which are quieter on takeoff and landing (the F-15 also uses afterburner power for takeoff less frequently than F-4 aircraft).

Nellis Air Force Range and Associated Airspace

Flight operations in airspace associated with the NAFR occurs at subsonic and supersonic speeds and at various altitudes. Airspace where supersonic events occur is shown in Figure 2.6. Other noise sources within the NAFR include the use of explosive ordnance and new weapons systems in the various test, artillery, and bombing target ranges.

Indian Springs AFAF

The average number of daily operations at Indian Springs AFAF was approximately 270 departures and arrivals during the period January through March 1986. Of these operations, 61 percent were F-16 aircraft (41 percent by Thunderbirds, 20 percent by other F-16 activity); 26 percent were UH-1 helicopter activity; and approximately 10 percent were A-10 and A-7 aircraft. The annual operations at Indian Springs AFAF are expected to increase by 10 percent by the year 2000, but without a noticeable change in typical busy-day activity.

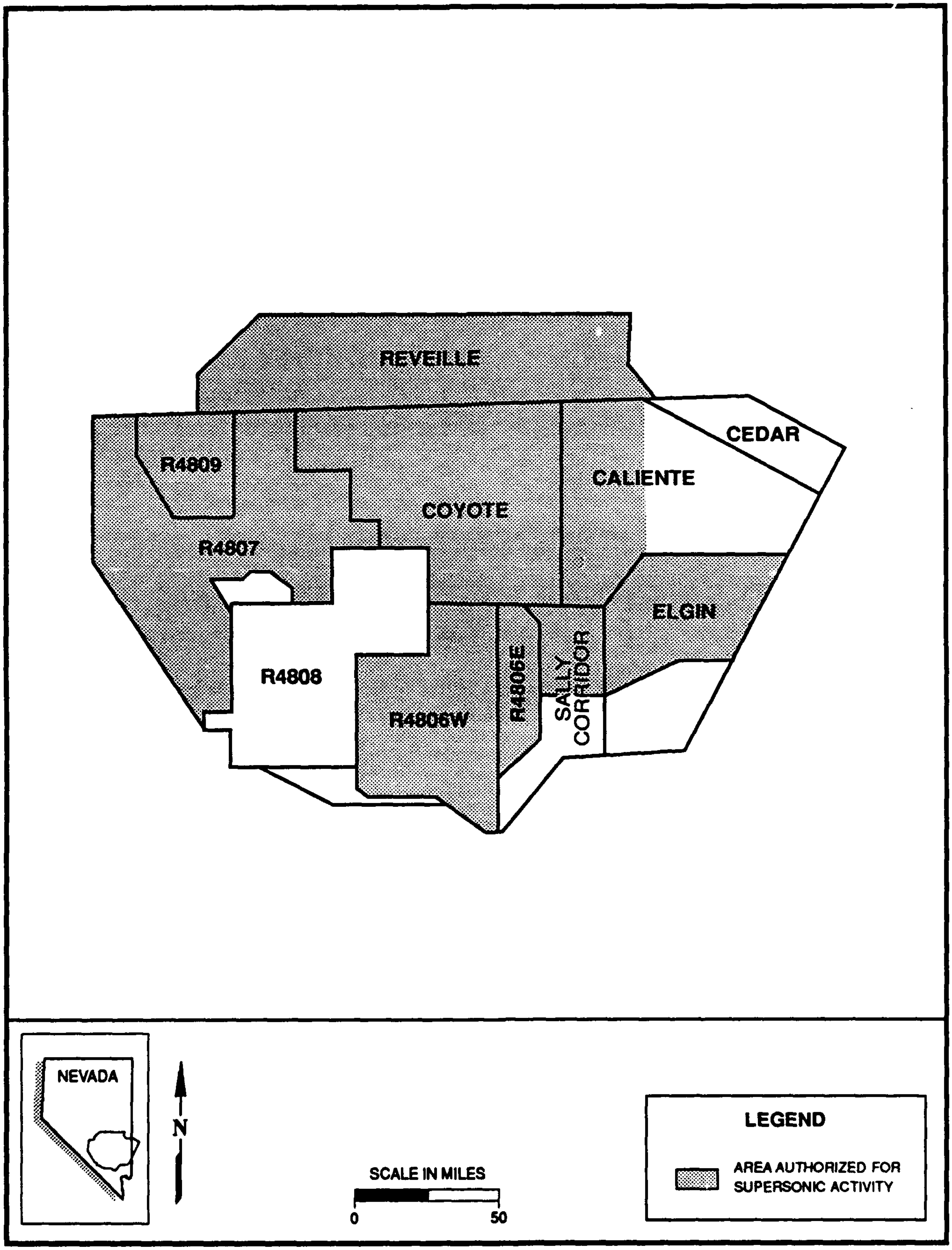


FIGURE 2.6 AREA AUTHORIZED FOR SUPERSONIC ACTIVITY WITHIN THE NELLIS AIR FORCE RANGE COMPLEX

2.2.7.2 Analysis of Effects

Noise and sonic boom impacts in the Nellis Range Complex (NAFR and associated airspace) have been documented in a Final Environmental Impact Statement (FEIS) for the Nellis Range Complex (Source: U.S. Air Force, Nellis AFB, 1977). Separate environmental assessments (EAs) address the Reveille extension of the Desert MOA and the A-10 LATN areas (Sources: U.S. Air Force, HQ TAC, 1982; U.S. Air Force, 1983b). The general public is prohibited access in the NAFR and can, therefore, be assumed to be unaffected by noise and sonic boom in the restricted areas of the range. The following analyses of effects are limited to an examination of areas where noise and sonic boom are known to, or may, have an effect.

Nellis AFB

Noise exposure (L_{dn}) contours for Nellis AFB have been published as part of the base AICUZ study (Source: U.S. Air Force, Nellis AFB, 1981) and the more recent EA for aircraft realignments (Source: U.S. Air Force, HQ TAC, 1988). L_{dn} contours are illustrated in Figure 2.7 (Source: U.S. Air Force, HQ TAC/URS Consultants, 1988b).

An evaluation of the potential effect on public health and safety within these contours has been made by estimates of the number of people exposed to each noise level and by estimation of the number of people who would be "highly annoyed". These estimations are based on census tract data, or populations within the mapped contours, exclusive of one census tract which encompasses Nellis AFB boundaries (Source: Clark County Department of Comprehensive Planning, 1988). The resulting estimates are shown in Table 2-3 for Nellis AFB operations during 1988. Estimates of highly annoyed populations are based on the relationship between L_{dn} and annoyance discussed in Section 1.4.1.7 and illustrated in Figure 1.7.

Although the number of aircraft flight operations at Nellis AFB is projected to increase by 20 percent by the year 2000, the percent usage by the various types of aircraft will also change. The effects of these changes in operations and fleet-mix usage were examined by the NOISEMAP modeling method which is a standardized noise prediction method developed by the Air Force (Source: U.S. Air Force, AMRL, 1984). The analysis indicated a reduction of land areas within the L_{dn} contours for the year 2000, relative to those for 1988, due to changes in aircraft fleet-mix using the base. However, noise-impacted populations are expected to increase due to changes in land use (population density) around the base. The year 2000 estimates of populations expected to be highly annoyed by aircraft noise are shown in Table 2-3. Estimates of highly annoyed populations are based on the relationship between L_{dn} and annoyance discussed in Section 1.4.1.7 and illustrated in Figure 1.7.

Nellis Air Force Range and Associated Airspace

Although the NAFR and associated airspace cover a large portion of southern Nevada, approximately half of this land coverage is in Restricted Areas with no permanent residents. Outside the Restricted Areas lie small towns, ranches and relatively remote

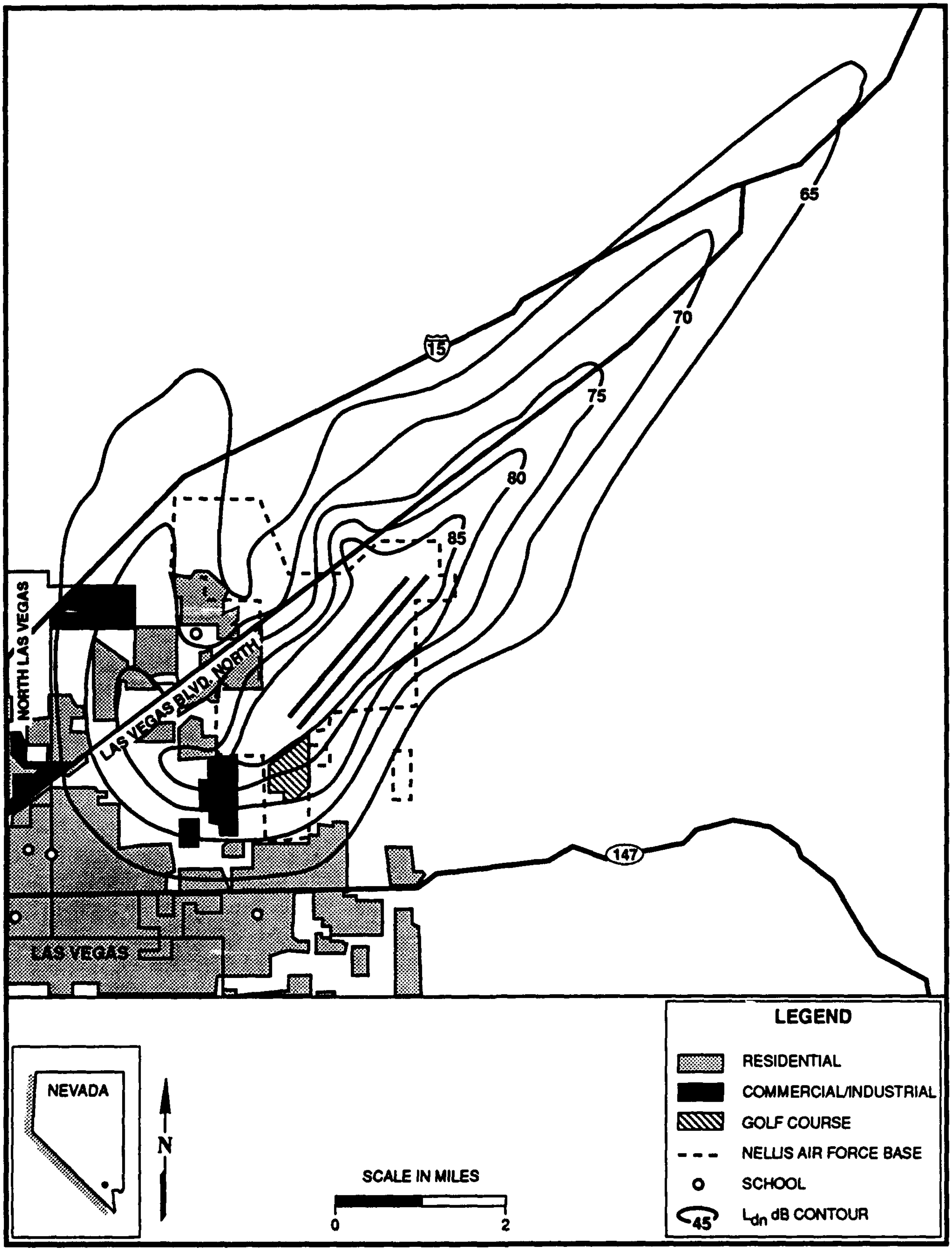


FIGURE 2.7 NELLIS AFB L_{dn} CONTOURS, 1988

Table 2-3. Population[1] Within L_{dn} Contours, Nellis AFB.

L_{dn} Contour	1988 No. of People	1988 Estimated No. of People Highly Annoyed	2000 No. of People	2000 Estimated No. of People Highly Annoyed
65	20,532	6,374	27,481	8,532
70	10,104	4,502	13,526	6,027
75	7,877	3,840	10,540	5,139
80	1,803	1,105	2,412	1,479

[1] These estimates are cumulative, e.g., populations within the L_{dn} 65 dB contour include those within higher L_{dn} contours.

residences within the area encompassed by the Desert MOA. Noise or sonic boom from military aircraft operations will be heard periodically in all of these sparsely populated areas. To minimize the potential effect of such events, the Air Force placed restrictions on the use of airspace surrounding these communities (Source: U.S. Air Force, Nellis AFB, 1988c). Specifically, flight training activity is restricted to at least 1,500 feet AGL within a 9,000 foot radius of the Nevada communities of Alamo, Crystal Springs, Hiko, Elgin, Mine, and Tule Springs. Additionally, 32 other locations (including communities, ranches, airfields, and wildlife ranges) are specifically designated as Low-Level Flight (LLF) or Noise Sensitive (NS) areas in which overflight restrictions are in effect. Over most of these areas, altitudes are restricted to at least 1,000 feet AGL within one nautical mile radius of the designated location.

Noise contours for L_{dn} or L_{dnmr} metrics are not available for the NAFR without extensive long-term noise measurements or statistical description of overflight occurrences. When overflights at subsonic speeds occur, their resulting single-event noise levels would be roughly equivalent to sound exposure levels indicated in Table 2-4 for the various types of military aircraft that use airspace over the NAFR.

A daily daytime occurrence of one overflight by an F-16 at 1,000 feet AGL would cause an L_{dn} value (day-night average noise level) of 46 dB. A 10 dB penalty would be added if the overflight occurred between 10 p.m. and 7 a.m. These low values of L_{dn} may generate some annoyance. If the occurrences increased in their regularity, the L_{dn} would increase at a rate of 3 dB for each doubling of the number of events, and the potential for annoyance would increase.

Table 2-4. Sound Exposure Levels (SEL, dB) of Typical Aircraft Used for Nellis AFB Missions at Typical Training Flight Speeds.[1]

Aircraft Type	% Usage		Height Above Ground Level (ft)			
	1986	2000	1,000	1,600	2,000	4,000
F-16	50	69	95.4	91.0	88.7	80.8
F-15	10	20	108.9	105.0	103.0	96.5
F-5	18	0	108.0	103.2	100.5	91.7
F-4	5	2	107.8	103.6	101.4	93.8
A-7	7	0	91.7	87.3	85.0	77.6
A-10	9	9	87.0	82.6	80.3	73.2

(1) Based on OMEGA 10 and NOISEFILE of the NOISEMAP system

Within the NAFR and associated airspace, subsonic military flights flown in accordance with the flight restrictions applicable over populated areas do not cause significant effects to public health and safety. However, complaints from individuals exposed to single-event noise levels can be expected.

Estimates and projections of supersonic event occurrences in portions of the Special Use Airspace are listed in Table 2-5. The estimated number of annual supersonic events in the Desert MOA, R-4806E, R-4806W, and R-4807 (Source: U.S. Air Force, 1978) were used to estimate sonic boom occurrences within the supersonic training areas. The Desert MOA estimates were further subdivided among the separate sections of the MOA (Caliente, Coyote, Elgin, Reveille, Sally, and Cedar) according to the typical percentage occurrences for 1983 (derived from U.S. Air Force, AMRL, Volume I, 1986 which provides an extensive review of supersonic events in Nevada airspace during the period 1969 to 1983).

Using these data, elliptical contours of sonic boom exposures at ground level were derived based on a modified version of the Oceana Model, which is described in detail in Bolt, Berenek, and Newman, Inc., 1983, and has been previously used in EIS documents. These ellipses, shown in Figure 2.8, represent the land areas over which there is an equal probability of sonic boom exposures, expressed in L_{Cdn}. The locations of the L_{Cdn} contours are based on information derived from the sonic boom inquiry database, used in the preparation of U.S. Air Force, AMRL, Volume I, 1986, Evaluation of Sonic Boom

Table 2-5. Estimate of Supersonic Flight Events Associated with the Nellis Range Complex.

Supersonic Training Area	Number of Supersonic Events 1988	2000
Caliente	784	940
Cedar	0	0
Coyote	712	855
Elgin	3,345	4,015
Reveille	216	258
Sally	72	87
R-4806E/Alamo	690	828
R-4806W	691	829
R-4807	1,381	1,657
TOTAL	7,891	9,469

Occurrences in Nevada. The contours are based on 1988 Nellis Range operations; contours for year 2000 operations are essentially identical and are, therefore, not shown.

Of the elliptical areas shown in Figure 2.8, only those on the east side of the Desert MOA are likely to affect resident populations. The largest estimated number of people that might be affected is 980 people, which assumes that 870 residents of the town of Alamo, Nevada, are within the L_{Cdn} 50 dB contour at the Coyote South Sector of the Desert MOA.

Single event levels of sonic boom under the area in which supersonic flight occurs are predicted by the Oceana model to range from 1 psf to 10 psf depending on various factors (aircraft type, altitude, speed and atmospheric conditions), with an average of the order of 4 psf. More recent model developments, specifically the White Sands Missile Range (WSMR) study (a refinement of the Oceana Model), indicate that overpressures of a lower magnitude may be expected; the average peak sonic boom overpressure was 0.67 psf with a minimum of 0.5 psf to a maximum of 6.67 psf with the majority of the booms being of a magnitude less than 1 psf. These levels would be sufficient to cause startle in humans and animals. Sonic booms in the lower range (less than 2 psf) have a low probability of causing window breakage in buildings. At higher levels, the probability would increase to about 0.01 percent probability at 4 psf (i.e., one in 10,000 panes) and to about 0.5 percent probability at 10 psf (i.e., one in 200 panes) (Source: Hershey and Higgins, 1976). In 1990, sonic boom breakage of windows occurred in the city of Caliente. This was

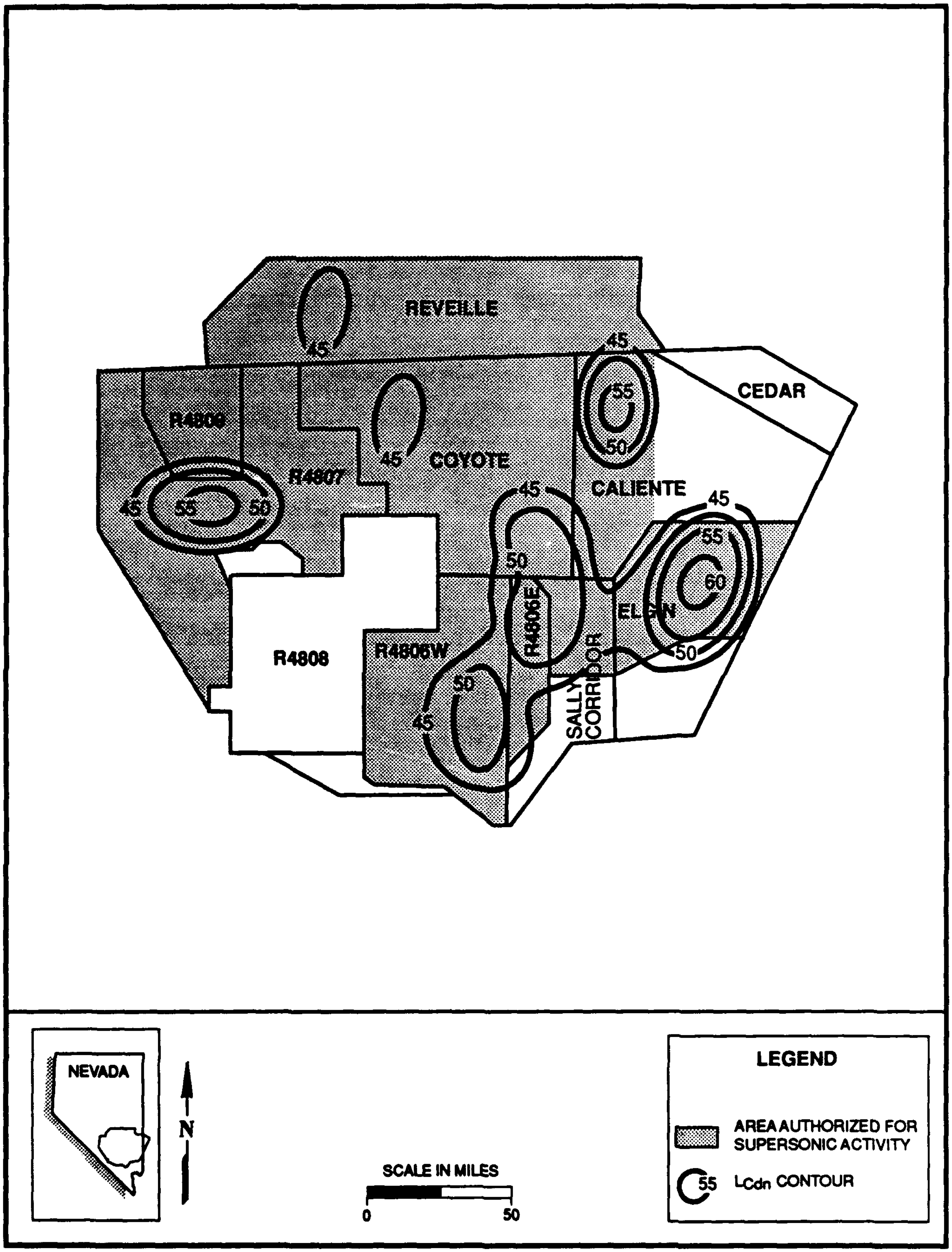


FIGURE 2.8 ESTIMATED SONIC BOOM L_{Cdn} CONTOURS, 1988, NELLIS-RELATED AIRSPACE

caused by unauthorized supersonic flight. Damage claims were settled by the Air Force in this incident.

The methodology used to determine probable noise from gunnery and explosive ordnance activities at the weapons ranges included the review of general activities at each range site. General types of ordnance are listed in the Nellis Range Operations Manual (Source: U.S. Air Force, 1987). Actual types, weights, and numbers of ordnance and gunnery used on the individual Nellis subranges were not available, but were estimated by comparing NAFR activities to NAS Fallon activities, for which subrange ordnance and gunnery data are available (Chapter 3). The number of dropped ordnance and quantity of small arms fire at the NAFR was estimated to be 25 percent greater than at NAS Fallon ranges.

SEL_c was determined for large impulsive sounds from bomb blasts and explosive ordnance using the methods described in Procedures and Data for Predicting Day-Night Levels for Supersonic Flight and Air-to-Ground Gunnery (Source: Bolt, Berenek and Newman, Inc., 1978). Based upon the number of ordnance dropped or rounds of small arms fired, and the percent of day/night activity, C-weighted L_{dn} values were calculated.

The expected L_{Cdn} 65 dB contour areas resulting from this analysis are illustrated in Figure 2.9. These areas are representative of the most severe noise levels, but are within restricted areas except for a small area on the western edge of the range. Since the general public is prohibited access to the NAFR, noise from bomb blasts and explosive ordnance does not result in significant effect to public health and safety.

<u>Indian Springs AFAF</u>

L_{dn} noise exposure contours for Indian Springs were derived from an analysis conducted by the Air Force for the year 1982 operations and were revised to reflect 1988 operations, which no longer include UH-1 helicopter activities. These L_{dn} contours are shown in Figure 2.10. The L_{dn} contribution from ground run-up is not a factor in the noise exposure at Indian Springs AFAF.

A housing count was conducted on March 31, 1989, to determine the number of people located within the Indian Springs AFAF L_{dn} contours. This count indicated that 247 mobile homes, not including the military housing, are located within the L_{dn} 65 dB contour, and 1 motel unit is located within the L_{dn} 70 dB contour. Estimates indicate that Indian Springs had a population of 2,570 in 1988. The L_{dn} 65 dB contour comprises approximately 25 percent of the Indian Springs area. Assuming a uniform distribution of population and an average household size of 2.6 people, approximately 645 people live within the L_{dn} 65 contour and 3 live within the L_{dn} 70 contour. Table 2-6 shows the populations estimated to reside within the L_{dn} 65 dB and 70 dB contours and the estimated number of people expected to be "highly annoyed" by aircraft noise based on the L_{dn} annoyance relationship discussed in Section 1.4.1.7. No increase in these population estimates is expected by the year 2000.

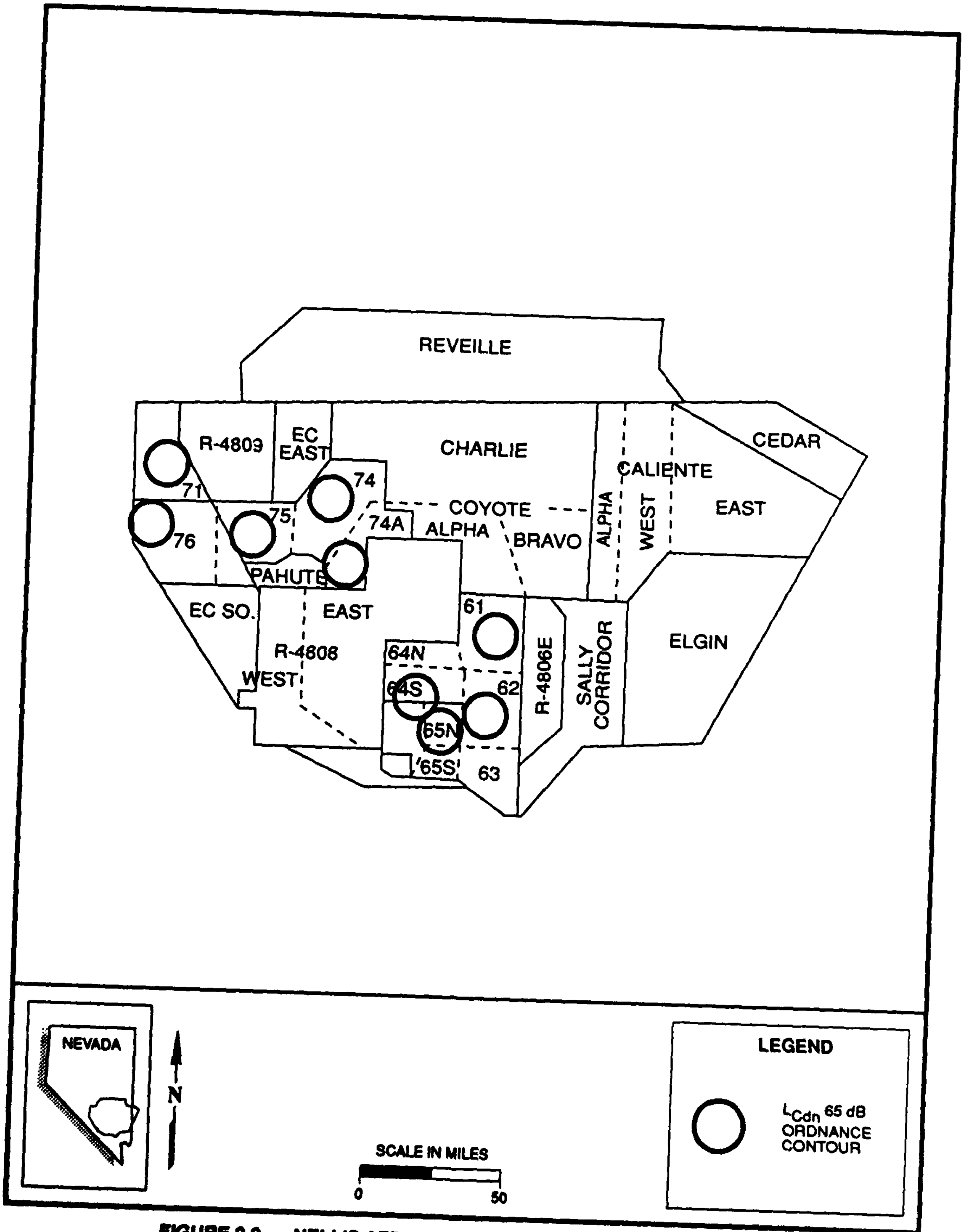


FIGURE 2.9 NELLIS AFB RANGES AND L_{Cdn} 65 dB CONTOURS

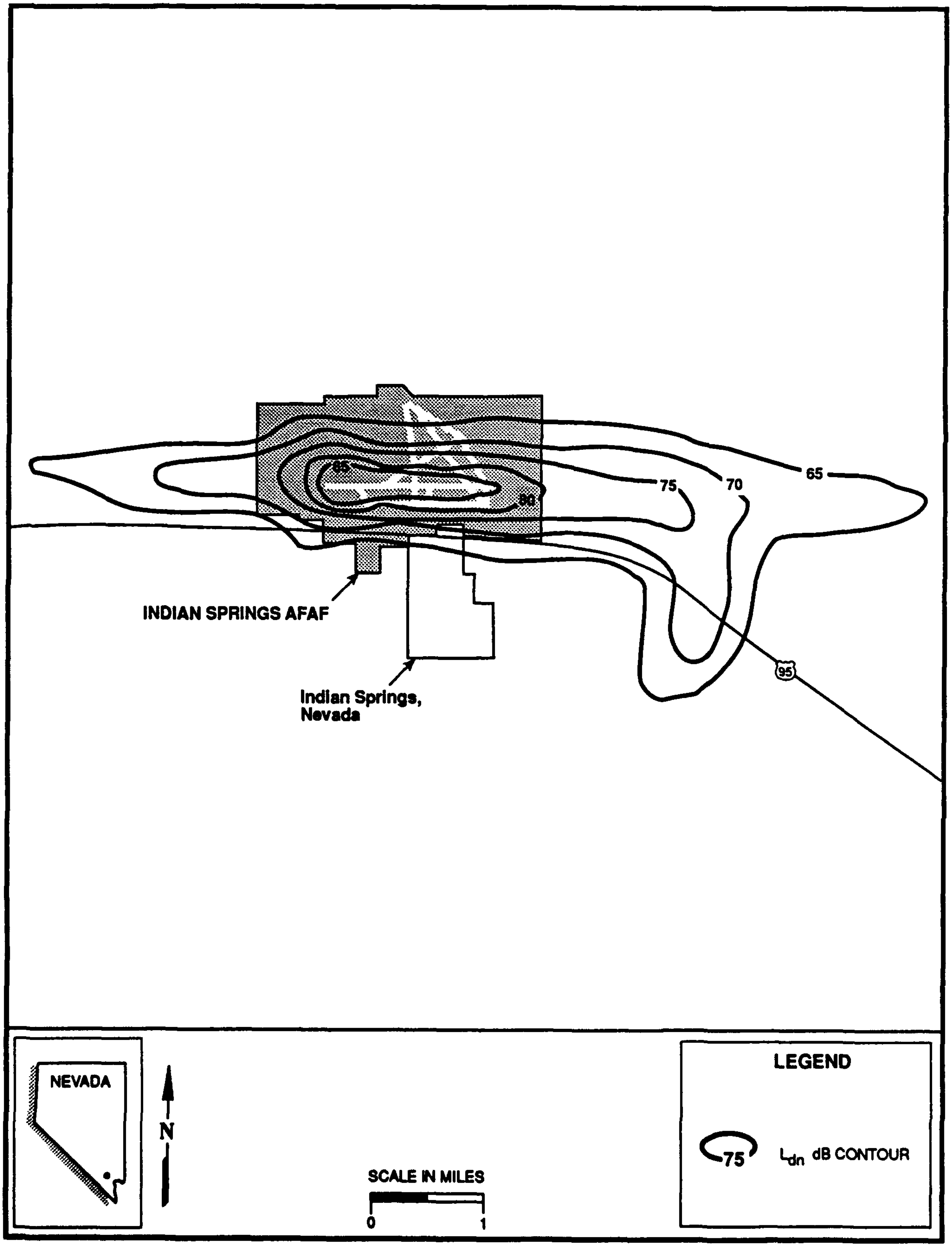


FIGURE 2.10 INDIAN SPRINGS AFAF L_{dn} dB CONTOURS, 1982

Table 2-6. Population Within the Indian Springs AFAF Contours[1].

(Year 1988)

L_{dn} Contour	No. of People	Estimated No. of Persons Highly Annoyed
65	645	115
70	3	1

[1] The estimates are cumulative, e.g., population within the L_{dn} 65 dB contour includes those within higher L_{dn} contours.

2.2.8 FACILITY ACCIDENTS

For munitions storage and handling, the DOD Ammunition and Explosives Safety Standards (DOD 6055.9-STD) (Source: DOD, 1984) have been implemented by the U.S. Air Force in Air Force Regulation (AFR) 127-100, "Explosives Safety Standards." Procedures relative to the prevention and control of spills from fuel storage and distribution systems at Nellis AFB are contained in Nellis AFB Spill Prevention And Response Plan, dated February 1984. Specific procedures relative to hazardous material (HAZMAT) bulk storage at Nellis AFB, Indian Springs AFAF, and Air Force activities on the TTR are contained in numerous Air Force publications. Of particular relevance to this discussion is AFOSH Standard 127-43, Flammable and Combustible Liquids. AFOSH standards are consistent with the corresponding standards promulgated under the Occupational Safety and Health Act.

2.2.8.1 Sources of Potential Effects

Munitions Handling and Storage

Large quantities of munitions are handled and stored at Nellis AFB in support of its operational and training missions. Current operations include daily buildup, transport, and loading of small practice bombs, flares, 20- and 30-millimeter target practice ammunition, general purpose bombs, and air-to-air missiles. There are six major explosives handling and temporary storage sites associated with flight-line operations.

The Nellis AFB munitions storage site is located in Area II. The site contains 132 earth-covered magazines, maintenance facilities, and holding/build-up pads. A munitions truck inspection point is located on the access road to the site.

The major explosive handling and storage sites at Indian Springs AFAF include munitions storage, munitions build-up, and flightline holding pads, all located on inactive runways and taxiways north of the main active runway. A loaded aircraft parking area is located on a taxiway near the west end of the active runway.

Fuel Storage

Fuels stored at Nellis AFB, Indian Springs AFAF, Tolicha Peak Electronic Combat Range, the NAFR, and TTR are described in Section 2.1.4.

Hazardous Material Bulk Storage

Nellis AFB stores and uses moderate amounts of oils, paints, solvents, thinners, adhesives, cleaning compounds, pesticides, batteries, compressed gases, etc. Base Supply receives HAZMAT and disburses them to customers from the indoor flammable/combustibles storage room in the bulk acid storage facility, compressed gas storage building, the open-storage area, and the chlorine warehouse. HAZMAT and pesticides are also stored and mixed in the Civil Engineering shops (Source: U.S. Air Force, 1989a).

There are no storage sites containing large amounts of hazardous material (solvents, paints, thinners, etc.) at Indian Springs AFAF. Bench stock levels of such materials are purchased as needed from Base Supply at Nellis AFB.

The 37th TFW at the TTR uses quantities of HAZMAT (e.g., solvents, degreasers, epoxy glues, and pesticides) that would be expected on a facility of this size. Materials are stored in a warehouse, at Base Supply (flammables and pyrotechnics), and in an outside shed (pesticides) near the Hazardous Waste Accumulation Facility. Pesticides will be moved to the new entomology shop when it is completed.

2.2.8.2 Analysis of Effects

Munitions Handling and Storage

Compliance with the DOD Ammunition and Explosives Safety Standards as implemented by AFR 127-100 ensures that the general public is protected in the event of a catastrophic (worst-case) explosives mishap. Representatives of the DOD Explosives Safety Board inspect Nellis AFB and Indian Springs AFAF annually. During the 1988 inspection, two Quantity-Distance (Q-D) problems at Nellis AFB and one at Indian Springs AFAF were noted. These Q-D problems involved on-site inhabited buildings located within the required safety zone. There were no Q-D violations relative to public access (Source: DOD, 1984). Therefore, current munitions operations at Nellis AFB and Indian Springs AFAF do not affect public safety and health. Future effect is contingent on continued compliance with applicable explosive safety standards. Approval of appropriate facilities by the DOD Explosives Safety Board will ensure that all applicable explosives safety standards are met.

Fuel Storage

Compliance with requirements and procedures outlined in the Nellis AFB Spill Prevention and Response Plan and other applicable regulatory requirements was evaluated in March 1988 as part of an overall environmental assessment of Nellis AFB (Source: U.S. Air Force, 1989a) conducted in accordance with the ECAMP developed by the U.S. Air Force. The most significant finding involved failure to maintain adequate corrosion protection for underground storage tanks. This finding, in conjunction with tank age and uncertainty regarding design and contents, was deemed to pose a potential immediate threat to the environment. Other major deficiencies involved the certification of the base spill response plan (which is under revision); training of Spill Response Team members; the absence of an impervious secondary containment for the above-ground tanks; failure to comply with the notification requirements for bringing new tanks into service or retiring old ones; and not draining tanks removed from service.

Current fuel storage and distribution systems at Nellis AFB and Indian Springs AFAF could create the potential for an effect on public safety and health. All regulated UST's have had leak detection and monitoring systems installed as of June 90. Results of the tests indicated that four leaks existed and corrective actions have already been taken. Additional investigations will be made to determine the extent of contamination, and appropriate remediation, in coordination with federal and state agencies, will be implemented. Leak detection and monitoring systems for the TFWC Range complex will be installed by 1992.

All underground storage tanks used for fuel storage at the TTR have been leak tested as of July 1989 and were found to be sound, with no leaks. Only ten of these tanks are regulated, but all of the tanks are being treated as if they were regulated. The pipeline used to transfer JP-4 fuel from the bulk storage area to the runway has not leaked. However, the impressed current cathodic protection system has failed and it is being evaluated for repair or replacement. One known fuel leak has occurred on the TTR at the fire training pit. Approval of a cleanup action plan was received from NDEP in June 1990 and cleanup will resume in the near future.

The routine fuel tank leak testing program at Indian Springs AFAF ensures that significant leaks are detected in sufficient time to allow for appropriate corrective action. This program, in conjunction with the secondary containment provided for the above ground tanks, minimizes the potential for effects to public safety and health from fuel storage or spills.

Hazardous Material Bulk Storage

An evaluation of HAZMAT storage at Nellis AFB was included in the ECAMP assessment. Several deficiencies, such as the lack of a 4-inch containment beam and a self-closing fire door at Base Supply, were noted. While these deficiencies potentially affect the health and safety of some Nellis AFB personnel, there is minimal potential for effect to public health and safety.

Nellis AFB experienced only 18 reportable mishaps involving fires or explosions from 1979 to 1988. All of these mishaps were relatively minor in nature and none caused off-site injuries or property damage (Sources: U.S. Air Force, 1989b).

There are no known effects on public health and safety resulting from HAZMAT storage at the TTR.

Due to the small amounts of HAZMAT stored at Indian Springs AFAF, the potential effect to public safety and health is negligible.

The continued execution of compliance and remediation programs will ensure that there are no effects by the year 2000.

2.2.9 AIRCRAFT MISHAPS

Aircraft operations at Nellis AFB and throughout the range complex are primarily governed by Nellis AFB Regulation 55-1 and a Nellis AFB supplement to Air Force Regulation 50-46. Both regulations contain specific procedures designed to enhance flight safety and minimize risks to personnel, property, and civil aviation. Procedures include base directives for handling and investigating any flight disturbances or safety hazards reported to Nellis AFB officials. An active midair collision avoidance program includes trips by flight safety, airspace management, and air traffic control personnel to California, Utah, Arizona, and southern Nevada to inform civilian pilots of flight operations around the NAFR and associated airspace environment. Nellis AFB also hosts tours so civilian pilots can visit air traffic and range control facilities to learn first-hand how they can receive flight assistance through Nellis-related airspace.

2.2.9.1 Sources of Potential Effects

A list of Nellis AFB-related aircraft mishaps between 1980 and March 1986 indicated a total of 24 mishaps occurred during this period with 11 mishaps on public and private land, 3 on Nellis AFB, and the remainder on federally restricted land. Six of the mishaps on public and private land occurred within 10 nautical miles of Nellis AFB. This total does not include three mishaps associated with the F-117A activities at the TTR. Even though it is not known if these three mishaps occurred on public lands in Nevada, the conclusions would not change; therefore, they are not accounted for in the analysis below.

2.2.9.2 Analysis of Effects

The six-year mishap history indicates an average of 1.8 off-range military aircraft mishaps occurred per year. The area where the public would be most likely affected by an aircraft mishap is approximately 21,500 square miles, and was computed by measuring the areal extent of the TFWC ranges and the LATN areas (within Nevada) and subtracting the Federally restricted lands within this region (Nellis AFB, Small Arms Range, NAFR, NTS, and TTR). Calculations were made to estimate the occurrence of an aircraft mishap affecting people living under this area for the years 1988 and 2000 using population estimates. The analysis conducted indicates that aircraft mishaps which affect people or structures in Nevada are extremely rare due to infrequent accidents and sparse development on lands not withdrawn beneath Nellis-related airspace. Consequently, the incremental risk to the public from such activities, is not considered to be an unreasonable effect now or in the year 2000.

The six-year mishap history indicates an average of one mishap per year attributed to takeoffs and landings at Nellis AFB occurred within 10 nautical miles of Nellis AFB runways. Close to the runways, the Air Force has established Accident Potential Zones (APZ) to be used in land-use planning. APZ/I is closer to the runways than APZ/II, and presents a greater degree of risk. These APZs are published in an AICUZ (Source: U.S. Air Force, Nellis AFB, 1981) and include listings of compatible uses in each zone. These documents are made available to support current local planning efforts and year 2000 planning.

2.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

Procedures for preventing and reporting any incidents involving the loss or release of aircraft parts and ordnance are contained in Nellis AFB Regulation 55-1 and a Nellis AFB supplement to Air Force Regulation 50-46. Dropped objects or ordnance must be reported to the range control or air traffic control facilities as soon as possible with the time, location, and description of the loss. When the potential loss of an object or hung ordnance is known to the pilot, the objects are jettisoned either within the range or a designated area 6.5 statute miles north of Nellis AFB, or aircraft are recovered to Nellis AFB or Indian Springs AFAF via routes that avoid overflying populated areas. Standard precautions taken for any aircraft carrying ordnance include arming and de-arming aircraft in protective locations on the base, departing Nellis to the north away from populated areas, and keeping the master arm switches in the safe position until within range target areas. In all cases, any aircraft carrying inert/training or explosive ordnance are required to avoid overflight of populated areas to the maximum extent possible.

2.2.10.1 Sources of Potential Effects

Objects and armaments dropped on the NAFR, on which the general public is prohibited, do not represent a potential effect to the population of Nevada. Only objects and armaments dropped off the NAFR are considered in this section. Based on the recent sweep of the bombing areas associated with Naval Air Station Fallon, it was determined that the highest density of ordnance was found within five miles of targets. Targets on the NAFR are located more than five miles from public lands and are usually buffered by additional withdrawn lands. Based on very few documented instances of armaments dropped off the NAFR over the past 10 years, the current and projected rate of occurrences is estimated to be .005 off-range armament drops per 1,000 sorties. The number of dropped objects (screws, bolts, inspection covers, miscellaneous aircraft parts) is difficult to determine, but is estimated to be 1.5 objects per 1,000 sorties. The average number of sorties conducted yearly in Nellis-related airspace is approximately 60,000, and is projected to be 72,000 by the year 2000. The current (1988) and projected (2000) average number of armaments dropped off the NAFR annually is 0.3 and 0.36, respectively. The current (1988) and projected (2000) average number of objects (aircraft parts) dropped off the NAFR annually is 90 and 108, respectively.

2.2.10.2 Analysis of Effects

As a worst-case, a 2,000-pound explosive bomb would affect an area of approximately 3.9 square miles and a dropped object or inert/training bomb is estimated to effect approximately 10 square feet. The area outside of the NAFR where the public could most likely be affected by dropped objects or armaments encompasses approximately 21,500 square miles. Based on the 1988 estimates provided above, and considering the low population density in these 21,500 square miles, calculations indicate that the frequency of injury or damage to structures is due to dropped parts or ordnance is infinitesimal. The analysis suggests that dropped objects or armaments from military aircraft do not present unreasonable risks to the people and property in the areas of concern, now or in the year 2000.

2.2.11 CHAFF AND FLARES

The use of chaff and flares is controlled by Nellis AFB personnel through operating procedures governing the use of the Nellis Range.

Chaff is restricted from use over wilderness areas, WSAs, *populated areas, and* national parks. The use of rope chaff, the type that has caused interference with civilian communication systems and transmission lines in California, requires an environmental assessment. Furthermore, chaff can be restricted under adverse wind conditions . It is not used in the vicinity of civilian airways. In addition, chaff usage is coordinated with the FAA. Daily chaff restrictions can be obtained through the Nellis weather system (Source: U.S. Air Force, Nellis AFB, 1988; Dickensheets, Nellis AFB Range Group, personal communication, 1989, 1991; McMillan, Nellis AFB Range Group).

Use of flares is restricted, and minimum drop altitudes are established to prevent fires. These altitudes account for complete burnout, plus a 100-foot buffer for self-protection flares and a 500-foot buffer for illumination flares. Furthermore, illumination flares are restricted to withdrawn lands. Self-protection flares cannot be dropped within three nautical miles of wildlife refuges, forested, or populated areas. Additionally, the range is continuously monitored to assess fire hazard conditions. Minimum drop altitudes may be increased to further guard against fires; and flare usage is restricted during high fire hazard conditions, and during the fire season. (Source: U.S. Air Force, Nellis AFB, 1988 and Dickensheets, Nellis AFB Range Group, personal communication, 1989, 1991).

The Air Force is readdressing the procedures for the use of self-protection flares over public lands in MOAs. Such usage may include additional controls to prevent safety hazards. For example, minimum altitude drops for flares may be increased to 5,000 feet AGL (Source: Dickensheets, Nellis AFB Range Group, personal communication, 1991;

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2. ECONOMIC A[illegible] DEMOGRAPHIC [illegible]

Indicators of economic and demograph[illegible] [illegible] Nellis- [illegible] activities for each county in the ROI and for the ROI in [illegible] [illegible] in [illegible] 2-7. Most of the economic and demographic effects occur in C[illegible]

2.3.1.1 Employment, 1988

In Clark County, almost 4 percent of the total employment (by place of residence) is a result of direct employment in Nellis AFB activities (14,060 jobs). When indirect employment (an estimated 12,000 jobs) is added to direct employment, approximately 7 percent of the total employment in Clark County is the result of activities related to the withdrawals.

Less than 1 percent of employment by residence in Nye County or Lincoln County is accounted for by direct Nellis-related employment including Air Force personnel assigned to TTR. DOE contractor employees supporting the 37th TFW at the TTR are included in the discussion of DOE employment in Section 5.3.1.1. When indirect employment associated with Air Force employment is added to its direct employment, Nellis-related activities do not contribute substantially to employment opportunities in either Nye or Lincoln County.

2.3.1.2 Gross Regional Product and Personal Disposable Income, 1988

Purchases associated with Nellis AFB activities contributed over $800 million to the gross regional product (GRP) of Clark County in 1988. This amount represents slightly less than 6 percent of the total GRP in the county. Approximately $6 million of GRP in Nye County (less than 1 percent of total GRP) is attributable to Nellis AFB activities, while a slight portion of GRP in Lincoln County is the result of Nellis AFB.

In 1988, activities associated with the withdrawals added more than $500 million to personal disposable income (PDI) available to Clark County residents, which represents 5.6 percent of all PDI in the county. Approximately $2 million of Nye County PDI (less than 1 percent of total PDI) is the result of Nellis AFB activities. The estimate of PDI in Lincoln County which is the result of Nellis AFB is barely measurable.

2.3.1.3 Population, 1988

Direct employees and their dependents comprise almost 41,000 residents of Clark County (6.3 percent of county population). When indirect employees and their dependents are considered, approximately 10 percent of Clark County residents (almost 62,000 residents) are the result of direct and indirect employment generated by Nellis AFB activities. The total population effect in Nye or Lincoln County attributable to Nellis AFB, considering both direct and indirect workers and their dependents, is about 1 percent of the population in either county. In the ROI overall, nearly 62,000 residents are associated directly or indirectly with employment at Nellis AFB.

2.3.1.4 School-Age Population, 1988

In Clark County, almost 6,000 persons in the total direct population are estimated to be age 6 through 17. Not all of these persons would be enrolled in public schools in Clark County, which reported about 100,020 students in 1988. Nevertheless, if all of them were enrolled, they would represent almost 6 percent of Clark County School District enrollment in 1988. When the indirect population estimated to be age 6 through 17 is considered, and assuming all of these persons were enrolled in public schools, the total school-age population directly or indirectly related to activities at Nellis AFB would account for nearly 9 percent of school enrollment in Clark County.

In neither Nye nor Lincoln County does the estimated number of persons age 6 through 17 among the direct population exceed 1 percent of the county's school district enrollment. When the indirect population age 6 through 17 is included, just over 30 persons in Nye County are school-age (1.1 percent of enrollment), and 5 persons in Lincoln County are school-age (less than 1 percent of enrollment).

2.3.1.5 Economic and Demographic Effects, 2000

Comparison of Table 2-7 and Table 2-8 indicates direct military employment associated with Nellis AFB activities is expected to decrease by 1,790 jobs by year 2000, primarily as a result of the potential movement of the 37th TFW from the TTR out of Nevada, and the population related to this employment is also forecast to decrease by nearly 6,000 persons. Indirect employment and population are also forecast to decline in 2000 from 1988 levels. The general levels of employment and population are projected to increase in Clark and Nye Counties while remaining about the same in Lincoln County between 1988 and 2000. Thus, the reduced employment and population generated by Nellis AFB activities are forecast to represent a smaller percentage of total employment and population in each of the three counties in 2000 than in 1988.

By 2000, Nellis AFB activities are forecast to add more than $1 billion to GRP of Clark County and $6 million to GRP of Nye County, which represents approximately 4 percent and less than 1 percent, respectively, of total GRP in the counties. As in 1988, less than 1 percent of GRP in Lincoln County is forecast to result from Nellis AFB activities in 2000. Projections of PDI for the year 2000 indicate that $762 million will be added to Clark County by Nellis activities and about $2 million will be added to Nye County. While Nellis-generated PDI is larger in 2000 than in 1988, it represents a smaller percentage of total personal disposable income in 2000 because total PDI is expected to increase.

Because the direct and indirect population in Clark County is forecast to decline and in Nye and Lincoln Counties remain about the same size between 1988 and 2000, the size of the school-age population (age 6 through 17) is also forecast to decline or remain about the same size. However, school age population directly or indirectly attributable to Nellis AFB will represent a smaller percent of county school district enrollment in 2000 than in 1988 because of expected growth in enrollments in each of the counties.

2.3.1.6 Economic Effects of Alternative Land Use

Table 2-9 compares economic and population indicators resulting in the year 2000 from continuing the land withdrawal and use of the land for other purposes. In Clark County, an equivalent number of private sector jobs was assumed to replace direct employment at Nellis AFB. Although civilian jobs are assumed to be replaced, total employment in Clark County could be smaller under alternative land uses due to the

Table 2-7. Indicators of Economic and Demographic Effects of Nellis AFB-Related Activities, 1988.

	Clark	Nye	Lincoln	Total
Total Employment[1]	375,200	12,700	2,300	390,200
Total Population	651,400	17,700	3,600	672,700
Employment From Withdrawals[1]				
Direct Military	10,190	60	10	10,260
Direct Non-military	3,870	N/A[2]	--	3,870
Total Direct Employment	14,060	60	10	14,130
Percent of County Total	3.7	0.5	0.4	3.6
Indirect Employment	11,970	10	5	11,985
Total Employment	26,030	70	15	26,115
Percent of County Total	6.9	0.6	0.7	6.7
Gross Regional Product (millions)	$864	$6	$0.1	N/A[3]
Percent of County GRP	5.6	0.7	0.2	
Personal Disposable Income (millions)	$534	$2	$0.0	N/A[3]
Percent of County PDI	5.6	0.8	0.1	
Population From Withdrawals				
Direct Military and Dependents	34,170	220	30	34,420
Non-military and Dependents	6,720	--	--	6,720
Total Direct Population	40,890	220	30	41,140
Percent of County Total	6.3	1.2	1.0	6.1
Indirect Population	20,770	10	0	20,780
Total Population	61,660	230	40	61,920
Percent of County Total	9.5	1.3	1.0	9.2
School-Age Population[4]				
Direct Military	4,580	30	4	
Direct Non-military	1,010	--	--	
Total Direct School-age	5,590	30	4	
Percent of District Enrollment	5.6	1.0	0.4	
Indirect School-age	3,120	20	1	
Total School-age Population	8,700	32	5	
Percent of District Enrollment	8.7	1.1	0.5	

(1) Full and part-time employment (jobs) by place of residence.
(2) Direct non-military employment in Nye County from Nellis AFB employment was not explicitly available and is included in the Clark County estimates.
(3) Gross Regional Product and Personal Disposable Income are not additive across counties.
(4) Since school districts correspond to county boundaries, total is not indicated.

Table 2-8. Projected Indicators of Economic and Demographic Effects, 2000.

	Clark	Nye	Lincoln	Total
Total Employment[1]	581,320	17,260	2,370	600,950
Total Population	953,710	26,410	3,630	983,750
Employment From Withdrawals[1]				
Direct Military	8,390	70	10	8,470
Direct Non-military	3,870	N/A[2]	--	3,870
Total Direct Employment	12,260	70	10	12,340
Percent of County Total	2.1	0.4	0.5	2.1
Indirect Employment	10,880	10	5	10,895
Total Employment	23,140	80	15	23,235
Percent of County Total	4.0	0.5	0.7	3.9
Gross Regional Product (millions)	$1,061	$6	$0.3	N/A[3]
Percent of County GRP	3.5	0.3	0.3	
Personal Disposable Income (millions)	$762	$2	$0.1	N/A[3]
Percent of County PDI	4.3	0.8	0.1	
Population From Withdrawals				
Direct Military and Dependents	28,160	230	40	28,430
Non-military and Dependents	6,720	--	--	6,720
Total Direct Population	34,880	230	40	35,150
Percent of County Total	3.7	0.9	1.0	3.6
Indirect Population	17,840	15	0	17,855
Total Population	52,720	245	45	53,005
Percent of County Total	5.5	0.9	1.2	5.4
School-Age Population[4]				
Direct Military	3,780	30	4	
Direct Non-military	1,000	--	--	
Total Direct School-age	4,780	30	4	
Percent of District Enrollment	4.5	0.8	0.4	
Indirect School-age	2,960	2	1	
Total School-age Population	7,740	35	5	
Percent of District Enrollment	7.7	1.2	0.5	

(1) Full and part-time employment (jobs) by place of residence.
(2) Direct non-military employment in Nye County from Nellis AFB employment was not available and is included in the Clark County estimates.
(3) Gross Regional Product and Personal Disposable Income are not additive across counties.
(4) Since school districts correspond to county boundaries, total is not indicated.

Table 2-9. Projected Indicators of Economic and Demographic Effects Attributable to Nellis AFB Activities and Alternative Land Use, 2000.

	Nellis AFB	Alternative Use High	Alternative Use Low	Percent Difference High	Percent Difference Low
CLARK COUNTY					
Total Employment[1]	581,320	570,100	570,100	(1.9)	(1.9)
Direct Employment	12,260	3,870	3,870		
Indirect Employment	10,880	8,050	8,050		
Total	23,140	11,920	11,920		
Percent of County Total	4.0	2.1	2.1		
Population	953,710	947,110	947,110	(0.9)	(0.9)
Gross Regional Product (millions)	$30,105	$29,770	$29,770	(1.5)	(1.5)
Personal Disposable Income (millions)	$18,191	$17,957	$17,957	(1.7)	(1.7)
NYE COUNTY					
Total Employment[1]	17,260	18,870	17,300	9.3	0.2
Direct Employment	70	1,460	100		
Indirect Employment	10	220	15		
Total	80	1,680	115		
Percent of County Total	0.5	8.9	0.7		
Population	26,414	27,526	26,466	4.2	0.2
Gross Regional Product (millions)	$1,346	$1,471	$1,349	9.3	0.2
Personal Disposable Income (millions)	$529	$578	$530	9.3	0.2
LINCOLN COUNTY					
Total Employment[1]	2,370	2,360	2,360	(0.6)	(0.6)
Direct Employment	10	0	0		
Indirect Employment	5	0	0		
Total	15	0	0		
Percent	0.68	0.00	0.00		
Population	3,630	3,610	3,610	(0.5)	(0.5)
Gross Regional Product (millions)	$85	$85	$85	0.0	0.0
Personal Disposable Income (millions)	$57	$57	$57	0.0	0.0

[1] Full or part-time employment (jobs) by place of residence.

reduction of military personnel. GRP in Clark County could be about $440 million less under alternative land use, and total PDI could be approximately $300 million less. These comparisons indicate that potentially less employment, GRP, and PDI in the county would result from using the land currently withdrawn for Nellis AFB for other economic activities.

In Nye County, mining and, to a smaller extent, grazing were considered to be reasonable alternative uses of the NAFR. The Nye County direct and indirect employment generated by mining on land currently withdrawn for the NAFR could be greater than the employment generated by Nellis activities in the year 2000. As a result, county GRP could range from slightly higher to over 9 percent larger under alternative land use than with the NAFR and Nellis AFB; PDI could be up to 9 percent larger if mining were to occur on the NAFR.

Mining and grazing were investigated as possible alternative land uses for the lands withdrawn for the NAFR in Lincoln County. Livestock grazing is limited in the area. In 1985, only one rancher grazed livestock on the Groom Mountain Range under permit from the BLM (Source: BLM, 1985). Although the potential exists for mining small vein deposits of precious metals on parts of the NAFR in Lincoln County, the associated development costs are high. In addition, the potential for disseminated gold deposits in the withdrawn lands in Lincoln County is poorly known. Thus, development of either of these resources is not expected by the year 2000. Because it is assumed that little, if any, employment could be generated by these activities in the county, and because Nellis AFB and the NAFR have little economic effect in the county, there could be virtually no change in either GRP or PDI.

2.3.2 HOUSING

2.3.2.1 Nye County

The communities located near Nellis-related withdrawals are Beatty, Amargosa Valley, Pahrump, and Tonopah. Beatty is currently experiencing no housing vacancy because of mining activity in the area. Tonopah is also experiencing some growth as a result of mining activities in the area (Source: Trish Rippie, Rippie Realty, personal communication, 1989). Pahrump continues to experience growth as a result of its proximity to Las Vegas and to the NTS (Source: DOE, Office of Civilian Radioactive Waste Management, 1988). According to a recent housing inventory in southern Nye County, (Source: Carlson, 1989), there are approximately 4,000 residential units in Beatty, Amargosa Valley, and Pahrump, with 15 percent (609 units) in Beatty, 10 percent (413 units) in Amargosa Valley, and 75 percent (2,987 units) in Pahrump. A "special census" conducted in Nye County in 1985 (Source: PIC, 1987) estimated that there were 1,722 housing units in Tonopah.

An estimated 2.61 persons per household lived in southern Nye County in 1988 (Source: PIC, 1987). Direct employees at Nellis AFB and their dependents are estimated to total 218 residents of Nye County (Table 2-6). Using these estimates and dividing total Nellis AFB-related residents by persons per household, approximately 84 residential units in southern Nye County are required by individuals who work at Nellis AFB and their dependents. These 84 residential units represent slightly more than 1 percent of the housing stock of 5,730 units in Tonopah, Beatty, Amargosa Valley, and Pahrump.

With the exception of Amargosa Valley, there is no housing vacancy in southern Nye County (Source: BLM, Draft EA, Proposed Mother Lode Project, 1989). This observation may be explained, in part, by builders' cautiousness, as indicated in a recent draft environmental impact statement for a proposed mine in Nye County near Beatty (Source: BLM, 1989).

> "The uncertainty of the status of military test site operations and mining activities in the area have contributed to the tight housing market. Developers are reluctant to take substantial risks when economic conditions are volatile; they also do not have the financial resources or commitment to develop the number of housing units needed to fill the current demand."

2.3.2.2 Clark County

Between 1980, when the population of Clark County was 463,000, and 1987, when the population was 655,000, the average annual growth rate of the county ranged from 2.76 percent to 7.71 percent (Source: Clark County Department of Comprehensive Planning, 1988). Since the 1980 Census, Clark County has averaged a yearly population increase of more than 27,000 residents. In 1988, permanent housing stock in the county consisted of 266,087 residential units (Source: Ted Carrasco, Clark County Department of Comprehensive Planning, personal communication, 1989), a 3 percent increase over 1986.

Using the estimate of 651,400 residents of Clark County in 1988 (Table 2-6) and the permanent housing stock in that year, the number of persons per household in the county is estimated to be 2.45 persons. Direct employees at Nellis AFB and their dependents are estimated to total almost 41,000 residents of Clark County, of which 34,170 are direct military personnel and their dependents (Table 2-7). In 1988, Nellis AFB reported that 26.6 percent of military personnel assigned to the base and their dependents lived in base housing (Source: U.S. Air Force, TFWC, 1988a). Applying this percentage to the number of direct military personnel and their dependents indicates that 9,089 military personnel and dependents lived on base. Subtracting the number of individuals living on base (9,090) from the total direct population (40,890) resulting from Nellis AFB (Table 2-6) indicates the number of individuals directly related to Nellis AFB who reside in private housing in Clark County (31,800 residents). Dividing total Nellis AFB-related residents who reside in private housing (31,800) by persons per household (2.45) indicates that approximately 13,000 residential units in Clark County are required by individuals who work at Nellis AFB and their dependents. These 13,000 residential units represent approximately 5 percent of the total housing stock in the county.

The housing stock of the Las Vegas metropolitan area (Clark County) and in the area south of Nellis AFB is increasing. The Las Vegas metropolitan area is one of the fastest growing areas in the nation. About 14 percent of the total 1987 Las Vegas housing stock (28,365 units) was in the area immediately south of the base. The average vacancy rate for this area was 5.9 percent, with over 800 new units under construction. Mobile homes are prominent near Nellis AFB, representing 28 percent of the housing in the area (Source: U.S. Air Force, HQ TAC/URS Consultants, 1988a). Some of the housing near the base was constructed in the 1940's. While rents are apparently lower near the base than in other parts of the Las Vegas metropolitan area, the age of the housing may be partly responsible for lower rents (Source: Jim Whitworth, President, Las Vegas Board of Realtors, personal communication, 1989). The land withdrawn for Nellis AFB proper could be a prime area for real estate development, however, net effect of the base on real estate throughout the area is positive (Source: Jim Whitworth, President, Las Vegas Board of Realtors, personal communication, 1989). Thus, the existence of withdrawn land for Nellis AFB does not appear to have an effect on the overall housing stock in Clark County.

2.3.2.3 Lincoln County

Caliente, Pioche, Panaca, and Alamo are the communities in Lincoln County nearest to Nellis AFB, and virtually all Lincoln County residents live in one of these communities. In 1980, these four communities had an estimated population of approximately 3,700 residents and a housing stock of 1,672 units (Source: PIC, 1987). Population did not grow between 1980 and 1988, while the estimated housing stock increased to 1,791 residential units (Source: PIC, 1987).

An estimated 2.74 persons per household lived in Lincoln County in 1988 (Source: PIC, 1987). Direct employees at Nellis AFB and their dependents are estimated to total about 30 residents of Lincoln County (Table 2-6). Using these estimates and dividing total Nellis AFB-related residents by persons per household, over 10 residential units in the county are required by individuals who work at Nellis AFB and their dependents. These residential units represent slightly less than 1 percent of the housing stock of 1,791 units in Lincoln County.

Approximately 23 percent of all housing units were vacant in 1987 (Source: PIC, 1987). The lack of economic and population growth in the county, in general, and the large number of vacant residential units in the county indicate that Nellis AFB does not have an effect on housing in Lincoln County.

2.3.3 SERVICES

2.3.3.1 Education

Each of the counties manages a countywide school district. The enrollments, percent change in enrollments, and number of teachers and administrative staff for each district are summarized in Table 2-10 (Source: Nevada Department of Education, Research Bulletin, 1989).

The Nye County School District maintains Kindergarten (K) through Grade 8 in Amargosa Valley, Duckwater, and Round Mountain; and K through Grade 12 in Beatty, Pahrump, Tonopah, and Gabbs. Nellis AFB-related students were estimated to comprise less than 1 percent (30 students) of all enrollments in the District in 1988.

Table 2-10. Education Characteristics in Clark, Nye, and Lincoln Counties, 1988.

	Clark	Nye	Lincoln	State
Enrollment				
1987	100,027	2,878	915	168,353
1988	105,151	3,080	972	176,474
Percent Change in Enrollment				
84-85	1.9	(0.09)	(0.8)	2.2
85-86	4.3	(3.4)	2.1	4.1
86-87	4.8	9.3	4.7	4.4
87-88	5.1	7.0	6.2	4.8
Number of Teachers	4,921	166	70	8,699
Elementary & Secondary	4,252	136	50	7,470
Special Education	575	18	8	1,025
Vocational	94	12	12	204
Salary (average - 1989)	$29,599	$26,710	$27,436	$28,736
Administrative				
Non-teachers[1]	787	27	14	1,437
Salary (average - 1989)	$39,470	$38,551	$43,675	$39,975
Ratio of Teachers to Students	1:21.4	1:18.5	1:13.9	1:20.3

Source: Nevada Department of Education, 1989.

(1) Includes service personnel, principals, and assistant principals, supervisors, superintendent, and assistant superintendents.

As of 1988, the Clark County School District was the 19th largest school district in the United States (Source: U.S. Air Force, HQ TAC/URS Consultants, Socioeconomic Assessment, 1988). Further, the District was one of only three among the 20 largest in the country to have an increase rather than a decrease in enrollment. The District maintains all public primary and secondary grades (K through 12). Nellis AFB-related students were estimated to comprise almost 6 percent (5,590 students) of all enrollments in the District in 1988.

The Lincoln County School District maintains K through Grade 6 in Pioche, and K through Grade 12 in Panaca, Caliente, and Alamo. Nellis AFB-related students were estimated to comprise less than 1 percent (4 students) of all enrollments in the District in 1988.

2.3.3.2 Law Enforcement

Each of the counties provides law enforcement services through their respective County Sheriff's Office, in conjunction with other law enforcement agencies, including the Nevada Highway Patrol and various local agencies. The DOE currently contracts with the Nye County Sheriff's Department for six officers at the NTS and six officers at the TTR to assist in civilian law enforcement. Table 2-11 provides a summary of the levels of service provided within each county, including number of officers, ratio of officers to population, and officers required given the presence of Nellis AFB-related population.

Table 2-11. Law Enforcement Characteristics in Clark, Nye, and Lincoln Counties, 1988.

	Clark	Nye	Lincoln
Staff			
Commissioned Officers	1,331[1]	77[2]	21[3]
Civilian Personnel	760		
Officers to Population	1:489	1:229	1:170
Officers Attributable to Nellis AFB Population	84	1	1

Source: [1]PIC, 1988b.
[2]Joanne Epperly, Nye County Sheriff's Department.
[3]Sergeant Whitson, Nevada State Highway Patrol.

Nellis AFB maintained a security force of 560 personnel in 1985 for law enforcement on the base and range complex (Source: U.S. Air Force, 1985). Nellis AFB has formal mutual assistance agreements with civil law enforcement agencies. NAFB Plan 10, Civil Law Enforcement plan, covers these agreements.

Since 1.2 percent (218 residents) of the Nye County population is estimated to be directly related to Nellis AFB, 1 of the commissioned officers in the county is attributable to Nellis AFB population. Since 6.6 percent (40,890 residents) of the Clark County population is estimated to be directly related to Nellis AFB, 84 of the commissioned officers in the county are attributable to Nellis AFB population. Since 1 percent (about 30 residents) of the Lincoln County population is estimated to be directly related to Nellis AFB, part of one of the commissioned officers' effort in the county is attributable to Nellis AFB population.

2.3.3.3 Fire Protection

Fire protection and emergency medical technician (EMT) services are provided by each county. Nellis AFB has a fire suppression staff of 83 personnel and 3 administrative support personnel (Source: Chief McCoomb, Nellis AFB Fire Department, personal communication, 1989). The base has mutual assistance agreements with Clark County, and the cities of Las Vegas, North Las Vegas, Henderson, and Boulder City. Clark County maintains a fire station at Indian Springs and has a mutual aid agreement with Indian Springs AFAF (Source: Chief O'Donnell, Indian Springs AFAF Fire Department, personal communication, 1989). Indian Springs AFAF Fire Department had 24 paid fire-fighters in 1982 (Source: Nevada Community Services, 1985). Nellis AFB has no agreements with Lincoln or Nye counties; however, the base does have an agreement with the BLM to cover the NAFR in Lincoln and Nye Counties. Fire protection is not affected in the three counties by Nellis-related withdrawals and associated airspace. The Air Force has a fire department at the TTR with 80 personnel assigned. There are two fire stations, one each in the industrial and housing areas.

2.3.3.4 Medical Care

Nellis AFB maintains a 35-bed hospital on base to serve active military personnel, their dependents, military retirees, and their dependents. Approximately 75 percent of the hospital's service is dedicated to serving active military personnel (Source: Col. Van Sweringer, Nellis Hospital, personal communication, 1989). During the year ended September 30, 1988, the hospital had 2,662 admissions and 203,064 outpatient visits (Source: U.S. Air Force, TFWC 1988c). During the same year, almost $13 million in civilian health care (CHAMPUS) payments were made (Source: U.S. Air Force, TFWC, 1988a). CHAMPUS permits military retirees and dependents of active-duty personnel to use civilian medical care when required services are not available from military facilities. Construction of a new Air Force/Veterans Administration hospital is planned to begin in 1991, with occupancy expected by 1994.

The Nellis hospital has an informal agreement with local hospitals which provides that during national emergencies, civilian hospitals would take overflow patients from Nellis hospital. While no agreement exists to allow overflow patients from civilian hospitals to use the Nellis hospital, the base would assist if there were dire emergencies (Source: Col. Van Sweringer, Nellis Hospital, personal communication, 1989).

In 1988, medical care was provided to Nye County residents by 8 licensed physicians (Source: Claire Mowrey, State Board of Medical Examiners, personal communication, 1989), 16 registered nurses, and 43 licensed practical nurses (Source: Martha Seely, State Board of Nursing, personal communication, 1989). There is one hospital in the county, located in Tonopah, which has 21 acute care beds and 24 long-term care beds (Source: Robert Crookham, Nevada Division of Health Resources, personal communication, 1989). Given the estimate of the Nye County population in 1988 (Table 2-6), there was one licensed physician for every 2,207 residents of the county. Approximately 1 percent of the population in Nye County (218 residents) is estimated to be directly related to Nellis AFB (Table 2-6). Considering the nonmilitary licensed physicians only, one of the physicians is attributable to Nellis AFB-related residents.

In 1988, medical care was provided to Clark County residents by 871 licensed physicians (Source: Claire Mowrey, State Board of Medical Examiners, personal communication, 1989), 2,024 registered nurses, and 612 licensed practical nurses (Source: Martha Seely, State Board of Nursing, personal communication, 1989). There are eight hospitals in the county which have 1,973 beds, which is almost 60 percent of all hospital beds in Nevada (Source: Robert Crookham, Nevada Division of Health Resources, personal communication, 1989). Given the estimate of the Clark County population in 1988 (Table 2-6), there was one licensed nonmilitary physician for every 748 residents of the county. Approximately 7 percent of the population in Clark County (40,890 residents) are estimated to be directly related to Nellis AFB (Table 2-6). Given the use of the Nellis AFB hospital by active and retired military personnel in Clark County, the number of nonmilitary licensed physicians attributable to Nellis AFB-related military and nonmilitary residents cannot be calculated with existing studies.

In 1988, medical care was provided to Lincoln County residents by two licensed physicians (Source: Claire Mowrey, State Board of Medical Examiners, personal communication, 1989), seven registered nurses, and four licensed practical nurses (Source: Martha Seely, State Board of Nursing, personal communication, 1989). There is one hospital in the county, which has 6 acute care beds and 14 long-term care beds (Source: Robert Crookham, Nevada Division of Health Resources, personal communication, 1989). Given the estimate of the Lincoln County population in 1988 (Table 2-6), there was one licensed physician for every 1,786 residents of the county. Approximately 1 percent of the population in Lincoln County (about 30 residents) are estimated to be directly related to Nellis AFB (Table 2-6). Considering the nonmilitary licensed physicians only, one of the physicians is attributable to Nellis AFB-related residents.

2.3.4 PUBLIC FINANCE

County and city governments along with special districts provide the community services such as law enforcement, education, health care, and other community services. In Clark County, the county government budget includes associated unincorporated communities as well as special fund entities such as McCarran International Airport. Additional local governmental entities providing services include the incorporated cities of Las Vegas, North Las Vegas, Henderson, Boulder City, and Mesquite. Educational services are provided throughout the county by Clark County School District.

Clark County government operating revenue is composed of general, proprietary, and town and special district funds. The public finance effect of activities associated with land withdrawal and defense-related airspace are most closely related to the general fund category. General fund county government resources (revenues plus opening balances) in Clark County for FY 89 were estimated at about $234,077,000 (Source: Nevada Legislative Counsel Bureau, 1988). Incorporated city general fund resources were as follows: Boulder City ($6,467,000), Henderson ($19,008,000), Las Vegas ($104,248,000), North Las Vegas ($21,699,000), and Mesquite ($1,426,000). Of the total county and city government general fund resources in Clark County ($400,127,000), about $38,812,000 can be attributed to Nellis AFB activities. Similarly, $29,768,000 of Clark County School District resources of about $342,159,000 can be attributed to Nellis AFB. This effect on general fund resources includes education impact aid of $1,264,000 (Source: U.S. Air Force, TFWC, 1988a).

Clark County government general fund expenditures in FY 89 were budgeted at $206,441,000. The incorporated cities budgeted the following general fund expenditures: Boulder City ($5,557,000), Henderson ($17,306,000), Las Vegas ($96,622,000), North Las Vegas ($20,093,000), and Mesquite ($1,310,000). Total governmental general fund expenditures in Clark County were about $347,329,000. Of this, about $33,691,000 may be attributed to the effects of Nellis AFB activities.

General fund expenditures of Clark County School District for FY 89 were budgeted at about $337,253,000 (Source: Nevada Legislative Counsel Bureau, 1988), of which about $29,341,000 resulted from Nellis AFB activities. During the 1987-1988 school year, the District had revenues from all sources that averaged $3,812 per student and expenditures that averaged $3,901 per student. For school year 1987-1988, less than 1 percent of the total budget for the Clark County School District was met through Federal impact aid from the Public Law (P.L.) 81-874 program (Source: U.S. Air Force, HQ TAC/URS Consultants, Socioeconomic Assessment, 1988). These Federal funds are received in lieu of property taxes. The aid is based on the number of military dependent children enrolled in the school district, their place of residence, and their average daily attendance at the public schools. Slightly more than $1 million in P.L. 81-874 funding was received by the District for students who lived on or off Federal property with at least one parent who was a uniformed military employee, and almost $100,000 for students who lived off base with a civilian parent who worked for the military.

Nye County general fund resources were budgeted at $7,212,000 in FY 89, while expenditures amounted to $7,059,000. The resource effect of Nellis AFB activities was $86,000, while the expenditure effect was $85,000. The Nye County School District had fund resources of $13,044,000 and expenditures of $12,742,000 (Source: Nevada Legislative Counsel Bureau, 1988). The effects of Nellis AFB activities on these categories are about $196,000 and $191,000, respectively. During the 1987-1988 school year, the District had revenues from all sources that averaged $4,552 per student and expenditures that averaged $4,507 per student.

Lincoln County general fund resources were budgeted at $1,534,000 in FY 89, while expenditures amounted to nearly $1,387,000. Caliente had general fund resources of $303,000 and expenditures of $258,000. The resource effect of Nellis AFB activities on total governmental general funds in Lincoln County was $18,000, while the expenditure effect was about $23,000. The Lincoln County School District had general fund resources of almost $5,158,000 and expenditures of about $4,957,000 (Source: Nevada Legislative Counsel

Bureau, 1988). The effects of Nellis AFB activities on these categories are about $26,000 and $24,000, respectively. During the 1987-1988 school year, the District had revenues from all sources that averaged $5,659 per student and expenditures that averaged $5,658 per student. For school year 1987-1988, the District received $3,500 from P.L. 81-874 for Federal impact aid to school districts. This amount represented less than 1 percent of all revenues received by the District in that year (Source: Nevada Department of Taxation, 1988a).

2.3.5 LAND USE

2.3.5.1 Agriculture

Table 2-12 summarizes the agricultural characteristics of each county. Grazing and crop production is prohibited on Nellis AFB and the NAFR, except for a portion of the Groom Mountain Range withdrawal; therefore, the economic contribution of agriculture to Nye and perhaps to Lincoln Counties is probably less than could occur if the NAFR were available for agriculture. Agricultural activity in Clark County would not be likely to increase if Nellis AFB was available for agricultural use. Most of the agriculture occurs in the Moapa Valley/Overton area, which is not affected by the withdrawal-related activities.

Table 2-12. Agricultural Characteristics in Clark, Nye, and Lincoln Counties, 1986[1].

	Clark	Nye	Lincoln	State
Employment	421	213	161	5,302
Percent of Total County Employment	0.1	2	7	N/A
Percent of State Ag. Employment	8	4	3	100
Cash Receipts (millions)				
Crops/Livestock	$16.6	$5.3	$4.92	$43.9
Percent of State	7	2	2	100
Livestock (head count)				
Cattle & Calves	6,000	24,000	20,000	610,000
Sheep & Lambs	0	2,000	0	86,000

[1]Source: State of Nevada, Office of Community Services, 1988 (1986 data).

2.3.5.2 Energy and Minerals

Table 2-13 summarizes the energy and mining activities in the ROI. Mining is of greater significance to the Nye County economy than to either Clark or Lincoln counties; a review of the net proceeds for each county illustrates the relative significance of mining.

Table 2-13. Energy and Minerals Characteristics in Clark, Nye, and Lincoln Counties.

	Clark	Nye	Lincoln
Tax Revenues[1]			
(Millions)	$.237	$1.9	$0.05
Percent of Property Tax	1.0	32.0	7.4
Percent of County Budget[1]	0.02	6.5	0.5
Employment[1]			
Percent of Total	1.0	10.0	1.2
Net Proceeds[2] (millions)			
1985-1986	$3.6	$56.7	$.630
1986-1987	$3.9	$59.9	$.089
1987-1988	$5.7	$112.8	$.133

Source: [1] State of Nevada, Office of Community Services, 1988.
[2] State of Nevada Department of Taxation, Annual Report, Fiscal 1987-1988, October 1988.

Minerals mined in Nye County during 1985 (Source: State of Nevada, Office of Community Services, 1988) included gold, molybdenum, clays, silver, magnesite, stone, copper, fluorspar, barite, and lead. Currently, there is a mining boom in Nye County (Source: BLM, 1989) that could extend into the NAFR, if mining were permitted. Thus, the contribution of mining to the economy of Nye County is probably smaller than it could be if the NAFR were available for this use.

Minerals mined in Clark County during 1985 (Source: Office of Community Services, 1988) included lime, sand and gravel, gypsum, stone, gold, and silver. The effect of Nellis AFB and the NAFR on the economic contribution of mining in Clark County is probably negligible. Mining activity would probably increase on land north of the base, but the existence of the base itself does not affect mining in Clark County.

Minerals mined in Lincoln County during 1985 (Source: Office of Community Services, 1988) included gold, silver, and perlite. The effect of Nellis AFB and the NAFR withdrawals on the economic contribution of mining in Lincoln County is negligible.

2.3.5.3 Outdoor Recreation

While a variety of outdoor recreation may occur on withdrawn lands if they were publicly accessible (Section 2.7), hunting is the only activity for which economic data exist. Table 2-14 provides a summary of hunting within the ROI (Sources: Kay, 1988; Kay, 1989).

Table 2-14. Economic Aspects of Hunting in Clark, Nye, and Lincoln Counties.

	Clark	Nye	Lincoln	State
Sheep/Deer/Elk				
Hunters	340	6,252	3,252	36,275
Dollars spent (millions)	\$.163	\$1.2	\$.397	\$13.768
Percent of State Total Dollars	1.2	8.7	2.9	100
Upland Game				
Days Hunted	25,545	5,284	5,938	112,811
Dollars spent (millions)	\$.751	\$.153	\$.239	\$3.581
Percent of State Total Dollars	20.9	4.2	6.6	100
Waterfowl				
Days Hunted	13,200	5,312	5,963	70,092
Dollars spent (millions)	\$.525	\$.152	\$.191	\$1.810
Percent of State Total Dollars	29.0	7.8	10.6	100

(Source: Kay, 1988; 1989)

Since recreational activities are generally prohibited on the NAFR and given the extent of existing expenditures by big game hunters in Nye County, the economic value of hunting or other recreational activities in the county would most likely be larger if the withdrawn lands were available. Additionally, the remoteness of the NAFR would be of high value to the wilderness-seeking recreationist (Source: DOI/BLM, 1981).

Almost all of the waterfowl hunting in Clark County occurs at the north end of Lake Mead, in the Moapa Valley/Overton area. Waterfowl hunting is not affected by the existence of Nellis AFB or the NAFR. Given the presence of upland game on the mountain ranges in Clark County (Source: DOI/BLM, 1981), effects on the economic contribution by upland game hunters would likely result from the withdrawn land. The effect of the base and the NAFR on other aspects of outdoor recreation are likely to be negligible.

Given the presence of upland and big game on the NAFR in Lincoln County, the economic contribution from hunting is most likely less, given that this land is withdrawn, than it would be without the withdrawals. The effect of the base and the NAFR on other aspects of outdoor recreation is likely to be negligible.

2.3.6 ECONOMIC DEVELOPMENT

The economy of Nye County depends largely on mining and military activities. Other important sectors include government and tourism. The history of the county is largely one of economic and population changes resulting from the discovery and development of various minerals (Source: DOE, Office of Civilian Radioactive Waste Management, 1988). Under the high mining development scenario, the extent to which mining is constrained by the existence of the NAFR is probably not offset by the economic contribution of Nellis-related activities to economic development in Nye County (Section 2.3.1.6).

Clark County is a large metropolitan area with an economic structure unlike other metropolitan areas because of the gaming industry, on which it is highly dependent. Nevertheless, it has a full range of services, facilities, and amenities commonly found in urban settings and has developed into a transportation center for southwestern and western states. The existence of Nellis AFB has undoubtedly contributed to the diversification of the economic structure in Clark County by reducing the overall dependence on the gaming industry, and thereby contributing to economic development (Section 2.3.1.6).

Many Lincoln County residents are employed by some level of government, but in general Lincoln County has experienced an economic decline in its other major activities (Source: DOE, Office of Civilian Radioactive Waste Management, 1988). With the exception of limited amounts of agriculture, recreation, and mining precluded by the existence of the NAFR, Nellis-related withdrawals have most likely had neither positive nor negative effects on economic development in the county.

2.3.7 SUMMARY

The primary identifiable effect of Nellis AFB and the NAFR (including the TTR) is the constraining effect on mining and grazing in Nye County. The contribution of mining to the economy of Nye County is constrained by the existence of non-accessible, withdrawn land used for the NAFR. To the extent that economic development in Nye County is constrained, public fiscal revenues and community services are potentially less with the withdrawal than would be without the NAFR. Nellis-related withdrawn land has a limited potential for effects upon the economic contribution of agriculture, recreation, and mining in Lincoln County relative to the total contribution of these sectors to the county economy.

In general, the beneficial effects resulting from Nellis AFB and the NAFR accrue to Clark County. Given that approximately seven percent of the employed labor force in Clark County is either directly or indirectly a result of Nellis AFB activities, the base has contributed positively to the overall economic diversification in the county and, thus, has resulted in beneficial effects in the county.

Nellis AFB-related land withdrawals have little effect on the Lincoln County economy. However, the potential for limited economic contributions to the county Gross Regional Product by agriculture, recreation, and mining is precluded on withdrawn land in the county.

2.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

This section identifies effects on plants, fish, and wildlife from activities associated with Nellis AFB, NAFR, and associated airspace. The plants, fish, and wildlife considered in this section are listed in Table 1-3, in Section 1.4.3.

2.4.1 NELLIS AIR FORCE BASE AND SMALL ARMS RANGE

Vegetation of the valley floors of southern Nevada are characterized by creosote-bursage (*Larrea tridentata- Ambrosia dumosa*) and salt bush (*Atriplex spp.*) vegetation associations (Source: Bradley and Deacon, 1967). Specific vegetation characterization of the Nellis AFB is limited, and based on the vegetation descriptions in recent environmental assessments (Source: DRI, 1985a; URS Corporation, 1987). No documentation describes the vegetation on the Small Arms Range. Aside from urban landscaping and a few remaining stands of native vegetation, Nellis AFB lands are highly disturbed and occupied by a variety of non-native invasive species including Russian thistle (*Salsola iberica*), and Mediterranean grass (*Schismus barbatus*).

There are a number of plant species occurring in Clark County that are candidates for listing as threatened or endangered. An off-season survey in 1985 of the Eastside Development on Nellis AFB (Source: DRI, 1985a) did not reveal any of the nine candidate species known to occur in the vicinity of the base. Given the disturbed nature of the area, the presence of sensitive species is unlikely, however, additional surveys during the growing season would be required to provide verification. The Small Arms Range has not been surveyed for rare plant species.

Nellis AFB has affected wildlife and vegetation resources in Nevada through urbanization of the base which has occurred steadily since 1929. Given the proximity of the base to Las Vegas, and the large population growth occurring in southern Nevada, it is likely that these effects would have occurred without Nellis AFB. The past use of the Small Arms Range as a pistol and target range has resulted in an unquantified amount of disturbance to the native wildlife and vegetation.

Ground surface activity resulting from base operations may be responsible for some habitat disturbance in the area. Also, toxic residuals derived from munitions use on Nellis

Small Arms Range and from aircraft ground servicing at Nellis AFB could be detrimental to wildlife in the area. The available information does not allow determination of the magnitude of effect, if any. Military aircraft use of Nellis AFB may result in noise impacts on wildlife populations on or near the base, but the net effect of these disturbances cannot be determined based on the existing information.

Effects on local ecosystem components by off-base activities associated with the Nellis AFB and its personnel is difficult to quantify due to the much larger civilian population resident within the Las Vegas Valley.

Wildlife species (for which mapped ranges were available) that may be affected by activities in the Nellis AFB and Small Arms Range withdrawals include the American kestrel, barn owl, burrowing owl, kit fox, gray fox, and Gambel's quail. However, not more than 1 percent of the range of any of these species is located within either withdrawal.

The desert tortoise was recently listed as threatened by the U.S. Fish and Wildlife Service (Federal Register, Volume 55, Number 63, April 2, 1990). Known desert tortoise range occurs throughout Clark County below elevations of approximately 4,000 feet. Tortoise habitat and this range tends to overlap with Nellis AFB and Small Arms Range withdrawals. Tortoises may be subject to effects from base operational activities, especially from increased human presence in the area. Populations of this long-lived species are generally threatened by illegal collection and off-road vehicle use in their habitat range. Furthermore, alteration of vegetation communities by human activities may reduce survivorship by decreasing food availability, access to burrows, cover, or predation resistance. None of these effects on tortoise have been quantified in this area. The human population associated with Nellis AFB is small in comparison to the population of the Las Vegas Valley metropolitan area.

Proposed changes in the boundaries of the Small Arms Range would result in the return of 5,789 acres to the BLM. When this change occurs, the BLM will evaluate the conditions of the natural resources to determine future use of the area. Effects on plants, fish and wildlife resources projected to the year 2000 are not expected to intensify, given the urbanized condition of Nellis AFB, and the expected reduction in size of the Small Arms Range.

2.4.2 NELLIS AIR FORCE RANGE

The NAFR is managed for natural resources pursuant to the Federal Land Policy Management Act (FLPMA), National Environmental Policy Act (NEPA), BLM planning regulations, and the Council on Environmental Quality (CEQ) regulations (Source: DOI/BLM, 1989). Management is performed by USFWS and BLM under two MOUs and a series of cooperative agreements.

The USFWS manages the Desert National Wildlife Refuge (NWR), which was established in 1936 and encompasses over 1.5 million acres in southern Nevada. The western half of Desert NWR is coincident with most of the South Range of the NAFR. Air Force operations within the boundary of Desert NWR are conducted in accordance with the

1961 Memorandum of Understanding between the Air Force and Department of the Interior. The primary management objectives of Desert NWR are to "preserve and protect natural environmental qualities vital to the perpetuation of an optimum population of desert bighorn sheep and other native wildlife" (Source: DOI/BLM, 1979). Public access and use of the overlap area is restricted to a desert bighorn sheep hunting period during the last two weeks of December.

The Nevada Wild Horse Range, 394,000 acres located in the north-central portion of the NAFR, is managed by BLM under a 1974 cooperative agreement in compliance with the Wild Horse and Burro Act of 1971 (P.L. 92-195), which requires a cooperative agreement for wild horses occupying jointly managed lands. In 1962, wild horse numbers were estimated at 200 head, "mainly in the area designated as the Nevada Wild Horse Range" (BLM 1984). In 1984, the population on NAFR, in and around the Nevada Wild Horse Range, was estimated at 4,890 head on 1,780,000 acres. The 1988 aerial census of the NAFR revealed a population of 6,233 wild horses, which represents a population 300 percent in excess of the appropriate management level recommended in the Nevada Wild Horse Range Herd Management Area Plan, present in an area approximately 4.5 times the size of the Nevada Wild Horse Range. The aerial census of 1991 estimated area horse numbers at 4,302 individuals, suggesting that horses may have moved out of the area. The goal of P.L. 92-195 is to protect wild horses by requiring adherence to the principles of multiple use, sustained yield, and environmental quality. It also protects them from unauthorized actions and requires management of their habitat to achieve and maintain an ecological balance and a population of sound, healthy individuals (Source: DOI/BLM, 1979). The 1974 cooperative agreement is intended to meet these requirements to the extent possible.

In addition to the two management areas described above, a Five-Party Cooperative Agreement was drafted in 1977 to provide overall protection, development and management of fish, wildlife, vegetation, watershed, and wild horses and burros on the NAFR, TTR, and the NTS. The terms of this agreement stipulated the establishment of a resource management plan for the NAFR. Under the preferred alternative of the draft plan, approximately 4,000 wild horses would be removed from 63 percent of the planning area not included in the Nevada Wild Horse Range. Soils, vegetation and wildlife habitat conditions are expected to improve as a result of this action.

The vegetation of the NAFR is characterized by floral elements of the Great Basin Desert in the North Ranges, and the Mojave Desert in the South Ranges, as well as transitional associations between the two desert types. In general, plant associations vary geographically and with elevation (Source: DOI/BLM, 1989). Alluvial deposits of the North Ranges are characterized vegetationally by a mosaic of high elevation shrub communities typically comprised of sagebrush (*Artemisia spp.*) rabbitbrush (*Chrysothamnus spp.*), horsebrush (*Tetradymia spp.*), and other shrub species. On the South Ranges creosote bush and bursage are the dominant species of the valley floors and lower bajadas between 500 and 4,200 foot elevation. This plant association may also be found up to 5,000 feet on arid south-facing slopes and small, isolated mountains; and may occur as small isolated stands as high as 6,000 feet. The blackbrush (*Coleogyne ramosissima*) community occurs on the upper bajadas at elevations of about 4,200 to 6,000 feet (Source: Bradley and Deacon, 1967). Salt bush communities are present in poorly drained soils, particularly along dry lake bed perimeters, on the North and South Ranges. These areas are typically characterized by shadscale (*Atriplex confertifolia*) and four-winged saltbush (*A. canescens*). Pinyon-juniper associations and mountain mahogany associations are typically found at the higher elevations of both the North and the South ranges.

Portions of the NAFR have been surveyed over the years for the presence of listed and candidate plant species and populations. These surveys include surveys of the Desert NWR (Source: Ackerman, 1981), TTR (Source: Rhoads et al., 1979), Groom Mountain Range (Source: U.S. Air Force, HQ TAC, 1986), and the North Ranges (Source: WESTEC, 1981). In addition, surveys for Beatley's milkvetch (*Astragalus beatleyae*) have been conducted in selected areas of the North Ranges (Source: O'Farrell and Collins, 1984). In 1989, none of the 29 species that have been surveyed over the preceding 10 years were formally listed as threatened or endangered, however, 17 species were candidates for listing, and one species (the Beatley's milkvetch) had attained Candidate Category 1 status, indicating that substantial information is available to support formally listing the species as threatened or endangered. Candidate species known to occur on the NAFR are listed in Table 2-15.

The Nevada Wild Horse Range, and other wild horse use areas comprise a substantial portion of the North Ranges. Major horse use areas include the Kawich Valley, Cactus Flat/Gold Flat, Goldfield Hills, and Stonewall Mountain areas. The present overpopulation of wild horses in these areas has and will continue to result in heavy-to-severe grazing within a one-quarter mile radius of water sources, and moderate-to-heavy grazing extending out to a 4.5 mile radius. A BLM assessment (Source: DOI/BLM, 1989) concluded that vigor and reproduction (including seed production, germination, and establishment) of the existing plant communities are decreasing, and weedy invader species are becoming established in some areas of the NAFR as a result of grazing pressure from wild horses.

In 1988 a total of 61 wild horses were poisoned on the TTR through an operator error related to clean-out of a hopper truck that contained runway deicing urea granules. The flushed-out fluid was spilled onto the ground and allowed to collect into pools which were used by the horses, resulting in toxic concentrations of blood ammonia levels. Corrective actions have been taken to preclude future similar problems.

The BLM preferred alternative for land management of the North Ranges would result in a reduction of wild horse numbers to the thriving ecological balance on the Nevada Wild Horse Range, and removal of horses from areas outside the Wild Horse Range. This action as well as other management actions would reduce and redistribute grazing pressure on 394,000 acres, and eliminate grazing pressure on 1,390,000 acres. (Source: DOI/BLM, 1989). Other BLM proposed actions for improving vegetation resources include livestock grazing improvements on the Bald Mountain Allotment, and construction of fences to protect riparian vegetation on Breen Creek from grazing.

The great vegetational diversity on the NAFR provides habitat for wildlife, which is also diverse and frequently abundant. The range overlap analysis conducted for this report

Table 2-15. Sensitive Plant Species Known to Occur in the Vicinity of Nellis AFR.

Species	Federal Status
Arctomecon merriamii	C2
Asclepias eastwoodiana	C2
Astragalus beatleyae	C1
Astragalus funereus	C2
Astragalus musimonum	C2
Camissonia megalantha	C2
Cymopterus ripleyi var. saniculoides	C2
Erigeron ovinus	C2
Frasera pahutensis	C2
Galium hilendiae var. kingstonense	C2
Lewisia maguirei	C2
Penstemon arenarius	C2
Penstemon fruiticiformis var. amargosae	C2
Penstemon pahutensis	C2
Penstemon pudicus	C2
Phacelia beatleyae	C2
Townsendia jonesii var. tumulosa	C2

C1: Indicates that there is substantial information available to support the biological appropriateness of proposing to list the species as endangered or threatened.

C2: Indicates that proposing to list as threatened or endangered is possibly appropriate, but conclusive data on biological vulnerability and threat are not currently available to support the proposed rules.

indicated that between 5 and 10 percent of the total Nevada range of three species (the pronghorn antelope, kit fox, and gray fox) lies within the NAFR. Less than 5 percent of the ranges of the mountain lion, bighorn sheep, and burro are located within this area. Over 6 percent of the raptor migration routes in Nevada are located over the NAFR. Mule deer are reported widespread throughout the Groom Mountain Range as well as in other portions of the North Ranges. The Groom Mountain Range chukar population is considered the best in Lincoln County (Source: U.S. Air Force, HQ TAC, 1986).

Wildlife and vegetation resources on the NAFR are likely to be locally affected in areas where ordnance delivery, associated reconnaissance, and construction activities occur. The extent of ground disturbance and overflight activities produce the potential for effects on wildlife populations. The large land area involved indicates that individuals in many wildlife populations may be subjected to military activities over their entire home range, which could reduce opportunities for dispersal in affected areas. The effect could be especially important for species (such as small rodents, birds, and reptiles) having populations that exhibit large fluctuations or exist in small, isolated habitat islands. Probable effects on wildlife populations from such factors cannot be quantified based on existing information.

Use of explosive munitions and testing of weapons systems on the NAFR introduces the potential for release of toxic materials into the environment. Wildlife population responses to this hazard have not been investigated in previous studies, therefore, the potential effects on these populations cannot be determined.

Existing threats to the survival of sensitive plant populations on the NAFR include bombing, construction, and ground reconnaissance activities associated with bombing. As stated in the Five Party Cooperative Agreement, bombing is not allowed above 3,600 feet elevation in Three Lakes Valley and above 4,000 feet in Indian Springs Valley. Many sensitive plant populations are found in the southern mountain ranges of the NAFR. Threats to these plant populations are minimal, provided ordnance dropping activities continue to be restricted to the valleys. Other populations of sensitive plant species, however, may exist in the valleys. For example, the valleys associated with the Halfpint Range on the Desert NWR are known habitat for two threatened plant species, *Astragalus funereus* and *Phacelia beatleyae* (Source: Ackerman, 1981).

Habitat of the threatened desert tortoise on the NAFR may occur below 4,000 feet in the Mojave Desert (i.e., the valleys and bajadas of the South Ranges). Types of activities that are potentially harmful to this species are described in Section 2.4.1. Ground disturbances by NAFR activities in desert tortoise habitat may affect this species. In recognition of the recent listing of the desert tortoise as a threatened species, USFWS recently completed an investigation of the status and distribution of the tortoise on portions of the DNWR that are non-coincident with the NAFR. Section 7 (endangered species) consultation with USFWS has been initiated by the NAFR, and programs are presently being developed and initiated by NAFR, in conjunction with efforts on the DNWR, to conduct a similar program for tortoise habitats on the portion of the DNWR coincident with the NAFR, as well as other potential habitats on the NAFR. In the interim, site-specific tortoise surveys and relocation efforts have been initiated for new target areas on the NAFR in order to comply with the Endangered Species Act.

Effects of supersonic operations on wildlife inhabiting the Desert NWR have not been quantitatively studied in the past. Casual observation by aircrew members reveals that bighorn sheep may react to sonic booms by "momentary concern, or stampeding for a short distance" (Source: DOI/BLM, 1979). One study reports that, desert bighorn sheep have been observed to offer no reaction to single sonic booms. Multiple sonic booms repeated several times a day with increasing frequency might possibly cause mule deer to become edgy and move around more; but, the effects of these events on breeding behavior is unknown (Source: U.S. Air Force, Nellis AFB, 1977). After a thorough review of the literature, the Air Force concluded in 1977, "data on animal responses to noise are insufficient to enable accurate deductions of potential impacts arising from range operations. There is particular uncertainty regarding the effects that might arise from long-term protracted exposure" (Source: U.S. Air Force, Nellis AFB, 1977).

Portions of the NAFR have been used for supersonic operations since 1955, without change in size or constituency of the bighorn population over a 25-year period. USFWS records from 1947 to about 1980 showed little change in the average population size of 1,500 sheep on the Desert National Wildlife Range (NWR). If reproductive success is a sensitive indicator of noise-induced effect, then it can be concluded that operations are not having an effect on the bighorn populations on Desert NWR (Source: DOI/BLM, 1979). New studies of noise effects on desert bighorn sheep are presently being conducted on the Nellis AFR (Section 8.4.5).

One positive aspect to the NAFR land withdrawal is that some areas are protected from effects of public use, such as on and off-road travel into remote areas. For example, the Groom Mountain Range was withdrawn in 1984 to provide a public safety and security buffer zone for national defense programs conducted on the NAFR (Source: U.S. Air Force, HQ TAC, 1986). The withdrawal of this area, as well as other lands within the NAFR for uses that do not disturb the natural environment, are considered a positive effect on wildlife resources since such closures eliminate some types of public effects. A measure implemented to compensate for loss of hunting on the Groom Mountain Range was the construction of wildlife watering structures (guzzlers) in locations off the withdrawal. This action is also considered a positive effect on wildlife. Effects on plants, fish and wildlife resources projected to the year 2000 are not expected to increase since changes in existing boundaries and activities of NAFR are not anticipated.

2.4.3 AIRSPACE

Analyses conducted for this report indicate that 13 percent of the historic Nevada range of the endangered peregrine falcon and 6 percent of the Nevada range of the endangered bald eagle are located under the Desert MOA and LATN areas. Of these percentages, six and two percent, respectively, are located beneath the LATN areas, which receive substantially less use than the Desert MOA. A portion of the Nevada range of the threatened desert tortoise is located under the NAFR complex and the LATN areas, in areas dominated by creosote bush, i.e., areas below approximately 4,200 feet elevation, except for playas. The amount and category of tortoise habitat located beneath the NAFR has not been fully assessed, therefore, it was not possible to accurately determine the actual percentage of habitat overlaid by Nellis airspace.

Substantial quantities of habitats for 22 other raptor species are also located under these reservations. More than 20 percent of all Nevada habitat of the flammulated owl and pygmy owl are located under the Desert MOA, suggesting that substantial numbers of the Nevada population of these species are exposed to supersonic noise and other aircraft disturbances. Some raptors may be sensitive to low-level flight activities, although the magnitude of the potential for adverse behavioral responses and possible collision by raptors with aircraft cannot be determined based on available information.

Greater than 10 percent of the range of mule deer, kit fox, gray fox, mountain lion, wild horse and Gambel's quail may be affected by supersonic operations in the Desert MOA.

Portions of the Pacific Flyway located beneath airspace associated with the Nellis AFB mission, are managed by the Pahranagat National Wildlife Refuge (NWR), Kirch Wildlife Management Area and other State wildlife management areas. Pahranagat NWR personnel have noted that low-flying aircraft over the refuge frequently cause nesting waterfowl to flush (Source: U.S. Air Force, Nellis AFB, 1977). The effects of disturbances at these specific locations have not been studied. The Air Force has placed restrictions on supersonic operations over some wildlife refuges in southern Nevada (Source: U.S. Air Force, HQ TAC, 1988d). Overflight of NWRs and WMAs in the vicinity of Nellis Air Force Range, including Desert NWR, Pahranagat NWR, Moapa NWR, Key Pittman WMA and Railroad Valley WMA, is restricted to a 2000 ft ceiling (5000 ft for supersonic operations). Aircraft are directed to avoid Pahranagat NWR, an important migratory stop-over, by 1 NM.

Southern Nevada provides habitat for many endemic species in the isolated springs of Ash Meadows National Wildlife Refuge, located under LATN West; and, Pahranagat and Moapa National Wildlife Refuges, both located under the Desert MOA. These refuges contain a high concentration of unique organisms which have evolved in isolation over the last few thousand years. Ten species of threatened and endangered fishes are exposed to defense-related aircraft overflights. The ranges of four of these species are located entirely under the Desert MOA, while the range of the other six species are located under LATN West.

Endemic fish populations located under supersonic use areas of the Desert MOA could experience noise events that may or may not be detrimental to the survival of the species. The low use of LATN West however, suggests that fish populations located under this reservation are far less likely to experience detrimental noise events. Previous studies have not examined responses of native fishes to aircraft noises, and the magnitudes of potential effects are unknown. However, studies of closely related fish species have found reduced egg viability and growth rates in populations subjected to noise (Source: Banner and Hyatt, 1973). Other studies with more distantly related species found that noise startled fish and caused avoidance reactions (Source: Schwartz and Greer, 1984). Protected fish in the State of Nevada are generally found in small isolated habitats capable of maintaining only limited populations. This distribution increases the risk of relatively small-scale, localized disturbances having effects on a large proportion of individuals in the species.

Proposed changes in military use of airspace in the vicinity of Nellis AFB and the NAFR are relatively minor in terms of effects to fish and wildlife resources. These changes include an expansion of R-4807, lowering of the floor, and extension of MTR IR-286, a boundary shift of R-4808 West and EC South, and redesignation of R-4807S to enable scheduling changes. No additional major effects to fish and wildlife resources are expected through the year 2000 as a result of proposed changes to Nellis airspace.

2.4.4 SUMMARY

Quantitative studies examining the effects of NAFR activities on vegetation resources and fish and wildlife populations have not been conducted. Effects from the major activities occurring within these withdrawals include ground surface disturbances by ordnance deposition and noise occurrences by subsonic and supersonic flight. Supersonic use of the NAFR and the Desert MOA may affect some fish and wildlife species inhabiting the area. Species of specific concern are the desert tortoise, endemic desert fish species, and waterfowl dependent on the migratory stop-over areas located beneath the Desert MOA. In particular, the threatened status of the desert tortoise in southern Nevada indicates that the continued survival of the species is of critical concern. Activities on the NAFR, as well as all other activities, could affect the survival of the species. The overall effects of activities associated with operations at Nellis on wildlife populations cannot be determined based on available information.

2.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

This section describes impacts on cultural and historical properties from activities associated with Nellis AFB, the NAFR, and associated airspace. Nellis AFB has conducted cultural resource surveys and consulted with the State Historical Preservation Office (SHPO) on all proposed target sites on the Range Complex. Recorded archaeological and historical records were searched for this report, and a summary of previously conducted inventories, surveys, record searches, and overviews is provided in Table 2-16.

2.5.1 NELLIS AIR FORCE BASE AND SMALL ARMS RANGE

Nellis AFB has been heavily affected by land disturbance (Sources: U.S. Air Force, TFWC, 1987; U.S. Air Force, 1985); the Small Arms Range has experienced an unknown amount of direct and indirect land disturbance. Six surveys, two cultural resource overviews, and an inventory of World War II structures have been prepared for lands on or adjacent to Nellis AFB and the Small Arms Range (Table 2-16). These studies incorporate approximately 3.5 percent of the withdrawn area and have identified two National Register eligible historic sites in the archaeologist's opinion: building 805 (Base Operations) on Nellis AFB and the Kyle Ranch in North Las Vegas. Based on Rafferty's examination of similar environments in the Las Vegas Valley and the limited surveys on and around Nellis AFB and the Small Arms Range, it is not likely that major cultural resources of National Register eligibility occurred in the previously disturbed areas (Source: Rafferty, 1984). Since most areas on Nellis AFB and Small Arms Range were not examined for cultural resources prior to being disturbed, it is not possible to determine if any cultural resources were affected. There are no impacts to known, recorded cultural resources on the base or Small Arms Range. The Air Force and BLM met and briefed the Chairman of the Intertribal Council on September 25, 1990, on the preliminary findings of the Special Nevada Report. As a result of that meeting, the Chairman scheduled another briefing with tribal members for mid-December 1990.

Table 2-16. Cultural Resources Studies, Nellis AFB and Nellis Air Force Range Complex.

Project Name	Acres Studied	Type of Study(1)	Sites Recorded	Reference
Nellis AFB/Small Arms Range				
Red Flag and Hospital Parcels	79.90	III	0	Retrospect, 1988
Railroad Spur Right-of-Way	3.20	III	0	ERC (no date)
Eastside Development	164.00	III	0	DRI, EA, 1987
Clewlow Survey, FPC Area II	70.00	III	0	USAF, HQ TAC, 1988
			0	& USAF, Nellis AFB, 1988
Hatoff Survey, Area II	80.00	III	0	BLM 5-102
Kern River Pipeline Overview	N/A	I	0	Dames and Moore, 1986
R&PP Application N-43395	2,280.00	III	0	Zale, Cook, and Lohse 1986
Las Vegas Valley Overview	N/A	I	0	Rafferty, 1984
Range 61 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	480	II	6	Bergin, et al., 1979
Range 62 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	1,600	II	30	Bergin, et al., 1979
UNLV Crownover Survey	1,001	III	24	UNLV, 1981 & UNLV, Vol. 1, 1980
IIRM Range 62	720	III	1	Durand, Reno, and McLane, 1988a
Range 63 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	400	II	4	Bergin et al., 1979
UNLV Crownover Survey	3,952	II	230	UNLV, 1981 & UNLV, Vol. 1, 1980
Electronic Warfare Survey	4	III	1	UNLV, 1979
LLLGB Survey	17	III	0	Durand, Reno, and McLane, 1988a
Range 64 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	1,280	II	12	Bergin et al., 1979
UNLV Crownover Survey	703	II	57	UNLV, 1981 & UNLV, Vol. 2, 1980
Range 65 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	320	II	8	Bergin et al., 1979
UNLV Crownover Survey 65-1	3,168	II	161	UNLV, 1981 & UNLV, Vol. 2, 1980
UNLV Crownover Survey 65-2	1,238	II	10	UNLV, 1981 & UNLV, Vol. 2, 1980
Range 71 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	3,520	II	35	Bergin et al., 1979
UNLV Crownover Survey	754	III	3	UNLV, 1981 & UNLV, Vol. 3, 1980

Table 2-16. Cultural Resources Studies, Nellis AFB and Nellis Air Force Range Complex (continued).

Project Name	Acres Studied	Type of Study(1)	Sites Recorded	Reference
Target 71-13 Survey	23	III	0	Reno, 1989b
Fence Line Survey	65	III	0	Brooks, Larson and King, 1976
Federick Rocket Car Test	1.5	III	0	BLM #5-316
EC East Range (Nellis Air Force Range Complex)				
TEWR Sites Survey #1	402	III	3	Henton, 1984l
TEWR Sites Survey #2	179	III	0	Henton, 1985d
Tower Site Survey near P-2	45	III	1	Henton, 1986g
Site P-31	34.5	III	0	McLane and Reno, 1989
TEWR Expansion	57	III	0	Reno, 1989
Wild Horse Ranch Survey	55	III	3	Budy, 1980a
Wild Horse Range Pipeline	survey in vehicle		0	Hatoff, 1976
UNLV Bergin et al., 1979 Sample Survey	1,840	II	36	Bergin et al., 1979
UNLV Crownover Survey	477	II	21	UNLV, 1981 & UNLV, Vol. 3, 1980
UNLV Ellis EW Site Survey	6	III	5	UNLV, 1979
MC EC East Survey, 1988	22	III	0	Durand, Reno, and McLane, 1988a
Range 74 (Nellis Air Force Range Complex)				
Brooks Survey, 1978	44	III	0	Brooks, Ellis, and Wilson, 1978
UNLV Bergin et al., 1979 Sample Survey	2,650	II	69	Bergin et al., 1979
UNLV Crownover Survey	8,450	II	126	UNLV, 1981 & UNLV, Vol. 3, 1980
Wheeler's, 1940 Surveys	Unknown	I	2	UNLV, 1984
Seafarer Survey	Unknown	I	3	NESC, 1977 & EDAW, not dated
RMS Antennae Survey	1.8	III	0	Rolf, 1978b
Range 75 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	2,080	II	31	Bergin et al., 1979
UNLV Crownover Survey	9,255	II	263	UNLV, 1981 & UNLV, Vol. 3, 1980
Seafarer Survey	Unknown	I	1	NESC, 1977
DRI Survey of 38 Targets	1,108	III	13	Henton, 1984d
Range 76 (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	2,960	II	52	Bergin et al., 1979
UNLV Crownover Survey	4,215	II	110	UNLV, 1981 & UNLV, Vol. 5, 1980
Seafarer Survey	Unknown	I	1	NESC, 1977
UNLV Ellis EW Site Survey	8	III	1	UNLV, 1979 & UNLV, Vol. 5, 1980

Table 2-16. Cultural Resources Studies, Nellis AFB and Nellis Air Force Range Complex (continued).

Project Name	Acres Studied	Type of Study[1]	Sites Recorded	Reference
DRI Survey of 38 Targets	1,108	III	21	Henton, 1984d
RMS Antennae Survey	1.8	III	0	Rolf, 1978b
Gapfiller Radar Site Survey	40	III	1	Rolf, 1978a
Range EC South (Nellis Air Force Range Complex)				
UNLV Bergin et al., 1979 Sample Survey	320	II	10	Bergin et al., 1979
FOL EC South	143	III	7	Durand, Reno, and McLane 1988a
Yucca Mountain Transfer	3,500	III	92	DRI Records
Groom Mountain (Nellis Air Force Range Complex)				
Final Environmental Impact Statement	5,376	III	268	BLM, 1985
Indian Springs Air Force Auxiliary Field				
N-25225, R&PP Application[2]	2.5	III	0	Martin, 1980
IS Roadway R/W N-27763[2]	Unknown	III	0	Rolf, 1975
12-5 KV Powerline N-30598[2]	0.1	III	0	Liebhauser, 1981
NC&NDAG R&PP[2]	2.5	III	0	Rafferty, 1982
R&PP Lease N-38127[2]	2.2	III	0	Sparks, 1984
R&PP Lease N-41004[2]	44.4	III	0	Zale, 1985
Runway Extension	80.7	III	3	Simmons and Lockett, 1986
Munitions Facility	100.0	III	0	Simmons and Orser, 1986
Six Parcels on NAFB	154.0	III	6	Durand, Reno, and McLane, 1988a

(1) Type I studies consist only of overviews of existing information. Type II studies consist of reconnaissance of a sample of a study area. Type III studies consist of surveys covering the entire study area.
(2) Surveys conducted outside of military reservation boundaries.

2.5.2 NELLIS AIR FORCE RANGE

A brief description of the types of land disturbing activities, previously identified cultural resources and known impacts on those resources that occur on the various subranges is provided to indicate the potential for impacts on cultural and historical properties on the NAFR. The highly diverse environment encompassed by the range includes numerous flora, faunal, geological and mineral resources that have attracted both prehistoric and historic populations to the area during the last 12,000 years. The range also encompasses over 14 important historic mining districts, most of which were established during the turn of the century (Source: Bergin et al., 1979).

Range 61 is used as a tactical firepower demonstration range using explosive ordnance (Source: UNLV, 1979). Cultural resource surveys were not conducted in advance of the land disturbance on Range 61, however, approximately 0.3 percent (480 acres) of this range has been surveyed since its development. Based on these samples, it is not possible to estimate the nature of cultural resources occurring on the range or the extent of impacts on those resources.

Range 62 is an unmanned tactical range with live ordnance allowed on specific targets (Source: UNLV, 1979). Approximately 1.8 percent (3,321 acres) has been surveyed for cultural resources; 720 acres of which were examined in advance of defense-related activities (Sources: UNLV, 1979; UNLV, 1980a; Durand et al., 1988). The records search indicated a total of 55 recorded sites on Range 62. These sites include 17 isolated artifacts, 19 lithic scatters, 5 toolstone quarries, 4 open temporary camps and 3 temporary camps in rock shelters.

Range 63 is an instrumented, manned, explosive bombing and gunnery range used for testing and evaluating new weapons systems (Source: DOI/BLM, 1981). Heavy ordnance contamination has occurred over large areas (Sources: DOI/BLM, 1981; UNLV, 1980a; Bergin et al., 1979). Approximately 2.5 percent (4,373 acres) has been surveyed for cultural resources but only 21 acres were examined in advance of defense-related activities. The records search indicated a total of 236 recorded sites on Range 63. These sites include only one historic age property. Prehistoric sites consist of 95 temporary camps, most containing hearths and located on or near the playa margins, 50 lithic scatters, 88 isolated finds and 3 limited activity localities.

Range 64 is an unmanned tactical range on which explosive ordnance is used (Source: DOI/BLM, 1981). About 0.5 percent (1,983 acres) has been surveyed for cultural resources; 703 acres have been proposed for target construction. The records search indicated a total of 71 recorded sites on Range 64. These sites include one historic resource, one prehistoric campsite, 25 lithic scatters, 3 toolstone quarries, 40 isolated artifacts and one petroglyph locality.

Range 65 is a manned, instrumented range on which inert/training ordnance only is used (Source: DOI/BLM, 1981). In total, 5.1 percent (4,726 acres) has been surveyed for cultural resources. The records search indicated a total of 182 recorded sites on Range 65. Two sites, Pintwater Cave and the Tim Spring petroglyph site, are listed in the National Register of Historic Places. The remaining sites include 4 historic properties, 32 prehistoric campsites, 71 lithic scatters, a toolstone quarry, 3 limited activity localities, and 69 isolated artifacts.

Range 71 is a radar bombing range on which, except for flares, rockets, and 20-30 mm ammunition, only inert/training ordnance is currently used (Source: DOI/BLM, 1981). Approximately 2.8 percent (4,364 acres) has been surveyed for cultural resources. The records search indicated a total of 47 recorded sites on Range 71. These sites consist of 16 historic properties, including early 20th Century boom towns, and 31 prehistoric properties. The prehistoric properties include 4 temporary camps, 7 lithic scatters, 7 localities, one displaying petroglyph panels, and 13 isolated artifacts.

The EC East Range is a manned electronic warfare range, previously used as a radar bombing range. No ordnance except flares and chaff is authorized (Source: DOI/BLM, 1981). In total, about 1.8 percent (3,117 acres) has been surveyed for cultural resources. The records search indicated a total of 65 recorded sites on the EC East Range. Five of these sites, including Gold Reed and the Wild Horse Ranch, are historic in age, 5 are prehistoric campsites, 10 are lithic scatters, 11 are specialized activity localities, and 34 are isolated prehistoric artifacts.

Range 74 is a visual bombing and gunnery practice range. Except for flares, rockets and 20-30 mm ammunition, inert/training ordnance is used on all but the simulated airfield target; explosive ordnance is used on that target. About 3 percent (11,146 acres) has been surveyed for cultural resources. Of that sample, 8,496 acres have been surveyed for potential impacts due to the construction activities. The records search indicated a total of 198 recorded sites on Range 74. Thirteen of the recorded sites are prehistoric temporary camps, 46 are lithic scatters four are limited activity localities, 7 represent ancient toolstone quarries and 104 are isolated artifacts. The 24 historic Euroamerican sites recorded include Johnnies Water, the Cliff Spring Ranch, Wheelbarrow Peak ruins, Oak Springs Butte Mine and the Indian Spring Ranch.

Range 75 is used primarily for visual bombing and gunnery practice with explosive ordnance (Source: DOI/BLM, 1981). About 6 percent (12,443 acres) of the range has been surveyed for cultural resources; to 363 acres of which were examined in areas of target construction. The records search indicated a total of 307 recorded sites on Range 75. These records include six prehistoric temporary camps, 84 lithic scatters, six toolstone quarries, 17 limited activity localities, and 188 isolated artifacts. Historic Euroamerican sites include two ranches at Gold Flat Wells No. 1 and 2, and four mining camps or localities.

Range 76 is a visual bombing and gunnery practice range on which explosive and inert/training ordnance are used (Source: DOI/BLM, 1981). The TPECR contains long-range and short-range strategic threat systems and associated point defense systems, along with appropriate acquisition and ground-controlled intercept radars. About 2.9 percent (8,333 acres) of the total range area has been surveyed for cultural resources. The records search indicated a total of 183 recorded sites on Range 76. Twenty-one of these sites are prehistoric campsites, 64 are lithic scatters, 26 mark localities of limited activity, five are toolstone quarries and 63 are isolated artifacts. Only four historic sites have been recorded; three of which (Monte Cristo Springs, Salisbury Well and Quartz Mountain Camp) were associated with ranching.

On the EC South Range, neither inert/training nor explosive ordnance is used. An unknown amount of land disturbance has resulted from the construction of roads and electronic warfare systems. In total, about 1.4 percent (3,963 acres) has been surveyed, which includes approximately 3,500 acres that have been surveyed for the DOE. The records search indicated a total of 92 recorded sites on the EC South Range. Two unrecorded mines and several unrecorded petroglyph and pictograph sites are known to occur on this range. Of the recorded sites, 14 are prehistoric temporary campsites, 12 are lithic scatters, 25 are limited activity localities, 2 are toolstone quarries, 4 are historic Euroamerican sites and 35 are isolated artifacts.

Since the Groom Mountain Range was withdrawn as a buffer zone, there are few activities that directly affect cultural resources through land disturbance (Source: BLM, 1985). The withdrawal excludes air-to-ground or targeting activities and the only other activities that may affect cultural resources are the construction of rocks, power lines, fences, and remote stations. Approximately 6 percent (5,376 acres) has been surveyed for cultural resources. The records search indicated a total of 255 recorded sites on the Groom Mountain Range. Of the 238 prehistoric sites in this sample, 31 are temporary camps, 52 are lithic scatters, 66 are limited activity localities, 5 are toolstone quarries and 84 are isolated artifacts. There are 17 identified historic Euroamerican sites.

The impacts to cultural resources located on the TTR are discussed in relation to DOE activities, in Section 5.5.

For all the NAFR (except for TTR), approximately 63,475 acres have been surveyed for cultural and historical resources. This sample, comprising about 2.4 percent of the NAFR (without TTR), ranges from 0.3 percent of Range 61 to a statistically representative 6 percent sample on the Groom Mountain Range. Those samples indicate that a diversity of cultural resources, ranging in age from the Paleoindian to historic Euroamerican periods, occur on the range and that many of these resources are eligible for nomination to the National Register of Historic Places.

Avoidance of identified sites has been the primary procedure used to minimize the potential for adverse impacts on cultural resources on the NAFR. Table 2-17 indicates the extent of impacts on known, recorded cultural resources throughout the NAFR by their eligibility status for nomination to the National Register of Historic Places. Of the 1,704 recorded cultural and historical sites, 21.6 percent (369 sites) are undisturbed, 57.3 percent (976 sites) are partially affected, and 11.3 percent (192 sites) are extensively affected or completely destroyed. There are 571 recorded sites (33.5 percent of all known sites) that are considered to be eligible for nomination to the National Register of Historic Place, of which 30 percent (171 sites) are undisturbed, 56 percent (320 sites) are partially affected, and 9.8 percent (56 sites) are extensively affected or completely destroyed.

2.5.3 INDIAN SPRINGS AFAF

Indian Springs AFAF, shown on early 19th Century maps as an "Indian Rancheria" and later as an important station on the Las Vegas and Tonopah Railroad, has experienced extensive land disturbance (Source: Durand et al., 1988). Three archaeological surveys, covering 334.7 acres, have taken place directly on the Indian Springs AFAF and represent approximately 8 percent of the 4,054 acres encompassed by the airfield. The records search conducted for this report indicated a total of six recorded sites on Indian Springs AFAF. Five of these sites were isolated artifacts that were considered not eligible for nomination

Table 2-17. Extent of Impacts on Recorded Archaeological Sites: Nellis Air Force Range[1].

	Recommended National Register Eligibility[2]							
Extent of Impact	Eligible	%	Not Eligible	%	Undetermined	%	Total	%
Undisturbed	171	30.0	167	21	31	9.6	369	21.6
Partial	320	56.0	458	57	198	61.5	976	57.3
Extensive	56	9.8	108	13	27	8.4	192	11.3
Unknown	24	4.2	77	9	66	20.5	167	9.8
TOTAL	571	100.0	810	100.0	322	100.0	1,704	100.0
(%)		33.5		47.6		18.9	100.0	

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.

(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

to the National Register of Historic Places and had been collected. The remaining site, a temporary camp, was evaluated through limited test excavations and also was determined not to be eligible for nomination to the National Register (Sources: Livingston and Pippin, 1989; NDHPA, personal communication, not dated).

2.5.4 AIRSPACE

Airspace use in the NAFR has a minimal potential to impact cultural resources. Long-term exposure to vibrations induced through overflight activities and sonic booms have the potential to affect standing historic structures and increase the rate of their natural degradation (Sources: Ellis, 1987; Konon and Schuring, 1985; Hershey et al., 1975). Other types of prehistoric cultural resources, such as standing wooden and dry-laid masonry structures, petroglyphs and pictographs, and rockshelters, also may be affected by overflight activities (Sources: Brumbaugh, not dated; King et al., 1985; Witten, not dated). However, few studies have been made of the impacts of induced vibrations on cultural resources. Most have focused on the short-term catastrophic effects of overflights rather than the long-term cumulative impacts and their contribution to degradation through natural weathering and seismic activity.

2.5.5 SUMMARY

Defense-related activities on Nellis AFB, the NAFR, and in airspace used for Nellis AFB missions have had impacts on cultural resources. The beneficial effects result from the withdrawal of certain areas from public access, such as the Groom Mountain Range, thereby reducing the threat of vandalism and unauthorized collection by amateur collectors; and the systematic recording of cultural resources through pre-activity and sample surveys. As it is evident that vandalism, theft, and inadvertent damage continue to occur at cultural resources on the range, it is also evident that damage to these resources due to training activities is greater than the damage due to vandalism, theft, and inadvertent actions.

With the exception of the Groom Mountain Range, defense-related activities on the NAFR have affected cultural resources. These impacts on recorded sites have resulted from heavy ordnance contamination, training activities, and the construction of roads and facilities. However, these impacts are not restricted only to established targets or to areas of live ordnance use, but include areas of off-road vehicular traffic. Most of the impacts have occurred because pre-activity surveys did not occur in advance of land-disturbing activities, or because measures were not taken to properly mitigate effects through consultation with the Nevada Division of Historic Preservation and Archaeology.

Impacts to cultural values and religious freedoms of Native American peoples with traditional ties to the NAFR have not been addressed in this section because coordination has not been completed. Nellis AFB officials have previously corresponded to Native Americans without reply. After December 1990 meetings with tribal council members, the effects of Nellis and other DOD-related withdrawals and use of airspace on cultural values and religious practices can be more thoroughly understood.

2.6 EFFECTS ON RECREATIONAL RESOURCES

2.6.1 LAND WITHDRAWALS

In general, the recreational resources of the land withdrawals are not as great as those elsewhere in the southern Nevada region; for example, Red Rock Canyon and the Toiyabe National Forest (Source: DOI/BLM, 1979a). However, the land withdrawals have precluded the use of more than 3 million acres of undeveloped lands in proximity to the largest population center in the State. These lands could be compatible with recreational activities such as hunting, hiking, sightseeing, camping and off-road vehicle (ORV) use.

The Groom Mountain Range has the potential to support 50 deer tags annually, and 800-1,000 hunter days annually for rabbits and upland game birds. Prior to closure to the public, actual use of the area was much less, estimated at 10-30 deer hunters spending 20-100 hunter-days annually, and relatively few upland game hunters. The area was known to produce trophy buck mule deer and was gaining popularity for chukar hunting in Lincoln County (Source: BLM, 1985). Portions of the rest of the NAFR may provide comparable hunting areas for mule deer, as well as chukar, quail, rabbits and doves. In response to the closure of the Groom Mountain Range to hunting, the Air Force offered to open 26 square miles of Stonewall Mountain on the northwest corner of the NAFR for bighorn sheep hunting. The proposed MOU for this action has not yet been approved by the Nevada Department of Wildlife. The Air Force also paid for the construction of "guzzlers" to provide supplemental water for wildlife in other areas to compensate for hunting values lost by withdrawal of the Groom Mountain Range.

Portions of the Desert NWR are located on the NAFR, and these lands are administered under a MOU between the Air Force and USFWS (Source: U.S. Air Force/ DOI, 1982). Public access to the NAFR portions of the Desert NWR is restricted by the MOU, which authorizes use of the area by the Air Force. In publicly accessible portions of the Desert NWR, hiking, hunting, wildlife observation, vehicle touring, and photography occur (Source: USFWS, not dated). These recreational activities would likely occur, also, on the portion of the refuge contained by the NAFR, if access were not restricted. An acknowledged effect of airspace operations on the Desert NWR is that noise levels produced by low-level flights are of a magnitude that affects wilderness characteristics such as solitude. Effects on recreation resources projected to the year 2000 are not expected to increase since changes in existing boundaries and activities of NAFR are not anticipated.

2.6.2 AIRSPACE

Table 2-18 indicates recreation areas located beneath airspace used for the Nellis AFB mission. These sites include 5 State Parks, 2 National Forest Management Areas (MAs), including 11 National Forest campgrounds, 4 National Wildlife Refuges (NWRs), 2 State Wildlife Management Areas (WMAs), and portions of 4 BLM Extensive Recreation Management Areas (ERMAs), which include 3 Special Recreation Management Areas (SRMAs). Several of these recreation areas are located beneath airspace used for supersonic operations, including portions of Quinn MA, Desert NWR, Caliente, Schell and Tonopah ERMAs; and all of Moapa NWR, Key Pittman WMA, and Railroad Valley WMA. In total, approximately 7.6 million acres of recreation areas, are located beneath airspace, including 6.4 million acres beneath Desert MOA and 1.2 million acres beneath the LATN areas. LATN airspace is used intermittently for low level training activities. Recreation areas located beneath the LATN areas may be exposed to overflight on an occasional basis.

A number of wilderness areas which are used for recreation are also located beneath Nellis airspace. These areas are described in Section 2.7.2.

The extent of overflight of recreation lands located beneath Nellis airspace cannot be precisely defined because the proportion of sorties occurring over specific areas within the airspace is not known. Overflights are likely to be far more frequent over lands under the Desert MOA than under the LATN areas. Based on a tabulation of management agency visitor use, approximately 2.3 million people visited recreation areas located beneath Nellis airspace in 1990 (see Footnote 8, Table 2-18). The effects of overflight disturbance on recreationists using these areas will vary by individual and depend on the type of activity being conducted. For example, hikers, hunters, and wilderness users are more likely to be

Table 2-18. Major Recreation Resources Located Beneath Airspace Used for Nellis AFB Mission.

Recreation Resource	Area (acres x 1000)	1990[1] Visitor Use (# people x1000)	Airspace[2,3]	Total Area Beneath Airspace (acres x 1000)
State Parks				
Beaver Dam	2.2	8.7	Desert	
Cathedral Gorge	1.6	39.8	Desert	
Echo Canyon Reservoir	0.9	47.1	Desert	
Kershaw-Ryan	0.3	Closed	Desert	
Spring Valley	1.2	92.9	Desert	
TOTAL	6.2	188.5		6.2
National Forest Management Areas (MAs)				
Humbolt National Forest Quinn MA[4]	165.5	NA	Desert (75)*	124.1
Toiyabe National Forest Mt. Charleston MA[4]	58.0	1215.7[5]	LATN W	58.0
TOTAL	223.5	1215.7		182.1
National Wildlife Refuges				
Pahranagat	5.4	88.0	Desert*	
Desert Range	1588.5	45.0	Nellis AFR (50)* Desert (30)*	
Ash Meadows	23.4	69.0	LATN W	
Moapa	0.03	Closed	Desert*	
TOTAL	1617.3	202.0		1300.0
Wildlife Management Areas				
Key Pittman	1.3	1.6[6]	Desert*	
Railroad Valley	14.7	NA	Desert*	
TOTAL	16.0	1.6		16.0

Table 2-18. Major Recreation Resources Located Beneath Airspace Used for Nellis AFB Mission (continued).

Recreation Resource	Area (acres x 1000)	1990[1] Visitor Use (# people x1000)	Airspace[2,3]	Total Area Beneath Airspace (acres x 1000)
BLM Extensive Recreation Mgmt Areas (ERMA) and Special Recreation Mgmt Areas (SRMA)				
Caliente ERMA	3416.4	68.8	Desert (85)(50)* LATN E (15)	3416.4
Stateline ERMA	1535.4	17.0[7]	Desert (<5) LATN W (30) LATN E (10)	
- Clark County SRMA	1310.1	41.0	LATN W (10)	
- Spring Mountain SRMA	767.4	4.4	LATN W	
- Red Rock Canyon SRMA	61.8	562.1	LATN W (90)	690.5
Schell ERMA	4239.1	48.0	Desert (25)(20)*	1059.8
Tonopah ERMA	6126.0	7.8	Desert (15)*	918.9
TOTAL	15316.9	749.1		6085.6
GRAND TOTAL	17180.0	2356.9[8]		7589.9

[1] Data not available (NA) for all sites.

[2] Numbers in parentheses represent percentage of recreation located beneath airspace; assume 100 percent if not indicated otherwise.

[3] *indicates percentage of recreation area located beneath airspace used for supersonic operations; assume 100 percent if not indicated otherwise.

[4] One campground is located within the Quinn MA; ten campgrounds are located within the Charleston MA.

[5] USFS data is expressed in visitor use days, not total number of visitors.

[6] 1988 visitor use.

[7] Figure represents visitor use in portions of the ERMA that are not designated as an SRMA.

[8] Number of visitors exposed to overflights is substantially less than the total visitor use figure because: 1) the entire recreation resource may not be located beneath the airspace; and 2) not all visitors will be exposed to overflights. Subtraction of visitor use of the Schell and Tonopah ERMAs reduces the estimate to approximately 2.3 million visitors using areas located beneath defense-related airspace (figure does not include visitor use data for Quinn MA or Railroad Valley WMA).

disturbed by overflight noise than recreationists engaged in activities that create noise. Many of the recreation areas in the southern Nevada area are used for "quiet" recreation activities. The overall effects of noise on recreationists are described in Section 8.7. No additional effects to recreation resources are expected through the year 2000 as a result of proposed changes to Nellis airspace, however, expansive population growth in southern Nevada will lead to a greater number of people using recreation areas, and subsequently a greater number of people that may be disturbed by noise from overflight.

2.6.3 SUMMARY

The withdrawal of more than 3 million acres of lands has restricted access to large expanses of Mojave and Great Basin desert lands that have recreational potential for activities such as primitive camping, hiking, rock hounding, touring, and nature study. Access to a portion of the Desert NWR is restricted and results in the additional loss of recreational resources.

Five State Parks, 2 National Forest MAs, 4 NWRs, 2 WMAs, and portions of 4 BLM ERMAs, which include 3 SRMAs are located beneath airspace used for the Nellis mission. Several of these areas are located beneath airspace used for supersonic operations. The effects of noise from overflight will vary by individual. These effects are discussed in Section 8.7. Increases in the population in southern Nevada may lead to a greater number of people who are disturbed by noise from overflight.

2.7 EFFECTS ON WILDERNESS RESOURCES

2.7.1 LAND WITHDRAWALS

2.7.1.1 Nellis AFB and Small Arms Range

EAs pertaining to Nellis AFB activities do not address wilderness issues since wilderness evaluation of withdrawn lands is not legally required. Nellis AFB does not contain the mandatory wilderness characteristics of size, naturalness, and opportunities for solitude or primitive recreation. The proximity of Nellis AFB to the Las Vegas metropolitan area indicates that even without the presence of the base, these lands would not yield suitable wilderness characteristics. There is no existing documentation describing the wilderness suitability of lands in the Small Arms Range.

The BLM's 1987 wilderness EIS for Clark County identified suitable wilderness areas in proximity to Nellis AFB. The closest WSA is the Muddy Mountains, located less than 5 miles east of the base. The Nellis and Evergreen WSAs are located adjacent to the southern border of the NAFR, possibly on the flight path of aircraft travelling between Nellis AFB and the NAFR. The closest U.S. Forest Service (USFS) wilderness is Mt. Charleston, located approximately 30 miles west of the Nellis AFB. Although suitable wilderness has been identified, there is presently no wilderness proposal for Lake Mead National Recreation Area, which is the closest National Park Service (NPS) facility to Nellis AFB. Effects by Nellis AFB activities on the Desert NWR proposed wilderness are examined in Section 2.7.1.2. Depending on the direction of the flight path of military aircraft as they arrive and depart Nellis AFB, some proportion of these flights may occur over nearby wilderness study areas.

In summary, there is little information available that is useful for assessing effects to wilderness resources by lands withdrawn for Nellis AFB and the Small Arms Range. On-site activities at either the base or Small Arms Range, in all likelihood, do not affect existing wilderness resources in Clark County. Flights leaving the base may affect wilderness resources of at least three WSAs, totalling nearly 105,000 acres, or 2 percent of the total state WSA acreage; and one USFS wilderness area, totalling 43,000 acres, or 5 percent of the State's USFS wilderness.

2.7.1.2 Nellis Air Force Range

In contrast to other military land withdrawals in Nevada, the NAFR has been partially inventoried for wilderness suitability. The passage of the Military Lands Withdrawal Act of 1986 (Public Law 99-606) directed the Secretary of the Interior to develop a resource management plan for the NAFR (with the exception of those lands under the jurisdiction of the National Wildlife Refuge System) in accordance with FLPMA. Planning criteria for the resource plan included provisions recognizing that the NAFR is reserved for an armament and high hazard testing area; training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and subject to other defense-related purposes consistent with the purposes specified in the Military Lands Withdrawal Act (Source: DOI/BLM, 1989).

An informal wilderness evaluation of the NAFR Planning Area was conducted by the BLM in coordination with the Sierra Club, Nevada Outdoor Recreation Association, University of Nevada, Reno Recreation Department, and Friends of Nevada Wilderness (Source: DOI/BLM, 1979). This evaluation concluded that lands falling within the NAFR Planning Area did not meet the minimum wilderness criteria. Aircraft operations, present land uses, and safety hazards of unexploded ordnance were cited as activities that detracted from the wilderness suitability of the area.

The Desert NWR totals 1,588,000 acres; 826,000 acres are located on the NAFR. Restricted airspace over the Desert NWR (R-4806) is used extensively for low-altitude flight activities. These activities are normally at subsonic speeds but generate high noise levels during their overflight. Air-to-air combat activities occurring at higher altitudes within this Restricted Area and the Desert MOA typically produce sonic boom.

In 1974, the USFWS proposed approximately 88 percent of the Desert NWR (1,443,100 acres) for inclusion in the National Wilderness Preservation System. Areas excluded from the wilderness proposal included lands within NAFR where target facilities are located. Target areas are generally located in valleys below 4,000 feet (below 3,600 feet for Three Lakes Valley). The Desert NWR proposed wilderness area is managed as a "defacto wilderness". Aircraft operations, where practical, are generally restricted to a minimum of 2,000 feet above ground level, except for special training missions (Source: DOI/BLM, 1979). The Public Land withdrawal EIS (Source: DOI/BLM, 1979) states that the wilderness designation will not affect the Air Force's use of the NAFR for bombing and gunnery practice, nor will continued military use, as described in the Memorandum of Understanding between the USFWS and the Air Force, prevent the USFWS from managing the area as a defacto wilderness.

In summary, wilderness resources have been and will continue to be affected by the withdrawal of the NAFR and associated operations. Nellis-related activities, as well as former land uses such as grazing and mining, have contributed to loss of wilderness characteristics on the North Ranges. On the South Ranges, concurrent military use of lands proposed for wilderness is considered compatible under the existing MOU. Effects on wilderness resources projected to the year 2000 are not expected to increase since changes in existing boundaries and activities of NAFR are not anticipated.

2.7.2 AIRSPACE

This section examines the effects of Nellis airspace on wilderness lands. The effects on recreational use of these lands is discussed in Section 2.6.2.

Table 2-19 and Figure 2.11 indicate fifteen BLM WSAs, two USFS wilderness areas, and portions of one USFWS proposed wilderness located under the Desert MOA. These WSAs, totalling 2,389,895 acres, represent approximately 21 percent of the total WSA land area, 7 percent of USFS wilderness, and 73 percent of the proposed USFWS wilderness in the State of Nevada. Fourteen of fifteen WSAs, both USFS wilderness areas, and the USFWS proposed wilderness are subject to supersonic activity. In general, the remoteness of wilderness coincides with the zones of maximum sonic boom noise levels and frequency of occurrence. Actual numbers of overflights of the wilderness areas beneath the Desert MOA are unknown. Table 2-19 also lists the five BLM WSAs and one USFS wilderness area located on lands beneath LATN East and West. These WSAs occupy 385,000 acres and represent nearly 8 percent of the total WSA land area in Nevada. The USFS Mt. Charleston Wilderness, totalling 43,000 acres is located beneath LATN West. This area represents five percent of the USFS designated wilderness in Nevada. Activities on the East LATN may occur over one WSA. Commercial and private overflight constitute a substantially greater number of aircraft flights over wilderness in these areas. No additional effects on wilderness resources are expected through the year 2000 as a result of proposed changes to Nellis airspace.

2.7.3 SUMMARY

The NAFR and associated airspace affect wilderness resources by the closure of over 3 million acres of lands to public use. In addition, overflight occurs over at least 20 WSAs totalling approximately 872,000 acres (17 percent of the total WSA land area in Nevada), and three USFS wilderness areas totalling 100,000 acres (12 percent of the USFS designated wilderness in Nevada).

Table 2-19. Wilderness Resources Beneath Airspace Used for Nellis AFB Mission.

Wilderness Resource	Total Area (Acres)	% Under Airspace	Est. Area Under Airspace (Acres)	% Beneath Supersonic Use Areas[1]	Airspace
Wilderness Study Area (BLM Resource Area)					
Evergreen WSA (Caliente)	2,694	100	2,694	100	Desert MOA
South Pahroc WSA (Caliente)	28,600	100	28,600	100	Desert MOA
Clover Mountains WSA (Caliente)	84,935	100	84,935	95	Desert MOA
Delamar Mountains WSA (Caliente)	126,257	100	126,257	100	Desert MOA
Meadow Valley Mountains WSA (Caliente)	185,744	100	185,744	70	Desert MOA
Mormon Mountains WSA (Caliente)	162,887	100	162,887	25	Desert MOA (80%) LATN East (20%)
Tunnel Spring WSA (Caliente)	5,400	100	5,400	0	Desert MOA
Fish & Wildlife #1 WSA (Caliente/Clark Co.)	11,090	100	11,090	30	Desert MOA
Arrow Canyon Range WSA (Clark)	32,853	40	13,141	40	Desert MOA
Weepah Spring WSA (Schell)	61,137	100	61,137	100	Desert MOA
Worthington Mountains WSA (Schell)	47,633	100	47,633	100	Desert MOA
Kawich WSA (Tonopah)	54,320	100	54,320	100	Desert MOA
Palisade Mesa WSA (Tonopah)	99,550	30	29,865	30	Desert MOA
South Reville WSA (Tonopah)	106,200	100	106,200	100	Desert MOA
The Wall WSA (Tonopah)	38,000	20	7,600	20	Desert MOA
Mount Sterling WSA (Clark)	69,650	10	6,965	0	LATN West
Grapevine Mountain WSA (Esmeralda-South Nye)	66,800	95	63,460	0	LATN West
Resting Springs WSA (Esmeralda-South Nye)	3,850	100	3,850	0	LATN West
Queer Mountain WSA (Esmeralda-South Nye)	81,550	40	32,620	0	LATN West
USFS Wilderness Areas (USFS National Forest)					
Mt. Charleston (USFS-Toiyabe)	43,000	100	43,000	0	LATN West
Quinn Canyon (USFS-Humboldt)	27,000	100	27,000	100	Desert MOA
Grant Range (USFS-Humboldt)	50,000	60	30,000	60	Desert MOA
USFWS Proposed Wilderness					
Desert NWR	1,443,100	87	1,255,497	70	Desert MOA R-4806, 4806E
TOTAL	2,832,250	82	2,389,895	53	

(1) The sound levels and overpressures resulting from supersonic flight do not normally affect the whole land area beneath airspace authorized for supersonic flight.

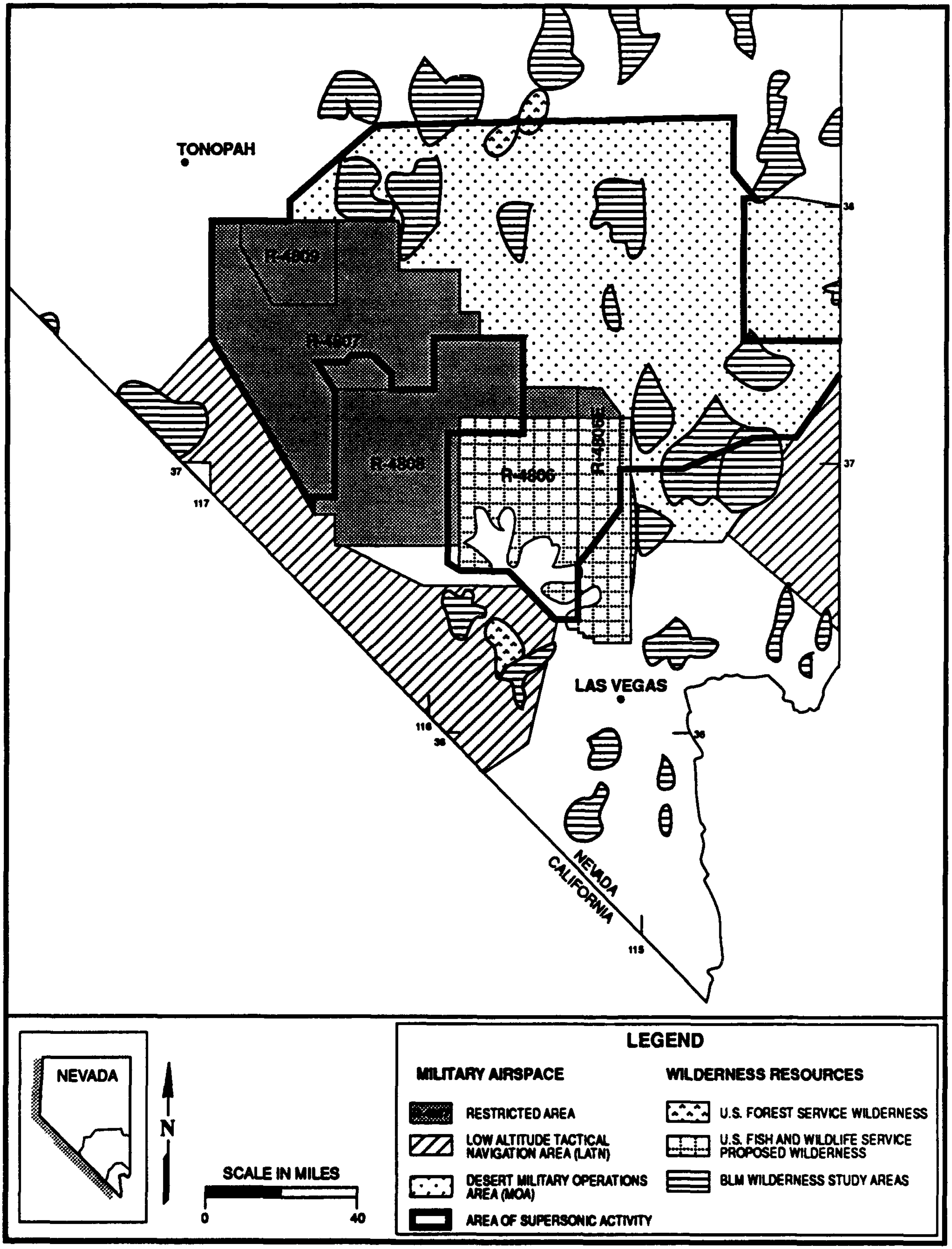


FIGURE 2.11 WILDERNESS RESOURCES AND AIRSPACE ASSOCIATED WITH NELLIS AFB MISSION

2.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

Figure 2.12 shows the geologic terrains and locations of mining districts for the Small Arms Range as the boundaries currently exist and for the proposed boundaries. Figure 2.13 shows the geologic terrains and locations of mining districts for the NAFR. Geologic terrains and mining districts in relation to Nellis AFB are not shown.

2.8.1 NELLIS AFB AND SMALL ARMS RANGE

Nellis AFB, covering a small area on the northern and western flanks of Sunrise Mountain east of Las Vegas, is almost entirely covered by alluvium. Due to its small size (11,193 acres), the presence of deep alluvium, and lack of known metallic mineralization in nearby rock outcrops, Nellis AFB is assessed as having very low base- and precious-metals potential. It is estimated that no metallic mineral deposits would have been mined within the area had it remained open for public development.

Most of the northern half of the Small Arms Range, a 10,760-acre area south of Gass Peak in the southern Las Vegas Range, is Paleozoic carbonate terrain. The southern half of the range is covered by alluvium. In other areas of Nevada, similar Paleozoic carbonate terrain has hosted porphyry molybdenum deposits, skarn tungsten deposits, polymetallic replacement deposits, and carbonate-hosted gold deposits. No mining districts occur on Nellis AFB or the Small Arms Range. The closest mining districts, Gass Peak and Dike, are within Paleozoic carbonate terrain and both have been mined for polymetallic replacement deposits. The Gass Peak district has produced zinc, lead, silver, and minor gold; the Dike district has recorded production of only lead.

The Gass Peak district is about 1.5 miles northwest of the Small Arms Range. Little is known about this district, but the mining properties seem to be associated with an east- to northeast-trending anticline; this anticline does not project into the Small Arms Range. The Dike district is located adjacent to the eastern boundary of the Small Arms Range in the southern end of the Arrow Canyon Range. Mineralization at the one mine in the Dike district is associated with northwest-trending faults, but these structures do not appear to extend into the Small Arms Range.

The part of the Small Arms Range that is Paleozoic carbonate terrain is assessed as having low potential for the development of additional polymetallic (base-metal) replacement deposits. The remainder of the Small Arms Range, which is covered by deep alluvium, is assessed as having very low metallic mineral development potential.

A cluster of thermal wells and springs in the southern part of Las Vegas Valley extends from north of Sunrise Mountain to Henderson and includes the area of Nellis AFB. Most of the thermal wells, however, are located southwest of the base. Nellis AFB is assessed as having low geothermal potential and the Small Arms Range, located several miles north of any known springs or wells, is also assessed as having very low geothermal potential.

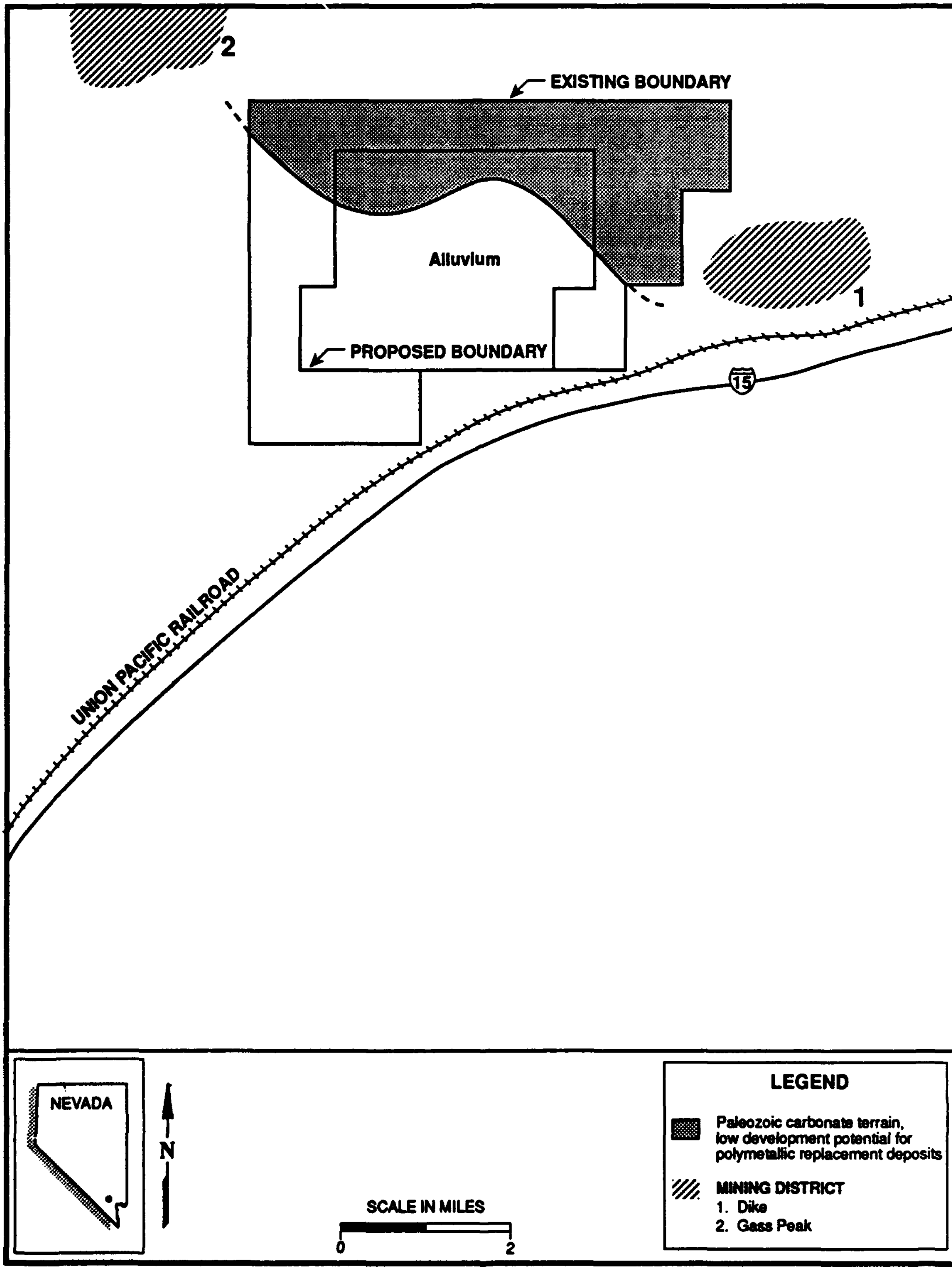


FIGURE 2.12 GEOLOGIC TERRAIN AND LOCATIONS OF MINING DISTRICTS FOR SMALL ARMS RANGE EXISTING AND PROPOSED BOUNDARIES

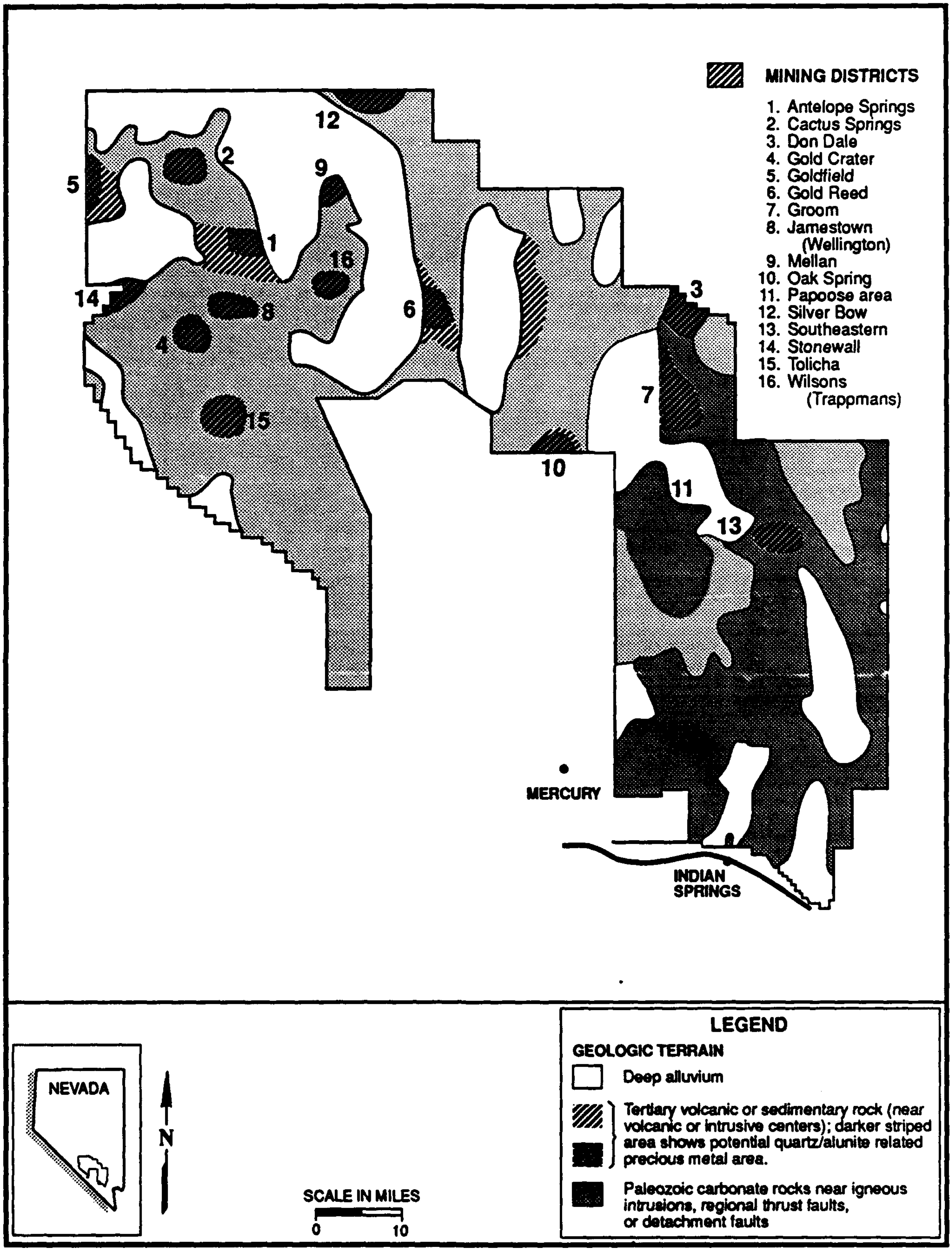


FIGURE 2.13 GEOLOGIC TERRAINS AND LOCATIONS OF MINING DISTRICTS FOR NELLIS AIR FORCE RANGE

The oil and gas potential of southern Nevada has traditionally been assumed to be low because of the complex structure of the area, as well as the discouraging results of exploration (Sources: Lintz, 1957; Smith, 1956). Bissell (1973) contends, however, that favorable structural features such as anticlines exist throughout the area and that these structures have not been adequately explored. Recent assessments of oil and gas potential in northeast Nevada by Moulton (1984), reports by Chamberlain (1986), and recent discoveries of oil in Paleozoic rocks in central Nevada, suggest that the crustal structure that earlier geologists thought was too complex is now one of the factors that makes southern Nevada somewhat interesting to exploration companies.

Nellis AFB and the southern half of the Small Arms Range are underlain by thick alluvium. Little is known about the Tertiary or pre-Tertiary rocks and structure below this alluvium. It is possible that small pools of oil could be contained in mid-Tertiary lake sediments or fractured igneous rock similar to the oil fields in parts of central Nevada. Furthermore, structural traps along the edge of the Las Vegas Range could contain oil beneath the Small Arms Range. Without additional studies, such as deep exploratory holes, it is assumed that potential exists for the accumulation of small oil pools beneath Nellis AFB and the Small Arms Range. It is concluded, however, that the withdrawal of this land has had no effect on oil and gas exploration in southern Nevada, nor will the continued withdrawal of these small tracts of land affect future exploration in southern Nevada. Thus, the withdrawals of Nellis AFB and the Small Arms Range have had no effect on Nevada's petroleum industry.

The only industrial materials that may have potential for development within the Nellis AFB and Small Arms Range are sand and gravel deposits on pediment slopes. The Las Vegas metropolitan area provides a ready market for sand and gravel for a variety of uses including fill materials, cement concrete, and asphaltic concrete. Other uses are subject to rigid specifications. Deposits within the Nellis AFB and Small Arms Range would be competing with similar deposits throughout the Las Vegas Valley. Sand and gravel from pediment slopes within the withdrawn areas are assessed as having moderate but limited development potential.

The only proposed boundary change is a reduction in the size of the Small Arms Range. This reduction would decrease the amount of withdrawn acreage on which potential development of mineral resources cannot occur.

2.8.2 NELLIS AIR FORCE RANGE

For the purpose of analyzing mineral resource potential, all of the Nellis Air Force Range is treated as one unit (the North and South Ranges, Indian Springs AFAF, TTR, and the Groom Mountain Range).

2.8.2.1 Base and Precious Metals

Regional Potential

The NAFR is composed of three basic geologic terrains: areas of deep alluvial cover; areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers; and areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, and detachment faults.

Areas of deep alluvial cover: For this study, bedrock more than 3,000 feet below the alluvial surface is considered beyond the reach of current mining. Approximately 30 percent of NAFR is included in this category, and it is assessed to be unfavorable for the discovery of mineral deposits.

Areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: These rocks occupy about 45 percent of the surface area of the NAFR. Elsewhere in Nevada, similar rocks and structural settings have hosted Comstock-type silver-gold deposits and hot-spring gold-silver and mercury deposits. In addition, a small part of this terrain along the northwest boundary of the North Range (east of the Goldfield mining district) is favorable for the occurrence of quartz-alunite gold deposits similar to those at Goldfield. Although there is moderate to high potential that deposits would be found in this terrain in the future if it were to be opened to mineral development, the area is assessed as having only low to moderate potential for a deposit to have been found between the time of land closure and the present. It is estimated that one small- to medium-sized precious-metals deposit may have been developed within parts of the NAFR outside of known mining districts had the area remained open to mineral development.

Areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, and detachment faults: Paleozoic rocks are exposed over about 25 percent of the NAFR. Favorable intrusive centers are known in only two small areas, but all of the southeastern portion of the NAFR is within a belt of extensive thrust faulting. Moreover, rocks along the eastern boundary of the South Range lie on the southern projection of the Northern Nevada Rift zone, an important ore control in the Carlin gold trend in northern Nevada. In other parts of Nevada, similar geologic terrains have hosted porphyry molybdenum deposits, skarn tungsten deposits, polymetallic replacement deposits, and carbonate-hosted gold deposits. Based on somewhat sketchy information from adjacent mining districts, the NAFR is assessed as having low to moderate potential for the development of one or two tungsten skarn deposits and/or polymetallic replacement deposits.

The potential for carbonate-hosted gold deposits in the NAFR is unknown. Similar to the huge Carlin-type deposits that are being extensively mined in the northern part of Nevada, these deposits could occur in carbonate-rock terrain in the Groom, Pintwater, and Desert Ranges in the southeastern part of the NAFR. Two of the important criteria for these occurrences, favorable carbonate host rocks and regional thrust faulting, occur here. Based on the limited information available, there may be a low to moderate potential for discovery of Carlin-type gold deposits somewhere in the Nellis South Range.

Potential of mining districts

Mining districts within areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: Seven mining districts and parts of three other mining districts occur on this terrain within the NAFR. Gold and silver are the only metals that could have been produced or could have potential for production within these districts. Precious-metal prices were static for a long period of time beginning in the early 1940's and extending into the late 1970's. Had these areas been open to exploration, deposits in these districts would most likely have been prospected starting in the late 1970's and they might have been active at the present time.

It is impossible to predict how many mines might be in operation in these districts and how large they might be had the land been open for exploration. It is possible that at least one, and up to three, medium-sized operations in or near one or two of the districts would currently be operating. One district, Tolicha, was examined in the field in 1983 during a mineral inventory of the NTS and surrounding areas (Source: Quade and Tingley, 1984). Almost every ore sample collected in the Tolicha district for that study was found to contain anomalous gold values. Pre-World War II exploration in the district was limited, and large areas along well-defined, mineralized vein systems remain to be explored. Three areas within this district, the Yellow Gold mine-Clarksdale mine area, the Landmark-Life Preserver mine area, and the Quartz Mountain mine area, have high to moderate potential for the development of minable gold resources.

Mining districts within areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, or detachment faults: Four mining districts and parts of two other mining districts are in this terrain in the NAFR. With the limited data available on all of these districts, except Groom and Don Dale districts, it is impossible to predict the number of mines that may have been found and operated in this area had it been open to prospecting for the past 47 years. Deposits of tungsten and molybdenum could have been prospected in the Oak Spring district, specifically in that part of the district that lies on the NTS, south of the NAFR boundary. Polymetallic replacement deposits are known to occur within the Groom, Papoose, and Southeastern districts. Deposits at Groom are fairly well documented and, although they have been in private ownership and available for development, they have not been extensively mined.

The Groom district has recently been studied by Quade and Tingley (1985) and an assessment of its mineral potential can be made with a higher degree of confidence than for any other NAFR district. The Groom mine has potential for producing lead, silver, and possibly zinc. Favorable geologic conditions, similar to those at the Groom mine, exist both north and south of the old mine. It is possible that exploration in these areas could result in the discovery of one or more orebodies of similar size and grade to those mined in the past at Groom. Mining of these orebodies would be by high-cost underground methods and success would depend on stable and fairly high metal prices. High to moderate potential also exists in the Groom district and in the southern part of the adjacent Don Dale district for development of small tonnages of gold-silver ore in narrow vein deposits in an area extending from the old Kahama mine north into the Don Dale District (Source: Quade and Tingley, 1985).

2.8.2.2 Energy Resources

Geothermal resources

Only two thermal springs, Cedar Spring on the east side of the Kawich Range and Ash Creek Spring on the west side of the Desert Range, are known to occur within the NAFR. Water temperature of these springs is in the 68°F to 122°F range (Source: Trexler et al., 1983). One test well on the east side of Frenchman Flat found warm water (100°F) at a depth of 1,853 feet (Source: Garside and Schilling, 1979). Although information on most of NAFR is limited, the geothermal resource potential is rated as very low.

Oil and gas resources

The geologic history of the NAFR is largely unfavorable for the preservation of large hydrocarbon accumulations that may have been generated from Paleozoic source rocks. The existence of several calderas and plutonic rocks of late Tertiary age suggests that subsurface temperatures probably destroyed any large oil accumulations that may have existed in the area.

For oil and gas to be generated, source rocks rich in organic debris are, over long periods of time, buried deeper and deeper below the surface where rising heat and pressure "mature" the organic debris and convert it to oil and gas. It is widely believed that oil forms at temperatures between 160°F and 300°F, and that gas forms at temperatures above 300°F (Source: Waples, 1984). The liquid and gaseous hydrocarbons generated during this maturation process are light in weight and tend to migrate toward the surface. If sufficient traps are available to prevent these products from escaping to the surface, the oil and gas can accumulate in subsurface reservoirs.

Studies just south of the NAFR suggest that subsurface temperatures as recently at 10 million years ago were as high as 450°F (Source: Bish, 1987). The preponderance of metal-mining districts on the NAFR likewise indicates that subsurface temperatures have been very high in the geologic past. At temperatures exceeding 300°F, gas is either diffused out of the source rock or destroyed, and oil is converted to graphite (Source: Hunt, 1979).

For oil and gas reservoirs to remain in place, they need protection from the flushing action of flowing ground water (Source: Osmond and Elias, 1971). The nature of ground water flow throughout the NAFR (Section 2.10), however, suggests that the rock is highly fractured. Such pervasive fracturing diminishes the chances that large accumulations of oil and gas currently exist even though the regional structure of the NAFR is broadly similar to the western Wyoming thrust belt, which is an important petroleum producer (Source: Dixon, 1982).

In view of the preceding discussion, the NAFR is considered to have a low potential for oil and gas resources. Some oil pools at distant locations from high-temperature sources could exist within NAFR in small structural traps (thrust faults or detachment surfaces) in Paleozoic and Tertiary rocks. The effect that the withdrawal of the NAFR has had on the oil and gas industry in Nevada is judged to be negligible in that very few exploratory wells have been drilled near the NAFR (Source: Brady, 1983). The withdrawal of the NAFR has had no effect on Nevada's petroleum industry.

2.8.2.3 Industrial Minerals and Materials

Much of the alluvium-covered areas along the lower flanks of the ranges within NAFR contain potential sand and gravel resources. These materials, however, do not have any unique value over similar material occurring in other areas throughout western Nevada. Most sand and gravel produced in Nevada is used for highway construction as portland and bituminous concrete aggregate, base, or fill material, and for building construction as aggregate. Because of their low unit value, sand and gravel deposits are generally not transported long distances. For economic reasons, sand and gravel operations in Nevada are, and will continue to be, developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within the NAFR, do not present a unique or particularly important resource in that there are few local consumers in the area.

2.8.3 SUMMARY

The NAFR has had a large restrictive effect on mineral development in Nevada because of the size of the withdrawal, however it is impossible to accurately assess the magnitude of this effect.

On a regional scale, there is low to moderate potential for development of small base-metal replacement deposits within the boundaries of both the Small Arms Range and NAFR. No estimate is made on the number of these occurrences possibly present within the Small Arms Range; up to three replacement deposits, including possibly one Carlin-type gold deposit, have potential for discovery and development within the NAFR. NAFR holds moderate to high potential for the discovery of precious-metals deposits in volcanic rocks; one or more of this type of occurrence could be discovered and developed.

Established mining districts are recognized within the NAFR. Within the NAFR, there is moderate to high potential for the discovery and development of one to three precious-metals deposits; these deposits could be developed within any of the ten separate mining districts included in the NAFR. Low to moderate potential is present in other districts for the development of small base-metal replacement deposits; moderate to high potential may exist in parts of the Groom Mountain Range for small, vein deposits of precious-metals.

The potential of Nellis AFB, Small Arms Range, and the NAFR for petroleum and geothermal resources is assessed as very low.

No specific areas of industrial minerals and materials potential have been identified within Nellis AFB, Small Arms Range, or the NAFR, although moderate potential exists for development of sand and gravel resources in parts of the NAFR as local needs arise.

A proposal to relocate the 37th Tactical Fighter Wing from the TTR will have no effect on mineral resources because the land will remain closed to mineral entry under the mining and mineral-leasing laws.

2.9 EFFECTS ON WATER RESOURCES

2.9.1 HYDROLOGIC AND WATER RESOURCE ENVIRONMENT

2.9.1.1 Nellis AFB and Small Arms Range

Nellis AFB and Small Arms Range are located in the northeast portion of Las Vegas Valley hydrographic basin, shown in Figure 2.14. Small portions of the base and Small Arms Range lap over into the Black Mountain and Garnet Valley basins, respectively.

Las Vegas Valley is bounded by high mountains except to the northwest and southeast. The basin is filled with alluvium to a depth in excess of 3,000 feet. The Spring Mountains on the west rise to over 10,000 feet. The Spring Mountains and those to the north contain thick sequences of carbonate rocks. The mountains to the south and east are primarily of volcanic origin. Mean annual precipitation in the basin ranges from over 30 inches on Mt. Charleston in the Spring Mountains to less than 5 inches on the valley floor. The valley, which is not topographically closed, drains to the Colorado River through the Las Vegas Wash in the southeast corner of the valley. There are no perennial streams entering the valley and ephemeral or intermittent streams generally evaporate or infiltrate near the head of alluvial fans. Flow in the Las Vegas Wash (145,600 acre-feet (AF) in 1988) is composed of treated sewage effluent, ground water discharge, and periodic storm flows.

The alluvial material in the Las Vegas Valley ground water basin forms relatively high permeability debris fans of coarse materials near the mountain fronts. At progressively lower elevations, the materials become finer in texture and stratification consists of layers of permeable sand and gravel and less permeable silt and clay. Scarps detectable in the Las Vegas area are believed to be faults extending to considerable depth and offsetting the various layers of material (Source: Maxey and Jameson, 1948). Some of these faults appear to result from differential consolidation of fine-grained sediments that underlie the central portion of the valley and coarser sediments in the west. Most of them are localized in areas where rapid transition in the subsurfaces occurs from coarse to fine materials (Source: Domenico et al., 1964).

The valley-fill alluvium has been characterized as consisting of two major aquifer zones: 1) the shallow aquifer zone extending to a depth of approximately 200 feet; and 2) the principal aquifer zone extending from below the shallow zone to a depth in excess of 1,000 feet (Source: Harrill, 1976). In the shallow aquifer zone, which is largely phreatic, the water table is found from near land surface to as much as 50 feet below land surface. Aquifers in the principal zone are generally confined, resulting in artesian conditions, though few wells now flow.

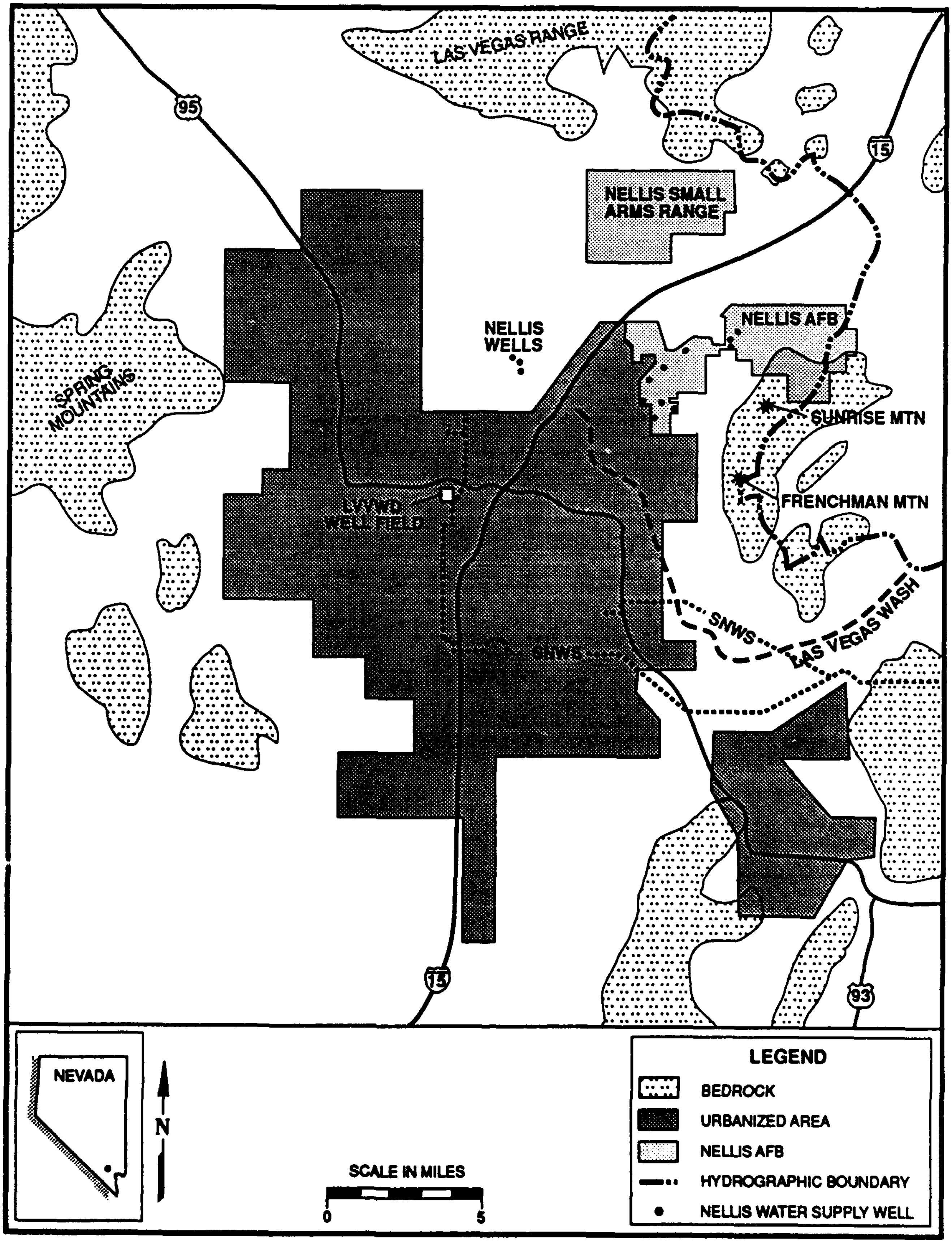


FIGURE 2.14 LAS VEGAS VALLEY HYDROGRAPHIC BASIN

Primary area of local recharge to the principal aquifer zone is in the Spring Mountains on the westerly side of the valley. Under natural conditions, recharge to the shallow aquifer zone was principally from upward leakage of water from artesian aquifers. Currently, this zone is recharged additionally by leakage from imperfect deep wells, sewage disposal, and watering of lawns, golf courses, and parks.

General movement of ground water is from west and northwest to east and southeast, but on a local basis this flow pattern is disturbed by pumpage from wells and resulting cones of depression. Hydrologically, the southern part of the valley is both a ground water and surface water discharge area.

Quality of Las Vegas Valley ground water varies considerably with location in both the shallow and principal aquifer zones. In the shallow zone, quality decreases from west and northwest to south and southeast, becoming extremely poor in the vicinity of Las Vegas Wash. Water in the principal aquifer zone supplying Las Vegas and North Las Vegas has total dissolved solids (TDS) concentration of 200 to 400 milligrams per liter (mg/l) and is high in bicarbonate, with hardness generally less than 300 mg/l. In the eastern and southeastern portion of the valley, ground water is more highly mineralized with high sulfate concentrations.

Estimates of total pre-development natural recharge to the artesian reservoir have ranged from 25,000 to 35,000 acre-feet per year (AFY) (Sources: Maxey and Jameson, 1948; Domenico et al., 1964). Induced infiltration from in-valley use of imported Colorado River water might increase the developed yield to 45,000 AFY.

The only surface water available in Las Vegas Valley is Colorado River water imported from Lake Mead. The Arizona vs. California decision of the U.S. Supreme Court established for Nevada an annual consumptive use allocation from the Colorado River of 300,000 AF. Average annual flow of the Colorado River is more than 13,000,000 AF. More than 300,000 AFY can be diverted to Nevada, but to do so there must be a return flow to the Colorado equivalent to the excess diversion. That return flow is derived from treated sewage effluent and discharge from the ground water reservoir of infiltrated Colorado River water. The full 300,000 AFY are not, however, available to the Las Vegas Valley. Nevada diversions from the Colorado River in the Laughlin area also come from this allotment. Federal government water uses, such as at Nellis AFB, are also part of Nevada's allotment.

Colorado River water is imported to the Las Vegas Valley through two separate pipeline systems: the Basic Management Incorporated (BMI) pipeline constructed in 1940 to Henderson, and the Southern Nevada Water System (SNWS), which first delivered water in 1971. In the Las Vegas Valley, the SNWS services Henderson, the Las Vegas Valley Water District, the City of North Las Vegas, and Nellis AFB. SNWS also serves Boulder City in Eldorado Valley.

Prior to 1971, virtually all of the Las Vegas Valley water supply, other than for the City of Henderson, was provided from the ground water reservoir. Henderson has never had access to good quality ground water and thus has been served by Colorado River water from the BMI and SNWS pipelines. Peak ground water use occurred in 1968 when an estimated 86,149 AF were pumped, representing nearly 93 percent of valley water use in 1968 (excluding Henderson). In 1972, after SNWS began operating, ground water pumpage decreased to 70,665 AF (63 percent of total, excluding Henderson); by 1988, ground water pumpage had declined only to 67,854 AF, but this represented just 28 percent of total water usage (excluding Henderson).

While actual ground water pumpage declined by less than five percent from 1972 to 1988, the relative use of ground water in the valley water supply decreased from 63 percent to 28 percent of total. However, the role of ground water is no less important today than it was in 1972. There are approximately 6,200 homes and a large number of business/ commercial establishments for which ground water is the sole source of water. In 1968, these users pumped approximately 30 percent of all ground water and in 1988 they pumped over 34 percent. Most domestic wells tap the shallow aquifer zone, while a large percentage of the other private wells tap the principal aquifer zone. For the major water purveyors (Las Vegas Valley Water District and City of North Las Vegas), ground water pumpage no longer represents the base supply, but now is critical in meeting summer peak water demands.

Another important component of the Las Vegas Valley water resource system is treated sewage effluent. A small portion of this effluent is reclaimed for industrial water uses (e.g., power plant cooling, construction and irrigation of golf courses), but most is discharged to the Las Vegas Wash where it flows to the Colorado River. These flows sustain the Valley's only major wetland area, and represent return flow credit to Nevada's Colorado River consumptive use allocation.

2.9.1.2 Indian Springs AFAF

Indian Springs AFAF is located in the southern portion of Indian Springs Valley, shown in Figure 2.15, which is recharged from the Pintwater Range and the Spring Mountains. Ground water is shallow, within 100 feet of the surface at lower portions of the valley. Confined aquifers underlie portions of the valley, and have been penetrated by wells at depths ranging from 400 to 600 feet. Recharge to Indian Springs Valley has been estimated at 500 AFY (Table 2-19), much of which leaves the basin as evapotranspiration or outflow to the Ash Meadows regional ground water system (Source: Maxey and Jameson, 1948).

2.9.1.3 Nellis Air Force Range

The 23 hydrographic basins partly included in the NAFR represent an extensive water resource potential (over 49 million AF in ground water storage and perennial yield of over 93,000 AF). Most (over 60 percent) of these water resources are on the withdrawn lands of NAFR, TTR, and NTS. It incorporates all, or part of, 23 different hydrographic basins, shown in Figure 2.16. With approximately 3 million acres of land, and an average precipitation of approximately 8 inches per yr, 2.1 million AFY of water could be available for ground water recharge on NAFR. Less than four percent of this amount, however, is estimated to actually reach the water table; the remainder is lost directly to evapotranspiration. Only limited data have been compiled from widely-scattered sites on NAFR. The

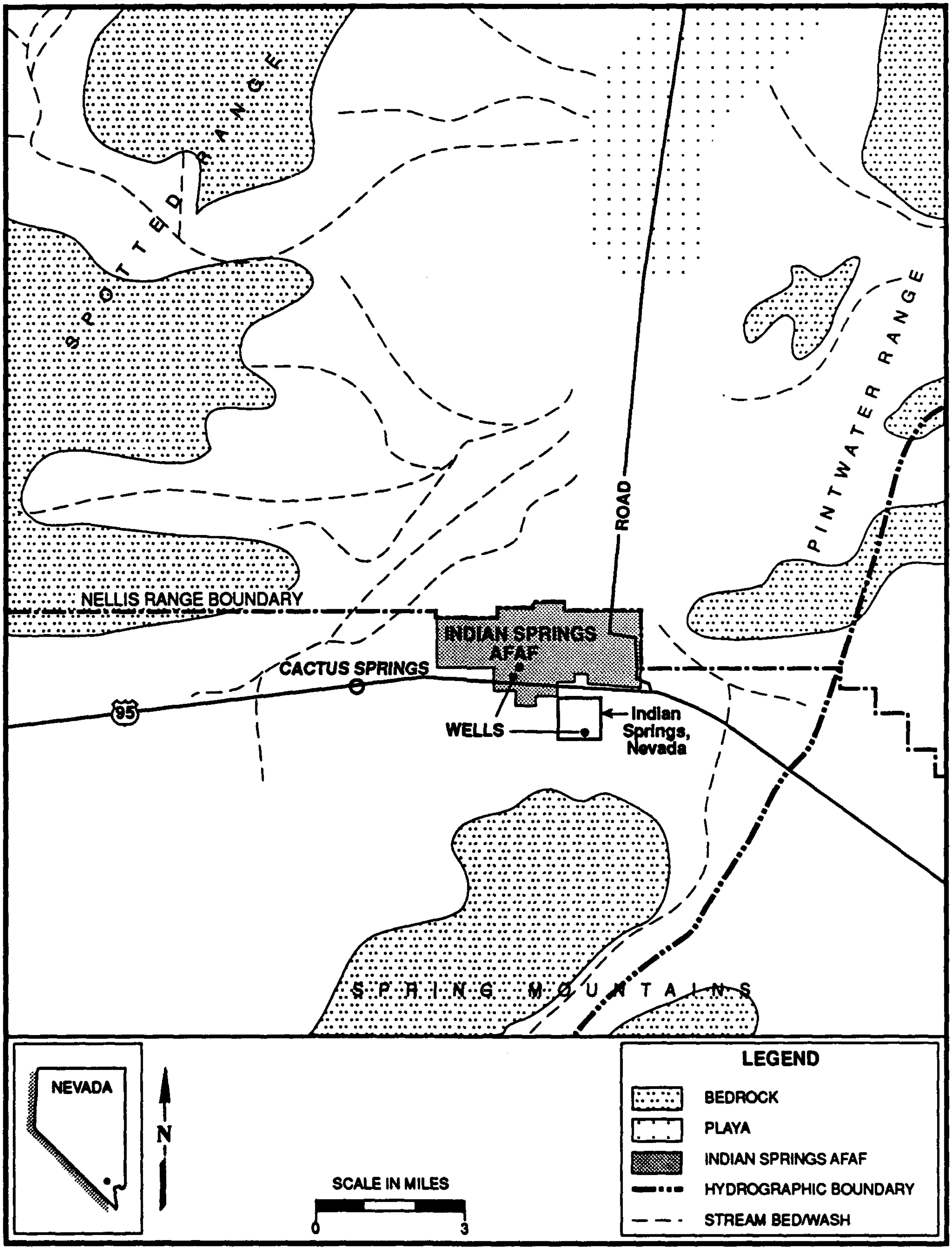


FIGURE 2.15 HYDROLOGIC FEATURES IN THE VICINITY OF INDIAN SPRINGS AFAF

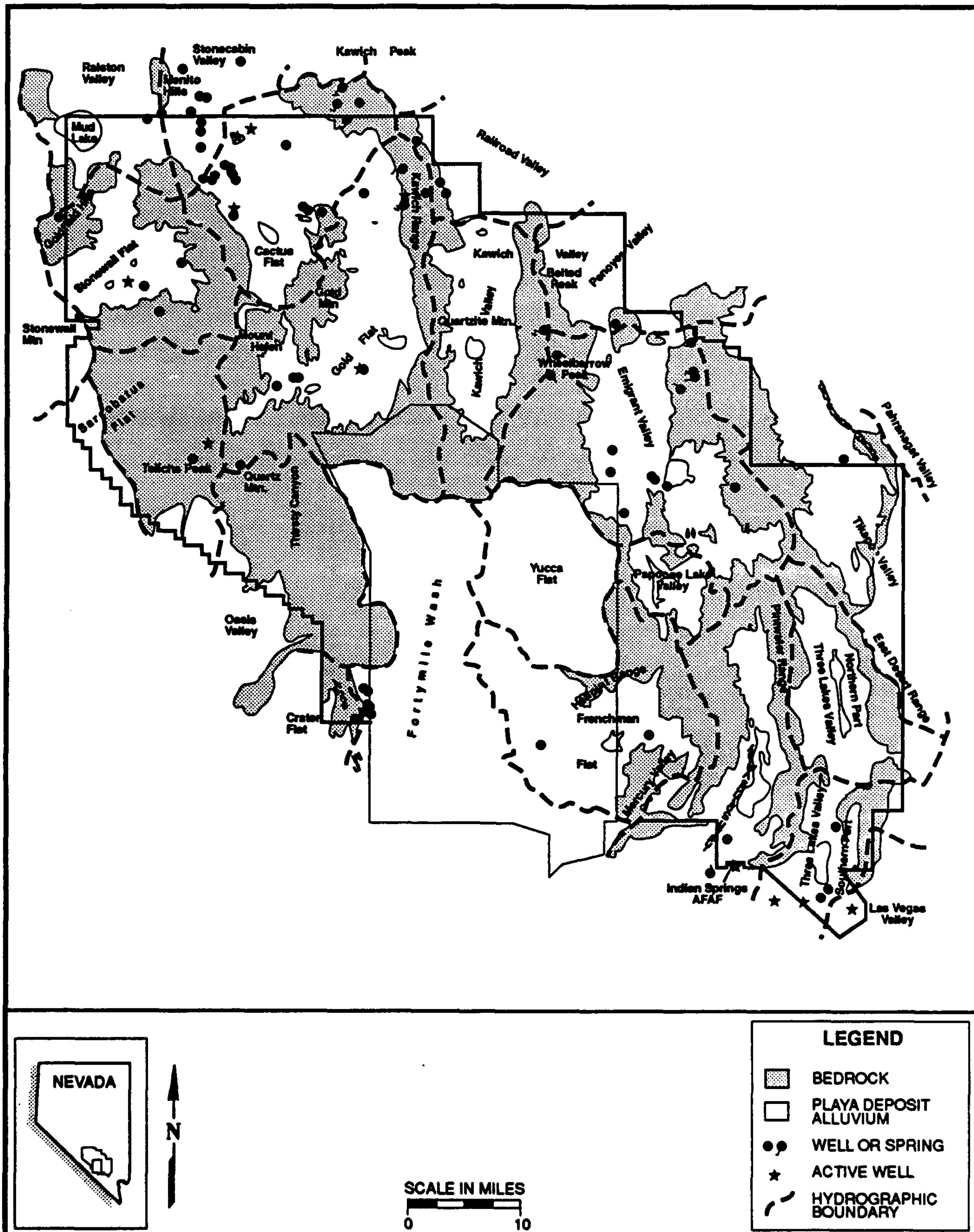


FIGURE 2.16 HYDROGRAPHIC BASINS OF THE NELLIS AIR FORCE RANGE

most definitive study of geology on the NAFR is U.S. Geological Survey (USGS) Professional Paper 651 (Source: Ekren et al., 1971).

The NAFR can be roughly divided along the eastern boundary of Nye County into two different hydrogeologic environments. The first of these environments corresponds to the South Range. It covers the south-eastern portion of the range and is characterized by precambrian and paleozoic carbonate mountain blocks separated by deep alluvium-filled valleys. Although most consolidated carbonate rock units have very low primary permeability, these blocks have been extensively fractured, creating secondary porosity and permeability which allows significant inter- and intra-basin flow. The South Range encompasses portions of five hydrographic basins, all of which are likely to be interconnected to larger regional ground water flow systems.

The second hydrogeologic environment represented on the NAFR corresponds to the North Range and is characterized by mountain blocks composed primarily of tertiary volcanic rock, which is the dominant rock-type on the North Range. Although more porous than the carbonate rocks, the volcanic rocks usually have lower transmissivities. Like the carbonates, these units have been extensively fractured and faulted, but the potential conduits for transmitting water are often re-cemented. The bedded nature of the volcanic rocks also acts as a barrier to water migration.

Common to both of these hydrogeologic environments are the alluvium-filled valleys, which act as catchment basins or reservoirs for runoff, particularly following the locally intense thunderstorms that are common during the summer. Often bounded by high-angle, normal faults, these basins store very large quantities of water, and release these reserves over a long period of time to the regional ground water systems. Depth to the water table in these basins varies widely, from a few feet to over a 1,000 feet. Table 2-20 summarizes the estimated water resource potential in the 21 basins included within the NAFR withdrawal (not including TTR or Las Vegas Valley). Table 2-21 summarizes estimated water resource potential in the basins included within the TTR.

2.9.2 WATER RIGHTS AND ALLOCATIONS

2.9.2.1 Nellis AFB and Small Arms Range

Ground water pumpage in the Las Vegas Valley has exceeded the estimated natural perennial yield (35,000 AF) since the early 1950's, peaking in 1968 at nearly 2.5 times the yield and currently at nearly 2 times the yield. If an infiltration enhanced annual yield of 45,000 AF is considered, the current pumpage is only 1.5 times greater. This overpumpage, or ground water mining, has had several consequences, including: 1) drying up the original large springs; 2) reducing the amount of ground water in storage; 3) increasing pumping lifts and thus the cost of ground water; 4) causing land subsidence and fissuring due to consolidation of confining clay layers in the principal aquifer zone; and, 5) reducing the transmissive and storage properties of the aquifers due to consolidation.

Table 2-20. Hydrologic and Water Resource Summary for Nellis Air Force Range (excluding portions in TTR and Las Vegas Valley).

Basin	Basin Area Total mi²	Basin Area Within NAFR mi²	Basin Area Within NAFR %	Groundwater Storage in Upper 100 ft of Saturated Sediment (AF)	Groundwater Perennial Yield (AFY)	Total Air Force Water Rights (AFY)	Air Force Groundwater Use in 1988 (AFY)
141 - Ralston V.	971	60	6.2	2,700,000	2,500	0	0
144 - Lida V.	535	11	2.1	1,500,000	350	0	0
145 - Stonewall Flat	381	313	82.2	820,000	100	0	-
146 - Sarcobatus Flat	812	333	41.0	2,400,000	3,000	159	-
147 - Gold Flat[1]	684	486	71.1	1,600,000	1,900	0	15[2]
148 - Cactus Flat	403	14	3.5	1,400,000	300	0	
157 - Kawich V.[1]	350	295	84.3	960,000	2,200	45	-
158 - Emigrant V.	767	740	96.5	1,600,000	2,810	197	-
159 - Yucca Flat[1]	305	6	2.0	520,000	350	0	0
160 - Frenchman Flat[1]	463	213	46.0	790,000	16,000	0	0
161 - Indian Springs V. (no. part)	655	427	65.2	1,800,000	500	900	298
168 - Three Lakes V. (no. part)	298	258	86.6	830,000	4,000	0	0
169 - Tikapoo (Tikaboo) V.	1,007	321	31.9	2,150,000	4,300	0	0
170 - Penoyer (Sand Spring) V.	700	155	22.1	2,200,000	4,000	0	0
173A - Railroad V. (so. part)	603	76	12.6	2,100,000	2,800	0	0
209 - Pahranagat V.	768	1	0.1	1,700,000	25,000	0	0
211 - Three Lakes V. (so. part)	311	171	55.0	860,000	5,000	0	1.2
225 - Mercury V.[1]	110	3	2.7	Minor	8,000	0	0
227 - Fortymile Canyon[1]	519	28	5.5	740,000	7,600	0	0
228 - Oasis V.	460	273	59.3	400,000	2,000	0	0
229 - Crater Flat	182	31	17.0	350,000	900	61	0
TOTALS	11,284	4,225	37.4	49,020,000	93,610	1,362	314.2

[1]Major portions of these basins are also included in the Nevada Test Site land withdrawal (Chapter 5).
[2]Defense-related water use included in Table 2-20.

Table 2-21. Hydrologic and Water Resource Summary for Tonopah Test Range (TTR).

Hydrographic Basin No. and Name	Basin Area			Groundwater Storage in Upper 100 ft Sat. Sediment (AF)	Estimated Perennial Groundwater Yield (AFY)	Total Defense Water Rights (AFY)	1988 Estimated Defense Groundwater Use (AF)
	Total Sq. Mi.	Portion Within TTR Sq. Mi.	Portion Within TTR %				
141 - Ralston V.	971	19	2.0	2,700,000	2,500	0	0
145 - Stonewall Flat	381	19	5.0	820,000	100	0	0
147 - Gold Flat	684	110	16.0	1,600,000	1,900	0	40[2]
148 - Cactus Flat	403	323	80.0	1,400,000	300	762[1]	160
149 - Stone Cabin V.	985	48	4.9	2,200,000	2,000	1,013[1]	240
TOTALS	3,424	519	15.0	8,720,000	6,800	1,775	440

[1]Not included in Table 2-23.
[2]Estimated construction and domestic water use.

Nevada water law provides the State Engineer with authority to designate ground water basins in which total diversions exceed the estimated average annual replenishment. In designated basins, the State Engineer has added authorities which include issuance of temporary permits to appropriate ground water. The Las Vegas Valley was designated in 1954 and all permits to appropriate ground water issued since then have generally been considered to be temporary permits. The temporary nature of the permits has applied not only to private domestic and commercial wells, but also to those of public and private water supply agencies and companies. Current status of Las Vegas Valley ground water appropriation rights are summarized in Table 2-22.

As water service has been made available to holders of temporary permits, the State Engineer has revoked the temporary permits. Both the Las Vegas Valley Water District and City of North Las Vegas have had their extensive temporary rights revoked. This process has resulted in the gradual decline of annual ground water pumpage in the Valley. Nellis AFB's continued use of its temporary ground water permits would contribute to the continued overdraft of the ground water basin with related effects on land subsidence, reduction of ground water in storage and a general increase in the cost of ground water pumpage by all users.

Nevada's allocation of Colorado River water is held in trust for the State by the Colorado River Commission. Applications to appropriate Colorado River water must not only have the approval of the State Engineer, but also that of the Commission. The Commission contracted, on behalf of the State, with the U.S. Bureau of Reclamation for construction of the SNWS diversion and transmission system and was responsible for constructing the water treatment works. The Commission is responsible for repayment of construction and operating costs and for contracting with users for water deliveries. Actual operation and management of SNWS is administered by the Las Vegas Valley Water District.

Colorado River Commission water deliveries for the current year establish "water entitlements" for the next year, which are annual rights to those amounts of SNWS water. Contracts specify both a maximum delivery rate and the annual entitlement. Table 2-23 summarizes current SNWS entitlements. Nellis AFB has a fixed entitlement of 4,000 AFY.

2.9.2.2 Indian Springs AFAF

There is a total of 4,430 AFY of ground water and surface-water rights in Indian Springs Valley, consisting of 1,326 AFY of ground water and 3,104 AFY of surface water (Table 2-24). Records in the Nevada State Engineer's Office indicate that the Air Force has appropriated 900 AFY of ground water. Total water rights in Indian Springs Valley exceed the estimated yield by approximately 2,930 AFY. There are no privately held water rights located within the Indian Springs AFAF withdrawal area.

Table 2-22. Summary of Groundwater Rights (AFY) for the Las Vegas Valley.

Agency/Entity/Group	Permanent	Temporary	Total
Las Vegas Valley Water District	39,680	0	39,680
City of North Las Vegas	5,521	0	5,521
Nellis Air Force Base	1,647	1,303	2,950
Domestic Wells[1]	0	6,220	6,220
Others	24,025	16,272	40,297
TOTALS	70,873	23,795	94,668

[1] Based on estimated use of 1 acre-feet per year per well. There is no actual paper right for domestic wells. Nevada law allows for the pumpage of 1,800 gallons per day for a well serving a single family residence. This allows each domestic well to have the potential to pump 2.02 AFY, which seldom occurs, making the 1 AFY assumption more realistic.

Table 2-23. Contract Entitlements for 1988 Delivery of Southern Nevada Water System (SNWS) Water.

User	Contract Turnout Capacities (ft^3/s)	Annual Entitlement[1] (acre-feet)
Las Vegas Valley Water District	413	155,935
City of North Las Vegas	92	16,044
City of Henderson	97	14,497
Boulder City	30	6,851
Nellis Air Force Base	6	4,000
TOTALS	638	197,327

[1]Except for Nellis AFB, the entitlement can increase based on current year actual use.

2.9.2.3 Nellis Air Force Range

Excluding Las Vegas Valley and the TTR, water rights (certificates, permits, and applications) total 58,164 AFY in the 21 hydrographic basins, wholly or partly included in NAFR, consisting of 42,737 AFY of ground water and 15,427 AFY of surface water (Table 2-24). Outside the TTR portion of the NAFR, military appropriations total 1,362 AFY with ground water and surface water comprising 1,134 and 228 AFY, respectively. Of these rights, 900 AFY are located in Indian Springs Valley. In eight of the basins, water rights exceed the estimated yield, but in the aggregate, over 35,000 AFY remains unappropriated. The records in the Nevada State Engineer's Office indicate that there are 188 AFY of water rights located within the NAFR withdrawal area (outside of TTR) held by private parties (Stonewall, 62 AFY; Sarcobatus Flat, 21 AFY; Gold Flat, 35 AFY; Kawich Valley, 55 AFY; and Tikapoo Valley, 7 AFY). Stock watering is the indicated use for all of these rights.

2.9.3 WATER DIVERSIONS AND CONSUMPTIVE USE

2.9.3.1 Nellis AFB and Small Arms Range

Nellis AFB obtains its water supply from two sources. First, water is derived from a system of 15 (2 inactive) wells whose locations are shown in Figure 2.14. Ground water pumpage from the Las Vegas Valley artesian basin for the period 1968-88 is summarized in Table 2-25. From this table, in 1988 Nellis AFB pumped from its wells 2,500 AF of ground water, which represented 3.7 percent of all the ground water pumped in the Las Vegas Valley artesian basin. There are no wells on the Small Arms Range or any significant water-using activities.

The second source of water for Nellis AFB is water imported from the Colorado River via the SNWS. In Table 2-25, water imports to the Las Vegas Valley from the Colorado River are summarized for the period 1968-88. In 1988, Nellis AFB received 1,600 AF of Colorado River water, which represents 0.8 percent of all the water imported to the Las Vegas area from the Colorado River. As an independent client of the SNWS, Nellis AFB can import up to 4,000 AFY of Colorado River water. Another option that may be available to Nellis AFB is to obtain additional Colorado River water by purchasing it from another water purveyor such as the City of North Las Vegas, (Source: Colorado River Commission (CRC), personal communication, 1989).

Combining the ground water and surface-water data in Table 2-24 shows that in 1988 Nellis AFB on-base water use was 4,100 acre-feet, or approximately 1.5 percent of total water use in Las Vegas Valley. This use, however, does not include that water used by Nellis AFB direct employees and their dependents who live off-base, of which according to Section 2.3.2.2 there are approximately 31,800. Using the average number of residents per household (2.45) presented in Sec 2.3, this translates to approximately 12,980 dwelling units off base. Using an annual consumption per dwelling unit of 0.68 acre-feet (Nev, Div of Water Planning, 1982) this translates to a 1988 off-base use of approximately an additional 8,830 acre-feet of water. Thus, the total Nellis AFB-related water use in 1988 would have

Table 2-24. Water Rights Status for Hydrographic Basins Associated With Nellis Air Force Range (excluding portions in TTR and Las Vegas Valley).

Hydrographic Basin	Air Force (AFY)			Others (non-defense)(AFY)			Total Appropriations (AFY)			Groundwater Perennial Yield (AFY)
NO. AND NAME	TOTAL	GW	SW	TOTAL	GW	SW	TOTAL	GW	SW	
141 - Ralston V.	0	0	0	6,713	4,951	1,762	6,713	4,951	1,762	2,500
144 - Lida V.	0	0	0	4,293	238	4,055	4,293	238	4,055	350
145 - Stonewall Flat	0	0	0	445	14	431	445	14	431	100
146 - Saracobatus Flat	159	159	0	1,741	1,666	75	1,900	1,825	75	3,000
147 - Gold Flat	0	0	0	35	35	0	35	35	0	1,900
148 - Cactus Flat	0(1)	0(1)	0(1)	223	0	223	985(1)	614(1)	371(1)	300
157 - Kawich V.	45	0	45	80	23	57	125	23	102	2,200
158 - Emigrant V.	197	14	183	41	0	41	238	14	224	2,180
159 - Yucca Flat	-(2)	-(2)	-(2)	0	0	0	42(2)	0	42(2)	350
160 - Frenchman Flat	-(2)	-(2)	-(2)	0	0	0	2(2)	0	2(2)	16,000
161 - Indian Springs V.	900	900	0	3,530	426	3,104	4,430	1,326	3,104	500
168 - Three Lakes V. (no. part)	0	0	0	12	0	12	12	0	12	4,000
169 - Tikapoo (Tikaboo) V.	0	0	0	948	7	941	948	7	941	4,300
170 - Penoyer V. (Sand Spring V.)	0	0	0	5,678	5,669	9	5,678	5,669	9	4,000
173A - Railroad V. (so. part)	0	0	0	5,259	5,143	116	5,259	5,143	116	2,800
209 - Pahranagat V.	0	0	0	18,444	18,444	0	18,444	18,444	0	25,000
211 - Three Lakes V. (so. part)	0	0	0	<1	<1	<1	<1	<1	<1	5,000
225 - Mercury V.	0	0	0	0	0	0	0	0	0	8,000

Table 2-24. Water Rights Status for Hydrographic Basins Associated With Nellis Air Force Range (excluding portions in TTR and Las Vegas Valley) (continued).

Hydrographic Basin	Air Force (AFY)			Others (non-defense)(AFY)			Total Appropriations (AFY)			Groundwater Perennial Yield (AFY)
NO. AND NAME	TOTAL	GW	SW	TOTAL	GW	SW	TOTAL	GW	SW	
227 - Fortymile Canyon	-[2]	-[2]	-[2]	1,601	145	1,456	1,629[2]	162[2]	1,467[2]	7,000
228 - Oasis V.	0	0	0	4,382	1,677	2,705	4,382	1,677	2,705	2,000
229 - Crater Flat	61	61	0	2,543	2,543	9	2,604	2,595	9	900
TOTALS	1,362	1,134	228	55,968	40,972	14,996	58,164	42,737	15,427	93,610

(1) See TTR, Chapter 5.
(2) See Nevada Test Site, Chapter 5.

Table 2-25. Summary of Las Vegas Valley Water Use, 1968-88 (Source: Coache, 1988).

	Ground Water Pumpage (in acre-feet)						Imports[5] (in acre-feet)							
							BMI Pipeline			Southern Nevada Water System[6]				
Calendar Year	LVVWD[1]	Nellis[2] AFB	NLV[2][f]	Permits[2]	Domestic[2]	Total Pumpage	LVVWD[3]	City of[3] Henderson	BMI[3]	LVVWD	Nellis AFB	NLV[f]	City of Henderson	Total[4] Imports
1968	48,080	2,605	9,753	20,197	[b]5,514	86,149	6,874	5,567	17,348	0	0	0	0	29,789
1969	47,879	2,661	9,895	19,584	[b]5,749	85,768	9,710	5,953	18,068	0	0	0	0	33,731
1970	48,010	2,449	11,473	17,772	[b]5,994	85,698	13,353	6,063	14,834	0	0	0	0	34,250
1971	45,200	2,409	12,836	18,084	[b]6,268	84,797	6,120	6,434	13,253	4,143	36	25	0	[e]30,129
1972	32,370	2,050	12,941	16,740	[b]6,564	70,665	0	6,607	13,077	42,038	1,291	1,477	4	65,240
1973	33,921	1,848	11,836	15,869	[b]6,904	70,378	0	5,190	14,631	48,674	1,276	2,341	1,735	75,001
1974	40,126	1,513	11,316	17,826	[b]7,253	78,034	0	4,303	15,038	49,278	1,897	3,333	1,936	76,168
1975	37,700	822	8,243	18,436	[b]7,474	72,675	0	4,851	11,923	54,735	1,885	6,302	1,547	81,753
1976	39,344	1,122	9,651	16,724	[a]3,236	70,077	0	5,206	8,810	59,349	2,060	6,466	1,895	84,473
1977	39,412	734	8,590	16,937	[a]3,380	69,053	0	5,501	7,066	60,244	2,628	6,318	2,160	85,577
1978	39,196	697	8,308	17,142	[a]3,655	68,998	0	5,633	7,678	67,203	2,513	6,073	2,309	92,222
1979	43,691	1,310	6,420	16,600	[a]4,009	72,030	0	5,715	8,981	78,788	2,179	8,136	2,943	108,446
1980	40,654	961	7,543	17,250	[a]4,228	70,636	0	5,572	9,206	89,568	2,060	6,957	3,655	119,318
1981	38,588	967	7,099	17,347	[a]4,406	68,407	0	4,912	8,146	104,800	2,302	8,170	5,453	134,571
1982	34,855	1,043	6,545	15,972	[a]4,530	62,945	0	5,459	6,090	103,249	2,041	8,428	5,062	130,860
1983	37,544	1,552	5,390	17,047	[c]5,690	67,223	0	4,634	6,542	104,670	1,969	8,763	6,670	133,243
1984	39,391	1,663	6,398	15,765	[c]5,782	68,999	0	4,312	7,535	113,640	2,091	10,491	8,324	146,690
1985	38,185	1,439	6,187	16,809	[c]5,857	68,477	0	3,785	6,880	119,844	2,268	11,193	9,595	155,396
1986	38,623	1,519	5,308	17,903	[c]5,972	[d]69,325	0	4,774	7,159	127,395	1,802	14,050	10,594	167,722
1987	37,145	1,855	5,635	16,540	[c]6,103	67,278	0	4,401	8,244	130,196	1,340	13,217	12,326	173,742
1988	37,096	2,501	5,076	16,960	[c]6,221	67,854	0	4,164	7,824	155,914	1,607	16,044	14,497	201,096

[1]From Records of the Las Vegas Valley Water District (LVVWD) using a conversion factor of 3.07 acre-feet per million gallons.
[2]From yearly pumpage inventories on record with the State Engineer's Office.
[3]Colorado River water diverted through the Basic Management pipeline.
[4]Includes losses from the Southern Nevada Water System.
[5]From revised records of Nevada Colorado River Commission.
[6]First water delivered on June 16, 1971.
[a]Dusty assigned to each domestic well ranges from 0.50 to 0.99 acre-feet per year.
[b]A duty of 1.61 acre-feet per year given to each domestic well.
[c]A duty of 1.0 acre-feet per year given to each domestic well.
[d]Revised from previously published figures due to correction of meter reading.
[e]Does not include 14,415 acre-feet diverted for testing of Southern Nevada Water System.
[f]City of North Las Vegas (NLV).

been approximately 10,940 acre-feet, or approximately 4.1 percent of the total 1988 Las Vegas Valley water use. Economically, the total Nellis AFB use resulted in the production of approximately 5.6 percent of the Clark County gross regional product (Table 2-7). If it is assumed that there is a 10 percent increase in the number of direct employees and their dependents by the year 2000 (Table 2-8 forecasts a decline), this would result in an approximate increase in water use to 12,030 acre-feet. This is approximately 2.4 percent of the currently forecast year 2000 water demand of approximately 500,000 acre-feet for the valley. Economically, in return for this water use, Nellis AFB-related activities are forecast in Table 2-8 to contribute 3.5 percent of the Clark County gross regional product with a reduced total direct employment.

Sufficient data are not available to determine the on-base end-use of water use on Nellis AFB; for example, landscape irrigation, human consumption, and industrial/construction uses. However, some perspective on the on-base consumptive use of water by Nellis AFB can be gained by comparing the rate of delivery of potable water to Nellis AFB to the rate of discharge of Nellis AFB waste water to the Clark County Sanitation District (CCSD). Using the 1988 data in Table 2-25, a total of 4,100 AFY, averaging 3.7 million gallons per day (mgd), were delivered to Nellis AFB. In April 1988, CCSD measured an average waste water discharge rate from Nellis AFB of 0.89 mgd, (Source: Wren-Jarvis, personal communication, 1989). Assuming that the waste water rate measured by CCSD was representative, the consumptive use (excluding recharge of the ground water system) on Nellis AFB was 2.8 mgd; or 76 percent of the potable water delivered. In comparison, using the data from Table 2-25, potable water was delivered in 1988 at a rate of 220 mgd to customers in the Las Vegas Valley who discharged to the CCSD and the City of Las Vegas waste treatment plants. The combined discharges from the waste treatment plants in 1988 was 130 mgd (Source: French, personal communication, 1989); therefore, the consumptive use on a valley-wide basis was 90 mgd or 41 percent of the potable water delivered. While the available data preclude a detailed explanation of the high consumptive use of water on Nellis AFB, possible explanations include: loss of water from the distribution system; watering of landscaping; underestimation of waste water discharge; or a combination of these factors.

The volume of Colorado River water consumed in the Las Vegas Valley is a crucial factor in the calculation of return flow credits that, in turn, affects the volume of water that Nevada can withdraw from the Colorado River.

The pumpage and consumption of water at Nellis AFB may also be linked to the land subsidence that is occurring in the vicinity of three Air Force wells in Clark County (Figure 2.14). In the vicinity of the Nellis AFB Craig Road well field, Craig Road has subsided approximately 9 inches in the last three years. There are also deep earth fissures in this area. This well field is located just to the east of a major scarp in the valley fill. Approximately 400 to 600 acres located to the southwest of the well field, including roads and housing developments, are affected by subsidence and fissuring (Source: Murchie, personal communication, 1989).

2.9.3.2 Indian Springs AFAF

Ground water pumpage at Indian Springs AFAF was approximately 298 AFY (0.27 mgd) in 1988. Since evaporation ponds are used to dispose of waste effluent, the complete 298 AF of water is consumptively used. Available data for the Indian Springs AFAF indicate good quality ground water with TDS of 330 mg/l and hardness of 250 mg/l and no objectionable concentrations of other minerals (Source: DOI/BLM, 1981).

2.9.3.3 Nellis Air Force Range

The rate of water pumpage and use on the NAFR is small. The Tolicha Peak installation in Gold Flat pumps 15 AFY (0.013 mgd). This estimate is based on one month of data. Current ground water use by the 37th TFW at the TTR is approximately 380 AFY. In addition, 1.2 AFY (0.001 mgd) of water is pumped on Subrange 63 (southeast of Indian Springs AFAF). With removal of the 37th TFW from the TTR, most ground water pumping (currently 380 AFY) is expected to be eliminated. Assuming a 10 percent grounds-keeping function remains, approximately 38 AFY would be pumped. Total Air Force pumpage from Stone Cabin Valley would be reduced to zero, and in Cactus Flat, Air Force pumping would be reduced from 160 AFY to 58 AFY. Limited available data indicate that quality of ground water on NAFR is good to excellent. A chemical analysis from subrange 63 shows TDS of 212 mg/l and hardness of only 170 mg/l, with no objectionable concentrations of other minerals (Source: DOI/BLM, 1981).

2.9.4 RESOURCE IMPAIRMENT AND OTHER EFFECTS

2.9.4.1 Nellis AFB and Small Arms Range

IRP studies at Nellis AFB have identified potential contributing sites and detected on-base contamination both in shallow monitoring wells and deep supply wells. Contaminant concentrations in deep supply wells are well below SDWA. Contaminants detected include halocarbons and aromatics (TCE and Toluene), pesticides (Aldrin and DDT isomers), nitrates, and phenols. Available data are insufficient to estimate the volume of ground water that has been impaired (and thus is unusable) or the volume that might be impaired. High nitrate concentrations exist in some private wells south of Nellis AFB. However, the source of the nitrate concentration is undetermined (Sources: Dames and Moore, 1985; Montgomery, 1989).

Estimates indicate that Nellis AFB consumes water at a relatively high rate compared to the rest of the Las Vegas Valley (76 percent vs. 41 percent, respectively) relative to its waste water discharge. Possible factors responsible for this difference include loss of water from the distribution system, watering of landscaping, underestimation of waste water discharge by CCSD, or a combination of these factors. Nellis AFB is currently working with the NDEP on revisions of the IRP program to ensure adequate clean-up of the waste sites and to protect the ground water for both current and future users.

There is limited data linking specific ground water pumpage and land subsidence; however, in the Las Vegas Valley, areas of extensive ground water pumping and subsiding areas are historically located in the same area (Source: Division of Water Planning, 1982). Pumping at the three Nellis AFB wells located off-base in Clark County could be related to subsidence in the area near the wells.

2.9.4.2 Indian Springs AFAF

At this facility, the depth to the ground water is less than 100 feet. J.M. Montgomery (1989) drilled test holes at each of three IRP sites at this facility and found either no, or low, soil concentrations of contaminants at the landfill and the waste water treatment plant. Higher concentrations of contaminants were found in the fire training area soils; samples at the surface and at a depth of 5 feet had contaminant concentrations above recommended standards. No significant contamination was detected in the ground water. Calculations have indicated that some contamination may reach the ground water in 10 to 30 years, and concluded that future extensive ground water development in this area could be a cause for concern (Source: Montgomery, 1989).

Actual water use at Indian Springs AFAF is much smaller than the associated water rights; approximately 600 AFY of water rights are not being exercised. A portion of these water rights could be reallocated to other uses.

2.9.4.3 Nellis Air Force Range

Approximately 1,000 tons per year of various types of explosive ordnance are dropped on the NAFR. Thus, since the establishment of NAFR, in excess of 40,000 tons may have been deposited in these areas, resulting in an uncertain quantity and distribution of explosion by-products. Since the target zones are on alluvial fans and playas, it is possible that these explosion by-products have resulted in the contamination of ground water. The amount of ground water contaminated by these activities is not known and cannot be estimated with existing studies.

Since 1971, residual ordnance components (e.g., bomb fragments, rocket casings, and flare casings), inert or live ordnance residuals, and inert/training bombs have routinely been gathered and disposed of in shallow on-site pits. Additionally, destroyed target materials (lumber, tanks, trucks, jeeps, etc.) have been collected and disposed of in impromptu landfills. There are approximately 46 EOD pits and 12 target/trash landfills on the ranges. One mine shaft has also been used for disposal of waste materials. The various landfills and mine shaft contain in addition to solid waste, various paint products and solvents, batteries, and petroleum products. The effect of these disposal sites on the ground water system cannot be estimated with existing studies.

There was also an approximately 3,500 gallon leak of gasoline from an underground tank at the Tolicha Peak range support facility in 1984. Whether this leak has resulted in ground water contamination and thus impairment of that resource is not known. The site is contained within the NAFR IRP.

2.9.5 SUMMARY

Several effects on water resources result from withdrawals for Nellis AFB and the NAFR. First, relative to other users in the Las Vegas Valley, the apparent consumptive use on Nellis AFB is high (i.e., 76 percent vs. 41 percent of potable water deliveries) relative to waste water discharge. The high consumptive use of water imported from the Colorado River on this facility has a small effect on the return flow credit calculation in Las Vegas Wash. While the pumpage of ground water from the Nellis AFB well fields has no effect on the return flow credit calculations, this pumpage may be a factor in the subsidence that is taking place in the vicinity of Craig Road and the three wells operated by Nellis AFB. The ground water pumpage and consumption at other locations on this withdrawal are small.

Second, very large quantities of water under the NAFR may not be available for development. The current sources of potable water in the Las Vegas Valley are the ground water aquifers of the Valley and imports of water from the Colorado River. Although all water supply estimates are uncertain, it was projected in 1982 that there will be an insufficient supply of water to meet the expected demand past the year 2020 unless alternative supplies are found (Source: Division of Water Planning, 1982). Given the recent rapid population growth of the Las Vegas metropolitan area, it is possible that demand may exceed supply by the year 2000 or 2010.

The potential of the deep carbonate aquifer is currently being investigated. The effect of the NAFR land withdrawal may have a major influence on this resource since the portion of this flow system that is nearest to the Las Vegas Valley underlies the southern and eastern areas of the NAFR. The exploration and development of this potential resource will require additional studies including the construction of wells and associated facilities on withdrawn lands (Source: Dettinger, 1989). If the carbonate aquifer is a viable future source of water for the Las Vegas metropolitan area, production wells on withdrawn lands may be needed along with pipelines, siphons, and open-channels.

The importation of water from adjacent alluvial ground water basins is another alternative source of water. In the 1971 study of potential new sources of water for southern Nevada, the ground water underlying withdrawn lands was not considered (Source: State Engineer's Office, 1971a). In a subsequent study, the magnitude of this potential resource was noted, but not considered in detail. There are a number of hydrographic basins that are either partially or completely on withdrawn lands. The combined withdrawals (NAFR and NTS) result in 13 basins which are over 50 percent withdrawn, 9 are over 80 percent withdrawn, and 6 are over 90 percent withdrawn. The 13 basins collectively represent over 50,000 AFY of perennial ground water yield and over 12,000,000 AF of ground water storage in the upper 100 feet of saturated sediments. The quantification and development of the potential water underlying NAFR requires detailed coordination for access to these currently restricted areas.

The use of surface water from outlying areas also has potential. In arid regions the annual precipitation can often be a significant source of water. For example, in the Las Vegas Valley, the annual precipitation is approximately 4 inches; using a basin area of 1,571 square miles, this translates to 330,000 AFY which exceeds the Nevada allocation of Colorado River water. There are a number of problems in developing this water supply alternative. For example, some of the precipitation recharges the shallow ground water system; the most severe precipitation events usually occur during the summer when potential evapotranspiration greatly exceeds the amount of precipitation; and in urban areas the water quality of storm water is generally poor. However, this potential source of water has been considered in the Las Vegas Valley, (Source: Division of Water Planning, 1982). One option not considered was to capture precipitation on undeveloped lands where the water quality would generally be good. Some of the areas closest to the Las Vegas Valley where this could be accomplished lie within the withdrawn lands.

Third, the quantity of water that has been and continues to be impaired by past and present activities on NAFR potentially affects water resources in Nevada. Sufficient data are not available to assess the amount of water or if any water contamination exists.

While the study time-horizons for this report are the years 1988 and 2000, and the projected supply shortfall is not expected until after year 2000, the problem of access is a present one. Major water supply developments often require 10 to 15 (or more) years to bring to fruition. Neither the extent nor characteristics of the ground water resources associated with the NAFR withdrawal are known. Before any plan for developing those ground water resources could be developed, additional extensive hydrologic studies are necessary. Resource evaluation, project planning, and project coordination could require more than a decade to complete.

2.10 SUMMARY

This chapter has identified effects and possible effects resulting from activities associated with the mission of Nellis Air Force Base, including activities that occur on the Nellis Air Force Range and in airspace used for the mission of Nellis AFB. These effects are summarized in Chapter 8, as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of these effects are also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 3

NAVAL AIR STATION (NAS) FALLON, NAS FALLON RANGE TRAINING COMPLEX (FRTC), AND ASSOCIATED USE OF AIRSPACE

3.1 EXISTING, PROPOSED, AND ENVISIONED ACTIVITIES

3.1.1 OVERVIEW OF EXISTING ACTIVITIES

The original facilities at Naval Air Station (NAS), Fallon were built in 1942 during the early stages of World War II and were used as an Army training post. The Navy assumed responsibility for the withdrawal in 1943 for the purpose of using the facilities as a training and support station for air groups on training missions (Source: OMNI-MEANS, Ltd., 1987).

NAS Fallon's mission is to maintain and operate facilities and provide services and material to support operations of aviation activities and units of the operating forces of the Navy and other activities and units designated by the Chief of Naval Operations. NAS Fallon is currently the only Navy facility where advanced integrated Carrier Air Wing (CVW) strike training can take place. Existing land withdrawals and airspace configuration do not allow adequately realistic training at the NAS Fallon Range Training Complex (FRTC) against present and future combat threat environments. With the continuing development of long-range stand-off weapons systems, air wing tactics and asset employment require greater airspace and land areas to eliminate existing training deficiencies.

3.1.2 LOCATION OF EXISTING ACTIVITIES

3.1.2.1 Land Withdrawals

Figure 3.1 shows the location of NAS Fallon, the associated ranges which comprise the FRTC, and proposed withdrawals associated with the NAS Fallon mission. Approximately 105,000 acres of withdrawn and acquired lands are encompassed within the boundaries of NAS Fallon and the ranges which comprise the FRTC.

NAS Fallon and the FRTC are located in the Carson Desert and surrounding valleys of Churchill County in west-central Nevada. Valley bottom elevations in the area range from 3,840 feet to 4,160 feet. The Dead Camel Mountains and the Sheckler Reservoir are to the west of the Station, and the City of Fallon and Carson River lie to the northwest. The Fallon Paiute-Shoshone Indian Reservation and the Stillwater Wildlife Management Area (WMA) and Stillwater National Wildlife Refuge (NWR) lie to the northeast of the Station, and the Stillwater Mountain Range and Carson Lake lie to the east and south, respectively. NAS Fallon is approximately 70 miles east of Reno and 6 miles southeast of Fallon. The City of Fallon and NAS Fallon are surrounded by ranching and agricultural activities. The Station encompasses 7,982 acres, of which approximately 3,934 acres of acquired lands are held in fee simple. The 2,934 acres of the acquired lands which are held

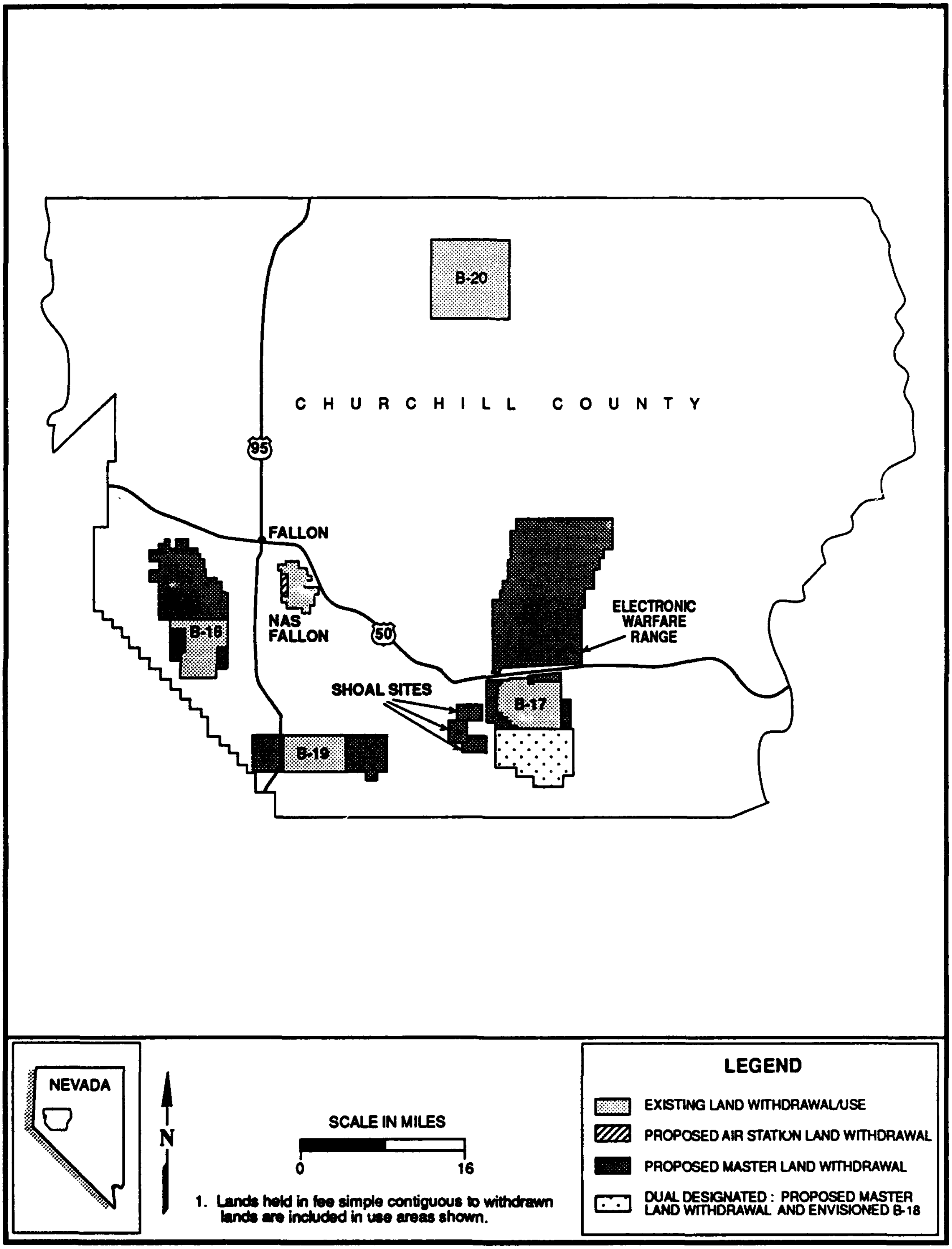


FIGURE 3.1 EXISTING WITHDRAWN LAND USES/WITHDRAWALS AND PROPOSED WITHDRAWALS ASSOCIATED WITH NAS FALLON MISSION

in fee simple are water-righted, and approximately 1,000 acres of the acquired lands which are held in fee simple are not water-righted. Prior to their acquisition, the water-righted lands held in fee simple were used for agricultural purposes. When they were privately owned, those lands were irrigated pursuant to their allocated water rights, and they were used to produce annual/perennial cash crops, for grazing, and for livestock production.

Specific land withdrawals for the FRTC are as follows:

Training Range Bravo 16 (B-16) was established in 1953 (Source: U.S. Navy, NAS Fallon, Uses of Public Land/Airspace, 1988) and is comprised of approximately 17,280 acres located in the southwestern portion of the Carson Desert. Located nine miles southwest of NAS Fallon and east of the Dead Camel Mountains, B-16 is used for practice in the basic techniques of air-to-ground bombing including special weapons delivery and conventional bombing using inert/training ordnance. Electronic scoring is available with the Weapons Impact Scoring Set (WISS). One conventional bull's-eye, one special weapons bull's-eye, and three spotting towers are located on B-16. Thirteen Military Training Routes (MTRs) which accommodate single aircraft, special strike requirements terminate at B-16 (Source: Western Division, Naval Facilities Engineering Command, RAICUZ Study, 1982b).

Training Range Bravo 17 (B-17) was established by permit in 1945 and was subsequently withdrawn in 1953 (Source: U.S. Navy, NAS Fallon, Uses of Public Land/Airspace, 1988) and is comprised of approximately 21,400 acres located in central Fairview Valley. Located 35 miles southeast of NAS Fallon, B-17 is the tactical target which is the focus of CVW training. B-17 is used for strafing, laser ranging and targeting, inert/training and explosive air-to-ground bombing, no drop bomb scoring (NDBS), close air support artillery spotting, and delivery of rockets and other explosive ordnance up to 1,000 pounds (Source: Western Division, Naval Facilities Engineering Command, RAICUZ Study, 1982b). Electronic scoring is available with the WISS. One strafing banner, multiple tactical target sites, one conventional bull's-eye, a high-explosive target impact area, two manned EW emitter sites, and three spotting towers are contained within B-17.

Training Range Bravo 19 (B-19) was established by permit in 1945 and was subsequently withdrawn in 1953 and is comprised of approximately 17,330 acres located just to the west of the Blow Sand Mountains. Located 15 miles south of NAS Fallon, B-19 is used for strafing, laser ranging and targeting, and inert/training and explosive air-to-ground bombing. Electronic scoring is available with the WISS. A strafing banner, a conventional bull's-eye, a high explosive target impact area, and three spotting towers are contained within B-19. Explosive devices up to 1,000 pounds are dropped on the target area.

Training Range Bravo 20 (B-20) is a weapons range that has been operational since the early 1940's. B-20 is comprised of approximately 41,007 acres in the Carson Sink area of the Carson Desert. Of the total acreage, approximately 19,430 acres were acquired by condemnation from the Southern Pacific Land Company. The remaining 21,577 acres were withdrawn by Public Law 99-606 in 1986. Located 35 miles northeast of NAS Fallon, B-20 is used for strafing, laser ranging and targeting, and air-to-ground bombing using inert/training and explosive ordnance. Explosives up to 2,000 pounds are dropped on the range. Electronic scoring is available with the WISS. Two strafing banners, two conventional bull's-eyes, a laser target, two spotting towers, and a lighted helicopter pad are located within B-20. The range was closed in January 1987 for target development and reopened in December 1988 for limited use (Sources: U.S. Navy, NAS Fallon, Uses of Public Land/Airspace, 1988; Western Division, Naval Facilities Engineering Command, RAICUZ Study, 1982). The final phase of range development at B-20, including instrumentation/data links, was completed in April 1990.

Public Lands Used but not Withdrawn

Electronic Warfare Sites (EWS). The Navy has authorizations for a total of 33 electronic warfare sites associated with its use of the Fallon bombing ranges. These sites, with associated powerlines, access roads and communication cable involve the use of 487 acres.

Land surrounding the rights-of-way are not authorized for defense-related uses. The land around each EWS was previously used for grazing and is still used for that purpose today. If land for the Electronic Warfare Range (EWR) is withdrawn as proposed in the Master Land Withdrawal, that land will still be available for grazing. Located approximately 35 miles east of NAS Fallon and immediately north of U.S. Highway 50 and B-17, the airspace above the EWS is used for practice in electronic jamming and defensive maneuvers to avoid detection by ground-based radar (Source: Western Division, Naval Facilities Engineering Command, Draft EIS, 1982c). Permanent and mobile EW radar sites, EW emitter sites, Tactical Aircrew Combat Training System (TACTS) tracking instrumentation subsystem (TIS) sites, NDBS sites, simulated surface-to-air missile sites, the *Centroid*, and a lighted helicopter pad are located in the EWS area. No ordnance is used in the EWS area. There are on-site personnel. Most of these sites are located in eastern Churchill County. Fifteen are located within the proposed Master Land Withdrawal area. The other eighteen sites are located primarily in Bell Flat, Dixie Valley, Fairview Valley and along the Gabbs highway south of Middlegate.

The Shoal Sites consist of 3 plots of public lands west of B-17 that encompass approximately 7,404 acres. The Navy's authorization to use two of the three Sites, the North and South Shoal Sites, was obtained by a Special Land Use Permit in 1965. That Special Land Use Permit has expired. Currently BLM authorizes Navy use of those two sites under casual use bases. The Navy currently uses the third Shoal Site, the DOE Site, pursuant to a Memorandum of Understanding (MOU) with the Atomic Energy Commission (now Department of Energy [DOE]). Since the Shoal Site was withdrawn for atomic testing only, the DOE has no authority to grant use of the site to the Navy for military maneuvers. The Shoal Sites are located in the Sand Springs Mountain Range and are bounded on all sides by other public lands. The North and South Shoal Sites are currently used for grazing. These sites are situated approximately 30 miles southeast of NAS Fallon and are used for strike rescue training under simulated combat conditions, primarily with helicopters. The Shoal Sites are not equipped with ordnance targets, and ordnance is not expended there.

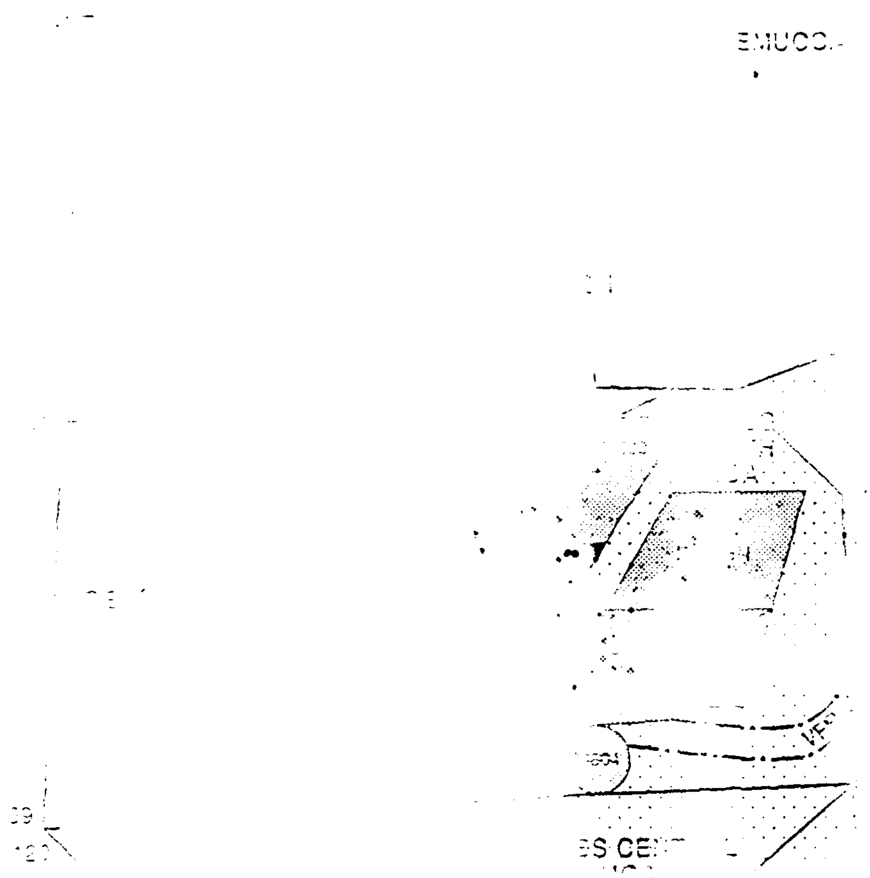
TACTS is an aircraft tracking and data communications system which affords military pilots the opportunity for state-of-the-art training in air-to-air combat, air-to-surface combat, and EW. TACTS enables an air wing to evaluate the effectiveness of an air strike and the need, if any, for modification in tactics or training to enable the air wing to achieve its target objective and to meet the threats presented. TACTS is a highly sophisticated computer tracking system which records the flight paths of aircraft involved in an air strike as well as opposing adversary aircraft, the point at which weapons (simulated or real) are employed by both "sides," and the simulated flight paths of the weapons. It also evaluates the recorded information to determine the effectiveness of the air strike. TACTS can also provide a "replay" of the air strike so the participants can view and evaluate their performance. Participating aircraft carry electronic "pods" which relay information concerning their flight paths and weapons employment to remote TIS sites. There currently are 27 TIS sites, each of which is approximately 16 feet by 16 feet and has its own right-of-way. TIS's are solar-powered. Additionally, there are two repeaters and two master sites. The TACTS sites are scattered throughout much of eastern Churchill County and in portions of Lander, Nye and Mineral Counties. Most are located in the Stillwater, Desatoya, Sand Springs, and Toiyabe Ranges.

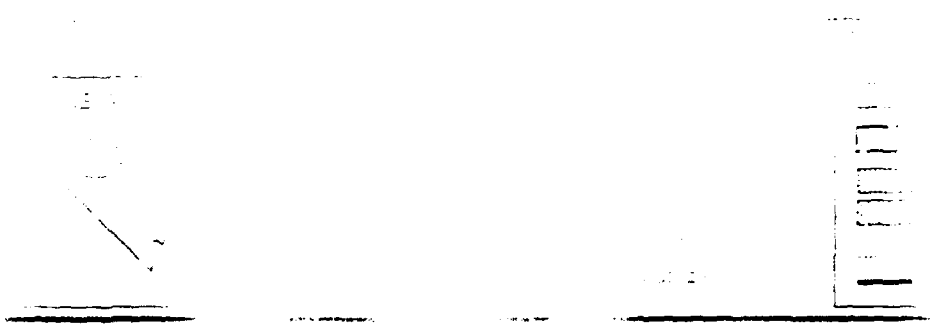
Public Lands Affected by Navy Activities. Ordnance intended to be dropped on B-16, B-17, and B-19 has impacted on the public lands adjacent to those bombing ranges. As a result, approximately 24,000 acres were closed by the Bureau of Land Management for public safety via an emergency closure. Further discussion of these lands and the Navy's ordnance retrieval effort are contained in Section 3.2.11.

3.1.2.2 Airspace

Existing and proposed airspace airspace associated with NAS Fallon is shown in Figure 3.2 and includes nine restricted areas, seven military operations areas (MOAs), and five air traffic control assigned airspace (ATCAA) areas. The training ranges described (Source: U.S. Navy, NAS Fallon, 1986) in Section 3.1.2.1 are located beneath that airspace. Supersonic flight is permitted in portions of three MOAs (Gabbs North, Gabbs Central, and Austin 1) at altitudes above 11,000 feet above mean sea level (MSL).

Restricted areas are located above and extend beyond the boundaries of the associated range or target. The restricted area over B-16, R-4803 South, includes approximately 113 square miles which overlie public land that is not withdrawn. R-4804, the restricted area over B-17, includes approximately 87 square miles which overlie public land that is not withdrawn. The restricted area over B-19, R-4810, includes approximately 93 square miles which overlie public land that is not withdrawn. R-4813, one of the restricted areas over B-20, includes approximately 531 square miles which overlie public land that is not withdrawn. Restricted area R-4812, associated with both B-17 and B-19, includes approximately 175 square miles which overlie public land that is not withdrawn. Hazardous military training activities such as artillery firing, air-to-ground gunnery and bombing, and firing of missiles (up to five-inch Zuni rockets) are conducted on withdrawn lands which lie beneath restricted areas. The restricted areas of the FRTC are "joint use areas," and civil aircraft are able to fly in those restricted areas when they are not being used for hazardous military training activities. Restricted areas R-4802, R-4803 North, R-4803 South, R-4804, R-4810, and R-4813 are used in conjunction with bombing, strafing, and rocket delivery practice on withdrawn ranges. Aircraft arm their weapons systems for use on adjacent ranges while in restricted area R-4812, and this restricted area is also used for strike rescue





training. Restricted areas R-4816 North and R-4816 South are used for practice in electronic jamming and defensive maneuvers to avoid detection by ground-based radar, and that airspace is within TACTS coverage.

The FRTC MOAs and ATCAAs are located to accommodate aircraft maneuvering in airspace adjacent to the restricted areas and are broader and higher than the restricted areas. Non-hazardous military training activities such as air combat maneuvers, air intercepts, and aerobatics are conducted in the MOAs. Civil aircraft flying by visual flight rules (VFR) can use the airspace within MOAs at anytime, including when military training activities are being conducted. As an additional safety precaution, civil VFR aircraft are encouraged to contact the NAS Fallon Desert Control air traffic control facility prior to flying in the MOAs. Civil aircraft flying by instrument flight rules (IFR) are eligible to use the airspace within MOAs. In practice air traffic controllers either route IFR traffic around MOAs or, when routing aircraft through MOAs, provide separation from military activities occurring within MOAs. In response to civil aviation interests expressing a need for a corridor to facilitate VFR transit of the FRTC, one was established by the Navy in 1958 (Figure 3.2). That action was taken prior to the modernization of NAS Fallon's air traffic control facilities and establishment of a terminal radar approach control (including a special use airspace (SUA) function). The ATCAAs associated with the FRTC are used to afford military aircraft using the complex the opportunity for flight above flight level (FL) 180. That airspace above FL 180 is under positive control by the Federal Aviation Administration (FAA) Air Route Traffic Control Centers (ARTCCs). Arrangements for use of that airspace by FRTC air traffic have been formalized through a letter of agreement between the Oakland and Salt Lake City ARTCCs and NAS Fallon. ATCAAs are made available to FRTC air traffic only when use by FRTC aircraft will not interfere with other air traffic in that airspace.

The AR associated with NAS Fallon is used when transferring fuel from one aircraft to another during flight. Civil aircraft flying VFR can use the airspace within this AR at anytime, including when refueling operations are being conducted. Civil aircraft flying IFR are eligible and may be assigned use of airspace within the AR. Air traffic controllers provide separation for IFR traffic from military aircraft using the AR.

MTRs associated with the FRTC are used for low level navigation and terrain following training. They are flight paths which are published for advisory purposes on aeronautical charts. Civil aircraft are eligible to use the airspace within MTRs at anytime, including while military aircraft are flying along the MTRs. MTRs are discussed in Chapter 7.

The Oakland and Salt Lake City ARTCCs routinely cap military operations associated with the FRTC at FL 280 in the Gabbs South and Austin 2 MOAs and FL 300 in the Gabbs North, Gabbs Central, and Austin 1 MOAs while they are routing civil air traffic over the FRTC airspace. High altitude tactics and portions of functional check flights (FCFs) must be performed at altitudes above FL 300. Accordingly, prior to practicing high altitude tactics or performing certain portions of FCFs, military aircraft must obtain clearance from FAA ARTCCs via NAS Fallon's Desert Control air traffic control facility.

3.1.3 MISSION AND FACILITY DESCRIPTIONS

NAS Fallon's mission is to maintain and operate facilities and provide services and material to support operations of aviation activities and units of the operating forces of the Navy and other activities and units designated by the Chief of Naval Operations. Occasionally, Nevada Air National Guard RF-4 fixed-wing aircraft, Nevada Army National Guard helicopters, and other units use NAS Fallon facilities. The Naval Strike Warfare Center also operates on site. The total number of aircraft operations at NAS Fallon and the FRTC was 144,000 in 1988.

Existing aircraft operations facilities at NAS Fallon include three runways, three aircraft parking aprons, five aircraft maintenance hangars, air traffic control, and various other aircraft support facilities. The three runways include the primary runway, the new parallel runway completed in 1989, and the crosswind runway. The primary runway is 14,000 feet long and 200 feet wide; the parallel runway is 11,000 feet long and 200 feet wide; and the crosswind runway is 7,000 feet long and 150 feet wide. A system of access taxiways exists for all runways.

The main aircraft parking apron is located parallel with and on the southwest side of the primary runway. Two aircraft maintenance hangars are located on this main apron. An additional apron and two hangars are located to the south of the main apron and are used for the Fleet Adversary Squadron and for the two permanent Fleet Replacement Squadron detachments. A fifth hangar, located on the third apron, is used for transient cargo/logistics aircraft and deployed helicopter units and is located south of and parallel to the crosswind runway (Source: Western Division, Naval Facilities Engineering Command, 1983).

Air traffic control facilities at NAS Fallon consist of a flight planning branch, an air traffic control tower, and a terminal radar approach control facility which provides control services for NAS Fallon and the FRTC. Other aircraft operations facilities include aircraft arresting gear at each of the six runway ends, crash/fire/rescue equipment, aircraft arming/dearming pads, a weapons loading area, and aircraft fuel storage and refueling equipment.

3.1.4 INFRASTRUCTURE

Living quarters at NAS Fallon consist of 301 family housing units, 725 bachelor quarters rooms for permanent/transient enlisted personnel, and 332 bachelor quarters rooms for permanent/transient officers (Source: OMNI-MEANS, Ltd., 1987).

The NAS Fallon Fire Department provides fire protection for facilities and aircraft plus fire prevention services including fire inspections and training in fire prevention methods (Source: Western Division, Naval Facilities Engineering Command, 1983). NAS Fallon has a mutual aid agreement with Churchill County to respond in emergency situations (Source: OMNI-MEANS, Ltd., 1987).

Electrical power for NAS Fallon and associated ranges is supplied by Sierra Pacific Power Company. There are 17 emergency generators at NAS Fallon including 2 each at B-16, B-17, B-19, and B-20, and 6 at the EWS. Natural gas is supplied by Southwest Gas Corporation. There is a central gas-fired heating plant, a 15 million British Thermal Unit (BTU) high temperature hot water boiler plant on the north side of the Station, and a 3 million BTU steam boiler plant on the south side of the Station (Source: Western Division, Naval Facilities Engineering Command, 1983).

NAS Fallon's sewer system has a capacity of 0.75 million gallons per day (mgd) and as of 1989 was operating at 0.4 mgd. The system serves NAS Fallon with the exception of the Weapons Department building and the ordnance storage area which are served by approved septic systems. Treated sewage effluent meets all adopted standards and is released along with storm water runoff into a drainage canal maintained by the Truckee-Carson Irrigation District (TCID) under a National Pollutant Discharge Elimination System permit issued by the State of Nevada (Source: OMNI-MEANS, Ltd., 1987). The EWR sewage is treated in septic tanks and discharged into leach fields (Source: Western Division, Naval Facilities Engineering Command, 1983).

NAS Fallon disposed of wet garbage in the Checkerboard Landfill located on NAS Fallon until 1965. From 1965 until 1979, NAS Fallon disposed of wet garbage in the Receiver Landfill located on NAS Fallon. Since 1979, NAS Fallon has contracted for disposal of wet garbage. It is disposed of in an approved Class I sanitary landfill owned and operated jointly by Churchill County and the City of Fallon. Municipal refuse and industrial trash were disposed of in the Southeast Runway Landfill on NAS Fallon from 194? until 1946. From 1946 until 1989, municipal refuse and industrial trash were disposed of in the Receiver Landfill (Source: Dames and Moore, 1988). NAS Fallon now contracts for disposal of all solid waste, with the exception of cardboard and wood, at the Churchill County/City of Fallon landfill (Source: OMNI-MEANS, Ltd., 1987). Cardboard and wood are disposed of through a recycling program managed by the NAS Fallon Morale, Welfare, and Recreation Department.

During 1987, 6,378 tons of ordnance were expended on B-16, B-17, and B-19 (Source: NAS Fallon Weapons Department). In 1988, 5,288 tons of ordnance were dropped. B-20 was closed from January 1987 through November 1988. Each range is closed one week per month to permit the range maintenance contractor to clean up the expended ordnance. Unexploded live ordnance (duds) are detonated in place by the NAS Fallon Explosive Ordnance Disposal unit. The collected ordnance debris is placed in designated staging areas at each range. A request for proposal has been prepared which provides for an on-site contractor to demilitarize the debris and dispose of it through the Defense Reutilization and Marketing Office.

Since 1962 NAS Fallon's potable water supply has come from three wells located approximately three miles northwest of the Station. Water from these wells does not meet the current federal or state maximum contaminant level (MCL) for arsenic. The MCL is 50 micrograms per liter and the concentration from the wells is between 80 to 90 micrograms per liter. Each of the three wells has a capacity of 3,000 gallons per minute (gpm). In 1989 NAS Fallon's water usage averaged 0.53 mgd with a peak average of 0.9 mgd during the summer months (Source: OMNI-MEANS, Ltd., 1987). Water for the "green belt" of cultivated fields surrounding the airfield which provides protection against foreign object damage (FOD) to aircraft engines, dust, and fire is supplied from a canal system that is operated by TCID. This canal system also supplies water for windbreak and erosion control plantings. The EWS Centroid has an on-site well and water storage tank (Source: Western Division, Naval Facilities Engineering Command, 1983).

NAS Fallon and the FRTC lie in a seismically active region called the Walker Lane (Source: Western Division, Naval Facilities Engineering Command, 1983). There is a potential source of geothermal energy at NAS Fallon. The Naval Weapons Center, China Lake, California, Geothermal Program Office, is the lead Navy office for geothermal matters and has prepared a draft environmental impact statement (EIS) for geothermal development at NAS Fallon.

3.1.5 PROPOSED AND ENVISIONED CHANGES

"Proposed" actions are those for which a formal request has been initiated. "Envisioned" actions indicate those that may be foreseen but where no formal proposal has been submitted. Proposed changes are shown in Figure 3.1. Envisioned changes to the boundaries of NAS Fallon and the FRTC are shown in Figure 3.3.

3.1.5.1 Land Withdrawals

Proposed Land Withdrawals

NAS Fallon has submitted an application for withdrawal of 400 acres of public land directly west of the Station. Seventy units of Navy family housing are currently located on the 400 acres proposed for withdrawal pursuant to a MOU with BUREC. The proposed land withdrawal will be used to establish a buffer area of 360 acres to eliminate potential encroachment with the remaining 40 acres being used for Navy family housing needs.

The Navy had proposed the withdrawal of approximately 181,323 acres of public lands for the FRTC. However, this acreage is currently under review and has been modified to include another approximately 7,000 acres as a result of the discovery of ordnance which had impacted on public lands adjacent to B-16, B-17, and B-19. Further discussion of these lands and the Navy's ordnance retrieval effort are contained in Section 3.2.11. A portion of this land is adjacent to existing weapons target ranges and would act as essential safety and noise buffer zones for the target ranges. The land withdrawn for the buffer zones would not be used for target areas or as the basis for expanding existing target areas. The remainder of the withdrawal is comprised of the Shoal Sites and land that will be used for the Electronic Warfare Range (EWR). That withdrawal is known as the Master Land Withdrawal. All land within the proposed Master Land Withdrawal is located within Churchill County and is shown in Figure 3.1. A description of the proposed Master Land Withdrawal is as follows:

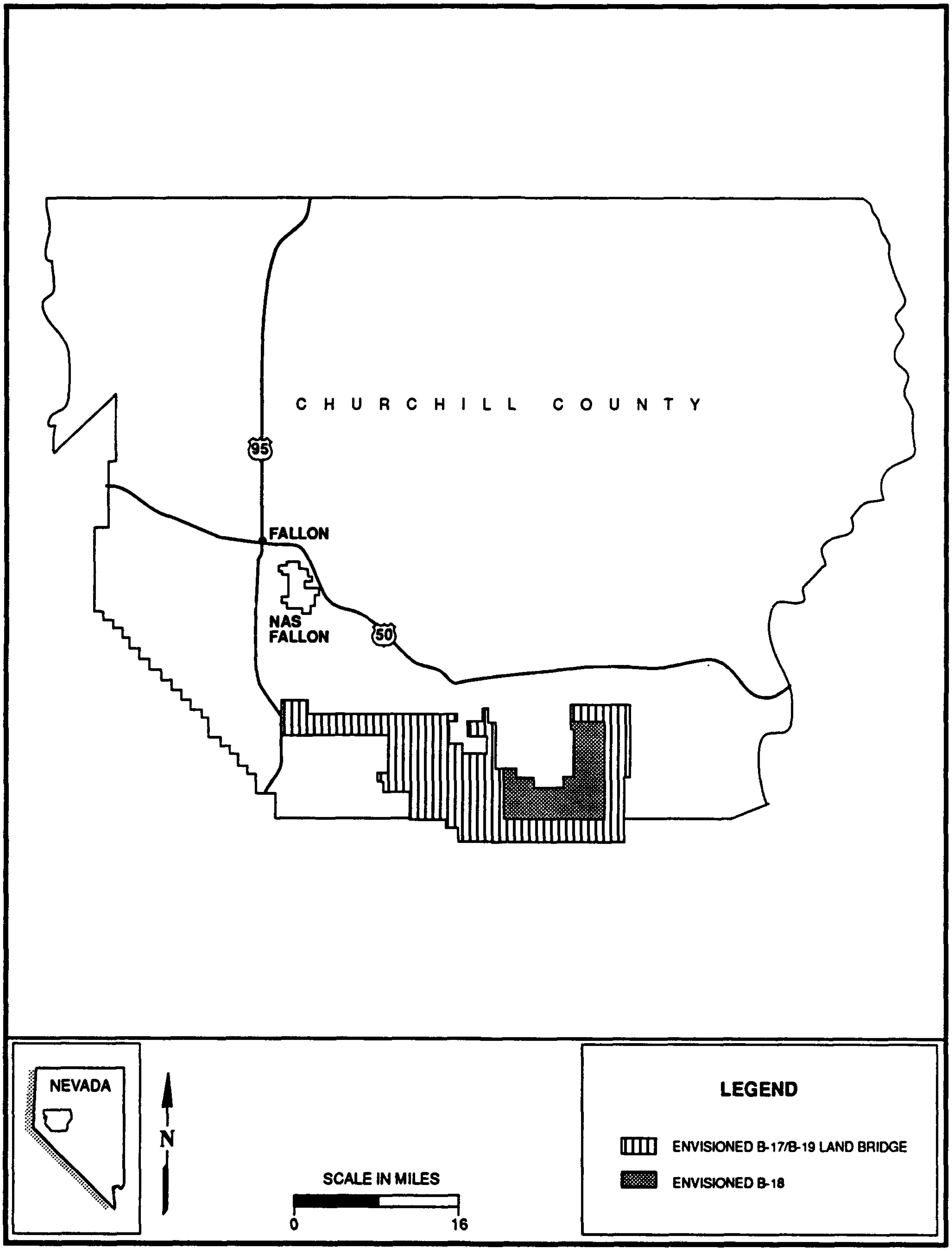


FIGURE 3.3 ENVISIONED LAND WITHDRAWALS/USES ASSOCIATED WITH NAS FALLON MISSION

B-16. The proposed land withdrawals for safety and noise buffer zones are to the north, west, and east of B-16; and they encompass a total of approximately 31,304 acres. Most of the acreage is currently withdrawn by the Bureau of Reclamation. Proposed improvement to B-16 includes the installation of a new fence along the west and south sides. B-16 will continue to be limited to the use of inert/training ordnance only.

B-17. The proposed land withdrawals for safety and noise buffer zones are to the north, west, south, and east of B-17; and they encompass approximately 31,905 acres. Future plans for B-17 include increasing the target density and modification of existing target designs.

B-19. The proposed land withdrawals for safety and noise buffer zones are to the west and east of B-19; and they encompass approximately 18,038 acres. The proposed B-19 development will consist of four unmanned EW emitter sites located within existing Navy-controlled land. A fifth EW site will be located west of U.S. Highway 95 on land that is included in the proposed Master Land Withdrawal.

Electronic Warfare Range (EWR). No lands are currently withdrawn in the EWR. The proposed land withdrawal for the EWR will total approximately 92,673 acres. A total of 62 EW emitter sites will be employed if all proposed sites are added to the range assets. The lands in the proposed EWR land withdrawal may be available for chaff use, flare drops, employment of Smokey Sams (pyrotechnic devices simulating surface-to-air missiles), and additional defense-related purposes.

Lands Proposed to be Used but not Withdrawn

TACTS coverage would be expanded to include the airspace to the eastern extremities of the current FRTC. Twenty-seven additional TIS sites and one master TIS site are planned. The total land within the rights-of-way required for all of these sites will be less than one-half acre. These sites (Figure 3.4) would be located in Churchill, Nye, Mineral, Pershing, and Lander counties. Most would be located in Fairview, Dixie, Edwards Creek, Reese River, and Smith Creek Valleys and in the Sand springs, Shoshone, and Toiyabe Mountain Ranges.

Additional rights-of-way are proposed to increase the number of EW sites by 29. They would have associated roads, power lines, or generators, and communications cables. Sites would be located in churchill, Nye, Mineral, Pershing, and Lander counties. Most would be located in Fairview, Dixie, Edwards Creek, Reese River, and Smith Creek Valleys and in the Sand Springs, Shoshone, and Toiyabe Mountain Ranges.

Range Air Surveillance System (RASS) is a surveillance radar system designed to provide the FRTC with low altitude radar coverage in the areas of high air traffic density. It will also enhance NAS Fallon's Desert Control air traffic control facility's ability to ensure air traffic separation and safety. Installation is proposed to commence in 1991. The RASS will be comprised of three high-speed, short-range, terminal-type radars. One will be located in Dixie Valley on lands within the Master Land Withdrawal. A second will be

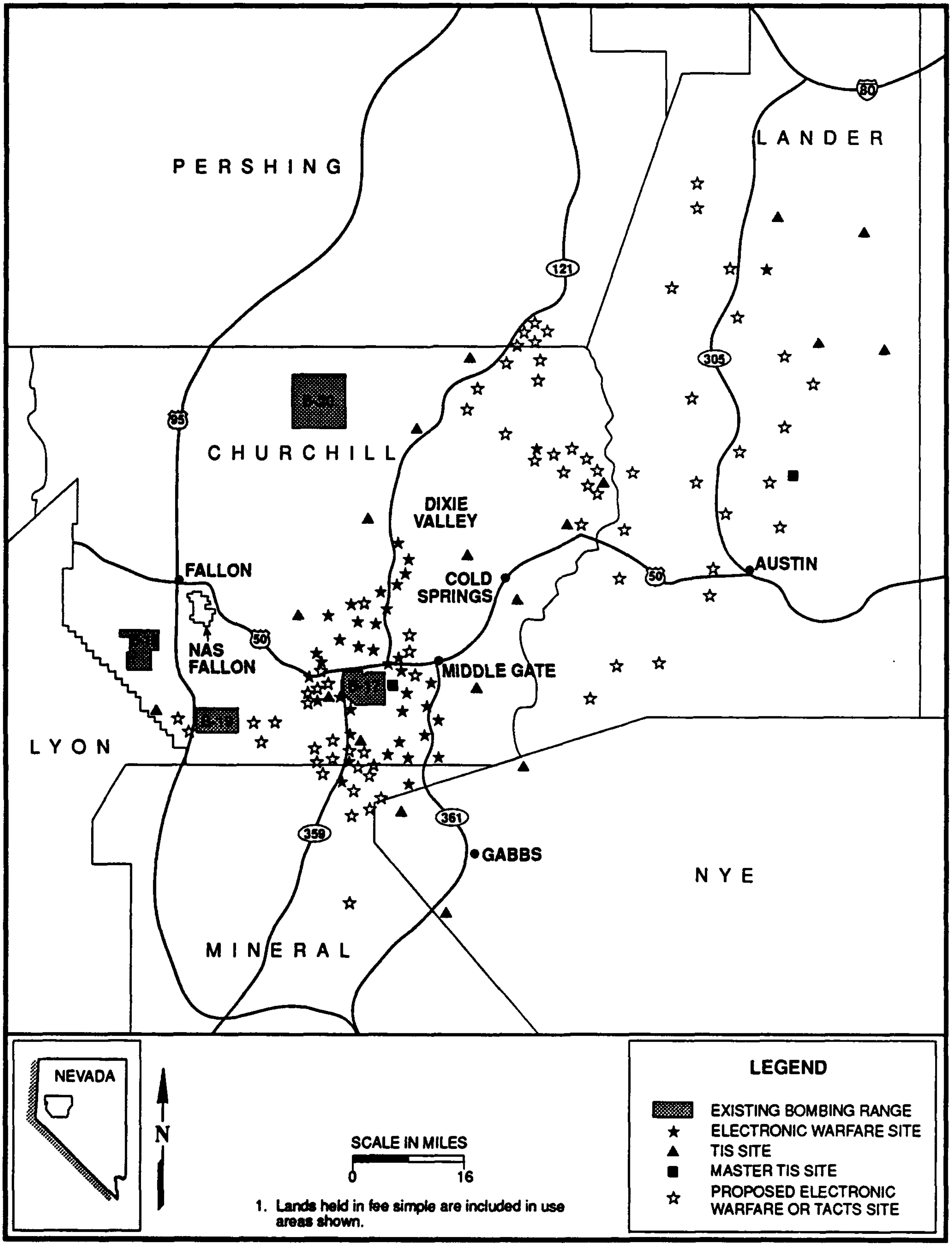


FIGURE 3.4 EXISTING EW/TIS SITES AND PROPOSED EW OR TACTS SITES

located just west of Nevada State Route 361 and approximately 6 miles south of Gabbs, Nevada. The third will be located on top of Vigus Butte which is situated just northwest of Austin, Nevada. Less than one acre of land will be required for each site. Each RASS installation will operate in a completely autonomous mode. No remote operator personnel will be required. All system functions, alarms, and monitoring efforts will be accomplished remotely by digital microwave linked to NAS Fallon. Enhanced communications equipment is planned for installation at the Austin RASS site and if necessary, the Gabbs RASS site, which will cure the current inadequate communications coverage in the eastern portions of the FRTC and at low altitudes. The Navy has produced a Draft EA for this proposal.

Envisioned Land Withdrawals

Approximately 202,000 acres of public lands would be contained in 2 envisioned land withdrawals for the FRTC. Those lands would be used for a "land bridge" between B-17 and B-19 and for a new target range tentatively designated Training Range Bravo 18 (B-18) (Source: U.S. Navy, NAS Fallon, Response to Task 4, 1988). Figure 3.3 also shows the envisioned withdrawals. Those envisioned withdrawals are not part of the proposed Master Land Withdrawal. Envisioned withdrawals are as follows:

B-17/B-19 Land Bridge. The envisioned land bridge would encompass approximately 122,600 acres of withdrawn public land, would connect B-17 and B-19 target ranges, and would be contiguous to the envisioned B-18 target range. Additionally, approximately 17,000 acres of land within the Walker River Paiute Indian Reservation would be sought. The land bridge would facilitate use of air-launched, stand-off weapons between the two target ranges and would allow for expanded strike rescue operations. In addition, frequent helicopter strike rescue and/or low altitude operations would be conducted throughout the area.

B-18. This envisioned target range would encompass approximately 79,000 acres of withdrawn public land and would be for the development of impact areas and tactical targets to meet tactical requirements for aircrews. The envisioned B-18 would be located contiguous to B-17. Approximately 25,840 acres of the land that is proposed for withdrawal in the proposed Master Land Withdrawal as part of the B-17 safety and noise buffer zone would become incorporated as part of the envisioned B-18 if such action is undertaken by the Navy. Thus, only approximately 53,160 additional acres would be withdrawn for the envisioned B-18. The target range would be within TACTS coverage and located near available threat systems. The envisioned B-18 would be used for dropping and firing live and inert/training ordnance. It would also be used as an impact area for air-launched weapons and for close air support operations, helicopter operations and rocket firing, Smokey Sam firing, and motorized artillery firing.

3.1.5.2 Airspace

Two new instrument flight rules (IRs) MTRs are proposed. There is also a proposal to realign the airspace associated with NAS Fallon based on recommendations from the Federal Aviation Administration (FAA) which resulted from the Special Use Airspace Review of FRTC airspace conducted by the FAA in June 1990. That proposed realignment would delete one restricted area, decrease the size of two other restricted areas, increase the size of one restricted area, modify the ceilings of four other restricted areas, modify the times of designation for eight restricted areas and five MOAs, decrease the size of one MOA, and create an additional MOA (Figure 3.2). Additionally, there is an envisioned realignment of the FRTC airspace which would modify one MOA and four restricted areas. Three new MOA/ATCAAs and an extension of the area in which supersonic flight is authorized would also be provided (Figure 3.5). These changes would cure existing training deficiencies. These changes are shown in Figure 3.5 and are described more completely as follows:

Two new MTRs, identified as IR 205/IR 210, are proposed to support training requirements associated with NAS Fallon. They are routes which will utilize the same flight path but will be flown in opposite directions. The route number will indicate the direction of flight. IR 205/IR 210 will be used by Navy aircraft practicing a high density, multi-structure strike scenario using NDBS and would provide training in locating, identifying, and targeting structures in all weather and lighting conditions. These proposed coincident routes are approximately 50 miles long and would transit in the vicinity of the Walker River Indian Reservation, the eastern shore of Walker Lake, the Hawthorne Army Ammunition Plant (HWAAP), and areas to the east. Portions of the route will be flown at 3,000 feet AGL and a minimum altitude of 1,500 feet AGL has been established for both MTRs. It is estimated that as many as 350 monthly sorties would occur on these routes upon implementation with an assumed increase to 385 sorties a month by the year 2000.

Elimination of Restricted Area R-4802, which is completely contained within Restricted Area R-4813, is proposed.

Reduction of the airspace included within Restricted Area R-4803S by eliminating the eastern arched-portion is proposed. The proposed modification to Restricted Area R-4803S would also alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a Notice to Airmen (NOTAM).

The proposed modification to Restricted Area R-4803N would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

Reduction of the airspace included within Restricted Area R-4813 is proposed by eliminating approximately 20 square miles on the southern end. The proposed modifications to Restricted Area R-4813 would also raise the ceiling to FL300, divide the airspace into high and low areas (R-4813A and R-4813B), and alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

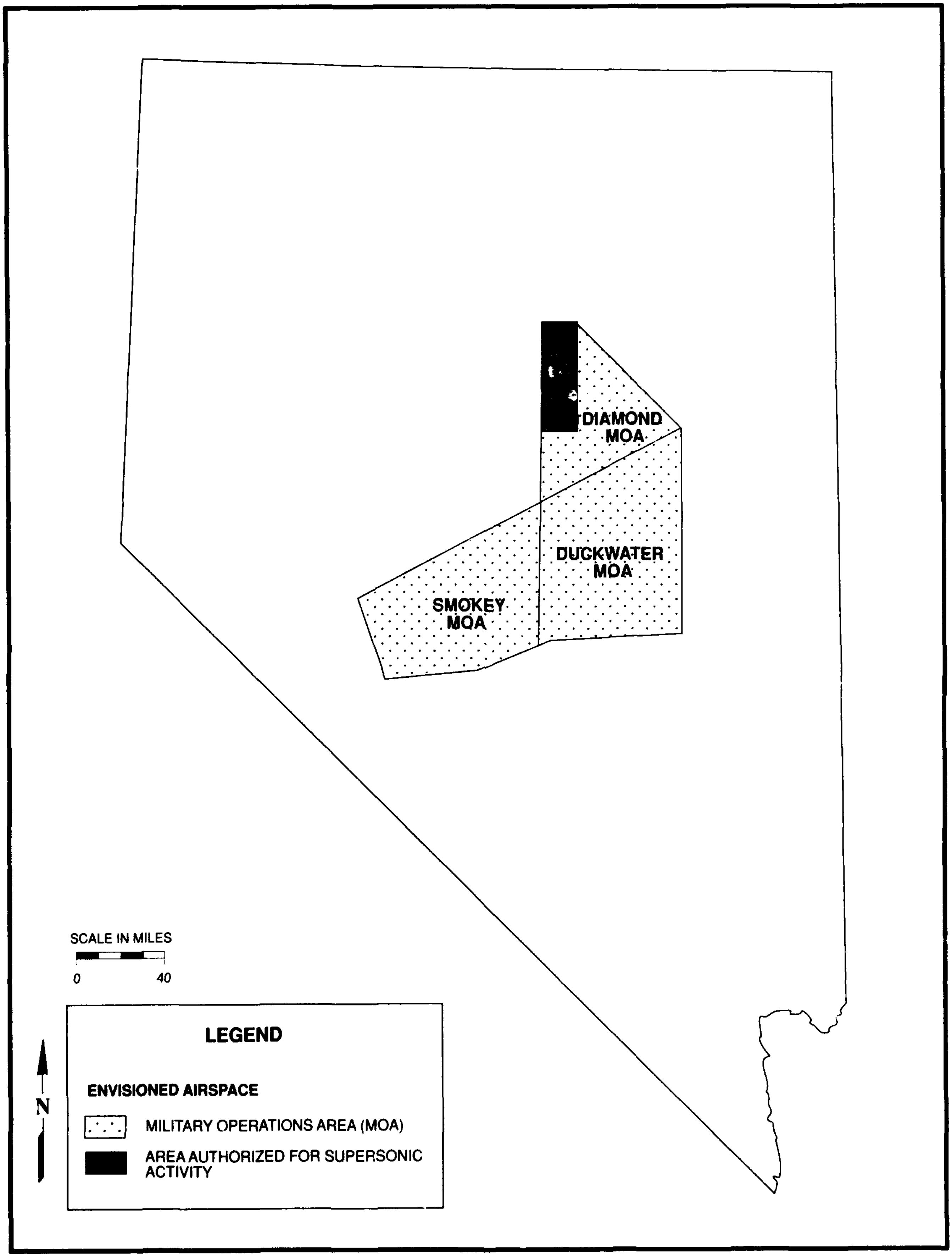


FIGURE 3.5 ENVISIONED CHANGES IN NAS FALLON AIRSPACE

A modification to the boundaries of Restricted Area R-4816S is proposed which would extend the southeastern corner approximately 10 miles. The proposed modification to Restricted Area R-4816S would also alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modification to Restricted Area R-4816N would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Restricted Area R-4804 would be to raise the ceiling to FL300, to divide the airspace into high and low areas (R-4804A and R-4804B), and to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Restricted Area R-4810 would be to raise the ceiling to FL300, to divide the airspace into high and low areas (R-4810A and R-4810B), and to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Restricted Area R-4812 would be to raise the ceiling to FL300, to divide the airspace into high and low areas (R-4812A and R-4812B), and to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to the Ranch MOA would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours in which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Carson MOA would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours during which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Gabbs North MOA would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours during which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to Gabbs South MOA would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours during which training could be conducted would run from 7:45 a.m. through 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

The proposed modifications to the Gabbs Central MOA would be to decrease the airspace by a three nautical mile radius centered on Gabbs Airport below 2,000 feet AGL and would be to alter the designated hours so that training in the area could be conducted from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours during which training could be conducted would run from 7:45 a.m. to 6:15 p.m. The designated hours on Sunday would be eliminated. Other hours would be allowed by the issuance of a NOTAM.

It is proposed that a MOA designated the Delta MOA be established to the west of and adjacent to Restricted Area R-4803S. The boundaries of the Delta MOA would be three nautical miles to the west of Restricted Area R-4803S and would extend ten nautical miles to the north. The floor of the Delta MOA would be 1,200 feet AGL, and the ceiling would be 9,000 feet MSL. It is proposed that the designated hours of the Delta MOA would allow training to be conducted in the area from 7:15 a.m. to 11:30 p.m., Monday through Friday. On Saturday the hours during which training could be conducted would run from 7:45 a.m. to 6:15 p.m. Other hours would be allowed by the issuance of a NOTAM.

The current vertical limits for the Ranch MOA are 500 feet above ground level (AGL) to 9,000 feet MSL. The envisioned modification would raise the ceiling to, but not including, 18,000 feet MSL which would allow for tactics that the creation of the land bridge would permit.

The envisioned modifications to Restricted Area R-4804 would be to raise the ceiling to FL 450 and to realign the boundaries to coincide with the perimeter of the envisioned land bridge and B-18.

The envisioned modifications to Restricted Area R-4810 would be to raise the ceiling to FL 450 and to realign the boundaries to coincide with the perimeter of the envisioned land bridge and B-18.

The envisioned modifications to Restricted Area R-4812 would be to raise the ceiling to FL450 and to realign the boundaries to coincide with the perimeter of the envisioned land bridge and B-18.

The envisioned modification to Restricted Area R-4813 would be to raise the ceiling to FL 450.

It is envisioned that the "VFR corridor" would be phased out. As the FRTC evolved, civil aviation interests expressed the need for a "corridor" to facilitate VFR transit of the complex. The corridor was established by the Navy in 1958, prior to modernization of NAS Fallon air traffic control facilities and establishment of a terminal radar approach control (including an SUA function). Since modernization was completed, the NAS Fallon Air Traffic Control Facility has conducted periodic surveys to evaluate its ability to provide civil aviation traffic direct routing through the FRTC. Survey data (Source: NAS Fallon, Civil Aviation Surveys 1985, 1986, 1987, 1988, 1990) clearly indicate the NAS Fallon Air Traffic Control Facility is capable of providing real-time routing through the complex without resorting to a fixed corridor path. The VFR corridor is perceived as an interim measure by the Navy and may be phased out upon attaining improved air traffic control capability provided by the RASS. Those radar/communications upgrades are designed to provide the increased margin of safety necessary to eliminate the VFR corridor requirement and accommodate the increasing volume of military tactical aircraft using the FRTC.

The envisioned Diamond MOA would cover 2,085 square miles and would have a floor of 10,000 feet MSL with a ceiling of 18,000 feet MSL. The ATCAA above the Diamond MOA would extend to the altitude authorized by Salt Lake City ARTCC for the time period requested for the FRTC use. The envisioned Diamond MOA/ATCAA would be used for strike aircraft rendezvous outside the threat envelope of emitters located in the EWR and B-17 and for stand-off jammer (airborne platforms) operations. In conjunction with the envisioned establishment of the Diamond MOA/ATCAA, there would be an envisioned realignment of the area in which supersonic flight is authorized. The current area in which supersonic activity is authorized would be extended 13 miles eastward (an area of approximately 520 square miles) into the Diamond MOA/ATCAA. That extension would provide the minimum airspace necessary for supersonic intercept at the edge of the threat envelope. The floor for supersonic activity would remain at 11,000 feet MSL.

The envisioned Duckwater MOA would cover 4,818 square miles and would have a floor of 10,000 feet MSL with a ceiling of 18,000 feet MSL. The ATCAA above the Duckwater MOA would extend to the altitude authorized by Salt Lake City ARTCC for the time period requested for the FRTC use. The envisioned Duckwater MOA/ATCAA would be used to provide a rendezvous area that is terrain-masked from the EWR and B-17 and an additional jammer axis in conjunction with the one in the envisioned Diamond MOA/ATCAA.

The envisioned Smokey MOA would cover 3,853 square miles and would have a floor of 200 feet AGL with a ceiling of 18,000 feet MSL. The ATCAA above the Smokey MOA would extend to the altitude authorized by Oakland/Salt Lake City ARTCC for the time period requested for the FRTC use. The envisioned Smokey MOA would provide a tactical, low-level ingress to B-17, B-18, and B-19 target areas from the southeast. Envisioned threat systems in the Gabbs Central MOA would provide realistic resistance to the strike aircraft.

3.1.5.3 Facilities

The Capital Improvements Plan for NAS Fallon consists of several proposed/ envisioned projects which extend beyond the 1990's. These projects are required to provide for optimal land use and attractive working conditions without compromising the Station's ability to meet its assigned mission. Significant future projects, which are proposed/ envisioned, include senior bachelor enlisted quarters, perimeter security fencing, a transportation compound, a chief petty officer's club, a combined theater, post office and gymnasium, a commissary, a Navy Exchange Complex, a medical/dental facility, a crash house addition, a bachelor officers quarters' renovation, an aircraft x-ray facility, an aircraft high power turn-up facility, a security building, an airfield operations building, an engine build-up facility, taxi lanes to the aircraft direct fueler, a maintenance hangar, and a family services center (Sources: Western Division, Naval Facilities Engineering Command, Capital Improvements, 1986).

3.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from defense-related uses of airspace and land withdrawals associated with NAS Fallon. Sources of potential effects and analysis of effects on public health and safety are identified.

3.2.1 GROUND MOTION

Activities related to NAS Fallon, the FRTC, and associated airspace do not result in ground motion.

3.2.2 AIR QUALITY

Construction and operation of facilities at NAS Fallon and the FRTC are conducted in compliance with the rules and regulations of the Navy and the State of Nevada Division of Environmental Protection (NDEP). The Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) at levels that are designed to protect public health and safety.

3.2.2.1 Sources of Potential Effects

NAS Fallon

NAS Fallon is located in an area that is in compliance with NAAQS for all regulated pollutants. Air emissions from NAS Fallon activities originate from the following sources: aircraft flight operations, aircraft ground maintenance operations, ground support equipment operations, surface coating operations, fire training exercises, motor vehicle operations, fuel storage and refueling, and heat and power production.

Detailed emission inventories for those activities at NAS Fallon are not available. Since the emission-generating activities at NAS Fallon are similar to those at Nellis Air

Force Base (AFB) (Section 2.2.2.1), the quantity of emissions resulting from NAS Fallon activities may be estimated by comparing the number of flight operations at the two installations. The emission inventory given for Nellis AFB had an associated flight operations level of 164,000 airfield operations in 1986 (Source: U.S. Air Force, Nellis AFB, undated). NAS Fallon logged 89,700 airfield operations in 1986 (Source: LCDR B. Herman, ATC Officer, NAS Fallon, personal communication, 1990) which is approximately 55 percent of the number of airfield operations at Nellis AFB. The comparison is based on 1986 data because the only air emission inventory data available were from Nellis AFB for 1986. On this basis, activities at NAS Fallon are estimated to generate approximately 55 percent of the air pollution emissions from ground facilities that are generated by the facilities in Nellis AFB as shown in Table 3-1.

For this analysis, flight operations at NAS Fallon were projected to increase by approximately 10 percent by the year 2000. Air emissions from activities that are directly related to flight operations were assumed to increase by slightly more than 10 percent because of a different aircraft mix using the facilities and airspace; air pollutants from indirectly-related activities are assumed to increase by less than 10 percent. These assumptions are conservative (i.e., health-protective), somewhat better than worst-case, since cleaner-burning engines, improvements in emission control technology, and additional emission control requirements are likely to result in less of an emission increase than is projected for the year 2000.

The number of airfield operations at NAS Fallon is projected to increase from 97,700 airfield operations in 1988 to 107,500 airfield operations in the year 2000. At Nellis AFB the 1988 total of 170,000 airfield operations was projected to increase by 20 percent to 204,000, by the year 2000. On the basis of this comparison, the emission inventory at NAS Fallon is projected to be approximately 53 percent of the year 2000 inventory for Nellis AFB as shown in Table 3-1.

FRTC

The FRTC is located in an area that is in compliance with NAAQS for all regulated pollutants. This section deals with air emissions released by surface activities on the FRTC. These activities include ground activity, ordnance delivery, and weapons firing on B-16, B-17, B-19, and B-20 and various ground activities on the EWS and the Shoal Sites. Air emissions resulting from inflight aircraft activity over the FRTC are addressed in the next section.

Detailed emission inventories for the FRTC activities are not available, but the magnitude of the emissions can be estimated by comparing the relative amounts of ordnance dropped on the Fallon and Nellis Ranges as an indicator of surface activity on the two ranges. Total tonnage of ordnance dropped on the Fallon Ranges for 1988 was 5,300 tons, which is approximately 75 percent of the ordnance delivery rate for the Nellis Ranges. Therefore, the resulting air emissions from surface activities on the Fallon ranges would be approximately 75 percent of the emissions from the Nellis AFB Ranges.

Table 3-1. Air Emission Estimates for NAS Fallon (tons/year) (1986 and 2000)[1]

Source	Year (P/F)[2]	CO[3]	HC[4]	NO_x[5]	PM(6)	SO_x[7]
Aircraft Flight Operations	P	1,244.1	343.5	188.9	11.7	36.3
	F	1,484.7	409.9	225.4	13.9	43.3
Aircraft Ground Maintenance Operations	P	40.8	12.8	29.0	0.7	3.5
	F	71.4	22.6	50.9	1.1	6.2
Ground Support Equipment Operations	P	37.7	11.7	5.8	3.8	0.7
	F	66.2	20.6	10.2	6.7	1.1
Surface Coating Operations	P	0.0	53.4	0.0	0.0	0.0
	F	0.0	89.9	0.0	0.0	0.0
Fire Training Exercises	P	3.0	2.5	0.0	0.7	0.0
	F	4.8	4.0	0.0	1.0	0.0
Motor Vehicle Operations	P	365.4	55.4	65.3	14.4	10.1
	F	587.8	89.1	105.0	23.2	16.3
Fuel Storage and Refueling	P	0.0	214.1	0.0	0.0	0.0
	F	0.0	360.2	0.0	0.0	0.0
Heating and Power Production	P	2.2	0.4	9.0	0.2	0.1
	F	3.5	0.5	14.6	0.3	0.1
TOTAL	P	1,693.2	693.8	298.0	31.5	50.7
	F	2,218.4	996.8	406.1	46.2	67.0

(1) 1986 estimates assumed for present
(2) P = Present; F = Future (Year 2000)
(3) Carbon Monoxide
(4) Hydrocarbons
(5) Oxides of Nitrogen
(6) Particulate Matter
(7) Oxides of Sulfur

Source: U.S. Air Force, Nellis AFB, 1986.

The estimated increase of 10 percent by the year 2000 in the sortie activities and the ordnance delivery rate on the FRTC would result in an equivalent increase in surface air emissions.

NAS Fallon Airspace

NAS Fallon airspace is located in an area that is in compliance with NAAQS for all regulated pollutants. Air emissions in airspace associated with NAS Fallon result from activities during a variety of training exercises. These aircraft emissions are dispersed over large areas thereby reducing the localized air quality impact. An emission inventory was developed for defense-related aircraft operations in NAS Fallon airspace by using the same approach as was described for the Nellis AFB airspace. This emission inventory is based on the aircraft mix, aircraft sortie rate, and the engine emission profile for each aircraft type. The inventory is summarized in Table 3-2 under the columns labeled "Emission Rate." The first line for each airspace represents the present concentration. Using the conservative (i.e., health-protective), somewhat better than worst-case "volume of airspace" approach described in Section 1.4.1.2, a typical daily concentration was calculated for each pollutant.

The envisioned addition of three MOAs will have the effect of enlarging the areas in which activities occur, without a corresponding increase in activities, so that the volume of airspace in which these activities occur should increase in relation to the number of operations. Consequently, the predicted air quality concentrations should decrease.

Emissions estimates for aircraft activities in NAS Fallon airspace for the year 2000 are also summarized in Table 3-2. These estimates are based on the forecast 10 percent increase in sorties and a slightly different aircraft mix. The second line for each airspace represents the projected concentration. The projected concentration computation does not take into account the envisioned MOAs.

3.2.2.2 Analysis of Effects

NAS Fallon and the FRTC are located in an area that is in compliance with NAAQS for all regulated pollutants. The air emission sources associated with these facilities are minor and are spatially dispersed. Air emissions from activities occurring at NAS Fallon and the FRTC do not decrease air quality in the area below acceptable levels.

NAS Fallon airspace is located in an area that is in compliance with NAAQS for all regulated pollutants. Comparing the results shown in Table 3-2 in the column labeled "Concentration" with the applicable NAAQS clearly indicates that NAS Fallon airspace activities do not decrease air quality in the area below acceptable levels.

3.2.3 WATER QUALITY AND FLOOD HAZARD

Figure 3.6 shows the location of NAS Fallon and the FRTC in the context of regional hydrographic basins. The Station, B-16, and B-20 are located in the Carson Desert Hydrographic Basin which is often referred to as Lahontan Valley. B-19 is located primarily

Table 3-2. Summary of Aircraft Exhaust Emissions and Estimated Ambient Air Quality Impacts (Concentrations) for NAS Fallon Operations.

Airspace	Area (mi^2)	Year (P/F)[4]	Emission Rate (tons/year) CO[5]	HC[6]	NO_x[7]	PM[8]	SO_x[9]	Daily Concentration ($\mu g/m^3$)[3] CO[5]	HC[6]	NO_x[7]	PM[8]	SO_x[9]
R-4802	28	P	50.13	5.67	450.32	16.32	29.06	0.0481	0.0054	0.4327	0.0156	0.0279
R-4813[1]		F	54.72	6.32	473.95	17.07	34.48	0.0525	0.0060	0.4554	0.0164	0.0331
R-4803NS	133	P	39.89	4.47	358.45	12.85	23.12	0.0428	0.0048	0.3852	0.0138	0.0248
		F	43.40	5.01	376.23	13.52	27.35	0.0466	0.0053	0.4043	0.0145	0.0293
R-4804	120	P	69.52	7.86	623.58	22.61	40.26	0.0828	0.0093	0.7428	0.0269	0.0479
		F	75.44	8.72	654.27	23.54	47.58	0.0898	0.0103	0.7793	0.0280	0.0566
R-4810	120	P	50.02	5.65	448.74	16.27	28.95	0.0595	0.0067	0.5345	0.0193	0.0344
		F	54.25	6.27	470.40	16.92	34.21	0.0646	0.0074	0.5603	0.0201	0.0407
R-4812	174	P	14.45	1.64	129.70	4.71	8.36	0.0039	0.0004	0.0355	0.0012	0.0022
		F	23.31	2.61	224.00	7.69	13.56	0.0063	0.0007	0.0613	0.0021	0.0037
R-4816NS	872	P	84.73	9.58	759.61	27.55	49.03	0.0555	0.0062	0.4980	0.0180	0.0321
		F	91.87	10.61	795.71	28.64	57.86	0.0602	0.0069	0.5217	0.0187	0.0379
AUSTIN 1[2]	3238	P	75.07	8.49	673.53	24.42	43.46	0.0132	0.0014	0.1189	0.0043	0.0076
		F	81.58	9.42	706.23	25.43	51.39	0.0144	0.0016	0.1247	0.0044	0.0090
AUSTIN 2	1136	P	39.24	4.43	351.77	12.73	22.71	0.0197	0.0022	0.1770	0.0064	0.0114
		F	41.50	4.89	366.51	13.09	26.64	0.0208	0.0024	0.1844	0.0065	0.0134
GABBS N[2]	3644	P	126.04	14.25	1,130.7	40.98	72.97	0.0197	0.0022	0.1774	0.0064	0.0114
		F	137.00	15.80	1,185.8	42.66	86.25	0.0214	0.0024	0.1860	0.0066	0.0135
GABBS S/C[2]	1634	P	99.43	11.25	892.75	32.36	57.59	0.0347	0.0039	0.3123	0.0113	0.0201
		F	108.08	12.47	935.73	33.66	68.07	0.0378	0.0043	0.3274	0.0117	0.0238
RANCH	564	P	50.02	5.65	448.74	16.27	28.95	0.0253	0.0028	0.2274	0.0082	0.0146
		F	54.25	6.27	470.40	16.92	34.21	0.0274	0.0031	0.2384	0.0085	0.0173

Table 3-2. Summary of Aircraft Exhaust Emissions and Estimated Ambient Air Quality Impacts (Concentration) for NAS Fallon Operations (continued).

Airspace	Area (mi^2)	Year (P/F)[4]	Emission Rate (tons/year) CO[5]	HC[6]	NO_x[7]	PM[8]	SO_x[9]	Daily Concentration ($\mu g/m^3$)[3] CO[5]	HC[6]	NO_x[7]	PM[8]	SO_x[9]
CARSON	171	P	50.13	5.67	450.32	16.32	29.06	0.0139	0.0015	0.1254	0.0045	0.0080
		F	54.72	6.32	473.95	17.07	34.48	0.0152	0.0017	0.1320	0.0047	0.0096
Primary NAAQS ($\mu g/m^3$, from Table 1-3) presented here for comparison purposes[10]								10,000[11]	N/A[12]	100[13]	50[14]	365[14]

(1) R-4802 is included with R-4813 and the same emission rates apply for both.
(2) Emissions for supersonic flights included in Gabbs North, Gabbs Central, and Austin 1 MOA calculations.
(3) Micrograms per cubic meter
(4) P = Present; F = Future (year 2000)
(5) Carbon Monoxide
(6) Hydrocarbons
(7) Oxides of Nitrogen
(8) Particulate Matter
(9) Oxides of Sulfur
(10) Estimated air quality effects (daily concentrations) from NAS Fallon operations cannot be directly compared with the NAAQS because an ambient background concentration must be added to the NAS Fallon effects, and the averaging periods are not the same for all pollutants. However, the NAAQS can be used to assess the relative magnitude of air quality effects.
(11) 8-hour average.
(12) N/A = There is no NAAQS for HC.
(13) Annual average.
(14) 24-hour average.

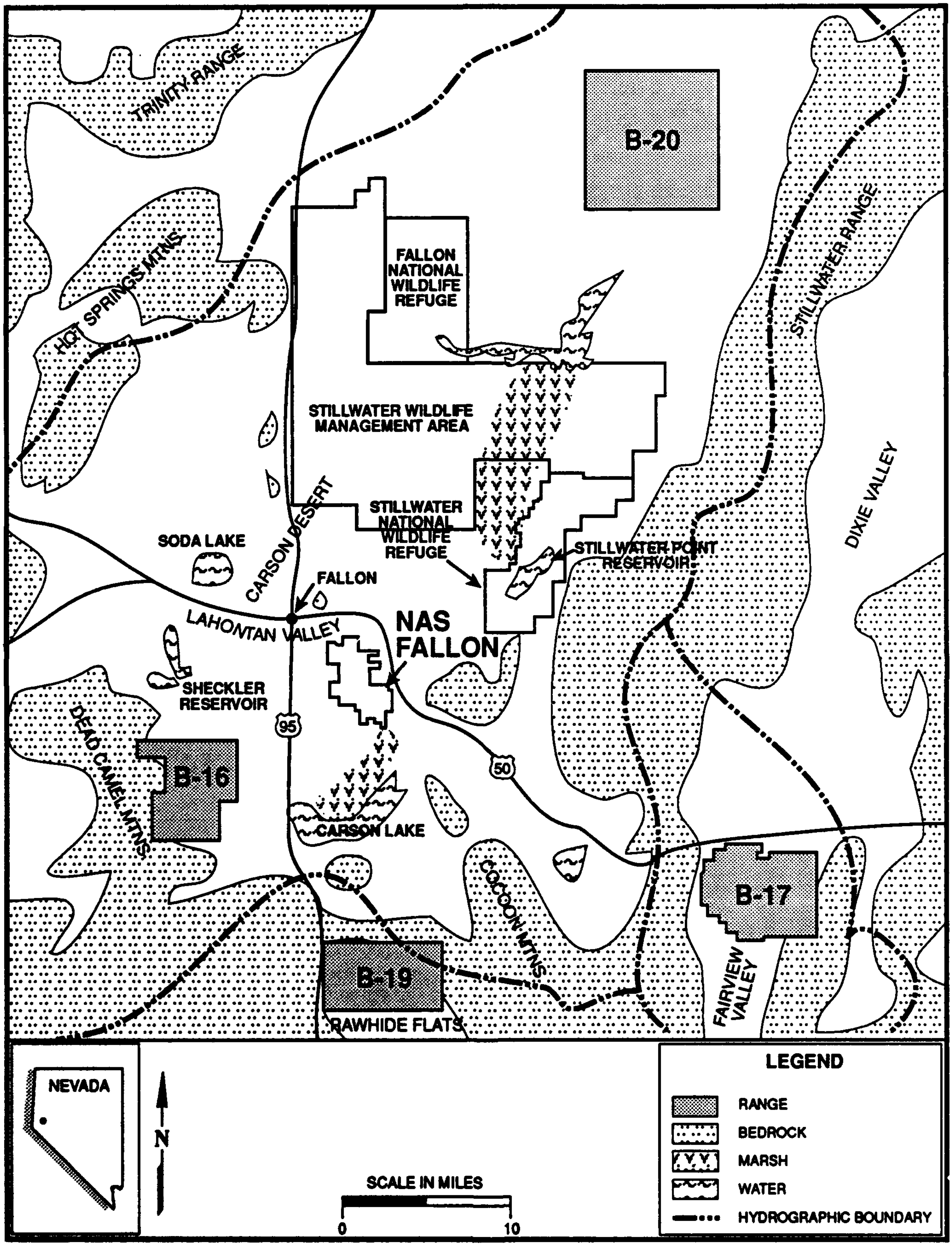


FIGURE 3.6 HYDROGRAPHIC BASINS AND PRINCIPAL HYDROLOGIC FEATURES FOR NAS FALLON AND ASSOCIATED TARGET RANGES

within the Rawhide Flats Hydrographic Basin, but it extends into Carson Desert. B-17 is located in the northern portion of the Fairview Valley Hydrographic Basin. The EWS extends from the northern end of the Fairview Valley Hydrographic Basin into the southern end of the Dixie Valley Hydrographic Basin. The Shoal Sites lie on the mountain range separating the Fairview Valley and Carson Desert Hydrographic Basins.

Pursuant to the Comprehensive Environmental Response Compensation and Liability Act, studies are being conducted on NAS Fallon to define the scope of existing ground water contamination. There have been no studies conducted by the Navy to evaluate the potential for flood hazard at NAS Fallon. However, a 1985 Federal Emergency Management Agency (FEMA) flood insurance rate map defines two areas on the eastern side of the Station as being mapped within the 100-year floodplain. The remainder of NAS Fallon was not mapped as being in the 100-year floodplain. No construction has occurred on the FRTC that would significantly increase the peak flood flows above those that would be expected if the drainages were not on the withdrawn lands.

3.2.3.1 Sources of Potential Effects

As a part of the Defense Environmental Restoration Program (10 U.S.C. Sections 2701-2706), NAS Fallon began its Installation Restoration Program (IRP) in 1987. Historical record searches and witness interviews led to the identification of 27 potential IRP sites at NAS Fallon. Twenty-one of those sites were recommended for additional investigation or remedial action (Source: Dames and Moore, 1988). Those 21 sites include fuel storage and handling areas, the fire training pit area, pesticide storage and handling areas, landfills, sewage lagoons, and leach fields. The locations of all 27 potential IRP sites are shown on Figure 3.7.

Any potential flood hazard at NAS Fallon would be the result of the facilities on the Station creating a backwater or concentrating and diverting flood water to lands adjacent to the Station. There is also the potential for any flood waters to transport contaminants located on withdrawn land downstream. The 1985 FEMA flood insurance rate map defines two areas on the eastern side of the Station as being mapped within the 100-year flood plain. However, flood elevations and hazard factors were not determined in that mapping effort. The remainder of NAS Fallon was not mapped as being in the 100-year floodplain. The Station area was mapped on the basis of aerial photography and/or U.S. Geological Survey topographic maps.

The only land area off NAS Fallon with any permanent structures or facilities with water supply or waste treatment facilities is that on which the EWS centroid is located. The only potential ground water contamination sources within the EWS are the waste water treatment facilities at the EWS Centroid and the limited fuel storage. There have been no reported fuel spills, and the treatment plant meets environmental regulations for waste disposal. The facilities and activities on the EWS represent no known effect on public health and safety relative to ground water, nor are they expected to in the future.

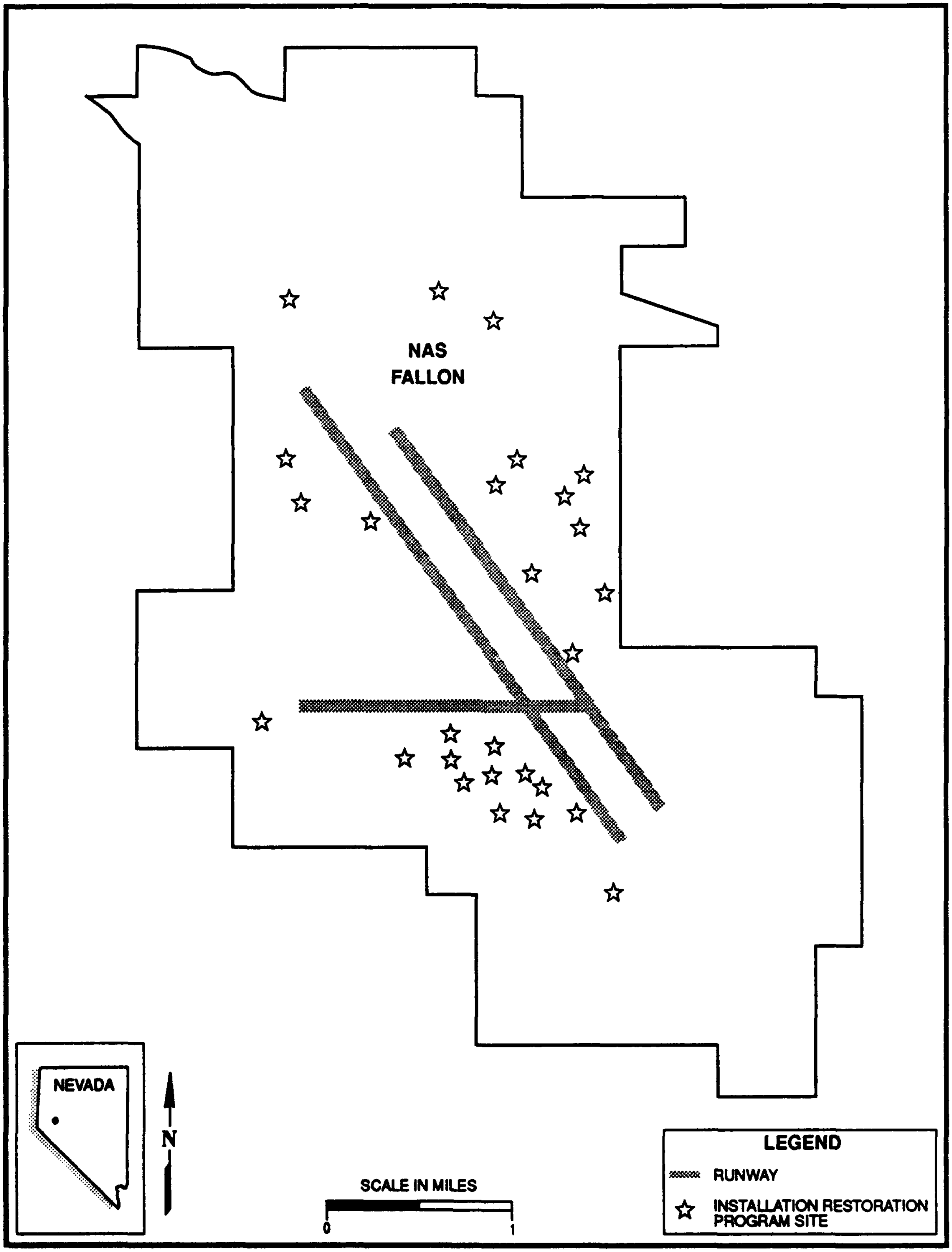


FIGURE 3.7 INSTALLATION RESTORATION PROGRAM SITES ON NAS FALLON

All FRTC target ranges are controlled access areas. There is no ground water or surface water developed for domestic, agricultural, or industrial use on the ranges; nor are there any water supply developments in their immediate vicinities, with the exception of B-16. Sheckler Reservoir is located northwest of that target range. Ground water at B-20 is believed to be very saline and unsuitable for domestic supplies. Ground water data for B-16, B-17, and B-19 do not exist.

The primary source of contaminants from FRTC are related to explosive ordnance and pyrotechnics. Some of the chemical compounds and materials which probably occur on these ranges are nitrate, trinitrotoluene, ammonium picrate, cyclotrimethylene-trinitramine, sodium sulfide, sodium hydroxide, cyanide, dimethylhydrazine, and nitric acid.

The FRTC withdrawals discussed in this chapter are located on valley bottom lands and therefore represent no public health and safety concerns with respect to floods originating on them. Additionally, there have been no Navy activities at the existing Shoal Sites that would exacerbate runoff from that small mountainous area; and there are no downstream developments that would be threatened by a flash flood.

3.2.3.2 Analysis of Effects

Ground Water Quality

In connection with the NAS Fallon IRP Program, 15 soil samples and 1 water sample were collected for analysis from 5 of the IRP sites at NAS Fallon (Source: Dames and Moore, 1988). The soil samples indicated volatile organic contaminants ranging in concentration from 9 to 1,400 micrograms per kilogram for non-hazardous compounds and up to 710 micrograms per kilogram for some hazardous compounds. Total petroleum hydrocarbons ranged from 40,000 to 17,000,000 micrograms per kilogram in concentration. Because of the local hydrogeology, each of those 5 on-Station sites represents an existing or potential ground water contamination problem (Source: Dames and Moore, 1988). Initial testing of ground water off NAS Fallon and water in the drains has not revealed the presence of contaminants resulting from NAS Fallon operations. However, as part of the IRP, further testing off base will be conducted.

Hydrogeologically, the Carson Desert ground water reservoir in the NAS Fallon vicinity can be characterized as consisting of the following four aquifer systems (Source: Glancy, 1986):

1) a shallow alluvial aquifer system extending from land surface to a depth of approximately 50 feet,

2) an intermediate alluvial aquifer system extending from a depth of approximately 50 feet below land surface to a depth of between 500 and 1,000 feet,

3) a deep alluvial aquifer system extending from below the intermediate alluvial aquifer system to a depth of approximately 2,200 feet below land surface, and

4) a basalt aquifer underlying the alluvial material throughout much of the basin but protruding as a plug up into the sediments to a depth of 200 to 600 feet below land surface to the northwest of the NAS Fallon withdrawal.

This characterization of the alluvial systems is not based on lithology but on differences in water chemistry and salinity. The shallow system generally contains high, though widely variable, levels of total dissolved solids (TDS). TDS range from approximately 1,000 to over 11,000 milligrams per liter (mg/l) in many areas. That water is not suitable for domestic use without reverse osmosis or distillation treatment. TDS within the intermediate aquifers range from approximately 300 mg/l near the City of Fallon to levels in excess of 1,000 mg/l near NAS Fallon.

The above four aquifer systems are all in hydraulic communication. Thus, changes or stresses in one system will be expressed or seen in the others. Beneath the southern two-thirds of NAS Fallon, vertical hydraulic gradients indicate that the flow of ground water is upward into the shallow system (Source: Glancy, 1986). In the northern portion, flow is downward through the shallow system. In conjunction with those vertical gradients, there is a regional lateral gradient in the shallow aquifers for flow of ground water toward the southeast. Around NAS Fallon, however, that regional lateral flow is probably disrupted by TCID agricultural drainage canals that intercept the water table.

Depth to ground water beneath NAS Fallon is shallow, ranging from approximately three feet in the southeastern portion to six feet to eight feet in the northwestern portion. Seasonal fluctuations in water table depth range from 1 foot to 2.5 feet depending upon precipitation, irrigation, and drainage conditions. The developed portion of NAS Fallon, including all of the identified IRP sites, is surrounded by major TCID agricultural drainage canals. These canals are 8 feet to 10 feet deep and carry shallow ground water, irrigation tail water from off-Station sources as well as on-Station sources, surface runoff, and waste water discharge off base to Stillwater Point Reservoir from where it is discharged to the Stillwater WMA.

Because of the shallow depth to ground water, contaminants spilled or placed in landfills are expected to contaminate the ground water. However, there are no water-supply wells on the Station, and the closest well is one-half mile southwest of the Station (Source: Dames and Moore, 1988) and separated from the Station by the Lower Diagonal Deep Drain. Because there is an apparent upward ground water flow gradient beneath the IRP sites, contamination of deep aquifers is not expected (Source: Dames and Moore, 1988). In the event that ground water contamination should begin to migrate off station, the agricultural drains surrounding the station would limit the extent of contamination to surrounding shallow ground water.

Based on the local hydrologic conditions (shallow water table and agricultural drains), ground water contaminants generated at NAS Fallon could become publicly accessible at Stillwater WMA (Source: NEESA, 1988). The discharge of these water contaminants to publicly accessible areas presents a public health risk, but available data suggest that the magnitude of this risk is small. However, any additional pollutant loads to the already stressed marsh environment cannot but aggravate the situation in that ecosystem. Ground water contamination at NAS Fallon or on the FRTC does not, nor is it expected to, affect public health or safety.

Because of hydrologic conditions (see Section 3.10) and the isolation of the ranges from public water resources, any potential ground water contamination on B-16, B-17, B-19, or B-20 represents no known effect on public health and safety. However, the potential contamination could present some public health and safety concerns if the water beneath those ranges were to be developed at some future time for public supplies, though, because of natural water quality considerations, this is unlikely for Range B-19 and even less so for B-20.

Floods and Surface Water Runoff

There are three areas of concern addressed here relating to flooding and surface water runoff: 1) the potential effect of NAS Fallon and its drainage facilities on off-site public health and safety, 2) the potential for the transportation of surface contaminants to areas where they may endanger public health and safety, and 3) the potential for exposure, transportation, and dispersal of buried contaminants to areas where they may impair a public water supply or endanger public health and safety.

Existing topography at NAS Fallon is flat land with a low gradient. Efforts to remediate past hazardous waste disposal practices and contamination through NAS Fallon's IRP are already underway. With the IRP being underway, there is a low probability that surface contaminants or subsurface hazardous wastes will be transported off Station.

Existing studies (Source: Wadell, 1986; Western Division Naval Facilities Engineering Command, 1983) do not provide sufficient information upon which to make conclusions respecting the potential for flood damage upstream and downstream from NAS Fallon structures or bridges or increased flows from large impermeable areas such as runways, aprons, streets, parking lots and roofs on NAS Fallon.

The operation of NAS Fallon requires the use and storage of solvents, petroleum products, and ordnance. Maps indicate that all surface water originating from, or running over the Station, is eventually discharged to the Stillwater WMA. The extent to which there are structures on the Station to detain and control contaminant substance runoff is unknown. Whether surface runoff has carried and dispersed contaminant materials is also unknown. However, the existing oil and hazardous waste management plan (Source: Radian Corporation, 1988) should limit any potential public health risks.

Twenty-seven IRP sites have been identified on NAS Fallon (Source: NEESA, 1988). The potential for these contaminants to be uncovered, transported, and dispersed by surface water flooding to areas where either a public supply of water may be impaired or public health and safety endangered cannot be determined on the basis of existing studies. As previously noted, however, the majority of NAS Fallon lies outside the FEMA flood insurance rate map 100-year floodplain.

There are no data regarding the presence of the constituents of ordnance or the by-products of detonation on the FRTC ranges; however, the isolation of those ranges from public water resources significantly reduces the likelihood such constituents or by-products could contaminate those resources. B-16 and B-20 are the only ranges that potentially may experience surface water runoff onto publicly accessible land areas.

While several ephemeral stream channels from the Dead Camel Mountains converge to the northwest of B-16, cross the range, and lead to Carson Lake, only inert/training ordnance is used on B-16. Thus, the probability of ordnance-related contaminants being present on or being carried off B-16 is small, as is the probability that any surface contaminants might ultimately reach Carson Lake. B-20 is subject to periodic inundation when water levels rise in the Carson Sink. As water levels recede, any dissolved contaminants may be carried to lower areas of the sink and concentrated by evaporation. Whether this might provide public access to potential contaminants is uncertain, but it would be limited due to its extremely remote location. Thus, any public health risk from B-20 is negligible. No reasonable possibility exists for the transport of ordnance constituents or by-products by surface water to publicly accessible areas because of hydrologic conditions (see Section 3.9) and the relative isolation of the FRTC ranges.

Waste Water Treatment and Disposal

Waste water generated at NAS Fallon is handled by an aerated lagoon system located at the Station. Sanitary and minor industrial wastes entering the treatment plant are pre-treated in a grit chamber and discharged to two ponds which are equipped with a series of aerators. Biodegradable wastes are oxidized, and the effluent is chlorinated prior to discharge to a nearby ditch pursuant to permit. The system has a capacity of 0.75 mgd and was operating at 0.4 mgd in 1989. The handling of waste water on NAS Fallon poses no apparent risk to public health and safety.

3.2.4 IONIZING RADIATION

Activities associated with NAS Fallon, the FRTC, and associated airspace do not produce ionizing radiation as a by-product.

3.2.5 NON-IONIZING RADIATION

The effects of electromagnetic radiation discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible light radiation. Systems producing RF/microwave radiation include radio and television transmitters, microwave ovens, radar systems, microwave communication systems, sterilization systems used for medical supplies, welding equipment, and medical equipment. No sources other than radar systems are further considered in this section because of the other sources' very low potential for hazard to the public due to low emission levels, location, or stringent emission controls.

The effects of laser radiation discussed in this section refer only to those effects that can potentially affect the general public. Lasers are used for target designation and air-to-ground ranging by the military. These devices are not considered lethal. They are, nevertheless, capable of delivering sufficient energy or power in the beam of light to damage the retina of the human eye. Laser devices are, however, only used on designated laser target ranges; and at NAS Fallon the potential for harm to the public is extremely remote.

3.2.5.1 Sources of Potential Effects

NAS Fallon uses radio frequency radiation (RFR) emitters extensively in radar and communications systems at the Station and the FRTC. The majority of the RFR emitters are located on the EWS. A variety of systems are used including those that mimic surface-to-air missiles, ground-jamming systems, and early-warning radar. Radar systems and other sensors located on the aircraft are used to target and attack these ground-based systems.

The EWS contains a number of EW emitter sites located in Dixie Valley/Fairview Valley. Threat systems at these sites may include the following radar simulators: surface-to-air missile simulators, a multi-band track-while-scan (TWS) radar, TWS I-band radar, multi-band radar, anti-aircraft artillery simulators, early warning or acquisition radars, and a ground-based jammer. These systems include manned and unmanned, and fixed and mobile emitters.

Lasers used in NAS Fallon operations range from Class I (low powered) to Class IV (high powered). Procedures for laser use are specified in the "Range Users Manual for Naval Air Station, Fallon," NAS Fallon Instruction (NASFINST) 3752.1C. No laser operations are authorized on B-16. Laser systems and targets must be specifically authorized, and all laser use must be logged by the Range Operations Center. Lasers are not activated until the proper laser target is identified under the cross hairs of the scope or operator monitor. Laser use is stopped if target tracking is not proper, if the system is not tracking in the immediate target area, if ordered by the Range Monitor or the WISS Operator, or if unauthorized or unprotected personnel enter the range area. Laser use is authorized only in certified laser operating areas which are within restricted areas and only over withdrawn lands.

3.2.5.2 Analysis of Effects

There is no known health risk to the public from RFR emitted by NAS Fallon radar systems due to procedures established to maintain safe distances (NAS Fallon Instruction 5101.90). The potential exists for electromagnetic interference of other electromagnetic systems from airborne systems and the EWS. Guidance for avoiding frequency interference is specified in "Performing Electronic Countermeasures in the United States and Canada," Chief of Naval Operations Instruction (OPNAVINST) 3430.9C.

The only ranges on which laser use is authorized are B-17, B-19, and B-20. No laser can be energized on those ranges without specific permission and clearance, and no laser surface danger zone extends beyond range boundaries. There has been no effect, nor is there expected to be any effect, on the public health and safety as a result of the use of lasers in connection with operations at NAS Fallon and the FRTC. No changes in effects are anticipated for the year 2000.

3.2.6 SOLID AND HAZARDOUS WASTE

3.2.6.1 Sources of Potential Effects

Hazardous wastes are managed in accordance with the procedures outlined in NASFINST 5090.1, "Hazardous Waste Management Plan," dated March 1, 1989. That plan was developed in compliance with Navy requirements prescribed in OPNAVINST 5090.1, "Environmental and Natural Resources Manual."

Hazardous waste generation rates have been recorded at NAS Fallon since 1985. Annual quantities of hazardous waste and recyclable petroleum products were 100,000 pounds in 1985, 150,000 pounds in 1986, and 400,000 pounds in 1987. The large increase in 1987 reflects a major cleanup campaign at NAS Fallon resulting in disposal of large quantities of outdated and unneeded materials.

NAS Fallon and its associated housing units generate approximately 75,000 cubic yards of non-hazardous solid industrial and domestic waste and construction debris per year (Source: NAS Fallon Environmental Quality Program Coordinator [EQPC]). Most non-hazardous solid wastes generated at the Station are disposed of by a contractor in an approved Class I sanitary landfill operated jointly by Churchill County and the City of Fallon. All construction debris and domestic garbage from NAS Fallon housing and food service operations are collected by a contract refuse service and are delivered to the joint City of Fallon/Churchill County Class I landfill for disposal.

3.2.6.2 Analysis of Effects

Hazardous waste management practices at NAS Fallon preclude any effect on public health and safety as a result of hazardous waste generation at the Station. Compliance with the "NAS Fallon Hazardous Waste Management Plan," NASFINST 5090.1, ensures that hazardous wastes and recyclable petroleum products are handled and disposed of in an environmentally acceptable manner. The NAS Fallon program is routinely inspected by NDEP for compliance with applicable Federal and State regulations.

Hazardous Materials (HAZMAT) inspections conducted during 1987 and 1988 indicated two minor administrative violations, such as improper labeling of containers. The most recent HAZMAT inspection (March 28, 1989) noted seven violations ranging from improper labeling of containers to storage of wastes in the central storage area in excess of the 90-day limit. All of these violations were found to be rectified during a reinspection conducted in July 1989.

In addition to the State of Nevada inspections, hazardous waste activity is routinely inspected by higher-level Navy authorities such as the Inspector General and the Naval Facilities Engineering Command. Only minor administrative deficiencies have been noted during these inspections.

Past hazardous waste management practices at NAS Fallon may not have been in compliance with today's standards, but they were acceptable procedures at the time. As part of the Defense Environmental Restoration Program, a preliminary assessment was conducted in 1988 to identify all sites posing a potential threat to human health or the environment due to contamination from past operations involving HAZMAT (Source: Dames and Moore, 1988). Ground water contamination is of principal concern. A Remedial Investigation/Feasibility Study involving sampling and monitoring of identified potential past hazardous waste sites is underway to further determine which sites are in need of remediation and the appropriate procedures to be used. The third and final part of the IRP will be remediation of any identified contamination. Continued implementation of the above programs will ensure that there are no effects in the year 2000.

3.2.7 NOISE AND SONIC BOOM

3.2.7.1 Sources of Potential Effects

The locations of NAS Fallon and the FRTC are shown in Figure 3.8. The initial Air Installations Compatible Use Zones (AICUZ) study for NAS Fallon flight operations was conducted in 1977 and was initially updated in 1983 (Source: Wolf, 1987). The current update is in development and will provide current and projected noise contours. The current update is being conducted primarily to consider operations from the new parallel runway and the introduction of the F/A-18 aircraft.

In November 1982, a detailed Range Air Installations Compatible Use Zones (RAICUZ) study (Source: Western Division, Naval Facilities Engineering Command, RAICUZ, 1982b) was conducted for the FRTC. The RAICUZ study did not address average noise exposures such as the L_{dn} contours in the vicinity of the EWS, but it did show typical magnitudes of single event levels and discussed concerns regarding residential development in the Dixie Valley Settlement. Those concerns are no longer relevant because all the residents of the Dixie Valley Settlement who wished to leave the area to avoid the effects of supersonic flight have sold their property to the Navy and have been relocated out of Dixie Valley at Navy expense. The sonic boom exposure from supersonic flight activity was addressed in detail in the EIS documents and the record of decision prepared in conjunction with the creation in 1985 of the area designated for supersonic flight within the FRTC (Sources: Western Division, Naval Facilities Engineering Command, Draft Comprehensive EIS, 1984; Western Division, Naval Facilities Engineering Command, Final Comprehensive EIS, 1985). Accordingly, to minimize the potential effect of sonic boom noise on public health and safety, the Navy placed lateral and vertical restrictions on the area designated for supersonic flight so as to avoid populated areas to the maximum extent possible.

Monthly operations in the FRTC MOAs are approximately 1,000 sorties in the Austin 1 and Austin 2 MOAs, 1,100 sorties in the Gabbs North and Gabbs Central MOAs, 900 sorties in the Gabbs South MOA, 460 sorties in the Ranch MOA, and 200 sorties in the Carson MOA (Sources: Booz, Allen & Hamilton, Inc., 1987; U.S. Navy, March, 1987; U.S. Navy, January, 1987; U.S. Navy, February, 1987; LCDR B. Herman, ATC Officer, NAS Fallon, personal communication, 1990). The number of sorties may increase by 10 percent

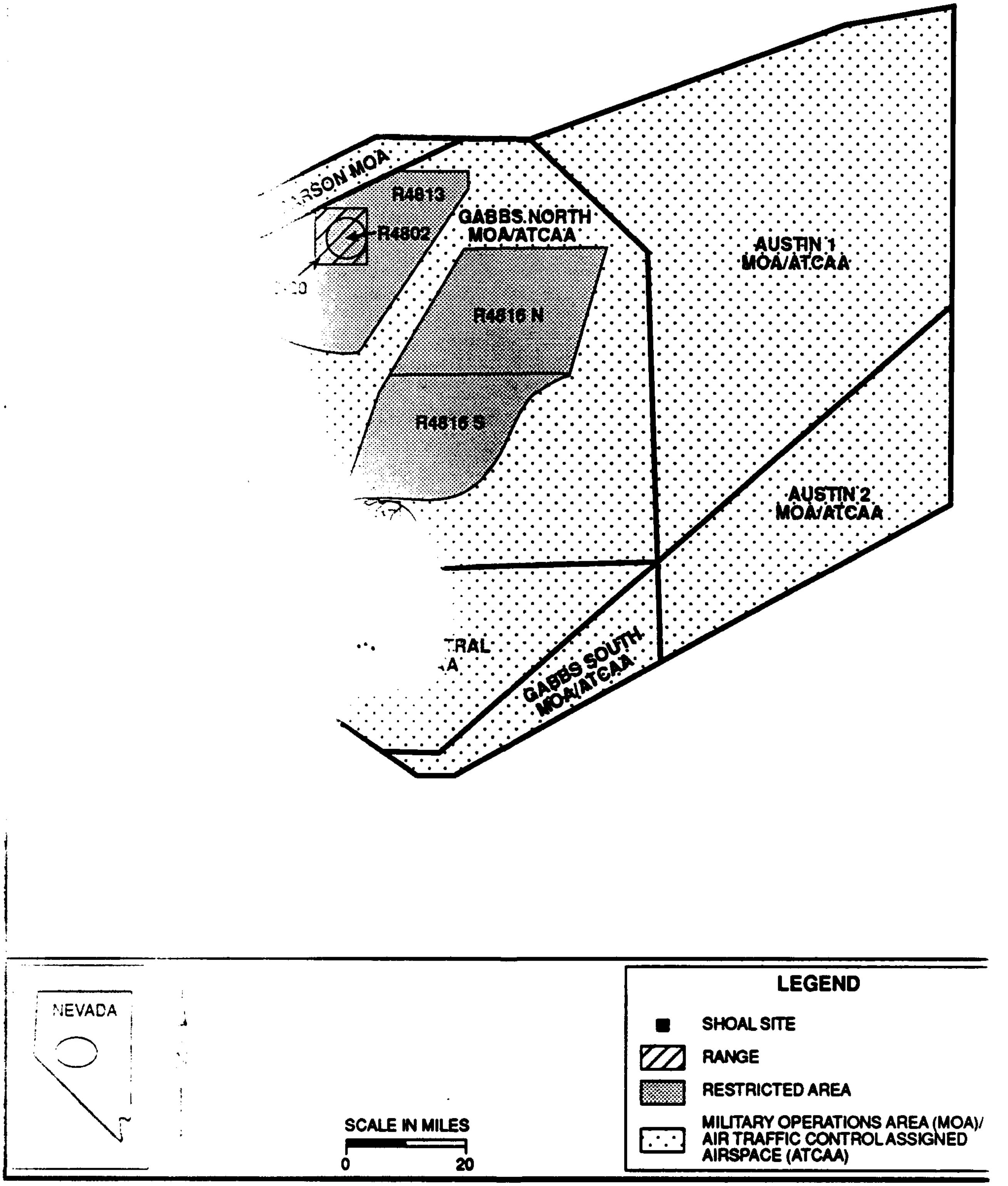


FIGURE 3.8 **TRAINING RANGES AND AIRSPACE ASSOCIATED WITH NAS FALLON MISSION**

by the year 2000. Supersonic activity is estimated to be approximately 31 supersonic events per month and is projected to increase 10 percent by year 2000. Actual activity may vary and is dependent upon future world threat scenarios and DOD force structures.

3.2.7.2 Analysis of Effects

Aircraft Operations

The evaluation of noise resulting from NAS Fallon aircraft operations is based on the latest draft AICUZ study update (Source: Wolf, 1988) for NAS Fallon. That draft update provided L_{dn} contours for operations during 1986 as shown in Figure 3.9.

A housing count provided by the Office of the Churchill County Assessor was used to estimate the number of people located within the 1988 NAS Fallon L_{dn} contours. Approximately 87 housing units are located within the L_{dn} 65 dB contour to the L_{dn} 70 dB contour, 73 housing units are located within the L_{dn} 70 dB contour to the L_{dn} 75 dB contour, and 8 housing units are located within the L_{dn} 75 dB to the L_{dn} 80 dB contour. Based on a housing study of the Fallon area conducted in 1985 by the Nevada Department of Transportation (NDOT) Special Studies Division (Source: Mike Lawson, NDOT, personal communication, April 19, 1989), 98 percent of the homes in the Fallon urban and rural areas were determined to be occupied with an average of 3.2 persons per dwelling unit. These factors were used to estimate the number of people located within the L_{dn} 65 dB, 70 dB, 75 dB, and 80 dB contours listed in Table 3-3. Also shown in this table is the number of persons estimated to be highly annoyed by aircraft noise exposure. Estimates of highly annoyed population are based on the relationship between L_{dn} and annoyance discussed in Section 1.4.1.7 and illustrated in Figure 1.7.

To determine the effects of future operations at NAS Fallon, a 10 percent increase in sorties was projected, and the aircraft mix was adjusted to reflect replacement of A-7 and A-4 aircraft by F/A-18 aircraft. The L_{dn} 65 dB contour was predicted to increase in size by approximately 18 percent in the year 2000 as a result of these changes. To project the expected number of people located within the future NAS Fallon L_{dn} contours, estimated population data for the year 2000 were used. The projected number of people located within the future NAS Fallon L_{dn} contours is also listed in Table 3-3 along with the number of persons estimated to be highly annoyed by aircraft noise exposure. Estimates of highly annoyed population are based on the relationship between L_{dn} and annoyance discussed in Section 1.4.1.7 and illustrated in Figure 1.7.

The Navy published L_{dn} noise contours for low-altitude flights into B-16 in the 1982 RAICUZ study (Source: Western Division, Naval Facilities Engineering Command, RAICUZ, 1982b). Those contours are shown in Figure 3.10. The L_{dn} 60 dB contour encompassed 32,695 acres of land with very few (5 to 10) residents in that area. Primary noise complaints associated with B-16 operations were from residents or others outside of the noise contour areas and related to low-level flights outside of the normal patterns.

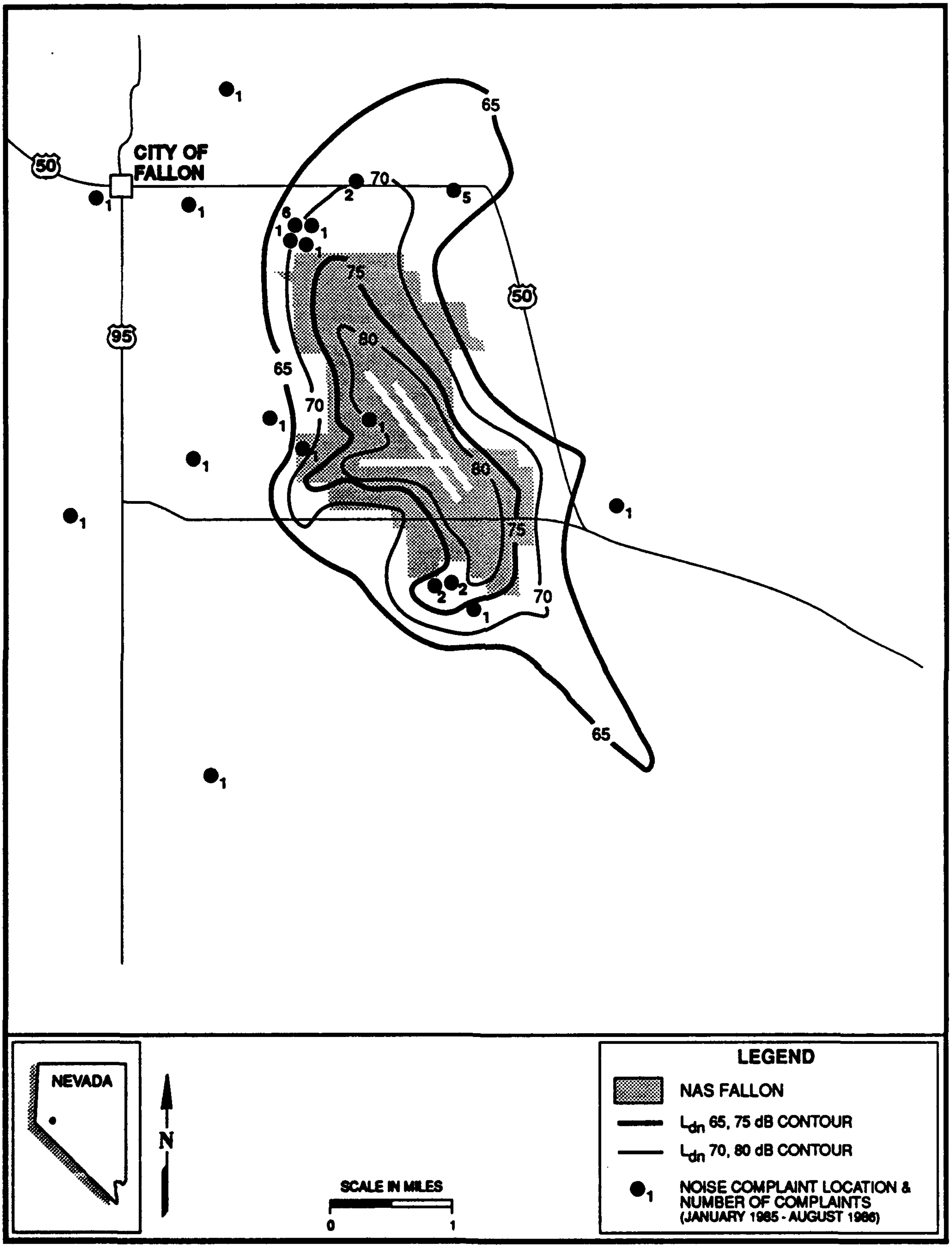


FIGURE 3.9 NAS FALLON L_{dn} NOISE CONTOURS, 1988 DRAFT AICUZ UPDATE

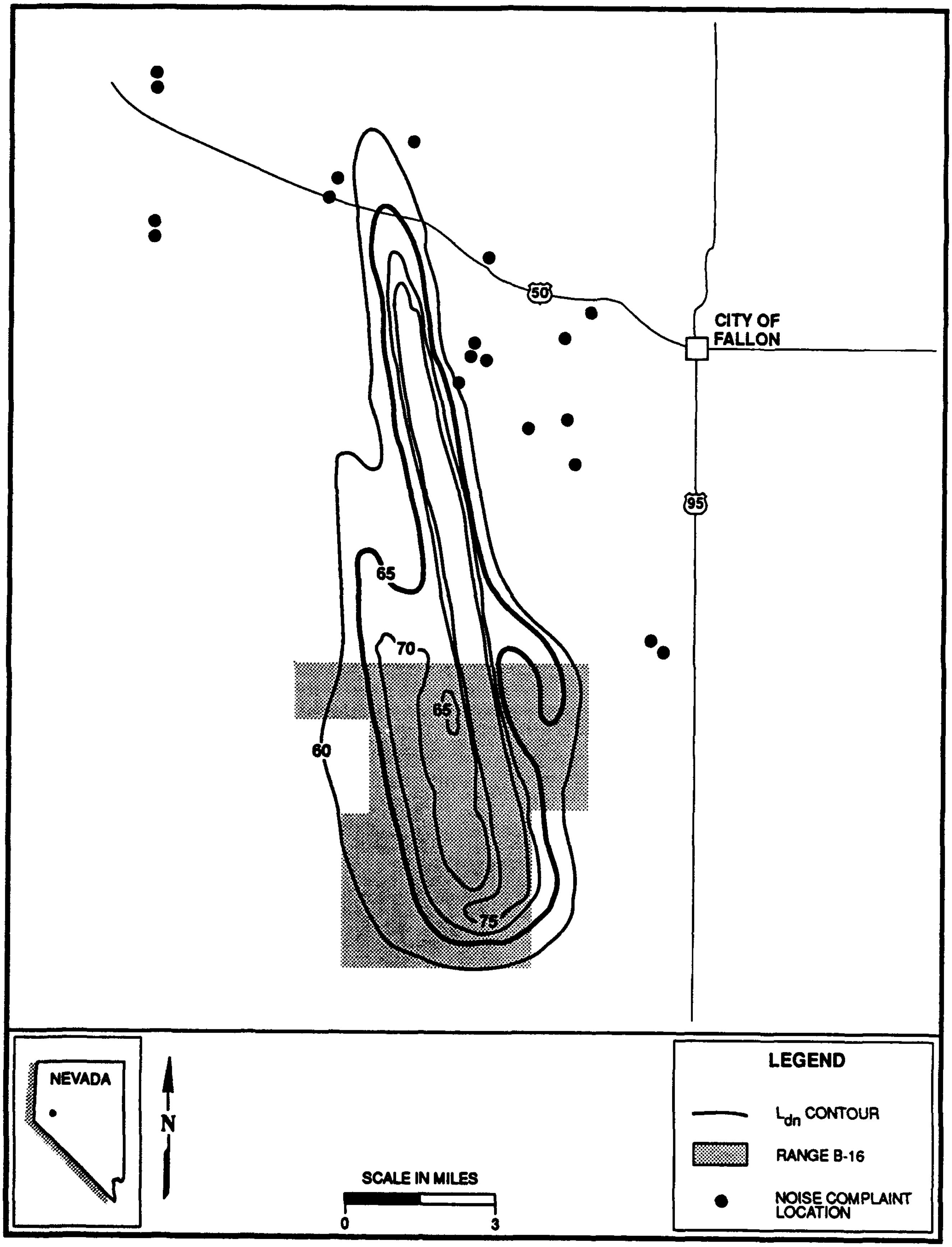


FIGURE 3.10 B-16 L_{dn} NOISE CONTOURS, 1982

Table 3-3. Population Within L_{dn} Contours, NAS Fallon(1).

L_{dn} Contour	1988 No. of People	1988 Estimated No. of People Highly Annoyed	2000(2) No. of People	2000(2) Estimated No. of People Highly Annoyed
65	538	132	769	186
70	260	82	365	113
75	26	12	26	12
80	0	0	0	0

(1) These estimates are cumulative, e.g., populations within the L_{dn} 65 dB contour include those within higher L_{dn} contours.

(2) Estimates for CY 2000 account for changes in aircraft operations, aircraft types and a 24 percent increase in population density in the area between the L_{dn} 65 and 75 dB levels.

The typical busy day use of B-16 decreased from about 200 passes per day in 1981 (Source: Western Division, Naval Facilities Engineering Command, RAICUZ, 1982) to about 190 per day in 1988. While that difference would not affect the noise level contours, the change in types of aircraft using the range will affect total noise levels. Typical sound exposure levels (SELs) for various aircraft using B-16 are shown in Table 3-4 for various overflight heights. The decrease in use of the A-7 aircraft and transition to the F/A-18 by 1992 is likely to increase the cumulative noise around B-16.

Estimates of noise impacted land areas using the 1981 and 1988 operations data indicate that the L_{dn} 60 dB contour area would increase by approximately 33 percent and the L_{dn} 65 dB contour area would increase by about 50 percent in 1988 relative to 1981. A further 10 percent increase in B-16 usage by the year 2000, if combined with further residential development in the vicinity of B-16, can be expected to further aggravate the noise problem. However, the residential population within the L_{dn} 65 dB contour is not expected to increase relative to that of 1988.

The noise effects on Dixie Valley associated with the EWS and the supersonic flight over the area have been mitigated by the Navy's purchase of the property of all residents who wished to vacate the Dixie Valley Settlement and those residents relocating from Dixie Valley. Noise levels from low-altitude, subsonic operations in the general area of the EWS would be similar to those listed in Table 3-4 for the aircraft types shown. Use of the EWS has increased from about 30 sorties per busy day in 1981 to about 42 sorties per busy day

Table 3-4. Sound Exposure Levels (SEL, dB) of Typical Aircraft Using B-16 at Typical Training Flight Speeds.[1]

Aircraft Type	B-16 Usage (%)		Height Above Ground Level (ft)		
	1981	1988	250	500	1,000
A-7	67	27	97	92	86
A-6	16	17	118	113	107
F-111	13	7	120	114	108
F/A-18	--	45	125	119	113

[1]Based on OMEGA 10 and NOISEFILE of the NOISEMAP system.

in 1988. The frequency of use by various aircraft types has also changed. The proportion of A-7 flights has decreased from 34 percent of total sorties to 11 percent of the total sorties, and A-6 flights have increased from 5 percent of the total sorties to 25 percent of the total sorties. F/A-18 aircraft were not included in the 1981 use of the EWS, but they comprised 20 percent of the sorties flown in the EWS in 1988. Flight activity in the airspace north and east of the EWS is distributed over a very large land area beneath restricted areas R-4816 North and R-4816 South and the surrounding MOAs. Flight paths in that airspace are more varied, and recurring flight paths in that airspace tend to be much less frequent than those in the SUA associated with the target ranges.

The area in which supersonic flight is authorized is shown in Figure 3.11. While sonic booms occur at random locations throughout the area, historical data shows that, over time, the preponderance of the booms will occur in an area that coincides with the centroid of the maneuvering activity. This centroid is not necessarily fixed at one location but will, in fact, move as a function of the maneuvering activity. Figure 3.11 represents an illustration of the centroid and thus allows analysis of the accumulative impact of sonic booms over time. The area within the L_{Cdn} 45 dB contours is approximately 560 square miles and areas within the L_{Cdn} 50 dB and L_{Cdn} 55 dB contours are approximately 280 and 20 square miles, respectively. These space average noise levels represent 1988 operational activity estimates which indicate 31 supersonic events per month would be anticipated. Given the population density beneath the area in which supersonic flight is permitted (i.e., 310 residents per 5,500 square miles), one person is estimated to reside within the L_{Cdn} 55 dB contour, 16 persons are estimated to reside within the L_{Cdn} 50 dB contour, and 31 persons are estimated to reside within the L_{Cdn} 45 dB contour.

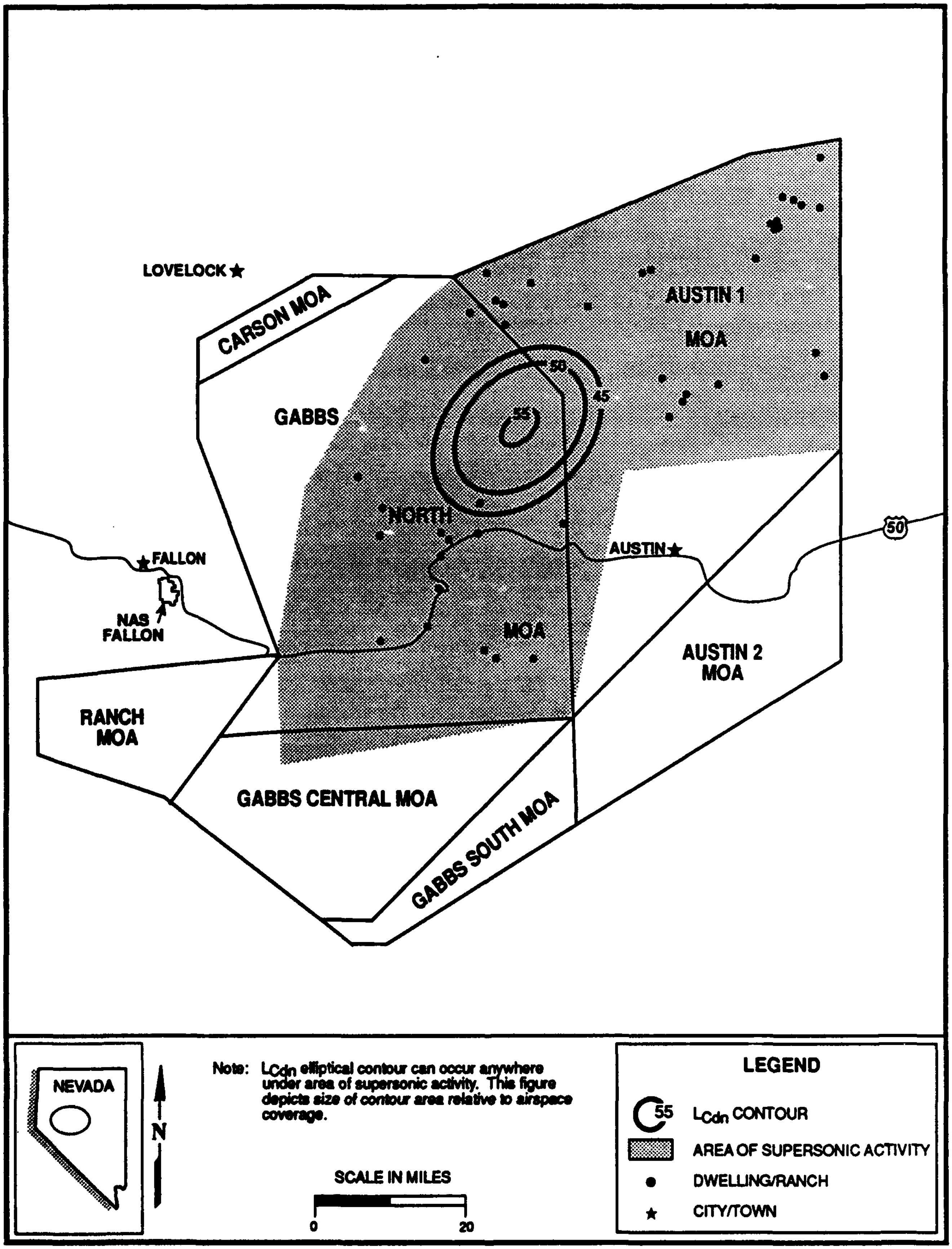


FIGURE 3.11 NAS FALLON AREA OF SUPERSONIC ACTIVITY, L_{Cdn} CONTOURS, AND GEOGRAPHIC DISTRIBUTION OF DWELLINGS AND RANCHES

A 10 percent forecast increase of supersonic activity within the approved airspace by the year 2000 will not change the L_{cdn} contour areas by any significant amount. The impacted population estimates will therefore be similar to those of 1988, with this population experiencing a 10 percent increase in sonic boom occurrences.

The Navy has taken sonic boom measurements since late 1985. Data measurements taken during 1989 indicate an average overpressure of 1.26 psf with a minimum of 0.5 psf to a maximum of 9.35 psf. These measured levels would be sufficient to cause startle to some humans and animals (Source: U.S. Navy, NAS Fallon, 1989). The lower range of sonic boom levels (less than 2 psf) have a low probability of causing window breakage in buildings. At higher levels, the probability would increase to about 0.02 percent probability at 4 psf (i.e,. one in 10,000 panes) and to about 0.5 percent probability at 10 psf (i.e., one in 200 panes) (Source: Hershey and Higgins, 1976).

FRTC

The methodology used to determine noise levels resulting from gunnery and explosive ordnance activities at the FRTC included determining actual types, weights, and numbers of ordnance and gunnery used on the ranges on a busy day. An A-weighted SEL was determined for air-to-ground gunnery, and the C-weighted SEL was determined for large impulsive sounds from bomb blasts and explosive ordnance. The A-weighted and C-weighted L_{dn} values were calculated based on the number of ordnance dropped, rounds of munitions fired, and the percent of day/night activity. Noise contours resulting from those activities on that portion of B-17 designated "B-17E (East)," B-19, and B-20 are shown in Figure 3.12. Live ordnance is only used on that portion of B-17 designated "B-17E."

Only inert/training ordnance may be used on B-16, and only NDBS is allowed on that portion of B-17 designated "B-17W (West)." There are no existing or projected future noise effects from use of weaponry on those ranges.

Although similar types of ordnance are used on all of the ranges and the calculations used to determine the noise contours do not take into consideration the shielding that occurs from natural topography, the noise contours for the ranges differ. That is due to the fact that the noise contours are based on the types of ordnance used, the quantity of each type of ordnance dropped, and the number of sorties flown. The types of ordnance used on, the quantity of each type of ordnance dropped on, and the number of sorties flown to each range are different.

Based on the number of rounds and day/night range activity on B-17E, the L_{dn} 65 dB contour produced by air-to-ground gunnery occurs at a distance of 355 feet from the aircraft flight path. Noise exposure from gunnery activity is virtually undetectable from the noise generated by the aircraft involved in the gunnery activity. Bombs that exceed 1,000 pounds are not authorized on B-17E. The L_{Cdn} 65 dB contour for explosive ordnance dropped on B-17E would be located 35,376 feet (6.7 miles) from the impact area. This is considered to be a worst-case estimate because it does not account for shielding from natural topography. The calculations also assume that all live dropped bombs explode within the target area.

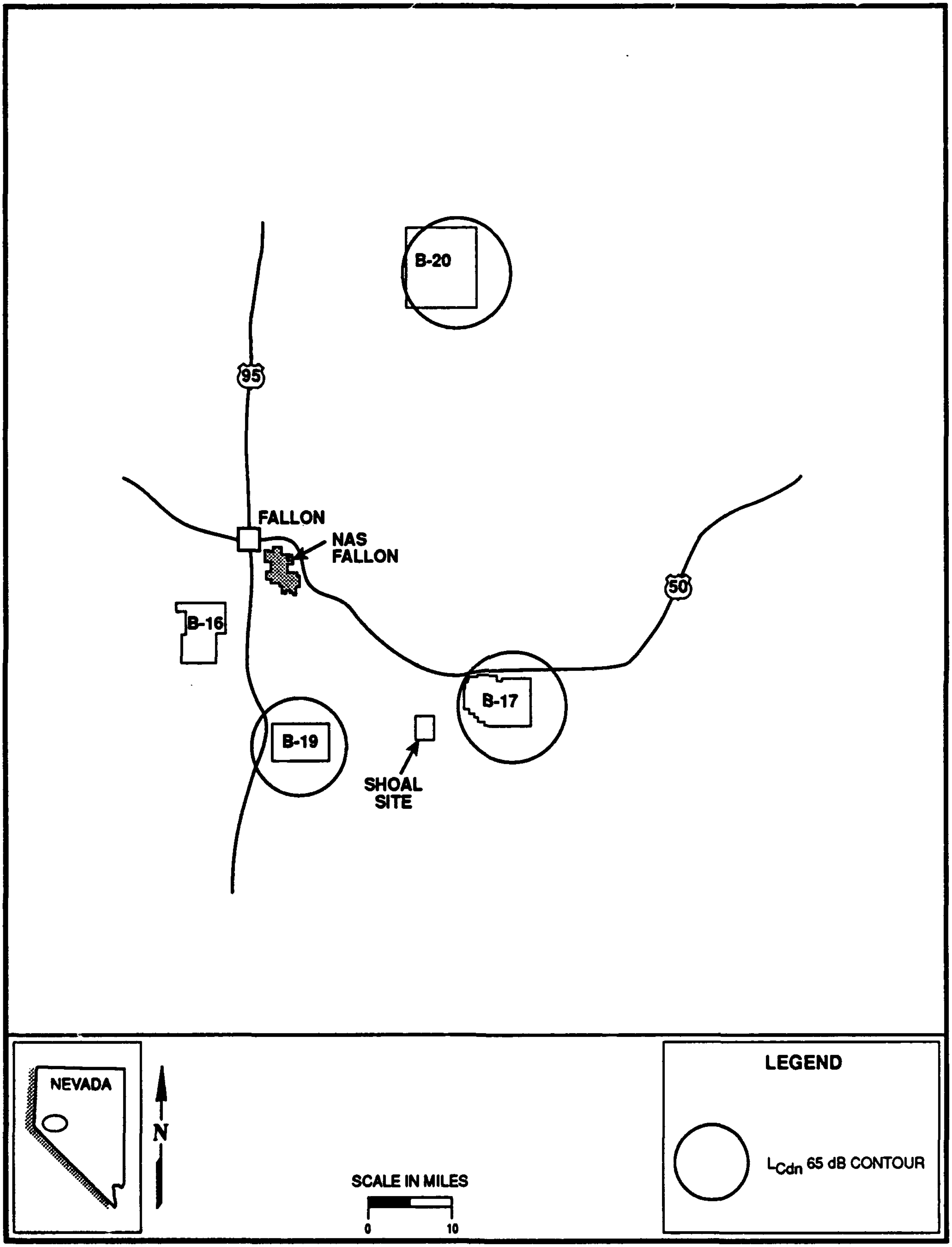


FIGURE 3.12 NAS FALLON RANGE TRAINING COMPLEX AND L_{Cdn} 65 dB NOISE CONTOURS

B-19 activities include the delivery of explosive ordnance and air-to-ground gunnery. Bombs that exceed 1,000 pounds are not authorized on B-19. The L_{dn} 65 dB produced by gunnery activity occurs at a distance of 402 feet from the aircraft. Noise exposure from gunnery activities is virtually undetectable from the noise generated by the aircraft involved in the gunnery activities. The L_{Cdn} 65 dB contour for explosive ordnance dropped on B-19 would be located 30,096 feet (5.7 miles) from the impact area. That is considered to be a worst-case estimate because it does not account for shielding from natural topography. The calculations assume that all live dropped bombs explode within the target area.

Since B-20 was closed from January 1987 through November 1988, current data were not available upon which to perform an analysis to determine noise levels resulting from gunnery and explosive ordnance activities. Air-to-ground gunnery activity at B-20 is comparable to B-17E. Accordingly, the L_{dn} 65 dB contour resulting from air-to-ground gunnery would be 355 feet from the aircraft flight path. Delivery of explosive ordnance on B-20 is also comparable to B-17E with the added factor that live ordnance up to 2,000 pounds may be dropped on B-20. The limited number of 2,000 pound live ordnance drops does not affect the L_{Cdn} 65 dB contour. Accordingly, the L_{Cdn} 65 dB would be located 35,376 feet (6.7 miles) from the impact area. This is considered to be a worst-case estimate because it does not account for shielding from natural topography. The calculations also assume that all live bombs dropped explode within the target area.

3.2.8 FACILITY ACCIDENTS

The DOD Ammunition and Explosive Safety Standards, DOD 6055.9-STD, (Source: U.S. DOD, 1984) have been adapted, tailored, and expanded for specific Navy application in Naval Sea Systems Command Technical Manual NAVSEA OP 5, "Ammunition and Explosives Ashore" (NAVSEA OP 5). The weapons safety program at NAS Fallon is outlined in NASFINST 8020.4L. Numerous other directives pertain to safety precautions for specific types of weapons (e.g., Naval Air Systems Command Instruction 11-85-5, "Airborne Rockets, Safety Handling Instructions").

Specific procedures relative to the prevention and control of spills from fuel storage and distribution systems at NAS Fallon are specified in NASFINST 5090.2, "Oil/Hazardous Substance Spill Prevention, Control, and Countermeasure Plan (SPCC)," dated March 1, 1989. That plan was prepared in accordance with Title 40, Code of Federal Regulations (CFR), Parts 112, 116, and 265, as mandated by OPNAVINST 5090.1. A companion document, NASFINST 5090.3, "Oil/Hazardous Substances Spill Contingency Plan (SCP)," contains detailed procedures to be followed in the event of a spill. Specific requirements and procedures relative to the storage of HAZMAT at NAS Fallon are contained in Naval Supply Systems Command Instruction 5100.27, "Navy Hazardous Material Control Program," and NASFINST 5100.1E, "NAS Fallon Occupational Safety and Health Manual." Those documents are consistent with the standards and regulations promulgated pursuant to the Occupational Safety and Health Act in 29 CFR Part 1910.

3.2.8.1 Sources of Potential Effects

Munitions Handling and Storage

NAS Fallon handles more assembled munitions than any other naval air station in the world due to the large-scale training operations involving explosive ammunition conducted on the FRTC. During 1987, 6,378 tons of munitions were expended on the bombing ranges; 5,288 tons of munitions were expended on the ranges in 1988. A munitions maintenance, assembly, and storage area is located at the north end of the Station. The site contains 16 standard earth-covered magazines and 3 non-standard, box-type magazines. The standard earth-covered magazines have maximum explosive design limits ranging from 15,000 to 225,000 pounds net explosive weight. The total quantity of high explosives stored at the site varies considerably from time to time depending on the number of aviation units deployed to NAS Fallon for training on the ranges. Loading of explosive ordnance on aircraft is restricted to a weapons loading area which is located at the north end of the airfield.

Fuel Storage and Distribution

The primary fuel storage site (Fuel Farm) at NAS Fallon is located west of the north end of the main runways. The Fuel Farm contains 12 storage tanks used for the storage of JP-5, aviation gasoline, diesel fuel, and mixed contaminated fuels (Source: Radian Corporation, 1988). Storage capacities vary from 4,000 to 1.2 million gallons (Sources: Radian Corporation, 1988; Western Division, Naval Facilities Engineering Command, Plot Plan, 1987). The Fuel Farm includes facilities for receiving JP-5 through a privately owned underground pipeline from Sparks, Nevada, and for distributing the fuel directly into the various tanks. The Fuel Farm also includes both fueling and defueling racks where fuel trucks are filled and emptied. Fuel is stored in lesser quantities at various locations throughout the Station and the FRTC for auxiliary power generators, boilers and heaters, and the auto service station. The storage capacities at those locations vary from 50 to 10,000 gallons (Source: Radian Corporation, 1988). Small fuel spills on open public lands have occurred when transporting fuel to generators associated with electronic warfare sites. The potential for future spills will increase if proposed expansion of EW sites occur.

Hot refueling lanes located east of the Fuel Farm are used to perform high speed refueling by pumping fuel directly into aircraft while their engines are running. Eight refueling stations are located in the lanes. Aircraft are also fueled by truck on the airfield's parking aprons.

Hazardous Material Bulk Storage

There are no storage sites containing large quantities of HAZMAT, other than munitions and fuel, at NAS Fallon. The Supply Department Warehouse can be compared to a typical hardware store with the normal complement (approximately 1,000 gallons) of paint, thinners, etc. Cases of lubrication oil, transmission fluids, etc., are stored in two small, remotely located quonset huts. Approximately 1,000 gallons of pesticides are stored in a small (20 feet by 55 feet) building at the Public Works Pest Control Facility. Wastes are temporarily stored at the Central Hazardous Waste Storage Facility. Wastes are normally stored in 55-gallon drums for periods not exceeding 90 days. The maximum volume of hazardous waste stored at that facility does not exceed 10,000 gallons.

3.2.8.2 Analysis of Effects

Munitions Handling and Storage

Compliance with the Explosive Safety Quantity-Distance (ESQD) requirements of the DOD Ammunition and Explosive Safety Standards as implemented in NAVSEA OP 5 ensures that the general public is protected in the event of a worst-case explosives mishap. Representatives of the DOD Explosives Safety Board inspect NAS Fallon regularly. The last inspection was conducted in February 1989. There were no ESQD violations. Munitions operations at NAS Fallon have not affected public health and safety. Continued compliance with applicable explosive safety standards will ensure that munitions operations do not affect public health and safety in the future.

Fuel Storage and Distribution

From February 1987 through February 1989, 3 fuel spills in excess of 1,000 gallons were found to have occurred at or near the NAS Fallon Fuel Farm (These spills are not part of the IRP discussed elsewhere). All free standing fuel was quickly cleaned-up, and none of the spilled fuel escaped the boundaries of the Station. Full implementation of the "Oil/Hazardous Substance, Spill Prevention, Control, and Countermeasures Plan" (NASFINST 5090.2) and its companion plan, "Oil/Hazardous Substance Spill Contingency Plan" (NASFINST 5090.3) has minimized the probability of a serious spill and ensures that public health and safety will not be affected in the event a spill does occur. In addition, NAS Fallon will continue to assess the extent of ground water pollution from previous spills and implement corrective measures as required and discussed in Section 3.2.6.

Hazardous Material Bulk Storage

All HAZMAT storage sites are inspected at least annually by fire safety and health inspectors. Since the Supply Department Warehouse and associated warehouses are operated by a civilian contractor, they are inspected by State of Nevada Occupational Safety and Health officials. There are no serious deficiencies related to HAZMAT storage, and there have been no fires associated with HAZMAT. Even in the event of a fire, an effect on public health and safety is unlikely due to the relatively small amount of HAZMAT stored at any one location and the distance to the nearest public residence (at least one-half mile).

Year 2000

No changes in effects due to facility accidents are anticipated for the year 2000.

3.2.9 AIRCRAFT MISHAPS

The primary procedures for flight safety and mishap prevention for the NAS Fallon and FRTC are outlined in NASFINSTs 3710.1, 3750.6, and 3752.1. NASFINST 3750.6 establishes the local flight safety program which is designed to ensure that information and education on safety related issues associated with NAS Fallon activities are properly disseminated. When tactically feasible, flight below 3,000 feet AGL is avoided over noise sensitive areas including the Stillwater WMA, the Fernley State WMA, Carson Lake, Pyramid Lake, and Walker Lake. Special procedures are established to safely accommodate aerial surveying or spraying operations conducted within the NAS Fallon Control Zone and/or the FRTC by requesting agencies. Any reported violations of flight regulations are investigated and acted upon as appropriate by the Commanding Officer, NAS Fallon. Similar procedures are followed on reports of near mid-air collisions or other hazardous situations. Aircraft mishap response actions for on-Station and off-Station mishaps are clearly defined in the NASFINSTs cited in this section.

3.2.9.1 Sources of Potential Effects

From 1964 to 1988, 75 aircraft mishaps occurred in conjunction with NAS Fallon activities. In 20 of those mishaps, the aircraft impacted on FRTC ranges. In 30 of those mishaps, the aircraft impacted on the NAS Fallon airfield, and in 25 of those mishaps, the aircraft impacted on public or private land. Unfortunately, there was one civilian fatality during that period as a result of an aircraft mishap occurring in conjunction with NAS Fallon activities. The investigation into that mishap concluded that the mishap was not caused by the military pilot (Source: U.S. District Court, 1987). That mishap occurred when, without authorization, the civilian pilot entered restricted area R-4803 South over B-16 at a time restricted area R-4803 South was active (reserved for military use) and caused a mid-air collision by flying into the flight path of a military aircraft which was engaged in bombing practice in that airspace.

3.2.9.2 Analysis of Effects

An average of one off-range mishap annually occurred between 1964 and 1988. Flight operations at NAS Fallon may increase by 10 percent by the year 2000; a 10 percent increase in the number of off-range mishaps may also occur (1.1 aircraft mishaps per year). Given the size of the area bordering the ranges and the population estimates for the years 1988 and 2000, the likelihood of a person sustaining injury or property damage due to an aircraft mishap is extremely small. The RAICUZ study (Source: Western Division, Naval Facilities Engineering Command, RAICUZ, 1982b) delineates range safety zones for the FRTC.

Accident Potential Zones (APZs) have been defined around NAS Fallon in accordance with DOD and Navy guidelines. APZs do not identify the probability of an mishap occurring; instead, APZs merely identify the probable mishap locations if a mishap were to occur. The draft update of the NAS Fallon AICUZ (Source: Wolf, 1987) identifies each APZ and previous mishap locations. For each category of APZ, the Navy has provided recommended land use compatibility guidelines for the City of Fallon and Churchill County.

Since the 1983 AICUZ update (Source: Western Division, Naval Facilities Engineering Command, 1983), four mishaps have occurred within five miles of the Station of which three occurred on Station. Thus, the likelihood of a person sustaining injury or property damage from aircraft operations at NAS Fallon is small. NAS Fallon is working with Churchill County to minimize potential impacts through the exchange of information. The change in flight activity projected for the year 2000 will not alter effects.

3.2.10 OBJECTS DROPPED FROM AIRCRAFT

Objects dropped from aircraft is defined to include all items other than armaments for this report. Health and safety considerations due to air-to-ground use of armaments are considered in the next section.

Procedures governing the reporting of dropped objects are specified in NASFINST 3710.1. If a pilot is aware that there is an object which may be about to fall off the aircraft (e.g., a loose cowling), the pilot is required to operate the aircraft in a manner that minimizes the possibility of the object falling off the aircraft, to avoid flying the aircraft over populated areas if possible, and to land the aircraft as soon as possible. Dropped objects of any type are to be reported as soon as possible to the NAS Fallon Operations Duty Officer and/or the NAS Fallon Range Department for appropriate follow-up action.

3.2.10.1 Sources of Potential Effects

Based on data supplied for military aircraft operating from Nellis AFB (Section 2.2.10), it is estimated that an average of 1.5 parts (screws, bolts, etc.) per 1,000 sorties fall off aircraft.

3.2.10.2 Analysis of Effects

The number of aircraft sorties occurring at the FRTC in 1988 was approximately 40,000, and it is projected to be 10 percent higher in the year 2000 (44,000). Using the estimated average of 1.5 dropped objects per 1,000 sorties, there were 60 dropped objects in 1988, and it is estimated that there could be 66 in year 2000. The land area where the public would be most likely affected by dropped objects is public lands located between the bombing ranges and the Station. Based on the analysis conducted (using 1988 data), the statistical probability of people or structures being struck by dropped objects is infinitesimal. This analysis indicates that dropped objects from military aircraft do not present an unreasonable risk to the health and safety of the people of Nevada. No change is predicted for the year 2000.

3.2.11 ARMAMENTS INADVERTENTLY DROPPED FROM AIRCRAFT

Armaments (ordnance) which inadvertently impact on lands adjacent to the target ranges are the subject of concern in this section.

Procedures governing the safe use of weapons systems and reporting armaments inadvertently dropped from aircraft are specified in NASFINST's 3710.1 and 3752.1.

Arming and dearming operations on NAS Fallon are conducted toward safe directions, away from people and property. In-flight safety precautions include confirming that target areas are clear of personnel and livestock prior to delivery and ensuring that the weapons systems' "master arm switch" is in the off position until major roads and highways have been crossed and the aircraft has entered restricted airspace. Aircraft experiencing difficulties with ordnance delivery systems are required to either proceed to B-17, B-19, or B-20 and jettison the malfunctioning ordnance or to return to NAS Fallon via a route of flight that is clear of inhabited areas. The intentional dropping or firing of any ordnance other than on a designated bombing range is prohibited. Armaments inadvertently dropped from aircraft of any type are required to be reported as soon as possible to the NAS Fallon Range Department and/or the NAS Fallon Operations Duty Officer for appropriate follow-up action.

3.2.11.1 Sources of Potential Effects

Ordnance intended to be dropped on B-16, B-17, and B-19 has impacted on the public lands and Walker River Paiute Indian Reservation lands adjacent to those bombing ranges. The surface of the known affected lands, approximately 37,000 acres, has been searched to recover that ordnance. In the November-December 1989 and June 1990 surface searches of those lands for ordnance, approximately 15,000 pieces of live ordnance were retrieved. Approximately 102 of those pieces of live ordnance were bombs (Source: U.S. Navy, NAS Fallon, Ordnance Search, 1990). On the basis of on-site monitoring controls, the average effectiveness probability for those surface searches was estimated to be 92.7 percent. There is no means available to accurately locate and/or identify subsurface ordnance. The approach used for estimating the location of subsurface ordnance is to assume that it is the same as surface ordnance.

3.2.11.2 Analysis of Effects

Inadvertent impacts of live armaments on public lands may have two effects. The first may occur during live armament impact with the ground, e.g., explosion. The second may occur if someone comes in contact with any live armaments or parts of live armaments after impact.

Most of the lands where ordnance was found off range are extremely remote, are difficult to reach, have limited recreational opportunities, and are visited infrequently. There have been no known injuries as a result of ordnance impacting off range on the lands adjacent to the FRTC bombing ranges. BLM effected an emergency closure of approximately 24,000 acres of the public lands where off-range ordnance was found. The approximately 9,000 acres of affected public lands controlled by the BUREC were not closed to the public. Surface searches conducted by the Navy have greatly reduced the risk to public health and safety. Areas presenting the greatest risk to public health and safety are those immediately adjacent to B-17 and B-19, and the risk in those areas is principally from subsurface ordnance. The Navy has recommended to the BLM that the portion of those lands where live ordnance was found remain closed to all activities except grazing. No live bombs were found on the lands adjacent to B-16. Accordingly, those areas adjacent to B-16 present a minimal risk to the public health and safety; and the Navy has recommended that

BLM reopen those lands to full public access. Pursuant to a cooperative agreement with the BLM, the Navy is taking steps to post all of the areas with appropriate warnings concerning the hazard of off-range ordnance and has modified its proposed Master Land Withdrawal to include the public lands where off-range ordnance was found. Additionally, the Navy entered a Memorandum of Agreement with the BLM and the State of Nevada which established the framework to manage any off-range ordnance problems that might occur in the future. That Memorandum of Agreement provides for continued reconnaissance of public lands by the Navy and expeditious retrieval of any ordnance sighted off range. Pursuant to that Memorandum of Agreement, the Navy has also established a "hotline" for reporting any sightings of off-range ordnance and has established a notification procedure to ensure that the BLM and the NDEP receive immediate reports of any instances of off-range ordnance. In addition to the foregoing, the Navy has modified its operating rules for ordnance delivery to minimize the risk of ordnance being dropped off range. With those measures in effect, the risk to public health and safety of the people of Nevada from armaments inadvertently dropped from aircraft is not believed to be unreasonable. No change is anticipated for the year 2000.

3.2.12 CHAFF AND FLARES

Requests for the deployment of chaff over the Fallon ranges is made to Nellis AFB, which coordinates with the FAA. The use of chaff is governed by Chief of Naval Operations Instruction 3430.9C, "Performing Electronic Countermeasures in the United States and Canada." This instruction is used by all services. The use of rope chaff, which may short-circuit high voltage transmission lines, requires that special precautions be taken and approval must come from the major command. However, it is NAS Fallon policy not to use rope chaff. Large-scale deployment of chaff requires 3 days advance notice to potentially affected agencies. Small deployments also require clearance. All efforts are made to deploy chaff in areas that do not affect other air traffic. Deployment is stopped in emergency situations or if heavy interference with other facilities occurs (Source: Departments of the Air Force, Army, and the Navy, 1978; and John Smith, 1991.)

Flare usage is also positively controlled such that the user must be granted permission for deployment. Minimum drop altitudes are established for each type of flare to ensure complete burnout prior to reaching the ground.

Additional constraints on the use of flares include the following drop restrictions: 1) not on public land; 2) when winds are in excess of 20 knots; 3) if high fire hazard as declared by the BLM or NAS Fallon; and 4) during high temperature periods, July through September (Sources: U.S. Navy, 1990; John Smith, personal communication, 1991; King, personal communication, 1991). Furthermore, all possible fire-starting pyrotechnic devices are limited to B-17 and B-19 (U.S. Navy, 1986).

NAS Fallon sweeps areas that are both off and on the range to minimize safety problems associated with chaff and flares. Off range sweeps occur at least once a year. In addition, helicopter surveys are conducted approximately four times per year. These surveys can detect illumination flares which are deployed via parachute.

On range sweeps occur more frequently. There are approximately eight one-week sweeps and one three-week sweep per year on each range. The sweeps focus on the portion of the range being used. All duds found on range are disposed of in place (Source: King, personal communication, 1991).

3.2.12.1 Sources for Potential Effects

Chaff and flares have been used in the FTRC for approximately 20 years.

NAS Fallon uses approximately 2,350 bundles of burst chaff per month, each consisting of 2.1 million human-hair-size fiberglass strands.

Approximately 120 flares are dropped over the Fallon ranges each month (Source: Smith, personal communication, 1991). The 1989 and 1990 off range sweeps of 112,000 acres discovered 406 duds. Since these were the first major off range sweeps, it is concluded that approximately 20 flares per year accumulated and were recovered. Recovered flares are brought on range and disposed of, unless there is a fire hazard due to weather conditions (Source: King, personal communication, 1991).

3.2.12.2 Analysis of Effects

The effects of flares include fires and potential safety problems if duds are found and handled by humans. Some flares contain a spring-loaded firing mechanism that may be ignited upon impact with the ground or upon subsequent handling if recovered. Testing indicates a high reliability rate for certain types of flares; a 100% ignition rate was claimed for one lot of 2,000 flares. Military standards allow for a failure (or dud) rate of between one and three percent (Source: McMillan, Nellis AFB Range Group, personal communication, McMillan, 1989).

The historical rate of fires is extremely low at NAS Fallon. The only recorded fire due to flares occurred in conjunction with the November sweep of B-16. In that incident, a dud was found off range and was disposed of on range resulting in a one-acre fire that did not require a fire fighting response (Source: King, personal communication, 1991). There are no known incidents of personal injuries due to handling of duds associated with FTRC.

The optimal concentration of chaff during deployment is approximately one fiber per five cubic feet of airspace. Because a bundle contains approximately 2.1 million fibers and weighs approximately 1 1/2 ounces, the resulting ambient concentration at release is 120 micrograms per cubic meter (mg/m^3). However, this chaff concentration at release altitude lasts only for an instant, as it is rapidly dispersed in the air, and may not reach the ground for some time due to the very slow settling rate of individual chaff fibers.

The minimum dimension of a fiber is 0.0003 inches, which converts to 7.6 micrometers. This is less than the 10 micrometer maximum size cutoff in EPA's standard for inhalable particulates. However, the concentration of 120 micrograms per cubic meter is below the EPA standard of 150 micrograms per cubic meter. Therefore, no effects are predicted based on EPA's standard.

Ingestion of chaff fibers has been studied in animals. No health hazard has been identified (U.S. Air Force, 1983 and Canada Department of Agriculture, 1972). Since these fibers are visible (they are the diameter of fine human hair), ingestion by humans can be avoided. Based on this avoidance and the health studies conducted, chaff does not pose a known health risk. The long-term effects of chaff are unknown.

Based on the restriction employed with the use of chaff, discussed above, interference with civilian aircraft navigational aids, communication systems, and transmission is minimized.

There are no anticipated changes in the use of chaff and flares for the year 2000. Consequently, impacts should not change.

3.3 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

This section describes effects on public and private property from activities associated with NAS Fallon. Topics addressed in this section include employment and other economic effects, population, housing, community services, public finance, and land uses. The measurable effects on public and private property occur in Churchill County.

3.3.1 ECONOMIC AND DEMOGRAPHIC EFFECTS

Indicators of economic and demographic effects for Churchill County in 1988 and projections of effects in the year 2000 are listed in Table 3-5.

3.3.1.1 Employment, 1988

NAS Fallon is the single largest employer in Churchill County, with nearly 23 percent (about 2,000 jobs) of total employment in the county occurring as a result of direct Federal civil service, military, and contractor employment in NAS Fallon activities. Local spending by these direct employees results in additional (indirect) employment in industries supporting NAS Fallon and the community. When the indirect employment (about 810 jobs) is added to direct employment, approximately 32 percent of all county employment is the result of NAS Fallon activities.

3.3.1.2 Gross Regional Product and Personal Disposable Income, 1988

NAS Fallon contributed approximately 27 percent of the gross regional product (GRP), $67 million, in Churchill County in 1988 and accounted for approximately 20 percent, $41 million, of personal disposable income (PDI) available to the residents of the County.

Table 3-5. Indicators of Economic and Demographic Effects in Churchill County Attributable to NAS Fallon, 1988 and 2000.

	1988	2000
Total Employment in Churchill County[1]	8,860	12,540
Total Population in Churchill County	15,960	19,550
Employment From Withdrawals[1]		
Direct Military	980	980
Direct Non-military	1,020	1,020
Total Direct Employment	2,000	2,000
Percent of County Total	22.5	15.9
Indirect Employment	810	850
Total Employment	2,810	2,850
Percent of County Total	31.7	22.7
Gross Regional Product (millions)	$67	$81
Percent of County GRP	26.6	19.4
Personal Disposable Income (millions)	$41	$59
Percent of County PDI	19.6	17.7
Population From Withdrawals		
Direct Military and Dependents	3,280	3,280
Non-military and Dependents	1,840	1,590
Total Direct Population	5,120	4,870
Percent of County Total	32.1	17.5
Indirect population	1,460	1,330
Total Population	6,580	6,200
Percent of County Total	41.2	31.7
School-Age Population		
Direct Military	440	440
Direct Non-military	480	430
Total Direct School-Age[2]	920	870
Percent of District Enrollment	28.8	22.4
Indirect School-age	220	200
Total School-Age Population	1,140	1,070
Percent of District Enrollment	35.8	27.5

(1) Full and part-time employment (jobs) by place of residence.

(2) Direct military and non-military students were obtained from Jim Costa, Churchill County School District, 1989, and are rounded counts from his records. For 2000, the direct students to direct population ratio in 1988 was assumed to remain constant.

3.3.1.3 Population, 1988

Approximately 32 percent of Churchill County residents are direct employees or dependents of direct employees associated with NAS Fallon activities. When the indirect population (the worker and household members associated with indirect employment) is considered, more than 41 percent of the residents (6,580 persons) are present within the County as a result of employment generated by NAS Fallon.

3.3.1.4 School-Age Population, 1988

The numbers of students enrolled in Churchill County public schools who are dependents of military members, Federal civil service employees, and contractor employees whose employment is directly associated with NAS Fallon are listed in Table 3-5 (Source: Jim Costa, Churchill County School District, personal communication, 1989). They constitute approximately 29 percent of the enrollment. If all school-aged dependents of workers whose employment is indirectly related to NAS Fallon activities are enrolled in school, then approximately 36 percent of the Churchill County school enrollment is a result of employment generated by NAS Fallon.

3.3.1.5 Economic and Demographic Effects, 2000

Total employment and population in Churchill County is forecast to increase between 1988 and 2000. Direct employment associated with NAS Fallon is not expected to change, and the population related to this employment is forecast to decline slightly. While indirect employment is forecast to increase slightly, indirect population is forecast to decline slightly between 1988 and 2000 as a result of national trends in population-to-employment relationships. Employment and population generated by NAS Fallon activities are forecast to represent smaller percentages of total employment and population in 2000 than in 1988 because of general employment and population growth in the County. Nevertheless, NAS Fallon activities are forecast to remain a substantial contributor to County employment, with almost 23 percent of employment attributable directly or indirectly to these activities. Similarly, more than 31 percent of the population in 2000 is forecast to be the result of employment generated by NAS Fallon.

By 2000, NAS Fallon activities are forecast to add more than $80 million per year to the GRP of Churchill County, which will represent approximately 20 percent of the total GRP in the County. Projections of PDI for the year 2000 indicate that $59 million will be added to the Churchill County economy by NAS Fallon activities, which will represent almost 18 percent of the PDI in the County.

Because the direct and indirect population in Churchill County is forecast to decline slightly between 1988 and 2000, the size of the total school-age population (ages 6 through 17) is also forecast to show a slight decline. As a percentage of forecast total enrollment, estimated school-age dependents of direct workers will continue to account for a substantial portion of public school enrollment (approximately 22 percent). When students who are indirectly related to NAS Fallon employment are included, approximately 28 percent of the forecast enrollment would be attributed to the employment generated by the Station.

3.3.1.6 Economic Effects of Alternative Land Use

Table 3-6 compares economic and population indicators forecast for the year 2000 from continued land withdrawal and use of the land for other purposes. Mining and grazing were considered reasonable alternative uses for the withdrawn public lands. Total employment in Churchill County would be substantially smaller under alternative land uses. GRP could be about $75 million less under alternative land uses while total PDI could be approximately $57 million less. These comparisons indicate that less employment in the County would result from using the land currently withdrawn for NAS Fallon for other economic activities and that GRP and PDI would experience a decrease.

Table 3-6. Projected Indicators of Economic and Demographic Characteristics in Churchill County: NAS Fallon and Alternative Land Use, 2000.

	NAS Fallon	Alternative Use	Difference	Percent Difference
Total Employment[1]	12,540	9,780	(2,760)	(22.0)
Direct Employment	2,000	50	(1,950)	(97.6)
Indirect Employment	850	40	(810)	(95.7)
Total	2,850	90		
Percent of County Total	22.7	0.8		
Population	19,550	18,130	(1,420)	(7.3)
Gross Regional Product (millions)	$402	$327	($75)	(18.7)
Personal Disposable Income (millions)	$322	$265	($57)	(17.7)

[1]Full and part-time employment (jobs) by place of residence.

3.3.2 HOUSING

In 1988, there were 6,647 residential units in Churchill County (Source: Paul Schultz, Churchill County Assessor's Office, personal communication, 1989). Single-family and agricultural residences comprised about half of these units (3,525 residences, or 53 percent). In 1985, there were an estimated 5,656 housing units in the City of Fallon and within a 10-mile radius of the City where 95 percent of the County's population resided (Source:

Western Division, Naval Facilities Engineering Command, 1987). Assuming that the population distribution and, therefore, housing distribution remained constant between 1985 and 1988, the number of residential units increased by almost 1,000 over the 3 years. NAS Fallon operates and maintains 301 military family housing units on the Station. An additional 80 housing units are included in the Fiscal Year 1991 Defense Appropriation; plans for their construction are currently being developed (Source: D. Precell, Public Works Department, NAS Fallon, personal communication, 1989).

In 1985, there was a very low vacancy rate, estimated at less than three percent, in the City of Fallon and the surrounding area. During this period there were only a few units available as rentals (Source: Western Division, Naval Facilities Engineering Command, 1987). The rental market was very tight in 1988; only a two to three percent vacancy rate existed due to construction activities in the region. The rental vacancy rate rose to 8 to 10 percent in 1989 as a result of an increased number of rental units being created and completion of regional construction projects (Source: Dan Whooley, President, Fallon Board of Realtors, personal communication, 1989).

In 1985, there was little speculative building of houses in the Fallon area (Source: Western Division, Naval Facilities Engineering Command, Housing Market, 1987). In part, developers felt that they would be taking unacceptable risks in building new homes or apartments to meet demand caused directly or indirectly by increases in military personnel at NAS Fallon because changes in Navy plans could just as easily result in a sudden decrease in demand. This caution was also recognized two years later in 1987, when the OMNI-MEANS Impact Assessment of NAS Fallon Expansion noted that "developers have remained cautious about building, in spite of the obvious high demand for housing. This is often the case in areas where a high percentage of employment is associated with military bases" (Source: OMNI-MEANS, Ltd., 1987).

As indicated in Table 3-5, almost 32 percent of employment and 20 percent of PDI in the county is estimated to result directly or indirectly from NAS Fallon activities. Any decline in NAS Fallon activities would rapidly spread throughout the economy of Churchill County and would quickly affect the housing market. Thus, developers' caution with respect to speculative housing construction appears warranted, with the result that the single-family residential housing market is likely to remain tight in the NAS Fallon area. The potential for developing residential areas near B-16 west of the City of Fallon may be negatively affected by aircraft-generated noise.

Over the past 40 years, greater land areas near FRTC target run-in lines have been exposed to intense but sporadic noise due to the evolution of aircraft and training requirements. As a part of its on-going AICUZ and RAICUZ programs, NAS Fallon has provided recommended compatible land use guidelines to Churchill County planning agencies in order to protect the health, safety, and welfare of people residing in the vicinity of NAS Fallon and the FRTC and to preserve the Navy's operational capability. In order to further address noise issues as related to the residential housing market, NAS Fallon also recommended in 1986 that Churchill County adopt a disclosure ordinance so that future residents of affected areas would be alerted to any noise impacts. It was recommended that the ordinance establish the requirement that a disclosure statement be attached to the deed or lease. That disclosure statement would require anyone selling or leasing residential property to disclose to a prospective purchaser or lessee that the property was subject to possible overflight and accompanying noise and vibration.

3.3.3 SERVICES

Table 3-7 provides a summary of statistics on enrollment in the Churchill County schools and the personnel employed by those schools in comparison to state levels, and Table 3-8 provides a summary of the personnel providing community services within Churchill County. Community service staffing-to-population ratios are presented in terms of population attributed to employment generated directly by NAS Fallon. The indirect population is not included in service-level attribution. Included in Table 3-8 is an estimate of the personnel providing the specific service, the ratio of service providers to population, and the number of personnel attributable to the direct population of NAS Fallon. In 1988, it was estimated that approximately 32 percent of the County population was present as a result of direct employment generated by NAS Fallon.

3.3.3.1 Education

Most of the Churchill County School District's students attend school in the City of Fallon. In 1988, approximately 29 percent of all enrollments in the District were directly related to NAS Fallon employment, which was an increase from approximately 22 percent in 1984 (Source: Jim Costa, Churchill County School District, personal communication, 1989). In 1988, 49 of Churchill County's 168 teachers could be attributed to student enrollment resulting from direct employment at NAS Fallon.

3.3.3.2 Law Enforcement

Law enforcement in Churchill County is provided by the County Sheriff's Department (23 officers), the City of Fallon Police Department (17 officers), and the State Highway Patrol (5 officers). Considering all law enforcement officers in the county (45 officers), there was one officer for every 355 county residents. Approximately 15 of the law enforcement officers in the county can be attributed to population resulting from direct employment at NAS Fallon.

The NAS Fallon Security Department has approximately 60 members (Source: LT Jolliff, NAS Fallon Security Department, personal communication, 1989) and provides security for the Station and FRTC (Source: Western Division, Naval Facilities Engineering Command, 1983). Since the Security Department is comprised of military members, Secretary of the Navy Instruction 5820.7B, which implements the Federal policy established in the Posse Comitatus Act, 18 U.S.C. section 1385, prevents the Station from entering into a mutual aid agreement with either the City of Fallon Police Department or the Churchill County Sheriff's Department.

NAS Fallon has proprietary jurisdiction over the Station and ranges. If a crime occurs on the Station, the Churchill County Sheriff's Department maintains the jurisdictional

Table 3-7. Education Characteristics in Churchill County.

	Churchill	State
Enrollment		
1987	3,172	168,353
1988	3,314	176,474
Percent Change in Enrollment		
84-85	7.6	2.2
85-86	3.6	4.1
86-87	4.6	4.4
87-88	4.5	4.8
Number of Teachers	168	8,699
Elementary & Secondary	140	7,470
Special Education	19	1,025
Vocational	9	204
Salary (average - 1989)	$30,159	$28,736
Administrative		
Non-teachers(1)	31	1,437
Salary (average - 1989)	$40,121	$39,975
Ratio of Teachers to Students	1:19.7	1:20.3
Teachers Attributable to NAS(2) Fallon-Related students	49	

(1) Includes service personnel, principals, and assistant principals, supervisors, superintendent, and assistant superintendents.

(2) Computed to be attributed to NAS Fallon as a result of direct employment; was not obtained from source document.

Source: Nevada Department of Education Research Bulletin Volume 30, "Student Enrollment and Licensed Personnel Information", March 1989.

Table 3-8. Services Characteristics in Churchill County.

	1988
Population	15,956
Percent NAS Fallon Direct	32.1
Law Enforcement Officers	45
Ratio to Population	1:355
Attributable to NAS Fallon	15
Fire Protection, Volunteer Personnel	30
Ratio to Population	1:532
Attributable to NAS Fallon	10
Licensed Physicians	14
Ratio to Population	1:1,140
Attributable to NAS Fallon	4

prerogative to investigate and refer cases for prosecution within the County system. An MOU regarding investigative jurisdiction has been entered into between NAS Fallon and Churchill County.

3.3.3.3 Fire Protection

The Fallon Volunteer Fire Department (VFD) provides fire protection to all areas of Churchill County and is the only civil fire suppression agency in the County. The only other fire suppression agency in the County is the NAS Fallon Fire Department which has 49 fire suppression personnel and 6 support personnel. NAS Fallon's Fire Department provides structural fire and aircraft crash protection for the entire installation. It also provides fire prevention services including building and facility fire inspections and training in fire prevention methods (Source: Western Division, Naval Facilities Engineering Command, 1983). The NAS Fallon Fire Department has a mutual aid agreement with Churchill County and will respond to emergency situations that occur off the Station (Source: OMNI-MEANS, Ltd., 1987). In 1988, the NAS Fallon Fire Department responded to 5 emergency situations which occurred off Station; and in 1989 the NAS Fallon Fire Department responded to 12 such calls.

The Fallon VFD has 2 paid and 29 volunteer fire suppression personnel (about 1 fire fighter for every 530 persons). Ten of these fire suppression personnel may be attributed to NAS Fallon direct population.

3.3.3.4 Medical Care

In 1988, medical care was provided to Churchill County residents by 14 licensed physicians (Source: Claire Mowrey, State Board of Medical Examiners, personal communication, 1989), 39 registered nurses, and 19 licensed practical nurses (Source: Martha Seely, State Board of Nursing, personal communication, 1989). There is one hospital in the County. It has 40 acute-care beds (Source: Robert Crookham, Nevada Division of Health Resources, personal communication, 1989). NAS Fallon maintains an outpatient acute-care clinic that during 1988 was staffed by one family practice physician, one general medical physician, support staff, and one flight surgeon (Source: LCDR Adams, NAS Fallon, personal communication, 1989). On a monthly basis, there are about 700 to 800 outpatient visits to the NAS Fallon Clinic by active duty and retired military personnel and their dependents. The clinic has a very limited capability to handle emergencies. Serious cases involving active duty and retired military personnel and their dependents are transferred to Churchill Community Hospital or Reno area hospitals after they have been stabilized. The NAS Fallon Clinic will stabilize non-military persons who are hurt on Station and will transfer them to Churchill Community Hospital for further treatment.

Considering the nonmilitary licensed physicians only, four to five of the physicians are attributable to population resulting from direct employment at NAS Fallon.

3.3.4 PUBLIC FINANCE

Churchill County, the City of Fallon, and Churchill County School District are the local government entities affected by the NAS Fallon land withdrawal and airspace activities. In fiscal year (FY) 89, general fund resources available to Churchill County government were budgeted at about $4,495,000 while expenditures were budgeted to be approximately $4,311,000 (Source: Nevada Legislative Council Bureau, December 1988). The City of Fallon general fund resources for FY 89 were approximately $2,427,000 while expenditures were about $2,008,000. The FY 89 fiscal effect of NAS Fallon activities on City and County general fund resources was about $2,852,000 while the effect upon expenditures was approximately $2,603,000.

During the 1987-1988 school year, the Churchill County School District had revenues from all sources that averaged $4,194 per student and expenditures that averaged $5,841 per student. During the 1987-1988 school year, the School District received an average of $583 in direct Federal assistance (P.L. 81-874 funding) for each student directly related to NAS Fallon living on the Station (247 students) and $162 in direct Federal assistance (P.L. 81-874 funding) for each student directly related to NAS Fallon living off the Station. This assistance amounted to 10 percent of the expenditures for NAS Fallon-related students living on Station and 2.7 percent of the expenditures for NAS Fallon-related students living off the Station. This assistance comprised 2.1 percent of total School District General Fund expenditures for that year (Source: Jim Costa, Churchill County School District, personal communication, 1989). Churchill County School District general fund resources were budgeted at $12,294,000 for FY 89 while expenditures were budgeted to be $11,776,000 (Source: Nevada Legislative Council Bureau, December 1988). NAS Fallon effects on the School District budget were $4,401,000 of resources and $4,215,000 of expenditures.

3.3.5 LAND USE

Agriculture provided 8.8 percent of all employment in Churchill County in 1986 and employed 710 people (Source: State of Nevada, Office of Community Services, 1988). In Churchill County, total cash receipts from marketing crops and livestock in 1986 was slightly more than $36.5 million, almost 15 percent of the statewide total for 1986. Sales of livestock contributed 80 percent of total cash receipts. As of January 1, 1987, there were 50,000 cattle and calves (9 percent of statewide total) and 5,000 sheep and lambs (6 percent of statewide total) in the county.

There are 2,934 acres of acquired, water-righted lands within the NAS Fallon boundaries. They were private lands which were purchased, not withdrawn, and are held in fee simple. The lands were acquired in the 1950's to ensure the existence of a buffer zone or green belt on the lands adjacent to the airfield. Navy control of these lands in the vicinity of the Station's runways ensures that the vegetation grown on the lands provides the necessary ground cover and soil stability to protect against FOD, dust, and fire and does not cause a significant bird strike hazard. Should an aircraft engine suffer FOD or a bird strike during the take-off roll, not only could an aircraft be lost; but also lives of naval aviator's could be lost. Should an aircraft impact on the acquired lands, proper ground cover will reduce the fire danger and could save aviator's lives. These acquired lands' water-righted status is derived from their inclusion in the Newlands Reclamation Project. The lands were irrigated and were used for the production of cash crops, for grazing, and livestock production prior to their acquisition by the Navy. These lands are now leased to private farmers for agricultural purposes including crop production, grazing, and livestock production. Those private farmers are responsible for growing vegetation which provides adequate ground cover while ensuring soil and water conservation. Since these lands are being used for the same purposes that they were used prior to their acquisition by the Navy, their acquisition has had no impact on land use in the County.

Use of some lands within the FRTC for bombing ranges precludes some grazing and livestock production in Churchill County. The inability to use those lands for agricultural purposes affects the economic contribution of agriculture in the county. The Navy has proposed the withdrawal of approximately 188,323 acres of public land for the FRTC. A portion of this land is adjacent to existing target ranges and would act as essential safety and noise buffer zones for the target ranges. The remainder of the withdrawal is comprised of the Shoal Sites and land that will be used for the Electronic Warfare Range. Most of that withdrawal would overlap current grazing allotments. This proposed withdrawal was addressed in a draft Environmental Impact Statement for the proposed Master Land Withdrawal, Naval Air Station, Fallon, Nevada, U.S. Navy, 1982. A portion of the land which would be withdrawn around B-16 is under BUREC jurisdiction and TCID administers the grazing permits for that land. The current use of federal lands for grazing is expected to continue around B-16 under TCID administration. The BLM manages three grazing allotment areas which are overlapped by the proposed safety and noise buffer zones for B-17. Establishment of the proposed safety and noise buffer zones for B-17 will not preclude grazing on those lands. The BLM also manages two grazing allotment areas which overlap the safety and noise buffer zones proposed for B-19. If those safety and noise buffer zones are established, grazing activities could continue without conflict with range activities. The BLM administers four grazing allotments which overlap the lands proposed for withdrawal and use as the EWR. Currently permitted grazing on those lands is expected to continue. NAS Fallon also envisions land withdrawals for a land bridge between Ranges B-17 and B-19 and for a new Range B-18 which encompass about 202,000 total acres. As with the Proposed Master Land Withdrawal, continuation of grazing allotments on this land is also envisioned with the exception within B-18 (79,000 acres).

Minerals mined in Churchill County during 1985 (Source: State of Nevada, Office of Community Services, 1988) included salt, diatomite, silver, gold, crushed and broken stone, iron ore, lead, and copper. In FY 87, mining generated total tax revenues in the County of $134,000, which represented approximately 4.3 percent of property tax revenues in the County. These tax revenues represented 0.4 percent of the total County budget for FY 87. In 1986, employment in mining was less than one percent of all employment in Churchill County (Source: State of Nevada, Office of Community Services, 1988). Net proceeds of mines in Churchill County have fluctuated between 1985 and 1988 (Source: State of Nevada Department of Taxation, Annual Report, Fiscal 1988, October 1988). In FY 86, net proceeds of mines in Churchill County totaled $403,845; in FY 87, they totaled $102,030; and in FY 88, they were $375,975. It is unlikely that the land withdrawals for NAS Fallon and the FRTC have had an effect on the economic contribution of mining in Churchill County (see Section 3.9 for further discussion of minerals).

While outdoor recreation could occur, to some extent, on withdrawn lands at NAS Fallon and FRTC if they were publicly accessible (Section 3.7), hunting is the only activity for which economic data exist. The Nevada Department of Wildlife (NDOW) has conducted studies to estimate the economic value of hunting to counties in Nevada (Source: NDOW, 1989). The study for big game hunters was done in 1986. Accordingly, 1986 statistics are provided for big game hunters. The study for hunters of upland game and waterfowl was done in 1987. Accordingly, 1987 statistics are used for hunters of upland game and waterfowl. In 1986, total expenditures in Churchill County by 415 big game hunters, all of whom hunted mule deer, totaled $63,545. Total expenditures by big game hunters throughout the state were estimated at $13,678,655 in 1986. Thus, less than one percent of all big game hunting expenditures accrued to Churchill County.

Hunters of upland game and waterfowl contribute more to the Churchill County economy than do big game hunters. Upland game hunters in Churchill County spent $203,180 which was 6 percent of all upland game hunter expenditures in the State in 1987. Waterfowl hunters in the County spent $393,405, which was 22 percent of all waterfowl hunter expenditures in the State in 1987. The annual hunter flow contributes significantly to the local businesses cash flow in Churchill County. For instance, it has been reported that during waterfowl season one may have difficulty finding a vacant motel room in Fallon during the weekend (Source: NDOW, 1989). The effects of land withdrawals for NAS

Fallon and the FRTC on the economic value of hunting in Churchill County have not been determined.

3.3.6 ECONOMIC DEVELOPMENT

The 1987 OMNI-MEANS Impact Assessment of NAS Fallon Expansion indicated that the diversification of the local economy has been identified as a central concern of Churchill County residents and local leaders. In general, the presence of NAS Fallon was viewed favorably in 1987 in the sense that "NAS Fallon and its base contractors require a talented labor force that would serve to establish a pool of occupational specialties that would not otherwise be drawn to the area. As a result, complemen'ary industries should be targeted that would find working relationships with these kinds of occupations desirable" (Source: OMNI-MEANS, Ltd., 1987). If complementary industries can be attracted to the Fallon area, the Station will have an additional beneficial effect on economic development in Churchill County.

3.3.7 SUMMARY

The existence of NAS Fallon has had beneficial effects on residents of Churchill County. The positive contribution of NAS Fallon to employment in the county is substantial, but the overwhelming dependence of the economy on one military activity and agriculture indicates a lack of economic diversification. Given that alternative uses of the land are quite limited, however, diversification in the absence of NAS Fallon would be unlikely. If industries that are complementary to the needs of NAS Fallon could be attracted to the area, economic diversification and development could result.

Direct and indirect employment generated by the Station has had a positive effect on the development of existing services and infrastructure of Churchill County, especially in the City of Fallon. The current levels of service to residents undoubtedly would not exist in the absence of NAS Fallon.

The primary potentially adverse economic effect resulting from NAS Fallon is the effect on housing. The housing market is very tight due to housing developers' cautious approach in responding to increased demand that results from employment at the Station. This situation is common in any area that is highly dependent on one economic activity, especially a military activity that can increase and decrease in response to political, rather than market, decisions.

3.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

This section identifies effects on plants, fish, and wildlife from activities associated with NAS Fallon, the FRTC, and associated airspace. The plants, fish, and wildlife considered in this section are listed in Table 1-4.

3.4.1 NAS FALLON

NAS Fallon is located in the Carson Desert, a location that was originally a greasewood (*Sarcobatus vermiculatus*) plant community which is typical of the alkali bottom lands of the region. Urbanization and agricultural activities on and about the Station have eliminated a large proportion of the original vegetation. There are a number of "old field" areas where the vegetation is characteristic of abandoned fields (Source: DRI, 1984).

Effects on wildlife and their habitats on NAS Fallon result from direct disturbance of ecological communities by land development on the Station, the potential for release of contaminants, and aircraft collisions with birds.

Development and operations of the Newlands Reclamation Project, which commenced in 1903, provided irrigation water to the Lahontan Valley and created its agricultural economy. Subsequently, the level of Pyramid Lake declined. Pyramid Lake is inhabited by the endangered cui-ui and the threatened Lahontan cutthroat trout. Distribution of the irrigation water in the Newlands Reclamation is managed by TCID in accordance with the approved Operating Criteria and Procedures (OCAP). A "no jeopardy" opinion was issued by the U.S. Fish and Wildlife Service with regard to the distribution of irrigation water provided for in the current OCAP concerning the cui-ui and the Lahontan cutthroat trout. Marshes at Stillwater, Carson Lake and north of Fallon have also shrunken. The cause and effect relationship, if any, between these non-defense-related activities is beyond the scope of this report.

In the early 1950's, the Navy acquired by purchase 2,934 acres of water-righted lands within the Newlands Reclamation Project. When these lands were privately owned, they were irrigated pursuant to their allocated water rights, and they were used to produce annual/perennial cash crops, for grazing, and for livestock. NAS Fallon uses these lands in the green belt of cultivated fields surrounding the airfield to provide protection for aviators and aircraft against foreign object damage (FOD), dust and fire in the vicinity of the runways. Thus, the pre-existing agricultural use of these acquired lands has not changed. Presently, the Navy is not using its full allocation of approximately 10,269 acre-feet of water.

3.4.2 FRTC

The FRTC includes the EWS, Shoal Sites, TACTS, and four bombing ranges, B-16, B-17, B-19, and B-20. Lands encompassed within B-16, B-17, B-19, and the EWS contain salt desert scrub vegetation (Source: Western Division, Naval Facilities Engineering Command, 1983) characterized by shadscale (*Atriplex confertifolia*), sagebrush (*Artemisia spp.*), and greasewood. B-20 is located on the Carson Sink, a barren alkali flat. An ecological discussion of the Shoal Sites is not available. Although there are no wetland areas within any of the withdrawn land areas, there are several wetland areas in the general vicinity of the withdrawn lands including the Stillwater WMA, the Stillwater NWR, and Carson Lake.

There are no known threatened or endangered plant species on the lands within FRTC. Two Candidate Category 2 plant species (species for which existing information indicates that proposing to list as endangered or threatened is probably appropriate) are known to occur in the general vicinity of FRTC. They are Nevada oryctes (*Oryctes nevadensis*) and dune penstemon (*Penstemon arenarius*). Other species known to occur in the vicinity are classified as Candidate Category 3 plant species (species that are no longer receiving consideration for listing as endangered or threatened). Surveys for sensitive plant species were conducted in conjunction with range condition surveys on B-17 in June 1985, on B-20 in February 1986, and on the EWS in August 1985 (Sources: DOA, Soil and Range Inventory, Bravo 20, 1986; DOA, Soil and Range Inventory, Bravo 17, 1985; and DOA, Soil and Range Inventory, EWR, 1985). Surveys do not appear to have been conducted on B-16 or B-19 (Sources: DOA, Soil and Range Inventory, Bravo 16, 1984; DOA, Soil and Range Inventory, Bravo 19, 1984). Since the Nevada oryctes is an annual plant which is identified primarily by its flowers and the B-20 and EWS surveys were conducted when it would have been dormant, it is possible that the presence of Nevada oryctes within B-20 and EWS could have gone undetected.

Land disturbing activities on the high explosive target impact areas of the bombing ranges of the FRTC include bombing, strafing, rocket delivery, and target development and maintenance. Land disturbances in other areas of the bombing ranges include vehicular traffic related to target maintenance and target development in inert/training and NDBS target areas. Those activities have caused disturbance to the native vegetation. Recovery of native vegetation in desert environments is typically slow and usually results in a shift in compositional dominance to weedy, non-native species. Soil Conservation Service (SCS) Range Condition Classes (Excellent, Good, Fair, Poor) were used to describe the present state of the vegetation on the FRTC compared to the expected natural potential for each area. Based on the standard criteria used by SCS for rangeland inventories, the following conditions were reported for the ranges: Excellent and Good range conditions on B-16 in 1984, Good, Fair, and Poor range conditions on B-17 in 1985, Good range conditions on B-19 in 1984, Fair and Poor range conditions on B-20 in 1986, and Good and Fair range conditions on the EWS in 1985.

The slow rate of recovery in desert ecosystems subjected to land disturbance associated with military training and other forms of vehicular traffic is well documented (Sources: Lathrop, 1983b; Webb et al., 1983; Wilshire and Nakata, 1976). Those studies indicate desert ecosystems subjected to soil disturbance of the magnitude that areas of the California desert experienced as a result of military tank maneuvers which took place from 1938 to 1942 would take from 75 to 100 years to recover (Source: Webb et al., 1983). Land on the bombing ranges within the FRTC, other than the high explosive target impact areas and associated roads and structures, is subjected to disturbances of much less magnitude. Effects on the desert ecosystem resulting from military training activities conducted on the FRTC may increase if the level of ground activity increases by the year 2000 (Sources: Western Division, Naval Facilities Engineering Command, Draft EIS, 1982; U.S. Navy, NAS Fallon, 1986).

3.4.3 AIRSPACE

Aircraft overflights associated with the NAS Fallon mission have the potential to produce effects on wildlife populations, but the magnitude of that potential is unknown.

The lands located under the airspace of the FRTC contain an assemblage of wetland and upland wildlife habitat. Wildlife habitats present in the vicinity of the FRTC include habitat of 2 endangered species (the bald eagle and peregrine falcon), 22 raptor species, and 13 game or other mammal species. Species for which at least 5 percent of its Nevada range is located beneath the FRTC include red tailed hawk (7%), rough-legged hawk (7%), northern harrier (8%), turkey vulture (8%), golden eagle (6%), barn owl (9%), flammulated owl (8%), great horned owl (7%), northern goshawk (14%), sharp-shinned hawk (12%), Cooper's hawk (12%), merlin (17%), kestrel (12%), burrowing owl (13%), sawwhet owl (15%), mountain lion (10%), and wild horse (10%). Approximately 12 percent of raptor migration routes in Nevada are located under FRTC airspace. A desert bighorn sheep herd has been reestablished in the Stillwater Mountain Range in recent years, and other reestablishment efforts have occurred in the Clan Alpine and Desatoya Mountains.

Portions of the State's wetland habitat lie beneath FRTC airspace and are used at various times of the year by an estimated 75 percent of Nevada's duck population, 50 percent of the State's Canada Goose population, and 65 percent of the State's tundra swan population. These wetlands also provide habitat for the largest inland nesting colonies of white pelicans and white-faced ibis in North America.

The Lahontan Valley Wetlands were recently classified as one of eight "hemispheric preserves" within the Western Hemisphere Shorebird Reserve Network (Source: Myers et al., 1987). These wetlands support in excess of 250,000 shorebirds during spring and fall migrations, a criteria for acceptance into the network. The Network links individual habitat areas together in a coordinated effort by Federal, State, and foreign wildlife management agencies to protect and manage critical habitats along the world's flyways. A "critical habitat" is an area along the flyway used by resident or migratory birds at some time of the year. The Lahontan Valley Wetlands are important for both nesting and migratory shorebirds and support very large concentrations of American avocets, black-necked stilts, Wilson's phalaropes, long-billed curlews, long-billed dowitchers, and sandpipers at various times of the year. Approximately one-half of Stillwater NWR, one of the most valuable areas for habitat, is located under a portion of Gabbs North MOA. Carson Lake, another important area is not under designated airspace but is in close proximity to NAS Fallon.

Under a Memorandum of Agreement between the U.S. Navy and the State of Nevada, a study was conducted from 1986 through 1988 to observe and monitor wildlife reactions to supersonic and low-level aircraft overflights occurring in the FRTC airspace (Source: NDOW, 1989). The results of that study indicated that aircraft overflights had little observable effect on bighorn sheep and wintering mule deer. American avocet, Swainson's hawk, golden eagle, cinnamon teal, mallard, gadwell, great blue heron, double-breasted cormorant, western grebe, and eared grebes appeared to habituate to overflight activities while bald eagles, snow geese, green-wing teal, pintail, widgeon, and long-billed dowitchers were observed to be sensitive to low-level overflights. NAS Fallon has entered into an MOU with the Department of the Interior (DOI) and the State of Nevada which requires NAS Fallon-related aircraft to avoid overflight of the Stillwater WMA and Carson Lake below 3,000 AGL whenever tactically feasible.

Because of the procedures established at NAS Fallon, the probability of fuel release over wildlife areas is small. Potential release of fuel by aircraft over wetlands and other wildlife habitat could be a concern associated with aircraft operations. NAS Fallon has a designated area over a playa for operationally required and emergency in-flight fuel release. Fuel release is only authorized at altitudes above 6,000 feet AGL and is only authorized over that area.

3.4.4 PROPOSED AND ENVISIONED CHANGES

Whether proposed and envisioned changes in the use of the FRTC on ranges and airspace will affect wildlife and vegetation resources is unknown. It is noted, however, that the envisioned changes would have the effect in most instances of enlarging the areas in which activities occur (an increase of approximately 100 percent) without a corresponding increase in activities (an increase of approximately 10 percent) and, thus, reduce the frequency with which they would occur over any given area.

One of the modifications proposed to R-4813 would be to allow training in this restricted area after 11:30 PM. This area is located above the Lahontan Valley, a major migratory stopover along the Pacific Flyway. Nighttime overflights above 3000 feet AGL may disturb flight patterns of migratory birds in this area.

Lands located beneath the envisioned Smokey, Diamond, and Duckwater MOAs include portions of the Paradise-Shoshone, Toiyabe, Toquima, and Monitor Management Areas in the Toiyabe National Forest. Species range and the percentage of range which would lie partially under envisioned airspace include: red-tailed hawk (21%), ferruginous hawk (20%), flammulated owl (20%), northern goshawk (37%), Cooper's hawk (18%), sharp-shinned hawk (30%), rough-legged hawk (17%), golden eagle (10%), burrowing owl (8%), long-eared owl (15%), mule deer (15%), red fox (13%), mountain lion (16%), wild horse (12%), sage grouse (15%), chukar (15%), and blue grouse (14%). Bighorn sheep have been successfully reestablished in the Toiyabe Range, and elk have become successfully reestablished in the Monitor Range. The new ranges of both of these species would be located beneath the envisioned realignment.

3.4.5 SUMMARY

Activities on and in the vicinity of NAS Fallon have eliminated a large portion of the native vegetation. No studies have been conducted which document effects on plants, fish, and wildlife on and in the vicinity of NAS Fallon from activities associated with the Station. Activities on the bombing ranges of the FRTC have disturbed native vegetation. The greatest land disturbances have occurred in the high explosive target impact areas. Recovery from those land disturbances would be slow because the bombing ranges are located within the desert ecosystem. There are no other documented effects on fish and wildlife from activities on the ranges of the FRTC. Activities in the airspace over the FRTC have little observable effect on big game or some species of birds. Other species of birds appeared sensitive to low-level overflights, but flights over Stillwater WMA and Carson Lake are to remain above 3,000 feet AGL whenever tactically feasible. It is noted, however, that the envisioned changes would have the effect, in most instances, of enlarging the areas in which activities occur without a corresponding increase in the number of activities and, thus, reduce the frequency with which they would occur over any given area. The effects of defense-related activities for the year 2000 are not expected to be greater than for present-day activities.

3.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

This section describes the cultural and historical resources on NAS Fallon and the FRTC ranges and discusses whether they have been impacted. Archaeological and historical records were searched for this report, and a summary of previously conducted inventories, surveys, record searches, and overviews is provided in Table 3-9. Despite the archaeological and historic research in the region, knowledge of past human occupation of this area is limited. This fact was noted in the Nevada State Historic Plan and its associated Archaeological Element (Sources: Woodward-Clyde, Cultural Resources Overview, not dated; Hanes and Ball, 1982; Lyneis, 1982). Prehistoric occupation of the area may have been initiated as early as 13,000 years ago. By the time of contact with Euroamericans in the middle 1800's, the area was habitually utilized by the highly nomadic Northern Paiute hunters and gatherers. The history of Euroamerican presence in the area began in 1827.

The Navy is preparing a cultural resources overview and management plan for NAS Fallon and the FRTC including the proposed Master Land Withdrawal (Sources: Western Division, Naval Facilities Engineering Command, 1983; Woodward-Clyde, Cultural Resources Overview, not dated). It is Navy policy to perform cultural surveys in advance of its defense-related activities to identify existing cultural resources at the environmental stage of project planning. It is also Navy policy to take steps to avoid impacting such resources by avoidance even when they may not qualify for listing on the National Register of Historic Places. In 1989, cultural surveys were begun on the undisturbed portions of the Station (Source: Busby et al., 1989). Two additional overviews have been prepared by the BLM for areas around and partially encompassed by NAS Fallon facilities, and one has been prepared by the Navy (Sources: Bard et al., 1981; Pendleton et al., 1982; Hanes and Ball, 1982). These overviews indicate that less than 0.3 percent of the withdrawals has been surveyed.

3.5.1 NAS FALLON

Much of the land within NAS Fallon has been extensively disturbed by construction of NAS Fallon facilities and by agricultural activities. Six cultural resources were recorded on NAS Fallon prior to Busby's (1989) study. These sites are the original station (Van Voorhis Field), Redman's Toll Bridge (dating back to 1861), two prehistoric temporary campsites and two prehistoric specialized activity localities (one containing human burials). Two of the sites have been partially impacted; whether any of the other four sites may have been impacted is unknown. The two prehistoric specialized activity localities, 26Ch109 and 26Ch911, have been recommended as eligible for nomination to the National Register of Historic Places by the archaeologists recording the sites, and no recommendation has been

Table 3-9. Cultural Resources Studies, NAS Fallon and the FRTC Ranges, Existing, Proposed, and Envisioned.

Project Name	Acres Studied(1)	Type of Study(2)	Sites Recorded	Reference
NAS Fallon				
Johnson, 1982 NAS Fallon Overview	0	I	4	Woodward-Clyde, not dated
60 KV Powerline (Crew, 1984)	7.3	III	0	Woodward-Clyde, not dated
Optic Cable NAS Fallon boundary	0.6	III	0	Intermountain Research, 1987
Overview and Class III	3,939.0	III	43	Busby et al., 1989(3)
B-16				
Red Mountain Common Use Area	3.0	III	0	Buder and Bennett, 1976
Powerline Right-of-Way N-16376	10.0	III	2	Hatoff and Ruhstaller, 1977
Geothermal Test Holes	1.0	III	0	Hatoff, 1977b
Churchill Sanitary Landfill	80.0	III	1	Pope, 1983
Petty-Ray Seismic Lines	87.6	III	0	Drews, 1982
B-17				
IR-206 Landing Area	40	III	1	Self, 1989
Material Sites in Dixie Valley	10	III	1	Rusco, 1975a
Geothermal Exploration NV-030-31	15	III	0	Hatoff, 1977a
U.S. 50 Betterment, EA 71083	169.69	III	0	Bunch, 1982
Frenchman Well Guzzler No. 1	0.02	III	0	Bardwell, 1980d
Frenchman Station Water Tank	0.47	III	0	Mabe, 1981a
La Beau - Navy Fence	10	III	1	Hatoff and Mabe,1979
Oxbow R/W Realignment	101.82	III	0	Juell, 1987a
EW Range Improvements	30.30	III	3	Intermountain Research, 1987
EWR				
Material Sites in Dixie Valley	10	III	1	Rusco, 1975
EW Range Improvements	202.15	III	0	Intermountain Research, 1987
Oxbow Geothermal NV-030-31	0.50	III	0	Bennett, 1977
US 50 Betterment	794.00	III	0	Seldomridge, 1986
La Platta Fence (JDR 5124)	8.00	III	0	Abbett, 1977
Material Pits SR 121	460.00	III	0	Bunch, 1982a
Grimes Point to Sand Spring	77.60	III	0	Matranga, 1982
Frenchman Stock Water Trough	1.15	III	0	Mabe, 1981a
EW Communication Site	15.00	III	0	Pope, 1982
U.S. 50 Betterment Labou Flat	108.00	III	0	Matranga, 1980
Frenchmen Flat EW No Drop	61.80	III	0	Hatoff, 1983a
SW Frenchman Stock Water	1.00	III	0	Mabe, 1984

Table 3-9. Cultural Resources Studies, NAS Fallon and the FRTC Ranges, Existing, Proposed, and Envisioned (continued).

Project Name	Acres Studied(1)	Type of Study(2)	Sites Recorded	Reference
North Well IDR-6334	9.00	III	0	Hatoff, 1984
Bell Mountain Mine	243.30	III	0	Armentrout, 1981
Hunt Energy NOI N3-07-79	2.47	III	0	Hatoff, 1979c
SCS-BLM Soil Pits	20.26	III	0	Ratzlaff, 1980
H&H Motorcycle Race	11.00	III	1	Hatoff, 1978a
Lizard Study Plot Fence	1.00	III	1	Hatoff, 1978b
Oxbow Geothermal Staging Areas	34.30	III	1	Simmons, 1987
EW Communication Site	3.00	III	1	Hatoff, 1982b
U.S. Energy Powerline Corridor	2,147.00	III	0	Botti, 1985
Frenchman Pasture Fence	1.29	III	1	Hatoff, 1985a
Oxbow Alternate Route	871.00	III	4	Sutton, 1985
Chalk Mtn Pipeline Extension	7.20	III	0	Hatoff, 1987b
Right-of-Way N-45136	2.35	III	0	Pope, 1987
EW Threat Simulators	206.68	III	0	Drews, 1985
Oxbow Access Roads	20.00	III	0	Pierce, 1987
<u>Envisioned B-18</u>				
Red Top Canyon Guzzler	0.02	III	0	Bardwell, 1980b
Fairview Guzzler	0.02	III	0	Bardwell, 1981d
Arterial Canyon Guzzler	0.02	III	0	Bardwell, 1981b
Bell Canyon Water Storage	0.82	III	0	Mabe, 1983
Bell Canyon Guzzler No. 1	0.10	III	0	Jaquet, 1979
Bell Canyon Guzzler No. 3	0.02	III	0	Bardwell, 1980a
Bell Canyon Guzzler No. 4	0.02	III	0	Bardwell, 1980d
Bell Canyon Material Sale	10.00	III	0	Hatoff, 1980a
Bell Canyon Drift Fence	0.04	III	0	Mabe, 1981c
Red Top Canyon Drift Fence	0.19	III	0	Mabe, 1981c
MCON Project P-269	513.35	III	?	Juell, 1987c
EW Range Improvements	0.82	III	0	Intermountain Research, 1987
<u>B-19</u>				
NAS Fallon Powerline	10.00	III	1	Hatoff and Ruhstaller, 1977
Rollin A Well	1.00	III	0	Mabe, 1981d
South Bass Flat Stock Water	Unknown	III	0	Mabe, 1981f
<u>Envisioned Land Bridge</u>				
Occidental Drill Sites	12.00	III	0	Callaway, 1981
North La Beau Boundary Fence	20.00	III	0	Hatoff, 1982a
Breccia Canyon Guzzler	0.02	III	0	Bardwell, 1980f
Contact Canyon Guzzler	0.02	III	0	Bardwell, 1980g
Bills Canyon Guzzler	0.02	III	0	Bardwell, 1981b
Fourmile Canyon Guzzler	0.02	III	0	Bardwell, 1981c

Table 3-9. Cultural Resources Studies, NAS Fallon and the FRTC Ranges, Existing, Proposed, and Envisioned (continued).

Project Name	Acres Studied(1)	Type of Study(2)	Sites Recorded	Reference
South La Beau Boundary Fence	30.00	III	0	Hatoff, 1987a
Cocoon Mountain Guzzlers	0.07	III	0	Bardwell, 1981a
Slate Mountain Guzzler	0.02	III	0	Bardwell, 1981e
Bell Flat Corral (JDR 6163)	1.40	III	0	Mabe, 1981b
Rawhide Road Guzzler	0.02	III	0	Bardwell, 1981f
West Lucky Boy Guzzler	0.02	III	0	Bardwell, 1981g
S. Bass Flat Stock Water	6.90	III	0	Mabe, 1981f
Bell Mountain Mining Borrow Sale	7.00	III	0	Buder, 1981
SR 361 Betterment	760.96	III	0	Matranga, 1982
Wightman Well Corral (JDR 6272)	6.90	III	0	Mabe, 1983
Fairview Comm. Site & Powerline	31.04	III	0	Hatoff, 1983b
Dixie Valley Partnership Wells	13.77	III	0	Stornetta, 1984b
Material Pits SR 361	160.00	III	0	Matranga, 1984
Arterial Canyon Guzzler #1	0.02	III	0	Bardwell, 1980b
GZ Canyon Guzzler #1	0.02	III	0	Bardwell, 1980c
Bell Canyon Guzzler #1	0.02	III	0	Bardwell, 1980e
State Communications Board ROW	0.06	III	0	Pope, 1980
Slate Mountain Drift Fence	1.43	III	0	Mabe, 1980a
7C-2 Stock Trough (JDR 6139)	1.20	III	0	Mabe, 1980b
7C-1 Stock Trough and Storage	3.20	III	0	Mabe, 1980c
Material Pits SR 361, Bell Mountain	50.00	III	0	Seldomridge, 1987
76 Desert Bums Motorcycle Race	1,380.00	III	0	York, 1976
Navy Remote Comm. Sites	0.01	III	0	Pope, 1984
SR 23 ROW, Gabbs	131.00	III	0	Matranga, 1980
South Bell Flat Fence	25.30	III	0	Hatoff, 1981
South Bell Hwy Well JDR 6188	1.60	III	0	Mabe, 1981e
Petroglyphs Survey, WRIR	Unknown	III	0	Tipton, 1985
Rawhide Cemetery & Wightman Wells	10.50	III	0	Pope, 1979
56 SCS Soil Survey Pits	39.12	III	0	Linebaugh, 1981
SPPC'S Power Corridors	Unknown	III	?	Tuohy, 1974

(1) Acres in Table do not necessarily reflect acres studied on withdrawals.

(2) Type I studies consist only of overviews of existing information. Type II studies consist of reconnaissance of a sample of a study area. Type III studies consist of surveys covering the entire study area.

(3) Not included in analysis.

made for the other sites. The majority of the original construction pre-dated Federal requirements for conducting cultural surveys in advance of land-disturbing activities, and it is not possible to evaluate whether the cultural resources were impacted by this construction.

3.5.2 EXISTING, PROPOSED, AND ENVISIONED FRTC

B-16 incorporates approximately 17,280 acres of the Lahontan Valley northeast of the Dead Camel Mountains (Source: U.S. Navy, NAS Fallon, Uses of Public Land/ Airspace, 1988). Approximately 31,304 additional acres which will provide safety and noise buffer zones around B-16 are proposed for withdrawal in the proposed Master Land Withdrawal. B-16 is used for air-to-ground bombing using inert/training ordnance. Approximately 182 acres (0.4 percent) of the proposed land withdrawal have been surveyed for cultural resources. There are no surveys on B-16. There are five recorded sites in the buffer zones adjacent to B-16 included within the proposed Master Land Withdrawal. These sites are a large prehistoric lithic scatter, an isolated artifact, Salt Cave (containing pictographs and stratified calcium deposits), the Jarvis Ranch (an historic site containing two prehistoric human burials), and a stratified prehistoric campsite. The prehistoric campsite has been recommended as eligible for nomination to the National Register of Historic Places by the archaeologists recording the sites; the isolated artifact was recommended as not eligible; and no recommendations have been made for the other sites.

B-17 is the focus of CVW training. Approximately 21,400 acres are withdrawn for B-17. Approximately 31,905 additional acres which will provide safety and noise buffer zones around B-17 are proposed for withdrawal in the proposed Master Land Withdrawal. B-17 is used for strafing, air-to-ground bombing using explosive ordnance up to 1,000 pounds and inert/training ordnance, and NDBS. Approximately 377 acres (0.6 percent) of the existing and proposed withdrawal have been surveyed for cultural resources, but only 102 acres were surveyed in advance of military activities. There are 15 recorded sites on B-17. These cultural resources are nine historic and six prehistoric sites. The historic age cultural resources include the townsites and cemetery of Fairview, Frenchman (Bermond) Station, the Snyder Mine, the NV Crown Mine, the Mizpah Mine, the Donneyville Road, and an historic corral and water tank. The Pony Express Trail, as well as Simpson's 1859 exploration route, not included in the total, also crossed B-17. Two sites, a historic corral and water tank at 26Ch199 and a prehistoric activity locality at 26Ch1005 have been recommended as eligible for nomination to the National Register of Historic Places by the archaeologists recording the sites; the six prehistoric sites have been recommended as not eligible; and recommendations have not been made for the remaining eight sites.

B-19 encompasses approximately 17,331 acres of withdrawn land just west of the Blow Sand Mountains. Approximately 18,038 additional acres which will provide safety and noise buffer zones around B-19 are proposed for withdrawal in the proposed Master Land Withdrawal. B-19 is used for strafing and air-to-ground bombing using explosive ordnance up to 1,000 pounds and inert/training ordnance. The historic routes of Joseph Walker (1833), Edward Kern (1838), and John Bidwell and Captain John Bartelson (1841) all traversed B-19 in the area of Stinking Springs (Source: Woodward-Clyde, Cultural Resources Overview, not dated). It is also near this area (Hathaway Beach Site) that archaeologists have found cultural remains belonging to the Western Pluvial Lakes

Tradition, dating some 9,000 years ago or more (Source: Woodward-Clyde, Cultural Resources Overview, not dated) which may be indicative of similar resources on B-19. Approximately 11 acres (0.03 percent) have been surveyed for cultural resources. There are six recorded sites on B-19. These sites are two isolated bifaces, two prehistoric temporary camps, a prehistoric activity locality, and the Cinnabar Hill Mine (discovered in 1937). One of the prehistoric campsites (26Ch110), the prehistoric locality at 26Ch943, and the Cinnabar Hill Mine have been recommended by the archaeologists recording the sites as eligible for nomination to the National Register; one site has been recommended as not eligible; one site, an isolated basalt biface, was collected by archaeologists when it was recorded; and a recommendation has not been made for the remaining site.

B-20 encompasses approximately 41,007 acres of withdrawn and acquired land in the Carson Sink. No additional withdrawal of land for B-20 is contemplated. B-20 is used for strafing and air-to-ground bombing using explosive ordnance up to 2,000 pounds and inert/training ordnance. Approximately 200 acres (0.5 percent) have been surveyed for cultural resources. There is one recorded site, an isolated dart point, on B-20. Lone Rock, also located on B-20, is mentioned in Northern Paiute mythology as representing Wolf's head (Source: Loud and Harrington, 1929:161-162). Because Wolf is an important mythological character in Native American religions, this feature, called mosi'i in Northern Paiute, may be of religious importance to the Northern Paiute.

No lands are currently withdrawn for EW Sites. Rights-of-way for 33 EW emitter sites and the centroid encompass approximately 467 acres. Approximately 92,673 acres which will comprise the EWR are proposed for withdrawal in the proposed Master Land Withdrawal. Ordnance is not used on the EW Sites, nor will it be used on the EWR. The proposed EWR is projected to receive more improvements than any of the other ranges. The developments outlined in Sections 3.1.2.1 and 3.1.5.1 for the EWR have disturbed or would disturb less than two percent of the approximately 92,673 acres proposed for withdrawal. The Overland Mail Road, established in 1862, directly cross-cuts the proposed EWR (Source: Woodward-Clyde, Cultural Resources Overview, not dated). The Clan Alpine, Louderback, and Stillwater Mountain Ranges surrounding the proposed EWR were also the scene of much middle and late 19th century mining, and several historic sites pertaining to that period occur on the proposed withdrawal. Approximately 5,319 acres (5.7 percent) of the proposed withdrawal have been surveyed for cultural resources, but only 488 acres were surveyed in advance of military activities. There are 16 recorded sites on the proposed EWR, 6 of which are historic mining sites. These are Fairview Station (1862-1876), the Townsite of Kingston (1906), the Eleven Mile Canyon Mill, the Red Top Mine (1906-1907), the Tent Camp of Victor (1907-1908), and the Vulture Mine (1907-1908). Recorded prehistoric sites are five isolated artifacts, two specialized activity localities, and one lithic scatter. Only one site, a prehistoric lithic scatter at 26Ch1181, has been recommended by the archaeologists recording the sites as eligible for nomination to the National Register of Historic Places; six sites have been recommended as not eligible; and recommendations have not been made for the remaining nine sites. One site, an isolated bifacially flaked tool at 26Ch606, was collected by archaeologists at the time it was recorded.

One cultural resource survey has been conducted on the DOE Shoal Sites and covered 0.3 acres (less than 0.01 percent of the withdrawal). No sites were recorded during this survey; however, one recorded archaeological site was located during the records search. Whether this site is eligible to be recommended for the National Register of Historic Places is undetermined, and whether it may have been impacted is unknown.

An envisioned land bridge would link B-17 and B-19 and would encompass approximately 122,600 acres of public land. It is not a part of the proposed Master Land Withdrawal. The envisioned land bridge would lie beneath the area that would be used to air launch stand-off weapons between B-17 and B-19 and would enable expanded strike rescue operations to be conducted. There would be no target areas within the land bridge. Approximately 2,694 acres (2.2 percent) of the envisioned land bridge have been surveyed for cultural resources. Seven acres of which were examined prior to construction of EW sites located on rights-of-way (Source: Hatoff, 1983b; Pope, 1984). There are 21 recorded sites. Three of these resources are historic mines: the Cinnabar Hill Mine, worked between 1937 and 1940, the Kaiser (Baxter) Mine, where flourspar was mined between 1928 and 1957, and the Yankee Girl Camp, discovered in 1907 and part of the Rawhide mining boom. Known prehistoric sites are three prehistoric temporary camps, seven lithic scatters, one pictograph locality, five prehistoric toolstone quarries, and two isolated artifacts. Four sites, two prehistoric campsites (26Ch74 and 26Ch309), a lithic scatter (26Ch942), and a quarry (26Ch1237), have been recommended by the archaeologists recording the sites as eligible for nomination to the National Register of Historic Places; nine sites have been recommended as not eligible; and recommendations have not been made for the remaining eight sites.

Also envisioned is a target range tentatively designated B-18 that would be located south and southeast of B-17 and would encompass approximately 79,000 acres. It is not a part of the proposed Master Land Withdrawal. The envisioned B-18 would be used for strafing, air-to-ground bombing using explosive ordnance of up to 1,000 pounds and inert/training ordnance, and other activities. Approximately 525 acres (0.7 percent) of that envisioned range has been surveyed for cultural resources. There are three recorded sites within the envisioned B-18. Two of these sites, a lithic scatter and a toolstone quarry, are prehistoric in age. The third is the Bell Mountain mine which operated during the early 1900's. Two of these sites, the prehistoric lithic scatter (IRS 600-1) and quarry (IRS 600-2) have been recommended by the archaeologists recording the sites as eligible for nomination to the National Register of Historic Places. No recommendation has been made for the Bell Mountain Mine.

Table 3-10 indicates the nature of impacted, recorded cultural resource sites on existing, proposed, and envisioned land withdrawals within the FRTC by their recommended eligibility for nomination to the National Register of Historic Places. Of 45 recorded sites, on existing and proposed withdrawals, it is known that 3 sites are undisturbed, that 7 sites have been partially impacted, and 1 site has been extensively impacted or completely destroyed. Whether the remaining 34 sites have been impacted is unknown. Seven of the 45 sites have been recommended by the archaeologists recording the sites as eligible for nomination to the National Register of Historic Places. Of those seven sites, two have been partially impacted. Whether five of those sites have been impacted is unknown. However, 96 percent of all known cultural resources have not been evaluated for their eligibility for nomination to the National Register of Historic Places.

Table 3-10. Extent of Impacts on Recorded Archaeological Sites: Existing, Proposed, and Envisioned FRTC[1].

	Recommended National Register Eligibility							
Extent of Impact	Eligible	%	Not Eligible	%	Undeter-mined	%	Total	%
Undisturbed	1	7.6	3	12.5	1	3.1	5	7.3
Partial	6	46.2	11	45.8	0	0.0	17	24.6
Extensive	0	0.0	1	4.2	0	0.0	1	1.4
Unknown	6	46.2	9	37.5	29	96.7	44	66.7
TOTAL	13	100.0	24	100.0	30	100.0	67	100.0
(%)		19.4		35.8		44.8	100.0	

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.
(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

Of the 21 recorded sites within the envisioned land bridge, two are undisturbed; eight have been partially impacted; and one has been extensively impacted or completely destroyed. Whether the other 10 sites have been impacted is unknown. Four of the 21 sites have been recommended by the archaeologists recording the sites as eligible for nomination to the National Register of Historic Places. One of these sites recommended as eligible is undisturbed, and two of these sites have been partially impacted. Whether the fourth site recommended as eligible has been impacted is unknown, and whether the remaining 17 sites are eligible for nomination to the National Register of Historic Places is undetermined. Nine of the recorded sites on the envisioned land bridge have been recommended as not eligible for the National Register. Eligibility recommendations have not been made for the remaining eight sites. Of the sites for which eligibility recommendations have not been made, one has been partially impacted, but it is unknown whether the remaining seven sites have been impacted.

Of the three sites recorded on envisioned B-18, two have been partially impacted. Whether the third site is impacted is unknown. The two partially impacted sites have been considered potentially eligible for nomination to the National Register of Historic Places. No eligibility recommendations have been made for the third site.

3.5.3 AIRSPACE

Airspace use in the FRTC has a minimal potential to impact cultural resources. Long-term exposure to vibrations induced through overflight activities and sonic booms have the potential to affect standing historic structures and increase the rate of their natural degradation (Source: Ellis, 1987; Konon and Schuring, 1985; Hershey, Kevala, and Burns, 1975). Other types of historic cultural resources older than 50 years , such as wooden and dry-laid masonry structures, petroglyphs and pictographs, and rockshelters, also may be impacted by overflight activities (Sources: Brumbaugh, not dated; King/Algermissen and McDermott, 1985; Witten, not dated). However, few studies have been made of the impacts of induced vibrations on cultural resources. Most have focused on the short-term catastrophic impacts of overflights rather than the potential contribution to long-term cumulative impacts to degradation. Also contributing to the long-term cumulative impacts of degradation are such things as natural weathering and seismic activity.

3.5.4 SUMMARY

The National Historic Preservation Act was passed in 1966 after most of the existing land on the Station and FRTC had been withdrawn. Adequate data are not available to quantify how much land disturbance had occurred prior to or has occurred after the passage of this Act or to indicate the extent to which cultural resources occur on the existing, proposed, or envisioned withdrawals. As a result, adequate data are not available to accurately assess the extent to which cultural resources may have been impacted by non-defense-related activities such as natural weathering, vandalism, previous historic activity, or seismic activity or the extent to which they may have been or continue to be impacted by NAS Fallon activities. The Navy has taken steps to protect cultural resources by developing a Draft Cultural Resources Management Plan. Two cultural resources overviews have been prepared for areas covered by NAS Fallon, existing ranges, and the land proposed for withdrawal in the proposed Master Land Withdrawal (Source: Woodward-Clyde, Cultural Resources Overview, not dated). These overviews and the Master Plan for NAS Fallon (Source: Western Division, Naval Facilities Engineering Command, 1983) outline procedures to be followed in considering the effects of NAS Fallon activities on cultural resources. The Navy also has contracted for a Class III survey for cultural resources on 3,934 acres acquired adjacent to NAS Fallon (Source: Busby, et al., 1989). The Draft Cultural Resources Management Plan for NAS Fallon proposes that areas severely disturbed at previous bombing targets and centers of playas that are more than 100 meters from the edge be exempt from archeological inventory. No formal data recovery programs designed to mitigate potential impacts have been conducted.

Much of the acreage comprising NAS Fallon and the FRTC ranges has been subjected to some sort of land disturbance, either from construction or aerial weapons training (Source: Woodward-Clyde, Cultural Resources Overview, not dated). Ninety-seven percent of the lands within the Station have been disturbed by construction and agricultural activities. Land disturbance on the FRTC ranges has been less extensive, but few surveys have been conducted in the heavily used areas. As a result, the full extent of the land disturbance in those areas has not been documented. Likewise, 12 cultural resources surveys have been conducted directly in advance of military or defense-related activities. However, existing studies in areas on and around NAS Fallon and its ranges indicate that cultural resources potentially eligible for listing in the National Register of Historic Places exist on these lands.

Consultation with Native American communities is essential to understanding the impacts of governmental activities upon Native American historic, cultural and religious values. Consultation between the Navy and the Native American leaders in the vicinity of NAS Fallon and FRTC has and continues to occur with respect to military activities. Impacts to cultural values and religious freedom of Native American peoples with traditional ties to NAS Fallon and FRTC lands have not been addressed in this section because consultations have not been completed. Without consultation with Native American spiritual leaders the impact of the NAS Fallon-related withdrawals and associated airspace on their cultural values and religious practices cannot be determined.

3.6 EFFECTS ON RECREATIONAL RESOURCES

3.6.1 LAND WITHDRAWALS

Recreation potential on NAS Fallon and the FRTC is limited. Of the Navy-owned lands, NAS Fallon is situated in an agricultural valley, and lands on Bravo 20 consist primarily of salt flats and have limited recreation potential. Of the 77,587 acres of withdrawn public lands, portions of B-19 are habitat for chukar (Source: Western Division, Naval Facilities Engineering Command, 1983). The Blow Sand Mountains in the B-19 withdrawal may have had potential for off-road recreation vehicle use prior to B-19's use as a bombing range.

Proposed and envisioned withdrawals may also potentially affect recreation access to some areas. Sheckler Reservoir on the proposed B-16 buffer zone is presently used for hunting, fishing, and other water-based recreation. Current proposals would maintain public access. Organized recreation use of areas within the proposed B-16 buffer zone may become restricted with this withdrawal. All of these areas will be subject to closure for national defense purposes. Proposed buffer zones for B-19 may involve an area used for hunting access in the Desert Mountains, although this area is projected to remain generally open. Light recreation use of lands north and east of B-19 has been eliminated due to the presence of off-range ordnance discussed in section 3.2.11.

The Electronic Warfare Range proposal may restrict access, on a periodic basis, to lightly used dispersed recreation opportunities in the La Plata and South Stillwater Ranges.

The envisioned land bridge between B-17 and B-19 and proposals to withdraw the Shoal sites may result in periodic closure of lands used for recreation purposes. Potentially affected areas would include the Sand Springs Range which is used for upland game hunting. Portions of this area may also have rock climbing or hiking potential. Access to Fairview Peak and Lee Hot Springs may also be affected by periodic closures. The envisioned B-18 withdrawal would include areas of Fairview Valley and Bell Flat which are used for low-intensity dispersed recreation. If that withdrawal is affected, these areas would be closed to recreation use.

3.6.2 AIRSPACE

The area beneath the FRTC airspace includes a portion of the Stillwater NWR and the Stillwater WMA which is the largest wetland habitat area in the State. The Stillwater marshes are used extensively by recreationists for waterfowl hunting, fishing, and wildlife observation. The surrounding uplands and mountains are managed by the NDOW for deer, elk, and upland game hunting. Other uses of the Stillwater wetlands include picnicking, camping, off-road vehicle (ORV) use, and horseback riding.

An MOU among the Navy, DOI, and the State of Nevada concerning use of the SUA associated with NAS Fallon provides for compliance with the Navy's General Flight and Operating Instructions as well as a mutual understanding of the nature of aircraft operations over wildlife, recreation, and wilderness resources. Procedures incorporated in the MOU include a minimum altitude of 2,000 feet AGL for supersonic events over the Clan Alpine and Desatoya WSAs and a minimum altitude of 3,000 feet AGL, whenever tactically feasible, over Stillwater WMA and Carson Lake.

NDOW conducted a recreation survey in 1986 and 1987 to determine recreationists' opinions about defense-related overflights of recreation areas in the vicinity of NAS Fallon (Source: NDOW, 1989). Those surveyed included hunters, fishermen, trappers, horseback riders, ORV users, and bird watchers. Based on the opinions of 722 individuals surveyed, some recreational experiences are being affected by air operations associated with NAS Fallon. Seventy-five upland game hunters (54 percent), 63 deer hunters (37 percent), and 87 waterfowl hunters (30 percent) were annoyed to some degree by aircraft disturbance. Sixty people (51 percent) engaged in non-hunting, recreational activities were annoyed to some degree by aircraft disturbance. In total, 39 percent of the recreationists surveyed were annoyed to some degree by aircraft disturbance. In response to the question of whether they were annoyed to the degree that it would affect their decision to recreate in the area, approximately 20 percent of the recreationists surveyed responded that the annoyance they experienced would affect their decisions to return to the area for recreational pursuits. It should be noted that this survey was directed primarily towards hunters and did not include a census of wilderness users.

Overflights by aircraft using the Austin 1 and 2, Gabbs North, Central, South, and Carson MOAs occur over portions or all of a number of established recreation areas (Table 3-11). These areas include Berlin-Ichthyosaur State Park, portions of 4 National Forest Management Areas (including 2 National Forest campgrounds), approximately 50 percent of Stillwater National Wildlife Refuge, small portions (less than 5 percent) of 3 BLM Extensive Recreation Management Areas, larger portions (50-90 percent) of 3 other Extensive Recreation Management Areas, 1 BLM Special Recreation Management Area, and 1 other BLM recreation site. Additionally, Sheckler Reservoir is beneath Restricted Area R4803N. Various types of recreation activities may be conducted in these areas. Use of Nevada's recreation sites is described in more detail in Section 8.7. Airspace vertical lower elevationlimits for subsonic flight are 100 to 500 feet AGL. Several of these areas are likely to be subject to supersonic overflight at altitudes above 11,000 feet MSL and sonic booms (Table 3-11).

Types of recreation occurring under these areas and discussion of the effects of overflight on recreation activities are discussed in Section 8.7. Overflights also occur over a number of wilderness areas which are used for recreation. These areas are described in Section 3.8.2. Existing use of airspace by NAS Fallon potentially affects the recreation experiences of recreationists visiting wilderness resources by the noise resulting from overflight of seven BLM WSAs, totaling approximately 600,000 acres or 12 percent of all state WSAs. The statewide effects of airspace activities on wilderness is discussed in Section 8.8.

Table 3-11 also lists recreation areas located partially or totally beneath the envisioned Diamond, Duckwater, and Smokey MOAs. These areas include Belmont Courthouse State Park, portions of four National Forest Management Areas (including 5 National Forest Campgrounds), small portions (less than 5 percent) of 1 BLM Extensive Recreation Management Area, and larger portions (40-45 percent) of 3 other Extensive Recreation Management Areas. Existing USFS wilderness and BLM WSAs are also located under portions of the envisioned MOAs. These areas are described in Section 3.7.2. Approximately 287,000 acres (36 percent) of USFS wilderness and 305,000 acres (6 percent) of BLM WSAs are located beneath the envisioned additions to and realignments of FRTC airspace. The Roberts Mountain WSA is located beneath an area envisioned for supersonic operations above 11,000 feet MSL which would result in occurrences of sonic booms over this WSA. This could result in overflight of less than 1,000 feet at the higher elevations. Airspace lower vertical elevation limits would be 10,000 MSL for the envisioned Diamond and Duckwater MOAs, and 200 feet AGL for the envisioned Smokey MOA. Lower airspace floors will tend to make overflights a more readily obvious occurrence in recreation areas located beneath them. Recreation experiences in wilderness areas beneath this envisioned airspace could be adversely affected by noise. The effects of overflight on recreationists is discussed in greater detail in Section 8.7.

The effects of defense-related activities for the year 2000 are expected to be experienced in a greater number of wilderness resources than is the case with present-day activities. Envisioned changes would have an effect, in most instances, of enlarging the area in which activities occur (an increase of approximately 100 percent) without a corresponding increase in the overall number of activities occurring (an increase of approximately 10 percent) thus reducing the frequency with which they would occur over any given area. Low-level, high-speed overflight is likely to affect a portion of recreationists beneath the envisioned Smokey MOA which would have a floor of 200 feet AGL. Areas of higher elevation beneath the envisioned Diamond and Duckwater MOAs could experience similar effects.

A portion of the Paradise-Shoshone, Toiyabe, Toquima, and Monitor Management Areas which comprise a large portion of the Toiyabe National Forest would be located beneath a portion of the envisioned Smokey MOA. A smaller portion of the Monitor

Table 3-11. Major Recreation Resources Located Beneath Fallon Defense-Related Airspace.

Recreation Resource	Area[1] (acres x 1000)	1990[1] Visitor Use (# people x 1000)	Airspace[2,3] Existing	Airspace[2,3] Envisioned	Total Area Beneath Existing or Envisioned Airspace (acres x 1000)
State Parks					
Belmont Courthouse	.001	3.3		Smokey	
Berlin-Ichthyosaur	1.1	14.2	Gabbs S		
TOTAL	1.1	17.5			1.1
National Forest Management Areas (MAs) and Campgrounds					
Humboldt National Forest					
White Pine MA	344.6	NA		Duckwater (80)	275.7
- Currant Creek				Duckwater	
- White River				Duckwater	
Toiyabe National Forest					
Paradise-Shoshone MA	267.8	NA	Gabbs N (<5)*3 Gabbs S (30) Gabbs C (20) Austin 1 (<5)*		160.7
Toiyabe MA	541.0	NA	Austin 2 (35) Austin 1 (15)	Smokey (50)	541.0
- Big Creek			Austin 1		
- Bob Scott			Austin 1		
- Kingston				Smokey	
- Peavine Creek				Smokey	
Toquima MA	435.4	NA	Austin 2 (20)	Duckwater (80)	435.4
- Pine Creek				Duckwater	
Monitor MA	728.5	NA	Austin 2 (<5)	Diamond (<5) Smokey (60) Duckwater (20)	655.7
TOTAL	2317.3	255.1[4]			2068.5
National Wildlife Refuge					
Stillwater NWR	146.2	7.3	Gabbs N (50)		73.1

Table 3-11. Major Recreation Resources Located Beneath Fallon Defense-Related Airspace (continued).

Recreation Resource	Area[1] (acres x 1000)	1990[1] Visitor Use (# people x 1000)	Airspace[2,3] Existing	Airspace[2,3] Envisioned	Total Area Beneath Existing or Envisioned Airspace (acres x 1000)
BLM Extensive Recreation Mgmt Areas (ERMAs) and Special Recreation Mgmt Areas (SRMAs)					
Egan ERMA	3842.2	36.8		Diamond (10)	1536.9
				Duckwater (30)	
- Loneliest Highway SRMA	18.8	12.3		Diamond[5]	
				Duckwater[5]	
Lahontan ERMA	2790.0	415.7	Gabbs C (10)		1534.5
			Gabbs N (40)		
			Ranch (5)		
- Churchill Co. SRMA	10.0	44.0	Gabbs N[6]		
Shoshone-Eureka ERMA	4300.0	16.9	Austin 1 (30)(20)*		4300.0
			Austin 2 (10)		
			Gabbs C (<5)		
			Gabbs N (<5)		
			Gabbs S (<5)		
			Smokey (15)		
			Diamond (20)*		
			Duckwater (10)		
- Hickison Petro. Site			Austin 2		
Sonoma-Gerlach ERMA	4414.0	114.8	Carson MOA (<5)		2.2
Tonopah ERMA	6126.0	7.8	Gabbs S (<5)		2450.4
				Smokey (25)	
				Duckwater (10)	
Walker ERMA	1920.0	155.3	Gabbs C (<5)		192.0
				Smokey (<5)	
TOTAL	23392.2	762.1			10016.0

percent) of USFS Nevada wilderness and 305,000 acres (6 percent) of BLM Nevada WSAs would lie beneath the envisioned additions to, and realignments of, airspace associated with the NAS Fallon mission. The magnitude of any effect on the recreational experiences of recreationists visiting wilderness resources from noise resulting from aircraft overflight is a matter of individual perception. The effects of defense-related activities for the year 2000 are expected to be realized in a greater number of wilderness areas than for present-day activities. The envisioned changes would have the effect, in most instances, of enlarging the areas in which activities would occur without a corresponding increase in the number of activities and, thus, reducing the frequency with which they would occur over any given area. While the frequency of military overflights over any given point would be reduced, a larger area would be involved.

3.6.3 SUMMARY

NAS Fallon and the FRTC land withdrawals have a limited effect on recreation, but their existence can and does restrict recreational use. Proposed and envisioned land withdrawals would result in periodic closures of land used for recreational purposes and the imposition of other restrictions that do not currently exist. A number of areas used for recreational purposes are located beneath portions of existing and envisioned FRTC SUA. Recreation experiences in areas located beneath this airspace may be affected by noise. The effects of defense-related activities for the year 2000 may be expected to be greater than for present day activities.

3.7 EFFECTS ON WILDERNESS RESOURCES

This section examines the effects of NAS Fallon activities on the lands comprising wilderness resources. The potential effects of these activities on recreational use of wilderness resources are discussed in Section 3.6.2.

3.7.1 EXISTING, PROPOSED, AND ENVISIONED LAND WITHDRAWALS

The withdrawn lands within NAS Fallon were withdrawn years prior to passage of FLPMA. Wilderness evaluation has not been conducted and is not required for those lands withdrawn prior to the effective date of that Act. The closest BLM WSAs to the Station are Job Peak and the Stillwater Range which are located approximately 20 and 30 miles east of Fallon, respectively. The closest USFS wilderness area to the Station is the Mt. Rose Wilderness Area located 70 miles west of NAS Fallon. The Station is surrounded by agricultural lands which eliminates the possibility that activities on the Station have any effect on wilderness resources. None of the currently withdrawn or adjacent owned parcels have been evaluated for wilderness potential. Active bombing, facility development, and land use activities prior to their withdrawal or acquisition have likely eliminated any wilderness qualities present.

Lands located within the proposed and envisioned land withdrawals were analyzed for wilderness qualities by the Bureau of Land Management during its 1979 wilderness inventory. If approved by Congress, the proposed Master Land Withdrawal for FRTC would

Table 3-11. Major Recreation Resources Located Beneath Fallon Defense-Related Airspace (continued).

Recreation Resource	Area[1] (acres x 1000)	1990[1] Visitor Use (# people x 1000)	Airspace[2,3] Existing	Airspace[2,3] Envisioned	Total Area Beneath Existing or Envisioned Airspace (acres x 1000)
<u>Other</u>					
Sheckler Reservoir	NA	0.7[7]		R4803	
GRAND TOTAL	25856.8	762.3[8]			12159.8

1 Data not available for all areas.

2 Figures in parentheses represent percentage of recreation area located beneath airspace; assume 100 percent if not indicated otherwise.

3 * indicates percentage of recreation area located beneath airspace used for supersonic operations.

4 Total represents combined visitor use of the Austin and Tonopah Range Districts, which includes Paradise-Shoshone, Toiyabe, Toquima, and Monitor MAs. Visitor use for White Pine MA is not available and thus, not included. Figure is for visitor days, not total number of visitors.

5 The Loneliest Highway SRMA consists of four sites: Cold Creek Reservoir is located beneath the envisioned Diamond MOA; Illipah Reservoir is located beneath the Duckwater MOA; approximately 10 percent of the Pony Express Trail is located beneath the Diamond MOA; and the fourth site, Garnet Hill, is not located beneath existing or envisioned defense-related airspace.

6 Churchill County SRMA consists of three sites: Cold Springs is located beneath Gabbs N; Grimes Point and Sand Mountain are not located beneath existing or envisioned airspace.

7 Represents ten year average for angler use.

8 Figure excludes visitor use for White Pine MA, Churchill County SRMA, Sonoma-Gerlach and Walker ERMAs. Number of visitors exposed to overflights is less than visitor use estimate because: 1) the entire recreation resource may not be located beneath the airspace; and 2) not all visitors will be exposed to overflights.

Management Area would be located under a portion of the envisioned Duckwater MOA. The Belmont Courthouse State Park is located under a portion of the envisioned Smokey MOA. These management areas provide opportunities for recreation activities such as hiking, camping, vehicle touring, hunting, fishing, snow recreation, and wildlife observation. Whether recreationists using those areas would be annoyed by aircraft activities in these envisioned MOAs is unknown. Existing U.S. Forest Service (USFS) wilderness and BLM WSAs, which are used for recreation, are also located under portions of the envisioned MOAs. These areas are described in Section 3.7.2. Approximately 287,000 acres (36 result in the withdrawal of approximately 188,323 additional acres of BLM-managed lands. Lands proposed for withdrawal would include about 25 percent of the Job Peak WSA. The Navy plans no surface disturbing activities that would degrade wilderness characteristics in this area. The proposed and envisioned withdrawals, other than that portion encompassing 25 percent of the Job Peak WSA, were not identified as having sufficient wilderness characteristics to warrant WSA designation. Nevertheless, wilderness characteristics may still exist in those areas and would be degraded by land-disturbing activities.

3.7.2 EXISTING, PROPOSED, OR ENVISIONED AIRSPACE

Table 3-12 and Figure 3.13 show six BLM WSAs and a portion of a seventh BLM WSA that are located beneath portions of the FRTC airspace. The Clan Alpine WSA and a portion of the Stillwater Range and Job Peak WSA are located in proximity to the proposed Electronic Warfare Range. Four entire WSAs and portions of two others are located beneath supersonic use areas. In total, approximately 12 percent of the BLM WSA acreage in Nevada lies beneath the existing FRTC airspace. While aircraft using the FRTC facilities overfly WSAs, those overflights have not prevented certain of those areas from being recommended for designation as wilderness areas. There are four TACTS sites located within Wilderness Study Areas. Stipulation 14 in the right-of-way reservations for those sites states:

> "Any TACTS site located in an area designated as wilderness by Congress will be reevaluated by the Bureau of Land Management in order to determine if removal is necessary to the proper management of that area as wilderness. If it is determined that the management of the area would be impaired by the continued use of the site, the site must be removed."

The envisioned realignment of FRTC airspace includes the realignment of several restricted areas, extension of the area in which supersonic flight is authorized, and designation of the Diamond, Duckwater, and Smokey MOAs/ATCAAs. Wilderness resources that would be located beneath the envisioned realignment of airspace are indicated in Table 3-13. Figure 3.14 shows the location of wilderness resources that would be located beneath the envisioned realignment. In total, approximately 6 percent of the BLM WSA acreage in Nevada and 36 percent of the USFS wilderness resources in Nevada would lie beneath the envisioned realignment of FRTC airspace.

Opportunities for solitude are an integral part of the wilderness resource. An absence of man-made noise contributes to solitude. Low-level military overflights can intrude on solitude, but those intrusions do not destroy the wilderness aspect of the area. Over the majority of the wilderness resources, those intrusions are momentary. There are, however, three WSAs which lie beneath the Gabbs North and Austin 1 MOAs which are subject to periodic concentrations of overflight, much of which can be low-level, as a result of their proximity to EW sites and TACTS instrumentation. They are the Augusta, Clan Alpine, and Desatoya WSAs.

Table 3-12. BLM Wilderness Study Areas Located Beneath Airspace Used for the NAS Fallon Mission.

Wilderness Resource (Resource Area/District)	Total Area (Acres)	Percent Under Airspace	Estimated Area Under Airspace (acres)	Percent Beneath Supersonic Use Areas[1]	Airspace
Clan Alpine Mountains (Lahontan)	196,128	100	196,128	100	Gabbs North
Stillwater Range (Lahontan)	94,607	100	94,607	100	Gabbs North
Augusta Mountain (Winnemucca)	89,372	100	89,372	100	Gabbs North (50%) Austin 1 (50%)
Destoya Mountains (Lahontan)	51,262	100	51,262	100	Gabbs North
Job Peak (Lahontan)	90,209	100	90,209	55	Gabbs North
Gabbs Valley Range (Walker)	79,600	45	35,820	0	Gabbs Central (40%) Gabbs South (5%)
Simpson Park (Shoshone-Eureka)	49,670	100	49,670	50	Austin 1 (80%) Austin 2 (20%)
TOTAL	650,848	93%	607,063	70%	

(1) The sound levels and overpressures resulting from supersonic flight do not normally affect the whole land area underlying airspace authorized for such activities although sonic booms may occur anywhere within the area.

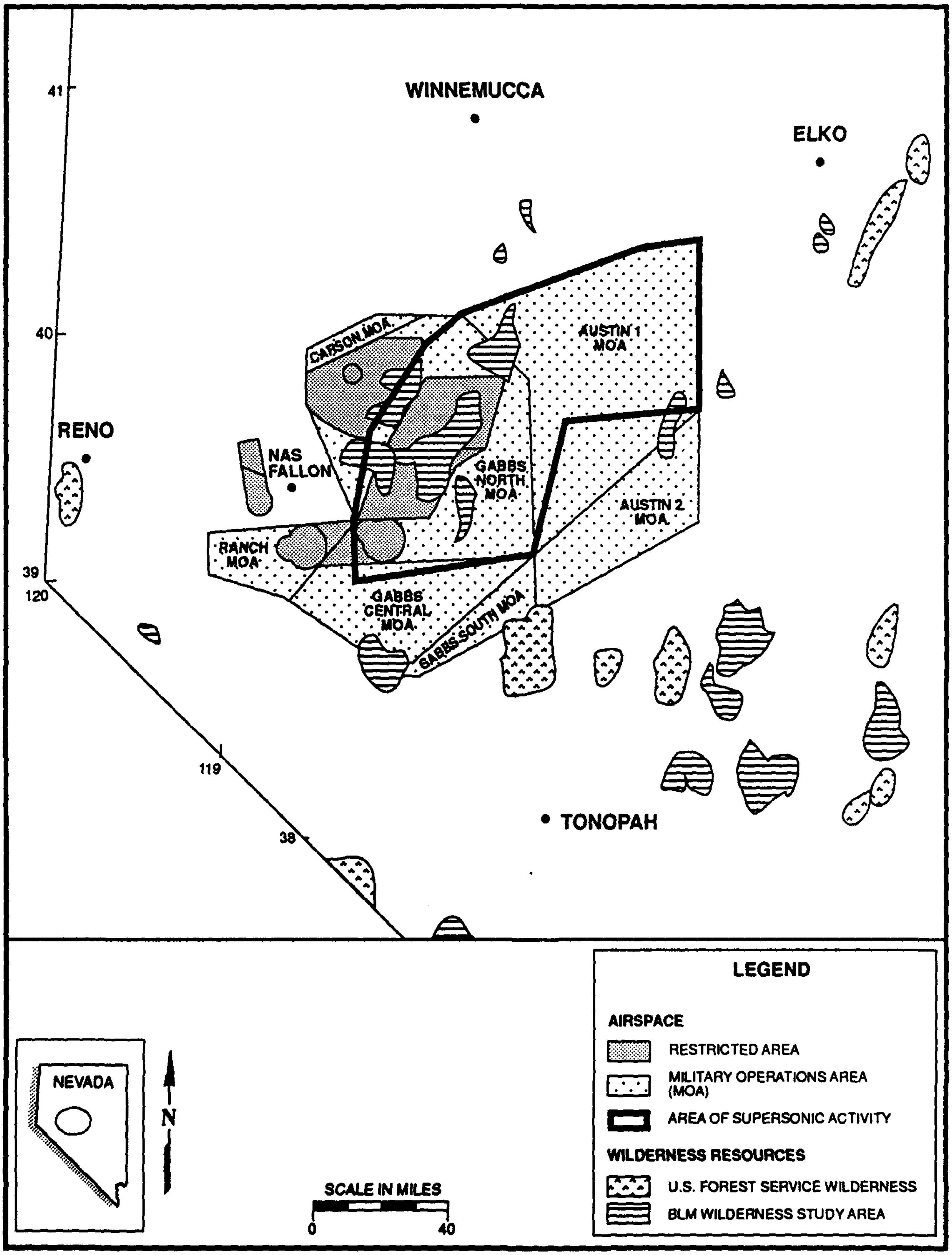


FIGURE 3.13 WILDERNESS RESOURCES IN RELATION TO AIRSPACE FOR NAS FALLON MISSION

Table 3-13. Wilderness Resources Located Beneath the Envisioned NAS Fallon Defense-Related Airspace and Within the Proposed Land Withdrawal.

Wilderness Resource	Total Area (Acres)	Percent Under DOD-Related Airspace	Estimated Area (acres)	Land Withdrawal or Airspace
BLM				
Job Peak WSA (Lahontan)	90,209	40[1]	36,084	EWR Proposed Withdrawal
Antelope Range WSA (Shoshone-Eureka)	87,400	100	87,400	Duckwater MOA
Park Range WSA (Egan)	47,268	100	47,268	Duckwater MOA
Fandango WSA (Tonopah)	40,940	100	40,940	Duckwater MOA
Morey Peak WSA (Tonopah)	20,120	100	20,120	Duckwater MOA
Roberts Mountain WSA (Shoshone-Eureka)	15,090	100	15,090[2]	Diamond MOA
Blue Eagle WSA (Tonopah)	59,560	50	24,780	Duckwater MOA
Riordin's Well WSA (Egan)	56,800	50	28,400	Duckwater MOA
USFS				
Currant Mountain (USFS-Humboldt)	36,000	100	36,000	Duckwater MOA
Arc Dome (USFS-Toiyabe)	115,000	100	115,000	Smokey MOA
Alta Toquima (USFS-Toiyabe)	38,000	100	38,000	Smokey MOA
Table Mountain (USFS-Toiyabe)	98,000	100	98,000	Smokey MOA
TOTAL	704,387	83	587,082	

(1) Percent within the proposed Master Land Withdrawal.
(2) Portion beneath airspace envisioned for supersonic use.

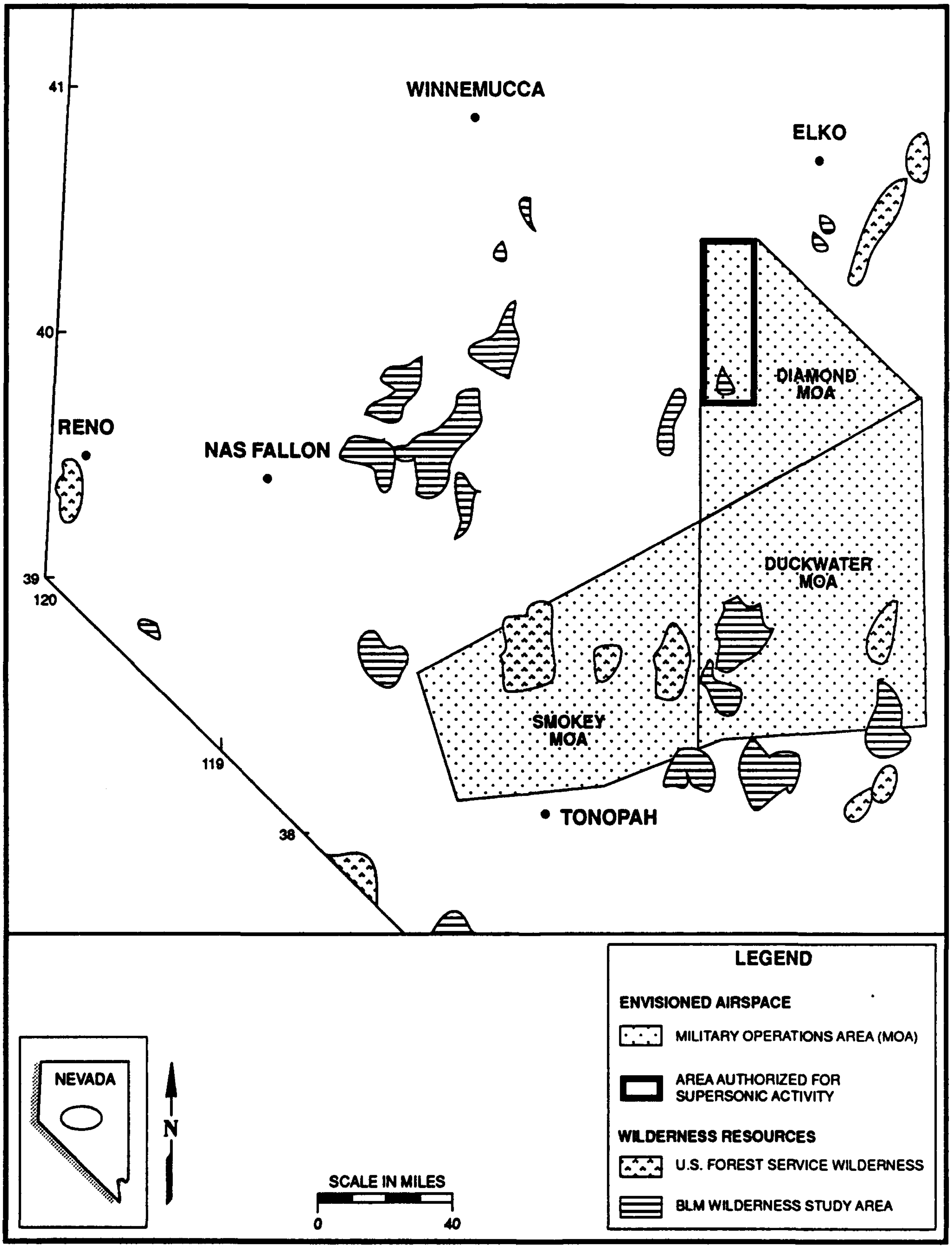


FIGURE 3.14 WILDERNESS RESOURCES IN RELATION TO ENVISIONED AIRSPACE FOR NAS FALLON MISSION

3.7.3 SUMMARY

Proposed withdrawals include about 36,000 acres of the Job Peak WSA. The Navy plans no surface disturbing activities on this acreage which would degrade its wilderness characteristics. On the remaining 460,000 acres of existing, proposed, and envisioned withdrawals, wilderness characteristics have not been determined sufficient to warrant designation of any areas as wilderness areas or identification of WSAs. Wilderness characteristics that do exist within those areas would be degraded by land-disturbing activities.

Existing, proposed, and envisioned FRTC SUA would be located above 871,000 acres of lands designated as BLM WSAs, and 287,000 acres of National Forest Wilderness Areas. This includes five WSAs and a portion of two other WSAs (520,900 acres) located beneath areas in which supersonic flight is authorized (Tables 3-12 and 3-13). Opportunities for solitude are an important aspect of the wilderness resource areas. An absence of man-made noise contributes to solitude. Low-level military overflights can intrude on solitude, but those intrusions do not destroy the wilderness aspect of an area. Over the majority of the wilderness resources, those intrusions are momentary. Accordingly, low-level military overflights do not preclude the designation of wilderness areas by Congress. The wilderness resources most affected by overflights are BLM's Clan Alpine, Augusta, and Desatoya WSAs. The statewide effects of overflights on wilderness areas are further discussed in Section 8.8.

3.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

Figure 3.15 shows the geologic terrains and locations of mining districts, NAS Fallon, and the existing FRTC. Figure 3.16 shows geologic terrains and locations of mining districts and proposed land withdrawals in the proposed Master Land Withdrawal. Figure 3.17 shows geologic terrains and locations of mining districts and envisioned land withdrawals.

3.8.1 NAS FALLON

All of NAS Fallon is covered by thick deposits of alluvium interlayered with recent basalt flows. The metallic mineral potential of this area is assessed to be very low. There are no mining districts within or adjacent to NAS Fallon.

Studies of the geothermal resource potential of NAS Fallon have been made under the direction of the Geothermal Program Office, Naval Weapons Center, China Lake, California (Sources: Katzenstein and Danti, 1982; Katzenstein and Bjornstad, 1987). Katzenstein and Bjornstad (1987) concluded that there is a moderate-to-high temperature geothermal resource at an exploitable depth at the southeastern corner of NAS Fallon. They further concluded that this resource could be used to make NAS Fallon energy self-sufficient. An EIS is being prepared for the eventual development of this resource.

For more than 50 years, ranchers in the Fallon area have produced natural gas from shallow (less than 150 feet deep) wells drilled into the Wyemaha Formation of Quaternary

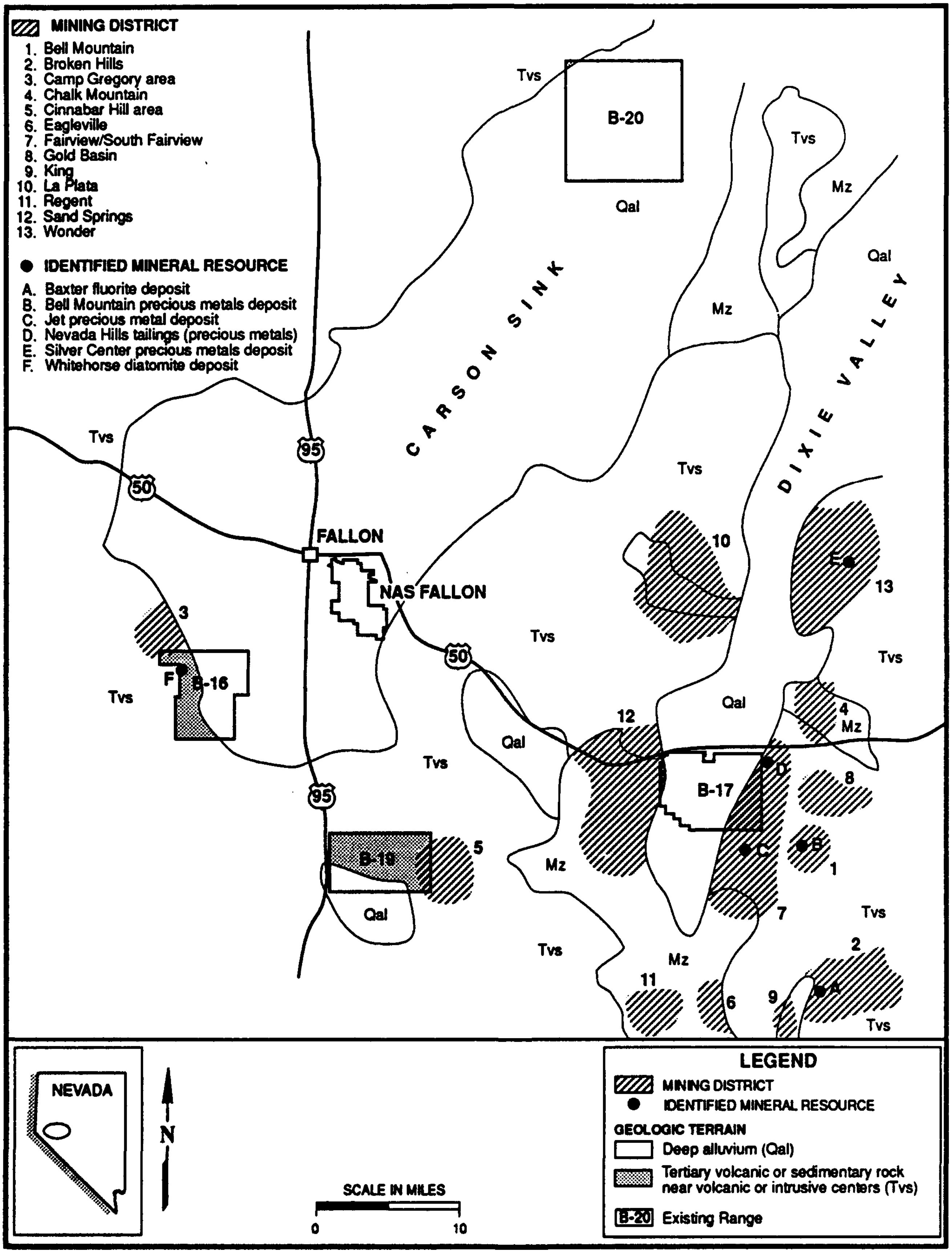


FIGURE 3.15 GEOLOGIC TERRAINS AND MINING DISTRICTS, NAS FALLON TARGET RANGES

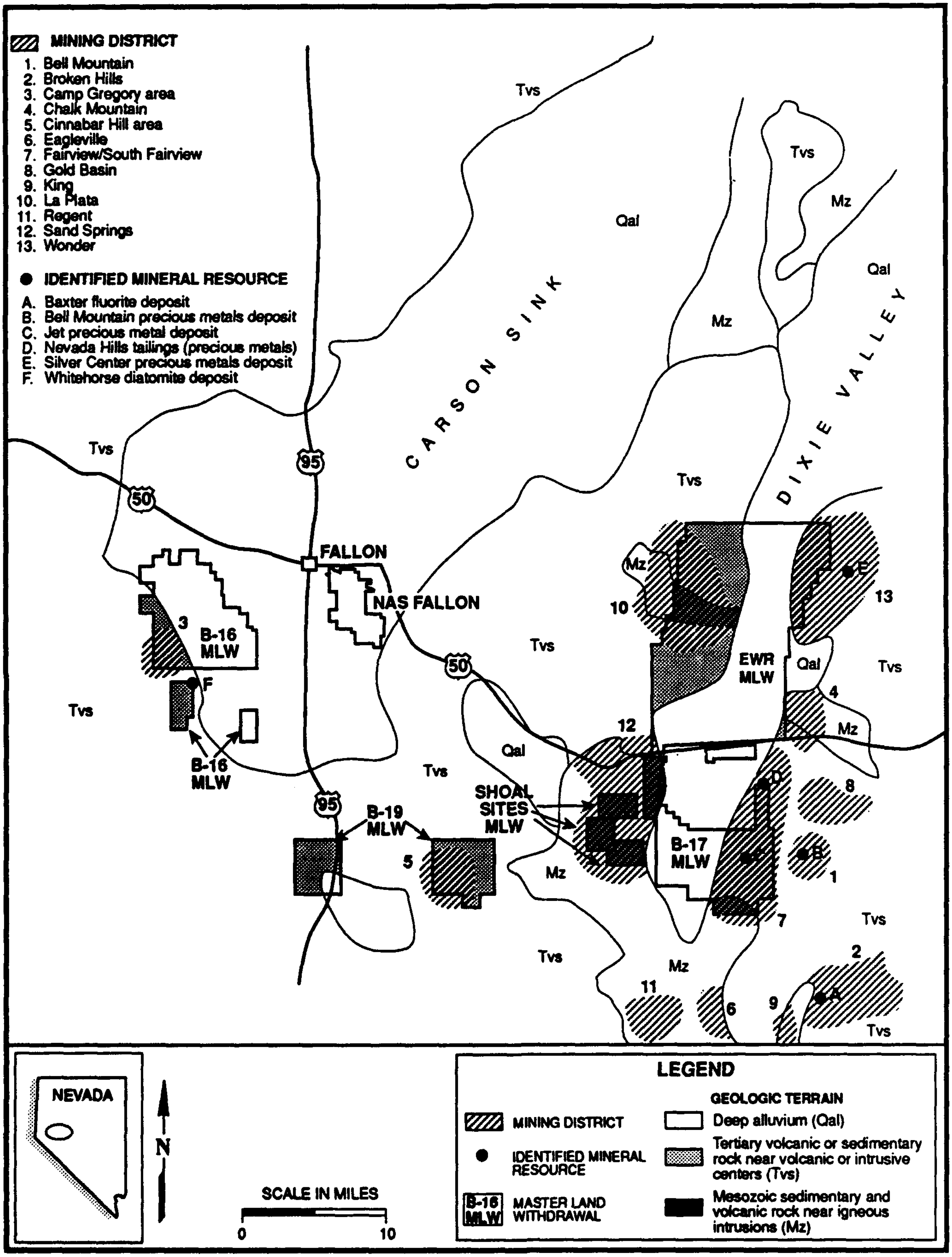


FIGURE 3.16 GEOLOGIC TERRAINS AND MINING DISTRICTS, MASTER LAND WITHDRAWAL, NAS FALLON

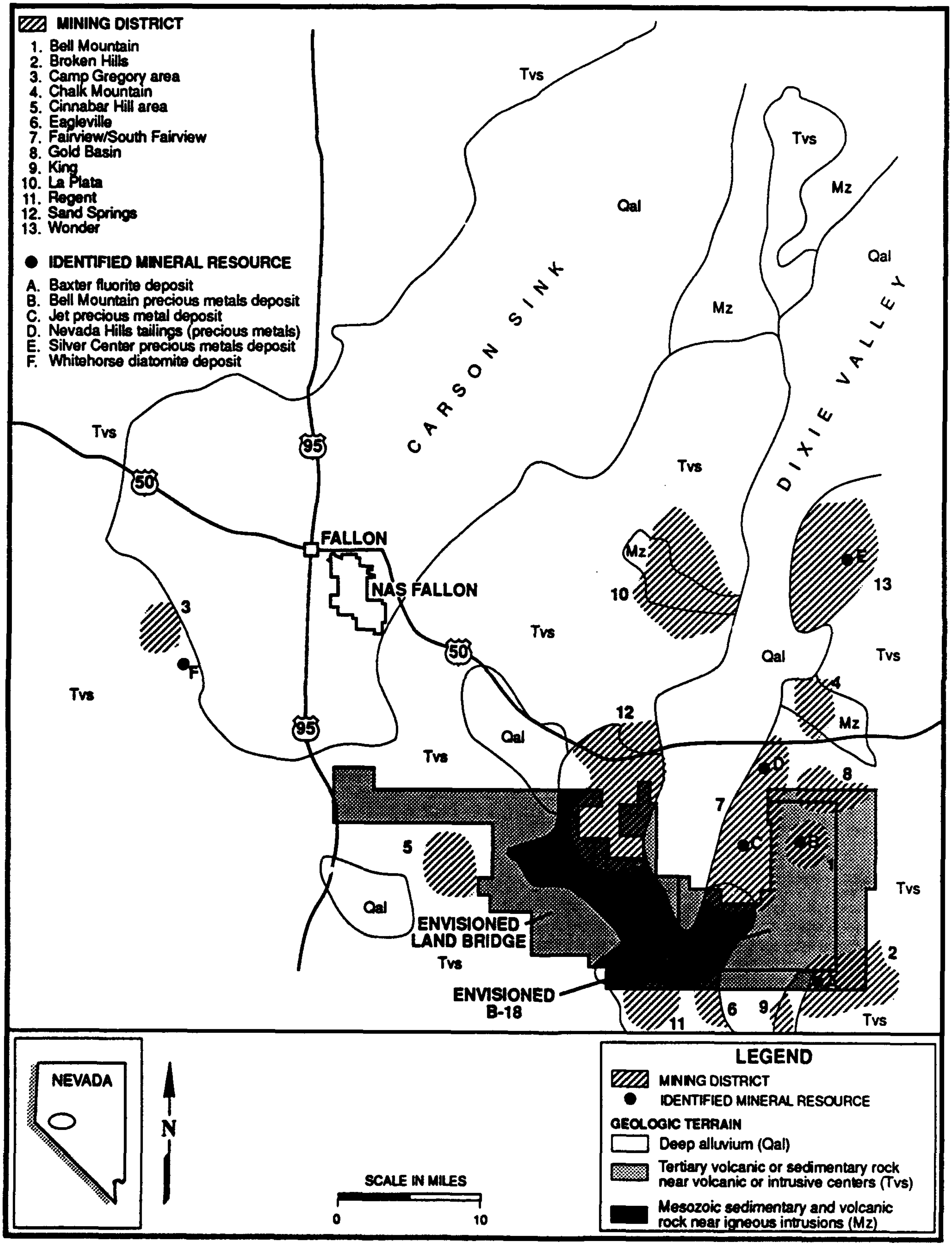


FIGURE 3.17 GEOLOGIC TERRAINS AND MINING DISTRICTS, ENVISIONED LAND WITHDRAWAL, NAS FALLON

age (Source: McDaniel, 1985). In 1974, an 11,000-foot test well was drilled near the east side of what is now B-20 (Source: Hastings, 1979). Results of the 1974 test, which are considered broadly applicable to the entire Carson Desert basin, indicated that organic-rich source rocks exist in the Carson Desert basin, but their shallow depth of burial and the lack of sufficiently high subsurface temperatures suggest that only small amounts of oil have been generated within the basin. The Carson Desert basin, including the withdrawn lands within the basin, is not favorable for oil and gas. The shallow methane gas produced in the basin is believed to be generated by decomposing vegetation buried in recent lake deposits, and commercial deposits of gas are not likely to be present (Source: Horton, 1964). The withdrawal of NAS Fallon has had no effect on the petroleum industry in Nevada.

NAS Fallon is located on the southern margin of the Carson Sink area of the Carson Desert, a deep basin that could have potential for mineral-bearing brine. Drilling in deeper parts of the basin several miles to the north failed to indicate the presence of saline minerals (Source: Papke, 1976). The potential of this area for the development of mineral-bearing brine is assessed to be very low.

3.8.2 EXISTING FRTC RANGES

3.8.2.1 Base and Precious Metals

Regional mineral potential

B-16, B-17, B-19, and B-20 are underlain by three basic geologic terrains: 1) areas of deep alluvial cover, 2) areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers, and 3) areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions. After four decades of ordnance delivery, mineral and/or geothermal exploration on some portions of existing withdrawals could pose an extreme safety hazard due to the possible presence of surface and subsurface live, undetonated ordnance.

Areas of deep alluvial cover: Bedrock is estimated to be beyond the reach of current mining interest beneath the eastern margin of B-16, beneath all but the extreme western margin and southeast corner of B-17, beneath the south-central edge and the southwestern corner of B-19, and beneath all of B-20. The mineral development potential of the alluvium-covered portions of these ranges is assessed to be very low.

Areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: These rocks in similar structural settings elsewhere in Nevada have hosted Comstock-type silver-gold deposits, hot spring gold-silver deposits, quartz-alunite gold-silver deposits, hot spring mercury deposits, and volcanogenic uranium deposits. Small portions of B-16 and B-17 and most of B-19 are underlain by rocks of these types. Of this total area, only the western part of B-19 is far enough from the influence of adjacent mining areas to be given a general classification. This area, lying between an active hot spring system and a known hot spring gold-mercury occurrence, is assessed as having low to moderate potential for the development of similar deposits.

Areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions: These rocks in similar structural settings elsewhere in Nevada have hosted skarn tungsten deposits, copper skarn deposits, polymetallic replacement deposits, carbonate-hosted gold deposits, and simple antimony deposits. Only a few acres of land along the western boundary of B-17 are occupied by this terrain, and since this area is directly east of and within the influence of the adjacent Sand Springs mining district, the area is covered in the following district assessment section.

Potential of mining districts

Mining districts within areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: Portions of three mining districts fall within this permissive terrain and extend into the FRTC. The western portion of B-16 is within the Camp Gregory mining area; the southwestern part of the Fairview silver-gold district is within the boundaries of B-17; and the eastern part of B-19 is within the Cinnabar Hill area of the northern Terrill mining district. The adjacent parts of these districts, outside of the boundaries of the FRTC, were investigated in detail under a contract from the U.S. Navy (Source: Quade and Tingley, 1987). The results of this study were extrapolated to assess the portions of the mining areas included within the target ranges.

- B-16: There is low potential for the development of hot springs-type precious-metals deposits in the northwestern portion of this range. Most of the mineral indications point to the northeast from the Camp Gregory outcrop area, but mineral zones could exist to the east of the old camp within B-16.

- B-17: There is moderate to high potential for the development of one or more small-sized to medium-sized silver-gold deposits in the northeastern part of this range. Two areas of high potential in the adjacent Fairview district, the Nevada Hills mine area and the Mizpah-Jelinek mine area, extend into B-17, and a larger area of moderate potential envelopes the two areas of higher potential.

- B-19: Mineralization at the Cinnabar Hill mercury mine occurs along silicified shear zones in rhyolitic volcanic rocks. These shear zones strike northwest and project into B-19. Several areas of mineralization are exposed in these silicified, breociated rocks where they are exposed between Cinnabar Hill and the eastern boundary of B-19. To the northwest along this trend, north of the northern boundary of B-19, mineralization similar to that exposed at Cinnabar Hill can be seen in exposures east of Allen Hot Springs. The geologic setting and type of mineralization present at Cinnabar Hill and Allen Hot Springs is similar to that found at the Paradise Peak gold mine to the southwest in northwestern Nye County. The area extending from Cinnabar Hill across the northeast portion of B-19 to Allen Hot Springs has high potential for the discovery of hot springs-type precious-metals deposits and may present the best mineral development potential of all the FRTC.

Mining districts in areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions: Only one mining district that involves any of the ranges (Sand Springs in the northern Sand Springs Range) is occupied by these rock types. The western boundary of B-17 lies immediately east of mineralized outcrops in the Sand Springs district; the areas of best potential lie west of the range boundary; but favorable structures could project into the range. This area, lying east of the Summit King mine, is assessed as having moderate potential for the discovery of precious-metals deposits. This same general area has low potential for the discovery of skarn tungsten deposits. The developed tungsten deposits in the Sand Springs Range south of the Summit King area are very small and have had only limited production; undiscovered deposits that may be beneath the western edge of B-17 could be expected to be similar.

3.8.2.2 Energy Resources

Geothermal resources

Studies of the geothermal resource potential of B-16, B-17, B-19, and B-20 have been made under the direction of the Geothermal Program Office, Naval Weapons Center, China Lake, California (Sources: Katzenstein and Danti, 1982; Katzenstein and Bjornstad, 1987; Whelan et al., 1980; and Bruce, 1980).

B-16: Thermal gradients in the northern half of the range are higher than normal and it is possible that geothermal fluids are migrating into the area from Lee Hot Springs to the southeast (Source: Katzenstein and Danti, 1982). Based on these studies, B-16 is considered to have marginal geothermal potential, but it is also considered an area warranting further investigation (Source: Katzenstein and Bjornstad, 1987).

B-17: Thermal gradients in the area are low; no thermal wells or springs occur in the area; and no hydrothermal alteration or mineralization of the type generally associated with hot springs was noted in the area. Based on these findings, the geothermal potential of B-17 is considered to be low (Source: Whelan et al., 1980).

B-19: B-19 is considered to have better than average geothermal potential; thermal gradients in the range are above average for the Basin and Range; and it is possible that geothermal fluids associated with adjacent Lee Hot Springs extend into the area in the subsurface (Source: Katzenstein and Danti, 1982).

B-20: Bruce (1980) noted that an 11,000-foot oil test hole was drilled at the northeast corner of the range and encountered a water temperature of less than 300°F. The remote location of B-20 would preclude practical or profitable geothermal development by the Navy, and no additional geothermal studies have been carried out in the area.

Oil and gas resources

The oil and gas potential of the FRTC is considered to be very low (Section 3.8.1). The withdrawal of B-16, B-17, B-19, and B-20 has had no effect on the petroleum industry in Nevada.

3.8.2.3 Industrial Minerals and Materials

Many of the alluvium-covered areas along the lower flanks of the mountain ranges within B-16, B-17, and B-20 contain potential sand and gravel resources. These materials, however, do not have any unique value over similar materials that occur in other areas throughout western Nevada, and their potential cannot be rated. For economic reasons, sand and gravel operations in Nevada are, and will continue to be, developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within these three ranges, do not present a sufficiently unique resource to merit classification.

An identified resource of diatomite on the White Horse claims (Source: Vanderburg, 1940) lies just to the west of the western border of B-16. The host for the diatomite (the Truckee Formation) extends into B-16, and there is low-to-moderate potential for similar deposits of diatomite in the southwestern portion of B-16.

B-20 is located on the northern margin of the Carson Sink, a deep basin which could have potential for mineral-bearing brine. Drilling in deeper parts of the basin several miles to the south of B-20 failed to indicate the presence of saline minerals (Source: Papke, 1976). The potential of B-20 for the development of mineral-bearing brine is assessed to be very low.

3.8.3 PROPOSED MASTER LAND WITHDRAWAL

A mineral resource inventory of the proposed Master Land Withdrawal area was completed in 1986 (Source: Quade and Tingley, 1987). Most of the Navy's proposed and envisioned land withdrawals will be available for entry under the mining and mineral leasing laws, although the Navy will likely impose some restrictions on exploration and development (Source: L. Jones, Natural Resources/Real Estate Director, Public Works Department, NAS Fallon, personal communication, 1989). Those parts that might remain open to mineral access have not yet been identified. Mining exploration and operations in the Cinnabar Hill, Nevada Hills, and Fairview areas could pose an extreme safety hazard due to the possibility of surface and subsurface live, undetonated ordnance. Although the Master Land Withdrawal is only proposed, Congress has closed the proposed withdrawal area to the filing of mining claims under the 1872 Mining Law until Congress acts on the proposed withdrawal. Except for existing claims, the area is closed to mining.

3.8.3.1 Base and Precious Metals

Regional Mineral Potential

Proposed Master Land Withdrawal lands have three geologic terrains: areas of deep alluvial cover, areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers, and areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions.

Areas of deep alluvial cover: Bedrock is estimated to be beyond the reach of current and future (year 2000) mining interests beneath more than half of the proposed withdrawal.

The mineral development potential of the deep alluvium-covered lands is assessed to be very low.

Areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: These rocks, in similar structural settings elsewhere in the region, have hosted Comstock-type silver-gold deposits, hot spring gold-silver deposits, quartz-alunite gold-silver deposits, hot spring mercury deposits, and volcanogenic uranium deposits. Outside of defined mining districts, these rocks are assessed as having low mineral development potential.

Areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions: These rocks, in similar structural settings elsewhere in the Reno two-degree quadrangle, have hosted skarn tungsten deposits, copper skarn deposits, polymetallic replacement deposits, carbonate-hosted gold deposits, and simple antimony deposits. Outside of established mining districts, these rocks occur only in one small area east of Chalk Mountain; this area is assessed as having low mineral development potential.

Potential of Mining Districts

Portions of seven mining districts and mining areas are included within the boundaries of the proposed Master Land Withdrawal. Districts that are most affected by the proposed withdrawal are the Fairview and Wonder districts on the east side of Fairview Valley/Dixie Valley. In Fairview Valley, the major mining area is outside of the proposed withdrawal boundary, but mineralized ground could extend into the area. Most of the South Fairview district (a subunit of the Fairview district) and all of the western Wonder district (the Victor area) are also included within the proposed Master Land Withdrawal. Only a small portion of the Chalk Mountain district is affected, and on the west side of Fairview Valley/Dixie Valley, extensions of both the La Plata and Sand Springs districts fall within the withdrawal boundary. To the west, two other mining areas fall within withdrawal areas: the Cinnabar Hill portion of the Holy Cross district in the Barnett Hills and the Camp Gregory area on the northeast flank of the Dead Camel Mountains. These two areas have not been important mineral producing areas in the past, but both areas are sites of recent mineral exploration. Several of these areas have moderate-to-high potential for the discovery of mineral deposits. These areas are generally adjacent to known mines and mineralized ground in the mining districts bordering the proposed withdrawal. Areas of moderate precious-metals potential occur in parts of the Fairview, La Plata, and Holy Cross districts, and in the Camp Gregory area, areas of high precious-metals potential occur in the Fairview, Wonder, Sand Springs, and Holy Cross districts.

Areas in the Chalk Mountain, La Plata, and Sand Springs districts contain moderate potential for other elements including base metals, tungsten, and molybdenum.

Identified Mineral Resources

Identified mineral resources are contained in two areas within the boundaries of the proposed Master Land Withdrawal; a third identified mineral resource lies just outside the area; but its development could be affected by the presence of the withdrawal in that those parts of the proposed Master Land Withdrawal that will remain open to mineral exploration and development are not yet known.

Identified mineral resources within the area include a possible 1.8 million tons of open-pit gold ore at the Jet deposit, Fairview district, and an unknown tonnage of open-pit silver ore on the Silver Center deposit, Wonder district. Just north of the proposed withdrawal boundary in the northern Fairview district, the tailings of the Nevada Hills mine also constitute an identified mineral resource.

At the Jet deposit, a limited number of samples collected by Spectrum Exploration within a large silicified zone west of the old Nevada Fairview (Gold Coin) property enabled Jonson (1986b) to calculate a possible ore tonnage for the area. No valid determination of ore grade in the identified tonnage can be made because of the limited sampling.

The Silver Center deposit, located northwest of Wonder just outside the eastern boundary of the proposed withdrawal area, operated for a short time in 1984-1985. The deposit was contributing about 300 tons per day to a 750-tons per day leach operation; the remainder of the tonnage came from tailings from the old Wonder mine. No information is available on how much ore was mined from Silver Center or what tonnage of ore remains on the property.

The Nevada Hills tailings, located below the old Nevada Hills mill foundations about 1,000 feet north of the northern boundary of the proposed withdrawal area, may contain a reserve of material amenable to heap leaching. Jonson (1986a) mentioned that the tailings pile contains about 200,000 tons of material containing 0.01 ounces of gold and 2.5 ounces of silver per ton. These tailings are located on patented mining claims owned (in 1986) by Tenneco Minerals.

3.8.3.2 Energy Resources

Geothermal Resources

Data from thermal springs, water wells, and geothermal exploration wells have been used to define areas of the State that have potential for geothermal resources (Sources: Garside and Schilling, 1979; Trexler et al., 1983). Based on presently available data, only two areas within the proposed Master Land Withdrawal are assessed as having potential for development of geothermal resources: the southern part of Dixie Valley northeast of Fallon and an area adjacent to U.S. Highway 95 about 20 miles south of Fallon. Three deep geothermal exploration wells were drilled in the southern part of Dixie Valley in 1981 and 1982; no information on these wells is available; and no further work has been attempted in the area. Oxbow Geothermal developed a major geothermal resource in northern Dixie Valley, 30 miles to the north, but has no plans to do more work in the southernmost part of the valley. The second area, south of Fallon, is adjacent to the Lee Hot Springs geothermal area. What little is known of the geology of the area suggests that any possible subsurface extensions of the geothermal resources would be to the east or west of Lee Hot Springs. There is no known subsurface information in this area that would suggest that the area of the proposed withdrawal has anything other than a speculative geothermal potential (Source: Garside, in Quade and Tingley, 1987).

Oil and Gas Resources

The oil and gas potential within the proposed Master Land Withdrawal is considered to be very low (Section 3.8.1). The proposed Master Land Withdrawal will have no effect on the petroleum industry in Nevada.

3.8.3.3 Industrial Minerals and Materials

Many of the alluvial areas along the lower flanks of the mountain ranges within the proposed Master Land Withdrawal contain potential sand and gravel reserves. These materials, however, do not have any unique value over similar materials that occur in other areas throughout western Nevada, and their potential cannot be rated. For economic reasons, sand and gravel operations in Nevada are, and will continue to be, developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within the proposed withdrawal area, do not present a sufficiently unique resource to merit classification.

Sodium compounds have been produced from Fourmile Flat, west of the Sand Springs Range, and from Soda Lake, west of Fallon. Borates have been mined from Eightmile Flat, west of the salt mine area. The lands within the proposed Master Land Withdrawal, however, do not contain closed basins that might have potential for any saline minerals, carbonates, or borates. Deposits of these compounds are not believed to constitute potential resources within this area.

An identified resource of diatomite has been described on the Whitehorse claims in the Camp Gregory area, southwest of the City of Fallon. The diatomite occurrence has been known for many years (Source: Vanderburg, 1940), but there has been no production or development. The deposit has been drilled and trenched, but information on tonnage and grade is not available.

3.8.4 ENVISIONED B-18 AND B17/B19 LAND BRIDGE

3.8.4.1 Base and Precious Metals

Regional Mineral Potential

Three basic geologic terrains underlie the envisioned B-18 and envisioned B-17/B-19 Land Bridge areas (Figure 3.16): areas of deep alluvial cover, areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers, and areas of Mesozoic sedimentary or volcanic rocks near igneous intrusions.

Areas of deep alluvial cover: A portion of southern Fairview Valley is deep alluvium. Bedrock beneath this alluvium is beyond the reach of current and foreseeable (year 2000) mining interests. This area is assessed as having low mineral potential.

Areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: In similar structural settings elsewhere, these rocks have hosted Comstock-type silver-gold deposits, hot spring gold-silver deposits, and hot spring mercury deposits. Deposits of these types in the north, south, and western parts of the envisioned withdrawal add to the favorability of the intervening lands; the area is assessed as having moderate-to-high potential for the development of precious-metals deposits.

Areas of Mesozoic sedimentary or volcanic rock near igneous intrusions: These rocks in similar structural settings elsewhere in Nevada have hosted skarn tungsten deposits, copper skarn deposits, polymetallic replacement deposits, carbonate-hosted gold deposits, and simple antimony deposits. Tungsten has been produced from deposits on the north and south borders of the area, and similar deposits could be developed within the area. The area underlain by these rocks is assessed as having a low-to-moderate development potential for skarn tungsten.

Potential of Mining Districts

Portions of nine mining districts are included within the boundaries of the envisioned land withdrawal (Figure 3.17). Districts that would be most affected by the withdrawal are the Bell Mountain and Gold Basin districts in Churchill County and the Broken Hills and Eagleville districts in Mineral County. Only outlying portions of the Sand Springs, Fairview/South Fairview, Cinnabar Hill, Regent, and King districts would be affected. Two of these districts, Bell Mountain and Broken Hills, contain identified mineral resources. In 1989, exploration was being conducted in seven of the nine districts.

Mining districts within areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers: The entire Bell Mountain district, major portions of the Gold Basin, King, and Broken Hills districts, and a small part of the Fairview district occur in this terrain within the envisioned withdrawal area. The included part of the Broken Hills district is prospective mainly for fluorite, but the others are precious-metals districts. Bell Mountain contains measured reserves of gold-silver ore and has good potential for additional deposits in the eastern part of the district. Several areas within the Gold Basin district display structures and alteration indicative of the presence of disseminated, volcanic-hosted precious-metals deposits. The King district, on the south border of the proposed withdrawal in Mineral County, has similar potential. There is exploration activity in all of these districts at the present time; all three have moderate-to-good potential for the discovery of additional large-tonnage, low-grade precious-metals deposits. Only a small, eastern fringe of the Fairview district extends into the area; this area has a low mineral development potential.

Mining districts within areas of Mesozoic sedimentary or volcanic rock near igneous intrusions: Portions of the Sand Springs, Regent, and South Fairview districts within this area are peripheral to skarn tungsten occurrences. The largest of these, the Nevada Scheelite mine in the Regent district, is one of the largest former producing tungsten mines in the State. The area of the envisioned withdrawal north of this mine has moderate potential for the development of tungsten resources. Molybdenum is reported present in the Regent district, and the intrusive contact area near Big Kasock Mountain has moderate resource potential for the development of porphyry molybdenum deposits. The included parts of Sand Springs and South Fairview districts are assessed to have low resource development potential for these types of deposits. In the King district, precious-metals mineralization occurs along the north-trending contact between Tertiary volcanic rocks and Mesozoic metavolcanic rocks. Potential for disseminated precious-metals occurrences in this district is moderate-to-good. In the Eagleville district, located between the Regent and King districts on the southern border of the envisioned withdrawal, gold has been produced from narrow, northwest-trending quartz-barite veins. There is moderate potential for development of additional, similar deposits in this district.

Identified Mineral Resources

Exploration in the early 1980's at the Bell Mountain mine defined a proven precious-metals resource containing 1 million tons grading 0.055 ounces gold and 1.4 ounces silver per ton. In addition, 50,000 tons of material containing 0.14 ounces gold and 3.3 ounces silver per ton are present in a separate ore zone. The deposit also contains an additional 1 million tons of possible ore with a grade of 0.022 ounces gold and 1.0 ounces silver per ton (Source: Bonham, 1986). Plans have been announced to place this property in production in 1991 (Source: Tingley, 1990).

3.8.4.2 Energy Resources

Geothermal Resources

Data from thermal springs, water wells, and geothermal exploration wells have been used to define areas of the State that have potential for geothermal resources (Sources: Garside and Schilling, 1979; Trexler et al., 1983). Based on currently available data, only Lee Hot Springs and Allen Hot Springs, located on the western tip of the envisioned land bridge, have moderate potential for development of geothermal resources. Hot water, at a surface temperate of 190°F to 212°F, discharges from Lee Hot Springs; Allen Hot Springs flows only intermittently. This area had been under lease for geothermal exploration, and several test holes have been completed. Drilling results indicate that bottom-hole temperatures are similar to those at the surface. Based on these drilling results, the exploration company rated the geothermal potential of the area as marginal, and the leases were dropped. The presence of flowing hot water, however, is considered significant enough to assess the geothermal development potential of this area as moderate.

Oil and Gas Resources

The oil and gas potential of the envisioned B-18 and envisioned B-17/B-19 Land Bridge are considered to be very low (Section 3.8.1). The envisioned withdrawal of B-18 and the B-17/B-19 Land Bridge will have no effect on the petroleum industry in Nevada.

3.8.4.3 Industrial Minerals and Materials

Many of the alluvial areas along the lower flanks of the mountain ranges within this area contain potential sand and gravel reserves. These materials, however, do not have any unique value over similar material occurring in other areas throughout western Nevada, and their potential cannot be rated. For economic reasons, sand and gravel operations in Nevada are, and will continue to be, developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within the envisioned withdrawal area, do not present a sufficiently unique resource to merit classification.

There is moderate potential for the development of small deposits of vein barite in the Eagleville district in the southern part of the area. There is also good potential for the development of moderate-sized deposits of fluorite in the vicinity of the Baxter (Kaiser) mine in the western Broken Hills district in the southeastern corner of the envisioned withdrawal.

The Baxter mine contains small reserves of fluorite which occur as pillars and narrow segments of vein material in the underground workings (Source: Papke, 1984). This constitutes the only identified industrial mineral resource in the area.

3.8.5 SUMMARY

3.8.5.1 Existing Withdrawals

Existing withdrawals for NAS Fallon and the FRTC have and will continue to exclude mineral exploration and potential mineral development.

The withdrawal of NAS Fallon has not had a noticeable effect on the mining and petroleum industry in Nevada in that the potential of NAS Fallon to contain metals or commercial quantities of oil and gas is very low. The geothermal potential of NAS Fallon is high and the Navy is currently investigating the development of this energy source for the base. A moderate-to-high potential exists for the development of one or more small-size to medium-size silver-gold deposits in the northeastern part of B-17. Part of B-19 has high potential for the discovery of hot springs-type precious-metals deposits. B-19 has the best mineral development potential of the existing ranges. Little mineral potential exists on B-20. A low-to-moderate potential exists in B-16 for deposits of diatomite. After four decades of ordnance delivery, mineral and/or geothermal exploration on portions of existing withdrawals could pose an extreme safety hazard due to the possible presence of surface and subsurface live, undetonated ordnance.

3.8.5.2 Proposed Master Land Withdrawal

The proposed Master Land Withdrawal is currently closed under the mining and mineral leasing laws. When Congress acts on the proposed withdrawal, parts of this area may be reopened to mineral exploration and mining.

Several areas within the proposed Master Land Withdrawal have moderate-to-high potential for the discovery of base and precious metals, tungsten, and molybdenum. These areas are generally adjacent to known mines and mineralized ground in the mining districts bordering the proposed withdrawal. Identified mineral resources within the proposed Master Land Withdrawal include a possible 1.8 million tons of open-pit gold ore and an unknown tonnage of open-pit silver ore. An identified resource of diatomite has been described within the area encompassing the proposed Master Land Withdrawal. No production or development is known from the site, and information on tonnage and grade is not available. Mining exploration and operations in the Cinnabar Hill, Nevada Hills, and Fairview areas could pose an extreme safety hazard due to the possible presence of surface and subsurface live, undetonated ordnance.

3.8.5.3 Envisioned B-18 and B-17/B-19 Land Bridge

The envisioned land bridge is currently open under the mining and mineral leasing laws. It is believed that portions of the envisioned withdrawals would be open for mineral exploration and mining should the withdrawals occur. Within the envisioned withdrawal, all areas of Tertiary volcanic or sedimentary rock near volcanic or intrusive centers (Figure 3.17) are assessed as having moderate-to-high potential for precious metals deposits. Areas of Mesozoic sedimentary and volcanic rock near igneous intrusions (Figure 3.16) are assessed as having low-to-moderate potential for skarn tungsten deposits.

All or part of nine mining districts are included within the boundaries of the envisioned land withdrawal. Two of these districts, Bell Mountain and Broken Hills, contain identified mineral resources. In 1989, exploration activity was noted in seven of the nine districts; much of this activity was in areas either outside or peripheral to the envisioned withdrawal. In three districts (Gold Basin, Bell Mountain, and Broken Hills), however, exploration activity was inside the envisioned boundaries of the withdrawal. A moderate-to-high potential exists for the discovery of large-tonnage, low-grade precious-metals deposits in two of these districts, Bell Mountain (in addition to the identified deposit) and Gold Basin. The small part of the Fairview district within the envisioned withdrawal is assessed as having low mineral potential. The portion of the Broken Hills district within the envisioned land withdrawal has moderate-to-high potential for discovery of additional reserves of fluorite. The Regent district has moderate resource potential for skarn tungsten and porphyry molybdenum deposits; the portions of the Sand Springs and South Fairview districts within the envisioned withdrawal area are assessed as having low resource potential for these types of tungsten and molybdenum deposits.

3.9 EFFECTS ON WATER RESOURCES

3.9.1 HYDROLOGIC AND WATER RESOURCE ENVIRONMENT

3.9.1.1 NAS Fallon

NAS Fallon is situated in the central portion of the Carson Desert Hydrographic Basin which is the terminus sub-basin of the larger Carson River basin (Figure 3.18). B-16 and B-20 are also located in the Carson Desert Hydrographic Basin. B-16 is situated in the southwestern portion of that basin while B-20 is situated in the northeastern portion (Figure 3.19). A small portion of B-19 is also located within the Carson Desert Hydrographic Basin. The proposed withdrawal for the safety and noise buffer zones around B-19 and the envisioned withdrawal for the land bridge would increase the FRTC withdrawn land area which would be situated in the Carson Desert Hydrographic Basin.

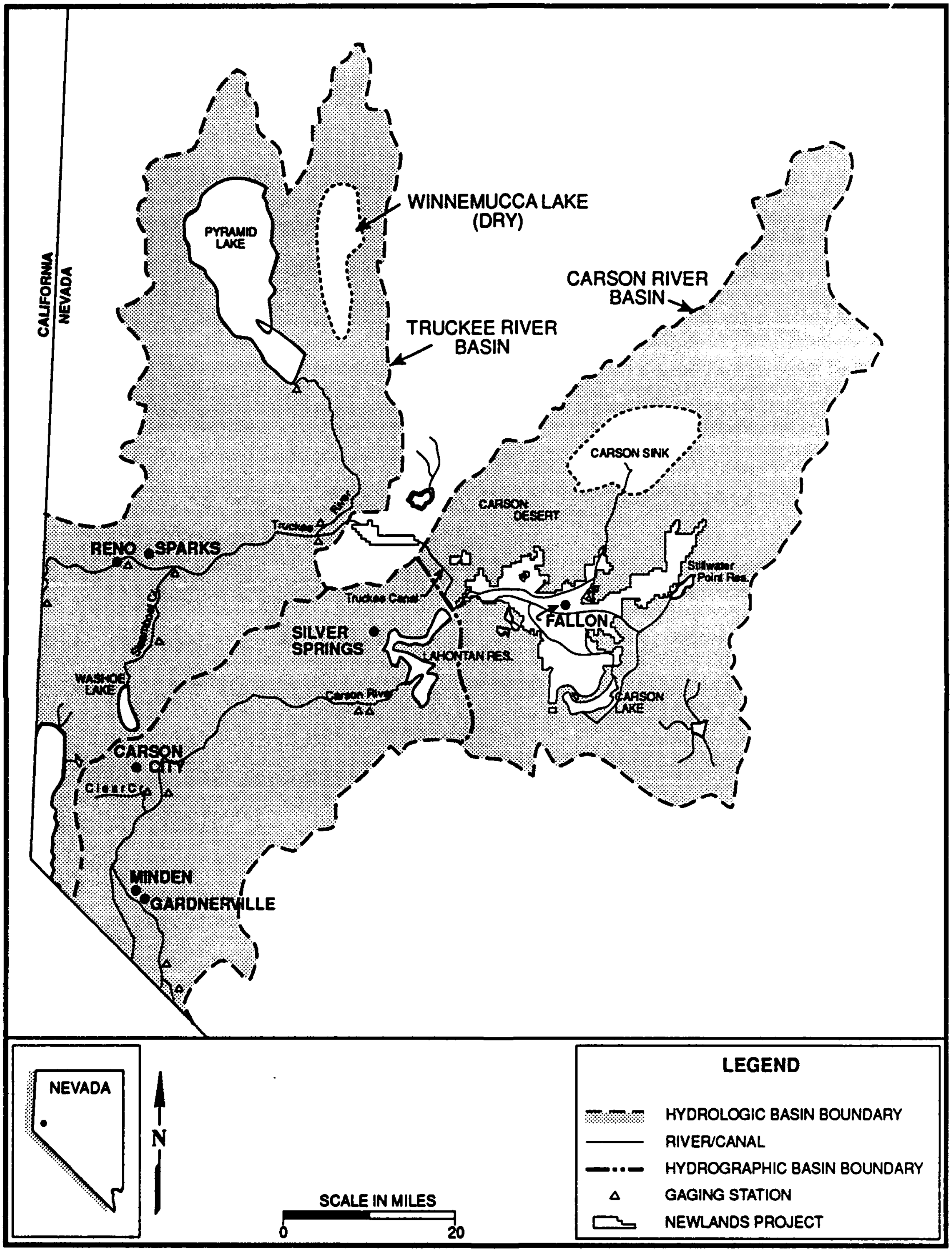


FIGURE 3.18 NEVADA PORTIONS OF TRUCKEE AND CARSON RIVER BASINS

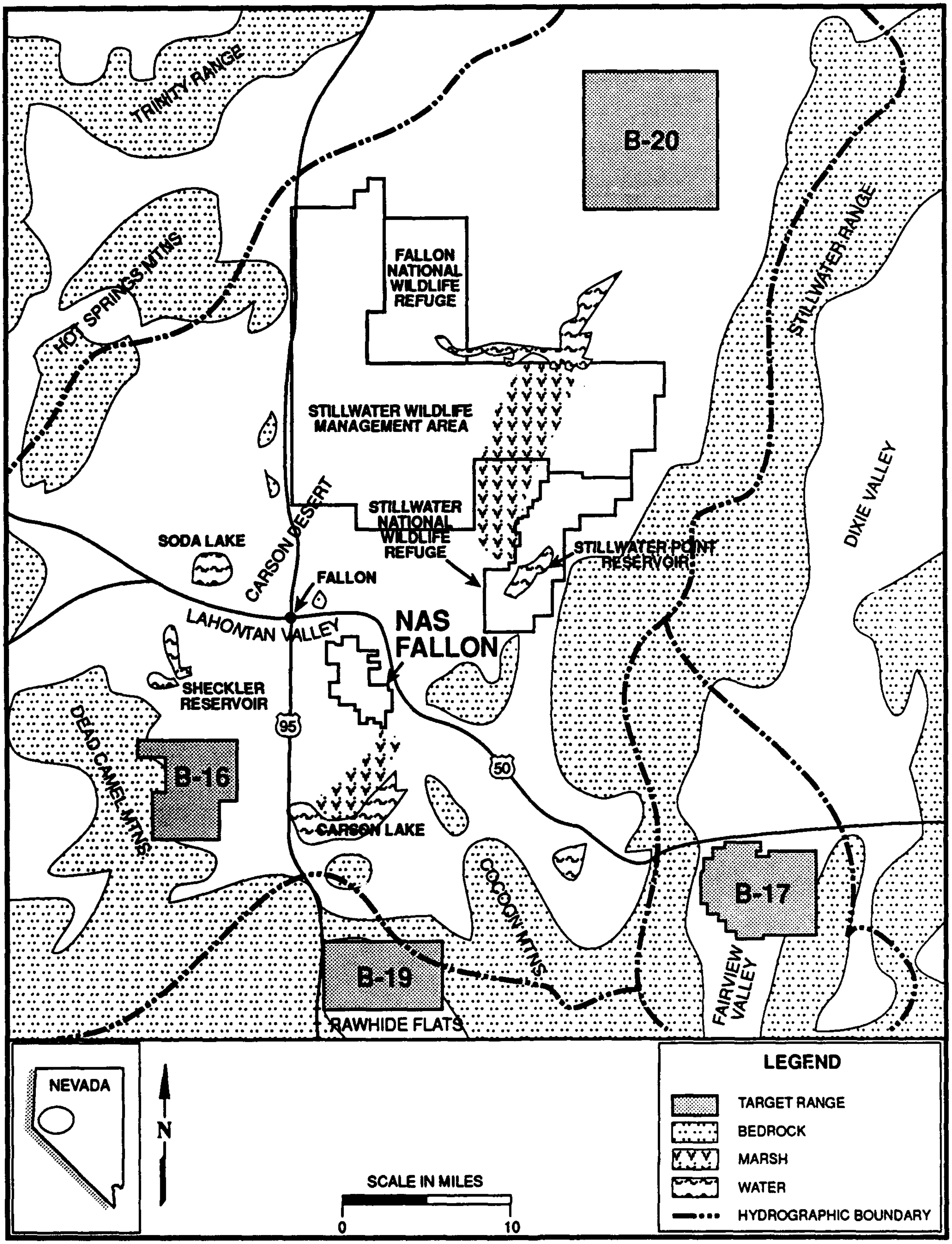


FIGURE 3.19 HYDROGRAPHIC BASINS AND PRINCIPAL HYDROLOGIC FEATURES FOR NAS FALLON AND ASSOCIATED RANGES

Surface Water

In 1904, the U.S. Reclamation Service (now the BUREC) diverted Truckee River water through a canal constructed from Derby Dam to the Carson River to support development of the Newlands Reclamation Project in the Carson Desert. In the period from 1904 to 1964, diversions of Truckee River water averaged over 300,000 acre-feet per year (AFY).

The Newlands Reclamation Project irrigation and drainage system is operated by the TCID. In 1985, 63,100 acres were irrigated in the Newlands Reclamation Project (Source: U.S. DOI, 1987). Within the irrigation network is a series of over 10 storage and regulating reservoirs. Combined flows of the Carson and Truckee rivers are stored in Lahontan Reservoir (Figure 3.18). Releases from that reservoir are made to the Lower Carson River and are then diverted by a series of main canals and lateral canals for delivery to the Newlands Reclamation Project lands currently under irrigation.

The naturally shallow water table in the Carson Desert was made shallower by irrigation. Because of that, a series of main drains and lateral drains were constructed to lower the water table. The drains carry irrigation return flow (tail water) away from the fields. Some of that water is recovered in the storage and regulating reservoirs for reuse (e.g., Stillwater Point Reservoir). Most of the drain water is, however, discharged to the Stillwater marshes. That water is generally of poor quality. It contains nutrients, agricultural chemicals, and high concentration of dissolved minerals leached from the soil and concentrated by evapotranspiration.

Ground Water

Hydrogeologic characteristics of the Carson Desert Hydrographic Basin ground water are described in Section 3.2.3. The Carson Desert Hydrographic Basin ground water reservoir is characterized as being comprised of four separate aquifer systems (Source: Glancy, 1986):

1) a shallow alluvial aquifer system extending from land surface to a depth of approximately 50 feet,

2) an intermediate alluvial aquifer system extending from a depth of approximately 50 feet below land surface to a depth of between 500 and 1,000 feet,

3) a deep alluvial aquifer system extending from below the intermediate alluvial aquifer system to a depth of approximately 2,200 feet below land surface, and

4) a basalt aquifer underlying the alluvial material throughout much of the basin but protruding as a plug into the sediments to a depth of 200 to 600 feet below land surface to the northwest of the NAS Fallon withdrawal.

The basalt aquifer yields large quantities of fresh water and has been extensively developed for the City of Fallon's entire municipal supply, NAS Fallon, and several private users (Source: Glancy, 1986). Most of the rural population obtains water from domestic wells that tap the shallow aquifer system. A small percentage of the rural population obtains water from wells completed in the intermediate aquifer system (Source: Glancy, 1986). Quality of shallow aquifer water varies greatly, and the water in some areas of the County is not suitable for domestic use without desalinization treatment. Intermediate aquifer water quality is generally quite good, but quality appears to deteriorate in a southeasterly direction from the City of Fallon. Three wells in the intermediate aquifer south and east of NAS Fallon yield water of very poor quality. North of NAS Fallon, the quality is significantly better, and it is in that area where most recharge to the basalt aquifer is believed to occur. The deep alluvial aquifer system is not well defined. Based on limited drill logs and chemical data, water quality in that system is poor.

Carson Desert Hydrographic Basin natural recharge from precipitation is estimated to be less than 2,000 AFY (Source: Glancy and Katzer, 1975). Recharge from infiltration of river water and irrigation is many times greater than recharge from precipitation.

Conditions Near NAS Fallon

NAS Fallon is located within the Newlands Reclamation Project which provides irrigation water for the Lahonton Valley agricultural economy. Distribution of irrigation water in the Newlands Reclamation Project is managed by TCID. During a normal year, the TCID irrigation canals contain water during the irrigation season (March 15 through November 15); the canals are dry at other times. There are eleven lateral irrigation ditches that lead into the Station. These lateral irrigation ditches connect with the "L" Line Canal which runs adjacent to NAS Fallon. There are three drainage canals that are 8 to 10 feet deep which cross the Station. These drainage ditches carry agricultural tail water from off-Station sources, and they collect agricultural tail water and surface water runoff from NAS Fallon. These drainage canals intercept the water table, and they carry water throughout the year. The drainage water is of poor quality since it contains agricultural tail water from both off-Station and on-Station sources, treated sewage effluent from both NAS Fallon and the City of Fallon, and runoff from NAS Fallon and other areas. The estimated discharge of treated sewage effluent from NAS Fallon is approximately 400 AFY (Source: Ott Water Engineers, 1986). NAS Fallon treated sewage effluent meets EPA and NDEP standards.

In the vicinity of NAS Fallon, the direction of flow in the shallow aquifer is to the southeast (Source: Glancy, 1981). Around NAS Fallon that flow may be disrupted by TCID agricultural drainage canals that intersect the water table. The TDS concentration is estimated to be 1,000 mg/l or more which is at the upper limit of potability. The water is generally hard and has variable and relatively high arsenic concentrations. Shallow aquifer recharge at NAS Fallon is principally from agricultural irrigation which is, in part, responsible for the high salinity. Depth to saturation from recharge is largely controlled and modulated by the agricultural drains which means that the drains tend to reduce the higher water levels from recharge. Discharge from the shallow aquifers occurs by evapotranspiration, seepage to drains, and leakage to the underlying intermediate aquifer. The vertical hydraulic gradients in the southern two-thirds of NAS Fallon indicate that the flow of ground water is upward into the shallow system (Source: Glancy, 1986). In the northern portion, flow is downward through the shallow aquifer system.

The depth to the ground water beneath NAS Fallon is shallow ranging from approximately three feet in the southeastern portion to 6 to 8 feet in the northwestern portion. Seasonal fluctuations in water table depth range from 1 foot to 2.5 feet depending on precipitation, irrigation, and drainage conditions. Tail water and runoff from NAS Fallon is eventually carried to Stillwater Point Reservoir where it is discharged to the Stillwater WMA and Stillwater NWR (Figure 3.20).

3.9.1.2 B-16 (Existing Range and Proposed Buffer Zone) and B-20

B-16 and B-20 are both located in the Carson Desert Hydrographic Basin. As a part of the proposed Master Land Withdrawal, the Navy has proposed the creation of safety and noise buffer zones around B-16 by withdrawing lands on the west, north, and east of the range as shown in Figure 3.21. No land withdrawals are planned for B-20.

Included within B-16 are alluvial fans and valley bottom lands with areas of alkali flats and sand dunes. Several major ephemeral stream channels converge to the northwest of B-16 and cross the range. They eventually lead to Carson Lake. The proposed safety and noise buffer zones would incorporate higher elevation terrain at Red Mountain and additional alluvial fans, valley bottom lands, alkali flats, and sand dunes. Those proposed buffer zones would also incorporate Sheckler Reservoir, two smaller ponds, marsh areas, and segments of three main irrigation canals. There are no perennial streams or springs within the B-16 or the proposed buffer zones, and no wells have been drilled for water supply. The water table beneath the bottom land areas is probably shallow, especially in the vicinity of Sheckler Reservoir. There are no data available concerning the quality of the ground water beneath B-16 or the proposed buffer zones.

B-20 is located in the barren alkali flat area of the Carson Sink. That area is normally dry, but it can be flooded during very high runoff conditions. Depth of the water table is expected to be shallow. Shallow ground water is expected to be very saline due to the evaporative environment. Nothing is known about deeper ground water conditions beneath B-20. No water supply wells have been drilled at B-20.

3.9.1.3 B-17 and EWR (Existing and Proposed)

The location of B-17, the proposed withdrawal for safety and noise buffer zones around B-17, and the proposed EWR withdrawal are shown in Figure 3.22 in the context of the hydrographic boundaries of Dixie and Fairview valleys. The proposed land withdrawal for the EWR encompasses the topographic divide between those two valleys. Dixie Valley and Fairview Valley are very similar Hydrographic Basins. Neither basin has any surface water outflow, and Fairview Valley is topographically closed. Dixie Valley receives surface water from ephemeral streams to the north and south and subsurface water from all connected basins including Fairview Valley. Precipitation ranges from 5 to 20 inches per year with the least precipitation occurring on the valley floor and larger amounts occurring at higher elevations. Most recharge is from springtime snowmelt in the mountains. Thick deposits of older and younger alluvial material act as major reservoirs for storage and transmission of ground water.

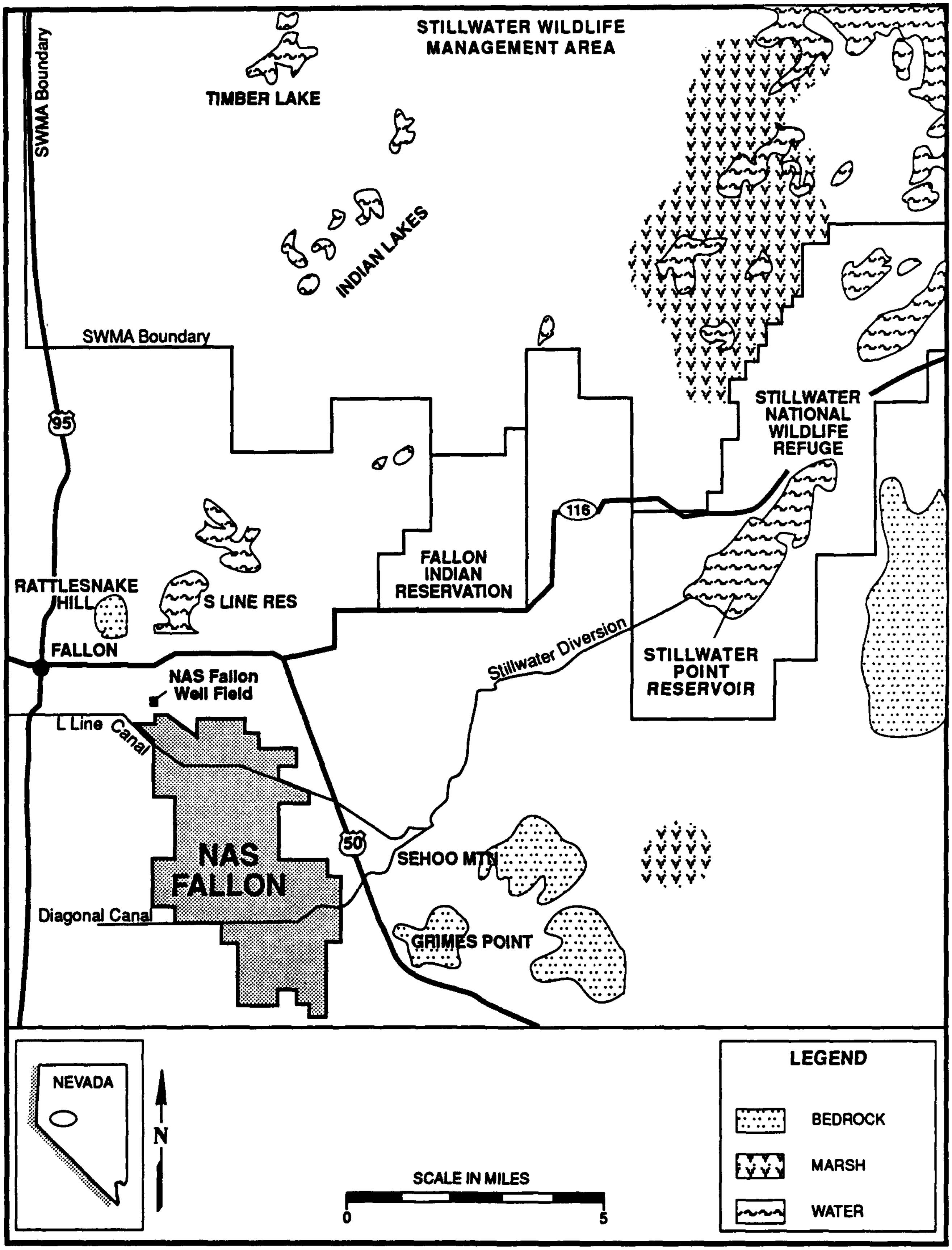


FIGURE 3.20 HYDROLOGIC AND WATER RESOURCE FEATURES IN THE VICINITY OF NAS FALLON

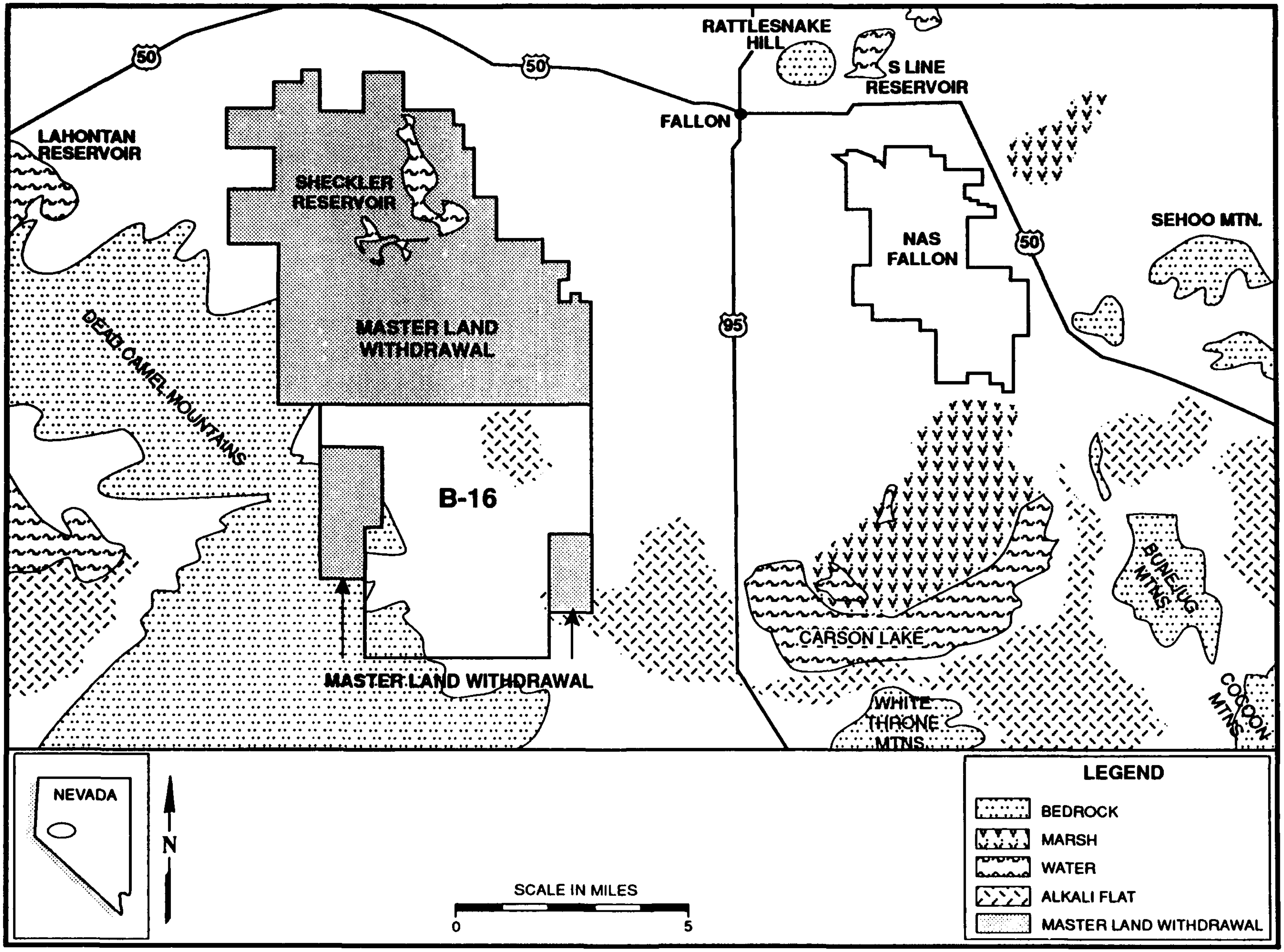


FIGURE 3.21 HYDROLOGIC AND WATER RESOURCE FEATURES IN THE VICINITY OF B-16

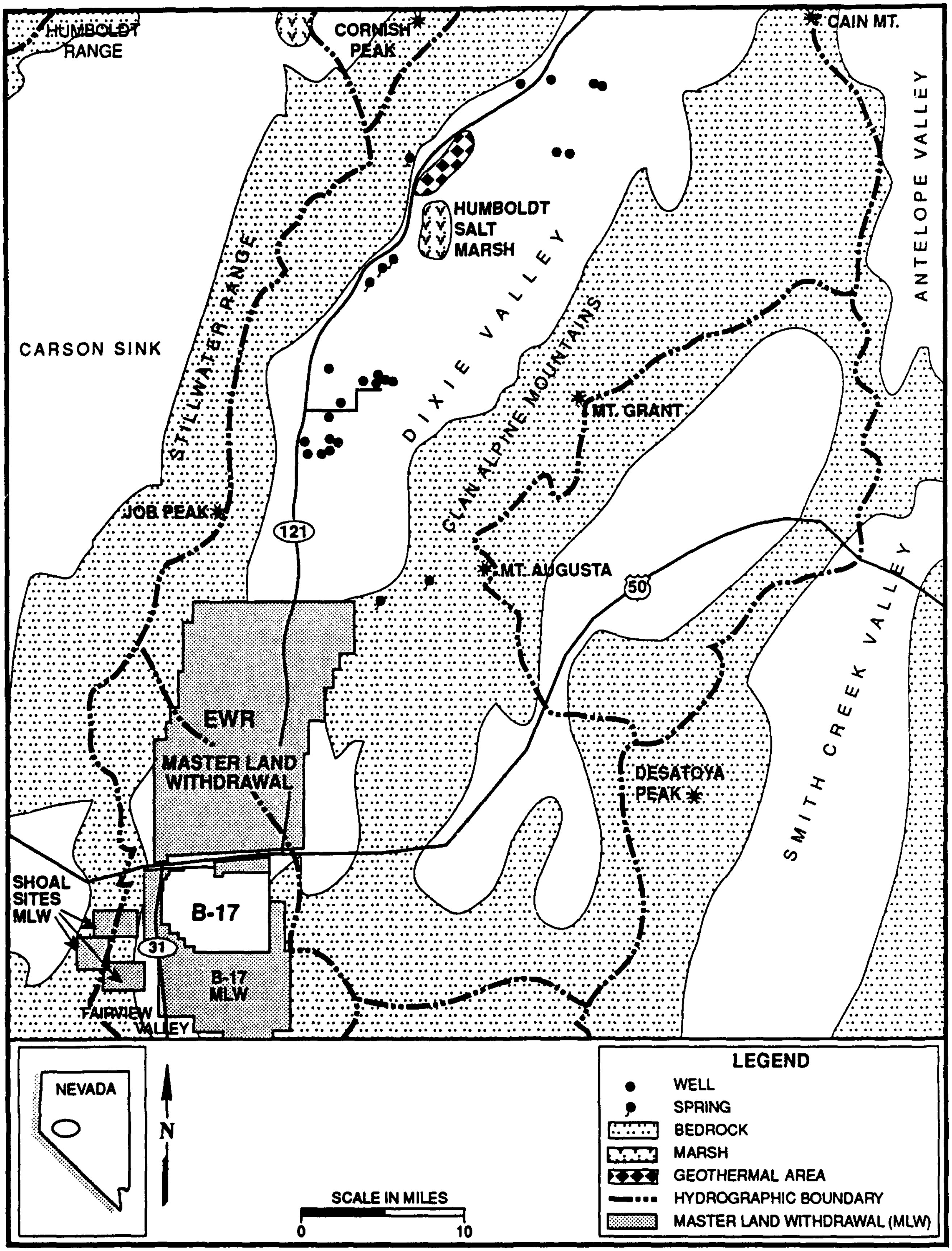


FIGURE 3.22 FAIRVIEW AND DIXIE VALLEYS HYDROGRAPHIC BASINS WITH SHOAL SITES, B-17, EWR, AND MASTER LAND WITHDRAWAL

Fairview Valley receives approximately 100,000 AFY of precipitation, but only 500 AFY are estimated to infiltrate into the ground water reservoir as recharge. The remainder of the precipitation either evaporates directly or is transpired by the vegetation cover. It is believed that subsurface waters move from the mountains in the southern end of Fairview Valley to the valley axis and then northward (Source: Cohen and Everett, 1963). Surface water drains towards Labou Flat in central Fairview Valley. Fairview Valley is hydrologically connected in the subsurface to Dixie Valley. An estimated 500 AFY of ground water is discharged to Dixie Valley. Consequently, the estimated ground water budget is only 500 AFY with a perennial yield of only 250 AFY. There is one perennial stream (Horse Creek), and there are only a few springs in Fairview Valley. Water development has been minimal. There are only seven reported wells. Well depths vary considerably, but they average 500 feet deep where a confined aquifer is tapped. The static water level in those wells averages approximately 265 feet below land surface. There is no water development associated with B-17. There are two Navy wells in the northern end of Fairview Valley at the EW Centroid, and the Navy has also purchased water rights at Frenchman which is just north of B-17 along U.S. Highway 50.

Dixie Valley receives approximately 460,000 AFY of precipitation which is estimated to result in 6,000 AFY of recharge to its ground water reservoir. The remainder of the precipitation either evaporates directly or is transpired by the vegetation cover. Dixie Valley receives an estimated 7,400 AFY of subsurface inflow from tributary basins, but future development of the tributary basins, such as could be undertaken by ranchers, geothermal developers, or water purveyors, could intercept this subsurface inflow. Within Dixie Valley there is an estimated 3,500,000 acre-feet of ground water stored in the upper 100 feet of saturated alluvium. Water development has occurred primarily for irrigation and stock watering purposes, although there is also extensive geothermal development. Many of the wells are free flowing. There are many springs in Dixie Valley with most of them in the central and northern half of Dixie Valley. Most of the springs are warm or hot. Estimated spring discharge is 3,000 AFY of which 2,000 AFY is lost through evapotranspiration (Source: Cohen and Everett, 1963). Most wells have been drilled in the central and northern portion of the basin.

3.9.1.4 B-19, Proposed Shoal Sites, Envisioned B-18, and Envisioned Land Bridge

The location of B-19, the proposed Shoal Sites withdrawal, the envisioned B-18, and the envisioned land bridge are shown in Figure 3.23 in the context of hydrologic characteristics. The Blow Sand Mountains run southeast to northwest and are the topographic divide between Rawhide Flats and Carson Desert. There are approximately 1,400 feet of relief where precipitation averages between 8 and 12 inches per year with the least precipitation occurring on the valley floor and larger amounts occurring at higher elevations. Rawhide Flats ground water reservoir receives an estimated 150 AFY of recharge from precipitation. All of the estimated 350 AFY subsurface inflow to Rawhide Flats is contributed from the Carson Desert Basin. There is no perennial surface water flow into or out of Rawhide Flats, nor is there any significant runoff from the surrounding mountains. There are no streams, and only one spring is located within B-19. No water development is associated with B-19.

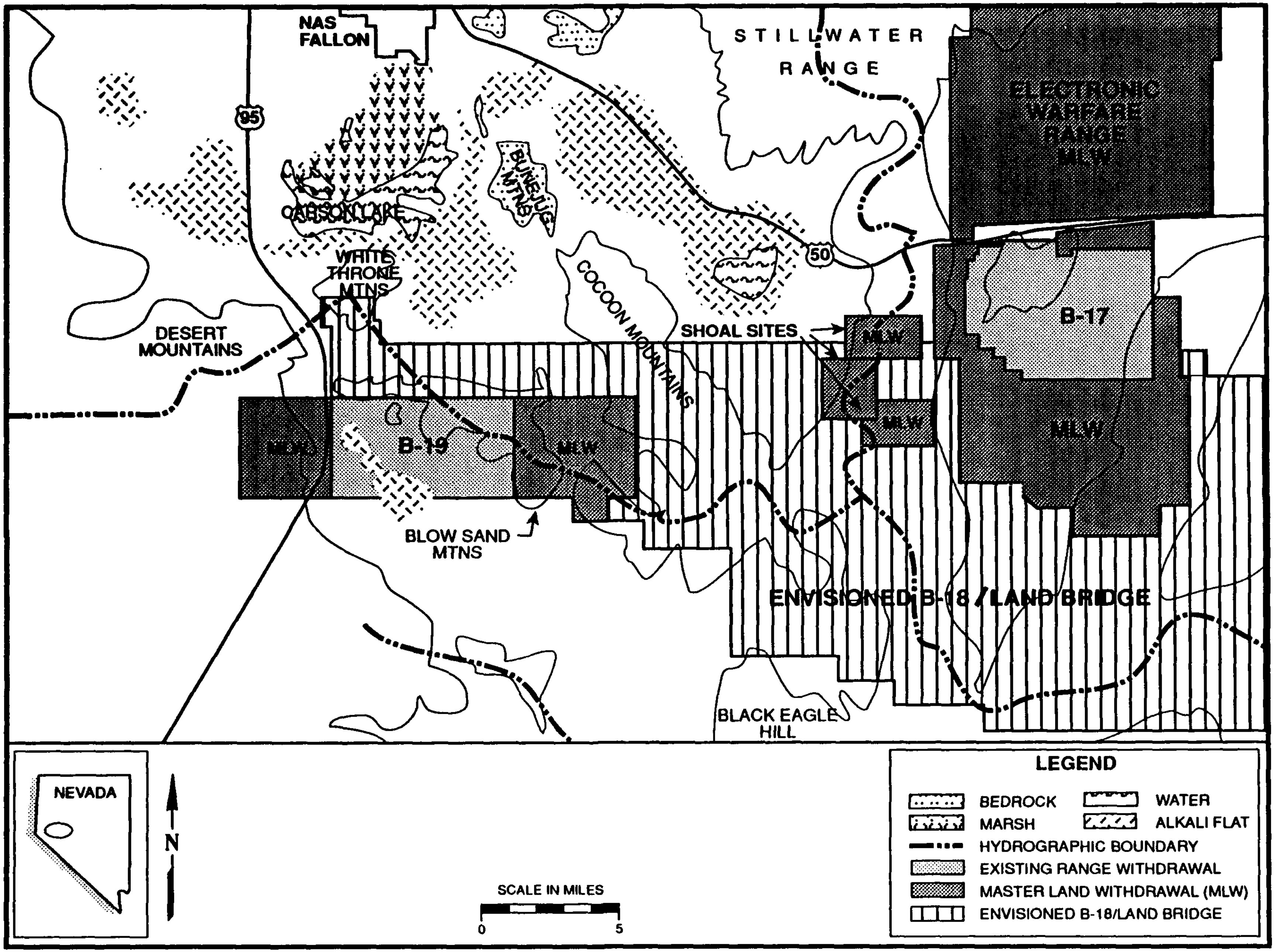


FIGURE 3.23 HYDROLOGIC FEATURES IN VICINITY OF B-17, B-19; MASTER LAND WITHDRAWAL; ENVISIONED B-18/LAND BRIDGE WITHDRAWAL

The proposed Shoal Sites withdrawal consists of approximately 7,404 acres near the summit of Sand Springs Range. The mountain range runs north and south with similarly trending valleys on the east and west. The withdrawal encompasses Gote Flat and extends northwest into Carson Desert and east toward Fairview Valley. Precipitation at the Sites may be as much as 15 inches per year. No permanent bodies of water, springs, or streams exist on lands in the proposed withdrawal; but there is a major ephemeral drainage course in the eastern portion toward Fairview Valley. There is no water development expected with the proposed Shoal Sites withdrawal.

No water development or water use is expected with the envisioned B-18.

The portion of the envisioned land bridge located north of B-19 would incorporate several existing wells in addition to Lee and Allen Hot Springs whose waters are thermal and undrinkable. The portion of the envisioned land bridge located south of B-17 would incorporate several wells and a spring located on the west side of Fairview Valley. There is no water development expected with the envisioned land bridge.

3.9.2 WATER RIGHTS AND ALLOCATIONS

3.9.2.1 NAS Fallon

Surface water rights in the Newlands Reclamation Project are administered by TCID. The Navy owns, in fee simple, approximately 2,934 acres of water-righted land in the Newlands Reclamation Project area. Those water-righted lands are entitled to an allocation of 10,269 AFY of surface water (Section 3.3.5 for a description of the purpose for and use of those lands). Total ground water rights in Carson Desert amount to approximately 41,100 AFY. The City of Fallon holds rights to 5,498 AFY of ground water, and NAS Fallon holds rights to 2,298 AFY of ground water.

3.9.2.2 Existing, Proposed, and Envisioned FRTC Withdrawals

There are no ground water rights associated with B-16 and B-20, nor are there any such rights associated with safety and noise buffer zones proposed for withdrawal adjacent to B-16. None of the land within the proposed buffer zones for B-16 is arable land entitled to the Newlands Reclamation Project water rights.

A total of 55 AFY of ground water has been appropriated in Fairview Valley. Of that 55 AFY of ground water, 26 AFY have been appropriated by the Navy for the EW Centroid. There are no private water rights holdings located within the proposed EWR withdrawal area. There are no water rights or proposed water uses associated with B-17 or its associated portion of the proposed Master Land Withdrawal. Also, there are no water rights or anticipated water uses with the envisioned B-18 withdrawal.

Water rights permits and certificates for a total of 37,739 AFY have been issued for Dixie Valley consisting of 35,096 AFY for ground water and 2,643 AFY for surface water. The Navy has made applications to the Nevada State Engineer for acquisition of 9,811 AFY ground water and 1,628 AFY surface water for a total of 11,439 AFY. These water rights applications are associated with the Navy's purchase of private lands in Dixie Valley to eliminate a situation where private citizens would be living under constant exposure to sonic booms. The Navy is seeking perfection of these water rights applications in order to ensure that additional individuals do not obtain the water rights and use them to develop additional settlements beneath the area in which supersonic activity is authorized. Water rights certificates and permits exceed the estimated yield by approximately 20,000 AFY in Dixie Valley.

There are water rights for 114 AFY of ground water and 18 AFY of surface water in Rawhide Flats Hydrographic Basin for B-19 and the proposed Shoal Sites withdrawal for a total of 132 AFY. The Navy does not hold any of those water rights. No water rights or water uses are associated with safety and noise buffer zones for B-19 proposed for withdrawal as part of the proposed Master Land Withdrawal. There are no water rights associated with the Shoal Sites withdrawal, and there are no water rights immediately surrounding mountainous terrain that would be incorporated in the envisioned land bridge.

3.9.3 WATER DIVERSIONS AND CONSUMPTIVE USE

3.9.3.1 NAS Fallon

NAS Fallon holds rights to 2,298 AFY of ground water for domestic consumption. It uses an estimated average of 590 AFY. That ground water is used for domestic and industrial purposes and landscape irrigation uses on NAS Fallon and associated military housing units. Both the City of Fallon and NAS Fallon pump their ground water from well fields near Rattlesnake Hill located to the northwest of the Station. NAS Fallon does not expect any increase in its ground water usage, however, as the City's water needs increase, there is the potential for problems to develop related to well interference and to possible deterioration of the quality of this source if it is over stressed. Good quality water for domestic use is a problem in the Fallon area due to its scarcity.

The surface water-righted lands on NAS Fallon are part of the Newlands Reclamation Project. Although these water-righted lands have an entitlement to 10,264 AFY, since 1985 only 7,700 AFY have been used. In response to concerns for allocations and use of water in the Truckee and Carson river basins, Congress in 1990 (P.L. 101-618) directed the Navy to study its greenbelt irrigation to determine whether alternative land management practices could satisfy the Navy's safety and FOD concerns. Any further reductions in surface water use would be used to benefit the Pyramid Lake endangered fishes or supplement flows to the water short Lahontan Valley wetlands.

3.9.3.2 Existing, Proposed, and Envisioned FRTC Withdrawals

The only current water use associated with B-17 and EWS activities is at the EW Centroid in northern Fairview Valley. That use amounts to less than 10 AFY of ground water. No additional water would be used in the portion of the proposed Master Land Withdrawal for the safety and noise buffer zones around B-17 and for the EWR.

The Navy does not use any water within B-16, B-19, B-20, or the proposed Shoal Sites withdrawal. Water use is not anticipated for the proposed safety and noise buffer zones adjacent to B-16 and B-19 which are part of the proposed Master Land Withdrawal or for the envisioned land bridge.

Activities in the envisioned B-18 would not create added water use in Fairview Valley.

3.9.4 RESOURCE IMPAIRMENT AND OTHER EFFECTS

3.9.4.1 NAS Fallon

Because of the shallow depth to ground water, contaminants that have been spilled or placed in landfills at NAS Fallon (Section 3.2.6) may contaminate ground water (Source: ORNL, 1989). With an upward ground water flow gradient beneath the identified sites, contamination of the deeper aquifers would not be expected (Source: Dames and Moore, 1988). In the southern portion of the Station, there is an upward water flow gradient. Thus, the probability of contamination of the deeper aquifers from contaminants spilled or placed in landfills on that portion of NAS Fallon is unlikely. However, if the local ground water flow gradient is downward (Source: ORNL, 1989), then contaminants may reach the deeper aquifers (Source: ORNL, 1989). In the northern portion of the Station, there is a downward water flow gradient. The IRP sites in the northern portion of the Station contain primarily hydrocarbon contamination. Based on the local hydrologic conditions (shallow water table and agricultural drains) in the northern part of the Station, ground water contaminants from north of the Lower Diagonal I Drainage Canal may enter that Drainage Canal and continue downstream to the Stillwater WMA and Stillwater NWR (Source: Dames and Moore, 1988). There is only one IRP site north of the Lower Diagonal I Drainage Canal which is the roads that were treated in the 1940's for dust abatement. NAS Fallon has instituted its IRP to define the extent to which contaminants have entered the shallow ground water and to develop remediation programs to minimize and prevent off-station effects.

Water used to irrigate the green belt of cultivated lands surrounding the airfield which provides protection against FOD, dust, and fire is Newlands Reclamation Project irrigation water. Management of NAS Fallon greenbelt irrigation is discussed in Public Law 101-618.

3.9.4.2 Existing, Proposed, and Envisioned FRTC Withdrawals

There are no data respecting the presence of the constituents of ordnance or the by-products of detonation on FRTC bombing ranges; however, the isolation of those bombing ranges from public water resources significantly reduces the likelihood such constituents or by-products could contaminate those resources. There is a low probability for the transport of such constituents or by-products by surface water to publicly accessible areas because of hydrologic conditions and the relative isolation of the ranges.

New facilities would not be created in conjunction with the withdrawal of the lands for the proposed safety and noise buffer zones adjacent to B-16 which are part of the proposed Master Land Withdrawal. Only inert/training ordnance is authorized on B-16. Given the variability of Carson Desert shallow ground water quality and that only inert/training ordnance is authorized, ground water impairment is unlikely. The target range may have reasonable water quality since it is close to potential recharge areas from the alluvial fans on Dead Camel Mountains. Direction of ground water flow is most likely toward Carson Lake. In the unlikely event that impairment occurred, impaired water could migrate outside the withdrawal.

As a result of the naturally high salinity of the ground water at B-20, munitions residue on B-20 would not impair the low utility of the ground water. The ground water in that area is not potable and is too saline for irrigation. Given the distance to any producing wells and the fact that B-20 is in a regional hydrologic sink, migration of that water would not be expected.

Activities at the EWS facilities or activities associated with the proposed EWR withdrawal are not likely to impair ground water resources of either Fairview Valley or Dixie Valley. Waste water at the EW Centroid is treated and discharged in an accepted manner.

B-17 and the envisioned B-18 could pose a limited potential for ground water impairment in Fairview Valley from infiltration of munitions residues if there were such residues in sufficient quantities. There are *no* data which would indicate that such residues are present in sufficient quantities to infiltrate and to impair the ground water. Limited available data indicate that the static water level is 200 to 300 feet below land surface. As a result, any contaminants which might be present would have to traverse an extensive unsaturated zone before reaching the zone of saturation; and the possibility of any contaminants reaching the zone of saturation is extremely slight. There is also some indication of low permeability confining beds above the producing aquifer zones which would further mitigate against resource impairment. However, the lateral extent and continuity of the confining layers are unknown. Withdrawal of lands for the safety and noise buffer zones adjacent to B-17 which are a part of the proposed Master Land Withdrawal will not increase the probability for contamination because the size of the target impact areas will not change.

There is no known impairment of water resources due to use of the proposed Shoal Sites withdrawal.

B-19 could impair water sources if there were munitions residues in sufficient quantities; but the conditions at B-19 are similar to the conditions at B-17; and the possibility of any contamination occurring even if sufficient residues were present is extremely slight. Withdrawal of the lands for the proposed safety and noise buffer zones adjacent to B-19 which are part of the proposed Master Land Withdrawal would not increase the probability for contamination because the size of the target impact areas will not change. Loss of public access to developable ground water lying directly beneath these withdrawals would occur, but the volume of water affected would be small.

3.9.5 SUMMARY

3.9.5.1 Current Activities

The diversion and use of water at NAS Fallon and FRTC amounts to approximately 8,316 AFY. Water used to irrigate the green belt of cultivated lands surrounding the airfield which provides aviator and aircraft protection against FOD, dust, and fire is Newlands Reclamation Project irrigation water. Since the Station does not use its total allocation, water savings are provided throughout the area.

A more direct effect of water use on NAS Fallon is related to water quality. While data are not available to determine the amount or extent of water contamination resulting from water use at the station, properly treated waste water, agriculture drainage, and surface run-off continue to be discharged to irrigation canals which eventually transport the water contaminants to the Stillwater marshes.

3.9.5.2 Year 2000 Activities

In year 2000 the level of some Navy effects is expected to increase, but others should be alleviated. Issues related to water quality should be reduced as the Navy continues with the IRP to remediate contaminant sites.

Overall, the Navy does not anticipate an increase in levels of training activities that would increase their water use. However, as water use in the region continues to expand and change, the Navy's water use and water rights will become more significant. A particular area of concern may well be with the joint use of the basalt aquifer. Another area of concern may be the water rights held in Dixie Valley. The Navy's land acquisition included water rights to ensure that additional individuals would not obtain them and reside in Dixie Valley beneath the area in which supersonic flight is authorized.

3.10 SUMMARY

This chapter has identified effects and possible effects resulting from activities associated with the mission of NAS Fallon and FRTC. Those effects are summarized in Chapter 8 as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of those effects is described in Chapter 9.

CHAPTER 4

HAWTHORNE ARMY AMMUNITION PLANT

4.1 EXISTING, PROPOSED, AND ENVISIONED ACTIVITIES

4.1.1 OVERVIEW

In 1928 the U.S. Navy began building an ammunition and processing facility known as the Hawthorne Naval Ammunition Depot. The Hawthorne location was chosen after an ammunition plant explosion in New Jersey in 1926, when the decision was made to construct a plant in a less populated area closer to the West Coast. When the United States entered World War II, the Depot became the staging area for bombs, rockets, and ammunition for almost the entire war effort. It also served as an important ammunition center during the Korean War and the Vietnam conflict with several thousand structures on 236 square miles of land. In October 1977, the Depot was turned over to the Army and the name was changed to Hawthorne Army Ammunition Plant (HWAAP). In December 1980, HWAAP became a government-owned, contractor-operated facility.

4.1.2 LOCATION OF EXISTING ACTIVITIES

Figure 4.1 shows the location of HWAAP and Special Use Airspace (the Controlled Firing Area within HWAAP boundaries and Restricted Area R-4811).

4.1.2.1 Land

HWAAP is located in the Walker Lake Valley of Mineral County in west-central Nevada. The town of Hawthorne (population 6,300) is surrounded on three sides by the HWAAP withdrawal. HWAAP encompasses 147,431 acres and includes the highest portion of the Wassuk Mountains (Mt. Grant, elevation 11,239 feet) to the west. Walker Lake and the Gillis Range are directly north and east, respectively, of HWAAP. The southern one-third of Walker Lake is located within the HWAAP boundaries (Source: U.S. Army, HWAAP, 1988). The land underlying the Controlled Firing Area (CFA) in the southeast corner of HWAAP is used for surface-to-surface ballistics testing of mortars and is currently being evaluated for changes to the withdrawal.

Land beneath Restricted Area R-4811 is leased from the U.S. Forest Service (USFS) and used periodically by HWAAP for munitions demolition. It has been used for emergency demolition since 1984 on a case-by-case approval from the State of Nevada. Major clean-up was completed in 1984 by the Army Technical Escort Teams and Explosive Ordnance Disposal Teams. Final clean-up was completed in 1986. An application for permit for open burning and open detonations expired March 31, 1985. Another permit for open burning and open detonation of waste explosives was submitted in November 1988 by the U.S. Army Corps of Engineers (COE).

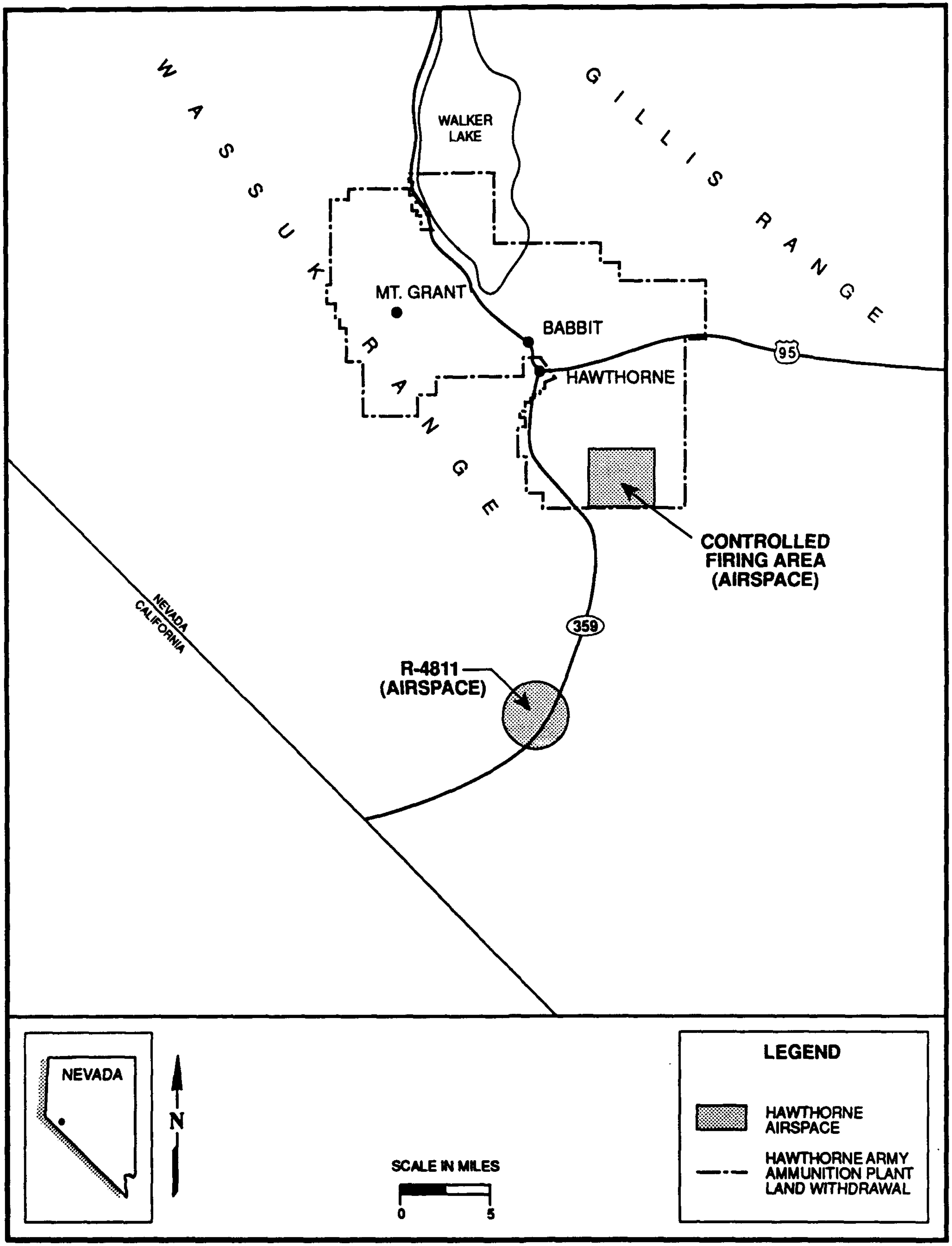


FIGURE 4.1 HAWTHORNE ARMY AMMUNITION PLANT, CONTROLLED FIRING AREA, AND RESTRICTED AREA 4811

4.1.2.2 Airspace

The Controlled Firing Area is designated Special Use Airspace, which does not restrict aircraft transit. A Notice to Airmen (NOTAM) is issued when surface-to-surface mortar ballistics tests are scheduled.

Restricted Area R-4811 is located approximately 25 miles south of the HWAAP reservation boundary. This 1.5 nautical mile radius cylinder of airspace is reserved from the surface to 15,000 feet mean sea level (MSL). The airspace is restricted because fragments from detonation of explosives can rise to 15,000 feet. No routine defense-related flying activity occurs within R-4811.

4.1.3 MISSION AND FACILITY DESCRIPTIONS

The mission of HWAAP is to serve as an ammunition depot; produce, assemble, test, and demilitarize munitions; maintain equipment; and provide tenant support. The demilitarization mission includes disposal of various small caliber ammunition and fuzes using a rotary furnace located near the southeast corner of Walker Lake. The only active testing program in 1989 is the use of an 81 mm and 60 mm mortar range underlying the Controlled Firing Area. A special demilitarization project to dispose of 3.5 million 20 mm rounds, unstable five-inch, 54 caliber propelling charges, and 28 sixteen-inch rounds was accomplished in fiscal year (FY) 89 at the site underlying Restricted Area R-4811. If other testing programs or regular disposal actions were to be implemented, local and Federal permits and authorizations would be required and obtained. There has been no regular open burning or detonation at HWAAP since the expiration of the State approved open burning and open detonation permit in 1985.

HWAAP supports three tenant activities. The U.S. Army Information Systems Command is responsible for tenant activities and for planning, installing, and operating communications and electronic systems for the plant. The Naval Undersea Warfare Engineering Station, Keyport Detachment, renovates, assembles, and maintains naval mines. Since 1987, the Naval Strike Warfare Center, Fallon Detachment, has been developing a no-drop bomb scoring system for night radar (47 watts) attack targets in simulated complex urban areas and score weapons delivery accuracy for the targets.

Other activities at HWAAP include a small arms range used for weapons qualification/familiarization by plant security force personnel and area national guard units. Additionally, HWAAP has completed construction of a mortar firing range for the testing of 60mm and 81mm mortar ammunition and a new surveillance workshop for inspection of all types of munitions.

HWAAP has 1,793 permanent, earth-covered munitions magazines and 97 permanent explosive storehouses, with a combined storage capability of approximately 92,250,000 cubic feet (Source: U.S. Army, COE, 1988). No chemical, biological, or radiological materials are handled. Various conventional, non-lethal chemical (smoke and incendiary) and riot control munitions are handled and stored at HWAAP. As of June 1988, storage utilization was 68 to 70 percent of capacity with 354,000 tons of ammunition on-site, approximately 38 percent of which is repairable and 10 percent is unusable. National Aeronautics and Space Administration (NASA) stock is stored along with Minuteman and Polaris missiles. A barbed wire fence surrounds HWAAP's storage area (Source: J. Wallace, HWAAP, personal communication, 1988).

Housing units at HWAAP consist of approximately 80 active and 50 inactive family units, and 16 active and 77 inactive dormitory units (Source: Facilities Engineering Department, HWAAP, 1981). Medical facilities include an inactive dental clinic and a medical clinic.

Fire protection is provided by 24 fire fighters stationed at 2 fire stations located on HWAAP. They are available 24 hours a day, 7 days a week. HWAAP's Fire Department has a Mutual Aid Agreement with the Hawthorne-Mineral County Fire Department.

4.1.4 INFRASTRUCTURE

Process steam and compressed air systems are located throughout the installation. Fuel oil for these plants is stored at HWAAP, which maintains a fuel supply reserve capacity of slightly less than 644,000 gallons. Many of the steam plants also generate steam for heating purposes. Some heating in the industrial area is provided by liquid petroleum (LP) gas, which is stored at HWAAP. HWAAP has no facilities that use natural or liquified natural gas. Electricity is supplied by Sierra Pacific Power Company, and HWAAP has 13 emergency generators.

HWAAP's sewer system has a 0.4 million gallons per day (mgd) capacity. The installation has 62 septic systems located throughout the complex. HWAAP's storm sewer system consists of 1,100 feet of underground piping with the remainder of the system consisting of open ditches. Storm water runoff empties into Walker Lake. HWAAP has a Mutual Aid Agreement with Mineral County for the construction, installation, maintenance, operation, and repair of a sanitary sewer and effluent bed on two parcels of HWAAP land.

A 53-acre sanitary landfill equipped with a double chamber incinerator is located at HWAAP. The landfill has been approved by the Nevada Division of Environmental Protection (NDEP).

The water supply system at HWAAP consists of catchment basins, four reservoirs, eight wells, and above-ground steel storage tanks. Water tanks have a total storage capacity of 380,000 gallons. HWAAP has an agreement with the town of Hawthorne to provide the installation with water in emergency situations, and vice-versa (Source: RMS Corporation, 1986).

4.1.5 PROPOSED AND ENVISIONED CHANGES

4.1.5.1 Base Closures and Realignment Effects

HWAAP's mission may incorporate realignment of conventional ammunition missions from three depot activities according to the Base Realignments and Closures, Report of the

Defense Secretary's Commission, December 1988. The closure of the Navajo Depot Activity (Arizona) would relocate the ammunition mission and a portion of the serviceable stocks to HWAAP. The closure of Fort Wingate Depot Activity (New Mexico) would relocate the ammunition mission and portions of the serviceable ammunition and components currently stored there to HWAAP. The realignment of Umatilla Depot Activity (Oregon) and Pueblo Army Depot (Colorado) would relocate the conventional ammunition mission and a portion of the serviceable ammunition stocks to HWAAP. No additional land withdrawals would accompany these consolidations within the current HWAAP mission. As part of the current mission activity, approximately 58,000 short tons of ammunition and explosives would be transferred to HWAAP from FY 90 through FY 95 (Source: U.S. Army, HWAAP Information, 1989). Employment is not anticipated to change as a result of these mission realignments at HWAAP.

4.1.5.2 Western Area Demilitarization Facility

Full operation of the Western Area Demilitarization Facility (WADF) would provide the capacity to safely demilitarize certain types of conventional ammunition. The facility was constructed at HWAAP under the supervision of the U.S. Navy and completed in 1984. Its operation at full capacity would accommodate 5,000 to 10,000 short tons of ammunition and explosives and employ 40 to 60 people. It would probably be operated by a contractor, under the staff supervision of the U.S. Army. The facility consists of 16 structures including a steam plant and administration/laboratory facility. The actual operating facilities are connected to a water treatment plant and controlled by remote, driverless cars for movement of ammunition stocks. Stocks can enter the facility via either motor or rail mode of transportation (Source: U.S. Army, HWAAP Information, 1989). Before the WADF could become operational, facilities would have to be significantly upgraded to meet air pollution emission requirements.

4.1.5.3 Combat Logistics Supply Center

The U.S. Navy has successfully evaluated the trial operation for a Combat Logistics Supply Center (CLSC) at HWAAP. The CLSC now supplies the Navy with nonexplosive items of equipment. The program uses 60,000 feet of available warehouse space and employs 10 people.

4.1.5.4 M252 Mortar Test Range

HWAAP is the site selected for the M252 Mortar Test Range. The range will be used to conduct ballistic test firing of 81MM M252 mortar ammunition in support of the Weapons Quality Engineering Center. The location of the range is entirely within the boundaries of HWAAP at the Old Bomb Disposal/Rocket Test Range. Ammunition will be checked for compliance with standard ballistic/firing tables for that type of ammunition by firing from a fixed mortar position toward a target.

Anticipated environmental impacts are expected to be minimal. No hazardous waste will be generated from this project and all incompatible use zones, as far as environmental noise is concerned, from ammunition firing and detonations will be entirely contained within the boundaries of HWAAP. Testing will not be conducted during adverse weather conditions or temperature inversions. The air pollution arising from the testing of high explosive and illuminating rounds will be primarily normal combustion by-products with no environmental impact. The major air pollutant from white phosphorous ammunition will be phosphorous pentoxide which will settle to the ground with minimal environmental impact.

There are no federally-listed endangered species known to exist within the proposed test area.

4.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from activities associated with HWAAP. Sources of potential effects and analysis of effects on public health and safety are identified.

4.2.1 GROUND MOTION

Activities related to HWAAP do not result in any significant ground motion.

4.2.2 AIR QUALITY

Construction and operation of facilities at HWAAP are conducted in compliance with the rules and regulations of the Nevada Division of Environmental Protection (NDEP). HWAAP has 43 air quality permits that specify the conditions under which each emission source may operate, including limits on process rate, operating hours, and specific emission control requirements (Source: Department of Agriculture, Nevada, 1988).

4.2.2.1 Sources of Potential Effects

Air pollutants from HWAAP originate from the following sources and activities: furnaces, incinerators, and flashing chambers; boilers; back-up power generators; fire training exercises; motor vehicle operations; fuel storage; concrete batch plant; aggregate crusher/conveyor; and intermittent operations (weapons firing, open munitions disposal).

With the exception of the WADF, the furnaces, incinerators, flashing chambers, boilers, and back-up power generators use diesel fuel. The annual consumption was 1,161,174 gallons in 1988 and 1,368,948 gallons in 1989.

The WADF uses three boilers fired by a choice of multifuels (diesel or coal with the primary fuel being diesel) for heat and process steam production. Coal is burned at the rate of 300 tons per boiler per month (Source: Day and Zimmerman, Basil Corporation, 1987).

Using emission factors for industrial boilers, from EPA Compilation of Air Pollutant Emission Factors, AP-42, Volume 42: Mobile Sources (Source: EPA, 1980), the following emission rates have been calculated for trucks and equipment at HWAAP:

Pollutant	Diesel Boilers	WADF Boilers
NO_x	11.6 tons/year	113.4 tons/year
CO	2.9 tons/year	3.2 tons/year
HC	0.1 tons/year	0.4 tons/year
SO_2	24.7 tons/year	2.6 tons/year
PM	1.2 tons/year	432.0 tons/year

Fire training exercises are conducted a few times per year and result in negligible emissions on an annual basis. Emissions from motor vehicle operations and fuel storage have not been quantified, but can be approximated by comparing the number of HWAAP employees to the number of employees at Nellis Air Force Base (AFB), for which a detailed emission inventory is available (Section 2.2.2). The 916 personnel employment level at HWAAP (Source: RMS Corporation, 1986) is approximately 6 percent of the estimated 15,000 personnel at Nellis AFB (Source: U.S. Air Force, Mission of TFWC, 1988e), so the estimated emission rates for motor vehicle operations and fuel storage are assumed to be correspondingly low at HWAAP.

The concrete batch plant and aggregate crushing/conveying operations are used to support HWAAP only, so the particulate emissions from these sources are minimal on an annual basis. The other intermittent sources of air pollution include mortar test firing and munitions detonation for testing and disposal (Source: Day and Zimmerman, Basil Corporation, 1987). Emissions from these sources have not been quantified, but are expected to be small on an annual basis.

Under current projections to the year 2000, HWAAP is not expected to exceed growth of more than 5 percent. No new construction is anticipated, except for a modernized truck lot due to other base closures. Future activities at HWAAP are expected to produce a very minor and insignificant increase in air emissions.

4.2.2.2 Analysis of Effects

The Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) at levels that are designed to protect public health and safety with an adequate margin of safety (Table 1-4, Section 1.4.1.2). Air pollutants from HWAAP facilities are in compliance with their air permits (Source: J. Brandmueller, NDEP, personal communication, 1990). Furthermore, they are distributed throughout the withdrawn area, thus contributing to dispersion of the pollutants. The surrounding region is currently in compliance with the NAAQS, and no public health and safety effects are evident from HWAAP activities.

4.2.3 WATER QUALITY AND FLOOD HAZARD

Studies and monitoring of hazardous and toxic waste at HWAAP are continuing under provisions of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

4.2.3.1 Sources of Potential Effects

A 1988 ground water contamination survey at HWAAP identified 82 potential hazardous waste disposal sites, 42 of which were selected for additional study or initial remedial action (Source: U.S. Army, 1988). The potential for contamination is the result of past waste disposal practices at HWAAP. Principal chemical compounds in munitions that are currently controlled as hazardous or toxic waste are ammonium picrate (Compound D), trinitrotoluene (TNT), cyclotrimethylene-trinitramine (RDX), sodium sulfide, sodium hydroxide, dimethyl hydrazine, and nitric acid. No direct action has been undertaken to remediate potential hazardous and toxic waste contamination of ground water. Waste management practices have been implemented to prevent exacerbation of the existing level of ground water contamination.

Flood hazard to public health and safety resulting from HWAAP is related primarily to floods generated by precipitation in the surrounding mountains. HWAAP has constructed drainage facilities that may put the town of Hawthorne at greater risk than if the drainage facilities did not exist. There is also a potential for floods originating either off or on HWAAP to transport hazardous and toxic wastes to Walker Lake. Waste water is generated at HWAAP, and lagoons for the treatment of the waste water generated at HWAAP and the town of Hawthorne are located on withdrawn lands.

4.2.3.2 Analysis of Effects

Ground Water Quality

The Walker Lake basin is bounded by high mountains and the valley is filled with alluvial materials to depths of over 1,000 feet. Ground water recharge occurs from precipitation on the surrounding mountains. In the Hawthorne area, most of the recharge is believed to occur from or along the Wassuk Range. Under natural conditions, ground water flow is generally from the mountain ranges toward the north-south axis of the valley and then northwestward toward Walker Lake along the valley axis. A 1974 study by the U.S. Geological Survey showed that the natural flow pattern has been altered by ground water pumpage in the vicinity of HWAAP and the town of Hawthorne. Natural ground water quality in the area is strongly influenced by geothermal conditions to the northwest of Hawthorne and HWAAP.

Figure 4.2 shows the direction of ground water flow and hazardous waste sites related to HWAAP. Of the 42 potential hazardous waste sites selected by the Army for additional investigation or initial remedial action, 11 sites are in two areas upgradient of major ground water pumpage: 1 is approximately five miles east of Hawthorne, and 10 are approximately 16 miles to the south-southeast of Hawthorne. The remaining 31 sites are to the north of Hawthorne and currently down gradient from the major pumping area. Natural ground water flow from these sites is toward Walker Lake.

Demilitarization activities and the discharge of explosive wastes at HWAAP since the 1930's have had a cumulative effect on ground water contamination. Principal chemical

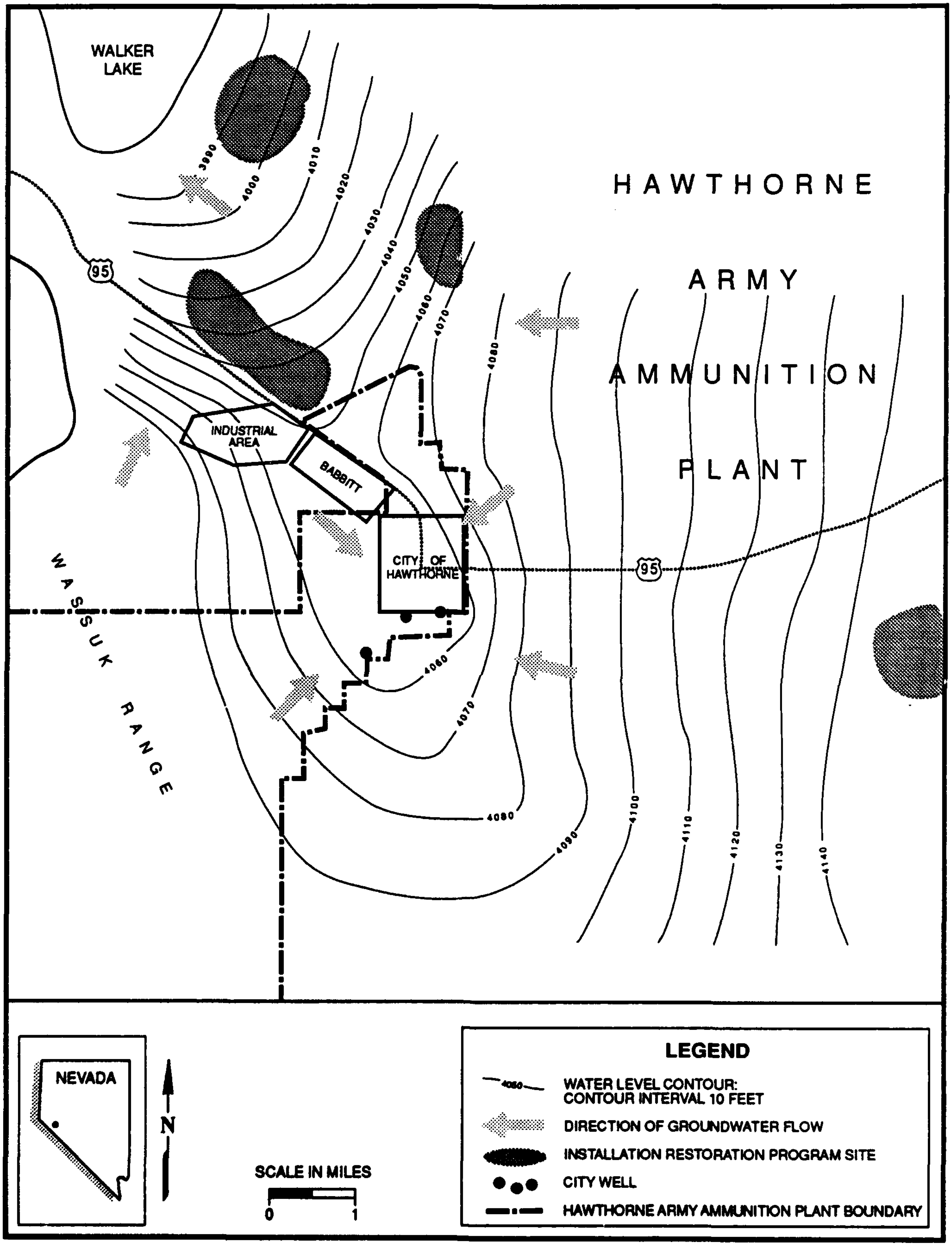


FIGURE 4.2 HAWTHORNE ARMY AMMUNITION PLANT - GROUNDWATER FLOW AND HAZARDOUS WASTE SITES

compounds in the munitions wastes include Composition D, TNT, RDX, and lesser amounts of sodium sulfide, sodium hydroxide, dimethyl hydrazine, and nitric acid, plus a variety of organic and inorganic products of the chemical reactions between TNT, RDX, and the two sodium compounds. These materials, some of which are now controlled as hazardous and toxic wastes, were historically discharged into unlined ditches and infiltration basins where they infiltrated to the alluvial materials and the shallow ground water.

In 1976, the U.S. Geological Service (USGS) began to study the extent of ground water contamination associated with HWAAP. From 1976 through 1981, 37 shallow ground water-monitoring and sampling wells were drilled by USGS and the Army Toxic and Hazardous Materials Agency. These wells were in the area north of Hawthorne, extending into the south end of Walker Lake. On the basis of USGS sampling and chemical analysis, a plume of potentially contaminated shallow ground water was delineated by USGS and is shown in Figure 4.3. The most widespread contaminant found was total nitrogen, which ranged in concentration from 40 to 130 milligrams per liter (mg/l). The dominant nitrogen species was nitrate, for which the National Interim Drinking Water Standard is 10 mg/l. TNT was the only hazardous compound detected in the shallow ground water. The maximum concentration of TNT measured was 430 parts per billion (ppb); the U.S. Army's proposed drinking water standard for TNT is 44 ppb. The migration rate for TNT was found to be significantly less than the migration rates of nitrogen species (NO_3 and NO_2) and other contaminants; the highest concentrations of TNT were found adjacent to the disposal pits and decreased essentially to zero 3,200 feet downgradient.

For all contaminants, the greatest concentrations were detected in the area of shallow (20 feet or less) ground water table at the northerly portion of the USGS study area. Further to the south, where the water table approaches a depth of 100 feet or more, lower concentrations of both nitrogen and TNT were detected. The USGS concluded that the contaminants may be stored in the sediments overlying the water table.

Water and sediment samples were collected by the Army from the southern end of Walker Lake in 1978. The water samples had no detectable TNT, although 2 of 12 sediment samples had concentrations ranging from 5 to 200 ppb. These concentrations may result from test firings into Walker Lake, rather than from ground water discharge (Source: U.S. Army Toxic and Hazardous Materials Agency, 1981). The U.S. Army Toxic and Hazardous Materials Agency concluded that no public health or safety problem was created by the observed contamination in either ground water or Walker Lake. The conclusion regarding ground water was based on the fact that the contaminated water is not currently pumped for domestic supply nor does the plume appear to be moving toward the area of major domestic pumpage. The conclusion regarding Walker Lake was based on the limited number of contaminated sediment samples and the assumption that TNT would remain largely tied up in the sediments; and that the large dilution effect of Walker Lake would reduce concentrations to near-zero levels if TNT reached the water.

These conclusions notwithstanding, concern over the contamination has continued. Active ground water monitoring is being conducted and additional studies are being implemented. HWAAP will work with the NDEP on implementation of further IRP studies

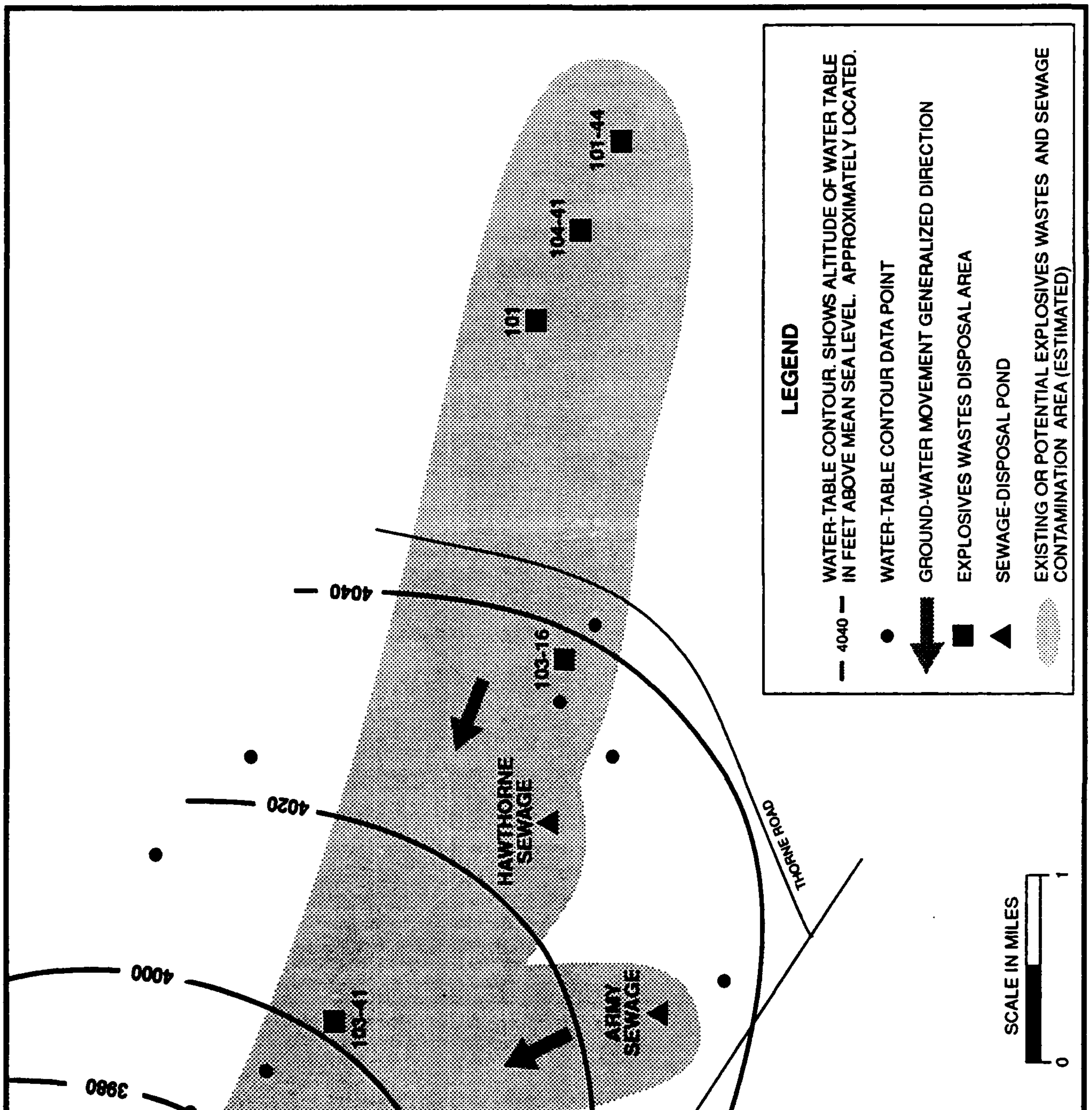


FIGURE 4.3 HAWTHORNE ARMY AMMUNITION PLANT - POTENTIAL GROUNDWATER CONTAMINATION PLUME

and on remediation actions that may be indicated by those studies or included in the RCRApermit to be issued by NDEP. Waste management practices have been changed to prevent exacerbation of the existing level of shallow ground water contamination. The potential for future effects on public health and safety is uncertain because contaminant migration depends, in part, on the extent of ground water pumpage. The most recent hydrologic investigation of the entire southern Walker Lake basin was completed in the mid-1970's (USGS) and indicated a significant cone of depression in the vicinity of major ground water pumpage. If the town of Hawthorne experiences the nearly 20 percent growth projected for year 2000, the suitability of its water supply could be jeopardized if ground water contamination spreads into areas of major ground water pumpage.

Floods and Surface Water Runoff

There are four issues related to flooding and surface water runoff: 1) the effect of HWAAP and its drainage facilities on off-site public health and safety; 2) the potential for the transport of surface contaminants from HWAAP to areas where they may endanger public health and safety; 3) the potential for the uncovering, transport, and dispersal of buried hazardous and toxic wastes to areas where they may impair a public water supply or endanger public health and safety; and 4) the potential for transport of surface contaminants and other materials off-site to areas where they may impair a public water supply or endanger public health and safety. Each of these issues is addressed in this section.

First, drainage facilities protecting HWAAP may have inadvertently put the town of Hawthorne at greater risk than it would be if the drainage facilities did not exist (Sources: Federal Emergency Management Agency (FEMA), 1983 and maps; FEMA, 1984). Flood flows on the alluvial fan on which the town of Hawthorne is located are artificially constrained on the southern side by a levee constructed to protect HWAAP facilities. In particular, the HWAAP levee that limits the width of the alluvial fan on which the town of Hawthorne is located may increase the risk of physical and material damage from flooding and the cost of living in the portion of Hawthorne generally west of 5th Street, due to the requirement for flood insurance.

The potential effect on public health and safety of other levees constructed to protect HWAAP cannot be evaluated on the basis of existing studies. Most of the levees constructed to protect HWAAP were built without the benefit of a master drainage plan, and may exacerbate existing, natural drainage problems.

Second, there is not sufficient information available to conclude that contaminants from HWAAP could not be transported off-site by flooding, to a location where they may impair a public water supply or public health and safety. The critical facilities at HWAAP appear to be adequately protected from the 100-year flood event (Source: Woodward-Clyde, 1985), although the methodology used to reach this conclusion is unknown.

Third, available studies preclude any conclusion regarding the potential for risk to public health and safety emanating from waste buried at HWAAP in the historic past. While the release of buried contaminants to the ground water system has been considered

(Source: U.S. Army, 1988), the potential release and dispersion of these contaminants by surface water has not been considered in previous studies.

Fourth, there is a potential for contaminants and munitions by-products resulting from activities conducted beneath Restricted Area R-4811 to be transported by surface water to a location where they may impair either a public water supply or public health and safety. This potential hazard, however, has not been addressed in previous studies. The potential for the transport of contaminants from the Small Arms Range to Walker Lake by surface runoff or flooding has not been addressed in previous studies.

Waste Water Treatment and Disposal. Waste water generated on HWAAP and from the town of Hawthorne is collected and treated in separate lagoons located on HWAAP. The waste water treatment and disposal facility meets NDEP standards. However, the waste discharge may contribute to local shallow ground water contamination, as indicated in Figure 4.3.

4.2.4 IONIZING RADIATION

Activities associated with HWAAP do not result in ionizing radiation.

4.2.5 NON-IONIZING RADIATION

Electromagnetic radiation hazards discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible (light) radiation. Systems producing RF/microwave radiation include radio and television transmitters, microwave ovens, radar systems, microwave communication systems, sterilization systems used for medical supplies, welding equipment, and medical equipment. Microwave ovens, sterilizing equipment, welding equipment, and medical equipment are not considered further in this section because of their very low potential hazard to the public due to low emission levels or stringent emission controls.

Laser radiation hazards discussed in this section refer only to those hazards that can potentially affect the general public. Lasers are used in navigation and target designation by the military. These devices are capable of delivering sufficient energy or power in the beam of light to damage the human eye or burn the skin. They are generally not considered lethal. The major concern is associated with the human eye where retinal damage can occur. The power levels required to cause injury to the skin are quite high, at least several watts-per-square-centimeter.

HWAAP operates under the Department of Defense (DOD) Instruction 6055.11 for protection of persons from radio frequency radiation (RFR) exposure which lists permissible exposure limits for unrestricted areas. Army Technical Manual FM 11-490-30 (Source: U.S. Army, 1981), "Electromagnetic Radiation Hazards," lists recommendations for the control of other electromagnetic hazards.

4.2.5.1 Sources of Potential Effects

Potential sources of RFR emissions consist of a few on-site radar systems and communication systems. Lasers are not used in HWAAP-related activities.

4.2.5.2 Analysis of Effects

Radar systems operated in compliance with DOD instruction 6055.11 will ensure that the public is not exposed to health and safety hazards from RFR emissions. The public, local agencies, and private enterprise may experience some electromagnetic interference from DOD RFR emitters.

4.2.6 SOLID AND HAZARDOUS WASTE

Activities at HWAAP are governed under RCRA Part A Interim Status Permit. A RCRA Part B Permit Application that functions as the HWAAP hazardous waste management plan has been submitted to the State of Nevada for approval. The RCRA Part B Application addresses waste analysis, preventive procedures, structure and equipment, precautions to prevent ignition or reaction of ignitable or reactive waste, inspection, security, training, contingency plan, and closure plan. The Part B Application is intended to cover full-scale operation of the plant, and addresses all waste management facilities of HWAAP. Facilities can be classified into four generic categories: 1) impoundments; 2) incinerators; 3) tanks; and 4) container storage. Only incinerators and container storage facilities are *involved in current operations* at HWAAP.

Non-hazardous solid wastes are disposed of in a sanitary landfill, which occupies approximately 40 acres within a 53-acre site at HWAAP. The landfill has been approved by the NDEP (Source: RMS Corporation, 1986).

4.2.6.1 Sources of Potential Effects

Current sources of hazardous waste at HWAAP are the maintenance shops located in the main-base industrial area and the disposal activities that occur in the WADF. Hazardous wastes may also be generated by the sporadic munitions renovation projects that occur in the production area of HWAAP or WADF. Unstable explosives in munitions storage are also considered to be hazardous waste by RCRA definition.

Wastes generated in the base maintenance shops include spent solvents, paint, thinners, and recyclable petroleum products. Container storage buildings are used to temporarily store this waste as well as those generated by ammunition renovation activities. The wastes are disposed of by shipping to an EPA-approved off-site treatment, storage, or disposal facility.

4.2.6.2 Analysis of Effects

All activities at HWAAP are governed by the procedures specified in the RCRA Part B Permit Application (Operation Plan). Adherence to the Operation Plan will ensure that hazardous wastes are handled and disposed of in an environmentally acceptable manner, thus minimizing the potential for offsite effects of HWAAP activities.

In 1987, the U.S. Army Environmental Hygiene Agency (AEHA) conducted an investigation of 82 sites that were considered to be potential sources of ground water contamination (Section 4.2.3). A follow-up inspection, which included representatives of the EPA and the State of Nevada, was conducted in 1988. It was recommended that 42 of these sites receive additional environmental investigations and initial remedial action. The recommended investigations will determine the extent to which public health and safety has been, or may be, affected.

4.2.7 NOISE AND SONIC BOOM

The Army has no standard noise abatement procedures that apply to HWAAP, although the overall procedures for the demilitarization of stock pile ordnance and ammunition serve to suppress noise emissions. These procedures include the burying of charges in pits and covering them with earth before detonation in remote areas, and the use of a demilitarization furnace. HWAAP is not under an area of supersonic flight activity and is not exposed to sonic booms.

4.2.7.1 Sources of Potential Effects

Major sources of noise at HWAAP consist of mortar testing at the Controlled Firing Area, gun shots at the small arms range, and the demolition of stock pile ordnance and ammunition. The locations of these activities, and the L_{Cdn} 65 dB contour for the Controlled Firing Area, are shown on Figure 4.4. Routine disposal of armaments by open burning has been halted at HWAAP. In the future, however, HWAAP may be periodically allowed by the State of Nevada to dispose of certain munitions by open burning.

4.2.7.2 Analysis of Effects

To estimate the noise associated with mortar fire at the Controlled Firing Area, the U.S. Army PEAKEST computer model was used (Source: USA-CERL, not dated). The PEAKEST model estimates the flat-weighted peak noise levels produced from surface and buried charges, and was developed by the Army COE, Army Construction Engineering Research Laboratory. Peak sound pressure levels were converted to C-weighted sound exposure levels (SEL_c) using factors cited by the American National Standards Institute (ANSI) "Method For Assessment Of High-Energy Impulsive Sounds With Respect To Residential Communities." (Source: Bolt, Berenek and Newman, Inc., 1978). The methods cited were used to estimate the reduction of sound levels with distance.

Approximately 45 rounds of mortar shells are delivered per day in the Controlled Firing Area. The shells are comprised of approximately three pounds of Composition D explosives. The PEAKEST model estimated peak noise levels to be 140 dB at a distance of 1,000 feet, equivalent to SEL_c of 120 dB at 1,000 feet. The L_{Cdn} 65 dB contour is estimated to occur at 2.09 miles (11,027 feet) from the Controlled Firing Area, as shown on Figure 4.4.

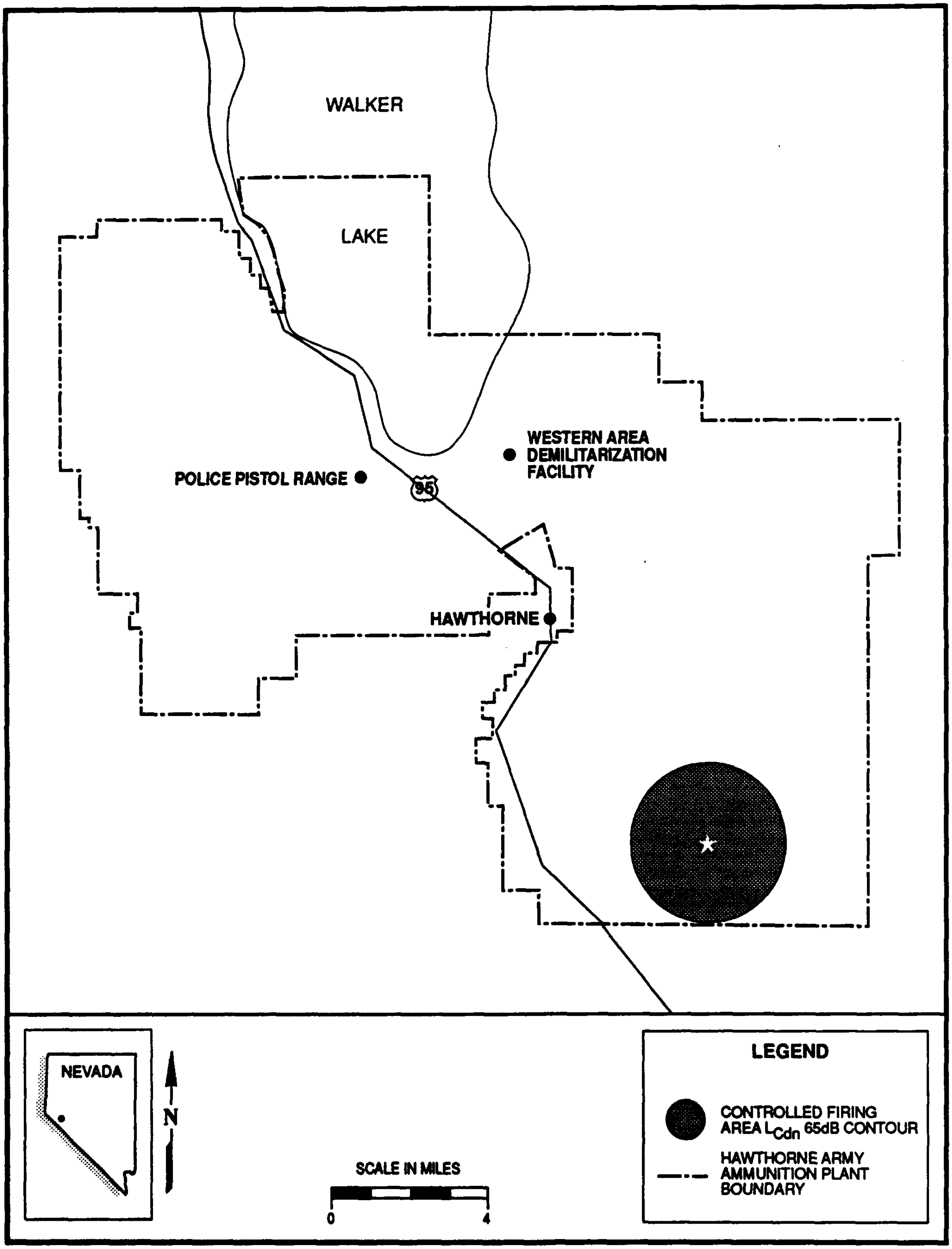


FIGURE 4.4 HAWTHORNE ARMY AMMUNITION PLANT CONTROLLED FIRING AREA L_{Cdn} 65 dB NOISE CONTOURS

Disposal of large munitions may be permitted by the State of Nevada. The noise from disposal of one 16 inch shell in a single day was calculated. A 16 inch shell is estimated to use approximately 142 pounds of Composition D, detonated by a 40 pound shaped charge. The standard procedure is to bury the shaped charge and 16 inch shell under four feet of earth. The estimated peak noise level of a 16 inch shell disposal is 139 dB at a distance of 1,000 feet, equivalent to SEL_c of 113 dB at 1,000 feet. The L_{Cdn} 65 dB contour is estimated to occur at 851 feet.

HWAAP has received authorization from the State of Nevada to dispose of 3.2 million 20 mm shells. The disposal method consists of burying approximately 68 boxes containing up to 180 cartridges per box at a depth of 6 to 8 feet, adding 1,100 pounds of TNT as a detonator. No more than six of these charges will be detonated in one day. The estimated peak sound pressure level of one charge is 150 dB at 1,000 feet, equivalent to SEL_c of 124 dB. Assuming six charges a day, the L_{Cdn} 65 dB contour would occur at a distance of 1.4 miles (7,413 feet) from the disposal area. Disposal of the 16 inch shells and 20 mm shells would occur at Restricted Area R-4811.

Noise levels from the disposal of munitions in furnaces at the Western Area Demilitarization Facility are not available. Because of the remote locations of this facility, munitions disposal noise levels are not likely to be detectable by the general public.

4.2.8 FACILITY ACCIDENTS

The basic explosive safety requirements and procedures are outlined in Army Material Command Regulation (AMCR) 385-100, which implements the DOD Ammunition and Explosives Safety Standards (Source: DOD, 1984).

Site-specific requirements and procedures are included in the HWAAP "Accident Prevention Program" directive. Specific requirements and procedures relative to the safe storage of hazardous materials (HAZMAT) at HWAAP are prescribed in AMCR 385-100 and the HWAAP "Accident Prevention Program." The U.S. Army has adopted all applicable standards promulgated under the Occupational Safety and Health Act relative to HAZMAT storage.

4.2.8.1 Sources of Potential Effects

Munitions Handling and Storage

Munitions-related activities at HWAAP can be grouped in four general categories: shipping and receiving; load, assembly, and packaging; demilitarization and disposal; and storage.

Munitions are shipped to and from HWAAP via rail and truck. HWAAP includes an extensive railway system that allows direct delivery to most operational facilities. Six loading docks are strategically located for this purpose. These docks can be used to load and unload trucks. A truck inspection station is provided for required inspections of all munitions trucks entering or leaving the facility.

The load, assembly, and packaging operations are located in the production area of the installation, north of U.S. Highway 95. These operations are being conducted on a minor scale that involves inserting explosive components into a fuse. The major munitions demilitarization and disposal activities are performed in the WADF located in northwest corner of the installation, near Walker Lake, and in open demolition areas in the southern portion of the installation.

Most of the remaining area that comprises HWAAP is dedicated to the storage of various types of munitions, propellants, and other explosives. The plant maintains almost 2,000 explosive storage facilities; the vast majority of these are permanent-type earth-covered magazines. The rest of the facilities (approximately 100) are permanent-type explosives storehouses (Sources: RMS Corporation, 1986; William McRaney, personal communication, 1989).

Fuel Storage

Diesel fuel is stored at seven primary sites at HWAAP, with a total capacity of 513,000 gallons. There are two main stations for receiving and storing gasoline at HWAAP with a total capacity of 56,000 gallons. The primary liquid petroleum (LP) gas receiving point is the Babbit tank farm, which consists of five, 30,000-gallon tanks for a total storage capacity of 150,000 gallons. In addition, there are 53 LP gas tanks of capacity ranging from 50 to 1,150 gallons at different locations on HWAAP.

Hazardous Material Bulk Storage

Large quantities of HAZMAT, other than explosives, are not maintained at the installation, pursuant to the HWAAP Accident Prevention Program Manual. HAZMAT (solvents, paints, thinners, etc.) ordered for use at HWAAP are received by Base Supply Shipping and Receiving in the Industrial Area, which transfers the material to one of three bulk storage locations. All of these bulk storage sites are converted above-ground munitions storage magazines constructed of reinforced concrete. The materials are issued from these storage sites (normally a one-day need) to various users.

4.2.8.2 Analysis of Effects

Munitions Handling and Storage

Compliance with the Explosive Safety Quantity-Distance (ESQD) requirements of the DOD Ammunition and Explosives Safety Standards (DOD 6055.9-STD), as implemented in AMCR 385-100, ensures that the general public is protected in the event of a catastrophic explosives mishap at HWAAP. Compliance with these requirements is routinely checked during inspections and surveys conducted by the HWAAP safety staff, higher-level U.S. Army safety officials and the DOD Explosives Safety Board. No ESQD compliance deficiencies were observed during the 1989 evaluation by the DOD Explosives Safety Board.

The effectiveness of the HWAAP Explosives Safety Program is demonstrated by an impressive safety record. Only three serious ordnance-related mishaps have occurred since

1971, none of which have resulted in off-site (public) property damage or injuries. The last event was in 1989 when propellant charges stored in earth covered igloos spontaneously ignited. There was fire damage to the igloos, but not personnel injuries.

Based on demonstrated compliance with applicable explosive safety standards and the excellent safety record, current munitions handling and storage operations at HWAAP do not affect public safety and health. Continued operations in compliance with applicable explosives safety standards will ensure that public health and safety is not affected by munitions handling and storage in the future.

Fuel Storage

No fuel storage sites were considered to be potential sources of ground water contamination during a 1987 survey of HWAAP conducted by the AEHA. Therefore, current fuel storage operations do not affect public health and safety. Implementation of the procedures outlined in the Contingency Plan contained in the RCRA Part B Permit Application should effectively minimize on-site and off-site effect of an accidental major spill. Effective maintenance and leak testing of the existing storage tanks will ensure that public health and safety are not affected by fuel storage at HWAAP in the future.

Hazardous Material Bulk Storage

All HAZMAT storage sites are inspected at least annually. There are no outstanding deficiencies that might affect public health and safety. Continued operation in compliance with applicable standards and HWAAP policy to limit the quantity of HAZMAT stored on the installation to the absolute minimum will ensure that public health and safety is not affected by HAZMAT storage at HWAAP in the future.

4.2.9 AIRCRAFT MISHAPS

Activities associated with HWAAP do not involve the use of aircraft.

4.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

Activities associated with HWAAP do not involve the use of aircraft. Therefore, the potential for objects and armaments to be dropped accidentally from aircraft does not exist.

4.3 EFFECTS OF PUBLIC AND PRIVATE PROPERTY

This section describes effects on public and private property from activities associated with HWAAP. Topics addressed in this section include employment and other economic effects, population, housing, community services, public finance, and land uses. The measurable effects on public and private property occur in Mineral County.

4.3.1 ECONOMIC AND DEMOGRAPHIC EFFECTS

Indicators of economic and demographic effects for Mineral County in 1988 and forecasts of effects in the year 2000 are specified in Table 4-1.

4.3.1.1 Employment, 1988

HWAAP is the single largest employer in Mineral County, with over 23 percent (almost 850 jobs) resulting from direct employment at HWAAP. When secondary employment (an estimated 290 jobs) is added to direct employment, approximately 32 percent of all employment in the county is the result of HWAAP activities.

4.3.1.2 Gross Regional Product and Personal Disposable Income, 1988

Purchases associated with HWAAP contributed almost 22 percent of the gross regional product (GRP), or $28 million to Mineral County in 1988. Activities associated with HWAAP contributed 21 percent of all personal disposable income (PDI), or $17 million, available to the residents of Mineral County in 1988.

4.3.1.3 Population, 1988

Almost one-fourth of Mineral County residents are direct employees at HWAAP and their dependents. When the secondary population is considered, more than 32 percent of the residents (2,030 persons) are estimated to result from direct and secondary employment generated by HWAAP.

4.3.1.4 School-Age Population, 1988

The direct school-age population, ages 6 through 17 (230 persons), is estimated to account for almost 20 percent of public school enrollment in the county, assuming all of the school-age population were enrolled in public schools. When school-age dependents of indirect workers are considered and if all the dependents were enrolled in public schools, over 26 percent of school enrollment is represented by dependents of HWAAP-induced workers in the county.

4.3.1.5 Economic and Demographic Effects, 2000

Comparison of total employment and total population in Mineral County in 1988 and 2000 (Table 4-1) indicates that employment and population are forecast to increase between 1988 and 2000. Direct employment at HWAAP is expected to increase slightly, while the population related to this employment is forecast to decrease slightly. Indirect employment and population are forecast to decline between 1988 and 2000. Employment and population generated by HWAAP activities are forecast to represent smaller percentages of total employment and population in 2000 than in 1988 because of general employment and population growth in the county. Nevertheless, HWAAP activities are forecast to remain a substantial contributor to county employment, with more than 21 percent of employment

Table 4-1. Indicators of Economic and Demographic Effects in Mineral County Attributable to Hawthorne Army Ammunition Plant, 1988 and 2000.

	1988	2000
Total Employment in Mineral County[1]	3,570	5,220
Total Population in Mineral County	6,290	7,640
Employment From Withdrawals		
Direct Military	10	10
Direct Non-military	840	930
Total Direct Employment	850	940
Percent of County Total	23.8	18.1
Indirect Employment	290	170
Total Employment	1,140	1,120
Percent of County Total	32.0	21.4
Gross Regional Product (millions)	$28	$36
Percent of County GRP	21.7	17.0
Personal Disposable Income (millions)	$17	$28
Percent of County PDI	21.0	20.5
Population From Withdrawals		
Direct Military and Dependents	30	30
Non-military and Dependents	1,480	1,370
Total Direct Population	1,510	1,400
Percent of County Total	24.0	18.3
Indirect Population	520	250
Total Population	2,030	1,650
Percent of County Total	32.2	21.6
School-Age Population		
Direct Military	5	5
Direct Non-military	225	205
Total Direct School-age	230	210
Percent of District Enrollment	19.6	14.9
Indirect School-age	80	40
Total School-age Population	310	250
Percent of District Enrollment	26.2	17.6

[1]Full and part-time employment (jobs) by place of residence.

attributable directly or indirectly to these activities. Similarly, almost 22 percent of the population in 2000 is forecast to result directly or indirectly from HWAAP activities.

By 2000, HWAAP activities are forecast to add $36 million to GRP of Mineral County, which represents almost 17 percent of total GRP in the county. Projections of PDI for the year 2000 indicate that $28 million could be added to Mineral County PDI by HWAAP activities, which represents almost 21 percent of all PDI in the county.

The school-age population comprised of dependents of direct HWAAP workers is estimated to decline slightly from 1988 by 2000. The percentage of county enrollment represented by this population is forecast to decline from almost 20 percent in 1988 to approximately 15 percent in 2000, because of increased public school enrollment in the Mineral County School District. When the indirect population, age 6 through 17, is considered in 2000, nearly 18 percent of enrollments would be represented by dependents of direct and indirect workers.

4.3.1.6 Economic Effects of Alternative Land Use

Table 4-2 compares economic and population indicators resulting in the year 2000 from continuing the HWAAP land withdrawal and use of the land for other purposes. Mining and grazing were considered reasonable alternative uses for the withdrawn lands. Total employment in Mineral County would be substantially smaller under alternative uses. GRP could be about $37 million less under alternative land use, and total PDI could be approximately $30 million less under alternative land use.

4.3.2 HOUSING

In July 1989, there were slightly more than 2,800 residential housing units in Mineral County (Source: Shari McPherson, Mineral County Assessor's Office, personal communication, 1989). This estimate does not include residential housing owned by American Indian people in the county. County-wide, approximately 47 percent of all residences (1,322 units) are single-family dwellings and 37 percent (1,027) are mobile homes. Approximately 87 percent (2,438 residences) of the 2,800 units are located in the town of Hawthorne.

The total number of housing units in which direct employees of HWAAP and their dependents reside may be estimated. Persons per household is estimated by dividing the population of Mineral County in 1988 (Table 4-1) by the number of residences in the county, resulting in an estimate of 2.25 persons per housing unit. Dividing the direct population associated with HWAAP (1,510) by the estimated persons per housing unit (2.25) results in an estimate of the number of residences maintained by HWAAP employees. Approximately 670 housing units in Mineral County are maintained by HWAAP employees and their dependents, which is 24 percent of the total number of residential units. If one

Table 4-2. Projected Indicators of Economic and Demographic Effects in Mineral County Attributable to HWAAP and Alternative Land Use, 2000.

	HWAAP	Alternative Use	Difference	Percent Difference
Total Employment[1]	5,220	4,140	(1,080)	(20.7)
Direct Employment	940	25	(915)	(97.3)
Indirect Employment	170	5	(165)	(97.1)
Total	1,110	30		
Percent of County Total	21.5	0.67		
Population	7,640	7,030	(610)	(8.0)
Gross Regional Product (millions)	$209	$172	($37)	(17.7)
Personal Disposable Income (millions)	$139	$109	($30)	(21.6)

[1] Full and part-time employment (jobs) by place of residence.

assumes that all of the employees of HWAAP and their dependents reside in Hawthorne, which has 2,438 residences, they would maintain approximately 27 percent of all housing in the city.

The government owned housing at Babbitt has been declared excess, sold on an individual unit basis, and in some cases moved to other locations. There are currently three groups of housing other than what was known as Babbitt, at the Hawthorne Army Ammunition Plant. One consists of 16 units for unaccompanied officers and civilian employees. The other two include a tract of 50 homes and another of 30 homes. These 80 homes are about 93 percent occupied. A fourth tract of 50 homes had a few occupants in 1989 but the units have been declared excess and most have been sold.

Discussions with the Mineral County Assessor Office (Source: Shari McPherson, Mineral County Assessor's Office, personal communication, 1989) indicated that the housing market is very tight in Mineral County, and in Hawthorne, especially. Although there are now more apartments than before, there are very few rentals available. According to the Assessor's Office, much of the housing demand is being filled by mobile homes.

There has been no housing market analysis conducted for Mineral County and HWAAP. The constraint on housing development discussed under NAS Fallon (Section 3.3.2) could be applicable to Mineral County. Housing builders and developers in Mineral County may be unwilling to build housing without already having a buyer. Residents have seen dramatic employment swings at HWAAP, and since the installation is the driving force of the economy of Mineral County, any downturns at HWAAP reverberate throughout the county and quickly affect the housing stock. This effect was recognized in the 1986 Master Plan for Mineral County, Nevada (Source: Mineral County, Nevada, 1986):

> "Housing in Mineral County has been the center of concern in consideration of our drastic changes in employment over the years. As this plan relates on several occasions, we have a highly-volatile population base which rapidly changes at the mercy of mineral prices and HWAAP operations."

4.3.3 SERVICES

Table 4-3 provides summary information on education and Table 4-4 provides a summary of community services in Mineral County. Included in Table 4-4 is an estimate of the personnel providing the specific service, the ratio of service providers to population, and the number of personnel required to support the direct population of HWAAP.

Mineral County School District maintains all public primary and secondary grades, Kindergarten through 12. Most of these students attended school in Hawthorne. Almost 20 percent (230 students) of all enrollments in the District in 1988 were estimated to be HWAAP-related. The teacher-to-student ratio of 1:16.9 indicates that almost 14 of Mineral County's teachers may be attributed to HWAAP-related population.

Law enforcement in Mineral County is provided by the County Sheriff's Department (20 officers) and the State Highway Patrol (2 officers); the City of Hawthorne does not have a Police Department. There is no formal, mutual aid agreement between the Mineral County Sheriff's Department and the HWAAP. Five of the 22 law enforcement officers in Mineral County may be attributed to HWAAP-related population.

Volunteer fire departments are located in Luning, Mina, Schurz, and Walker Lake. The Mineral County Fire Department (FD), located in Hawthorne, is part-paid and is the only department on which there is information on the number of personnel. Mineral County FD has 4 paid fire suppression personnel, 90 volunteer fire-fighters, and 4 mechanics. HWAAP has a staff of 24 fire suppression personnel and one secretary-dispatcher (Source: Chief Jim Fairfield, HWAAP, personal communication, 1989). A mutual aid agreement between HWAAP and Mineral County exists under which HWAAP will respond to Mineral County FD requests for fire suppression within the county and the Mineral County FD will assist on base providing the fire is in a non-explosive area. Currently, no mutual aid agreement is in place for ambulance services. Using the fire protection personnel staffing-to-population ratio of 1:53 indicates that 29 fire protection personnel may be attributed to HWAAP-related population.

Table 4-3. Education Characteristics in Mineral County.

	Mineral	State
Enrollment		
1987	1,159	168,353
1988	1,150	176,474
Percent Change in Enrollment		
84-85	3.2	2.2
85-86	(3.1)	4.1
86-87	(0.8)	4.4
87-88	(0.8)	4.8
Number of Teachers	68	8,699
Elementary & Secondary	54	7,470
Special Education	10	1,025
Vocational	4	204
Salary (average - 1989)	$28,939	$28,736
Administrative		
Non-teachers[1]	112	1,437
Salary (average - 1989)	$42,577	$39,975
Ratio of Teachers to Students	1:16.9	1:20.3

[1] Includes service personnel, principals, and assistant principals, supervisors, superintendent, and assistant superintendents.

Table 4-4. Services Characteristics in Mineral County.

	1988	
Population	6,290	
Percent HWAAP	24.0	
Law Enforcement Officers[1]	22	
Ratio to Population	1:286	
Attributable to HWAAP	5	
Fire Protection, Personnel[2]	118	
Ratio to Population	1:53	(1:67 without HWAAP)
Attributable to HWAAP	29	(using the 1:53 ratio)
Licensed Physicians	5	
Ratio to Population	1:1,259	
Attributable to HWAAP	1	

Source: [1]Sergeant Whitson, Nevada State Highway Patrol, personal communication, 1989
[2]Chief Jim Fairfield, HWAAP, personal communication, 1989

In 1988, medical care was provided to Mineral County residents by 5 licensed physicians (Source: Claire Mowrey, State Board of Medical Examiners, personal communication, 1989), 13 registered nurses, and 8 licensed practical nurses (Source: Martha Seely, State Board of Nursing, personal communication, 1989). There is one hospital in Hawthorne which has 15 acute-care beds and 20 long-term care beds (Source: Robert Crookham, Nevada Division of Health Resources, personal communication, 1989). HWAAP maintains an outpatient clinic and a small pharmacy, and provides some laboratory services (Source: Gary Sivertsen, Hawthorne Army Dispensary, personal communication, 1989). The clinic serves 300 to 400 outpatient visits monthly by active military personnel, their dependents, military retirees, government, and contractor employees. Civilians are not treated by the clinic. The clinic does not have a mutual aid agreement with the hospital in Hawthorne. One licensed physician may be attributed to HWAAP-related population using the current 1:1,259 physicians-to-population ratio.

4.3.4 PUBLIC FINANCE

Mineral County and Mineral County School District are the local government entities affected by the HWAAP activities. In FY 89, general fund resources available to Mineral County government were about $3,132,000 while expenditures were just over $3,132,000 (Source: Nevada Legislative Council Bureau, 1988). The fiscal effect of HWAAP-related activities on county general fund resources and expenditures are about $1,009,000.

During the 1987-1988 school year, the Mineral County School District had revenues from all sources that averaged $4,289 per student and expenditures that averaged $4,680 per student. During the 1987-1988 school year, the District received a total of $379,722 in Federal assistance (P.L. 81-874 funding) for HWAAP-related students and other federally related students. The P.L. 81-874 funding comprised 7.3 percent of general fund resources during that year (Source: Mineral County School District, 1989). Total Mineral County School District general fund resources were budgeted at $5,582,000 for FY 88-89 while expenditures were $5,355,000 (Source: Nevada Legislative Council Bureau, 1988). HWAAP effects on the school district budget were $1,462,000 of resources and $1,403,000 of expenditures.

4.3.5 LAND USE

Agriculture provided 1.2 percent of all employment in Mineral County in 1986 and employed 35 residents of the county (Source: State of Nevada, Office of Community Services, 1988). In Mineral County, total cash receipts from marketing crops and livestock in 1986 was slightly less than $1.3 million, less than one percent of the statewide total for 1986. Sales of livestock contributed 88 percent of total cash receipts. As of January 1, 1987, there were 4,700 cattle and calves (one percent of statewide total) and no sheep or lambs in the county. Currently, there are no grazing leases on HWAAP land, nor are there plans to lease HWAAP lands for grazing in the future. HWAAP land withdrawals may preclude some agricultural production in Mineral County, but the effect on the economic contribution of agriculture is probably negligible.

Minerals mined in Mineral County during 1985 (Source: State of Nevada, Office of Community Services, 1988) included gold, silver, and mercury. In FY 87, mining generated total tax revenues in the county of $247,000, which represented approximately 18.2 percent of property tax revenues in the county. These tax revenues represented almost two percent of the total county budget for FY 87. In 1986, employment in mining was 14 percent of all employment in Mineral County (Source: State of Nevada, Office of Community Services, 1988). Net proceeds of mines in Mineral County declined sharply between 1985 and 1988 (Source: Nevada Department of Taxation, 1988b). In FY 86, net proceeds of mines in Mineral County totaled $4.3 million; in FY 87, they totaled $3.9 million; and in FY 88, they were $1.4 million. It is unlikely that the HWAAP land withdrawal has had measurable effects on the economic contribution of mining in Mineral County.

The public is authorized access to HWAAP land for hunting, fishing, and sightseeing on a controlled basis. Eligibility for hunting is the same as for other areas of the State and restrictions generally are established by the State of Nevada. Fishing eligibility is limited to active duty military and their dependents; retired military and their dependents; and civilian employees of the plant and their dependents. (Note: Currently, with approximately 900 civilian employees; over 900 military retirees in the county; and the dependents of both, it appears a majority of Mineral County residents are eligible to fish at HWAAP.) Finally, the general public is eligible for sightseeing with the only restriction being the plant's ability to process visitor permits. Between 1984-1988 an average of 1598 people were granted access to HWAAP for recreational purposes with 44 percent being sightseers. Because of the drought and fire restrictions, recreational visitors only averaged 1211 during 1989 and 1990, with 16 percent being sightseers. Since hunting and sightseeing are allowed with limited restrictions and no fishing opportunities would exist except for Government stocking of a man-made reservoirs, it is likely that the withdrawal has had only minimal adverse impacts on the economic contribution of recreation in Mineral County.

4.3.6 ECONOMIC DEVELOPMENT

The effect of HWAAP on the economic development of Mineral County has been both positive and negative in terms of economic development and economic diversification. If HWAAP did not exist, the county may be more dependent on agriculture, mining and, to a smaller degree, tourism-related services than it is currently and less economic diversification may be present. Thus, HWAAP contributes to the diversification that exists in the county. Concurrently, however, the presence of HWAAP may inhibit other types of industry and services from locating in the county, inasmuch as HWAAP activities and, thus, the labor force associated with HWAAP may fluctuate rapidly. In this manner, the presence of HWAAP may inhibit further economic diversification in the county and, therefore, constrain economic development.

The Mineral County Nevada 1986 Master Plan (Source: Mineral County, Nevada, 1986) clearly recognizes the importance to, and the constraints imposed on, economic development by the presence of HWAAP.

> "We have survived economically, mainly because of Hawthorne Army Ammunition Plant operations, mining, and tourism-related commerce . . . mining and minerals, base activities, and tourism are all imperative to sustain our economy and are each highly volatile. In fact, the county population has dropped over the last decade as a direct result of the above-related activities. Every effort to diversify our economy through economic development, industrial promotion, tourism promotion, and recreation expansion has been undertaken by local, state, and federal government and civic groups. This effort is essential but seems futile when in the snap of a finger, we lose or gain hundreds of jobs as has been done in the past. This county has an excellent record of enduring economic hardships."

4.3.7 SUMMARY

The effect of HWAAP on the economic development of Mineral County has been both positive and negative in terms of economic diversification. If HWAAP did not exist, there may be less economic development and less economic diversification in Mineral

County. However, the employment changes associated with HWAAP mission levels may inhibit some types of industries from locating in Mineral County.

Employment generated by HWAAP has had a positive effect on the development of existing services and infrastructure, which would otherwise not exist at the current level in the absence of HWAAP.

The primary identifiable effect resulting from HWAAP is the effect on housing. The housing market is extremely tight in the town of Hawthorne due to the reduction of housing at HWAAP and housing developers' cautious approach to responding to increased demand that results from employment at HWAAP.

4.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

This section identifies effects on plants, fish, and wildlife resources from HWAAP activities. The plants, fish, and wildlife considered in this section are listed in Table 1-4 in Section 1.4.3.

The altitudinal gradient within the HWAAP land withdrawal supports a series of elevationally determined plant communities. The valley floor (4,500 feet), is occupied by mixed desert shrub vegetation, comprised of sagebrush, greasewood, hopsage (*Grayia sp.*), and Mormon tea (*Ephedra sp.*). The lower sagebrush plant association is dominant in the valley foothills and canyon bottoms at 4,500 to 6,000 feet elevation. This vegetation type is characterized by sagebrush, bitterbrush (*Purshia tridentata*), rabbitbrush, horsebrush, Mormon tea, and a number of species of annual and perennial desert grasses. Pinyon-juniper associations (*Pinus monophylla-Juniperus osteosperma*) are found at elevations between 6,000 and 8,000 feet elevation. Above the pinyon-juniper zone, the upper sagebrush vegetation type occurs, which is characterized by high elevation species of sagebrush and bitterbrush.

Three reservoirs and twelve miles of creeks with associated riparian vegetation and wet meadows occur within the HWAAP land withdrawal. Riparian species present along the creeks and other water bodies include cottonwood (*Populus sp.*), willow (*Salix sp.*), and quaking aspen (*Populus tremuloides*). There are also a number of wet meadows associated with the springs providing the headwaters for the streams of Mount Grant.

The Mt. Grant area was originally obtained by the U.S. Army as a land withdrawal of public lands administered by the Department of the Interior for the purpose of operating an ammunition storage facility. Public access to Mount Grant has been restricted since about 1928 and the area has been managed for watershed purposes during this time. Surface waters from most of the major drainages are diverted to supply water to the Army. Domestic livestock grazing is not permitted but on rare occasions cattle from adjacent grazing allotments to the west enter the area.

The Nature Conservancy, in cooperation with the Bureau of Land Management, recently completed an ecological survey of the Mt. Grant area in order to provide base-line biological information for use in the Bureau's review of the Army's withdrawal. That review is required by the Federal Land Policy and Management Act to determine if the withdrawal is being used for the purpose for which it was originally withdrawn and whether the withdrawal should be continued.

The study found no evidence of endangered species on the withdrawal. Thirteen plant communities were mapped. The types of communities present are not unique, although the overall condition of the communities is exceptional for Nevada. This is likely due in part to the absence of livestock grazing.

The study concludes that the "healthy, natural communities of the Mt. Grant area contribute significantly to the biological diversity of the state." Management recommendations are for the protection of the natural diversity through designation of the Mt. Grant area as a BLM Area of Critical Environmental Concern or equivalent designation such as a Research Natural Area or a Congressional National Conservation Area. The Mt. Grant area is also considered appropriate for scientific and educational purposes.

Good ecological conditions can correspond to good habitat conditions for wildlife, although no habitat inventories have been completed for the Mt. Grant area. Wildlife species found in the mountainous areas of HWAAP include, mule deer, mountain lion, gray fox, kit fox, sage grouse, mountain and California quail, and chukar. HWAAP prepared a Fish and Wildlife Management Plan for lands within the withdrawal. In general, the forested areas of Mt. Grant are used for wildlife protection. The Army's extensive water development facilities in the area may be affecting wildlife populations, but the extent or direction of impacts has not been determined.

Activities at HWAAP include primarily surface activities associated with the storage and maintenance of stockpiled ordnance. In addition, there has been a history of testing and detonation in the area, including launching of rockets into Walker Lake (Source: U.S. Air Force, AMRL, 1986). Potential for pollution of Walker Lake resulting from actions associated with operation of HWAAP is limited, and is discussed further in Section 4.9. Disturbance of soils and plant communities from the construction of bunkers and roadways on HWAAP was extensive in the past. Defense-related effects on wildlife may also result from spills of toxic and hazardous materials. Another potential effect to wildlife at HWAAP is the testing of 81 mm mortar rounds in the Controlled Firing Area. These activities may cause noise disturbance and projectile impacts may cause disturbance of soil and vegetation.

Most of the lands in the HWAAP withdrawal are not used for high-intensity activities. Unimproved grounds comprise approximately 90 percent of the withdrawal (Source: Day and Zimmerman, Basil Corporation, 1985).

Restricted Area R-4811, located in the Bridgeport Pinyon-Juniper Management Area of the Toiyabe National Forest, is sometimes active with underground demolitions that have been approved by the State of Nevada on a case-by-case emergency basis. The area has been subject to explosive ordnance testing in the past. The USFS has proposed that use of this area be terminated or the land transferred to DOD (Source: U.S. Forest Service, 1986).

The effects of activities in R-4811 on local wildlife populations have not been addressed in previous studies.

In summary, portions of the land area on the HWAAP have been disturbed by the use of explosive ordnance and construction. In addition, there is potential for the release of toxic and hazardous materials at HWAAP that could affect plants, fish, and wildlife resources (Section 4.9). There is also a history of water pollution (Section 4.2.3). Localized effects on wildlife from operations at HWAAP may have occurred. Approximately one-third of the HWAAP withdrawal (that portion in the Mt. Grant area) remains relatively unused and unaffected by typical public-land pressures such as wildlife habitat, watershed protection, low-intensity recreation, and light-to-moderate livestock grazing. However, the effects of HWAAP on plants, fish, and wildlife have not been fully analyzed. Proposed changes for HWAAP to the year 2000 are not expected to affect fish and wildlife resources.

4.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

This section describes impacts on cultural and historical properties from activities associated with HWAAP. Recorded archaeological and historical records were searched for this report, and a summary of previously conducted surveys, and overviews is provided in Table 4-5.

HWAAP currently consists of 2,911 structures, of which two-thirds are explosive storage magazines (Sources: J. Wallace, HWAAP, personal communication, 1988; MacDonald and Mack Partnership, 1984). About 160 of the magazines are typically excavated approximately 4 feet below the ground surface, cover an area of about 0.02 acres, and are completely covered with earth obtained from the immediate vicinity. An earth barricade is provided on the opposite side of the depressed entrance, and each has an individual access road. Another 1,156 magazines are conventional, single-arch, high-explosive storage igloos similar in character but are about twice as large. Other magazine types are structurally different, but have disturbed roughly equivalent areas. Nearly 200 reinforced concrete warehouses provide inert storage.

The personnel and industrial areas contain the headquarters, administration, engineering and maintenance facilities, and housing and community services for the installation. Finally, the original facility included unknown miles of roads and railway connecting the magazines with the Personnel and Industrial Area and the Southern Pacific Railroad.

The U.S. Army, with assistance from the National Park Service, has contracted both an historic properties report and archaeological overview for the HWAAP (Sources: MacDonald and Mack Partnership, 1984; Cleland et al., 1987). This area is also covered by the cultural resources overview prepared for the Carson City District Office of BLM (Source: Pendleton, 1979). According to the cultural resources overview, the facility's prime archaeological research value lies in its potential to provide a prehistoric cultural chronology. Additional themes for which the prehistoric archaeological record of the HWAAP has a potential to address include piñon utilization, documentation of the Western Pluvial

Table 4-5. Cultural Resources Studies, Hawthorne Army Ammunition Plant.

Project Name	Acres Studied [1]	Type of Study[2]	Reference
HWAAP Land			
HWAAP Pit, EA 71069	158.08	III	Barnette, 1982
Eaton and Smith R-O-W	3.33	III	Beals, 1978
E.A. 70847, SOS-21(2)	2.96	III	Jerrems, 1977
U.S. 95 Betterment E.A. 70894	Unknown	III	Sapir & Whitney, 1980
U.S. 95 R-O-W Betterment	523.51	III	Seldomridge, 1986
Fiber Optic Cable Trench	Unknown	III	Young, 1987
Water Pipeline (IMR#563)	103.03	III	Stornetta, 1985
Seismic and Testing Geotech Loc.	Unknown	III	Thompson, 1982
S.R 359 (31) Betterment E.A.	242.42	III	Tomlinson, 1985
Mortar Range (ARS #484)	1,283.00	III	Young, 1988
Hist Prop, NPS #CX-0001-2-0033	N/A	I	MacDonald & Mack, 1984
Overview & Management Plan	N/A	I	Cleland, 1987
Draft Hawthorne AAP (ARS #480)	N/A	I	Burke, 1989
BLM Land			
ByPass Road (N-4534)	8.72	III	Beals, 1979
Non-Comp Sale, N-4534	8.21	III	Boykin, 1987
Lucky Boy Fence	30.30	II	Schuler, 1983
N. Whisky Flat Fence	42.42	III	Armentrout, 1982
Below Restricted Area R-4811			
Reconstruction of HWY 31	Unknown	III	Stearns, 1979
Paper presented at, 1986 GBAC	Unknown	Research	Wilke, 1986

(1) Acres in table do not necessarily reflect acres studied on withdrawals.
(2) Type I studies consist only of overviews of existing information. Type II studies consist of reconnaissance of a sample of a study area. Type III studies consist of surveys covering the entire study area.

Lakes Tradition, high altitude zone utilization and past man/environmental relationships. According to the historic properties surveys, approximately 90 percent of the structures remaining on HWAAP today date to the original construction period of 1928 to 1931 and WWII, and the entire facility may be eligible for nomination to the National Register as an Historic District (Sources: MacDonald and Mack Partnership, 1984; Burke, 1989).

In response to Europeans intrusion after the discovery of the Comstock Lode in 1859, the U.S. General Land Office set this area aside as part of the Walker River Paiute Indian Reservation. Even so, prospectors illegally mined in the mountains west of Walker Lake during the 1860's and 1870's. In 1881 Hawthorne, then called Milbrae, was established as a railhead on the Carson & Colorado Railroad and this drew hundreds of prospectors to the area. Resulting mines included Corey Creek, Alum Creek, Cottonwood Canyon, Dutchman, Pamlico, and La Panta, and mining camps were established at Coreyville, Dutch Creek and McKenzieville. Hawthorne lost its railroad in 1905 when Thorne, eight miles northeast Hawthorne, (and situated within the HWAAP), became the new railhead on the Mina branch of the Southern Pacific Railroad. A year later, the southern portion of the Walker River Paiute Indian Reservation, including lands now within the HWAAP, was ceded to the government by the Northern Paiute in exchange for allotments and cash.

Mining again boomed with the discovery of the Lucky Boy, Bruce Lode, and Jobo Lode mines and mining camps were established at Oro City (Jaggersville) and Lucky Boy. Hawthorne became the seat of Mineral County in 1911 only to almost burn to the ground in 1926, one year prior to the Navy's decision to build its ammunition depot in the area.

Fourteen cultural resources surveys have been conducted within or near the boundaries of the HWAAP (Table 4-5). Combined, these surveys have covered somewhat over 2,406 acres or 1.6 percent of the total withdrawal. Approximately 1,400 acres were surveyed for defense-related activities. The records search conducted for the Special Nevada Report (SNR) indicated 85 prehistoric and 15 historic age cultural resources are known to occur on the HWAAP. Two of the 85 prehistoric sites are temporary camps, 46 are lithic scatters, four are specialized activity localities, nine are toolstone quarries and 24 are isolated artifacts. Seven of the 15 historic sites have a mining theme; the others relate to either a military theme or urbanization theme. Table 4-6 summarizes the nature of impacts on these sites by their eligibility for nomination to the National Register of Historic Places. Of the 100 sites, 1 is undisturbed, 16 have been partially impacted, and 3 have been extensively impacted or completely destroyed. The extent of impacts on 80 sites is unknown. Fourteen sites have been considered eligible for nomination to the National Register, seven of which have been partially impacted, and the extent to which the other seven may have been impacted is unknown. Fifty-six percent of the cultural resources on HWAAP have not been evaluated for their eligibility to the National Register.

Six sites on Restricted Area R-4811 were identified during the records search. One of those resources is an historic corral, two are isolated artifacts, two are lithic scatters and one is a prehistoric temporary game fence and petroglyphs. The antelope game fence was first recorded in December of 1845 (Source: Kern, 1876). Three of these sites have been partially impacted; the extent to which the other three sites may have been impacted is

Table 4-6. Extent of Impacts on Recorded Archaeological Sites: Hawthorne Army Ammunition Plant[1].

	National Register Eligibility[2]							
Extent of Impacts	Eligible	%	Not Eligible	%	Undetermined	%	Total	%
Undisturbed	0	0.0	1	3.3	0	0.0	1	1.0
Partial	7	50.0	4	13.8	5	8.9	16	16.0
Extensive	0	0.0	2	6.9	1	1.8	3	3.0
Unknown	7	50.0	23	76.0	50	89.3	80	80.0
Collected	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	14	100.0	30	100.0	56	100.0	100	100.0
(%)		14.0		29.0		56.0	100.0	

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.

(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

unknown. One site has been considered eligible for nomination to the National Register and has been partially impacted.

The original construction of HWAAP undoubtedly had a major impact on previously existing cultural resources in the area, but because surveys were not conducted in advance of the land disturbance, the extent of these impacts is unknown. If the Historic Preservation Plan is adopted and followed, impacts to the remaining cultural resources may be minimized (Source: Burke, 1989).

In summary, it is not possible to assess the impacts of historic land disturbance of HWAAP on cultural resources, because surveys did not precede most land-disturbing activities. Many cultural resources were undoubtedly impacted. The Army has recently initiated procedures that should substantially reduce future impacts. These procedures include the preparation of two cultural resources overviews, the nomination of HWAAP facility to the National Register, and the preparation of an Historic Preservation Plan. Although no formal data recovery programs designed to mitigate potential impacts have been conducted on HWAAP, one isolated artifact has been collected by archaeologists during a cultural resource survey in order to avoid impacts to that site. There has been some consultation with Native American people regarding their concerns during the preparation of the Historic Preservation Plan, but this consultation is preliminary, and there has not been systematic study about the effect of military and defense-related activities on their religious freedoms. Thus, the extent to which traditional values and religious practices of Native American people are affected by HWAAP activities are unknown.

4.6 EFFECTS ON RECREATIONAL RESOURCES

The HWAAP land withdrawal includes the Mt. Grant portion of the Wassuk Range. The area is open to the public for limited activities (i.e., hunting, sightseeing, and camping) under controlled access. Annual use of the area from 1984 to 1988 averaged about 1,400 permit holders per year. In view of the fact that many recreational uses are permitted in the most pristine portions of the HWAAP, overall recreational values are not lost by the continued withdrawal of these lands. However, recreational opportunities are reduced on the Mt. Grant portion of the withdrawn lands where defense-related activities restrict or limit access to the general public.

Land beneath Restricted Area R-4811 is leased USFS land in the Bridgeport Pinyon-Juniper Management Area of the Toiyabe National Forest. The area is used infrequently to destroy unsafe explosives/munitions. All use must be justified to and approved by the NDEP. New Bomb, the land beneath R-4811, was operational for approximately three months in 1990. Status application is being prepared by the U.S. Army COE to bring the area into service for open burning and open detonation of waste explosives, which is a use considered inappropriate by the USFS (Source: U.S. Forest Service, 1986). Recreational use of the Bridgeport Pinyon-Juniper Management Area is typically "light and dispersed" (Source: U.S. Forest Service, 1986), suggesting that recreational resources in the National Forest are not affected by the presence of HWAAP.

Proposed changes to HWAAP to the year 2000 are not expected to affect recreational resources.

4.7 EFFECTS ON WILDERNESS RESOURCES

Wilderness resources on the HWAAP land withdrawal have not been evaluated nor is there a requirement for evaluation since the lands are withdrawn for defense-related purposes. Most of the HWAAP is not open to the public because of security requirements. Mt. Grant, in the Wassuk Range, is located within the withdrawal and is used by the public under permit by the Army for hunting and fishing.

The western and southern boundaries of the HWAAP are located approximately 10 miles east of the Toiyabe National Forest, however, these forest lands do not contain wilderness. The HWAAP withdrawal is completely surrounded by BLM's Walker Resource Area, which contains two Wilderness Study Areas (WSAs). The closest BLM WSA is the Gabbs Valley Range, located approximately 15 miles northwest of HWAAP. Discussions of wilderness in BLM planning documents do not indicate any relationship or conflict between HWAAP and BLM wilderness plans.

Restricted Area R-4811 is located adjacent to the Anchorite Hills area of the Toiyabe National Forest in west-central Nevada. There is no wilderness proposal for this portion of the National Forest, and there are no BLM WSAs in the immediate vicinity. The small size of the Restricted Area, the nature of the activities there, and the lack of wilderness on adjacent National Forest or BLM lands preclude the potential for effects to wilderness resources.

Proposed changes to HWAAP to the year 2000 are not expected to affect wilderness resources.

4.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

4.8.1 BASE AND PRECIOUS METALS

4.8.1.1 Regional Mineral Potential

Three basic geologic terrains occur in the HWAAP, as shown in Figure 4.5: areas of deep alluvial cover, areas of marine andesitic to rhyolitic volcanic flows of Triassic age, and areas of Triassic shale or carbonate rock intruded by Mesozoic granitic stocks.

Deep alluvial material fills the Walker Lake basin east and southeast of the town of Hawthorne. This area is assessed as having very low mineral development potential.

Areas of marine andesitic to rhyolitic volcanic flows of Triassic age within the HWAAP fall within the haloes of influence of mining districts either within or bordering the HWAAP. No regional mineral development assessment is needed.

Areas of Triassic shale or carbonate rock intruded by Mesozoic granitic stocks in similar structural settings elsewhere in Nevada have hosted skarn tungsten deposits, copper skarn deposits, polymetallic replacement deposits, carbonate-hosted gold deposits, and simple antimony deposits. Small outcrops of these rocks, mainly granite in the southern Wassuk Range and granite and shale in the southwestern Garfield Hills, are found in the southern part of the area. Based on the types of mineralization known to occur in rocks of these types in adjacent mining districts, this class is assessed as having low mineral development potential for small skarn tungsten deposits and small gold deposits in quartz veins. Low potential also exists for the development of a small- to medium-sized porphyry molybdenum deposit in the general area between Cat Creek and the southern boundary of the western lobe of the withdrawal. Most of this area is within the Mt. Grant mining district.

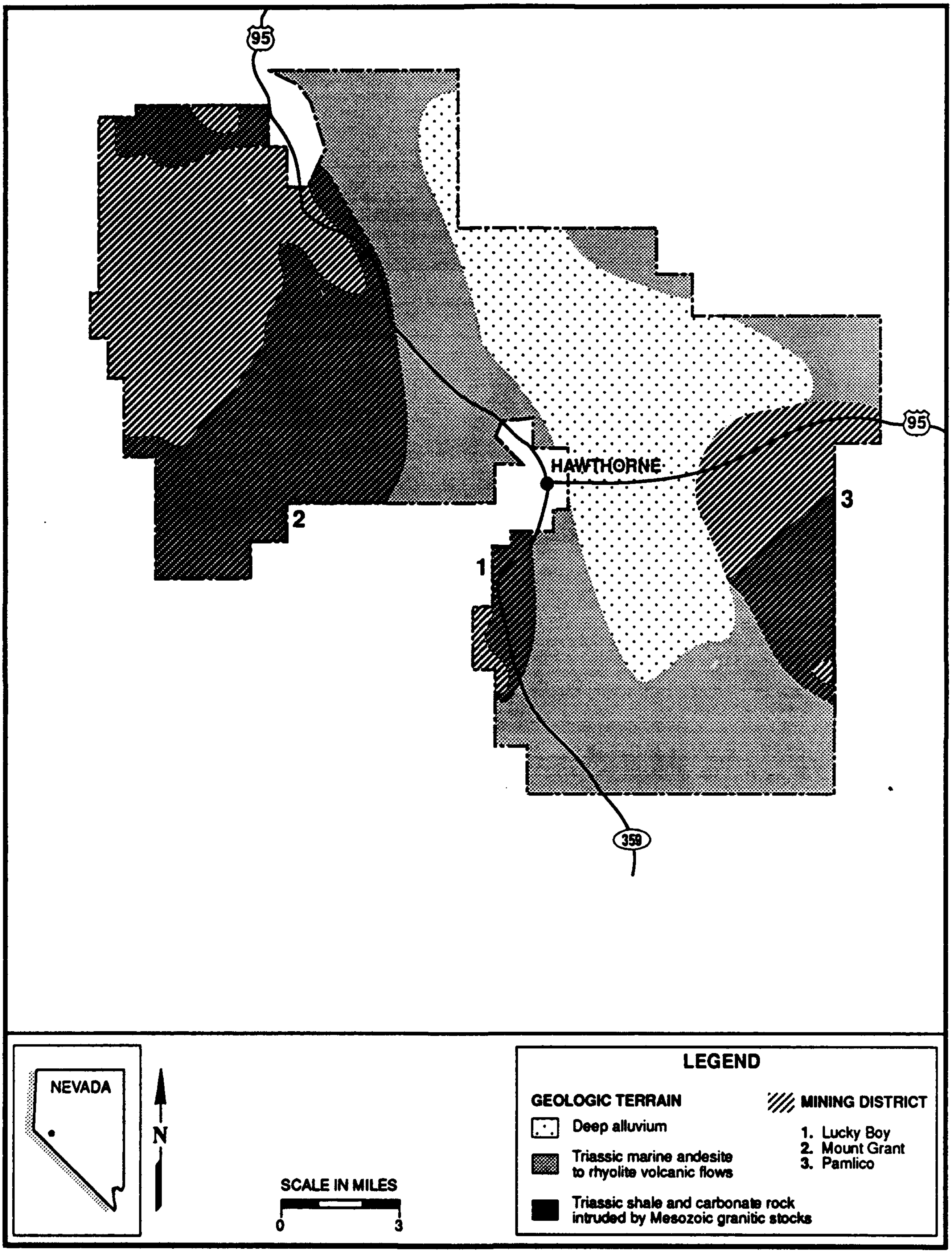


FIGURE 4.5 GEOLOGIC TERRAINS AND MINING DISTRICTS, HAWTHORNE ARMY AMMUNITION PLANT

4.8.1.2 Potential of Mining Districts

With respect to mining districts within areas of marine andesitic to rhyolitic volcanic flows of Triassic age, rocks of this age and composition have, in other areas, hosted massive sulfide deposits and low-sulphur gold-quartz veins. Rocks of this type are found on the northwestern tip of the Garfield Hills on the eastern border of the HWAAP, on the northwestern slope of Mt. Grant on the western side of the HWAAP, and at the eastern foot of Lucky Boy Pass along the southwestern border of the HWAAP. The two outcrop areas in the northwestern Garfield Hills are within the Pamlico mining district, the large outcrop area on Mt. Grant is within the Mt. Grant mining district, and the area at the foot of Lucky Boy Pass is within the Lucky Boy mining district.

Pamlico district: The main Pamlico mine area, located about one-half mile east of the eastern boundary of the HWAAP, occurs within this geologic terrain. Gold-silver mineralization at Pamlico occurs in northwest-trending quartz veins that cut metavolcanic rocks of the Triassic Luning Formation. Gold values are confined to the veins and alteration is not extensive (Source: Archbold and Paul, 1970). Structures associated with the known mines, however, project to the northwest into the HWAAP. There is low to moderate potential for discovery of similar gold-bearing vein deposits within the small area of similar geologic terrain within the withdrawn area.

Mt. Grant district: This district has limited gold production from quartz veins in metavolcanic rocks. The veins are narrow, and old workings in the area are not extensive. Small gold-placer deposits have been exploited in Lapon Canyon; these placer deposits have formed from weathering of the narrow gold-bearing veins. This area has low-to-moderate potential for development of small deposits of gold in quartz veins. The placer deposits have largely been exploited but low potential remains for development of similar, small gold placers adjacent to the known deposits.

Lucky Boy district: Only a small part of the Lucky Boy district extends into the HWAAP. Silver-lead mineralization at the Lucky Boy mine occurs along structures associated with a northeast-trending granite contact zone; these structures project into the HWAAP northeast of the old mine camp. Due to the distance from known mineralization, however, the area within HWAAP is assessed as having low potential for the development of deposits of silver and lead.

With respect to mining districts within areas of Triassic shale or carbonate rock intruded by Mesozoic granitic stocks, rocks of this terrain underlie portions of the Pamlico and Mt. Grant mining districts. In the Pamlico district, both carbonate and granitic rocks crop out but rocks of this terrain within the Mt. Grant district consist entirely of granitic rocks.

Pamlico district: Mineral deposits in this terrain in the part of the Pamlico district within or adjacent to the HWAAP include gold in limonitic quartz lodes, copper in skarn zones, and gold- and silver-bearing galena in quartz veins. Skarn deposits of iron and an occurrence of uranium are also reported. At the La Panta mine, the major gold-bearing, limonitic quartz lode mineralization appears to follow a northwest structural trend (Source:

Archbold and Paul, 1970). The gold- and silver-bearing quartz veins southwest of La Panta follow more northerly trends and have very slight possibility of projecting into the withdrawn area. Based on very limited information, this area is assessed as having low potential for development small deposits of these commodities.

Mt. Grant district: A large part of the Mt. Grant district within the HWAAP, extending from Mt. Grant southeast to the southern boundary of the withdrawal, is occupied by this terrain. According to Vanderburg (1937b), mining in this area has been confined to narrow, gold-bearing fissures in granodiorite. Recent reconnaissance in this area (Source: Tingley and Quade, in preparation) confirmed that there are numerous small mine workings and prospects in the area, all associated with shear zones and narrow quartz veins in granodiorite. Vanderburg (1937b) reports the presence of molybdenite in Corey Canyon and ". . . on ground included in the Naval Ammunition Depot." This area is assessed as having moderate development potential for small gold-bearing vein deposits and low-to-moderate potential for development of porphyry molybdenum deposits.

4.8.2 ENERGY RESOURCES

4.8.2.1 Geothermal Resources

Geothermal resources are known in one restricted area in the vicinity of the HWAAP. Studies in this area confirmed the presence of a shallow geothermal resource (less than 1,000 feet) beneath the southern Walker Lake basin with an areal extent of several tens of square miles (Source: Trexler et al., 1983). This resource is now being utilized by a motel and casino in Hawthorne for space heating (Source: EG&G Newsletter, May-June, 1987). The resource extends under HWAAP lands and there is high potential that additional geothermal development could take place within HWAAP.

4.8.2.2 Oil and Gas Resources

Areas of bedrock within and near the HWAAP are chiefly of igneous origin and are unfavorable as a source rock for petroleum. Tertiary and Quaternary sedimentary rocks in the Walker Lake basin were deposited in environments that were broadly similar to the same-age rocks in the Fallon basin (Section 3.9). The favorability of the Walker Lake basin for oil and gas is considered to be similar, though lower, than the oil and gas potential of the Carson Desert basin. Organic-rich source rocks could exist in the Walker Lake basin, but they are probably too shallow, and hence have probably not been sufficiently heated, to have generated commercial quantities of oil. Shallow pockets of methane gas in subcommercial quantities could exist in sediments below the lake, similar to the methane gas accumulations in the Fallon basin (Section 3.9). It is concluded that the withdrawal of HWAAP has had no effect on the petroleum industry in Nevada.

4.8.3 INDUSTRIAL MINERALS AND MATERIALS

Much of the alluvial areas along the lower flanks of the ranges within the HWAAP contain potential sand and gravel reserves. These materials, however, do not have any unique value over similar material occurring in other areas throughout western Nevada, and their potential cannot be rated. For economic reasons, most sand and gravel produced in Nevada goes into highway construction as portland and bituminous concrete aggregate, base, or fill material, and for building construction as aggregates. Because of their low unit value, sand and gravel deposits cannot be transported economically over long distances. As in the past, sand and gravel operations in Nevada will continue to be developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within the HWAAP, do not present a sufficiently unique resource to merit classification.

4.8.4 SUMMARY

Withdrawal and controlled access of HWAAP has limited, and will continue to limit, mineral exploration but Army policy has been to facilitate oil and gas leasing to the maximum extent practicable. A low-to-moderate potential exists for the discovery of gold-bearing vein deposits in a small area along the east side of the HWAAP. Along the western side of the withdrawal, low-to-moderate potential exists for development of small deposits of gold in quartz veins, small gold placers, and porphyry molybdenum deposits. HWAAP lies within a known geothermal area and there is a high potential that exploitable geothermal resources exist beneath HWAAP.

4.9 EFFECTS ON WATER RESOURCES

4.9.1 HYDROLOGIC AND WATER RESOURCE ENVIRONMENT

Hydrologic and water resource features of land in the vicinity of HWAAP are shown in Figure 4.6. The land withdrawn for HWAAP incorporates portions of the Walker Lake Valley and East Walker Area hydrographic basins, which are both sub-basins of the Walker River Basin. Walker Lake Valley is further divided into three hydrographic subareas: Schurze (subarea A) to the north of Walker Lake; Walker Lake (subarea B); and Whiskey Flat-Hawthorne (subarea C). The withdrawal encompasses approximately 22 percent of the Walker Lake Subarea, 29 percent of Whiskey Flat-Hawthorne Subarea, and 1 percent of the East Walker Area Basin (Figure 4.6). Walker Lake Valley is bounded in the west by the Wassuk Range (11,239 feet MSL at Mt. Grant), on the east and southeast by the Lower Gills Range and Garfield Hills, and on the south by the Excelsior Mountains. Walker Lake currently occupies approximately 38,000 acres in the central portion of the valley.

The Wassuk Range gives rise to several perennial streams, most originating in Mt. Grant watersheds. Estimated annual stream runoff is 14,700 acre-feet (AF) (Source: State Engineer's Office, 1971). HWAAP uses Cottonwood, Rose, and Cat Creeks as part of its water supply and the town of Hawthorne uses Corey Creek. However, both HWAAP and the town of Hawthorne pump ground water, because these creeks are insufficient to satisfy total water needs.

In the Whiskey Flat-Hawthorne Subarea, most of the ground water recharge is believed to occur from or along the Wassuk Range. Under natural conditions, ground waterflow is generally from the mountain ranges toward the north-south axis of the valley and then northwestward toward Walker Lake along the valley axis. Stratigraphically, beneath the HWAAP north of the town of Hawthorne, the valley fill consists of typical alluvial sediments with inter-bedded lake deposits of clays and fine silt. The thick lake clays may represent an impediment to vertical movement of ground water in some areas, although their lateral continuity and extent are not well known. The lithologic logs for most deep wells (depths greater than 200 feet) indicate the presence of clays of various thicknesses, elevations, and physical characteristics, but there is little correlation between the described units, except near Walker Lake. The most recent (1974) hydrologic study of the Hawthorne area indicated that the natural ground water flow pattern has been altered by ground water pumpage in the vicinity of HWAAP and the town of Hawthorne.

Natural ground water quality and temperature in the area are strongly influenced by geothermal conditions to the west and northwest of the HWAAP housing and industrial complex and the town of Hawthorne. Representative water quality data are presented in Table 4-7. Ground water quality is highly variable and of generally poor quality. Total dissolved solids (TDS) is high and there are concentrations of sulfate, arsenic, and fluoride that exceed health standards. Recently, the town of Hawthorne developed two new wells in Whiskey Flat to increase the reliable supply of low-temperature, good quality water. Estimated ground water yield of the Whiskey Flat-Hawthorne Subarea is 5,000 acre-feet per year (AFY), with approximately 900,000 AF of ground water stored in the upper 100 feet of saturated sediments. However, much of the ground water in storage is of poor chemical quality, thus, undesirable as a supply of water. Walker Lake is not used for water supply. From 1908 to 1988, its surface declined at an average rate of over 1.4 feet per year (113 feet) due to upstream irrigation diversions and evaporation. As a consequence, it is highly saline and unsuitable for domestic, irrigation or industrial uses. The USGS has cautioned that any substantial drawdown of ground water levels near Walker Lake could induce inflow of the highly mineralized lake water into the ground water reservoir (Source: Everett and Rush, 1967).

4.9.2 WATER RIGHTS AND ALLOCATIONS

Water rights certificates, permits, and applications in the Walker Lake and Whiskey Flat-Hawthorne Subareas amount to 54,133 AFY, comprised of 41,788 AFY for ground water and 12,370 AFY for surface water. HWAAP has water rights for 7,928 AFY, consisting of 399 AFY for ground water, and 7,529 AFY for surface water.

In the East Walker Area basin, there are privately held water rights amounting to 164 AFY within the HWAAP boundaries on the western slopes of the Wassuk Range.

4.9.3 WATER DIVERSIONS AND CONSUMPTIVE USE

HWAAP used approximately 976 AF (0.87 mgd) of water in 1989. Approximately 0.34 mgd average was used for operations at HWAAP. During the months of April through October 1989, an additional 0.5 to 1.6 mgd was used for landscape irrigation on HWAAP. Water consumption data for HWAAP from 1972 through 1989 shows the facility using a high of 2,050 AF (1.873 mgd) in 1972, to its current lowest water use of 976 AF (0.87 mgd)

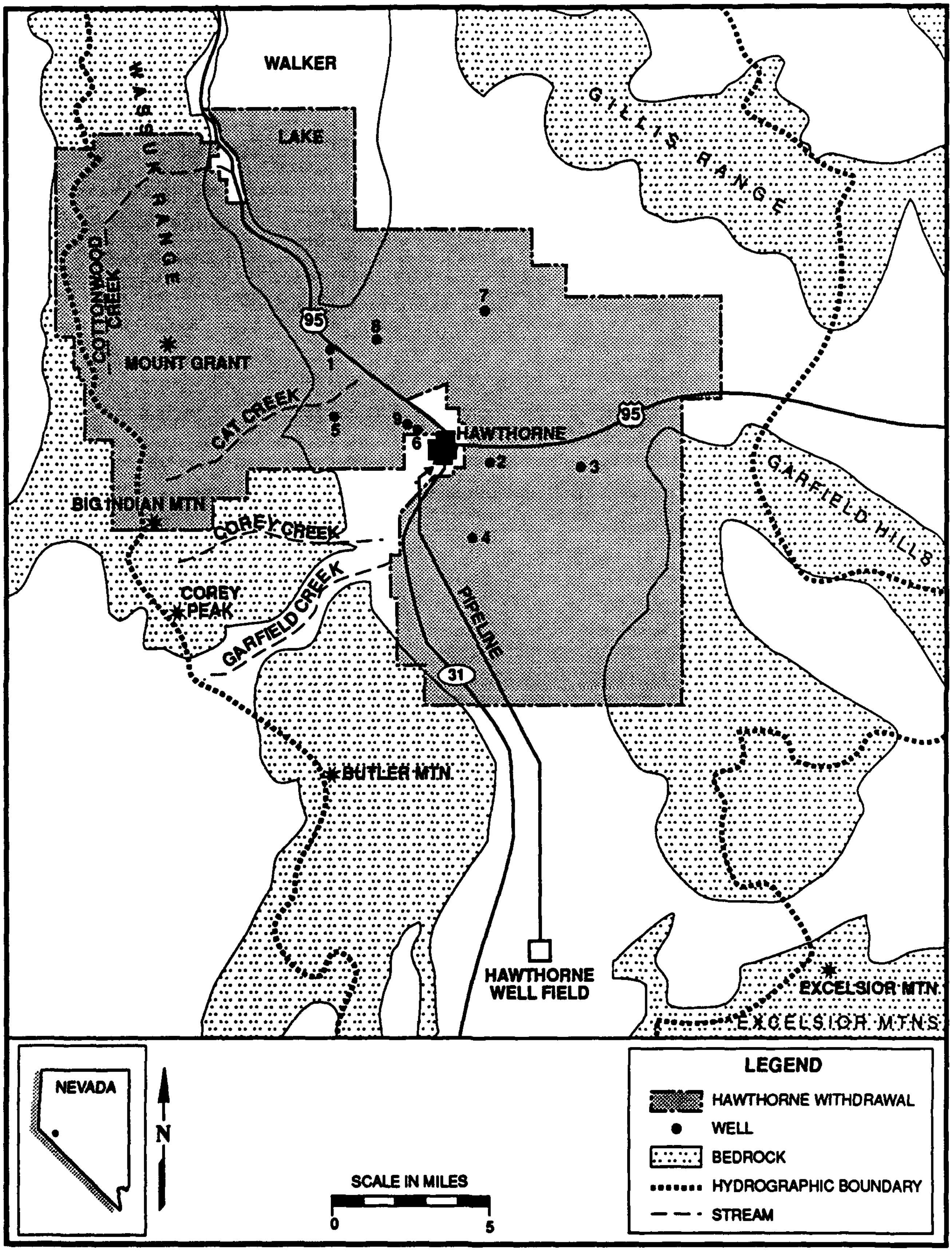


FIGURE 4.6 HYDROLOGIC AND WATER RESOURCE FEATURES AT HAWTHORNE ARMY AMMUNITION PLANT

Table 4-7. Representative Quality of Surface Water and Groundwater in the Hawthorne Area[1].

	No. Samples	Temp °F	Silica SiO_2	Iron Fe	Calcium Ca	Magnesium Mg	Sodium Na	Potassium K	Bicarbonate HCO_3	Sulfate SO_4	Chloride Cl	Fluoride F	Arsenic As	Nitrate NO_3	Total Dissolved Solids
Groundwater															
Whiskey Flat	1	51	-	-	30	13	-	44	90	93	38	-	-	-	~300
Hawthorne	1	80	25	0.01	82	14	148	6.4	82	403	79	0.7	-	0.2	810
HWAAP #1	1	150	32	0.04	53	3.8	176	5.5	52	383	60	1.6	-	0.2	742
HWAAP #2	4	-	66	0.5	80	7	212	12	131	466	95	1.28	0.012	0.5	1,007
HWAAP #3	9	-	60	0.16	32	4	238	15	111	386	100	4.9	0.049	0.1	881
HWAAP #4	2	-	30	0.36	109	28	95	6	112	361	90	0.23	-	1.3	784
HWAAP #5	1	135	48	0.09	34	0	243	7	44	470	82	5.48	0.122	0.0	935
HWAAP #6	1	-	26	0.16	15	14	148	6	88	363	85	1.31	0.00	1.0	813
HWAAP #7	1	-	-	0.54	23	3	35	2	95	49	11	0.7	0.02	0.6	184
HWAAP #8	1	-	-	0.02	68	7	201	7	146	389	85	4.0	0.06	24.5	-
Surface Water															
Black Beauty Res.	2	-	15	0.01	29	4	12	2	87	18	5	0.13	0.003	0.3	115
Squaw Creek	1	-	17	0.00	47	4	12	1	127	31	3	0.13	0.0	0.1	182
House Creek	1	-	24	0.01	40	6	19	2	163	18	6	0.16	0.0	0.6	177
Cat Creek	1	-	24	0.10	37	6	14	2	137	24	5	0.16	0.0	0.2	165
Rose Creek	1	-	13	0.02	20	2	5	1	63	9	0	0.14	0.0	0.1	72
Cottonwood Creek	1	-	26	0.03	29	7	13	1	110	24	4	0.13	0.0	0.8	145

[1]Concentration of chemical constituents in mg/l.
The "-" indicates analyses/measurements not reported.

in 1989. The decline in water consumption is primarily based on the reduction in occupied family housing units and the vacating or removal of units from the Babbitt housing complex.

The water supply for HWAAP is derived from both surface runoff water and ground water. A part of this withdrawal is the 43,000-acre Mt. Grant watershed. Four reservoirs in Mt. Grant watersheds have a total storage capacity of 390 AF. When the water from the Mt. Grant watersheds is turbid, it is bypassed to Walker Lake because the HWAAP potable water supply system has a chlorinator only. Surface runoff water use at HWAAP in 1989 was approximately 602 AF.

There are nine wells on the HWAAP withdrawal (Figure 4.6). Wells 1 and 4 are currently operating and in the period from August 1988 to July 1989 produced approximately 140 AF of water. During this period, Well 1 was down for 4 months, and Well 6 produced 330 AF of water, which was more than average because Well 1 was inoperative. Historically, Well 6 has been used in the summer only and is planned to be given to the town of Hawthorne. Well 2 on HWAAP has a capacity of 230 gallons per minute (gpm) and is temporarily inoperative; Wells 3 and 5 are not in use because of high fluoride concentrations; Well 7 has a capacity of 240 gpm and is temporarily inoperative; and Wells 8 and 9 are inoperative with collapsed casings.

The water supply for the town of Hawthorne is derived from both surface and ground water sources. Hawthorne controls and has a reservoir in the Corey Creek watershed plus four water wells near, or in, the town. Additionally, the town has developed two wells, each with a capacity of 600 gpm, in the Whisky Flat area 15 miles south of the town. These wells were necessary because of lack of access to acceptable quality water in the area closer to town. Water supply to the town from these latter wells comes through a gravity pipeline, segments of which are on an easement within the boundaries of the HWAAP withdrawal. In the future, if the town needs additional water, extensive pumpage from the in-town wells could be a concern due to potential contamination from the HWAAP contaminated aquifers to the north. Occurrence of such extensive pumpage, however, is not considered to be likely.

4.9.4 RESOURCE IMPAIRMENT AND OTHER EFFECTS

Munitions demilitarization activities at HWAAP since the 1930's have resulted in ground water contamination (Source: Van Denburgh, et al., 1980). The Army has concluded that there were no water quality related public health or safety effects. The Mt. Grant watershed is a significant source of high quality water in this area of Nevada, and this resource has essentially been removed from public access. In the future, the contaminated ground water could present some public health concerns if those resources were to be treated and used for public supply.

4.10 SUMMARY

This chapter has identified effects and possible effects resulting from activities associated with the mission of HWAAP. These effects are summarized in Chapter 9, as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of these effects are also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 5

U.S. DEPARTMENT OF ENERGY ACTIVITIES

5.1 EXISTING, PROPOSED, AND ENVISIONED ACTIVITIES

5.1.1 OVERVIEW OF EXISTING ACTIVITIES

In the years following World War II, a suitable area was needed to conduct nuclear weapons testing. The criteria for such an area were low population density, favorable geology and year-round weather conditions, safety and security, accessibility, and available labor resources. An area within the Nellis Air Force Bombing and Gunnery Range, as Nellis Air Force Range (NAFR) was then called, met these requirements. In 1952, the land was withdrawn for the Nevada Test Site (NTS). Additional land was acquired through other withdrawals in 1958, 1961, and 1964, and through a Memorandum of Understanding (MOU) with the Air Force in 1967 for use of Pahute Mesa. Pahute Mesa is considered as part of the NTS for this report.

The NTS has served primarily as a proving ground for the testing and development of nuclear weapons. There were more than 685 announced nuclear detonations on the NTS from 1951 through 1988. All nuclear detonations since 1962 have been conducted below ground. One hundred tests were conducted aboveground prior to 1962. Over the years, the NTS has been used for many secondary purposes related to nuclear energy or the effects of radioactivity (Source: DOE, Nevada Operations Office, 1989c).

5.1.2 LOCATION OF EXISTING ACTIVITIES

The locations of land withdrawals discussed in this chapter are shown on Figure 5.1. The DOE withdrawals include the NTS, the Central Nevada Test Site (CNTS), Nelson Seismic Station, Mt. Brock Communication Site, and Project Shoal Site. DOE-related activities also occur on the Tonopah Test Range (TTR), which is a part of the NAFR withdrawal.

5.1.2.1 Nevada Test Site

The NTS is located approximately 65 miles northwest of Las Vegas in southern Nye County and consists of 814,528 acres of DOE withdrawn, controlled-access land. A detailed map of the NTS is provided on Figure 5.2. The NAFR adjoins the NTS on the west, north, and east and provides a buffer between the NTS and public land. Yucca Mountain and Timber Mountain border the NTS to the west, Pahute Mesa to the northwest, the Belted Range to the north, Groom Mountain Range to the northeast, the Spotted Range to the east, and the Spring Mountains to the south. Climate and vegetation are typical of areas of the southern Basin and Range Provinces, ranging from playas (dry lakes) in the lowest elevations to piñon pine and juniper forests in the highest elevations.

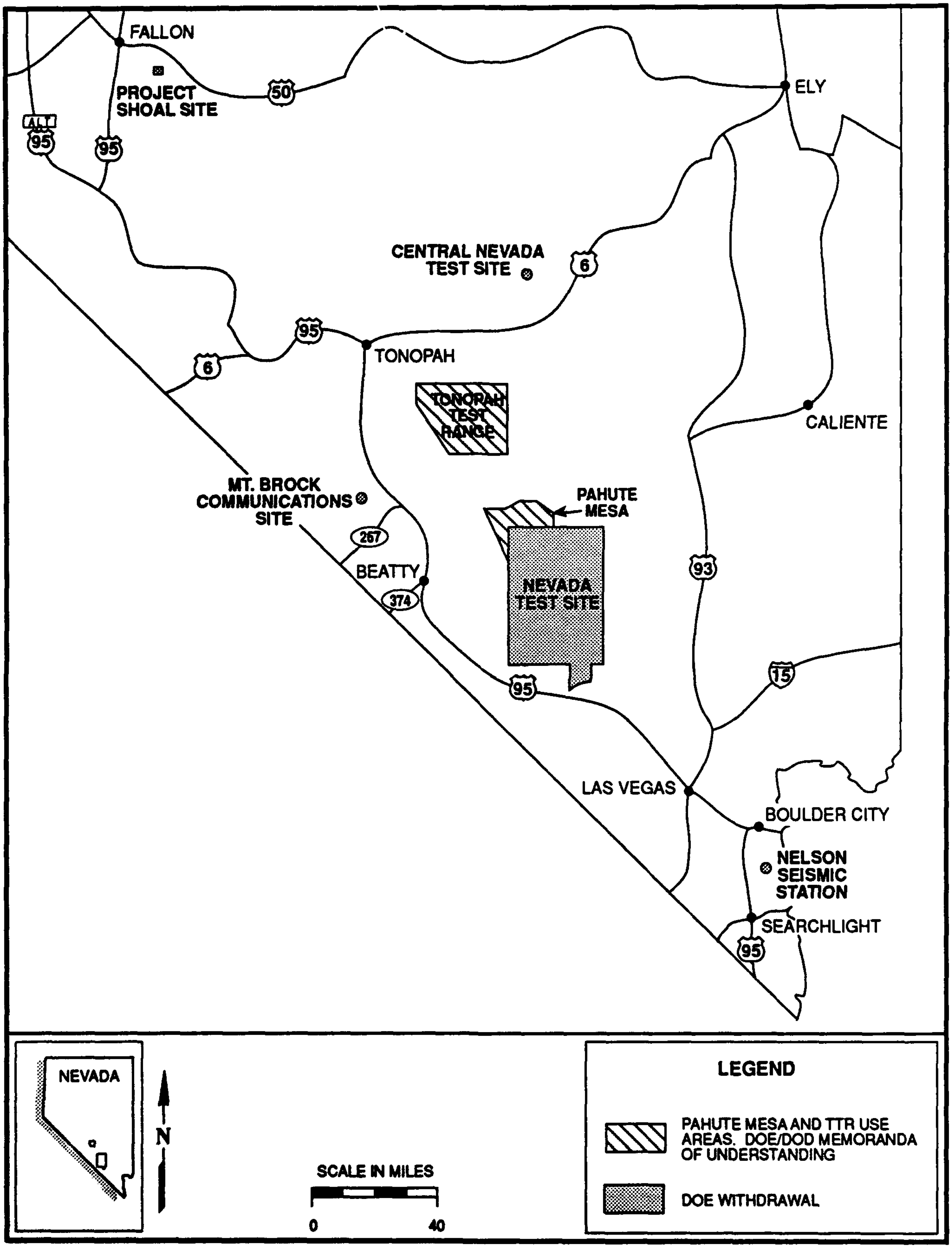


FIGURE 5.1 LAND WITHDRAWALS AND USE AREAS ASSOCIATED WITH DEPARTMENT OF ENERGY ACTIVITIES

5.1.2.2 Central Nevada Test Site

The CNTS consists of three non-contiguous areas in Hot Creek Valley, north of U.S. 6, approximately 80 miles east of Tonopah. A detailed map of the CNTS is shown in Figure 5.3. The unmanned sites are 5 miles apart at the farthest point and encompass a total area of 2,560 acres. The sites are surrounded by public land on which numerous unpatented mining claims exist. The CNTS is not fenced and is not posted "No Trespassing," but is posted "Do Not Dig." There is a concrete monument at the site describing historic events that occurred on the CNTS.

5.1.2.3 Nelson Seismic Station

The Nelson Seismic Station is located in a mining community at Nelson, Nevada and serves as a monitoring station for NTS activities. The unmanned site encompasses approximately 2.5 acres and has never been used for nuclear testing (Source: Clark, 1987).

5.1.2.4 Mt. Brock Communication Site

The Mt. Brock Communication Site is located on the summit of Mt. Brock and includes a total of 11.29 acres, 1.11 acres of which is fenced. Efforts to return the unused acreage to the Bureau of Land Management (BLM) have been initiated (Source: Clark, 1984b).

5.1.2.5 Project Shoal Site

The Project Shoal Site, commonly referred to as the Atomic Energy Commission (AEC) Site, was withdrawn in 1962 for AEC (now the Department of Energy) use by Public Land Orders 2771 and 2834. The site is located approximately 30 miles southeast of Naval Air Station (NAS), Fallon, in the Sand Springs Mountains. The site consists of approximately 2,560 acres and has been under joint-use control of the U.S. Navy and the DOE though a Memorandum of Understanding, No. AT(26-1)225, dated January 1, 1966. A general map of the Project Shoal Site is shown in Figure 5.4.

5.1.2.6 Tonopah Test Range

The TTR, located on the North Range of the NAFR, is operated for the DOE by Sandia National Laboratories (SNL). The TTR (approximately 385,000 acres), is used jointly by the 37th Tactical Fighter Wing (TFW) and the DOE, as well as other units scheduled by the 554th Range Group at Nellis AFB. DOE-related activities and employment in support of the 37th TFW are discussed in this section while Air Force activities and employment are presented in Section 2.1. Overall support activities for the 37th TFW, located on 1,530 acres of land within the northwestern portion of the TTR, are provided by two DOE contractors.

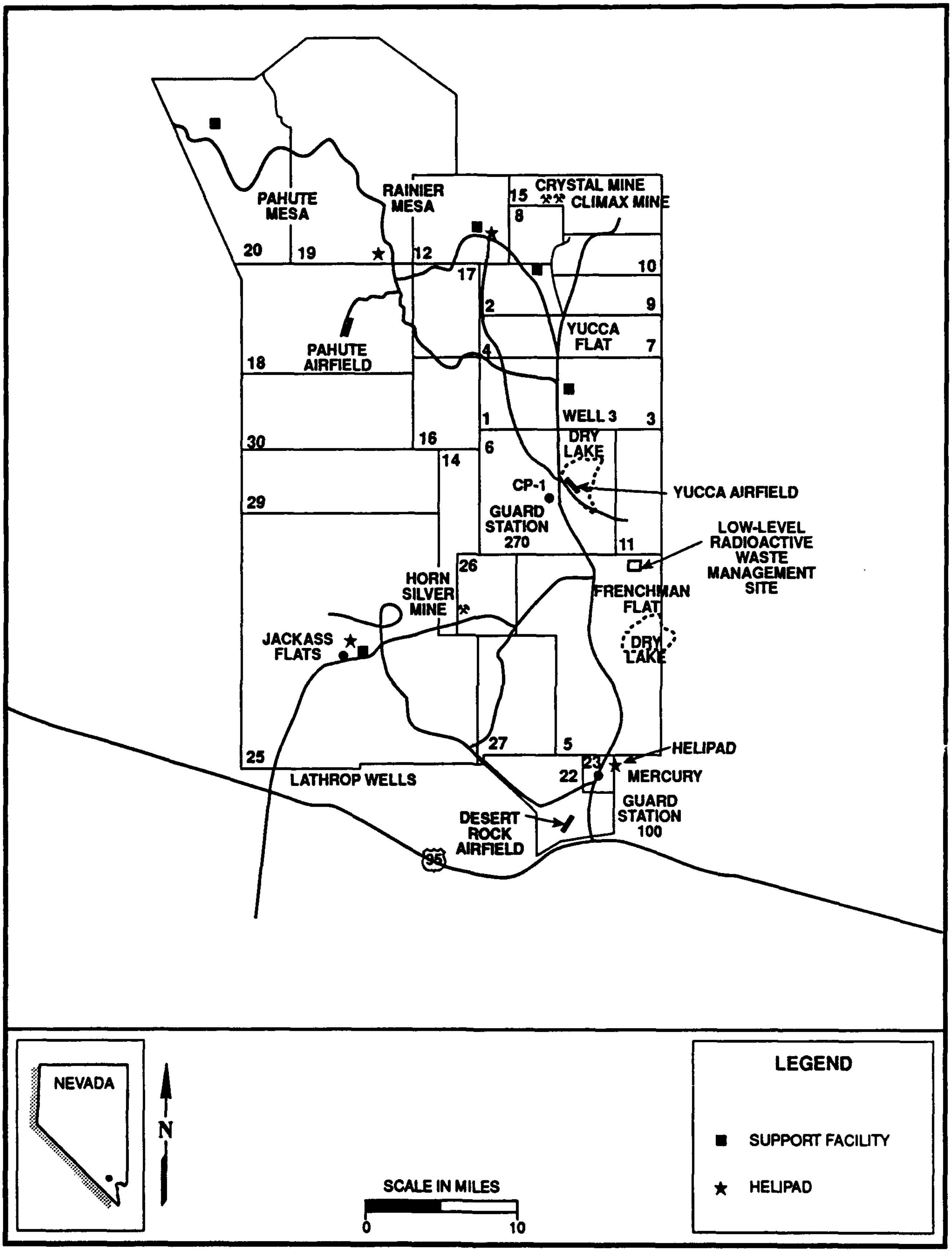


FIGURE 5.2 NEVADA TEST SITE

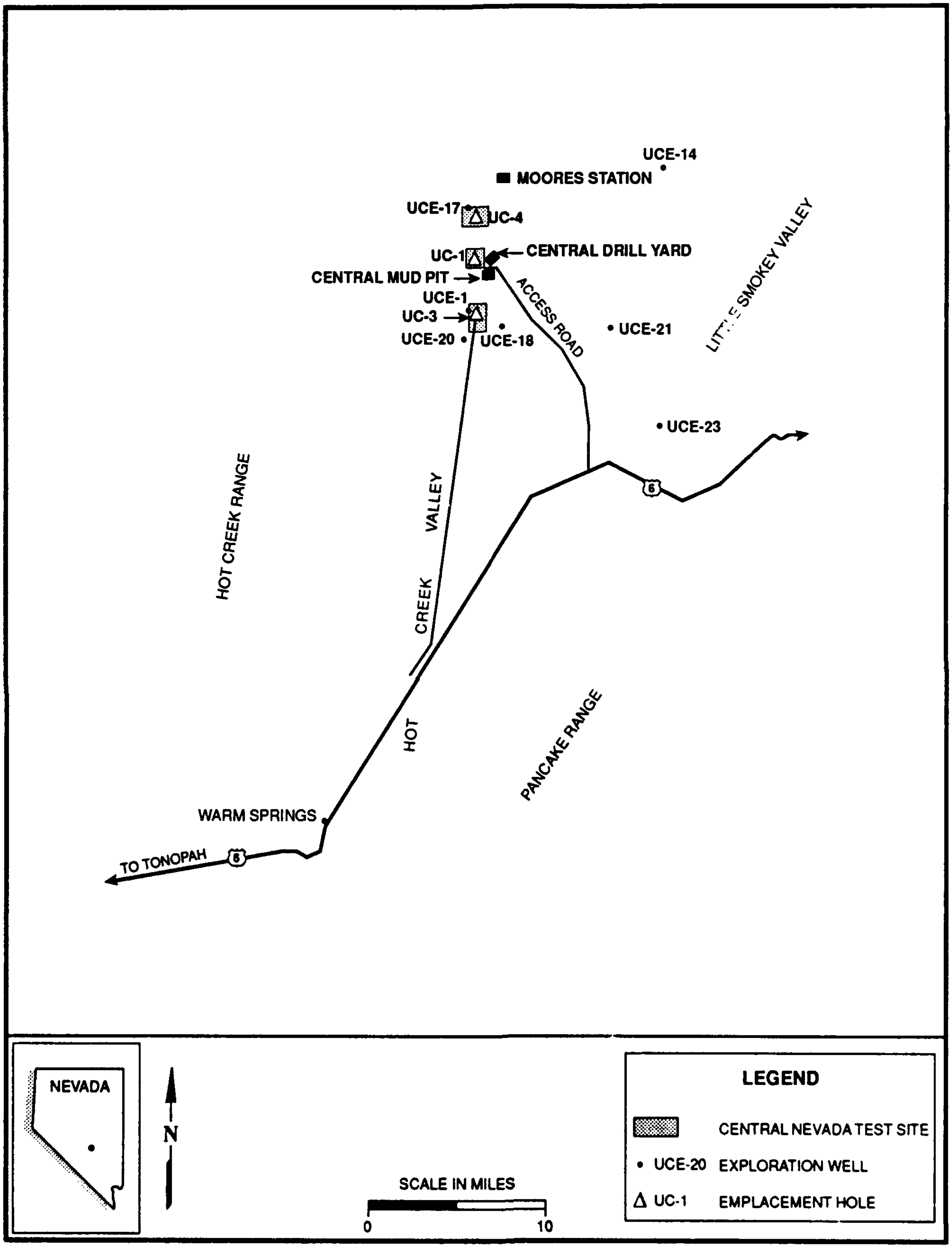


FIGURE 5.3 CENTRAL NEVADA TEST SITE

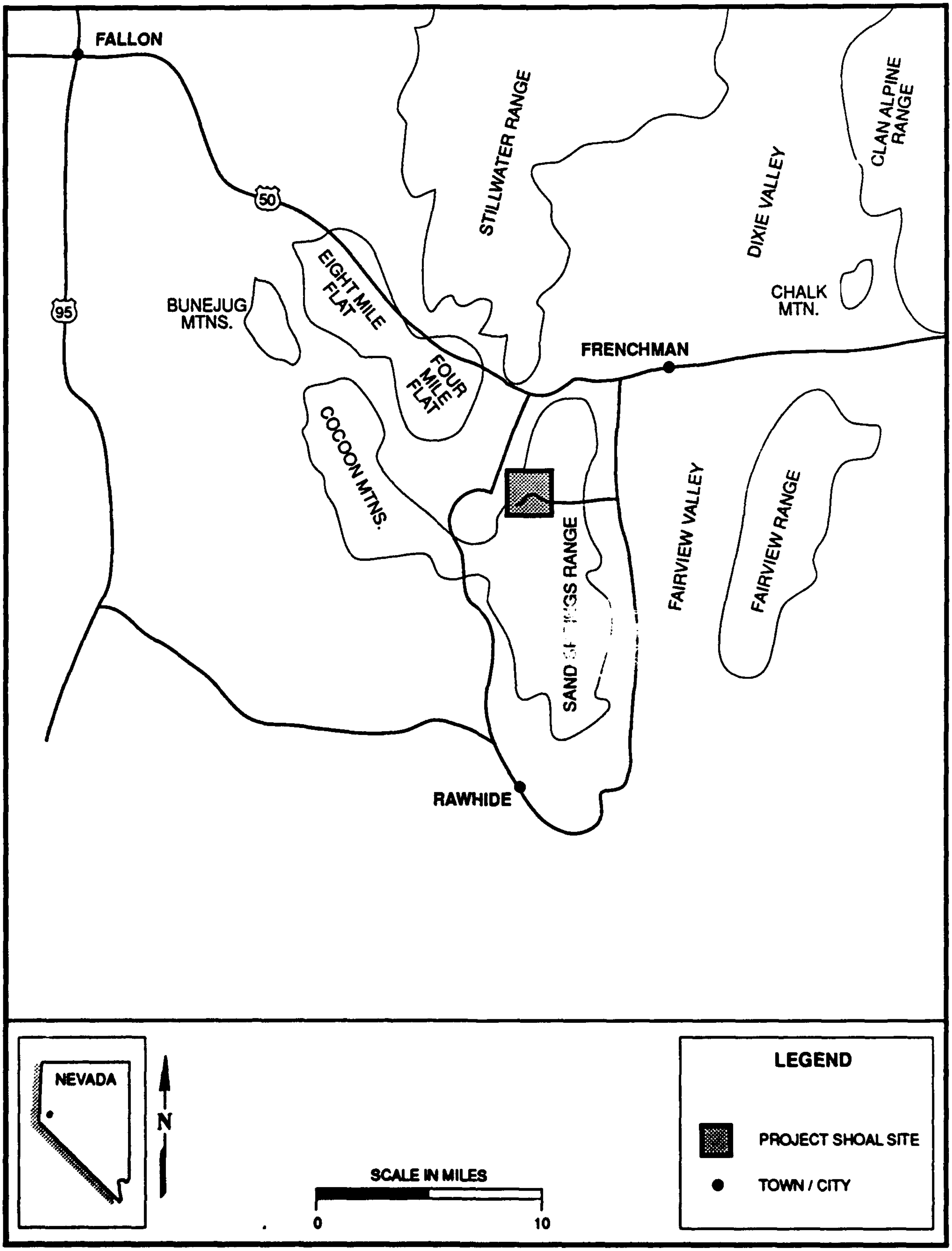


FIGURE 5.4 PROJECT SHOAL SITE

5.1.3 MISSION AND FACILITY DESCRIPTIONS

5.1.3.1 Nevada Test Site

The primary mission of the NTS is to provide a secure area for underground testing of nuclear weapons. Secondary missions include storage and disposal of low level radioactive wastes that have been generated on-site and off-site at other DOE facilities (Source: Reynolds Electrical Engineering Company, Inc. (REECo), 1988b).

Mercury, the main entrance to the NTS, is located in Area 23. Mercury contains facilities that house and support most of the research and administrative activities on the NTS. Area 6 contains the Control Point-1 (CP-1) where readiness briefings are held and final permission to arm the nuclear device and proceed with the test is given. CP-1 overlooks Yucca Flat, where a large percentage of the testing occurs.

Nuclear detonations have been used to experiment with new devices, proof-test warheads, safety-test designs, and to determine the effects of weapon outputs on military systems and components. Weapons effects test are primarily conducted in the NTS tunnels. Non-nuclear, Department of Defense (DOD) supported experiments include high-explosive chemical tests, which are conducted under static, dynamic, or inert conditions and use artillery, guns, aircraft, armored vehicles, demolitions, rockets, recoilless rifles, air-dropped ordnance, and electronic devices. Chemicals are tested for their performance (e.g., their ability to penetrate experimental barricades and armored structures).

The 1,527 foot Bare Reactor Experiment-Nevada (BREN) Tower located in Area 25 has been used for various complex tests. The Air Force Cambridge Research Laboratories have used weather equipment on the BREN Tower to calibrate acoustic sounding equipment (Source: ERDA, 1977).

Support facilities, utilities, laboratories, and offices exist at Frenchman Flat, Yucca Flat, Rainier Mesa and Areas 2, 3, and 25. A Liquefied Gaseous Fuels Spill Test Facility, located at Frenchman Flat, is a research and demonstration facility available on a user-fee basis to private and public sector sponsors to conduct spill-testing and safety research related to hazardous chemicals. Shop areas and warehouses are located in Mercury, Yucca Flat, Rainier Mesa, and Area 25 (Source: ERDA, 1977). Area 12 Camp (near Rainier Mesa) and Mercury are the only facilities that include food service and housing accommodations. Areas 6, 22, and 18 contain airfields, while Areas 6, 12, 19, and 25 have helipads. Areas 14, 16, 17, 29, and 30 have limited facilities but are used as exercise or support-activity areas.

The Desert Rock Airfield is located southwest of Mercury and north of U.S. 95 in Area 22. This airfield is used primarily to support DOE activities at the NTS. It also serves as a low-priority, emergency recovery airfield for Nellis AFB. Passenger and cargo type aircraft such as F-27s, DC-9s, Dash-7s, King Airs, C-130s, and a variety of helicopters use the airfield. The normal level of operations for Desert Rock Airfield is 3,500 to 4,000 per year; 2,500 aircraft operations occurred in 1988.

Detonation of nuclear devices on the NTS has occurred in surface tests (past method), down hole tests, tunnel tests, and cratering tests (past method). Most tests are announced to the public by the DOE. Announced tests prior to 1989 are summarized in DOE/NVO-209 (Rev. 10). The program associated with downhole tests and tunnel tests is ongoing. Currently used testing methods are described briefly in this section.

Downhole tests. Downhole tests are designed and conducted by the Lawrence Livermore National Laboratory (LLNL) and the Los Alamos National Laboratory (LANL). After a suitable site has been selected, generally in Yucca Flat or on Pahute Mesa, an emplacement hole is drilled. Special techniques developed at the NTS permit drilling of holes up to 12 feet (3.7 meters) in diameter to depths as great as 5,000 feet (1,525 meters). After the device and related equipment are lowered into the hole, the hole is carefully backfilled and sealed to prevent leakage of radioactive gas to the atmosphere.

When a nuclear device is detonated underground, the energy released immediately produces extremely high temperatures in the surrounding rock and soil. The temperature is high enough to vaporize the surrounding solid material. Pressures exceeding a million atmospheres are produced. An outgoing shock wave develops that is initially so strong that it vaporizes more of the surrounding material. As the shock wave expands, its intensity weakens until the surrounding rock and soil are melted rather than vaporized. The size of the underground cavity produced depends on the amount of energy released by the explosion, the depth of burial, and the physical properties of the rock and soil. At two to four times the cavity radius, the shock wave weakens so that its effect is limited to fracturing and heating the surrounding rock and soil. The generally spherical cavity is filled with vaporized material and lined with melted rock. After the cavity forms, the vaporized rock condenses and the molten rock flows towards the bottom, the residual gases cool, the pressure subsides, and collapse of the upper walls of the cavity begins. The cavity collapse is commonly initiated within a few minutes to several hours after its formation. Occasionally, it may be delayed for several days or weeks, but, once started, the collapse proceeds rapidly. This collapse progresses upward, producing a vertical, rubble-filled column known as a rubble chimney.

Following most nuclear tests, the chimneying process proceeds upward until it reaches the ground surface. The process terminates by the formation of a conical or bowl-shaped depression ranging from several tens of feet to a few hundred feet in diameter and up to 165 feet deep. These depressions are known as subsidence craters.

Tunnel tests. Underground tests conducted in the Rainier Mesa area are weapons-effects tests performed in tunnels mined horizontally into the Mesa. In these tests, the DOE works with the Defense Nuclear Agency (DNA) and national laboratories to measure the effects of blast-produced radiation on military hardware, such as rocket nosecones, warheads, satellites, and communications equipment.

A nuclear device is placed in the end of a tunnel, and a test chamber (as large as 20 feet in diameter) is placed a few hundred feet to as much as 2,000 feet down the tunnel from the device. A horizontal line-of-site pipe, which tapers from a diameter of a few inches at the device to about 14 to 16 feet at the test chamber, connects the device and the test chamber.

After the device is detonated, prescribed safety procedures are followed for reentering the tunnel, and removing the irradiated test materials and equipment for further evaluation.

NTS has been used for a number of other activities, including support functions for the NTS nuclear testing program and radioactive waste management (i.e., decontamination facilities, laydown yard, and laboratory facilities). Another unrelated activity which has added to the radioactive material inventory of the NTS is weapons safety tests as discussed below:

Weapons safety tests. Project 56 was a series of four safety tests conducted on the surface at the eastern edge of Yucca Flat. Safety tests are experiments designed to confirm that a nuclear explosion will not occur in case of an accidental detonation of the chemical explosives associated with the device. The four tests were detonated on November 1, 3, and 5, 1955 and January 18, 1956. Nuclear reactions did not occur to any appreciable degree at any of the test sites; however, plutonium was present and dispersed at the last three tests. In 1956, safety tests were concluded and decontamination efforts were conducted from mid-1956 to the early 1960's. Numerous studies by the Nevada Applied Ecology Group documented the extent of plutonium dispersal. Large portions of Area 11 remain contaminated by transuranics (TRUs) from these tests. Two trenches were filled with debris from the tests, including cables, scrap metal, boots, coveralls, and possibly contaminated wood. These trenches were covered with soil in the early 1960's.

Six experimental tests that involved development of nuclear reactors for a ramjet engine, as a part of Project Pluto, were conducted by LLNL in Area 26. Four tests of the so-called Tory II-A and two tests of the Tory II-C nuclear reactors were performed between 1961 and 1964. The leachfield constructed adjacent to the 401 MAD building in Area 26 handled radioactive liquids resulting from these tests (Source: ERDA, 1977).

Nuclear fuel recovery activities for the Tory II-C fuel tubes were carried out in the E-MAD facility in Area 25. The recovered fuel was shipped to the DOE's Idaho National Engineering Laboratory in 1978.

The DOE has conducted extensive research on the Project 56 to develop remediation techniques and will be conducting Environmental Restoration activities to evaluate the Pluto and Tory II-C sites.

Additional weapons safety tests were conducted on the TTR (Operation Roller Coaster) and one test was conducted on the southern portion of the NAFR north range.

5.1.3.2 Central Nevada Test Site

A large borehole, designed specifically for DOE nuclear testing, is centrally located within each of the withdrawn areas comprising the CNTS. Only one of these boreholes has been used for subsurface nuclear testing. They are protected by screens and grates. The unused boreholes are 120 inches in diameter and reach depths of 4,846 feet and 5,500 feet. The shallower borehole is cased with 56-inch casing. Two deep holes near the CNTS plus shallow springs and wells in the surrounding area are used to monitor the movement of radioactive contamination from the area used for a nuclear event (Source: Clark, 1984a). This monitoring and evaluation have found that there are no significant risks posed by this site; however, a drilling pit located at this site was found to contain chromium, a common constituent of drilling fluids. The DOE plans to further characterize the extent, and significance (in terms of risk) of this chromium as part of their Environmental Restoration Program.

5.1.3.3 Nelson Seismic Station

The Nelson Seismic Station serves as a monitoring station for NTS activities, is unmanned, and has never been used for nuclear activities (Source: Clark, 1987). The portal to the facility containing the seismic equipment is secured by a locked steel door. There are no other facilities at this site.

5.1.3.4 Mt. Brock Communication Site

The Mt. Brock Communication Site contains unmanned communication and support hardware that serve as a vital link in the NTS communication network. The fenced 1.11 acre site has not undergone any construction since the early 1960's. Propane is utilized for back-up power and the entrance is blocked by a locked gate.

5.1.3.5 Project Shoal Site

The Project Shoal Site was the location of a 1963 underground nuclear test. Land in the vicinity of, but not on, the site is largely unused except by a few miners who hold and work mining claims in the area. The DOE controls the site to monitor ground water. This Site is currently used by the Navy for strike rescue training, primarily with helicopter aircraft (Source: Western Division, Naval Facilities Engineering Command, 1982b).

5.1.3.6 Tonopah Test Range

The principal DOE activity at the TTR is stockpile reliability testing and R&D testing support of structural development, arming, fuzing and firing systems and weapons delivery systems related to nuclear weapons. Testing techniques include artillery firings, bomb drops, cruise-missile tracking and scoring, rocket launches, fly-arounds, terradynamic tests, and earth penetrator tests using air-drop, rocket boost and Davis gun. Structural testing of nuclear systems sometimes involves special nuclear material (SNM), however, all tests are performed on mock subassemblies only. The TTR does not test any hardware capable of nuclear yields.

5.1.4 INFRASTRUCTURE

Infrastructure exists only at the NTS and the TTR, therefore, other DOE withdrawals are not discussed in this section.

Utility systems and power lines closely parallel the road network on the NTS (Source: ERDA, 1977). There are 13 sanitary systems that have primary and secondary waste water treatment capabilities, and discharge into percolation/evaporation stabilization ponds. As of July 1988, all waste water facilities in Areas 6 and 25 (each area has four waste water facilities) have been approved and permitted; permit information for Areas 2, 12, and 23 has been submitted to regulatory authorities, and are pending (Source: REECo, 1988d). As of September 1988, the NTS had received 41 approved septic tank permits and had submitted one to the State of Nevada for approval. Sewage treatment plants do not treat wastes generated by any manufacturing process.

As of September 1988, there were 11 landfills on the NTS for disposal of dry solid wastes. The NTS disposal sites include construction and sanitary landfills or trenches in Areas 23 (Mercury), 6, 20, 25, a grease pit in Area 12, and subsidence craters used for landfills in Areas 3, 9, and 10. All landfills, with the exception of the subsidence craters, contain municipal and construction waste only (Source: REECo, 1988c).

Water is supplied to NTS facilities by several wells located on NTS. From 1961 to 1977 wells in Yucca Flat, Frenchman Flat, and Mercury Valley supplied approximately 970 acre-feet of ground water to NTS facilities annually. In addition to these areas, the NTS has wells on Pahute Mesa and in western Jackass Flats (Source: ERDA, 1977).

The NTS has an underground storage facility with capacities of 37,000 and 6,000 gallons for Jet A and JP-4 fuels, respectively. JP-4 fuel is also stored in an above-ground tank and in a mobile tanker with 1,200 and 5,000 gallons capacities, respectively (Source: REECo, 1988a).

State permitted DOE water sources at the TTR are Well 1A, BLM well (Mancamp area); Well 3A, 3B, EH-2 (Industrial area); Well 6 (Sandia area); the TECR well (O&M area). There is also a state permitted Sewage Lagoon at TIADS/Mancamp area (DOE/NV). Fourteen storage tanks at the TTR are used for fuel supply to generators at remote locations and for fueling Range vehicles. Seven of the eight aboveground tanks are of small volume (i.e., 40 to 500 gallons) and are relatively portable. One aboveground diesel tank at the TTR has a capacity of 1,000 gallons. Below-ground tanks are of average size for vehicle fuel dispensing (i.e., 1,000 to 10,000 gallons). Three bulk storage areas are used for the storage of drums and containers of oil and other products used in maintenance of vehicles and equipment.

5.1.5 PROPOSED AND ENVISIONED CHANGES

There are no planned or scheduled changes through the year 2000 in ownership, mission, boundaries, or use of the NTS, the CNTS, Nelson Seismic Station, Project Shoal Site, or DOE-related activities on the TTR. The Mt. Brock Communications Site has approximately 10 acres of unused lands, and action has been initiated to return this excess land to the BLM.

The potential movement of the 37th TFW from the TTR in the spring of 1992 could result in the reduction of the DOE contractor workforce currently supporting operations of the unit. The runway and navigational aids will remain open for use by the DOE and Air Force activities. Until a reuse proposal has been developed, the long-term effect on the DOE contractor work force cannot be determined. However, for this report, the activities are assumed to cease by the year 2000.

5.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from land withdrawals and activities associated with the DOE. Sources of potential effects and analysis of effects on public health and safety are identified.

5.2.1 GROUND MOTION

Ground motion studies have played a large role in the weapons testing program. SNL has developed a program for recording surface and subsurface motions resulting from underground nuclear explosions (Sources: Vortman, 1979; Vortman and Long, 1982). There are several factors that influence the level and duration of ground motion from these underground explosions, including 1) yield of the device; 2) ground-coupling at the source of the explosion, which is a function of depth of the device, local geology, and stratigraphy; 3) geological complexity along the transmission path; and 4) the topography and geology at the location receiving ground motion. There is always some variation or unknown associated with estimating these factors, but because of the long history of conducting weapon tests, the effects are reasonably predictable.

5.2.1.1 Sources of Potential Effects

The yield or size of underground nuclear explosions is limited by the Limited Test Ban Treaty to a maximum high-explosive equivalent of 150 kilotons (kt). For the purposes of the Special Nevada Report (SNR), all future weapons testing is assumed to occur under this limitation. Currently, underground nuclear testing is conducted in the Pahute Mesa and Yucca Flat areas. Because geologic structure may differ considerably among the testing areas, effects of tests in the unused areas are uncertain. Nevertheless, the geographic areas for testing and the yield limits can be used to estimate ground motion effects from future weapons tests. The principal testing areas are shown on Figure 5.5.

5.2.1.2 Analysis of Effects

Ground motion hazards can result from the underground nuclear explosion and secondary seismic effects. Because of the rather complete recording of ground motions emanating from NTS activities, the effects of the weapons testing program are predictable, and damage effects have been documented.

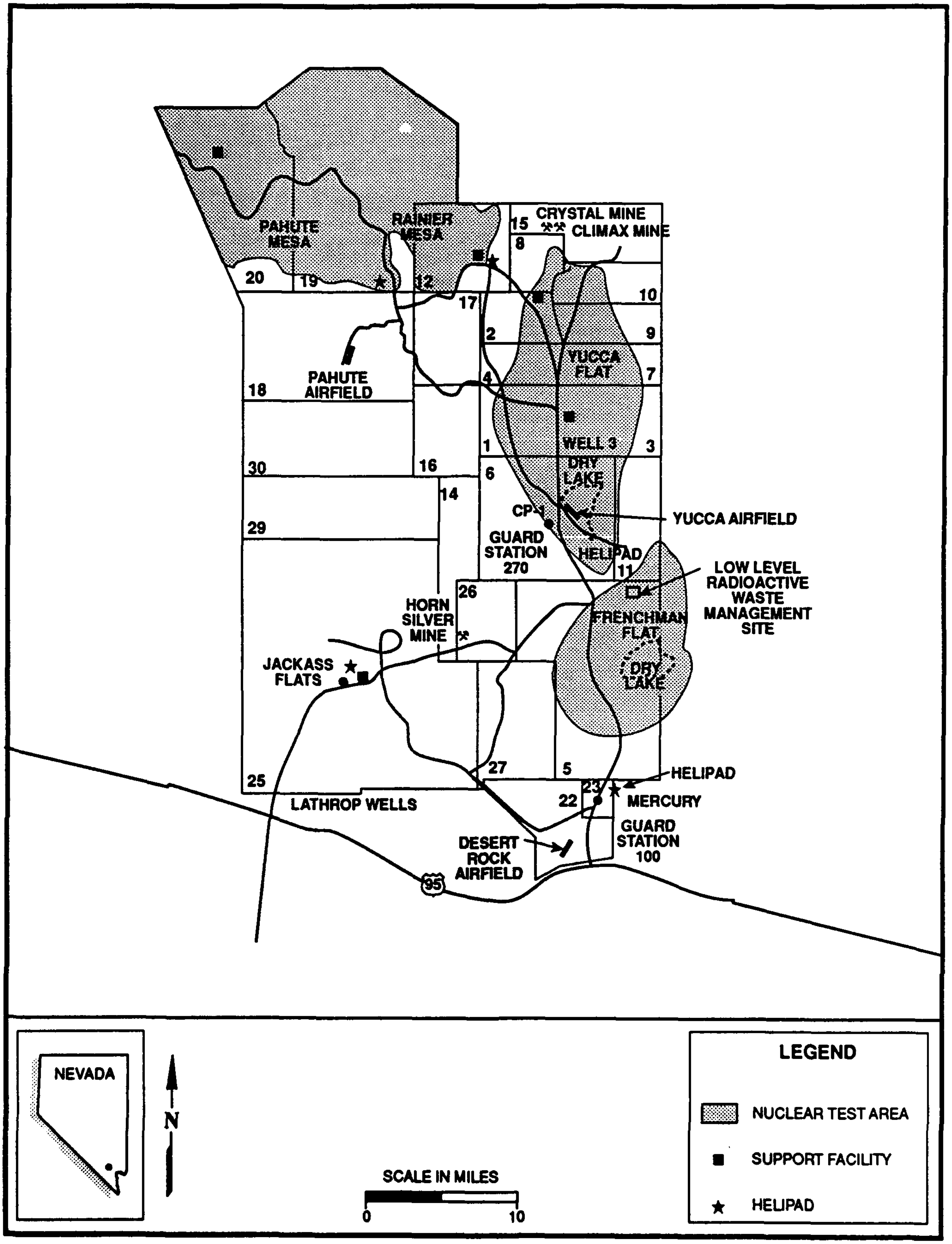


FIGURE 5.5 NEVADA TEST SITE PRINCIPAL NUCLEAR TEST AREAS

Communities within about 30 miles of testing areas that could be most affected by ground motion from underground nuclear explosions are Beatty, Amargosa Valley, and Indian Springs. The closest potential testing areas for these communities is 19 to 25 miles. Table 5-1 is a tabulation of peak horizontal ground motions for 150 kt tests at 19 miles, using regressions developed by Long (1986). Peak ground acceleration, velocity, and displacement were computed at the 50th and 84th percentiles of the log-normal distributions given by Long (1986) for rock and alluvium recording geology at 19 miles for a 150 kt test. Expected peak ground accelerations are well below 0.05g, which is the acceleration where slight damage might occur in typical buildings less than several stories in height.

Table 5-1. Predicted (50th and 84th percentiles) Peak Ground Motions at Localities Nineteen (19) Miles from Underground Testing Areas.

Distance (mi)	Yield (kt)	Acceleration (g's)		Velocity (ft/sec)		Displacement (inches)	
		50%	84%	50%	84%	50%	84%
Rock							
19	150	0.012	0.029	0.03	0.07	0.09	0.2
Alluvium							
19	150	0.009	0.016	0.03	0.06	0.11	0.24

NOTE: All peak values reported are the largest of the radial and transverse components.

Data pertaining to off-site damage support conclusions based on expected motion. The Nevada Test Site Environmental Impact Statement (EIS) (1977) reported that only architectural damage has been sustained in the local communities for tests greater than 100 kt. Since the Threshold Test Ban Treaty, only a few reports of damage to local communities occur each year, and these are of very minor nature. Beyond about 30 miles, structures would have to be higher than several stories tall before they would be affected. The closest location where structures of this height are located is Las Vegas. A smaller number of similar complaints have been recorded from people in Las Vegas high-rise structures.

Several Nye County mines are located in the testing vicinity, but all at a distance greater than 25 miles from the closest potential testing area. Because the distances from these mines to the underground nuclear explosions are approximately the same as, or greater than, the distances for communities, damage to structures in the mines is not expected. In investigations of earthquake effects to mines (Source: Owen, 1981), there are very few reports of damage. Surveys of mines in the vicinity of the NTS by Owen and Scholl further support these findings (Source: ERDA, 1977).

In addition to direct ground motion effects of underground nuclear explosions, there is also potential hazard from secondary seismic effects. Secondary effects are associated with co-seismic strain release attributed to release of tectonic strain, aftershocks that can be associated with tectonic strain release, and events associated with the collapse of cavities created by the underground nuclear explosions. Beyond 3-6 miles of even the largest , pre-Limited Test Ban Treaty underground nuclear explosion (greater than 1 megaton), there was no evidence of significant secondary seismic effects associated with the test; and in no case has the magnitude of an aftershock been larger than the magnitude of the underground nuclear explosion (Source: URS/John A. Blume and Associates, 1986).

5.2.2 AIR QUALITY

Construction and operation of facilities at the NTS are conducted in compliance with the rules and regulations of the Nevada Division of Environmental Protection (NDEP). The DOE maintains records of the actual hours of operation and production for each permitted source for submission to the NDEP as a permit condition.

The operation and maintenance of facilities at the CNTS, Nelson Seismic Station, Mt. Brock Communication Site, and Project Shoal Site result in minor amounts of maintenance-vehicle exhaust, fugitive dust and, in the case of the Mt. Brock Communication Site only, occasional propane combustion from a propane-fueled, back-up power generator. (Source: Clark, 1984b). These facilities do not generate emissions that are significant or permanent, and, therefore, do not affect public health and safety. The areas surrounding these four sites are in compliance with the National Ambient Air Quality Standards (NAAQS) established by the EPA (see Table 1-2 in Section 1.4.1.2). These four sites are not discussed further in this section.

The principal DOE activity at the TTR is research and development on nuclear ordnance. Some emissions related to activities such as commuting and space heating result from employees currently working at the facility. These emissions have not been quantified, but are expected to be relatively insignificant, particularly since they are dispersed over a large area. For example, 47 percent of the commuters reside in Clark County and 42 percent reside in Nye County. The surrounding area is in attainment for all NAAQS, so the air quality effect is insignificant.

5.2.2.1 Sources of Potential Effects

Air emissions from the NTS originate from concrete batch plants, aggregate crushing and processing, surface disturbance, fire training exercises, motor vehicle operations, boilers, fuel storage, and intermittent operations. The concrete batch plants, aggregate crushing and processing facilities, and surface disturbance activities are sources of particulate matter. These activities are largely intermittent and occur in support of specific testing programs on the NTS. Fire training exercises consist of periodic open burning in designated areas with approved fuel materials to provide training experience for fire and emergency personnel; these exercises occur only a few times per year.

The motor vehicle operations and boilers are the largest sources of air pollutants on the NTS. On-road motor vehicles travel a total of 2,000,000 miles per month and consume 169,000 gallons of gasoline monthly (Source: REECo, 1988a).

The boilers, construction equipment, and other diesel engines consume 187,000 gallons of diesel fuel per month (Source: REECo, 1988a). Using emission factors from the EPA's Compilation of Air Pollutant Emission Factors, AP-42, Volume II: Mobile Sources (Source: EPA, 1980) for 1987 model year light duty gasoline powered trucks at the 50,000 mile level, and for miscellaneous heavy duty construction equipment, the following emission rates have been calculated:

Pollutant	Trucks	Equipment
NO_x	28.6 tons/year	413.1 tons/year
CO	276.3 tons/year	172.3 tons/year
HC	21.8 tons/year	37.8 tons/year
SO_2	insignificant	34.9 tons/year
PM	insignificant	33.8 tons/year

Evaporative hydrocarbon losses from fuel storage depend on the amount of fuel stored and used. The NTS has total storage capacity of 400,000 gallons of gasoline and 500,000 gallons of diesel fuel. A detailed emission inventory is not available for the NTS. At Nellis AFB, for which a detailed emission inventory is available (see Section 2.2.3), the total storage capacity for all fuels is 2,700,000 gallons (Source: U.S. Air Force, undated). Since NTS fuel storage is approximately one-third of Nellis AFB storage, the evaporative hydrocarbon losses at the NTS are estimated to be one-third of the Nellis AFB estimate, resulting in approximately 130 tons/year of hydrocarbon evaporative losses at the NTS.

Aircraft operations at Desert Rock Airfield (Mercury) are relatively low (3,500 to 4,000 per year); therefore, the emissions resulting from related air and ground activities are negligible.

No substantial increases in air pollution emissions are expected at the NTS by the year 2000.

5.2.2.2 Analysis of Effects

All DOE facilities are in compliance with their air emission permits (Source: J. Brandmueller, NDEP, personal communication, 1990). Furthermore, emission sources for DOE activities are distributed over a large area, which assists in the dispersion of air pollutants released to the environment. The surrounding region is in compliance with all NAAQS; thus, no significant public health and safety concerns are evident.

5.2.3 WATER QUALITY AND FLOOD HAZARD

Radioactive wastes are a primary concern to the DOE and to the public. Sources of radioactive waste and control of these wastes are discussed in Section 5.2.4. Non-radioactive hazardous materials are handled in accordance with regulations of the Resource Conservation and Recovery Act, which also apply to the hazardous components of radioactive mixed wastes (Source: DOE, 1989a, 1989b). Waste water discharges are handled in accordance with applicable Federal and state laws and regulations. All waste water discharges at the NTS are permitted under the program of the National Pollutant Discharge Elimination System (Source: DOE, 1989b). The procedures followed are intended to protect the health and safety of the NTS workers and the environment.

5.2.3.1 Sources of Potential Effects

Nevada Test Site

Extensive underground nuclear testing has resulted in large amounts of radioactive materials beneath the land surface, above and beneath the water table, and some residual radioactive material at land surface. Radioactive wastes and contaminated equipment from the nuclear testing programs have been stored and disposed of on the NTS, although some of the radioactive waste, such as reactor fuel elements, has been shipped to the Idaho Nuclear Engineering Laboratory. Packaged transuranic wastes generated at LLNL are stored at the NTS, pending shipment to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. Low-level radioactive wastes have been, and are being, disposed of at selected locations on the NTS (Source: DOE, Nevada Operations Office, 1989c).

A preliminary environmental survey of the NTS (Source: DOE, 1988d) identified a number of non-radioactive potential sources of ground water contamination. These potential sources included waste water discharges, hazardous or mixed-waste discharges to waste management site, solid waste landfills and trenches receiving potentially hazardous waste, and over 50 inactive waste, spill or release sites.

Central Nevada Test Site

Two sources of water contaminants exist at the CNTS that represent potential effects to public health and safety. The first is the underground cavity created by the Project Faultless nuclear test in 1968. The level of radioactivity remains high in this underground cavity. The other source is represented by the drilling "mud pits" which contain hazardous material, such as chromium.

There are no watersheds on the withdrawal that represent a public hazard due to floods. Surface run-off from the site could, however, carry hazardous materials from the mud pits off-site to Moore Station Wash, a major ephemeral drainage in Hot Creek Valley.

The DOE has plans to conduct a remedial investigation/feasibility study (RI/FS) on the CNTS. Remedial actions will be determined by the RI/FS. Ground water levels in the shot cavity are measured on an annual basis to monitor the infill rate. Most test-related drillholes were plugged when the site was decommissioned, and drilling or excavation prohibited within 3,300 feet of surface ground zero.

Project Shoal Site

The only known source of water contaminants on the Project Shoal Site that represent a potential public health hazard or safety concern is the underground nuclear test cavity. The level of radioactivity in this cavity remains high. Since this withdrawal is small it represents no public hazards due to floods; and there are no surface contaminants to be carried off site by surface water run-off. As part of its Long Term Hydrological Monitoring Program, the DOE annually samples for radioactivity in seven wells that are located within several miles of the Project Shoal Site.

Tonopah Test Range

In 1988, the DOE conducted a Preliminary Assessment (PA) of potential hazardous and toxic waste sites on the TTR, relative to DOE activities at the TTR. The PA identified 18 potential sites; however, no soil or water samples were collected. These sites include french drains, septic tanks and leach fields, underground fuel tanks, landfills, sewage lagoons, and surface test areas where nuclear devices were destroyed by chemical explosives. Three sites did not contain hazardous or toxic materials (two landfills and an abandoned sanitary sewage treatment lagoon). At two sites, silver and photographic processing chemicals were discharged to french drains and leach fields. At four other sites, the contaminants include petroleum products, volatile organic compounds, and lead.

The remaining nine sites are contaminated with beryllium or radioactive materials. The radioactive residuals produced by four safety tests in 1963 (named Double Tracks and Clean Slate I, II, and III of Operation Roller Coaster) that involved destruction of nuclear devices by chemical explosion (non-nuclear detonations), remain on the TTR. Figure 5.6 shows the hydrologic basins and test areas on the TTR.

Two separate ground water systems (Cactus Flat and Stonewall Flat) are of importance. Because these systems are largely within restricted areas, there has been limited ground water development and little is known about the aquifers. In Cactus Flat, well logs indicate the sediments are composed of gravels, sands, silts, and clays but no continuous confining layers. The depth to ground water in Cactus Flat ranges from 90 to 150 feet, depending on the local surface elevation. Less is known of the Stonewall Flat ground water system. Desert Well, the only well in Stonewall Flat, has no recorded well log, however, the stratigraphy is thought to be similar to that of Cactus Flat. The depth to water at Desert Well was reported to be 110 feet. Regional ground water discharge from both of these systems is believed to be toward Sarcobatus Flat.

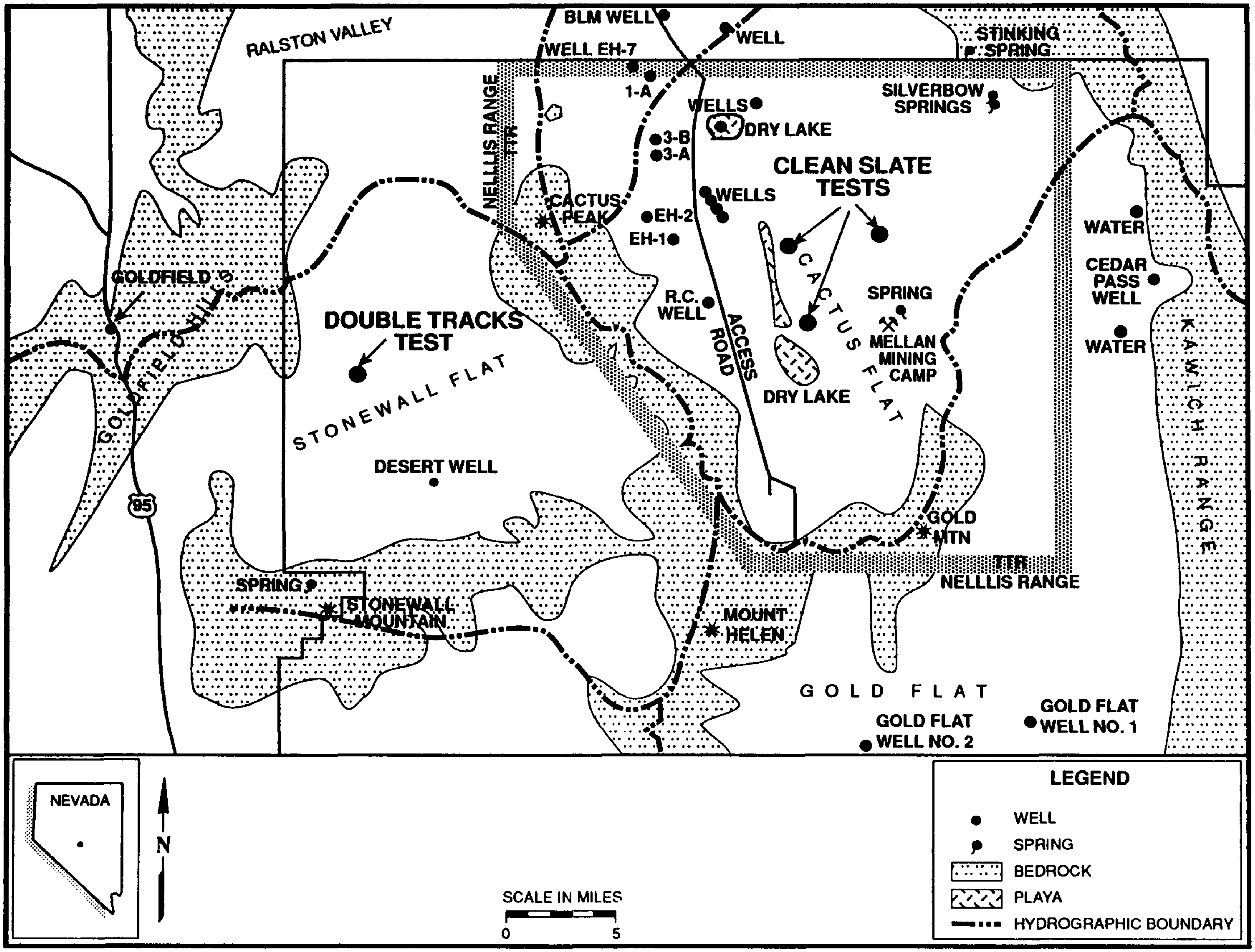


FIGURE 5.6 HYDROGRAPHIC BASINS AND WATER RESOURCE FEATURES AT TONOPAH TEST RANGE (TTR)

5.2.3.2 Analysis of Effects

Nevada Test Site

The hydrologic basins and directions of surface water flow are shown in Figure 5.7. Figure 5.8 shows regional ground water flow directions and areas where nuclear tests have been conducted below the water table. Hydrologically, the radioactive materials on the surface and those below the water table are the most important. Radioactive and non-radioactive hazardous waste lying beneath land surface but above the water table, are of lesser concern than waste below the water table because of the very long transit time through the unsaturated zone to the water table.

Ground Water. Hydrogeologically, the NTS is a complex region, composed of three primary classifications of aquifers: valley fill alluvium, volcanic rocks (e.g., tuffs, basalts), and carbonate rocks (e.g., limestone and dolomite). Depth-to-ground water varies from approximately 660 feet beneath valleys in the southern part to more than 1,640 feet beneath Pahute Mesa. Locally, there are perched water tables at shallower depths (Source: ERDA, 1977). Regionally, ground water flow is controlled by two major flow systems in the carbonate rock aquifers that underlie most of the NTS. The alluvial and volcanic rock aquifers generally overlie the carbonates, and ground water flow is from those units into the carbonates. Radioactive or other hazardous materials located in the thick (600 to 1,640 feet) unsaturated zone above the water table are expected to remain in that zone for an extended period before reaching the water table. At the Area 5 Low-Level Radioactive Mixed Waste Management Site, travel times to the water table range between nearly 19,000 years and over 113,000 years (Source: DOE Nevada Operations Office, 1989c).

Beneath the water table, movement of radionuclides away from the detonation points is greatly influenced by the process of sorption. This process tends to retard the movement of most nuclides. Tritium, the radioactive isotope of hydrogen, is the major exception. It tends to be incorporated in water molecules which move virtually the same as non-tritiated water. Tritium, however, has a relatively short half-life of 12.3 years. Thus, even though large quantities of tritium have been produced, it decays rapidly to stable hydrogen.

Ground water in some aquifers at the NTS is contaminated. Safe ground water supplies can, and have been, developed by NTS workers. The DOE maintains a comprehensive water quality monitoring program to ensure safety of the NTS water supplies.

While ground water in some aquifers at the NTS is contaminated, there is no indication of off-site ground water contamination. Any ground water contamination leaving the NTS is expected to be carried by one of the regional ground water flow systems (Figure 5.8). Ground water flow velocities in these systems range between 6 and 600 feet per year. Because of sorption, however, most nuclides (other than tritium) are not expected to move at that velocity (Source: DOE, 1988e). The travel time from the NTS to Ash Meadows discharge area of the Ash Meadows Flow System is approximately 300 years. Radioactive decay during this time, coupled with dilution, should reduce radioactivity concentrations to

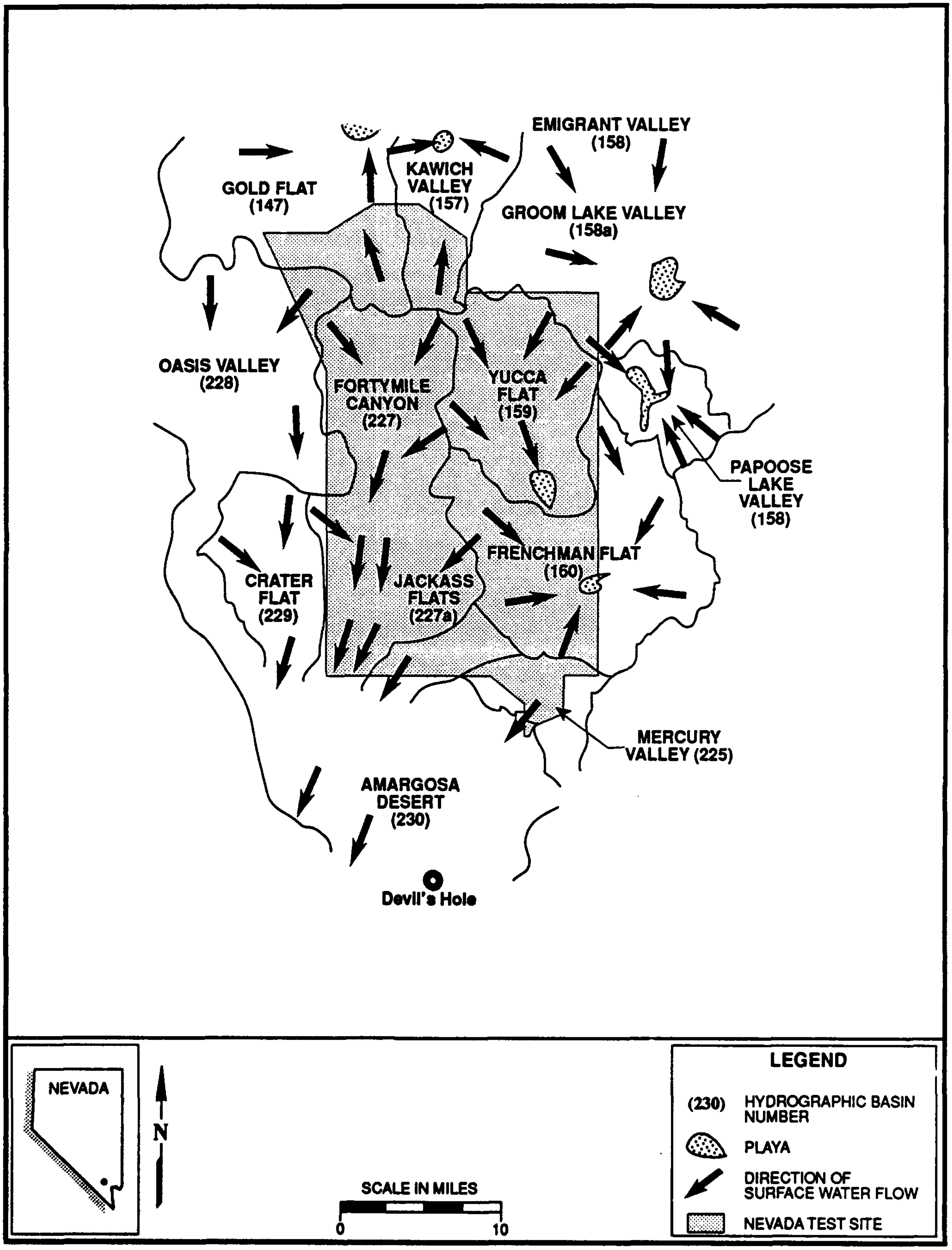


FIGURE 5.7 HYDROGRAPHIC BASINS AND SURFACE WATER FLOW, NEVADA TEST SITE

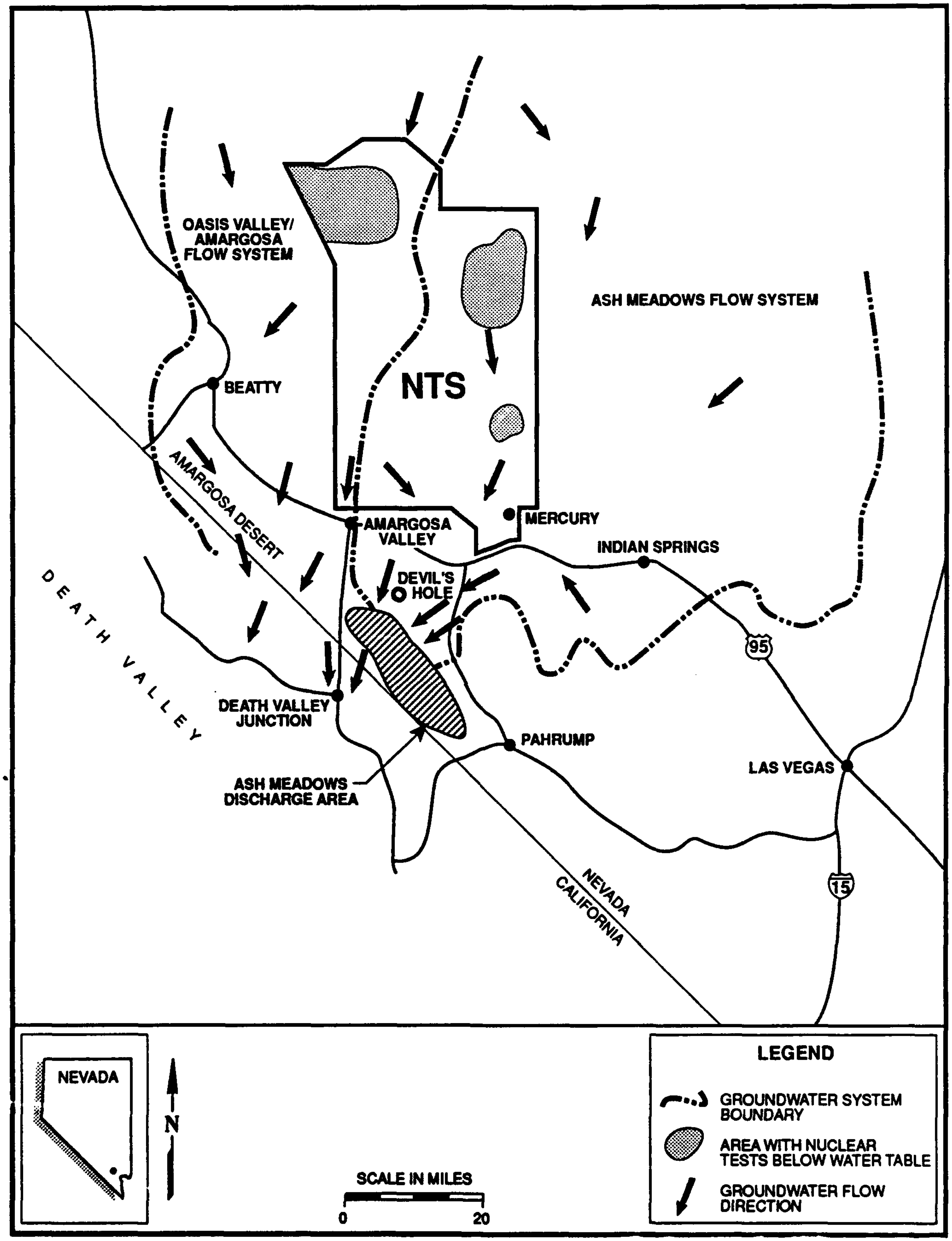


FIGURE 5.8 REGIONAL GROUNDWATER FLOW SYSTEMS IN RELATION TO THE NEVADA TEST SITE

well below regulatory limits (Source: DOE, 1988e). Thus, there are no known effects to public health and safety associated with contaminated ground water at the NTS, nor are any expected by year 2000.

Floods and Surface Water Runoff. Two watersheds on the NTS have the potential of endangering off-site public health and safety due to flooding: Fortymile Canyon and Jackass Flats watersheds. Using regional peak flood flow equations for the Southern Nevada area (Source: Squires and Young, 1983), the 100-year peak flow from the Fortymile Canyon drainage is estimated to be approximately 13,000 cubic feet per second; the peak flow from the Jackass Flats drainage is estimated to be approximately 8,200 cubic feet per second. No construction has occurred on the NTS to significantly alter these peak flows. Floods of this magnitude could reach U.S. 95. Past activities in these watersheds (for example, testing of nuclear weapons and work associated with nuclear rocket engine development) pose the potential for 100-year floods to transport and disperse contaminants beyond the boundaries of the NTS. Quantitative estimates of this potential cannot be determined without additional studies.

The DOE is implementing an Environmental Restoration Program at the NTS that will evaluate all active and inactive release sites and waste disposal sites in Jackass Flats and Fortymile Canyon. Any sites that could disperse contaminants off of the NTS as a result of flooding will be evaluated to determine the associated risk to human health and the environment. In the event that such risks exceed regulatory standards then the DOE will remediate these sites under the provisions of CERCLA which require protection from flood induced transport of contamination.

Central Nevada Test Site

Project Faultless (1968) was the only nuclear test conducted at the CNTS. Radioactivity from the test was contained during the event and all subsequent drillback operations. A radiological survey, made prior to demobilization and restoration, detected no radioactivity that could be attributed to the project.

Ground Water. The primary source of subsurface geologic data is the several exploratory holes that were drilled in the area. The emplacement hole for the Faultless test penetrated alluvium from the surface to a depth of 2,400 feet. The alluvium is underlain by tuffaceous sediments and zeolitized tuff from 2,400 to 3,275 feet, which was the total depth of the hole.

The water table in the immediate area of the Faultless site is approximately 500 feet below land surface. Hydrologic test holes drilled in the area indicate that ground water potentials do not increase or decrease with depth; therefore, the flow is lateral. The recharge area for Hot Creek Valley is found in the Hot Creek Range to the west and northwest of the valley. Water moves laterally from the alluvial fans toward the central portion of the valley. Ground water movement in the central portion of the valley and in the general area of the Faultless site is in a southeasterly direction towards Railroad Valley.

A hydrologic mound exists around the Faultless site, producing a gradient toward the test cavity's chimney. The chimney had not filled above 2,280 feet below land surface in 1972, four years after the test. In 1983, the fluid level in well UC-1-P-2SR was 1,088 feet below land surface and approximately 542 feet below the pre-event water level.

Numerous drill holes were plugged; two wells, HTH-1 and HTH-2, were left open for hydrologic monitoring. Well UC-1-P-2SR was also left open to monitor water levels and chemistry from above the shot cavity. A radiological survey of all surface facilities and shallow soils detected no radioactivity other than naturally occurring nuclides. Sampling for non-radioactive hazardous materials indicated that chromium and an organic solvent were present in an uncovered drilling mud pit.

A long-term hydrologic monitoring program is conducted by the DOE. Six wells and springs are monitored annually for tritium and no radioactivity above background levels has been found in these monitoring wells. Elevated levels of tritium have been found in well UC-1-P-2SR, which is believed to be connected to the test cavity.

Samples of the non-radioactive hazardous materials collected at the CNTS contain concentrations of chromium at levels that slightly exceed the EPA toxicity concentrations. However, because only two samples were collected, the extent of the chromium contamination cannot be determined, but there are roughly 10,000 cubic feet of crusted drilling mud in the mud pit. The chromium is believed to be from chrome lignosulfonate, an organic-based drilling mud additive used for controlling mud viscosity and water loss.

The potential for direct contact with radionuclides in the cavity (3,200 feet below ground) is minimal because no drilling or mining is permitted within 3,300 feet of surface ground zero. Well UC-1-P-2SR remains open to above the cavity to measure water levels. Direct contact of cavity water other than by authorized personnel is not likely. Direct contact with chromium in the mud, however, is possible.

Ground water is not likely to migrate away from the cavity-chimney complex until it has filled the available void volume and approaches the pre-event water table level. After this occurs, contaminated ground water could leave the chimney in a general south-southeast direction at a velocity of 0.4 feet per year. Another 80 to 100 years may elapse before filling to pre-event levels is complete.

Migration of chromium to the ground water from the central mud pit is unlikely due to the low permeability of mud. The depth to ground water at the central mud pit is estimated to be 500 feet.

There are no water wells used for domestic supply within a four-mile radius of the cavity and the potential for radioactive release to surface water is not plausible.

While there is a considerable inventory of radioactive materials beneath the water table and some non-radioactive hazardous material at land surface, there is no effect to public health and safety related to water supply, nor are effects likely to occur by year 2000.

Floods and Surface Water Runoff. Surface water runoff from the CNTS has a small probability of transporting contaminants to a location where they could impair either a current public water supply or public health and safety. The central mud pit is within one mile of several ephemeral streams. Based upon topographic maps of the area, the average slope from the mud pit to the ephemeral streams is two percent. Flash floods could cause migration of chromium or organic mud wastes; however, the levels of chromium are low, and surface water is not used for drinking water in the area.

Given the topography of the area and current land uses, the CNTS has no effect on public health and safety, and none is likely by year 2000, from the viewpoint of flooding.

Nelson Seismic Station

Surface water runoff from this site will not transport contaminants to a location where they could impair either a current public water supply or public health and safety. Given the topography of the area and current land uses, the Nelson Seismic Station has no effect on public health and safety, and none is likely by year 2000, from the viewpoint of flooding.

Mt. Brock Communication Site

Given the topography of the area and current land uses, the Mt. Brock Communication Site presents a minor effect to public health and safety because of a potential for the site access road to concentrate and increase flood flows into an inhabited area of the town of Tonopah. Any flooding effects that might be experienced are likely to be at the nuisance rather than hazard level. No changes to effects are likely by the year 2000.

Project Shoal Site

This site is located 5,200 feet above sea level on a gently rolling plateau that falls away steeply to valley floors to the east and west. No permanent bodies of water or perennial streams exist in the area; the major intermittent drainage course leads to Fairview Valley to the east. The water table is approximately 970 feet below the ground surface, with the piezometric surface sloping away from the site to both the east and the west. The underlying granitic rocks have little capacity to transmit water.

Ground Water Quality. Because the device was detonated below the water table, the ground water in the immediate vicinity is likely to be contaminated. Approximately 12 years are estimated to be required for the chimney to fill with water, after which the natural ground water conditions would prevail. However, because of the very low ground water velocities, direct flow to the vicinity of the nearest well is likely to take at least 750 years. Tritium will move only 3,300 feet in the 130 years needed for the estimated concentration to decay to the Recommended Concentration Guide level. Since the nearest producing well is 15,000 feet away, there is no radiological danger to any current local water sources.

Except for the buried contaminated soil and drill cuttings, no known radioactive objects that are water-soluble or flood-transportable were left on or near the surface.

An excavation and drilling exclusion area has been established in the region between 180 feet and 1,700 feet below the surface ground zero and out to a horizontal distance of 3,300 feet from the surface ground zero. The site is inspected often enough to ensure that no drilling into the cavity is taking place, therefore, there is little chance that any radioactivity will reach the surface. The potential for radioactive release into occasional surface water is therefore minimal. Thus, there is no water-related effect to public health and safety represented by the underground radioactivity at the Project Shoal Site, nor is there likely to be an effect by year 2000.

<u>Tonopah Test Range</u>

<u>Ground Water Quality</u>. With the exception of the employees at the TTR, there are no inhabitants within four miles of the Clean Slate and Double Tracks sites shown in Figure 5.6. The nearest town is Goldfield, which is 26 miles to the west. Several wells have been drilled in Cactus Flat for the purpose of supplying potable water.

Much of the contaminated area in Stonewall Flat is coincident with alluvial fans and ephemeral stream channels. There is a potential for ground water recharge in this type of environment. Soil surveys conducted at the contaminated site in Stonewall Flat indicate that plutonium has migrated to a minimum depth of 10 inches. Another potential source of ground water contamination is the Desert Well. The well was in place at the time the Stonewall Flat site was contaminated and it is located downwind within the contaminated area. Desert Well is not currently being used for any purpose. The next closest well is located in Goldfield.

The Landsat-5 image of the Stonewall Flat area indicates that several ephemeral channels from the Cactus Range, Goldfield Hills, and Stonewall Mountain cross the contaminated area. These drainage channels terminate in the playa in the central portion of Stonewall Flat. No permanent water exists in the area.

Each of the safety tests (non-nuclear destruction of nuclear devices) conducted in Cactus Flat has contaminated a sizeable area and was performed on the valley floor, not the alluvial fans. However, migration of contaminated material to the ground water is possible. The Landsat-5 imagery of this area indicates considerably more vegetation is present at the Cactus Flat sites than is present at the Stonewall Flat site. This vegetation should significantly reduce ground water recharge in the Cactus Flat area.

Two wells are located within a four-mile radius of the Cactus Flat sites. The Roller Coaster Well was constructed for a nuclear safety test in 1963 and is located next to the decontamination facility. Sandia 6 Well supplies Area III of the TTR. Since stratigraphic information in this area is sparse, the interconnectedness of the aquifer is not known.

While the radioactivity at the TTR represents a potential for contamination of local ground water resources, it does not have an effect on public health or safety since there is no public access to the TTR. Ground water pumpage in the Cactus Flat Basin is limited and confined to TTR use. The location of the supply wells several miles from the contaminated sites, as well as regular monitoring, ensures that workers are protected from potential health effects.

Floods and Surface Water Runoff. The potential for surface runoff to carry contaminants to the publicly accessible environment is limited. Surface water runoff from the Kawich Range crosses all of the Cactus Flat sites and terminates in the playas in the center of Cactus Flat. The playas of Cactus Flat were formed from surface runoff with subsequent evaporation and infiltration, and are classified as recharge playas. One significant ephemeral channel, Breen Creek, passes through the fenced area of Clean Slate II site before discharging to the playa. Surface runoff within Cactus Flat evaporates from the playas within the TTR. Runoff from the contaminated site in Stonewall Flat flows to a playa within the boundaries of the NAFR where it evaporates. There is no permanent body of surface water in the area to attract the public. Thus, any potentially contaminated surface runoff does not represent an effect to public health or safety. There are no major drainages on the TTR that represent an effect to public health and safety due to flooding and no effects are likely by year 2000.

5.2.4 IONIZING RADIATION

The principal Federal regulations governing radiation and radioactive materials originate from the Atomic Energy Act (AEA) of 1954. The Federal regulatory agency responsible for promulgating regulations under the AEA is the Nuclear Regulatory Commission (NRC). The AEA provides for states to enter into agreements with the NRC to assume responsibility for regulating radioactive materials. Title 10, Code of Federal Regulations (CFR) Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material" and Part 40, "Domestic Licensing of Source Material" are the principal NRC regulations affecting the studies conducted for this report.

The AEA governs the DOE activities; 10 CFR 30.12 and 10 CFR 40.11 exempt DOE from NRC licensing. DOE activities are governed by DOE Orders and guidance that meet the intent of the NRC regulations. DOE activities are also conducted to comply with requirements promulgated under the Clean Air Act (CAA) and the Safe Drinking Water Act (SDWA), which contain provisions relevant to radiation and radioactive materials.

DOE Orders that address protection of the public from ionizing radiation are DOE Order 5480.1B, "Environment, Safety, and Health Program for Department of Energy Operations," and other orders in the 5400 series. The primary directives for protection of the public are DOE Orders 5400.1 and 5400.5.

DOE regulations require that the radiation exposure by all pathways to any member of the public from DOE activities be less than 100 millirem per year and as low as reasonably achievable. In addition, DOE Order 5400.5, which implements 40 CFR 61 pursuant to the Clean Air Act, requires that radiation exposure by the air pathway from DOE activities be less than 10 millirem per year.

DOE Orders also mandate compliance with other applicable radiation protection regulations such as those that regulate drinking water.

DOE Orders also address the methods for transportation and disposal of radioactive material.

A most important protection mechanism is controlled access to the NTS. The DOE has also implemented procedures to control radioactive material on the NTS. These requirements are specified in the "Radiation Safety Manual" (Nevada Operations Order 54xg.1-39, October 1990) and the "NTSO Standard Operating Procedure."

These requirements, as implemented, are intended to ensure the following:

1) That personnel and equipment leaving the NTS are free of radioactive material (detectable above normal environmental background) and that the public does not have access to an area where radiation or radioactive contamination exists above applicable limits.

2) That all effluent streams are below the applicable release limits and as low as reasonably achievable.

3) That the radiation exposures to the public is less than 100 millirem per year (effective annual dose equivalent), which is less than naturally occurring background levels in the United States.

4) That radiation exposure to the public from the air pathway is less than 10 millirem per year.

5) That the ground water leaving the NTS is not altered in any manner consistent with applicable safe drinking water regulations.

6) That all radiation exposure of the public is as low as reasonably achievable.

7) That proper control of radioactive material is maintained within the NTS (i.e., posting of areas and equipment as appropriate, taking steps to preclude the release of radioactivity to the environment, wherever feasible).

8) That facilities and areas are decontaminated to the lowest possible levels, within the constraints of applicable crite.ia and DOE congressionally-authorized funding.

9) That all activities are implemented in a manner that minimizes the potential for accidental release of radioactive material and minimizes the magnitude of any release that does occur.

10) That the DOE implements a program to minimize public exposure should an accident occur.

11) That all pathways by which the radioactive material exposes the public are monitored and documented, typically involving on-site and off-site monitoring. Part of this program is an appraisal to assure implementation of requirements.

12) That DOE documents the results of these activities in a manner that allows public access to the information while assuring the requirements of national security are met.

The DOE has implemented a program to decontaminate facilities and areas no longer in use, an example of which is the radiological survey and cleanup of Area 25 from 1974 through 1983. This program involved the decontamination of the facilities at the Nuclear Rocket Development Station (NRDS) after the termination of the mission in 1973. Most of the area has been made available for other DOE activities. Those areas not completely decontaminated have been posted to assure effective control of the radioactive material remaining in these areas. This program is documented in Nevada Test Site Area 25 Radiological Survey and Cleanup Project 1974 - 1983 (Source: McKnight, 1984).

The DOE has implemented procedures to prevent accidents from nuclear testing, such as venting, and to minimize the public exposure should a venting occur. To minimize the probability of ventings, the DOE and its contractors have established detailed guidelines for evaluating the potential for a loss of containment (venting). These guidelines are briefly summarized in "Guidelines for Evaluating the Containment of Underground Nuclear Detonations" (Source: Olsen, 1987).

As part of the pre-test contingency planning process, predictions of radiation dispersion and radiation exposure to off-site populations are made, based on the worst-case assumption that each nuclear test will result in a massive release of radioactive materials (Source: Environmental Monitoring System Laboratory (EMSL), 1989). The meteorological data required for use in the prediction are provided by the Weather Service Nuclear Support Office (WSNSO), which is part of the National Oceanic and Atmospheric Administration (NOAA).

Twice daily, a weather observatory at the Desert Rock Airfield provides upper-air observations of pressure, temperature, humidity, and winds aloft to altitudes of nearly 90,000 feet mean seal level (MSL). Similar observations are taken in Yucca Flat to at least 25,000 feet MSL for event support. At the Yucca Flat station, upper-air data are taken 4 to 6 hours prior to an event and again at detonation time. These data, as well as data from as many as seven additional stations surrounding the NTS, are used to define airflow patterns for each event.

In the hours preceding a scheduled event, predictions are made of the fallout dispersion pattern and the maximum radiation exposures that might occur in the event of a release of radioactive materials. Based on these predictions, a scheduled test would be postponed if there is any possibility that the winds would be expected to carry any accidental release of radioactive materials in excess of established exposure guidelines into populated areas where protective actions cannot be taken.

DOE Nevada Operations Office's "Emergency Preparedness Plan" addresses procedures for responding to emergencies. During tests, EPA personnel or other qualified personnel are stationed at critical areas to monitor any venting and to facilitate emergency response activities.

The environmental monitoring program is implemented by a support contractor and the EPA. This program consists of an on-site program and an off-site program. These programs are very extensive and include monitoring stations more than 100 miles from the NTS boundary. The on-site monitoring program is summarized in "On-site Environmental Report for the Nevada Test Site (January 1987 through December 1987)" (Source: Gonzales, 1988). The off-site monitoring program is summarized in "Off-site Environmental Monitoring Report Radiation Monitoring Around United States Nuclear Test Areas 1987" (Source: EPA, 1988). The program results are documented yearly in publicly available reports. The two documents referenced above are examples of these reports.

The CNTS was decommissioned as described in the Planning Directive and Summary Report for the CNTS demobilization, restoration, and monitoring activities (Source: DOE, 1973; DOE, 1974) The area was surveyed and found to contain no radioactive material in the surface soils (Sources: Eberline Instrument Corporation, 1973; Lynn, et al., 1970). The water in the nuclear detonation cavity was characterized in 1971 (Source: Nork, et al., 1971), and contains significant quantities of radioactive material. The ground water system is being monitored by the EPA (Source: EPA, 1988). The radioactive material has not moved in detectable quantities beyond the site boundary. The EPA will continue to monitor the surrounding ground water to detect radioactive material that may be transported beyond the site boundary. A monument has been installed at the site and the U.S. Government maintains control of this site to assure that the radioactive material underground is not disturbed. Further mitigation is not presently projected.

A spectral survey at the Project Shoal Site, (Source: Lynn, et al., 1970) indicated that Cs-137 is present at or near the surface of the site. The survey was followed by analysis of rodents in the area, which found no detectable Cs-137. These results indicate that Cs-137 was at sufficient depth to prevent its entry into the biosphere (Source: Lynn, et. al., 1970). The Project Shoal Site was decontaminated in 1971 (Sources: Nocilla, 1970; REECo, 1971).

The radioactivity in the ground water system associated with the detonation cavity at the Project Shoal Site has been characterized (Sources: Gardner and Nork, 1970; Nuclear Service Corporation, 1965). The EPA monitors ground water in the area and has measured radioactive material above natural background levels in the ground water beyond the detonation activity (Source: EPA, 1988). Monuments have been erected to identify this area and the U.S. government maintains control over this area.

Public access to the TTR is prohibited. The radioactive materials at sites on the TTR are controlled by fences and postings. In addition, a support contractor and the EPA monitor the releases from these areas as part of their routine monitoring activities at the NTS. The TTR is included in ongoing radiological decontamination plans by the DOE, which is evaluating the feasibility of decontaminating the areas in the TTR.

The only change by year 2000 is an undefined amount of reduction in contaminated areas on DOE withdrawals. As areas are decontaminated and radioisotopes decay, the number and extent of contaminated areas would be reduced.

5.2.4.1 Sources of Potential Effects

There are many sources of radioactive materials on the NTS, primarily the result of testing nuclear devices. Secondary sources associated with the DOE defense program activities include radioactive waste management activities and other DOE defense programs.

One of the potential sources of release from underground nuclear tests is the prompt release of gaseous and particulate material to the atmosphere (also known as venting). A venting produces a surface contamination deposition pattern similar to an above ground test with much less activity and a lower cloud height. Although improved test procedures and safety precautions assure that venting is unlikely to occur, there have been several atmospheric releases due to venting in the past. The worst case and last significant venting was the Baneberry event in December 1970. As a result of the Baneberry venting, maximum doses to a member of the public were approximately 500 millirem which was to a group of miners in a canyon within approximately 20 miles of the event (Source: EPA, 1972). The best documented venting occurred in March 1964. This event, known as the Pike event, is used for the basic modeling of an accidental venting during evaluations before a test is conducted and all safety precautions are designed to protect the public using this scenario (Source: NOAA, 1986).

During current tests, the only source of release is in the form of core material brought up from drillbacks into test cavities, contaminated material removed from tunnels (from tunnel tests), and the gaseous releases (typically inert gases) from atmospheric changes, and from the filtering of vented gases during controlled releases following a test. The only activity that can result in off-site doses would be fission gas releases. The fission gas release from the Mighty Oak Nuclear Test resulted in a maximum off-site dose of less than 1 microrem (Source: EPA, 1986).

Fallout from pre-1963 above-ground and cratering tests has decayed to a point where radiation is non-detectable using standard survey techniques. Data on the effects from past tests are available in "A Perspective on Atmospheric Nuclear Tests in Nevada" (Source: DOE, 1988b), "Off-site Radiation Exposure Review Project Fact Book" (Source: DOE, 1988a), "Historical Estimates of External Gamma Exposure and Collective External Gamma Exposure From Testing at the Nevada Test Site" (Source: Anspaugh and Church, 1985).

DOE Order 5820.2A defines radioactive waste as solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering cost of recovery (Source: DOE, 1988a). There are various radioactive wastes at the NTS including wastes currently generated on-site, wastes remaining from discontinued site activities, and wastes received for storage or disposal from other DOE facilities. The radioactive materials in wastes from other DOE facilities consist of various types of materials, as described in Table 5-2.

Table 5-2. Radioactive Waste Definitions, Nevada Test Site, Mercury, Nevada.

Category	Definition
Source Material	Source Material is defined in paragraph 40.4(h) of 10 CFR Part 40 as (1) uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores that contain by weight 1/20 of 1 percent (0.05 percent) or more of (a) uranium, (b) thorium, or (c) any combination thereof. Source Material does not include Special Nuclear Material.
Special Nuclear Material	Special Nuclear Material is defined in Section 70-4 of 10 CFR Part 70 as (1) plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the Commission pursuant to the provisions of Section 541 of the Atomic Energy Act of 1954, as amended, determines to be Special Nuclear Material but does not include Source Material or (2) any material artificially enriched by any one of the foregoing but does not include Source Material.
By-product Material	Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident or to the process of producing or utilizing special nuclear material. For purposes of determining the applicability of the Resource Conservation and Recovery Act to any radioactive waste, the term "any radioactive material" refers only to the actual radionuclides dispersed or suspended in the waste substance. The nonradioactive hazardous waste component of the waste substance will be subject to regulation under the Resource Conservation and Recovery Act.

Most of the radioactive waste generated on-site is created by the nuclear testing conducted underground in tunnels and vertical drill holes. This test debris is intensely radioactive and remains underground where the detonations occur. Other radioactive wastes currently generated on-site include the following:

- Samples of the radioactive detonation debris (core samples) obtained for radiochemical analysis to determine the yield and performance of the test device.

- Contaminated drilling muds occasionally generated during drillback operations to obtain samples of detonation debris.

- Contaminated muck and debris generated during tunnel reentry and rehabilitation activities.

- Contaminated water discharged from the tunnels into holding ponds.

- Debris, trash, and other miscellaneous solid waste contaminated during drill back, tunnel reentry, and cleanup/rehabilitation activities of contaminated debris and soil from early-day atmospheric testing.

- Contaminated water and sludge generated during decontamination of clothing, instruments, equipment, and facilities.

- Liquid wastes generated by radiochemical laboratory operations.

- Waters pumped from wells used in the radionuclide migration study program.

Records are kept of effluent releases and wastes disposed in Radioactive Waste Management Sites (RWMSs) in Areas 3 and 5. Some of the wastes, including tunnel discharges, decontamination wastes, and laboratory wastes, could be mixed wastes, containing both hazardous and radioactive materials. Efforts are currently underway to characterize and quantify volumes of all waste streams on the NTS. Decontamination and laboratory discharges have been discontinued. Active facilities and sites used to manage these wastes are listed by area in Table 5-3.

Discontinued activities generated radioactive wastes which were disposed of in radioactive waste sites, tanks, and leachfields, which are now inactive. Wastes from the atmospheric testing consolidation sites are now being disposed of as bulk waste at the Area 3 RWMS. Packaged low-level radioactive wastes received from other DOE facilities are disposed of at the other RWMS, which is located in Area 5. Transuranic waste from LLNL is stored at the Area 5 RWMS until DOE completes the permanent storage site at the WIPP in New Mexico. Areas of surface and near-surface contamination resulting from discontinued activities are also a source of waste. They include equipment and facilities contaminated by these activities, which include test reactors, test cells, and testing support facilities.

Table 5-3. Radioactive Waste Management Facilities and Sites, Nevada Test Site.

Area	Status	Facility/Site
2	Inactive	Crater U2bu used for the disposal of contaminated drilling muds since 1980 and decontamination liquid wastes: total area is 1.5 acres; average tritium concentrations discharged are 4.0×10^{-6} uCi/ml; the annual discharge is 1.8×10^{-4} Ci (1).
3	Active/Inactive	Two holes U3axb1: RWMS used for disposal of off-site packaged and NTS truckload bulk radioactive waste. Because mixed waste is disposed of in the crater, a RCRA Part A closure plan was submitted for approval to theNevada Division of Environmental Protection (NDEP). There are two active holes U3ahat. Inactive hole U3fi was used for disposal of their classified core samples.
5	Active	RWMS used for disposal of packaged, classified and unclassified, low-level, and mixed wastes as well as storage of transuranic wastes; site was granted RCRA interim status in September 1987 (see text for details). Seepage/evaporation pond used for water pumped from Well RNM 2S is a part of the radionuclide migration study; the pond area is 1,000 square ft; average tritium concentrations discharged are 1.5×10^{-3} uCi/ml; the average annual discharge is 1.7×10^{-3} Ci(1).
6	Active	Seepage/evaporation pond has been used for liquid wastes, including mixed waste previously generated at the decontamination facility; discharge of mixed waste has been discontinued; the pond is constructed on a dry lake bed, covers a 1.0 acre area, and is unlined; the 1986 estimated annual volume discharged to the pond is 3.6 million gallons (1); average tritium concentrations are 1.1×10^{-5} uCi/m1; continued average annual discharge is 7.0×10^{-2} Ci(1); a RCRA Part A closure plan was submitted to NDEP.

Table 5-3. Radioactive Waste Management Facilities and Sites, Nevada Test Site (continued).

Area	Status	Facility/Site
8	Inactive	Hole U8d was used for disposal of contaminated liquid wastes; the cumulative volume discharged during the period June 1984 -December 1986 is 80,000 gallons [2]; average radionuclide concentrations are 1.0 x 10^{-5}uCi/m1; the average annual discharge is 7.0 x 10^{-5}Ci(1).
9	Inactive	Hole U9u used for disposal of contaminated drilling mud.
12	Active/Inactive	4 inactive piles for the disposal of contaminated tunnel muck and debris located at the following tunnels: U12e; U12g; U12n; and U12t; the piles contain low levels of radioactivity. 4 series of ponds used to dispose of water discharged from the tunnels and decontamination liquid wastes at the following active tunnels; U12e - 4 ponds; U12g - 1 pond; U12n - 5 ponds; and U12t - 6 ponds.
14	Inactive	Disposal of classified radioactive waste in the Horn Silver Mine.
23	Inactive	Leachfield at Building 650 was used for disposal of liquid mixed wastes from radiochemical laboratory operations with low levels of radioactivity; the cumulative volume discharge during the period June 1984 - December 1986 was 62.5 gallons; a RCRA Part A and Part B permit application and a closure plan have been submitted to NDEP.

(1) NVO, 1986a
(2) Clark 1987
(3) O'Neil, 1991

Profile samples indicate that the majority of plutonium dispersed by safety tests in Area 11 is present in the top 2 inches of the soil. For the Area 11 shots, there are three areas of primary contamination, sites B, C, and D, as well as overlap from sites C and D, and the low-level area surrounding the site. The plutonium - 239, 240 inventory for all of Area 11 is 36 Curies (+/- 4 Ci), which is divided between B site (6.2, +/- 1.1 Ci), C site (7.8, +/- 1.7 Ci), D site (17.1, +/- 3.2 Ci), a CD overlap region (0.75, +/- 0.32 Ci), and the low-level region surrounding these sites (4.5, +/- 1.4 Ci). The total number of curies deposited within the contaminated waste sites are not included in this inventory. This plutonium is deposited over approximately 1.8 square miles.

The source of radioactive material at the CNTS was an underground nuclear detonation in January 1968. As part of Project Faultless, a device "of less than 1 megaton", was detonated at a depth of 3,200 feet in drill hole UC-1 (Figure 5.3). The test did not result in a release of radioactivity to the surface. The hole was reopened and monitoring devices were installed. This resulted in some radioactive materials being brought to the surface. This material was disposed of within ground zero beneath several feet of uncontaminated soil.

The source of radioactive material at the Project Shoal Site consisted of a 12 kt yield nuclear test detonation on October 26, 1963. The device was placed in granite rocks 1,445 feet below-ground surface (Source: Gardner and Nork, 1970). The layout of the site is shown in Figure 5.4 in Section 5.1. The detonation was totally contained (Source: Kingsley, 1963). The detonation cavity was reentered and a small amount of radioactive material was brought to the surface. Contaminated surface soils generated during this activity were "consolidated and buried on-site under several feet of uncontaminated earth" (Source: REECo, 1971).

The radioactive material at the TTR is a result of DOE-related activities in 1963 and falls under DOE regulations. Operation Roller Coaster consisted of four safety shots named Double Track, and Clean Slate I, II, and III (Figure 5.6). These tests were designed to study plutonium dispersal from accidental non-nuclear explosions of plutonium-bearing weapons. At each of these tests, plutonium-bearing weapons were demolished with chemical explosions (Source: DOE, 1988b).

5.2.4.2 Analysis of Effects

Nevada Test Site

Because of the wide variety of activities at the NTS and their geographical dispersion, data from the environmental monitoring system program, which is actual measurement of the activity of interest, are used. Any concentration below the limits of detection would not result in a dose greater than guidelines or regulations allow. This is particularly true off-site, where the concentration of the radionuclides is further diluted by dispersion (usually several orders of magnitude). The effects of ionizing radiation on public health and safety are discussed based on both on-and-off-site monitoring data.

at the site boundaries will continue to be well within the standards for drinking water. Thus, no radiological effects to public health and safety occur or will occur by year 2000 unless these sites are disturbed.

Tonopah Test Range

The environmental monitoring data from the TTR indicate that the detectable amounts of radioactivity are being emitted are at or below minimum detectable concentration (Sources: Millard and West, 1987; EPA, 1988). Plutonium has remained essentially static in the desert environment because of the chemical and physical properties (see W.A. Bliss and F.M. Jakobowski, and I.H. Essington, cited in NVO-181). The isolation of TTR, the properties of plutonium and uranium, and the characteristics of the desert environment have resulted in no attributable effect to the public from ionizing radiation at the TTR and no effect is likely by the year 2000. There is no indication that any amount of radioactive materials released from TTR testing has reached the TTR boundary.

5.2.5 NON-IONIZING RADIATION

Electromagnetic radiation hazards discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible (light) radiation. Systems producing RF/microwave radiation include radio and television transmitters, microwave ovens, radar systems, microwave communication systems, sterilization systems used for medical supplies, welding equipment, and medical equipment. No sources other than radar systems are further considered in this section because of the other sources' very low potential for health hazard to the public due to low emission levels, location, or stringent emission controls.

The DOE uses the American National Standard for the Safe Use of Lasers, ANSI Z136.1-1980 (1986), as the approved criteria for the safe use of lasers and laser systems in all areas under the DOE jurisdiction. The DOE, through its Nevada Operations Office (DOE/NV) issued Order NV 54XB.1-6, 27 January 1983, which covers the NTS and all users of lasers at sites under the DOE/NV jurisdiction. This Order establishes the policy to administer the use of lasers by establishing operational controls that assume compliance with approved radiation exposure criteria and delineates responsibilities for conducting laser operations in accordance with these safety requirements.

5.2.5.1 Sources of Potential Effects

The DOE does not use radar systems on the NTS, however, microwave relay communication systems, similar to those used by railroads and telephone companies, are used. The TTR has a variety of radar and microwave systems in use that range from a few watts emitted power to one megawatt pulse power.

The application of lasers at the NTS is minimal and restricted to low-power or medium-power systems. Most lasers are used underground as construction tools for alignment purposes in tunnels or in emplacement holes. Occasionally, a few lasers are used for

The environmental monitoring data and the dose projections based upon on-site data are found in "On-site Environmental Report for the Nevada Test Site" (January 1987 through December 1987). These reports are issued annually. The maximum dose to an individual working and living just outside of the NTS boundary at the maximum exposure point would be less than 5 millirems per year and a typical value for any member of the public would be much less than 1 millirem per year. Projections based upon on-site data typically over estimate off-site doses.

The off-site environmental monitoring data, which are collected and reported by the EPA, and their dose projections, are found in "Off-site Environmental Monitoring Report Radiation Monitoring Around United States Nuclear Test Areas 1987" (Source: EPA, 1988). These reports are issued annually. The maximum dose to the public, projected by the EPA, was 0.0002 millirem per year. However, if an individual consumed an entire deer taken from the NTS, and the deer had the highest measured radiation content, then the maximum exposure an individual would receive is about 169 millirem in a year. The probability of anyone finding, killing, and entirely consuming a maximally exposed deer is believed to be extremely low. No activity above background radiation was detected in the ground water.

The area around the NTS receives between 50 and 140 millirem per year from natural background radiation (neglecting exposure to radon and its progeny). Based on the above, the probable off-site exposures do not result in an appreciable change in the public's yearly radiation exposure. As noted, even in projected worst case accident situations, public exposure was limited to 500 millirem, which is one tenth of the allowed exposure (5,000 millirem) for a radiation worker (as specified in DOE Order 5480.1 and the NRC's regulation 10 CFR Part 20).

Estimates of risk from radiation effects are dependant on many factors (i.e., age of the individual, amount of radiation, types of radiation). The best available data on risk estimates is found in the two studies by the National Academy of Science, "The Effects on Population of Exposure to Low Levels Of Ionizing Radiation: 1980" and "Health Risks of Radium and Other Internally Deposited Alpha-Emitters." The risk of radiation exposure can be approximated very roughly by assuming that the probability of producing one latent cancer is less than one chance in 10,000 from an exposure of 1,000 millirem.

Ionizing radiation resulting from activities on the NTS does not result in effects on public health and safety. No effects are likely to occur by year 2000. Some decreases in radioactive contamination are likely to occur as the DOE decontaminates various sources of radioactive material and applies better technology and techniques to the control of radioactive material.

Central Nevada Test Site and Project Shoal Site

There is no detectable radiological effect to the public from these sites. Public access to the surface of these sites would not result in exposure of the public over natural background radiation levels, however, drilling and excavation must be restricted indefinitely. Current projections are that the concentrations of radioactive materials in the ground water laboratory bench-type equipment alignment, while others are used outdoors for measurement purposes. There are no high-powered lasers in use and none are contemplated for use in laser research and development programs. There is an occasional use of laser directed optical tracking systems on the TTR. These lasers operate well within the range boundary and pose no eye hazard to the populations outside the range boundaries.

5.2.5.2 Analysis of Effects

The procedures specified in DOE Order NV 54XB.1-6 illustrate the precautions taken by the DOE that afford protection to the general public from hazardous exposure to lasers used in construction activities and related work. Effects to public health and safety from use of lasers are remote, given the safety procedures followed by the users. Effects will continue to be remote by year 2000. There have been no known incidents where the DOE's use of high powered RFR systems on the TTR has posed any hazard to public health and safety. Continued adherence to safe operating procedures will ensure protection of the general public from any potential hazards.

5.2.6 SOLID AND HAZARDOUS WASTE

The basic program implementation document published by the DOE is DOE Order 5400.1, "General Environmental Protection Requirements." DOE Order 5820.2A "Radioactive Waste Management" adopts 40 CFR Parts 260 - 265 as the technical basis for the DOE waste management program. NTS policy is to transport waste to an EPA-approved treatment, storage, or disposal (TSD) facility in less than 60 days.

5.2.6.1 Sources of Potential Effects

Operations at the NTS facilities generate a variety of hazardous waste, including radioactive wastes. This discussion is limited to the typical hazardous wastes regulated under the Resource Conservation and Recovery Act (RCRA), including such wastes that are also radiologically contaminated (mixed waste). Radioactive wastes are addressed in Section 5.2.5.

The types, quantities, and sources of hazardous waste and mixed waste generated at the NTS vary considerably because uses of the site and levels of activity change. For purpose of this discussion, the potential sources of hazardous waste/mixed wastes are grouped into the following four categories: construction, maintenance, and repair shops; laboratories; decontamination facilities; and event-related sources. Most of the construction, maintenance, and repair shops are located in Mercury. However, some have been established in other areas. Several laboratories are located in Area 23 (Mercury), including the contractor's radiochemistry and industrial hygiene labs. The major decontamination facility is located in Area 6, where equipment is decontaminated and contaminated clothing is processed. The event-related sources include device assembly facilities and test sites (tunneling, drill-back, etc.).

In general, the hazardous wastes generated by the construction, maintenance, and repair shops are non-radioactive. These wastes include spent solvents, corrosives, and expired chemicals. Waste polychlorinated biphenyls (PCBs) are generated in Area 6. Small quantities of both non-radioactive and mixed hazardous wastes are generated by the laboratories. The decontamination facilities use solvents, acids, and caustics to remove radioactive contamination, thus generating mixed wastes. Solvent-contaminated paper wipes are generated at device assembly facilities. Additionally, some of the test site tunnel and drill back activities generate mixed and explosive wastes.

It is likely that liquid wastes generated by the Area 23 radiochemistry laboratory contain some mixed wastes. Based on laboratory activities, the waste usually contains low level radioactivity and some amount of organic solvents, acids, or caustics. Laboratory procedures dictate that, if radioactivity is detected in the waste, it is to be solidified in beakers, drummed, and shipped to the interim-status Mixed Waste Management Unit (MWMU) at the Area 5 RWMS for disposal. If radioactivity is not detected, the waste is disposed of in sinks that drain to the building's leachfield via sewers. It is estimated that 25 gallons of this waste were discharged to the leachfield during 1986. Also, during 1986 1,730 cubic feet of the radioactive solidified waste were shipped to the Area 5 RWMS.

The Desert Rock Airfield is located in Area 22 (Figure 5.2). It is used by the DOE programmatic interests (National Laboratories, contractors, etc.) to support the NTS. The airfield also provides limited ground support services, including refueling. Between December 20 and 26, 1985, the LANL underground refueling system inadvertently released approximately 18,000 gallons of Jet A-50 fuel. The cause of the fuel leak was a malfunctioning in-ground steel tank (Source: Boyce, 1986) which contaminated the subsurface soil around the tank. A site characterization was performed in late 1989 to determine the extent of the plume and concentrations of contaminants. The information was provided to the NDEP, which determined that a cleanup of the site would not be required. Both EPA Region IX and the State of Nevada were notified of the fuel release by the Environmental Protection Division, DOE/NV.

A variety of activities at the NTS generate non-hazardous wastes. The wastes include trash, garbage, construction debris, machining metal chips, cutting oils, recyclable oils, and excess or spoiled drilling muds.

Solvent contaminated wipes generated during device assembly are burned along with other combustibles in an open cage in Area 27. Explosive waste left over from tunneling operations is detonated at a designated explosive ordnance disposal facility operated under a RCRA Part A permit. Waste and containers remaining after detonation are disposed of in the Area 6 landfill.

The disposal of non-hazardous wastes is accomplished by placement into one of the on-site landfills, listed below:

- Three sanitary landfills, located in Areas 6,10,23
- Three construction landfills, located in Areas 6,12,23

- Several solid waste trenches, located in Areas 6,12,23
- At least two craters located in Area 3 are used for the disposal of excess and spoiled drilling muds.

5.2.6.2 Analysis of Effects

The current method of disposal of non-radioactive hazardous wastes generated at the NTS is at an off-site EPA-approved facility, which ensures that wastes are disposed of in an environmentally sound manner. The use of the special DOE internal manifests and the EPA Uniform Hazardous Waste Manifests provides accurate tracking of waste streams from generation to final disposition.

The on-site disposal of mixed wastes in the Area 5 RWMS is conducted under a RCRA Part A Interim Status approval. The disposal of mixed waste from the Area 6 Decontamination Facility has been discontinued and the seepage/evaporation pond will be closed under RCRA as soon as a new RCRA-approved lined evaporation pond is completed. RCRA Part B Applications have been submitted for the MWMU in Area 5. The Area 3 RWMS mixed-waste disposal unit (U3ax-61) will be RCRA closed. The Part B permitting procedure places stringent controls on facility operations.

The NTS hazardous waste operations are routinely inspected by the EPA, NDEP, and the DOE. A thorough environmental compliance assessment of NTS was also conducted during June and July of 1987 by a DOE Headquarters team. Brief summaries of inspection results are provided in Table 5-4.

An aggressive environmental compliance program has been developed at the NTS to remedy problems associated with past activities and to ensure that future practices are in compliance with all applicable environmental regulations. This program, combined with the remoteness of the NTS, minimizes the possibility of effects on public health and safety that could result from solid and hazardous waste. Continued development of an aggressive environmental compliance program will minimize effects on public health and safety by year 2000.

No known effects to public health and safety are anticipated to result from solid and hazardous waste practices at the TTR, either now or by the year 2000.

5.2.7 NOISE AND SONIC BOOM

The remoteness of the area and the fact that nuclear tests are conducted underground minimizes the noise at the NTS. As such, the DOE does not implement specific noise abatement procedures to reduce noise resulting from activities at the NTS. Aircraft overflights of the NTS are restricted to subsonic speeds.

Table 5-4. Summary of Hazardous Waste Inspection Results at Nevada Test Site.

Inspecting Agency	Date	Survey Findings and/or Violation	Actions
NDEP	Feb 85	Cease and desist order for closure of the Area 23 Hazardous Waste landfill used for the disposal of solvents, corrosives, toxics, ignitables and miscellaneous liquid wastes.	Halted activities, submitted closure plan to the State in Nov. 1987. No reply has been issued to date. No further action can be taken without State feedback.
NDEP	Feb 87	Container labeling infractions.	Developed program to ensure proper identification, labeling and storage of hazardous wastes. Construction of new storage facility to meet regulatory requirements.
NDEP	Apr 88	Possible mixed wastes to leachfield or evaporation/infiltration pond. Possible release of hazard constituent solvents from shops. Use of French drains for solvent disposal.	Sample and assess nature of material. Waste discharge to leachfield, evaporation ponds, or French drains has been discontinued. A closure plan is being developed in conjunction with NDEP.
DOE	Apr 88	105 "findings of possible concern" were noted, covering a range of activities performed at NTS including radiation, hazardous waste, mixed wastes and releases to the environment. Included past activities and closed sites.	An Action Plan was developed and provided to the EPA, DOE, and the State in March, 1989. To date, more than 65 items have been completed, the others are being acted upon.
DOE	Mar 89	Violations of container management practices and record-keeping requirements.	Performed required tasks and ensured the availability of records materials.

5.2.7.1 Sources of Potential Effects

Major sources of noise at the NTS result from the firing of weaponry, the explosion of nuclear and non-nuclear ordnance, and operations at Desert Rock Airfield. The Desert Rock Airfield has a 7,500 foot runway, and had about 2,500 total operations in 1988. Aircraft using the airfield include F-27, Dash-7, DC-9, and King Air aircraft, plus various helicopters, and an occasional C-130 aircraft.

Activity at the TTR includes noise intensive operations listed in Table 5-5 (Source: Nevada DOE, undated). The 8 inch and 155-mm guns are reported by SNL to be inaudible at a distance of 5 miles. The Davis Gun is reported to be inaudible from a distance of about 8 miles. In the future, the 16-inch 3-barrel gun will be fired in the Antelope Tuff area. Occasional air drops and flyarounds are conducted on the TTR by subsonic and supersonic aircraft at both high and low altitudes.

Table 5-5. Tonopah Test Range Activity, 1988.

Type	Number
Airdrop Tests	93
Cruise Missile	1
Gun Tests:	
12" Davis Gun	21
8" Gun	12
155 mm Gun	112
Rocket Tests	39
Flyaround Tests	3

5.2.7.2 Analysis of Effects

Noise effects to the general public do not occur as a result of activities at the NTS. Noise related to aircraft use of the Desert Rock Airfield was assessed using the Integrated Noise Model (INM) and was found to be insignificant.

The single event and cumulative noise levels associated with the gun tests at the TTR were estimated using the methods described in "Procedures and Data for Predicting Day-Night Levels for Supersonic Flight and Air-to-Ground Gunnery" (Source: Bolt, Berenek and Newman, Inc., 1978). The estimates are shown in Table 5-6.

Table 5-6. Tonopah Test Range Gun Test Noise Levels at 1,000 Feet.

Gun Type	CSEL, dB	L_{Cdn}, dB
12" Davis Gun	127.3	65.7
16" Davis Gun	131.9	70.3
8" Gun	128.6	64.0
155 mm Gun	125.3	70.8
16" 3-barrel Gun	140.8	82.5

L_{dn} 65 dB noise contours caused by the 12 inch and 16 inch Davis guns and the 16 inch 3-barrel gun are confined to the TTR site. Therefore, noise produced by these activities would not affect public health and safety outside the TTR.

Rocket tests that occur within the TTR produce noise only while the rocket motor fuel is ignited at takeoff and during the first stage of the rocket flight. No explosive ordnance is used on these rockets. Noise produced by the rocket motor is not significant outside the TTR boundaries and, therefore, does not affect public health and safety.

Short-range attack missile flyaround test flights are typically subsonic and involve no explosives. The noise produced by these activities is barely audible outside of the TTR and, therefore, does not affect public health and safety.

Due to the remoteness of the TTR noise-related activities from the public domain, annoyance from this noise is not presently a factor nor is it expected to be so by the year 2000.

5.2.8 FACILITY ACCIDENTS

DOE Order 5480.1b establishes the basic Environmental, Safety, and Health (ES&H) program for all DOE operations. The DOE has also published numerous orders covering specific issues. These orders conform to Executive Order 12196 ("Occupational Safety and Health Programs for Federal Employees") and the regulations implementing the Occupational Safety and Health Act (OSHA) (29 CFR Part 1960, "Basic Program Elements for Federal Occupational Safety and Health Programs").

The Explosives Safety Standards of the Department of Defense (DOD Standard 6055.9, "Ammunition and Explosives Safety Standard") have been adopted by the DOE in directive DOE/NV/06194, "DOE Explosives Safety Manual." The protection of the general public and on-site personnel is ensured through the establishment of a safety buffer zone around each site where explosives are handled or stored.

The NTS is in the process of developing a formal Spill Prevention, Control, and Countermeasures (SPCC) Plan and an organized spill response team. In addition, berms of native soil have been constructed and NTS personnel are in the process of developing procedures and documents to ensure the effectiveness of SPCC.

Specific requirements and procedures in DOE Order 5480.4 govern the storage of hazardous materials (HAZMAT) at the NTS. In general, this directive mandates compliance with basic OSHA standards applicable to HAZMAT storage, such as 29 CFR 1910.106, "Flammable and Combustible Liquids." This OSHA standard, in turn, references guidance published in numerous national consensus standards, such as those of the National Fire Protection Association. In addition to applicable OSHA and national consensus standards, site-specific responsibilities and requirements for the transportation, storage, use, and disposal of HAZMAT are contained in REECo Procedure 3.2.51, "Hazardous Material Control."

5.2.8.1 Sources of Potential Effects

Munitions Handling and Storage

Various types of conventional explosives are used in tunneling and other activities at the NTS. These explosives are stored in four magazines located in Area 12, two of which are limited to detonators, fuses, etc. The amount of explosives stored in these magazines varies with the level of activity at the NTS. For example, in March 1989 the inventory included approximately 45,000 pounds of Class A explosives, 39,000 feet of primacord, and hundreds of fuse and delay caps. Waste explosives are detonated in a subsidence crater in Area 11.

TTR DOE activities require storage of various munitions for security forces and explosives, propellants and ordnance components for testing. The June 30, 1990 inventory showed 18,000 pounds of Class B propellant, 500 pounds of Class C ordnance hardware, 12,000 pounds of Class C munitions, and 400 pounds of Class A explosives.

Fuel Storage

Numerous fuel storage tanks are located on the NTS; most are underground. There are 44 underground tanks reportable under the RCRA. They are used to store gasolines, jet fuel, diesel fuel, and aviation gas, and range in size from 200 to 26,000 gallon capacities (Source: DOE, 1988d). There are a number of underground tanks used to store heating oil for consumptive use on the NTS. Fourteen of these tanks have a capacity of 1,000 or more gallons. There are an additional 20-30 smaller underground tanks (Source: DOE, 1988d). Most of these heating oil tanks are located in Areas 23 and 25.

Two large 420,000 gallon above-ground fuel storage tanks are located in Area 23; one contains diesel fuel, the other holds gasoline (Source: DOE, 1988d). There are eight other above-ground tanks for diesel fuel, gasoline, kerosene, and lube oil that range in capacity from 300 to 105,000 gallons (Source: DOE, 1988d).

Bulk fuel storage at the TTR is described in Section 5.1.4.

Hazardous Material Bulk Storage

Warehouses and other facilities for HAZMAT storage are located in Areas 23 and 6 of the NTS. The primary storage site is a warehouse in Area 23. This facility houses supplies of paints, compressed gases, and 55-gallon containers of acids, caustics, and flammable solvents. Lesser quantities of HAZMAT are stored in other warehouses located in Area 23. A covered, elevated concrete pad, adjacent to a warehouse in Area 6, is used to store 55-gallon drums of various oils and lubricants.

Activities at the TTR use quantities of hazardous materials (e.g., solvents, degreasers, epoxy glues, and pesticides) that would be expected on a facility of this size. Materials are stored in a warehouse, at Base Supply (flammables and pyrotechnics), and in an outside shed (pesticides) near the Hazardous Waste Accumulation Facility. Pesticides will be moved to the new entomology shop when it is completed.

5.2.8.2 Analysis of Effects

Munitions Handling and Storage

Compliance with the requirements of the DOD Ammunition and Explosives Safety Standards, as adopted in DOE/NV/06194, ensures that the general public is protected in the event of a catastrophic (worst-case) explosives mishap. The storage magazines (remotely stored in Area 12) meet OSHA standards and no serious problems were noted during a February 1989 "courtesy" review of NTS explosives operations by the DOD Explosives Safety Board (Source: B. Beam, REECo Explosive Safety Office, personal communication, 1989). Therefore, current operations do not affect public health and safety.

Fuel Storage

Several problems related to fuel storage were noted during a comprehensive environmental audit of the NTS conducted June 22 through July 10, 1987, by a private contractor serving the DOE Office of Environmental Audit (Source: DOE, 1988d). For example, only 15 of the 50 underground storage tanks investigated during the survey were provided with any type of corrosion protection; most of these tanks are more than 15 years old. It is generally accepted that steel underground tanks of such age, lacking corrosion protection, have a high probability of leaking. However, the rate of corrosion and tank deterioration at the NTS is lower than locations receiving more rainfall. In fact, all tanks and associated piping removed from the ground and disposed of in 1989 were structurally sound (Source: DOE, 1990). Nevertheless, the NTS had not tested any of its underground storage tanks for leakage prior to 1990. A "dip stick" method was used for inventory control, but such a measurement would not detect slow leaks. It was also noted during the assessment that many of the above-ground storage tanks lacked any secondary containment. Since the assessment, all above-ground tanks have been bermed.

Although no leaks or spills from untested fuel tanks are known to have occurred, the NTS has implemented a comprehensive action plan to address these concerns and other environmental problems documented during the 1987 audit. The multi-year action plan includes: sampling, removing tanks, removing contaminated soils, closure of tanks in place, and upgrading of tanks. Upgrading will consist of: vapor monitoring wells, spill prevention devices, double hulls, leak detectors, and double wall piping as required (Source: DOE, 1990).

All underground storage tanks used for fuel storage at the TTR have been leak tested as of July 1989 and were found to be sound, with no leaks. Only ten of these tanks are regulated, but all of the tanks are being treated as if they were regulated. The pipeline used to transfer JP-4 fuel from the bulk storage area to the runway has not leaked. However, the impressed current cathodic protection system has failed and it is being evaluated for repair or replacement.

Hazardous Material Bulk Storage

All HAZMAT storage sites are inspected at least once a year by fire, health, and safety personnel. The major sites mentioned in Section 5.2.7 were evaluated during the 1987 audit by a private contractor for the DOE Office of Environmental Audit (Source: DOE, 1988d). There are no outstanding deficiencies that might affect public health and safety. There have been no significant fires associated with HAZMAT storage during, at least, the past 5 years (1983 to 1988).

There are no effects on public health and safety resulting from HAZMAT storage at the TTR.

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Satisfactory resolution of any underground fuel tank problems and continued compliance with applicable environmental regulations will ensure that public health and safety are not affected by these activities in the future.

5.2.9 AIRCRAFT MISHAPS

Aviation safety requirements for the DOE and DOE-contractor aircraft operations at Desert Rock Airfield are outlined in DOE Order 5480.13. Any military flight activities conducted at Desert Rock Airfield or in portions of DOE restricted areas R-4808 and R-4809 are governed by both Air Force and Nellis AFB directives and any applicable DOE restrictions. Flight safety at Desert Rock Airfield is enhanced by a designated area that all Nellis aircraft operations avoid to remain clear of operations at this airfield. No aircraft-related mishaps have occurred at this facility. Therefore, activities at Desert Rock Airfield do not affect public health and safety. No changes are anticipated for the year 2000.

Approximately 35 rocket flight tests are conducted annually on the TTR and no mishaps have occurred during the past 30 years of the program. Safety policies and procedures have been established for rocket tests that ensure flight trajectories and impact areas do not present any risks to the public, participating personnel, or facilities. Rocket flight tests do not present any unacceptable risks to public health and safety and no change is anticipated for the year 2000. In addition to the 35 rocket tests, there are approximately 220 other tests per year that involved flight vehicles of some type. The same safety policies and procedures that are applied to rockets apply to these operations and do not present unacceptable risks to the public participants or facilities.

5.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

The DOE activities have not resulted in accidental drops of objects or armaments from aircraft, therefore, there have been no risks to public health and safety, nor are any expected by the year 2000.

5.3 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

This section describes effects on public and private property from activities of the DOE that occur at the NTS and the TTR, including support of the 37th TFW. Activities at these sites require permanent, direct employment. Activities at the CNTS, Nelson Seismic Station, Mt. Brock Communication Site, and Project Shoal Site do not require substantial, if any, permanent local employment and, therefore, do not generate measurable economic and demographic effects. Topics addressed in this section include employment and other economic effects, population, housing, community services, public finance, and land uses. The measurable effects occur primarily in Clark, Nye, and Lincoln counties, which comprise the Region of Influence (ROI) in this section.

5.3.1 ECONOMIC AND DEMOGRAPHIC EFFECTS

Indicators of economic and demographic effects for each of the counties in the ROI and for the overall ROI in 1988 are specified in Table 5-7. Most employment with the DOE consists of contractor (private sector) personnel. Most of the economic and demographic effects from the NTS and DOE activities at the TTR occur in Clark County, although the largest relative effects occur in Nye County.

5.3.1.1 Employment, 1988

Over 8 percent of the total employment in Nye County consists of employment at the NTS and the TTR (1,050 jobs), while secondary employment in Nye County induced by these activities consists of an estimated 120 jobs. Total employment (about 1,170 direct and indirect jobs) in Nye County resulting from DOE activities at the NTS and the TTR is more than 9 percent of all employment in the county. In Clark County, almost 2 percent of total employment consists of the 6,660 jobs provided by the NTS and the TTR activities. When indirect employment (an estimated 5,830 jobs) is added to direct employment, more than

Table 5-7. Indicators of Economic and Demographic Effects of Department of Energy Activities, 1988.

	Clark	Nye	Lincoln	Total
Total Employment[1]	375,200	12,700	2,300	390,200
Total Population	651,400	17,700	3,600	672,700
Employment From Withdrawals[1]				
Direct Military	40	0	0	40
Direct Non-military	6,660	1,050	50	7,760
Total Direct Employment	6,700	1,050	50	7,800
(Percent)	1.8	8.3	2.0	2.0
Indirect Employment	5,830	120	5	5,955
Total Employment	12,530	1,170	55	13,755
(Percent)	3.3	9.2	2.3	3.5
Gross Regional Product (millions)	$503	$96	$0.6	N/A[2]
(Percent of County GRP)	3.3	12.8	0.9	
Personal Disposable Income (millions)	$314	$35	$0.2	N/A[2]
(Percent of County PDI)	3.3	13.2	0.4	
Population From Withdrawals				
Direct Military and Dependents	140	0	0	140
Non-military and Dependents	11,570	1,460	70	13,100
Total Direct Population	11,710	1,460	70	13,240
(Percent)	1.8	8.3	2.0	2.0
Indirect Population	10,120	160	10	10,290
Total Population	21,830	1,620	80	23,530
(Percent)	3.4	9.2	2.3	3.5
School-Age Population[3]				
Direct Military	20	0	0	
Direct Non-military	1,730	220	10	
Total Direct School-age	1,750	220	10	
(Percent of Enrollment)	1.7	7.1	1.1	
Indirect School-age	1,520	20	0	
Total School-age Population	3,270	240	10	
(Percent of Enrollment)	3.1	7.9	1.2	

(1) Full and part-time employment (jobs) by place of residence.

(2) Gross Regional Product and Personal Disposable Income are not additive across counties.

(3) Since school districts correspond to county boundaries, total is not indicated.

3 percent of total employment in Clark County is the result of DOE activities. About 2 percent (55 jobs) of Lincoln County employment may be attributed to DOE employment either directly (nearly 50 jobs) or indirectly (5 jobs).

5.3.1.2 Gross Regional Product (GRP) and Personal Disposable Income (PDI), 1988

Purchases associated with the DOE activities contributed over $500 million to the GRP of Clark County in 1988, which represents slightly more than 3 percent of the total GRP in the county. More than $96 million of GRP in Nye County (almost 13 percent of total GRP) is attributable to these activities. Within Lincoln County, spending attributable to these activities represents about 0.9 percent of the county GRP.

In 1988, the DOE activities added more than $314 million to the PDI available to Clark County residents, which represents 3.3 percent of all PDI in the county. Approximately $35 million of Nye County PDI (almost 13 percent of total PDI) is the result of these activities. Less than 0.5 percent of the PDI in Lincoln County results from DOE activities.

5.3.1.3 Population, 1988

Over 11,700 residents of Clark County (almost 2 percent of total county population) are estimated to be direct employees or dependents of employees of the DOE and DOE contractors. Approximately 21,800 (3.4 percent) of the Clark County resident population is attributable to employment generated by DOE activities. Over 8 percent (1,460 persons) of the residents of Nye County are direct employees or dependents of employees of the DOE or its contractors. When the indirect population of 160 persons in Nye County is considered, more than 9 percent of the Nye County population is attributable to DOE activities. Over 2 percent of the Lincoln County population is directly or indirectly related to these activities.

5.3.1.4 School-Age Population, 1988

In Clark County, about 1,750 persons in the total direct population are estimated to be age 6 through 17. Not all of these persons would be enrolled in public schools in Clark County, which reported 100,027 students in 1988. Nevertheless, if all of them were enrolled, they would represent less than 2 percent of Clark County School District enrollment in 1988. When the indirect population estimated to be ages 6 through 17 is considered (1,520 persons), and assuming all of these persons were enrolled in public schools, the total school-age population (3,270 persons) directly or indirectly related to DOE activities would account for approximately 3 percent of school enrollment in Clark County. In Nye County, the estimated number of persons ages 6 through 17 among the direct population (220 persons) represents slightly over 7 percent of Nye County public school enrollment in 1988. When the indirect population age 6 through 17 is considered, almost 8 percent of enrollment is represented by the school-age population induced by DOE activities. In Lincoln County, slightly over 1 percent of the school-age population may be attributed to DOE activities.

5.3.1.5 Economic and Demographic Effects, 2000

Comparison of Table 5-7 and Table 5-8 indicates that total employment and total population in Clark, Nye, and Lincoln Counties are forecast to increase between 1988 and 2000. Direct employment associated with DOE activities is expected to decline (1,240 jobs), and the population related to this employment is also forecast to decline (about 2,510 persons) as a result of the potential movement of the 37th TFW out of Nevada. Indirect employment could also decline by about 415 jobs.

By 2000, the DOE activities are forecast to add $653 million to the GRP of Clark County, $88 million to the GRP of Nye County, and less than $1 million to the GRP of Lincoln County, which represent approximately 2 percent, 10 percent, and 0.7 percent, respectively, of total GRP in these counties. Projections of PDI for the year 2000 indicate that $449 million could be added to Clark County PDI by these activities, $18 million could be added to Nye County PDI, and less than $1 million could be added to Lincoln County PDI. While DOE-generated PDI is larger in 2000 than in 1988, it represents a slightly smaller percentage of total personal disposable income in 2000 because the total PDI in Clark, Nye, and Lincoln Counties is expected to increase.

Because the direct and indirect population in each county, resulting from DOE activities, is forecast to decline between 1988 and 2000, the size of the school-age population is also forecast to decline. As a result, the DOE related school-age population will represent a smaller percent of county school district enrollment in 2000 than in 1988.

5.3.1.6 Economic Effects of Alternative Land Use

Table 5-9 compares economic and population indicators for Clark, Nye, and Lincoln counties in the year 2000 resulting from continuing the land withdrawal and from use of the land for other purposes. In Clark and Nye counties, a caretaker force of one-third of the NTS employment by place of residence was assumed to remain regardless of alternative use of the NTS land. No assumed alternative use employment effects are forecast for Clark County. In Nye County mining and, to a smaller extent, grazing, were considered to be reasonable alternative use of the NTS lands. Considering the potential reduction in DOE contractor employment due to the movement of the 37th TFW from TTR before 2000, total employment could be up to 3 percent larger under the alternative uses of NTS. GRP could be up to $180 million more under the alternative land use of mining than under current NTS uses and total PDI could be up to $37 million more. These comparisons indicate that less employment in the county could result from continuing to use the land for NTS rather than for mining and that GRP and PDI could also be less. Total employment in Clark County could be almost 1.2 percent less under alternative use of NTS land, while GRP could be almost $355 million less and total PDI could be about $242 million less. Employment, GRP, and PDI would likely remain unchanged in Lincoln County, because the NTS and the TTR lands are located within Nye County and few economic effects are generated in Lincoln County by DOE activities.

Table 5-8. Projected Indicators of Economic and Demographic Effects of Department of Energy Activities, 2000.

	Clark	Nye	Lincoln	Total
Total Employment[1]	581,320	17,260	2,370	600,950
Total Population	953,710	26,410	3,630	983,750
Employment From Withdrawals[1]				
Direct Military	40	0	0	0
Direct Non-military	6,010	480	30	6,520
Total Direct Employment	6,050	480	30	6,560
(Percent)	1.0	2.8	1.2	1.1
Indirect Employment	5,530	10	0	5,540
Total Employment	11,580	490	30	12,100
(Percent)	2.0	2.8	1.3	2.0
Gross Regional Product (millions)	$653	$88	$0.6	N/A[2]
(Percent of County GRP)	2.2	6.5	0.7	
Personal Disposable Income (millions)	$449	$18	$0.1	N/A[2]
(Percent of County PDI)	2.5	3.4	0.2	
Population From Withdrawals				
Direct Military and Dependents	140	0	0	140
Non-military and Dependents	9,830	710	50	10,590
Total Direct Population	9,970	710	50	10,730
(Percent)	1.0	2.7	1.3	1.1
Indirect Population	9,040	20	0	9,060
Total Population	19,010	730	50	19,790
(Percent)	2.0	2.8	1.5	2.0
School-Age Population[3]				
Direct Military	20	0	0	
Direct Non-military	1,490	100	10	
Total Direct School-age	1,510	100	10	
(Percent of Enrollment)	1.0	0.8	0.4	
Indirect School-age	1,360	2	0	
Total School-age Population	2,870	102	10	
(Percent of Enrollment)	1.8	2.2	0.7	

[1]Full and part-time employment (jobs) of place of residence.

[2]Gross Regional Product and Personal Disposable Income are not additive across counties.

[3]Since school districts correspond to county boundaries, total is not indicated.

Table 5-9. Projected Indicators of Economic and Demographic Effects Attributable to DOE Activities and Alternative Land Use, 2000.

	DOE	Alternative Use High	Alternative Use Low	Percent Difference High	Percent Difference Low
CLARK COUNTY					
Total Employment(1)	581,320	574,390	574,390	(1.2)	(1.2)
Direct Employment	6,050	2,300	2,300		
Indirect Employment	5,530	2,360	2,360		
Total	11,580	4,660	4,660		
Percent of County Total	2.0	0.8	0.8		
Population	953,710	951,430	951,430	(0.2)	(0.2)
Gross Regional Product (millions)	$30,105	$29,750	$29,750	(1.3)	(1.3)
Personal Disposable Income (millions)	$18,191	$17,949	$17,949	(1.5)	(1.5)
NYE COUNTY					
Total Employment(1)	17,260	17,780	17,210	3.0	(0.3)
Direct Employment	480	790	340		
Indirect Employment	10	220	100		
Total	490	1,010	440		
Percent of County Total	2.8	5.7	2.5		
Population	26,410	26,823	26,370	1.6	(0.2)
Gross Regional Product (millions)	$1,346	$1,526	$1,338	13.4	(0.9)
Personal Disposable Income (millions)	$529	$566	$526	2.0	(0.5)
LINCOLN COUNTY					
Total Employment(1)	2,370	2,330	2,330	(1.3)	(1.3)
Direct Employment	30	0	0		
Indirect Employment	0	0	0		
Total	30	0	0		
Percent of County Total	1.3	0	0		
Population	3,630	3,550	3,550	(3.0)	(3.0)
Gross Regional Product (millions)	$85	$85	$85	0.0	0.0
Personal Disposable Income (millions)	$57	$57	$87	0.0	0.0

(1)Full and part-time employment (jobs) by place of residence.

5.3.2 HOUSING

Existing housing characteristics of Nye County are described in Section 2.3.2 for NAFR. An estimated 2.61 persons per household lived in southern Nye County in 1988 (Source: PIC, 1987). Direct DOE-related employees and their dependents at the NTS and the TTR are estimated to total 1,460 residents, for which approximately 560 housing units would be required in Nye County. These housing units represent nearly 10 percent of the total housing stock. During periodic mining booms in Nye County, the presence of these residents may exacerbate an extremely tight housing market in communities such as Beatty; however, the effect is likely to be very small.

Existing housing characteristics of Clark County are described in Section 2.3.2 for Nellis AFB. Using the estimate of 651,400 residents of Clark County in 1988 (Table 5-7) and the permanent housing stock in that year, the number of persons per household in the county is estimated to be 2.45 persons. Direct employees at the NTS and the TTR and their dependents are estimated to total 11,710 residents of Clark County (Table 5-7). Using these estimates, approximately 4,780 residential units in Clark County are required by individuals who work at the NTS or the TTR and their dependents. These 4,780 residential units represent about 1.5 percent of the total housing stock in the county. There is no indication that the number of DOE-related personnel residing in Clark County has any effect on housing.

Existing housing characteristics of Lincoln County are described in Section 2.3.2 for Nellis AFB and NAFR. Direct DOE-related employees and their dependents residing in Lincoln County are estimated to total about 70 (Table 5-7), for which nearly 30 housing units would be required. These residential units represent 1.5 percent of the 1,790 units in Lincoln County. Given the level of housing vacancy in Lincoln County, employment at the NTS and the TTR does not have effects on housing in Lincoln County.

5.3.3 SERVICES

Education and community services characteristics for Nye, Lincoln, and Clark counties were discussed Chapter 2 (Tables 2-10 and 2-11), and described in Section 2.3.

5.3.3.1 Education

In 1988, the Nye County School District maintained one teacher for every 18.5 students. DOE-related students were estimated to comprise approximately 7 percent (220 students) of all enrollments in Nye County in 1988 (Table 5-7). Thus, 11 or 12 teachers were necessary to support the DOE-related students in Nye County in 1988. The Clark County School District maintained one teacher for every 21.4 students in October 1988. DOE-related students were estimated to comprise almost 2 percent (1,750 students) of all enrollments in the Clark County School District in 1988, requiring about 82 teachers. Lincoln County School District maintained one teacher for every 13.9 students. DOE-related students were estimated to comprise slightly more than 1 percent (10 students) of 1988 enrollments, requiring about one teacher. There is no indication that education in any of these counties is affected by the number of DOE-related students.

5.3.3.2 Law Enforcement

The DOE maintains a private-sector security force on NTS, which has no jurisdiction off-site. There is an informal mutual aid agreement between the Nye County Sheriff's Department and the NTS under which the Sheriff can deputize NTS security for use on the NTS during anti-nuclear protests; during extreme emergencies, the NTS security force may be used off-site (Source: Mark Zane, Nye County Sheriff's Department, personal communication, 1989). The Sheriff's Department is responsible for, and is reimbursed by the DOE for, law enforcement during protest demonstrations at the NTS. Law enforcement support needed as a result of anti-nuclear protests at the Mercury entrance to the NTS is provided using reserve deputies from stations located throughout Nye County. The local support is then provided using 12-hour shifts and dispatchers during the period of the protest (Source: Joanne Epperly, Nye County Sheriff's Office, personal communication, 1989). There is a mutual aid agreement between the NTS and the Nye County Sheriff's Department for accidents and emergency assistance.

In 1988, the Nye County District Attorney's Office in Tonopah reported a significant increase in the misdemeanor case load due to the number of anti-nuclear protesters prosecuted in Nye County, and regarded these prosecutions as placing a significant financial and social burden on the county (Source: PIC, 1988a). The District Attorney has since stopped prosecuting misdemeanor trespass charges, and the extent to which a burden remains is unknown.

Considering all law enforcement officers in the Nye County (77 officers) and the estimated county population in 1988 (Table 5-7), there was one officer for every 229 county residents. Since slightly over 8 percent (1,460 residents) of the county population is estimated to be DOE-related (NTS and TTR), 6 of the commissioned law enforcement officers in the county are attributable to DOE-related population.

Considering all commissioned officers in the Clark County (1,331 officers) and the estimated county population in 1988, there was one officer for every 489 residents. Since 1.8 percent (11,710 residents) of the county population is estimated to be directly related to the NTS, 24 of the commissioned law enforcement officers in Clark County are attributable to DOE-related population at the NTS and the TTR. Since the entry to the NTS is located at Mercury, law enforcement at the anti-nuclear protests has been provided by Nye County. Therefore, there are no effects on law enforcement in Clark County resulting from the NTS or the TTR.

In Lincoln County, the DOE-related population estimated to consist of 70 residents (2 percent of the county population) requires less than one-half of a commissioned law enforcement officer's effort. It is unlikely that the size of the DOE-related population has an effect on law enforcement in Lincoln County.

5.3.3.3 Fire Protection

NTS maintains 14 fire suppression personnel at 3 fire stations located at Mercury, Area 6, and Area 12 on NTS (Source: Chief Ray Gudeman, NTS Fire Department, personal communication, 1989). Mutual assistance agreements exist between the NTS Fire Department, the BLM, and the Air Force for fire suppression at Indian Springs. There are no mutual aid agreements between the NTS and Clark or Lincoln counties for fire protection within those counties because the NTS is located in Nye County. There is no indication that the NTS or the TTR result in effects on fire protection within the Region of Influence.

5.3.3.4 Medical Care

The Occupational Medical Facility at the NTS maintains emergency stations at Mercury, NRDS, Area 6, Area 12, and Area 20. Five physicians, 5 nurses, 1 x-ray technician, 1 clinical laboratory technician, and 33 paramedics staff these emergency stations and the DOE Medical Facility in Las Vegas. The physicians and two of the nurses are based in Las Vegas while the remainder of the medical service personnel are located on the NTS at Mercury. Ten ambulances are available at the NTS. Three of the emergency stations are staffed on a 24-hour basis.

In 1988, there was one licensed physician for every 2,207 residents and one nurse for every 300 residents of Nye County. Since slightly over 8 percent (1,460 residents) of the county population is estimated to be DOE-related (NTS and TTR), about half of a physician's effort and most of five nurses' efforts may be attributed to the DOE-related population.

Given the estimate of the Clark County population in 1988 (Table 5-7), there was one licensed physician for every 748 residents of the county and one nurse for every 247 residents. Approximately 2 percent of the population in Clark County (11,710 residents) are estimated to be directly related to DOE employment at the NTS and the TTR (Table 5-7). Due to the regional nature of the health care system in Clark County and the relative size of DOE-related population, the NTS or the TTR result in modest demands upon the health care system.

There was one licensed physician for every 1,800 residents and one nurse for every 327 residents of Lincoln County in 1988. Approximately 2 percent of the population in Lincoln County (about 70 residents) are estimated to be directly related to DOE employment at the NTS and TTR (Table 5-7). The demand upon the health care system in Lincoln County by DOE-related population is slight.

5.3.4 PUBLIC FINANCE

General fund county government resources (revenues plus opening balances) in Clark County for FY 89 were estimated at about $234,077,000 (Source: Nevada Legislative Council Bureau, 1988). Incorporated city general fund resources were as follows: Boulder City ($6,467,000), Henderson ($19,008,000), Las Vegas ($104,248,000), North Las Vegas ($21,699,000), and Mesquite ($1,426,000). Of the total governmental general fund resources in Clark County ($400,127,000), about $13,604,000 can be attributed directly or indirectly to DOE-related activities. Similarly, $10,607,000 of Clark County School District resources of about $342,159,000 can be attributed directly or indirectly to the NTS and TTR.

Clark County government general fund expenditures in FY 89 were budgeted at $206,441,000. The incorporated cities budgeted the following general fund expenditures: Boulder City ($5,557,000), Henderson ($17,306,000), Las Vegas ($96,622,000), North Las Vegas ($20,093,000), and Mesquite ($1,310,000). Total governmental general fund expenditures in Clark County were about $347,329,000. Of this, about $11,809,000 may be attributed to the effects of DOE activities. General fund expenditures of Clark County School District were about $337,253,000, of which about $10,455,000 result from DOE activities.

Nye County general fund resources were budgeted at $7,212,000 in FY 89, while expenditures amounted to $7,059,000. The resource effect of the DOE activities was about $664,000, while the expenditure effect was $649,000. The Nye County School District had fund resources of $13,044,000 and expenditures of $12,742,000. The effects of DOE-related activities on these categories are about $1,030,000 and $1,007,000, respectively.

Lincoln County general fund resources were budgeted at $1,534,000 in FY 89, while expenditures amounted to nearly $1,387,000. Caliente had general fund resources of $303,000 and expenditures of $258,000. The resource effect of DOE-related activities on total government general funds in Lincoln County was $57,000, while the expenditure effect was about $51,000. The Lincoln County School District had general fund resources of almost $5,158,000 and expenditures of about $4,957,000. The effects of the NTS and TTR activities on these categories are about $88,000 and $84,000, respectively.

5.3.5 LAND USE

Since the NTS withdrawn land is primarily located in Nye County and the effects of the NTS and the TTR on Clark and Lincoln counties are similar to those of Nellis AFB and the NAFR in these counties (Section 2.3.5), Clark and Lincoln counties are not discussed in this section.

Agricultural characteristics of Nye County are summarized in Table 2-12 in Section 2.3.5. Grazing and crop production are prohibited in the NTS and the TTR; therefore the economic contribution of agriculture to Nye County is probably slightly less than would occur if the NTS and TTR were available for agriculture.

Table 2-13 in Section 2.3.5 summarizes the energy and mining activities in Nye County. Minerals mined in Nye county during 1985 (Source: Office of Community Services, 1988) included gold, molybdenum, clays, silver, magnesite, stone, copper, fluorspar, barite, and lead. Currently, there is a mining boom in Nye County (Source: BLM, 1989), that could extend into the NTS if mining were permitted. Thus, the contribution of mining to the economy of Nye County is probably smaller than it could be if the NTS were available for this use.

While a variety of outdoor recreation may occur on the NTS and the TTR if they were publicly accessible (Section 5.7), hunting is the only activity for which economic data exist. Table 2-14 in Section 2.3.5.3 provides a summary of hunting within Nye County. Since recreational activities are prohibited on the NTS and the TTR and given the extent of existing expenditures by big game hunters in Nye County, the economic value of hunting in the county would probably be larger if the NTS and the TTR were available. Additionally, the remoteness of the NTS could be of high value to the wilderness-seeking recreationist. Thus, the existence of the NTS and, to a lesser degree, the TTR has an effect on the economic contribution of outdoor recreation in Nye County.

5.3.6 ECONOMIC DEVELOPMENT

The economy of Nye County depends largely on mining and defense-related activities. Other important sectors include government and tourism. The extent to which mining is constrained by the existence of the NTS may not be offset by the economic contribution of NTS activities to economic development in Nye County, which is indicated by the range of projections of employment, gross regional product, and personal disposable income from the use of the NTS for mining and grazing (Section 5.3.1.6). Thus, the withdrawal of land for the NTS could have an effect on economic development in Nye County by prohibiting the use of the land for mining and grazing.

Clark County is a large metropolitan area with an economic structure unlike other metropolitan areas because of the gaming industry, on which it is highly dependent. Nevertheless, it has a full range of services, facilities, and amenities commonly found in urban settings and has developed into a transportation center for southwestern and western states. The existence of DOE-related activities has undoubtedly helped diversify the economic structure in Clark County by reducing the overall dependence on the gaming industry. These activities therefore contribute to economic development within the county (Section 5.3.1.6).

Many Lincoln County residents are employed by some level of government, but in general Lincoln County has experienced an economic decline in its other major activities (Source: DOE, Office of Civilian Radioactive Waste Management, 1988). The existence of DOE-related activities does not appear to have affected the level of general economic activity, as indicated by projections of employment, GRP, and PDI from the use of NTS for other purposes (Section 5.3.1.6). Thus, the DOE activities do not affect economic development in Lincoln County.

5.3.7 SUMMARY

The primary identifiable effect of the DOE withdrawals is the potentially constraining effects on mining and grazing in Nye County as a result of the NTS. The contribution of mining to the economy of Nye County may be constrained by the existence of non-accessible, withdrawn land used for the NTS. To the extent that economic development in Nye County is less with NTS than it could be without the withdrawal, public fiscal revenues and community services are potentially less. Except for the exclusion of mining from the NTS, the DOE withdrawals have little effect on the public and private property of Nye County.

In Clark County, DOE activities appear to have had an overall beneficial economic effect. Many of the employment benefits resulting from NTS and DOE activities at the

TTR accrue to Clark County. Most of the workforce employed at the sites live in Clark County. Alternative use of the NTS would be less beneficial to public and private property in Clark County.

The DOE withdrawals do not appear to have substantially affected public or private property in Lincoln County.

5.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

This section identifies effects on plants, fish, and wildlife from DOE-related withdrawals. The plants, fish, and wildlife considered in this section are listed in Table 1-4 in Section 1.4.3.

5.4.1 NEVADA TEST SITE

Natural resources on the NTS are managed under the Five-Party Cooperative Agreement between the DOE, the Air Force, the Nevada Department of Wildlife (NDOW), the BLM, and the U.S. Fish and Wildlife Service (USFWS) (Source: DOI/BLM, 1989). NTS lands generally coincide with the transition zone of the Mojave Desert and Great Basin Desert, and contain diverse elements of each area. Six primary vegetation associations are found on the NTS providing habitat for 188 species of birds, 45 mammals, and 32 reptiles (Source: ERDA, 1977). In particular, mule deer, wild horses, kit fox, gray fox, mountain lion, and chukar are present throughout portions of the NTS. The desert tortoise, recently listed as threatened by the USFWS, inhabits some of the creosote scrub communities in the Mojave Desert portions of the NTS.

The NTS is a particularly well-studied withdrawal, with respect to ecological resources. Several research programs were implemented over the last four decades to determine the effects of radiation in the environment following atmospheric and underground nuclear detonations. The International Biological Program (IBP), a desert ecosystem study administered through the National Science Foundation, emphasized preservation, use, and restoration studies. U.S. Energy Research and Development Administration (ERDA) (a predecessor to DOE) funded most of the NTS research in Rock Valley for this program. The Nevada Applied Ecology Group (NAEG) conducted a series of studies of plutonium-contaminated areas to determine, in part, the characteristics and distribution, the effects of plutonium contamination in the environment on native plants, animals, and ecological systems, and the need for removal of plutonium from the environment. The large amounts of data on desert ecosystems collected through these programs is regarded as a positive effect on plant and wildlife resources resulting from the NTS withdrawal.

The extensive work of Beatley (Sources: Beatley, 1976, 1977; O'Farrell and Emory, 1976) provides the most recent complete description of the geographic distribution and ecological characterization, including significant physiographic, geologic, climatic, and edaphic features for the vegetation mosaic of central-southern Nevada and the NTS.

The NTS is located on the transition between the Great Basin and Mojave Deserts. Vegetational constituents of both deserts occur on the NTS, contributing a complex and diverse flora. The extensive floral collections of Beatley and others have yielded 711 vascular plant taxa of 67 families. One third of the species belong to the Composite (sunflower), Gramineae (grass) and Polygonaceae (buckwheat) families. There are also 125 introduced species growing on the NTS, most occurring on disturbed soils (Source: Beatley, 1976).

Vegetation associations of the Mojave Desert portion of the NTS are typically dominated by creosote-bursage at elevations below 4,000 feet, and blackbrush above 4,000 feet. Hopsage-desert thorn (*Grayia spinosa-Lycium andersonii*) associations dominate the lower bajadas of the transitional desert zone while blackbrush is present on the upper bajadas. In the Great Basin Desert portion of the NTS, various species of sagebrush are the characteristic species. At the highest elevations of both deserts, piñon-juniper are characteristic, while at the lowest elevations, typically associated with saline and calcareous soils, saltbush commonly dominates.

Surveys conducted by Beatley (1977), Rhoads and Williams (1977), and Rhoads et al. (1978) provide site characterizations and geographic distributions of 29 sensitive plant species occurring on the NTS that were candidates for threatened or endangered listing at that time. The status of sensitive plant species changes as more information is collected, however, and in 1989, all of these species were listed as Candidate Category 1 , 2 or 3. Candidate Category 3 indicates that these species were once being considered for listing, but are no longer receiving this consideration. The eight species listed as Category 1 (C1) or 2 (C2) are listed in Table 5-10.

<u>Ecology of the Nevada Test Site</u> (Source: O'Farrell and Emory, 1976) and references therein contain the largest amount of information relating to ecological resources and the effects of activities at NTS on these resources. Ecological studies at the NTS have examined population dynamics, movement, and dispersal of various rodents (Sources: Allred and Beck, 1962; French et al., 1966; Jorgensen, 1963; Maza et al., 1973; Mullen, 1970; Rowland and Turner, 1964), lizards (Sources: Allred and Beck, 1962; Jorgensen and Tanner, 1963; Tanner and Krogh, 1973), and many invertebrates (Source: Allred and Beck, 1962; 1967).

The analysis of effects is largely confined to an overview of activities that have resulted in long-term effects on vegetation or wildlife. During the period of atmospheric testing, and in the three decades following, the Nevada Applied Ecology Group conducted numerous studies to examine the effects of plutonium dispersed into desert ecosystems by above-ground testing. Romney et al. (1963) determined that radioactive particles from fallout were selectively trapped in the hairs, crevices, and glands of leaf surfaces. Follow-up studies 20 years later indicate that radioactive particles continue to be resuspended and deposited in plant foliage growing in the original fall-out areas (Source: Romney et al., 1985). The ecological significance of this finding is unknown.

Damage from atmospheric testing was still apparent 20 years after the event in some areas. Field studies conducted between 1980 and 1983 (Source: O'Farrell and Sauls, 1985b)

Table 5-10. Sensitive Plant Species Known to Occur on the Nevada Test Site.

Species	Federal Status
Arctomecon merriamii	C2
Astragalus beatleyae	C1
Astragalus funereus	C2
Camissonia megalantha	C2
Frasera pahutensis	C2
Galium hilendiae var. kingstonense	C2
Penstemon pahutensis	C2
Phacelia beatleyae	C2

C1: Indicates that there is substantial information available to support the biological appropriateness of proposing to list the species as endangered or threatened.

C2: Indicates that proposing to list as threatened or endangered is possibly appropriate, but conclusive data on biological vulnerability and threat are not currently available to support the proposed rules.

indicated that pulverized, low fertility, overburden materials around the SEDAN test site differed from control site soil materials in species composition and structure of plant communities and small mammal populations. Although pulverized overburden was unique to this site, differences in mammal population characteristics were linked to the changes in plant species composition and structure, and the slow rate of succession to pre-test conditions at all sites. Circumstantial evidence suggests that exposure to chronic, low-level radiation, both externally and internally, may contribute to patterns of species diversity if radiosensitivity of the species is not equal (Source: O'Farrell and Sauls, 1985). Changes in species composition and relative abundance are more clearly related to alterations in vegetation structure and function. It was not possible to directly link population effects with exposure to radiation (Source: O'Farrell, not dated).

There are approximately 300 acres of land in four areas sufficiently contaminated by residual radioactivity to warrant removal of materials (Source: Wallace and Romney, 1975). Several studies have examined the potential for removing soil contaminated with radioactive material. Wallace and Romney (1975) concluded that restoration and revegetation of these sites would be very difficult, and that drastic alteration of the desert (resulting from decontamination activities) will result in serious ecosystem damage.

Potential effects on plant and wildlife resources resulting from underground testing include destruction or disturbance of terrestrial habitat by test-related operations (e.g., site preparation), ground motion, and post-test subsidence. In some cases, seepage, venting, or postshot drillback operations have allowed radionuclides to contaminate the surface (Source: DOE, 1989a). Additional studies are needed to determine the effects.

Portions of the NTS below 4,000 feet in the Mojave Desert may provide habitat for the threatened desert tortoise. Types of activities that are potentially harmful to this species were previously described in Section 2.4.1. In compliance with the Endangered Species Act, the DOE conducts pre-activity surveys and long-term monitoring for the potential presence on the NTS of the desert tortoise as well as for the C1 plant, Beatley's astragalus. A Biological Assessment is presently being prepared by DOE in consultation with the USFWS, which will cover all activities with the exception of the Yucca Mountain Project.

The DOE conducts limited biomonitoring studies of wildlife inhabiting the NTS. Biomonitoring of migratory deer during the period 1988-1989 indicated elevated concentrations of radioactivity, apparently as a result of drinking from unfenced contaminated ponds on the NTS. These concentrations are not high enough to pose a health threat to the individual deer, nor to other animals in the food chain, including humans.

Ground disturbance on the NTS results from construction activities associated with underground nuclear testing. In 1977, on-site disturbance was estimated to be several hundred acres of desert shrub and woodland vegetation annually, although much of the annual disturbance occurred in previously disturbed areas (Source: URS/John A. Blume and Associates, 1987). The slow rate of recovery of desert ecosystems is well studied. Vegetation recovery in disturbed areas depends, in part, on precipitation. Great Basin Desert vegetation exhibits a greater rate of recovery than vegetation of the Mojave Desert. Natural restoration of shrubs and perennial grasses was investigated on a bladed construction zone and a nuclear cratering event (Source: Hunter et al., 1985). The results of these studies revealed that some limited shrub restoration occurs in bladed areas over a 5-year period by sprouting of the sheared-off root systems and natural reseeding. Revegetation at the crater site 20 years after the event indicated that non-native annual plants were capable of establishing themselves to a limited extent. However, there was little natural restoration of native shrubs within the area disturbed by blast, radiation, or material throw-out, probably because of low moisture and infertile conditions associated with the throw-out burden. The establishment of non-native annual species typically results in the loss of habitat values.

A potential off-site effect of underground testing is the possibility of induced wave action of water at Devil's Hole (Source: ERDA, 1977). Many fish species are adapted to wave-action; however, the endangered Devil's Hole pupfish has uniquely evolved in a body of water normally protected from sudden motion. Some desert fish specialists believe that wave action during the spring months, if pronounced enough, could disturb pupfish eggs deposited on the shallow shelf of Devil's Hole by disturbing the protective algae layer covering the eggs, or actually moving the eggs off the shelf. If wave action occurs, it could result in partial or total loss of the annual hatch of the species. Seismic activity in the

Devil's Hole area resulting from NTS test events, to date, has not been of sufficient magnitude to cause adverse effects on the Devil's Hole pupfish population.

The restrictions on access to the NTS that have resulted from land withdrawal for the facility have probably resulted in some beneficial effects on wildlife resources in areas where test site activities do not affect those resources. The NTS contains large areas of relatively undisturbed wildlife habitat closed to hunting and other public use activities that might otherwise negatively affect habitat or wildlife populations.

5.4.2 CENTRAL NEVADA TEST SITE

Past DOE activities on the CNTS have affected plant and wildlife resources through land disturbance effects on wildlife populations and habitat. The inactive status of the CNTS suggests that activities at the withdrawal no longer affect these resources.

5.4.3 NELSON SEISMIC STATION

Effects on plant and wildlife resources resulting from use of this site are minimal due to its small size and location near the townsite of Nelson. Seismic monitoring activities on the site are also unlikely to generate substantial disruption to the surrounding ecological communities.

5.4.4 MT. BROCK COMMUNICATION SITE

The relatively small area of this withdrawal, and its proximity to the town of Tonopah reduces the potential for effects on plant and wildlife resources. Tonopah has been the site of extensive mining and prospecting activity, resulting in considerable disturbance to the local ecology. At present, the relatively limited range of passive activities carried on at the communication site suggest that any effect on plant and wildlife resources may be regarded as minor.

5.4.5 PROJECT SHOAL SITE

The Project Shoal Site was originally withdrawn by the DOE for use in conducting an underground atomic test. Current activities in the vicinity of the site consist of training for search and rescue operations. Although this withdrawal is relatively small, the particular nature of the current and historic use of the site suggest that there is the potential for long-term effects on plant and wildlife resources. The magnitude of this potential, however, cannot be determined without additional studies.

5.4.6 TONOPAH TEST RANGE

The TTR is contiguous with the North Range of the NAFR in central Nevada. The effects of activities at the TTR on plants, fish, and wildlife resources are discussed in Section 2.4.2.

5.4.7 SUMMARY

Because of its large size area and the nature of activities that occur there, the NTS is the DOE withdrawal with the greatest potential for affecting plant and wildlife resources in Nevada. Effects associated with underground nuclear testing are localized but potentially harmful to wildlife populations inhabiting lands near the location of subsidence craters.

Atmospheric testing, which was discontinued in the early 1960's, may have had lasting but localized effects from residual radiation in the environment and post-test land disturbance. The effects of residual radiation in the environment cannot be fully understood without additional and long-term studies. The effects of physical disturbance have resulted in slow rates of recovery of the vegetation, typically with annual, non-native species. This shift in species composition and community structure has similarly affected the structure and species composition of local small mammal populations.

The effects of underground testing have been, and continue to be, closely monitored during pre-shot and post-shot operations through endangered species surveys and environmental compliance reports. The major potential effects of underground testing include ground disturbance through associated construction activities. The natural establishment of weedy, non-native vegetation on disturbed areas is known to affect the species composition of native small mammal populations.

5.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

This section describes impacts on cultural and historical properties from DOE activities on the NTS, CNTS, Nelson Seismic Station, and the Mt. Brock Communication Site. Since the DOE conducts cultural resource surveys on the TTR, it is also discussed in this section. Recorded archaeological and historical site records were searched for this report, and a summary of previously conducted surveys and overviews is provided in Table 5-11. Table 5-12 lists the data recovery programs conducted to mitigate impacts on cultural resources on the NTS since 1985. In addition to the sites studied through these data recovery programs, a total of 27 small sites (20 artifacts or less) and 211 isolated artifacts have been totally or partially collected by archaeologists during cultural resource surveys in order to avoid impacts to those sites.

5.5.1 NEVADA TEST SITE

The routes of several early explorers and surveyors crossed the area now occupied by the NTS. Among the most famous of these include the Emigrant trail of the Death Valley Party. In addition to the numerous, uninventoried prospects and temporary mining camps as a result of early 20th Century activity, major mining Districts were established at Oak Springs, Mine Mountain and Wahmonie (Source: ERDA, 1977).

Ground disturbance associated with downhole tests include preparation of the drill pad, sump pond, trailer park, device-monitoring array, and access routes for water, electricity, and vehicles. This disturbance usually occurs within a 3,000 foot diameter area, not

Table 5-11. Cultural Resources Studies, Department of Energy.

Project Name	Acres Studied	Type of Study(1)	Sites Recorded	Reference
Misc. surveys FY 1977	1,165.00	II	23	Bath & Budy, 1977
DH U20ac, U20ad, U20ae	216.25	III	1	Budy, 1978a
DH Ve25A#1, Ve12#11, Ve25A#2	103.80	III	0	Bath, 1978
Drill Hole U19ab	29.39	III	0	Zerga, 1979a
Drill Hole U19ac	53.26	III	3	Zerga, 1979a
Drill Hole U19ad	20.20	III	0	Zerga, 1979a
Backhoe trenches Frenchmen Flat	64.28	III	0	Zerga, 1979a
Camera pad site & road extension	231.18	III	1	Pippin, 1979
Drill Holes DH-1, SH-1, T-23	2.41	III	2	Zerga, 1980a
3 MX shelter sites & access	Unknown	III	3	Johnson, 1981
Pipeline survey	55.64	III	6	Clerico, 1982c
Geophysical, Frenchmen Flat	99.31	III	2	Reno, 1982a
Expansion U20aj	27.03	III	0	Reno, 1982b
CDS test facility, U9CT	4.80	III	0	Reno, 1982c
M-X Egress Test Bed	60.00	III	0	Reno, 1982d
U20AL, skid & borrow	176.21	III	7	Reno, 1982e
Borrow pit near U20ai	3.71	III	0	Reno, 1982f
7 seismic lines	214.07	III	3	Reno, 1982h
Seismic line by U20aj	13.77	III	0	Ferraro, 1982a
M-X Egress drill hole & road	107.50	III	3	Shortridge, 1982b
LANL ground motion study	43.11	III	2	Ferraro, 1982b
Drill hole above N Tunnel	2.07	III	1	Shortridge, 1982b
Drill pad GZ04 above U12T	9.74	III	4	Reno, 1982j
69KV powerline for M-X egress	103.74	III	2	Reno, 1982k
Drill Hole U19af	509.41	III	27	Reno, 1982l
Drill Hole U9cw	206.61	III	1	Reno, 1982m
M-X Egress test bed	Unknown	II	0	Pippin, 1982a
Drill pad U20am	(No survey due to snow)			Pippin, 1982b
Drill pad Ue10aa	84.02	III	1	Pippin, 1982e
Area 2 looksee	184.54	III	0	Pippin, 1982f
Drill Hole Ue4ac	162.19	III	1	Pippin, 1982g
Drill pad U20am	206.61	III	1	Reno, 1982n
M-X Egress test bed	63.80	III	0	Reno, 1982o
Drill Hole U8j	91.83	III	0	Reno, 1982q
U10ca and pipeline	37.17	III	1	Clerico, 1983
M-X Area 25 rock source	Unknown	III	1	Lockett, 1983a
U10ca expansion	521.47	III	2	Reno, 1983a
4 Reports-USAF NH&S RDT&E	539.70	III	46	Pippin, 1983a
Drill Hole U19j & U19ad	556.36	III	7	Reno, 1983b
Drill Hole U19ao	259.96	III	16	Reno, 1983c
Drill Hole U19r	247.10	III	20	Pippin, 1983c
Drill Hole U2cq	206.61	III	0	Lockett, 1983b
Drill Hole U19ar	206.61	III	6	Reno, 1983e
Drill pad U20an	206.61	III	9	Reno, 1983f
Drill Hole U19ar	137.74	III	4	Henton, 1983a

Table 5-11. Cultural Resources Studies, Department of Energy (continued).

Project Name	Acres Studied	Type of Study(1)	Sites Recorded	Reference
Drill Hole U19at	206.61	III	?	Henton, 1983b
Drill Hole U19as	247.00	III	40	Henton, 1983c
Drill Hole Ue14b	29.94	III	36	Morgan, 1983
Drill Hole U19s	206.61	III	?	Henton, 1983d
Drill Hole U19k	206.61	III	?	Henton, 1983e
Yucca Flat optic fiber line	51.87	II	4	Henton, 1983f
Improvements to U19p portal	1,100.00	III	4	Henton, 1984a
Post-shot pad T Tunnel	199.09	III	9	Henton, 1984c
Area 12-N Tunnel optic fiber	59.28	III	1	Reno, 1984d
Drill Hole U19ac	132.23	III	10	Reno, 1984e
Drill pad above N Tunnel	255.89	III	1	Reno, 1984f
Drill Hole U19an	311.84	III	27	Henton, 1984e
Borrow pits #1, #3, & #4	59.53	III	6	Henton, 1984f
4 seismic lines, Yucca Flat	14.52	III	1	Henton, 1984g
Small bypass road	2.30	III	5	Henton, 1984h
DAF, Area 6	1630.20	III	9	Henton, 1984i
Drill Hole U20ao	296.40	III	10	Henton, 1984j
Drill Hole U19ab	84.71	III	11	Henton, 1984m
Drill Hole U20ap	206.61	III	9	Henton, 1984o
Drill Hole U20ak	206.61	III	13	Henton, 1984p
Yucca Flat seismic line	25.94	III	5	Henton, 1985e
N Tunnel blower pad	116.89	III	3	Henton, 1985f
NTS Security Training Site	89.92	III	9	Henton, 1985g
Drill Hole U20aq	206.61	III	7	Henton, 1985h
U19ar road realignment	29.84	III	1	Lockett & Henton, 1985
Drill Hole U19af	100.00	III	5	Lockett, 1985a
Drill Hole U19aq	51.65	III	20	Lockett, 1985b
Drill Hole U10ar, borrow #3	226.01	III	25	Henton, 1985i
Drill Hole U20as	23.08	III	2	Henton, 1985j
Drill Hole U10au	22.96	III	0	Henton, 1985k
Drill Hole U10at	206.61	III	8	Reno, 1986a
U20at borrow pit #2	37.79	III	4	Reno, 1986b
U20at borrow pit #1	36.73	III	4	Reno, 1986c
20-01 road cutoff	13.77	III	1	Reno, 1986d
Drill Hole U20av	362.72	III	7	Reno, 1986e
Drill Hole U20aw	206.61	III	7	Reno, 1986f
Seismic Emplacement Pahute Mesa	4.94	III	2	Henton, 1986b
Pahute Mesa Road, Phase 1	83.46	III	8	Henton, 1986c
Pahute Mesa Road, Phase 2		III	3	Henton, 1986d
Small radiographic facility	5.60	III	0	Henton, 1986e
Drill Hole U19aw	206.61	III	22	Lockett, 1986a
DNA drill holes 1,2,3	6.42	III	9	Lockett, 1986b
Drill Hole U20ap	162.19	III	1	Lockett, 1986c
U20ar at powerpole DDZ 42	1.95	III	2	Lockett, 1986d

Table 5-11. Cultural Resources Studies, Department of Energy (continued).

Project Name	Acres Studied	Type of Study(1)	Sites Recorded	Reference
Uu20ax, borrow pit, 2 roads	359.27	III	17	Reno, 1986h
DNA relocate hole 3	308.53	III	4	Reno, 1986i
U20ax, borrow pit, powerline	250.00	III	8	Lockett, 1986e
Microwave reflector pad	0.04	III	0	Henton, 1986g
Drill Hole U20ay, borrow pit	62.07	III	5	Henton, 1987a
Expansion U20n	0.75	III	1	Henton, 1987b
DNA UE12N #14 and #15	22.96	III	2	Lockett, 1987a
P-Tunnel Portal	45.91	III	1	Lockett, 1987b
Drill Hole U20az	72.78	III	12	Lockett, 1987c
DNA Ee12N13	5.51	III	1	Reno, 1987a
Drill Hole U20ay	206.61	III	6	Reno, 1987b
Drill Hole U19ay	75.76	III	2	McLane, 1987a
Drill Hole U19ax	72.31	III	11	Reno, 1988c
DNA Drill Holes #1, #2, and #3	430.37	III	35	Lockett, 1986b
18-03 Road	36.36	III	12	Reno, 1987c
U20ay borrow pit	3.67	III	0	Reno, 1987d
DNA Phase No. 2	381.72	III	58	McLane, 1987d
12-01 Road	51.97	III	0	McLane, 1987e
Drill Hole U20bb	162.19	III	4	Reno, 1987e
Drill Hole U20bc	206.61	III	9	McLane, 1988a
Drill Hole U8N	206.61	III	1	Reno, 1988a
CCT Van	7.12	III	2	Reno, 1988b
U19ax-Russian	18.00	III	4	Reno, 1988c
U19au CCT Ban Site #2	6.05	III	2	McLane, 1988c
U20aw Treaty Ver Sies Pad	0.72	III	0	McLane, 1988d
G-Tunnel Post Shot	412.16	III	41	McLane, 1988e
USGS HRMP#3	82.12	III	12	Livingston, 1988
Three Disturbed Areas	13.14	III	0	McLane, 1988f
Drill Hole U19av	206.61	III	9	Reno, 1988f
Drill Hole U20bd	195.15	III	36	McLane, 1988g
UE12t#7	6.74	III	2	McLane, 1988h
Drill Hole U20be	206.61	III	3	McLane, 1988i
Misty Zephyr	91.57	III	5	McLane, 1988j
Beatley Milkvetch fence	4.79	III	4	McLane, 1988k
Tongue Wash Water Line	25.19	III	3	Chapin, 1988
Airborne Response Team Hangar	64.96	III	2	McLane, 1989b
Drill Hole U20bf	225.89	III	6	McLane, 1989c
Drill Hole U19ba	14.21	III	1	McLane, 1989d
Rainier/Aqueduct Core Holes	9.42	III	6	McLane, 1989e
U19ay CCTV Van	7.85	III	0	McLane, 1989g
NNWSI Overview	N/A	I	N/A	Pippin, 1981
NNWSI Reconnaissance	4,368.00	II	178	Pippin, 1982c
Yucca Flat Reconnaissance	4,199.00	II	127	Reno, 1985
Pahute/Rainier Overview	N/A	I	N/A	Pippin, 1986d

Table 5-11. Cultural Resources Studies, Department of Energy (continued).

Project Name	Acres Studied	Type of Study[1]	Sites Recorded	Reference
Area 20 Reconnaissance	722.47	II	22	Pippin, et al., 1987
40 Mile/Yucca Wash Reconnaissance	2,037.75	II	159	Henton and Pippin, 1988a
<u>Central Nevada Test Site</u>				
Transmission line	Unknown	III	6	Brooks, 1979
CNTS Assessment	Unknown	II	Unknown	Brooks, 1969
<u>Tonopah Test Range</u>				
UNLV Bergin et al., 1979 Sample Survey	4,080	II	65	Bergin, et al., 1979
UNLV Crownover Survey	52	III	5	UNLV, 1981 & UNLV, Vol. 1, 1980
Electronic Warfare Survey	25	III	20	UNLV, 1979
Class II Survey Area 10	1,430	II	66	McLane, 1989
Pipeline and Man Camp Expansion	12	III	1	SR070783-1
Comm. Route and Haul Road	Unknown	III	6	Jackson, 1983
Sewage Lagoon and Haul Road	90	III	9	Reno, 1984a
Two Aggregate Pits	395	III	13	Henton, 1984b
Airfield Expansion	280	III	6	Reno, 1984a
Batch Plant and Borrow Pit	27	III	5	Henton, 1985a
Two Powerline Easements (off site)	9.6	III	1	Henton, 1985b
Support Facilities	277	III	8	Henton, 1985c
Fiber Optic Line	63	III	7	Pippin, 1986a
Haul Road East	83	III	2	Henton, 1986a
Camera Station and Borrow Pti	1.2	III	0	Henton, 1986f
Two Tower Sites and Cable Way	46	III	1	Henton, 1986g
Model Airfield and Enlargement	320	III	5	Reno, 1986g
Gabbard Hills Camera Station	12	III	0	Henton, 1986h
Instrumentation Site P-47	102	III	8	Reno, 1988d
PAB&B and HV Launcher	56.8	III	2	Reno, 1988e
Sandia Command Post	28	III	0	Henton, 1989a
Sandia Trespass Camera Station	5	III	1	Ball, 1979
Fence Line Survey	308	III	3	Brooks, Larson, and King, 1976

[1] Type I studies consist only of overviews of existing information. Type II studies consist of reconnaissance of a sample of a study area. Type III studies consist of surveys covering the entire study area.

Table 5-12. Data Recovery Programs Conducted for Cultural Resources on the Nevada Test Site.

Project Name	Date of Plan	Status
Drill Hole U19an	1985	Final Report Completed
Drill Hole U19aq	1986	Draft Report Completed
Borrow at U20at	1986	Draft Report Completed
Drill Hole U19as	1986	Draft Report Completed
Drill Holes U19aw, U20ar, & U20aw	1986	Data Recovery Partially Implemented
Drill Hole U20ax	1986	Draft Report Completed
Phase 2 Buckboard Mesa Road	1987	Draft Report Completed
Drill Hole U20az	1987	Draft Report Completed
Drill Hole Ue12N13	1987	Draft Report Completed
Drill Hole U19ao	1987	Field Work in Progress
Sample of Area 20	1987	Not Implemented
Road 18-03	1988	Report in Preparation
Drill Hole U19ax	1988	Draft Report Completed
Drill Hole U19ay	1988	Draft Report Completed
Drill Hole U20bc	1988	Report in Preparation
Long Range Study Plan, Pahute Mesa	1990	To be Implemented in FY 91
Drill Hole U19av	1988	Report in Preparation
Drill Hole U20bd	1988	Report in Preparation
G-Tunnel	1988	Not Implemented

all of which may be directly disturbed. Post-test ground disturbance may include drilling an additional hole, usually within the previously disturbed area. Ground disturbance associated with tunnel tests includes excavation of tunnels, each of which is used for numerous tests. Excavation results in tailing. Ground disturbance from both tunnel and downhole tests includes the potential for some disturbance of nearby cliffs. Additional ground disturbance on the NTS includes housing and population support facilities, and many other facilities located throughout the NTS. The total acreage disturbed on the NTS is unknown.

Systematic cultural resources studies were initiated on the NTS about 1978. Approximately 129 Class III surveys have been conducted in advance of proposed land disturbing activities and Class II sample surveys have been conducted in six areas. These surveys have covered approximately 32,010 acres or 3.9 percent of the total withdrawn area. All these surveys were in advance of defense-related activities.

The records search indicated 2,008 recorded sites on the NTS. These resources include 297 prehistoric campsites, 491 lithic scatters, 569 specialized prehistoric activity localities, 44 prehistoric toolstone quarries, 502 isolated prehistoric artifacts, five historic sites with a ranching theme, seven historic sites associated with mining and another 37 historic sites displaying other historic themes, mostly prospecting. The NTS contains an excellent and relatively unique record of this late period aboriginal adaptation. Table 5-13 summarizes the recorded archaeological sites on the NTS by their National Register of Historic Places eligibility and by the extent to which they have been impacted by DOE activities. The facilities associated with the testing of nuclear devices have not been inventoried as cultural resources, but many of these facilities are eligible for nomination to the National Register of Historic Places because of their association with activities that have significantly affected international affairs. For example, many facilities in Yucca and Frenchmen flats were associated with the early days of above ground nuclear testing and are unique resources representing activities that are now excluded by international treaty. Of the 2,008 cultural resources recorded on the NTS, 74.7 percent (1,500 sites) are undisturbed, 20.1 percent (403 sites) have been partially impacted, and 2.7 percent (55 sites) have been extensively impacted or completely destroyed. The extent to which 50 sites may have been impacted is unknown.

Table 5-13. Extent of Impacts on Recorded Archaeological Sites: Nevada Test Site(1).

Extent of Impact	Recommended National Register Eligibility (2)							
	Eligible	%	Not Eligible	%	Undetermined	%	Total	%
Undisturbed	819	69.3	664	83.8	17	50.0	1,500	74.7
Partial	328	27.8	73	9.2	2	5.9	403	20.1
Extensive	24	2.0	31	3.9	0	0.0	55	2.7
Unknown	11	0.9	24	3.1	15	44.1	50	2.5
TOTAL	1,182	100.0	792	100.0	34	100.0	2,008	100.0
(%)		58.9		39.4		1.7	100.0	

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.

(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

Of the 2,008 recorded sites, 58.9 percent (1,182 have been considered eligible for nomination to the National Register of Historic Places, 69.3 percent of which (819 sites) are undisturbed, 27.8 percent (328 sites) have been partially impacted, and 2.0 percent (24 sites) have been extensively impacted or completely destroyed.

Since 1978, most impacts from NTS-related activities have been avoided through pre-activity surveys in advance of all land-disturbing activities. Whenever possible, cultural resources are avoided by these activities. When cultural resources cannot be avoided, because of the intensity or extent of testing activities, DOE implements data recovery programs that retrieve scientific information from archaeological sites that may otherwise be affected by the activities. Thus, although in-place preservation is not always possible, impacts on cultural resources are minimized by current DOE programs of avoidance and data recovery.

Formal consultation with Native Americans indicate that the withdrawal of the NTS may have had an impact on the traditional and religious practices of certain Western Shoshone and Southern Paiute peoples by restricting their access to the withdrawal (Sources: Stoffle, 1987; Stoffle, Evans and Halmo, 1988). The DOE, through its Yucca Mountain and American Indian Religious Freedoms Act (AIRFA) Compliance programs has implemented initiatives to assess and mitigate its impacts on religious freedoms.

5.5.2 CENTRAL NEVADA TEST SITE

Two cultural resources studies have been conducted on and in the immediate vicinity of the CNTS. The acreage covered by these studies is unknown. One of these studies was the survey of a transmission line through the area and the other was an unfinished study to assess any potential impacts from activities on the CNTS and Base Camp. The transmission line survey identified six sites including an historic grave with associated cairn and historic artifacts, and several prehistoric limited activity localities (Source: Kensler, 1981). These studies indicated that more than 130 sites were found in the area of the CNTS, but only 7 recorded sites were identified during the records search, all of which have been partially impacted. Eligibility for nomination to the National Register of Historic Places for the seven sites is unknown.

5.5.3 NELSON SEISMIC STATION

This station is situated in the portal of a historic mine (Source: Clark, 1987). Gold was first discovered in this area in 1859. The town of Nelson was initially founded near the end of the nineteenth century and experienced a second boom in 1934, when its population reached 600. Because a cultural resource evaluation was not conducted prior to construction of the seismic station, its impact on this cultural resource is unknown.

5.5.4 MT. BROCK COMMUNICATION SITE

Because archaeological surveys were not conducted in advance of the construction of this or other facilities on Mt. Brock, it is not possible to assess the impacts of this withdrawal on cultural resources. Mountain overlooks, such as Mt. Brock, were often used by both historic and prehistoric Native American peoples, and their remains may have existed or may continue to exist in the area.

5.5.5 PROJECT SHOAL SITE

One cultural resource survey has been conducted on the Project Shoal Site and covered about 0.3 acres (less than 0.01 percent of the withdrawal). No sites were recorded during this survey; however, one recorded archaeological site and a prehistoric temporary camp, that consisted of five rock shelters were located during the records search for this report. The eligibility of this site for nomination to the National Register of Historic Places is undetermined, and the extent to which is may have been impacted is unknown.

5.5.6 TONOPAH TEST RANGE

Silver was first discovered in the TTR area in 1904 and three major mining camps (the Cactus Nevada Mine, Cactus Spring and Urania) were established during that year (Sources: Lincoln, 1923; Kensler, 1981). Mellan Mountain mining district was discovered in 1930 and pertains to a later gold rush in the Tonopah area. Cactus Spring itself, originally called Davenport, is the only major ranch on the TTR (Source: Kensler, 1981).

DOE has routinely conducted cultural resource surveys on the TTR. Since 1983, approximately 2 percent of the TTR (7,703 acres) has been covered by these surveys, but only 3,623 acres were surveyed in advance of direct land disturbance. The records search indicated 207 recorded sites on the TTR. Of those 207 sites, 21 are prehistoric campsites, 31 are prehistoric lithic scatters, 72 are localities of limited prehistoric activities, nine are prehistoric toolstone quarries, and 51 are isolated artifacts. Twenty Euroamerican historic sites are included in the data set. In addition to the sites studied during the above test excavations and data recovery programs, a total of 10 small sites (20 artifacts or less) and 15 isolated artifacts have been totally or partially collected by archaeologists during cultural resource surveys in order to avoid impacts to those sites.

Table 5-14 summarizes the recorded cultural resource sites by their National Register of Historic Places eligibility and by the extent to which they have been impacted by defense-related activities on the TTR. Of the 207 sites, 61.8 percent (128 sites) have been undisturbed by defense-related activities, 34.8 percent (72 sites) have been partially impacted, and 1.0 percent (2 sites) have been extensively impacted or completely destroyed. The extent to which 5 sites may have been impacted is unknown. Of the 207 sites, 60.9 percent (126 sites) have been considered eligible for nomination to the National Register of Historic Places, of which 46 percent (58 sites) are undisturbed and 48.4 percent (61 sites) have been partially impacted.

Most impacts to cultural resources on the TTR predate the initiation of pre-activity surveys in 1983. Since that time, impacts to cultural resources have been avoided by the modification of proposed activities, the retrieval of information during cultural resources surveys, or through data recovery programs. Thus, although in-place preservation is not always possible, impacts on cultural resources are minimized by current programs of avoidance and data recovery.

Table 5-14. Extent of Impacts on Recorded Archaeological Sites: Tonopah Test Range[1].

	Recommended National Register Eligibility [2]							
Extent of Impact	Eligible	%	Not Eligible	%	Undeter-mined	%	Total	%
Undisturbed	58	46.0	70	86.4	0	0.0	128	61.8
Partial	61	48.4	11	13.6	0	0.0	72	34.8
Extensive	2	1.6	0	0.0	0	0.0	2	1.0
Unknown	5	4.0	0	0.0	0	0.0	5	2.4
TOTAL	126	100.0	81	100.0	0	0.0	207	100.0
(%)		60.9		39.1		0.0		100.0

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.
(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

5.5.7 SUMMARY

The DOE has performed a variety of activities that have impacted cultural resources on the NTS, CNTS, Nelson Seismic Station, Mt. Brock Communication Site, Project Shoal Site, and the TTR. Pre-activity surveys in advance of land disturbance were not systematically conducted until about 1978 on the NTS, and 1983 on the TTR. The numerous land-disturbing activities carried out prior to that time had an impact on cultural resources. Since 1978, a comprehensive program of pre-activity surveys, avoidance of cultural resources, and data recovery projects on the NTS and the TTR has existed. Although in-place preservation is not always possible, this program has protected the research value of cultural resources on DOE withdrawals. A program has been implemented to periodically visit, and monitor any potential on-going effects at, previously recorded historic properties on the Nevada Test Site. Programmatic Agreements between the DOE, the Advisory Council on Historic Preservation and the Nevada State Historic Preservation Office have been implemented.

The withdrawal of the NTS has resulted in an effect on traditional and religious practices of Western Shoshone and Southern Paiute peoples by preventing them access to areas that are part of their traditional lands. The DOE is currently implementing programs to alleviate this effect.

5.6 EFFECTS ON RECREATIONAL RESOURCES

The NTS, which is surrounded except at its southern boundary by the NAFR, is a large, unpopulated expanse of undeveloped land. Little information is available about the recreational use of the NTS before its withdrawal, although it is known that the area was used for hunting prior to 1951 (Source: ERDA, 1977). Lack of public access to the NTS precludes use of the area for hunting, hiking, camping, vehicle touring, and other recreational activities that could be conducted in this primitive environment.

The CNTS, located in the Hot Creek Valley of northern Nye County, is surrounded by BLM lands dotted with numerous mining claims. There are no unique or other recreational attributes on these parcels that are not accessible on immediately adjacent public lands. The Project Faultless site is open to the public, and recreationists may visit this unique collapsed crater.

The immediate area surrounding the 2.5-acre Nelson Seismic Station is not known for its recreational resources. The small size of this withdrawal and lack of adjacent recreational lands suggests that this withdrawal does not affect recreational resources in Nevada.

The 11-acre Mt. Brock Communication Site is located atop Mt. Brock, south of Tonopah, in Nye County. The small size of this withdrawal and lack of adjacent recreational lands suggest that this withdrawal does not affect recreational resources of Nevada.

There is insufficient information available on the 2,560-acre Project Shoal Site to indicate whether this area contains notable recreational features. However, its location in the rough terrain of the Sand Spring Mountains suggests that the site may have rock climbing or hiking potential. These types of recreational features are located elsewhere in Nevada, so this withdrawal most likely does not affect recreation resources in Nevada.

5.7 EFFECTS ON WILDERNESS RESOURCES

The NTS occupies 814,528 acres of withdrawn land in southern Nye County. The Desert National Wildlife Refuge (NWR), which is managed by the USFWS is located directly east of the NTS, and the two areas are separated by a narrow band of the NAFR. The wilderness resources of the NAFR and the Desert NWR are discussed in Section 2.8. The closest U.S. Forest Service (USFS) wilderness is Mt. Charleston, located approximately 10 miles southeast of the NTS in the Spring Mountains. The closest BLM Wilderness Study Area (WSA) is Mt. Stirling, located approximately 10 miles southwest of the NTS in the Spring Mountains. Wilderness evaluations of the NTS have not been conducted because such evaluation is not required for lands withdrawn from public use. The NTS will be closed to the public until the DOE mission at the NTS is concluded. Wilderness resources, if present on the NTS, are not expected to be accessible before that time. Activities at the NTS do not affect existing, known wilderness or WSAs, nor are these activities likely to have disturbed unknown, but potential, wilderness resources on the NTS.

The CNTS consists of three separate parcels totalling 2,560 acres. The northern most site is located within the Toiyabe National Forest Monitor Management Area, and the other two sites are located on BLM lands managed in the Tonopah Resource Area. Numerous patented mining claims occur on the lands adjacent to these sites. There are several WSAs in this region. The Antelope and Park Ranges are located just north of the northern-most CNTS withdrawal; Fandango and Morey Peak are nearly adjacent to the west boundary of the CNTS. The closest USFS wilderness is the Toiyabe National Forest's Table Mountain, located approximately 15 miles west of CNTS. This withdrawal is located within a region of high mining potential. The CNTS has not been evaluated for wilderness suitability and there is no requirement to do so since the lands are withdrawn. The character of the surrounding environment, and the presence of roads and facilities on the withdrawal suggest that wilderness resources have been affected by mining activities. The CNTS withdrawal does not affect existing, known wilderness or WSAs.

The 2.5-acre Nelson Seismic Station site has been withdrawn since 1962, two years before passage of the Wilderness Act of 1964. The closest BLM WSAs are the North and South McCullough Mountains, located approximately 15 miles west of Nelson. The closest USFS wilderness area is Mt. Charleston, over 50 miles away from Nelson. The distances between areas of high wilderness potential and the Nelson Seismic Station preclude the possibility of effects to wilderness resources in Nevada from this withdrawal. The proximity of the withdrawal to the town of Nelson and its small size indicate that the withdrawal does not affect existing, known wilderness resources in Nevada.

The 11.29-acre withdrawal for the Mt. Brock Communication Site is located atop Mt. Brock, south of Tonopah in Nye County. The closest BLM WSA is the Kawich WSA, located 40 miles east of the site. The closest USFS wilderness is Arc Dome, 40 miles north of Mt. Brock. The great distances between these areas preclude the possibility of effects to these wilderness areas by this withdrawal. The small size of this withdrawal, its proximity to a major highway, and the absence of lands of suitable wilderness potential in the vicinity indicate that the withdrawal for the Mt. Brock Communications Site does not affect existing, known wilderness resources in Nevada.

The 2,560-acre Project Shoal Site is located approximately 30 miles southeast of NAS, Fallon, in the Sand Springs Mountains of Churchill County. The Sand Spring Mountains are managed by the BLM. The closest BLM WSA to this site is Job Peak, which is located 20 miles north of the site. The closest USFS wilderness is Arc Dome, 60 miles southeast of this withdrawal. The absence of lands of suitable wilderness potential in the vicinity of the Project Shoal Site indicate that the withdrawal has little potential to affect wilderness resources in Nevada.

The TTR is contiguous with the North Range of the NAFR in central Nevada. The effects of activities at the TTR on wilderness resources are discussed in Section 2.7.1.2.

In summary, DOE land withdrawals in Nevada total over 819,000 acres, but the distance from any of these withdrawals to USFS wilderness and BLM WSAs eliminates the potential for effects to existing, known wilderness resources in Nevada as a result of these withdrawals.

None of the DOE withdrawals have been evaluated for wilderness characteristics since they were withdrawn prior to passage of the Wilderness Act and the Federal Land Policy and Management Act (FLPMA). Two of the five DOE sites, Nelson Seismic and Mt. Brock Communication Site, are relatively small in area and are judged to have no effect on wilderness in Nevada. The lack of wilderness resources in the surrounding landscape and the presence of roads and facilities at the CNTS and the Project Shoal Site indicate that these withdrawals lack wilderness resources. Because of the size of the NTS withdrawal, the NTS may contain areas that are suitable for wilderness.

5.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

5.8.1 NEVADA TEST SITE

5.8.1.1 Base and Precious Metals

Regional mineral potential

The NTS consists of three basic geologic terrains shown in Figure 5.9: areas of deep alluvial cover, areas of Tertiary volcanic or sedimentary rock near a volcanic or intrusive center, and areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, or detachment faults.

Areas of deep alluvial cover: Bedrock is estimated to be beyond the reach of current mining interest (deeper than 3,000 feet). USGS-generated data have been used to estimate depth of cover in part of this area; for the remainder, cover depth was estimated. This covered area is assessed to be unfavorable for the discovery of mineral deposits.

Areas of Tertiary volcanic or sedimentary rock near a volcanic or intrusive center: These rocks in similar structural settings elsewhere have hosted Comstock-type silver-gold deposits, hot-spring gold-silver deposits, and hot-spring mercury deposits. There is moderate potential that deposits would be found in this terrain if it were to be opened to mineral development. The area is assessed as having only low-to-moderate potential for discovery of a deposit between the time of land closure and the present. It is estimated that one small-to-medium sized precious-metals deposit may have been developed within the NTS outside of known mining districts had the area remained open to mineral development.

Areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, or detachment faults: Favorable intrusive centers are known in four separate areas within the NTS and a belt of thrust faulting passes through the central part of the area, extending from the Calico Hills northeast through the Eleana Range. In other areas, rocks present in this

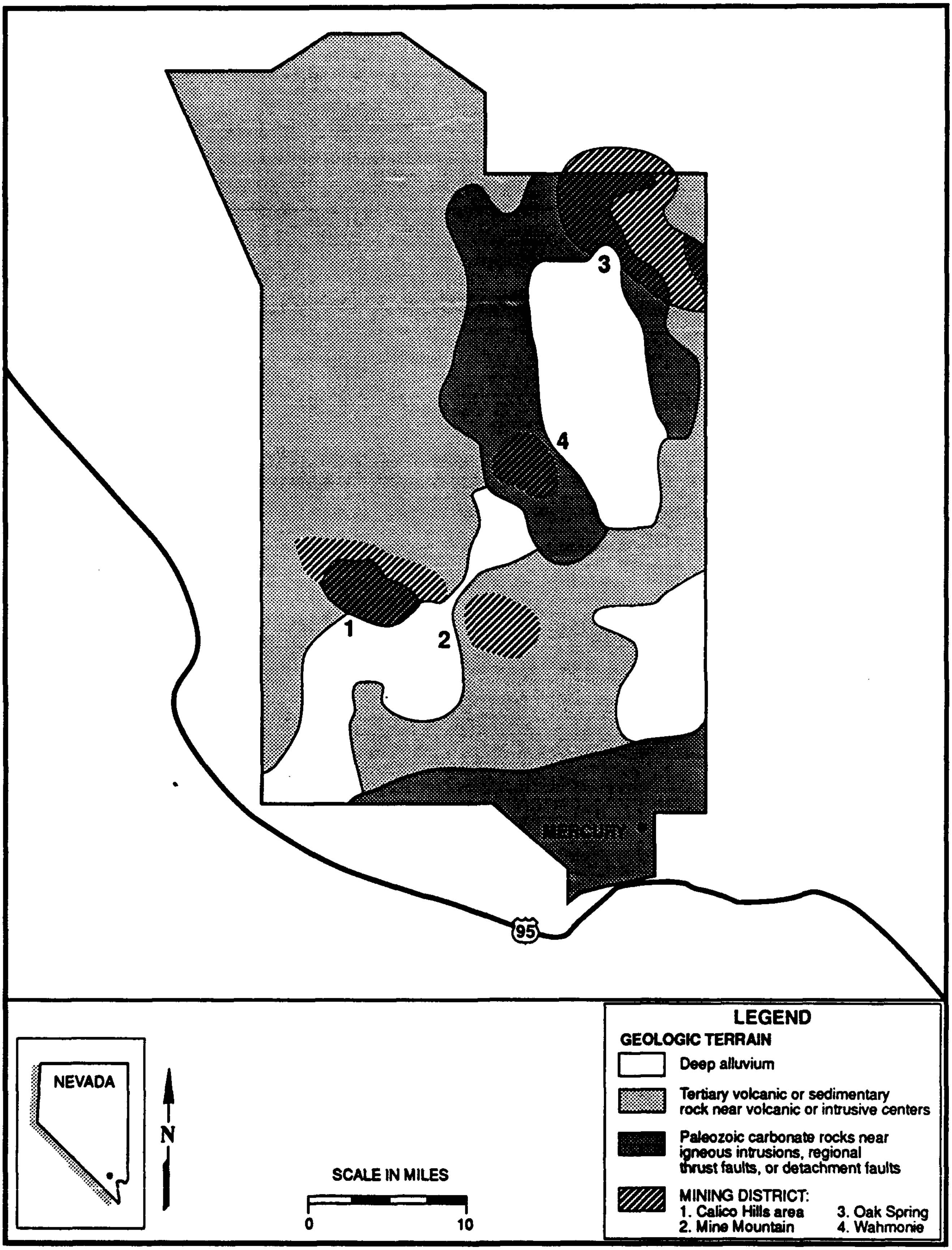


FIGURE 5.9 GEOLOGIC TERRAINS AND MINING DISTRICTS, NEVADA TEST SITE

terrain have hosted porphyry molybdenum deposits, tungsten skarn deposits, polymetallic replacement deposits, and carbonate-hosted gold deposits. Based on available information from adjacent mining districts, the NTS is assessed as having low-to-moderate potential for the development of one or two tungsten skarn deposits and/or polymetallic replacement deposits.

The potential exists for carbonate-hosted gold deposits on the NTS. These deposits occur in carbonate rock terrain in the Eleana and Halfpint Ranges in the central and eastern parts of the NTS. Three of the important criteria for these occurrences (favorable carbonate host rocks, regional thrust faulting, and intrusive rocks) occur here. Based on the limited information available, there may be a very low potential for discovery of a gold deposit.

Potential of mining districts

Mining districts within areas of Tertiary volcanic or sedimentary rock cover near volcanic or intrusive centers: Part of the Calico Hills mining area and all of the Wahmonie mining district are occupied by rocks of this terrain. Both areas are entirely within the NTS, but part of the Calico Hills area is occupied by Paleozoic carbonate rocks and will be assessed separately.

Gold and silver are the only metals likely to have been produced or have potential for production within the volcanic terrain portions of these districts. Precious-metals prices were static for a long time beginning in the early 1940's and extending into the late 1970's. Deposits in these districts would, therefore, most likely have been prospected starting in the late 1970's and they would be active at the present time. The portion of the Calico Hills area occupied by volcanic rocks has not been examined in detail and its mineral development potential cannot be assessed at a level much beyond the level estimated in the regional assessment. Surface exposures of volcanic rock exhibit vivid coloration due to bleaching and iron-oxide staining; a sample of this material showed anomalous values in arsenic, antimony, molybdenum, tin, and boron. Based on this limited information, the area is assessed as having low-to-moderate potential for the development of precious-metal or porphyry molybdenum deposits.

The Wahmonie district covers an area of several square miles surrounding the old Horn Silver Mine in the south-central portion of the NTS. Rocks cropping out in the district consist of andesites and latites that have been extensively hydrothermally altered. This zone of alteration forms an elliptically shaped halo around the old mine workings and can be traced on the surface for about 3 miles to the northeast and 5 miles to the southwest of the Horn Silver Mine (Source: Quade and Tingley, 1984). Based on available geological, geochemical, and geophysical data (Sources: Ekren and Sargent, 1965; Hoover et al., 1982; Quade and Tingley, 1984), the Wahmonie district is assessed as having high potential for the development of minable gold/silver resources.

Mining districts within areas of Paleozoic carbonate rocks near igneous intrusions, regional thrust faults, or detachment faults: All of two mining districts (Oak Spring and

Mine Mountain) and part of one mining district (Calico Hills) are within the NTS; all are occupied by Paleozoic carbonate rocks associated with igneous intrusions or regional thrust faults.

The Oak Spring district covers a large area with a varied geologic environment. Mineralization within the district is related to Mesozoic granitic bodies that crop out at Oak Spring, and 6 miles to the southeast at Twinridge Hill. The zone of alteration and mineralization associated with these plutons includes tungsten-bearing skarn deposits contiguous to the Climax stock at Oak Spring and polymetallic vein/replacement deposits at the Michigan Boy and Rainstorm mines to the southeast, near the Twinridge pluton. Examination and reconnaissance sampling of these deposits in 1983 (Source: Quade and Tingley, 1984) indicated that the district has high potential for the development of additional deposits of skarn tungsten mineralization and for discovery of porphyry molybdenum mineralization. Tungsten-bearing skarn deposits on the east side of the Climax stock were developed in the 1930's and provided the only recorded mineral production from this district. These deposits have not been adequately evaluated, but contain high potential for the development of additional tungsten ore. In addition, there are extensive areas of skarn development on the west and northwest margins of the Climax stock that have high potential for the discovery of tungsten ore. Portions of the area favorable for exploration are hidden under post-ore cover of Tertiary ash-flow tuffs. Deep excavations made in the central portion of the Climax stock for the Pile Driver, Tiny Tot, and Hard Hat nuclear tests, encountered interesting amounts of molybdenum and copper mineralization associated with fracture-controlled, potassic alteration within the stock. Reconnaissance geochemical sampling in silicified areas of the stock and in the contact zone to the northwest revealed areas of anomalous molybdenum values (Source: Quade and Tingley, 1984). Based on these data, this part of the Oak Spring district is assessed as having moderate-to-high potential for the development of a porphyry molybdenum deposit.

The Mine Mountain district has historically been prospected for mercury, but the lithologies, structure, and the geochemistry of ores present in the district all strongly fit the genetic model of a disseminated gold deposit (Source: Quade and Tingley, 1984). If this district had been open to public entry, prospecting would now be active in the area and there is a moderate-to-good chance that a disseminated gold deposit would be under development in the district.

In the central part of the Calico Hills mining area, small-scale prospecting has been done in metamorphosed outcrops of carbonate rocks of the Eleana Formation. The outcropping rocks have been altered to weak magnesian skarn and most of the prospecting has been for magnesite. A few small polymetallic vein deposits have also been prospected. Drilling conducted in the Fortymile Wash area by the DOE has revealed considerable thicknesses of metamorphic rock at depth, but neither a contact zone nor an intrusive body were found in the drill hole. This area is assessed as having low potential for the development of magnesite reserves and very low potential for development of polymetallic vein or metal-bearing skarn occurrences.

5.8.1.2 <u>Energy Resources</u>

<u>Geothermal Resources</u>

A few test wells in Yucca Flat and Frenchman Flat have reported thermal water (Sources: Garside and Schilling, 1979; Trexler et al., 1983). Water temperature reported from these wells is generally low (less than 150°F). Based on very limited information, the geothermal resource potential of the NTS is rated low.

<u>Oil and gas resources</u>

The oil and gas potential of the NTS is very low, and similar to that described for the NAFR (see Section 2.8.2.2). It is concluded that the withdrawal of the NTS has had no effect to the petroleum industry in Nevada.

5.8.1.3 <u>Industrial Minerals and Materials</u>

Much of the alluvial areas along the lower flanks of the ranges within the NTS contain potential sand and gravel reserves. These materials, however, do not have any unique value over similar material occurring in other areas throughout southern Nevada, and its potential cannot be rated. Most sand and gravel produced in Nevada goes into highway construction as portland and bituminous concrete aggregate, base, or fill material, and for building construction as aggregates. Because of their low unit value, sand and gravel deposits cannot be transported economically over long distances. As in the past, sand and gravel operations in Nevada will continue to be developed as close to consuming areas as possible. Sand and gravel deposits, while probably present within the NTS, do not present a sufficiently unique resource to merit classification.

According to Hoover (1968), zeolitized rocks crop out or underlie most of the volcanic outcrops and the alluvial basins at the NTS. Clinoptilolite and mordenite, either alone or in mixtures, are the most common zeolites in these deposits, but ferrierite, chabazite, and analcime also occur. Papke (1972), in referring to the NTS deposits and other large deposits elsewhere in Nevada, states that: "Because of their large size and extensive distribution . . . zeolite deposits of this type have great economic potential, especially for uses that require only impure materials of relatively low unit value. The deposits now being utilized in Japan are of this type." The deposits in the NTS were formed in unwelded tuffs by the action of mildly alkaline meteoric water (Source: Papke, 1972). In contrast, the zeolite deposits in the state that have been developed for exploitation are lake bed deposits that have been altered to zeolites under saline water-saturated conditions. The lake bed deposits, even though they are of higher grade, have not proven to be economical (Source: Hardyman et al., 1988); the only deposit known to be in production at this time is a small kitty-litter plant in Churchill County. Very little information is available on the tonnage and grade of the occurrences mentioned by Hoover (1968). The inference of extensive areal extent of the deposits, however, requires that they be assigned a low-to-moderate potential for the development of economic zeolite resources.

Barite is known to occur in the Mine Mountain district of the NTS. The barite occurs in veins associated with quartz and mercury, antimony, and lead mineralization. The veins cut Devonian carbonate rocks which form the upper plate of a thrust fault. The barite veins at this location are small, impure, and do not represent a potential barite resource. The Devonian carbonate rocks present, in north-central Nevada, host large-tonnage replacement deposits of barite. In this area, however, the rocks are southeast of the belt known to be favorable for barite deposition (Source: Papke, 1984) and have very low potential for development of barite resources.

Magnesite occurs in the Calico Hills area of the NTS associated with skarns formed in carbonate rocks of the Eleana Formation. The deposits are not extensive and have very low resource potential.

Fluorite is reported to be present in the Calico Hills area, occurring at veins and replacement bodies within Paleozoic sedimentary rock (Source: Jackson, 1988). Little is known about this occurrence; the fluorite was detected by x-ray analysis and is not readily detectable in hand specimen. This area may have a very low-to-moderate potential for development of small fluorite resources.

5.8.2 CENTRAL NEVADA TEST SITE

The geologic setting of the CNTS is illustrated in Figure 5.10. All three of the land parcels comprising this small withdrawal are covered by deep alluvial fill. Potential for the development of base- and precious-metals resources in this area is assessed as very low.

One test well in the southern part of the area encountered only warm water temperature (92°F) (Source: Trexler et al., 1983) at insufficient heat for geothermal use. However, the Hot Creek Canyon thermal area is only about 10 miles to the southwest and it is possible that thermal waters could be developed in the subsurface beneath parts of the CNTS. The geothermal resource potential of this area is assessed at low-to-moderate.

The CNTS is covered entirely by Quaternary alluvium. Pre-Tertiary bedrock bordering and presumably underlying the valley fill is similar to the bedrock in Railroad Valley to the east, where five oil fields have been discovered to date (Source: Weimer, 1988). Hot Creek Valley is considered to be favorable for small oil pools in Tertiary and Paleozoic rocks, similar to the small oil fields in Railroad Valley. The sites comprising the CNTS, however, are so small that oil and gas exploration companies could slant drill below the sites without occupying the surface. It is therefore concluded that this withdrawal has had no effect on the petroleum industry in Nevada.

Most of the alluvial material in the three portions of the CNTS are pediment and valley-fill deposits that were deposited at some distance from their source. The northernmost of the three areas that has potential for sand and gravel resources. These materials do not have any unique value over similar materials occurring in other areas in central Nevada and the potential is rated as very low.

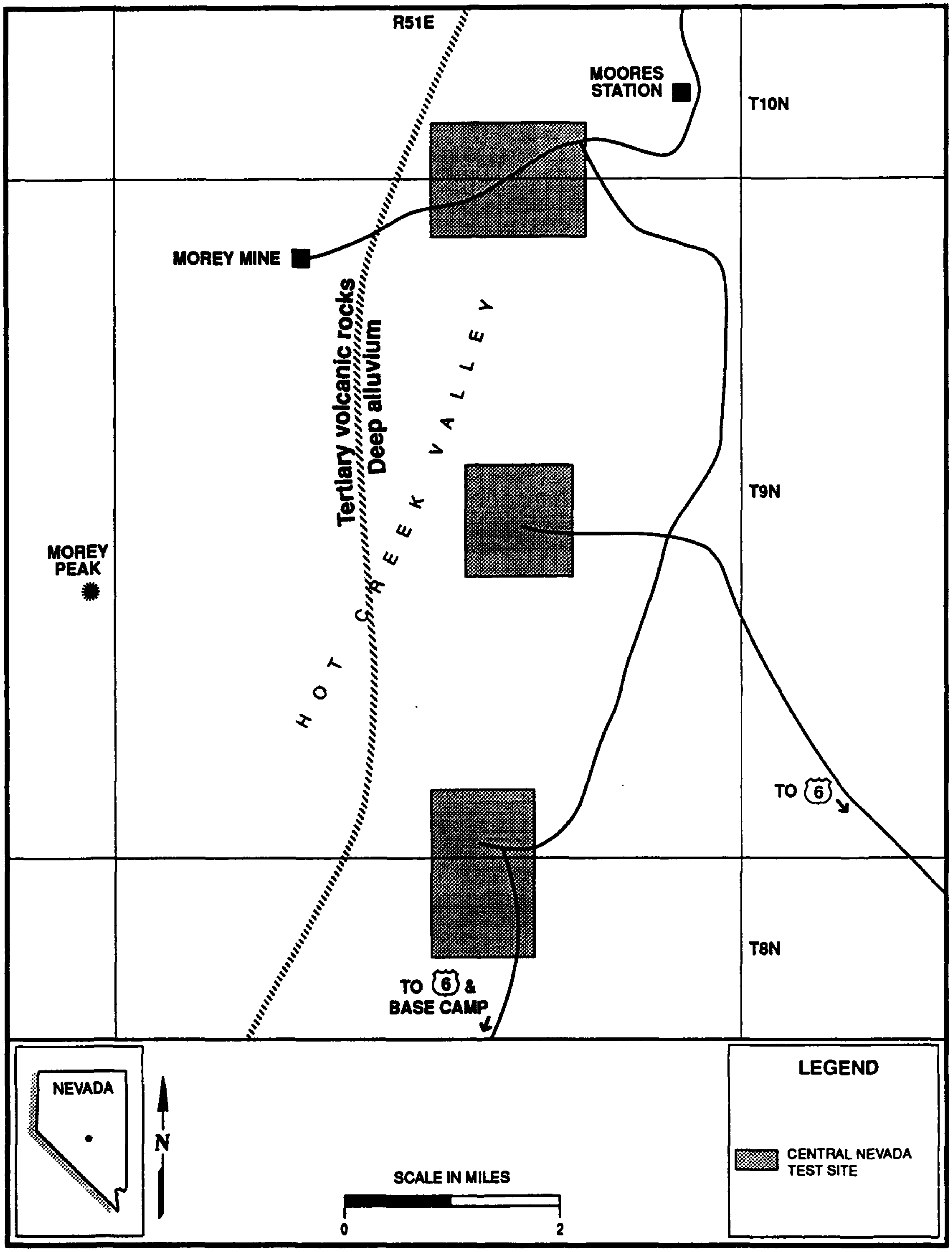


FIGURE 5.10 GEOLOGIC SETTING, CENTRAL NEVADA TEST SITE

5.8.3 NELSON SEISMIC STATION

The Nelson Seismic Station occupies 2.5 acres near the town of Nelson in southern Nevada. Nelson is the center of the Eldorado Canyon mining district, one of the oldest (1857) districts in the State (Source: Longwell et al., 1965). Gold, silver, copper, and zinc were mined from fissures in quartz monzonite of Tertiary age and from Precambrian gneiss and schist.

The overall potential for mineral and energy resources of the Nelson Seismic Station is very low. While the rocks at and beneath the site are favorable for base and precious metals, the probability is remote that so small a tract of land would contain commercial quantities of base and precious metals, industrial minerals, or oil and gas deposits. Therefore, the withdrawal of 2.5 acres for the Nelson Seismic Station has had no effect to mining or petroleum industries in Nevada.

5.8.4 MT. BROCK COMMUNICATION SITE

Mt. Brock occupies 11.29 acres on the outskirts of Tonopah. The overall potential for mineral and energy resources of the Tonopah area is described in Section 2.9.4 under the NAFR. Although the area comprising the Mt. Brock site is favorable for metals, the mineral potential of the site is considered to be low because the probability is remote that so small a tract of land would contain commercial quantities of base and precious metals at depth. Therefore, this withdrawal of 11.29 acres has had no effect to mining or petroleum industries in Nevada.

5.8.5 PROJECT SHOAL SITE

The Project Shoal Site has been examined by the Nevada Bureau of Mines and Geology (1963), and Quade and Tingley (1987). The area is entirely underlain by granitic rocks of the Sand Springs pluton and there are no known mines or mineral occurrences associated with this pluton. This area is assessed as having low mineral development potential.

Studies of the geothermal resource potential of this withdrawal have been made under the direction of the Geothermal Program Office, Naval Weapons Center, China Lake, California (Source: Whelan et al., 1980). Thermal gradients in the area were found to be low: no thermal wells or springs occur in the area, and no hydrothermal alteration or mineralization of the type generally associated with hot springs was noted in the area. The geothermal potential of the Shoal Site is considered to be low (Source: Whelan et al., 1980).

The withdrawal is underlain entirely by granitic rocks and the site is unfavorable for oil and gas resources. Therefore, the withdrawal has had no effect to the petroleum industry in Nevada.

With the possible exception of sand and gravel deposits from the limited pediment areas along flanks of the Sand Springs Range, the industrial mineral and materials development potential of the Project Shoal Site is very low. Sand and gravel deposits from the area could be expected to have no unique qualities when compared to similar deposits outside the site. Sand and gravel potential is assessed as very low.

5.8.6 TONOPAH TEST RANGE

The effects of the TTR on mineral and energy resources in Nevada are discussed in Section 2.8.

5.8.7 SUMMARY

Withdrawal of the NTS has excluded, and will continue to exclude, mineral exploration and potential development.

In areas outside of known mining districts, the following deposit types of base and precious metals may exist on the NTS: one small-to-medium sized precious-metals deposit; one or two tungsten skarn deposits and/or polymetallic replacement deposits; and one gold deposit. Possible deposits within existing mining districts include: a low-to-moderate potential for a precious-metal or a porphyry-molybdenum deposit in the Calico Hills mining district; high potential for gold-silver resources in the Wahmonie district that could support a moderate-sized mining operation; high potential for skarn tungsten mineralization and porphyry molybdenum mineralization in the Oak Spring district; and disseminated gold deposits in the Mine Mountain district.

The NTS is considered to have a low potential for geothermal, oil, and gas resources.

Industrial minerals and materials are widespread throughout Nevada. The unavailability of these minerals and materials from the NTS has and will probably continue to have little effect on the mining industry in Nevada.

5.9 EFFECTS ON WATER RESOURCES

5.9.1 HYDROLOGIC AND WATER RESOURCE ENVIRONMENT

5.9.1.1 Nevada Test Site

The NTS encompasses portions of 10 hydrographic basins, 6 of which are also encompassed by the NAFR (Section 2.9). These basins, and general directions of surface water flow, are shown in Figure 5.11. Figure 5.12 shows the regional ground water flow systems in relation to the NTS. Hydrologically, the NTS is a complex region, composed of three primary classifications of aquifers: valley-fill alluvium, volcanic rocks (e.g., tuffs, basalts), and carbonate rocks (e.g., limestone and dolomite). These water bearing units are sub-divided into eleven definitive aquifers/aquitards on the NTS, based on physical characteristics of the aquifer materials and their relationship to overlying and underlying hydrogeologic units. Porosity, permeability, and transmissivity of the various defined units differs

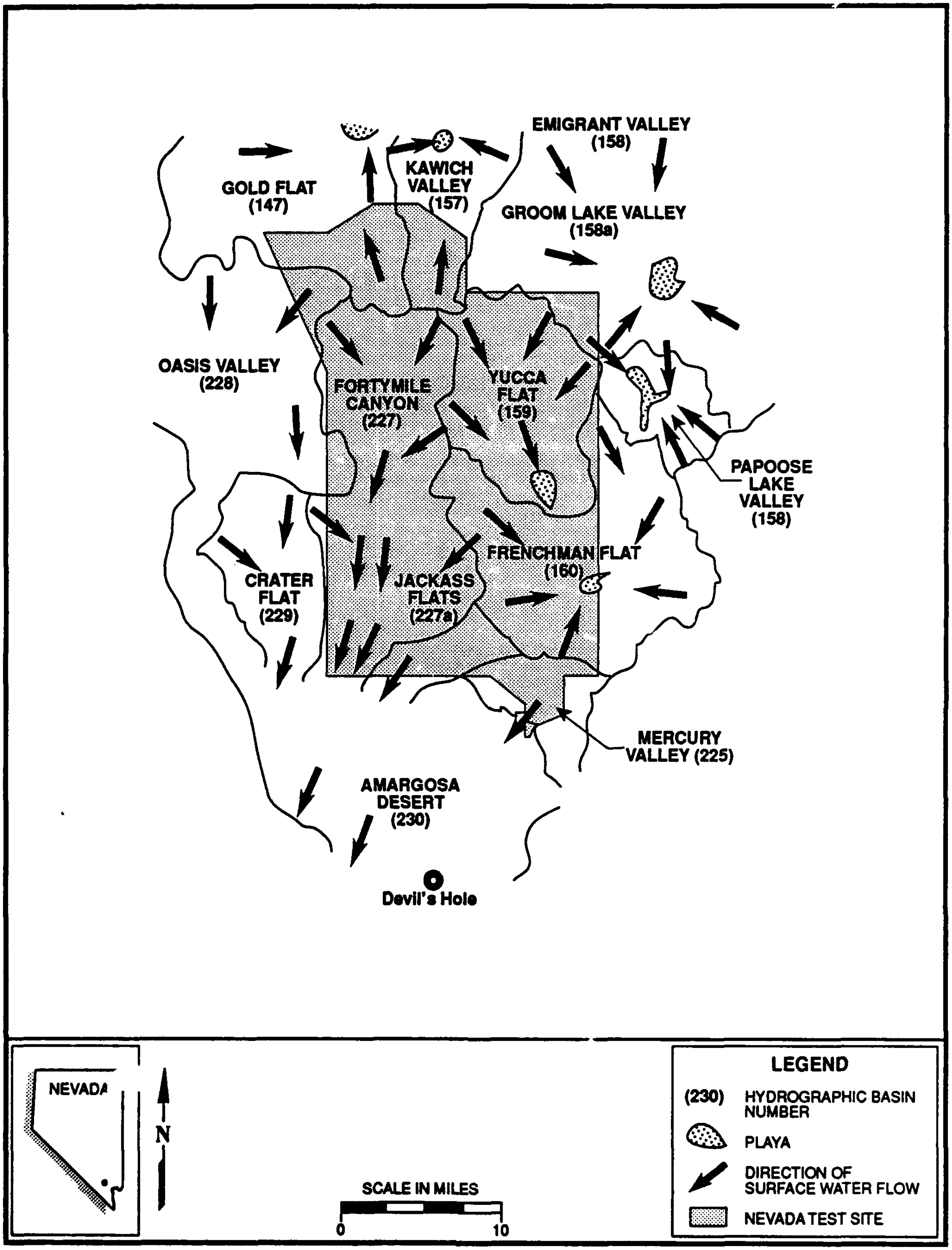


FIGURE 5.11 HYDROGRAPHIC BASINS AND SURFACE WATER FLOW, NEVADA TEST SITE

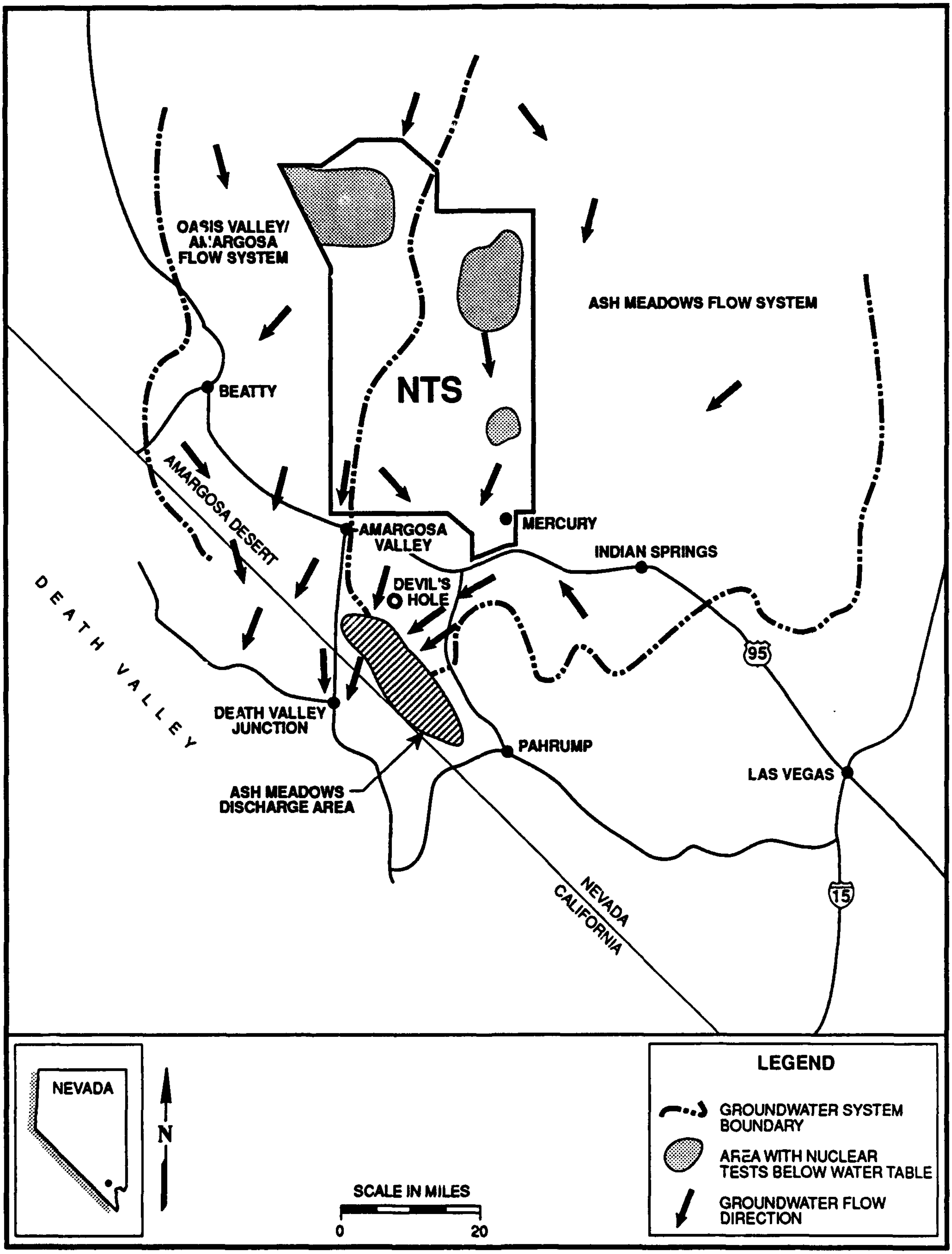


FIGURE 5.12 REGIONAL GROUNDWATER FLOW SYSTEMS IN RELATION TO THE NEVADA TEST SITE

widely. In the carbonate rocks, permeability is principally associated with fractures and solution features. Estimated fracture porosity is less than 1 percent, but transmissivity ranges from 600 to several million gallons per day per foot (gpd/foot). In the volcanic (tuff) aquitard, effective porosity ranges from 10 to 39 percent with transmissivity less than 200 gpd/foot (Source: DOE, 1988). Total porosity of the volcanic units beneath the water table where nuclear tests have been conducted averages approximately 40 percent. These data, in conjunction with chemical and isotopic data, have been used to differentiate local from regional ground water. Because of the hydrogeologic complexities, regional ground water flow at the NTS is not constrained by the hydrographic basins or directions of surface water flow, both of which are defined by local topography (compare Figures 5.11 and 5.12). The most comprehensive studies of the NTS hydrogeology were conducted by Blankennagel and Weir (1973) for Pahute Mesa, and by Winograd and Thordarson (1975) for the regional aspects of the NTS.

Local ground water discharge occurs from ten small seeps and springs, most of which are located near Pahute and Rainier Mesas. However, the major ground water discharge is via interbasin flow to the southwest (Figure 5.12). These mesas are the highest topographic features in the region and subsequently receive the most precipitation. Annual precipitation at Rainier Mesa is approximately 12 inches, while in the southern part of the NTS near Mercury the precipitation is only 6 inches (Source: French, 1986).

Short-duration, high-intensity precipitation events are thought to be significant to recharge in areas of the NTS. Runoff from such events follows surface water divides along stream-beds that have down-cut alluvial fans while flowing toward playas. Several such intermittent washes are thought to be significant potential recharge sources due to the high permeability of the sands and gravels in the stream bottoms, allowing rapid infiltration of the recharging waters. Preliminary data from Fortymile Wash suggest that during these periods recharge waters have infiltrated approximately 100 feet below land surface.

A relatively thick layer of unsaturated sediments overlies the major aquifers on the NTS. Depths to ground water range from approximately 660 feet beneath the southern valleys to more than 1,640 feet beneath Pahute Mesa, corresponding in part to topographic variations. Ground water in these deeper aquifers is generally influenced by regional ground water flow components from the underlying carbonate aquifers. Ground water flow within the carbonate rocks generally trends from north of the NTS to the southwest (Figure 5.12). Three ground water sub-basins have been identified on the NTS based on ground water divides: Ash Meadows sub-basin, Alkali Flat-Furnace Creek Ranch sub-basin, and Oasis Valley sub-basin. Ground water from the carbonate aquifer is thought to have a vertical flow component, allowing ground waters in the carbonate and overlying aquifers to mix. Available estimates of the ground water yield from hydrographic basins on the NTS are summarized in Table 5-15.

Domestic, industrial, and construction water supplies are provided by 17 active water wells dispersed across the NTS (3 more wells are inactive); no water from the springs and seeps are used for water supplies due to their low yields. Ground water is extracted from wells completed in alluvium, volcanic, and carbonate rock aquifers. The chemistry of the

Table 5-15. Hydrologic and Water Resource Summary for Hydrographic Basins at Nevada Test Site.

Hydrographic Basin No. and Name	Basin Area Total (mi^2)	Basin Area Portion Within NTS (mi^2)	Basin Area Portion Within NTS (%)	Groundwater Storage in Upper 100 ft Sat. (AF)	Groundwater Perennial Yield (AFY)	Total DOE Nevada Water Rights[1] (AFY)	DOE 1988 Federal Reserved Rights Water Use (AF)
147 - Gold Flat	684	88	12.9	1,600,000	1,900	0	155
157 - Kawich V.	350	55	15.7	960,000	2,200	0	0
158 - Emigrant Valley 158A	767	27	3.5	1,600,000	2,810	0	0
159 - Yucca Flat	305	285	93.4	520,000	350	42	335
160 - Frenchman Flat	463	236	51.0	790,000	16,000	2	800
225 - Mercury V.	110	52	47.3	Minor	8,000	0	0
226 - Rock V.	82	57	69.5	150,000	8,000	0	0
227 - Fortymile Canyon	519	455	87.7	740,000	7,600	28	275
228 - Oasis V.	460	28	6.1	400,000	2,000	0	155
230 - Amargosa Desert	896	1	0.1	3,500,000	24,000	0	0
TOTALS	4,636	1,248	27.7	10,260,000	72,860	72	1,720

[1] Listed as "USA" water rights in Office of Nevada State Engineer; purchased from private sector in association with original land withdrawal.

water varies from a sodium-potassium-bicarbonate dominated water to calcium-magnesium-bicarbonate type water depending on the mineralogic composition of the aquifers that the water is extracted from. Aquifer tests from wells completed in the various rock types on the NTS show a wide range of productivity, with average transmissivities of approximately 8,000, 32,000, and 13,000 gpd/foot (for the alluvial, volcanic, and carbonate rock units, respectively).

5.9.1.2 Central Nevada Test Site

The CNTS is located in the Hot Creek Valley hydrographic basin at the base of 10,209 feet Morey Peak. This withdrawal is shown in Figure 5.13. The basin is topographically closed except in the southeast where Hot Creek exits to flow into Railroad Valley. However, only low topographic divides separate Hot Creek Valley from southern Reveille Valley at the south and Little Fish Lake Valley to the northwest. Ground water discharges locally at several areas in Hot Creek Valley; Mifflin (1968) suggested that ground water may also flow into Railroad Valley. There are perennial streams in Moore Station Wash, Six Mile Canyon, Water Canyon, Four Mile Canyon, and Hot Creek Canyon and many springs, including hot springs in Hot Creek Canyon and at Warm Springs.

Depth to ground water in the valley ranges from land surface in the southeast near Twin Springs to nearly 50 feet approximately nine miles northeast of Warm Springs. Higher up on the alluvial fans depth to water ranges from 100 feet near Lower Hot Creek Ranch to approximately 500 feet beneath CNTS at the site of Project Faultless. In general, the quality of both ground water and surface water is good, with TDS ranging from 200 to 600 mg/l. Estimated perennial ground water yield is 5,500 AFY.

All the perennial streams in the valley have been developed for irrigation and the springs have been developed for both domestic supply and stock water. There has been limited ground water development, primarily for stockwater with some domestic use. Except for approximately 2,000 acres, all the land in the valley outside the withdrawals is public land. These public lands have been listed as suitable for settlement under the Carey and Desert Land Entry Acts. Many applications for this land and for ground water permits have been submitted. One large pivot irrigation system is currently (1989) being developed approximately eight miles northeast of Warm Springs.

5.9.1.3 Nelson Seismic Station and Mt. Brock Communication Site

The Nelson Seismic Station is located in a high desert mountain area at an elevation of approximately 3,000 feet west of the Colorado River. Precipitation at this withdrawal is minimal, often averaging less than 4 inches per year. There are no springs or streams located within the withdrawn area or its immediate vicinity. Water development is extensive from the Colorado River, but minimal in the Nelson area and there is no water development associated with the Nelson Seismic Station.

The Mt. Brock Communication Site is located at an elevation of approximately 7,000 feet on Mt. Brock within Ralston Valley. Precipitation in this high desert environment averages 6 to 8 inches per year mostly in the form of snow. There are no streams or springs

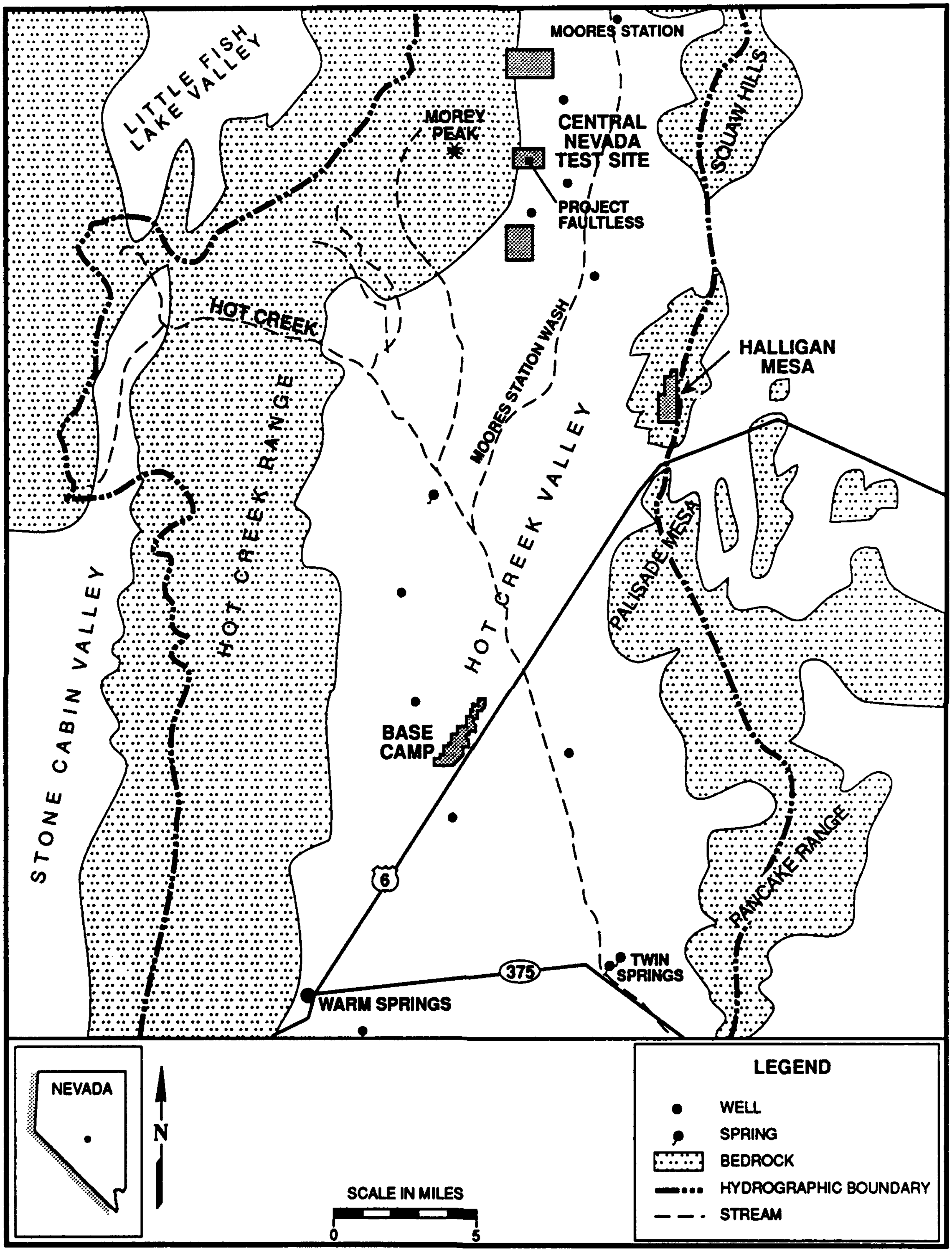


FIGURE 5.13 HOT CREEK VALLEY HYDROGRAPHIC BASIN, CENTRAL NEVADA TEST SITE, BASE CAMP AND HALLIGAN MESA

located in the withdrawn area. Significant water development associated with Tonopah is located several miles to the north, but there is no water development associated with the Mt. Brock Communication Site.

There are no known effects on water resources in the State of Nevada associated with either of these withdrawals. Therefore, they are not discussed further in this section.

5.9.1.4 Project Shoal Site

The Project Shoal Site is located on the Sand Springs Range between Fairview Valley and Carson Desert, and is located in the same hydrogeologic environment as Range B-19 of NAS, Fallon. The hydrological environment of the Project Shoal Site is described in Section 3.9.1.4.

5.9.1.5 Tonopah Test Range

The TTR incorporates portions of five hydrographic basins, ranging from most of Cactus Flat to only a small portion of Ralston Valley, as shown in Figure 5.14. The hydrographic basin boundaries are based primarily upon topography and thus indicate watersheds for surface water flow and not necessarily ground water divides. Mifflin (1968) concluded that Cactus Flat, Stone Cabin Valley, Ralston Valley, and Clayton Valley were all part of the same ground water flow system with discharge occurring in Clayton Valley, as shown in Figure 5.15. However, Rush (1970) suggested that Cactus Flat ground water may drain to Sarcobatus Flat and that all of the above basins may be part of a larger Sarcobatus Flat ground water flow system. Available data are insufficient to resolve the uncertainties regarding directions or volumes of ground water flow in the vicinity of the TTR.

Neither the Cactus Range nor the Kawich Range of mountains have perennial streams that flow into the TTR. Ephemeral streams do occasionally carry spring runoff and thunderstorm runoff to a north-south string of playas in the central portion of Cactus Flat. There are several small springs in both mountain ranges and one on the valley floor near Mellan in the south-central portion of Cactus Flat.

Water resource development at the TTR by SNL, the DOE, and the U.S. Air Force has been restricted to drilling of wells. Most of these wells are in the Cactus Flat hydrographic basin, though at least one well, and possibly two, are in the Stone Cabin hydrographic basin and one is in Gold Flat (Figure 5.14). The uncertainty is due to interpretation of the location of the low topographic divide between these basins near the TTR north boundary. One well is located on public land over a mile north of the TTR boundary, which puts it definitely within Stone Cabin Valley. While the existing wells may be in different hydrographic basins, all of them tap the same ground water flow system (Figure 5.15).

In Cactus Flat, well logs indicate the sediments are composed of gravels, sands, silts, and clays, but no continuous confining layers. The depth to ground water in Cactus Flat ranges from 90 to 150 feet depending on the local surface elevation. Estimated ground

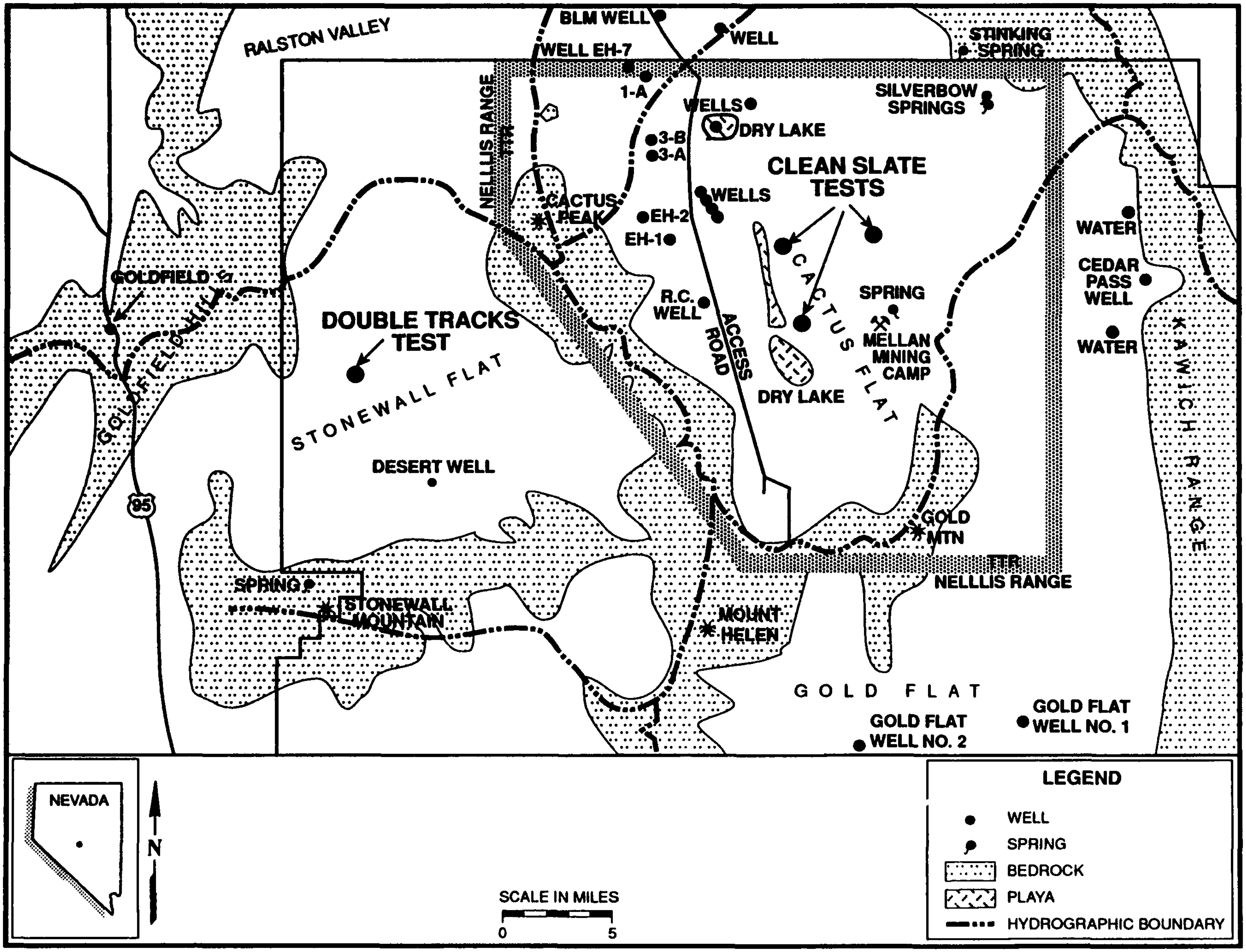


FIGURE 5.14 HYDROGRAPHIC BASINS AND WATER RESOURCE FEATURES AT TONOPAH TEST RANGE (TTR)

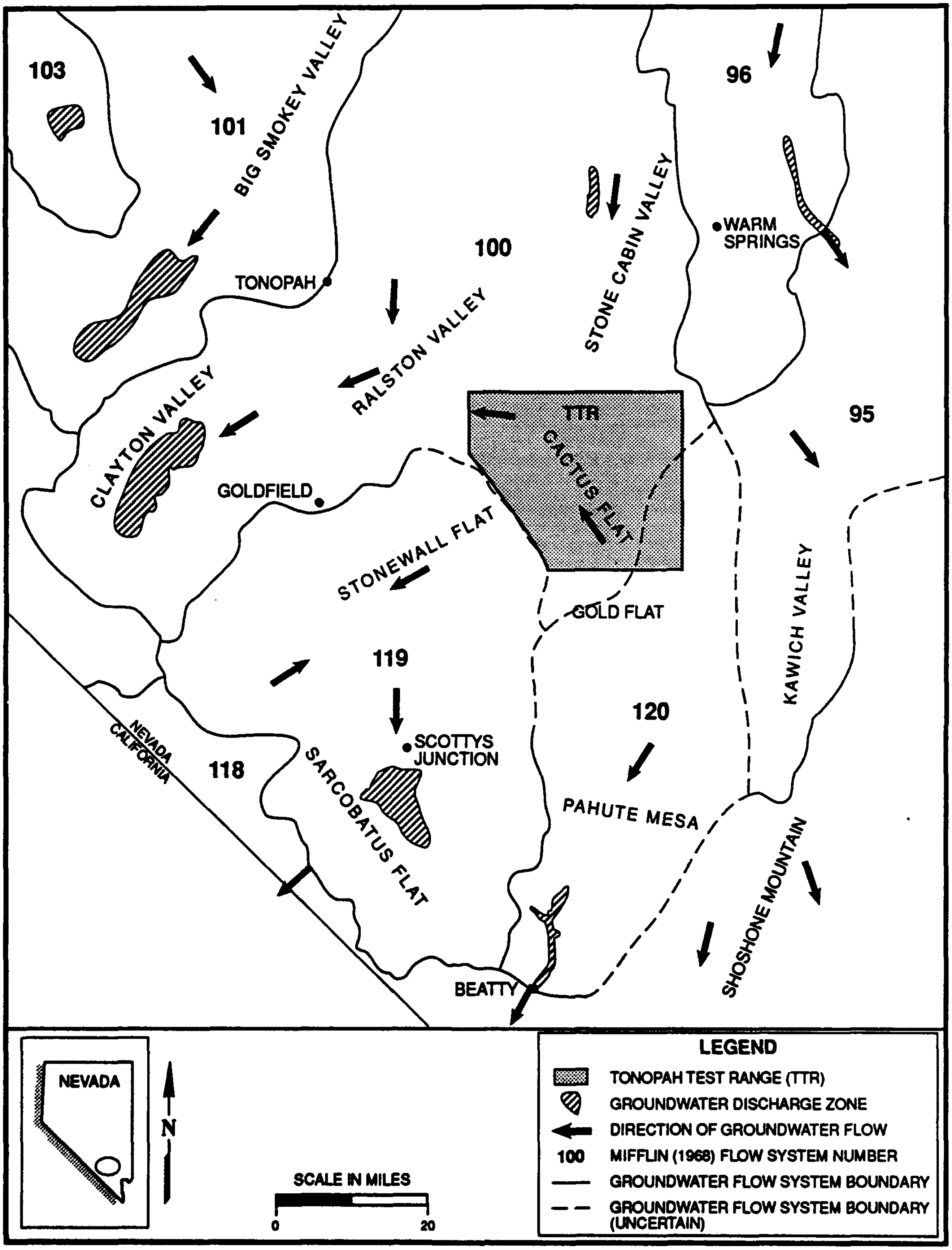


FIGURE 5.15 GROUNDWATER FLOW SYSTEMS IN THE VICINITY OF TONOPAH TEST RANGE

water perennial yield and storage for the TTR hydrographic basins are given in Table 5-16 (Source: Division of Water Planning, 1982). Water quality data for wells on the TTR are summarized in Table 5-17. In general, the water quality is excellent, with TDS in the 200 to 300 mg/l range.

5.9.2 WATER RIGHTS AND ALLOCATIONS

5.9.2.1 Nevada Test Site

DOE water rights from the ten hydrologic basins underlying the NTS total 72 AFY, with ground water and surface water comprising 17 and 55 AFY, respectively. A total of 117,415 AFY of water has been allocated from these basins, consisting of 62,348 AFY of ground water and 55,067 AFY of surface water. Of the total water right applications, 110,972 AFY is in the Amargosa Desert. Only in the Amargosa Desert basin do ground water rights exceed the estimated perennial yield. There are no private rights located within the withdrawn area. Under the doctrine of Federal Reserved Water Rights, the DOE also has an unquantified water right sufficient to meet the purposes of the NTS land withdrawal, subject to water rights that existed at the time land for the NTS was withdrawn. Estimated current water rights status for the hydrographic basins are summarized in Table 5-18.

5.9.2.2 Central Nevada Test Site

No water rights are associated with the CNTS.

5.9.2.3 Nelson Seismic Station and Mt. Brock Communication Site

No water rights are associated with either of these withdrawals.

5.9.2.4 Project Shoal Site

There are no water rights associated with the Project Shoal Site withdrawal.

5.9.2.5 Tonopah Test Range

Records of the Nevada State Engineer's Office indicate that there is a total of 12,468 AFY of water rights in the five hydrographic basins associated with the TTR, consisting of 8,496 AFY of ground water and 3,972 AFY of surface water. Federally owned, defense-related water rights total 1,775 AFY, with ground water and surface water comprising 1,627 and 148 AFY, respectively. Estimated current water rights status for the five affected hydrographic basins are summarized in Table 5-19. All the military water rights are located in Cactus Flat and Stone Cabin Valley. Collectively, over the five hydrographic basins, existing ground water rights exceed the estimated aggregate ground water perennial yield by nearly 1,700 AFY. Also, records of the Nevada State Engineer indicate that there are 95 AFY of privately held surface rights within the Cactus Flat segment of the TTR.

Table 5-16. Hydrologic and Water Resource Summary for Hydrographic Basins at Tonopah Test Range.

Hydrographic Basin No. and Name	Basin Area Total (mi^2)	Basin Area Portion Within TTR (mi^2)	Basin Area Portion Within TTR (%)	Groundwater Storage in Upper 100 ft Sat. Sediment (AF)	Estimated Perennial Groundwater Yield (AFY)	Total Defense Water Rights (AFY)	1988 Estimated Defense Groundwater Use (AF)
141 - Ralston V.	971	19	2.0	2,700,000	2,500	0	0
145 - Stonewall Flat	381	19	5.0	820,000	100	0	0
147 - Gold Flat	684	110	16.0	1,600,000	1,900	0	40(2)
148 - Cactus Flat	403	323	80.0	1,400,000	300	762(1)	160
149 - Stone Cabin V.	985	48	4.9	2,200,000	2,000	1,013(1)	240
TOTALS	3,424	519	15.0	8,720,000	6,800	1,775	440

(1)Not included in Table 2-23.
(2)Estimated construction and domestic water use.

Table 5-17. Summary of Water Quality Data for Some Wells Located at Tonopah Test Range, in Cactus Flat, Stone Cabin Valley, and Gold Flat Hydrographic Basins.

Basin	Stone Cabin Valley		Cactus Flat							Gold Flat
Well. Date Parameter	BLM 4/87	1-A 4/87	3-A 12/83	3-B 4/87	Sandia #9 4/87	EH-1 4/87	EH-2 4/87	Roller Coaster 4/87	Sandia #6 4/87	Cedar Pass 4/87
E.C. (umho/cm^2)	419	385	506	391	312	332	310	463	438	280
pH	8.02	8.17	7.85	8.26	8.23	8.75	8.16	8.02	9.14	8.21
Temp °F	63.5	68.0	--	68.0	62.6	--	71.6	77.0	73.4	80.6
SiO_2 (mg/l)	69.0	70.0	48.0	56.0	72.0	46.0	76.0	89.0	74.0	94.0
HCO_3 (mg/l)	170.0	160.0	240.0	167.0	134.0	123.0	110.0	126.0	132.0	107.0
CO_3 (mg/l)	--	--	--	--	--	10.7	--	--	29.7	--
Cl (mg/l)	20.1	17.8	14.7	15.8	12.8	12.3	15.9	44.9	17.0	14.7
SO_4 (mg/l)	41.1	37.0	42.8	35.9	27.8	30.0	36.5	102.0	37.8	26.3
NO_3 (mg/l)	6.82	5.14	1.95	4.40	3.64	2.13	4.47	4.47	3.10	3.35
Na (mg/l)	58.1	54.2	101.0	72.3	45.7	69.5	38.3	73.69	92.9	31.5
K (mg/l)	8.06	7.57	4.7	6.6	7.19	3.97	7.19	9.87	6.01	8.92
Ca (mg/l)	27.7	29.9	13.7	12.8	16.7	4.05	21.7	35.9	2.17	20.8
Mg (mg/l)	2.60	2.10	1.23	1.67	1.15	0.42	1.44	3.05	0.04	0.50

Table 5-18. Water Rights Status for Hydrographic Basins, Nevada Test Site.

Hydrographic Basin	DOE[2]			Other (Non-defense)			Total Water Rights			Groundwater Perennial Yield (AFY)
NO. AND NAME	TOTAL	GW	SW	TOTAL	GW	SW	TOTAL	GW	SW	
147 - Gold Flat	0	0	0	35	35	0	35	35	0	1,900
157 - Kawich V.	-[1]	-[1]	-[1]	80	23	57	125[1]	23[1]	102[1]	2,200
158 - Emigrant Valley 158A	-[1]	-[1]	-[1]	41	0	41	238[1]	14[1]	224[1]	2,810
159 - Yucca Flat	42	0	42	0	0	0	42	0	42	350
160 - Frenchman Flat	2	0	2	0	0	0	2	0	2	16,000
225 - Mercury V.	0	0	0	0	0	0	0	0	0	8,000
226 - Rock V.	0	0	0	0	0	0	0	0	0	8,000
227 - Fortymile Canyon	28	17	11	1,591	145	1,446	1,619	162	1,457	7,600
228 - Oasis V.	0	0	0	4,382	1,677	2,705	4,382	1,677	2,705	2,000
230 - Amargosa Desert	0	0	0	110,972	60,437	50,535	110,972	60,437	50,535	24,000
TOTALS	72	17	55	117,101	62,317	54,784	117,415	62,348	55,067	72,860

[1]See Nellis Air Force Range, Table 2-23.
[2]Listed as "USA" water rights in Office of Nevada State Engineer; purchased from private sector in association with original lands withdrawal.

Table 5-19. Water Rights Status for Hydrographic Basins, Tonopah Test Range.

Hydrographic Basin	Defense Related[1] (AFY)			Others (AFY)			Total Appropriations (AFY)			Groundwater Perennial Yield (AFY)
NO. AND NAME	TOTAL	GW	SW	TOTAL	GW	SW	TOTAL	GW	SW	
141 - Ralston V.	0	0	0	6,713	4,951	1,762	6,713	4,951	1,762	2,500
145 - Stonewall Flat	0	0	0	445	14	431	445	14	431	100
147 - Gold Flat	0	0	0	35	35	0	35	35	0	1,900
148 - Cactus Flat	762	614	148	223	0	223	985	614	371	300
149 - Stone Cabin V.	1,103	1,013	0	3,277	1,869	1,408	4,290	2,882	1,408	2,000
TOTALS	1,775	1,627	148	10,693	6,869	3,824	12,468	8,496	3,972	6,800

[1]Not included in Table 2-23 Air Force water rights.

5.9.3 WATER DIVERSIONS AND CONSUMPTIVE USE

5.9.3.1 Nevada Test Site

The NTS derives its complete water supply from the ground water aquifers underlying the area. Water supply has been developed and is managed on the basis of five service areas that support different NTS operating areas. Locations of the supply wells are shown in Figure 5.16 and recent water use is summarized in Table 5-20. Given the waste water disposal practices on the NTS and the depth to the ground water system, it is reasonable to assume that all of the water pumped on the NTS is consumptively used.

5.9.3.2 Central Nevada Test Site

There is no pumpage or use of water on the CNTS.

5.9.3.3 Nelson Seismic Station and Mt. Brock Communication Site

No pumpage or use of water occurs on either of these withdrawals.

5.9.3.4 Project Shoal Site

There is no pumpage or consumptive use of water on the Project Shoal Site.

5.9.3.5 Tonopah Test Range

Ground water is used at the TTR for domestic, industrial, and construction purposes. However, no specific data are available for 1988 water use in any category, and other data were used to develop estimates. There are approximately 3,000 personnel at the facilities for 5 days per week. Ground water use in 1988 is approximately 380 AFY. Of this amount, approximately 80 percent was pumped from the BLM well located north of the TTR on public land in Stone Cabin Valley. The balance of the domestic water and an estimated 100 AF of industrial and construction water were pumped from wells throughout Cactus Flat. An estimated 40 AF were pumped in Gold Flat. Water use and wastewater treatment practices at the TTR facilities suggest that virtually all of the 440 AF were consumptively used (through evapotranspiration).

Current ground water use by the 37th Tactical Fighter Wing at the TTR is approximately 380 AFY. With removal of the 37th TFW, most of that ground water pumping is expected to be eliminated. Assuming a 10 percent ground-keeping function remains, approximately 38 AFY would be pumped. Total pumpage from Stone Cabin Valley would be reduced to zero, and pumpage in Cactus Flat would be reduced from 160 AFY to 58 AFY.

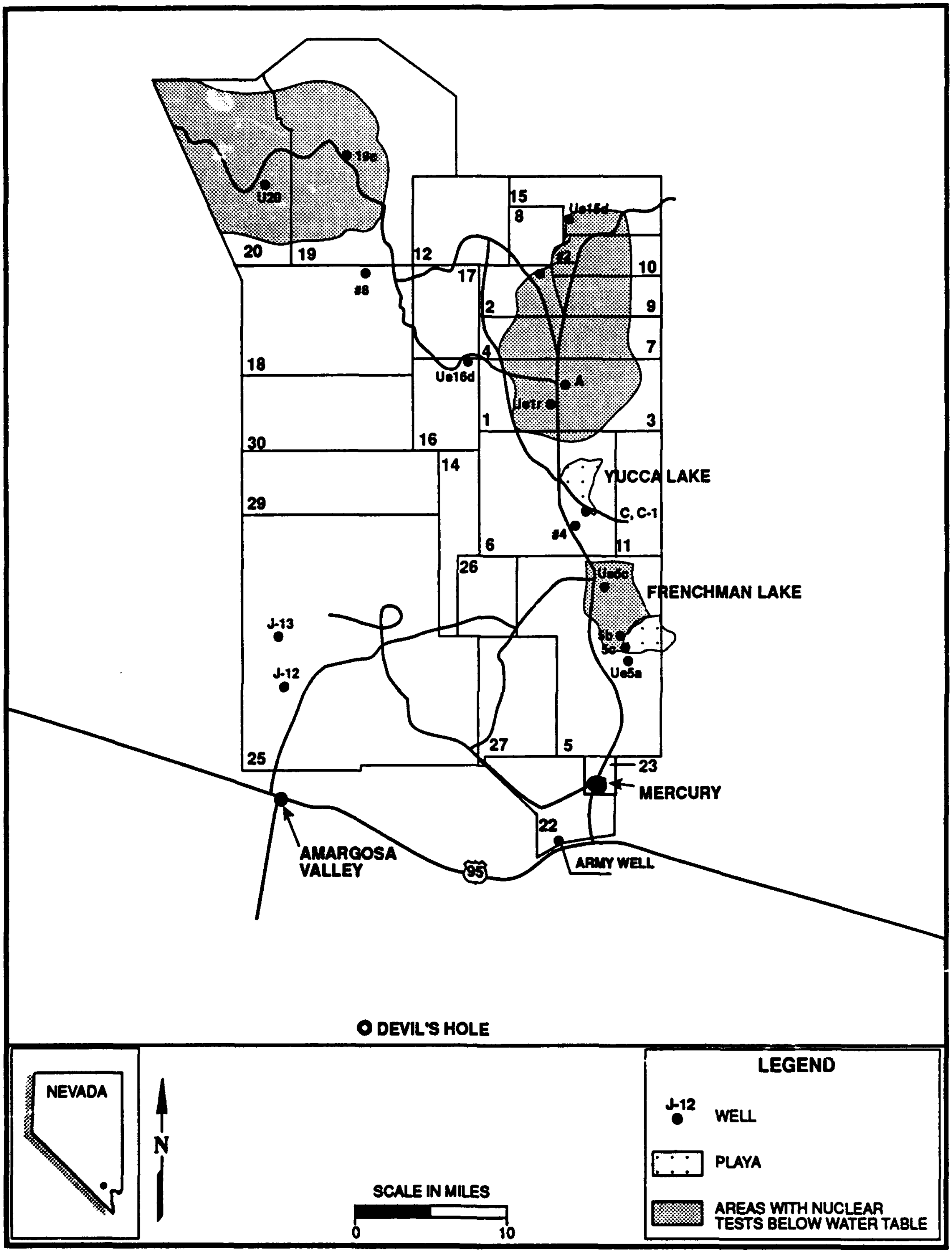


FIGURE 5.16 NTS WATER SUPPLY WELLS AND AREAS OF NUCLEAR TESTS CONDUCTED BELOW THE WATER TABLE (AFTER DOE, 1988)

Table 5-20. Groundwater Use Summary for Nevada Test Site, 1984-1988.

Water Service Area	NTS Operating Areas Served	Production Wells Total	Well No.'s	Primary Uses	Groundwater Pumpage, AFY 1984-88	1988
A	19,20	2	19C, U20	construction	410	310
B	2,4,7,8,9,10,12, 15,17,18	4	2, 8, Ue15d, Ue16d	domestic & construction	360	380
C (north)	1,3,6,11	7	C, C-1, -2, -3, -4, Ue1r, A	domestic & construction	370	310
C (south)	5,22,23,26,27	5	5b, 5c, Army 1 Ue5c,	domestic & fire protection	530	570
D	25	2	J-12, J-13	domestic & construction	170	150
TOTALS		20			1,840	1,720

5.9.4 RESOURCE IMPAIRMENT AND OTHER EFFECTS

5.9.4.1 Nevada Test Site

Regional ground water flow systems beneath the NTS are shown in Figure 5.12. Radioactive and other hazardous materials located in the thick (660 to 1,640 feet) unsaturated zone above the regional flow system water table are expected to remain in that zone for an extended period of time before reaching the regional flow system water table. At the Area 5 Radioactive Waste Management Site, travel times to the regional water table are estimated to range from nearly 19,000 to over 113,000 years, (Source: DOE, 1989c).

Figures 5.12 and 5.16 indicate the general areas within which nuclear tests have been conducted at or beneath the regional ground water table. At least 118 tests have been conducted beneath the water table. These tests resulted in known releases of radionuclides into the ground water. However, the exact volume of ground water impaired as a result of these tests cannot be calculated without additional studies. The principal uncertainty relates to the three-dimensional distribution of radionuclides surrounding the shot cavities. Investigations of the few test locations where radioactivity has been detected outside the cavities suggest that the radioactivity is generally confined to within 1,100 to 1,400 feet of the cavities (Source: DOE, 1988d) It is not known to what extent the observed occurrences are the result of dynamic injection related to the actual test or are the result of ground water transport (Source: DOE, 1988d). In response to this concern, a ground water characterization program is being implemented at the NTS as a key component of the DOE's environmental restoration activities. Expenditures for this program are expected to range from $160 million to $180 million over the next several years and will include 90 to 100 characterization wells.

Any contaminated ground water leaving the NTS would be expected to be carried by one of the regional ground water flow systems (Figure 5.12). Despite the areas of contaminated ground water, safe ground water supplies can and have been developed on the NTS. Not all of the aquifers that comprise the regional flow systems have been affected. Average ground water flow velocities in these systems have been calculated to range from 6 to 600 feet per year; however, these velocities could change in response to major off-site water resource development.

The volume of ground water underlying the NTS that has been removed from direct access to the public is large (Table 5-15), as is the estimated volume of impaired ground water. The impaired ground water will likely remain unusable for an extended period of time. Significance of the loss of access to the NTS ground water is diminished by the fact that even if access were provided, the water underlying portions of the NTS might not be useable as a potable supply in southern Nevada.

The presence of the Devil's Hole National Monument near the discharge area of the Ash Meadows Ground Water Flow System may reduce further any potential effect from ground water contamination under portions of the NTS by inhibiting ground water development. The endangered pupfish in Devil's Hole are sustained by that flow system and any ground water development that would adversely alter their habitat would be legally prohibited. This prohibition thus might preclude significant ground water development off the NTS, at least in the portion of the flow system between the NTS and Devil's Hole (Figure 5.12).

The DOE pumps and consumes only a limited amount of ground water at the NTS. The DOE considers these diversions to be within the doctrine of Federal Reserved Rights and thus not subject to the Nevada water law. Under the doctrine of Federal Reserved Rights, DOE may use the amount of water minimally required to satisfy the purposes for which the withdrawal was made.

5.9.4.2 Central Nevada Test Site

There are two potential sources of water contaminants at the CNTS. The first is the underground cavity created by the Project Faultless nuclear test. This test created a large quantity of radioactivity, and the radioactivity contained in the cavity created by the test remains high. The other source is drilling mud pits which contain hazardous material such as chromium.

The water table in the immediate area of the Faultless site is approximately 500 feet below the land surface. Ground water is not expected to migrate away from the cavity-chimney complex until water has filled the available void volume and approaches the pre-event water table level. After this occurs, contaminated ground water could leave the chimney in a general south-southeast direction at a velocity of 0.4 feet per year. Studies indicate that another 80 to 100 years may elapse before filling to pre-event levels is complete. While ground water in the immediate vicinity of the Project Faultless cavity is contaminated with radioactivity, the site is several miles from local water supplies and is far removed from current urban areas. The amount of water impaired is rather small. If it is assumed that the water contaminated by the test was within a 1,000 ft radius sphere surrounding the test point and that the porosity of the material surrounding the test was 40 percent, then the amount of impaired water is only approximately 38,000 AF.

The second potential source of ground water impairment is chromium contaminated drilling mud pits. There are approximately 10,000 cubic feet of crusted drilling mud in the mud pits and migration of chromium to the ground water from the central mud pit is possible, but unlikely due to the low permeability of the mud. The depth to ground water at the central mud pit is estimated to be 500 feet.

Effects of the CNTS on Hot Creek Valley water resources are believed to be insignificant since there is limited ground water development. In the future, should the valley ground water resources be developed, only a limited volume of water would be unusable due to impairment from radionuclide migration. The withdrawn area does not significantly reduce public access to the valley's water resources.

5.9.4.3 Nelson Seismic Station and Mt. Brock Communication Site

No impairment or other effects on water resources occur as a result of these two withdrawals.

5.9.4.4 Project Shoal Site

The nuclear device tested at the Project Shoal Site was detonated below the water table. Therefore, the ground water in the immediate vicinity is likely to be contaminated. Approximately 12 years are estimated to be necessary for the shot chimney to fill with water, after which the natural ground water conditions would prevail. Because of the low ground water velocities, direct flow to the vicinity of the nearest well is projected to take at least 750 years. Tritium would move only 3,300 feet in the 130 years needed for the estimated concentration to decay to the Recommended Concentration Guide level.

Although Project Shoal site is not far removed from current urban areas, the amount of water impaired is likely to be small. Water in the hydrographic basin to the west is of generally poor quality and thus contaminant migration (should it occur) would not represent loss of a significant water resource. Ground water quality in Fairview Valley is, however, of better quality and might be impaired if migration should occur.

5.9.4.5 Tonopah Test Range

Figure 5.14 shows the locations of nuclear safety tests (Clean Slate and Double Tracks) that contaminated areas on the TTR. In Stonewall Flat, much of the contaminated area is coincident with the alluvial fans and ephemeral stream channels ground water recharge environment. Soil surveys conducted at the Double Tracks site show that plutonium has migrated to a minimum of 10 inches, but there are no data indicating the maximum depth of migration. Nuclear tests in Cactus Flats were performed on the valley floor where recharge potential is lower. However, as with the Stonewall Flat site, migration of contaminated material to the ground water is possible.

In addition to the potential impairment of the water resource at the TTR by radionuclides, there is the potential for resource impairment by other materials. Eighteen potential hazardous and toxic waste sites have been identified, however, no soil or water samples were collected. These sites included French drains, septic tanks and leach fields, underground fuel tanks, landfills, and sewage lagoons. The potential for contamination of ground water at these sites cannot be determined without additional studies.

Available data do not allow an estimate of the quantity of ground water which may be impaired by defense-related activities, and thus unavailable for future development. Those data that are available (Table 5-17), most from sites several miles from areas of contamination, indicate that existing public water supplies have not been affected.

5.9.5 SUMMARY

Considering all of the DOE withdrawals, only the withdrawal of the NTS has had a major effect on water resources. There are three primary effects. The appropriation of water for use on the NTS has been pursuant to the doctrine of Federal Reserved Rights. The DOE used only 1,720 acre-feet of water under this doctrine in 1988 and is not likely to increase the level of use appreciably in the future.

The second DOE withdrawal effect is an additive effect with the NAFR withdrawals and that is the quantity of water is not available for public use on lands south of a line connecting Tonopah and Ely. The NTS lies over portions of 10 ground water basins (Table 5.15) and covers nearly 28 percent of the combined area of the basins. The significance of the lack of access to the NTS ground water is diminished by the unavoidable impairment of water on the NTS and the proximity of the Devil's Hole National Monument.

Third, the quality of water underlying certain portions of the NTS has been, and continues to be, impaired by past and present underground nuclear testing. The quantity of water that has been affected by radionuclides cannot be determined without additional studies; the principal uncertainty relates to distribution of radionuclides around the actual test points. Additionally, while the contaminated water poses no current effect to public health and safety off the NTS, water resources development near the boundaries of the NTS could be affected by the movement of on-site contaminated water, and the contamination of additional water could occur.

The DOE is implementing a ground water characterization and monitoring program at each of the NTS underground testing areas to determine the potential for movement of contaminated water. To a lesser degree, this potential exists at the CNTS, the Project Shoal Site, and the TTR.

Finally, hydrologic research and investigations supported by the DOE at the NTS have had a positive effect on the development of a better understanding of the hydrology of southern Nevada.

5.10 SUMMARY

This chapter has identified effects and possible effects resulting from activities associated with the mission of the Department of Energy in Nevada. These effects are summarized in Chapter 8, as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of these effects are also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 6

OTHER LAND WITHDRAWALS

6.1 EXISTING AND PROPOSED ACTIVITIES

Existing land withdrawals discussed in this chapter are the Beatty Radar Site, Ely Radar Station, Base Camp and Halligan Mesa, the Las Vegas Army Reserve Training Center, and Nevada land associated with the Utah Test and Training Range (UTTR) at Wendover Army Airfield (AAF). Proposed withdrawals are Hawthorne Reserve Component Training Center (RCTC) and the Ground Wave Emergency Network (GWEN) Relay Node Expansion. The Hawthorne RCTC project is not being actively pursued at this time.

6.1.1 LOCATION, MISSION, AND INFRASTRUCTURE OF EXISTING AND PROPOSED ACTIVITIES

The locations of existing land withdrawals are shown on Figure 6.1.

6.1.1.1 Beatty Radar Site

The Beatty Radar Site is located on the summit of a 4,800 feet peak, approximately 12 miles north of Beatty. The site encompasses 19 acres of land withdrawn by the Air Force from the Bureau of Land Management (BLM). The site has been inactive for more than 10 years, but was previously used by the National Aeronautics and Space Administration (NASA). The Air Force is processing the return of the 19-acre Beatty Radar Site to BLM because the site is excess to Air Force needs.

6.1.1.2 Ely Radar Station

The Ely Radar Station is in a chain of communication links between Edwards Air Force Base (AFB), California and Hill AFB, Utah. Ely Radar Station is the only manned link in Nevada. The site is approximately nine miles northwest of Ely atop Kimberly Mountain (9,240 feet elevation). It contains 10 acres of land withdrawn by the Air Force. Three people operate the station on a weekday basis. The station tracks aircraft and missiles via telemetry. It also provides a microwave relay communication link for aircraft to Hill AFB, Utah and Edwards AFB, California. The station hosts a data acquisition unit, of which telemetry and communications are a part. The telephone company, Federal Bureau of Investigation (FBI), and BLM also have equipment on site. There are no proposed changes in ownership, mission, boundaries, or use of the Ely Radar Station through the year 2000.

Electricity is provided to the site by local utility lines, and there are four 5 kilowatt (KW) diesel generators for backup power. All fuel tanks sit on unbermed concrete pads. No signs of leakage or spills are evident. Diesel is only used as a standby during missions. Propane is consumed at the rate of 3,000 to 3,500 gallons per year for space heating. The

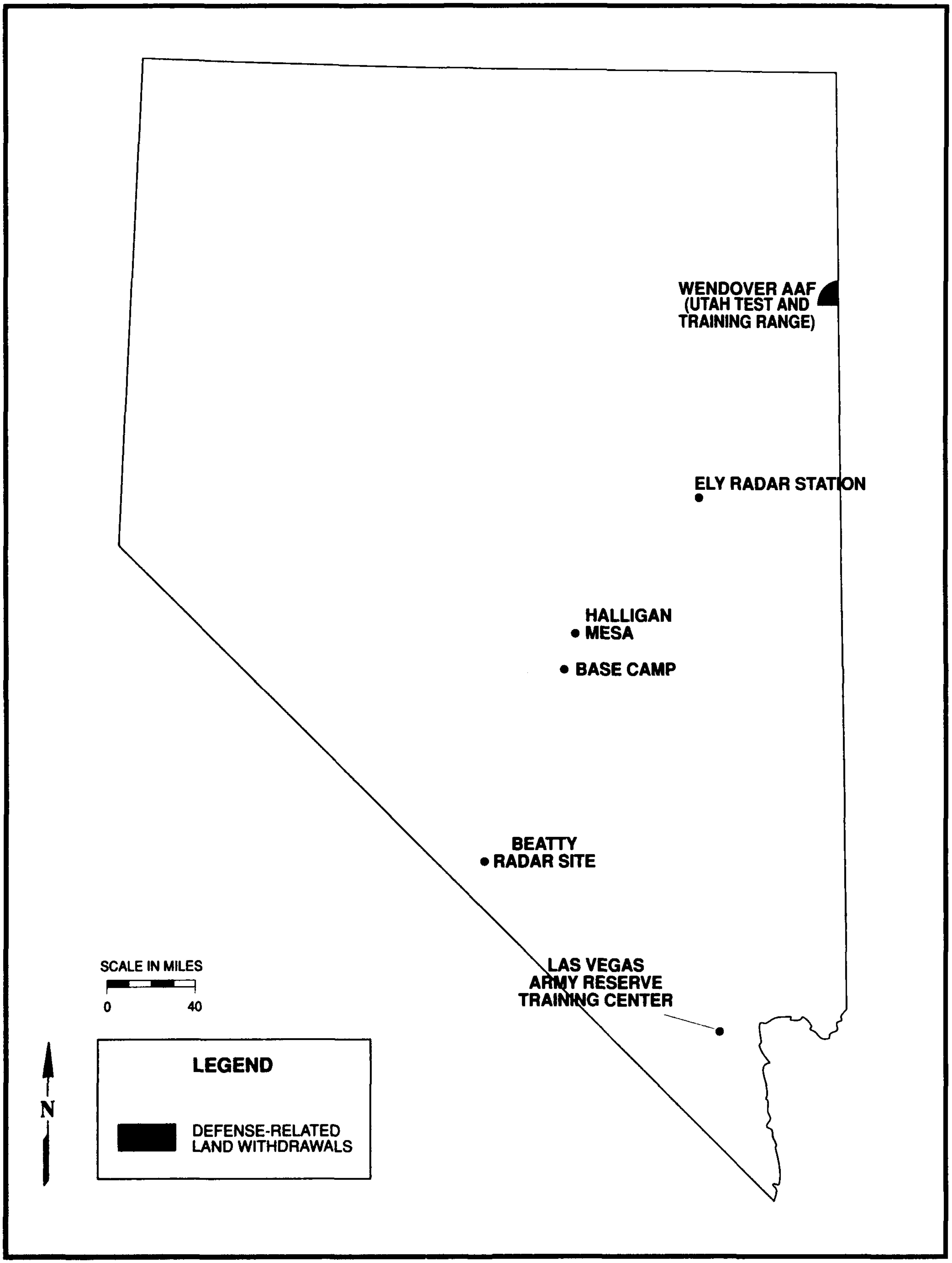


FIGURE 6.1 OTHER DEFENSE-RELATED LAND WITHDRAWALS IN NEVADA

site is equipped with a septic system, while potable water is trucked to the site. There are no residences or other signs of permanent occupation around the site (Source: J. Ambrose, personal communication, 1988).

6.1.1.3 Base Camp and Halligan Mesa

Base Camp and Halligan Mesa are withdrawn by the Air Force and occupy approximately 600 acres in Hot Creek Valley in north central Nye County. Base Camp is located 60 miles east of Tonopah on U.S. 6. A county road passes through Base Camp land. Halligan Mesa is located approximately 15 miles northeast of Base Camp along U.S. Highway 6 and then 3 miles northwest along a dirt road. There are no proposed changes in ownership, mission, boundaries, or use of Base Camp and Halligan Mesa through the year 2000.

An electronics and communications facility on Halligan Mesa, and an associated support area at Base Camp, are used for collecting data for Air Force testing programs conducted in the vicinity of the Tonopah Test Range (TTR) and the Nellis North Range. Base Camp is used as a staging and support area for field personnel and as a recreation area for military and contractor personnel. Base Camp has a recently extended and improved airstrip, several buildings for sleeping quarters, shop and maintenance buildings, and a recreation building. Base Camp is manned by three to six people. Halligan Mesa is unmanned and a helicopter pad is located near the facility (Source: E. Tilzey, personal communication, 1988).

6.1.1.4 Las Vegas Army Reserve Training Center

The Las Vegas Army Reserve Training Center is located in the City of Las Vegas. The training center contains five acres of land withdrawn by the Army. The training center is used as a Centroid and headquarters to recruit and train an Army Reserve component. Included in the facility are a headquarters building, a motor pool, and a maintenance area. The purpose of the motor pool is to transport tanks for the Army National Guard (Source: Capt. Keith, personal communication, 1989). There are no proposed changes in ownership, mission, boundaries, or use of the Las Vegas Army Reserve Training Center through the year 2000.

6.1.1.5 Land Associated with Wendover Army Airfield

Land withdrawn in Nevada associated with Wendover AAF (UTTR) consists of 15,010 acres in Elko County, south and west of the town of Wendover and east of U.S. 93. Occasional munitions testing activities occur on this land, which was previously used for conventional munitions testing, storage, testing of large rocket motors, and aerial flight testing of conventional air-to-ground munitions. The Air Force has proposed to return 321 acres of withdrawn land to BLM for further disposition. No further changes in status are expected by year 2000.

6.1.1.6 Proposed: Hawthorne Reserve Component Training Center

NOTE: The proposed Hawthorne Reserve Component Training Center (RCTC) project is not being actively pursued at this time. Analysis of effects from the proposed Hawthorne RCTC is limited to an evaluation of information provided in the environmental assessment (EA) that describes the proposed action (Source: Nevada Military Department, 1989).

The State of Nevada Military Department has proposed to obtain approximately 500,000-600,000 acres of land in west-central Nevada to use for a RCTC. This area would be near, or contiguous to, Hawthorne Army Ammunition Plant (HWAAP). Vacant facilities at HWAAP would be used to support the RCTC, and approximately 186 civilian employees would be required. The proposed action would allow the reserve component of the Army (Army National Guard and Army Reserve) to train at division strength. Potential effects of the Reserve Component Training Center are discussed in this chapter to the extent that information is available.

The proposed Hawthorne RCTC was evaluated in an Environmental Assessment in which two alternatives were presented in detail. Either alternative would use and improve existing facilities at HWAAP and similar training scenarios would be conducted on the maneuver area. The alternatives differ by geographic location of the maneuver. Alternative A (the Gabbs Valley site) would consist of use of approximately 586,000 acres of BLM lands adjoining HWAAP on the east side, and 24,000 acres of Navy withdrawn lands. Alternative B (Monte Cristo/Cirac Valley site) would consist of 500,000 acres southeast of Mina and northwest of Tonopah.

The proposed RCTC maneuver area would accommodate 12,000 to 15,000 military personnel, 5,700 rubber tire vehicles and 3,000 tracked vehicles. Two large-scale maneuvers, of one-month duration are proposed to occur each year. Additionally, the firing range facilities existing on HWAAP lands would be used year-round on weekends by 100-300 troops.

Federal legislation would be required for the National Guard or the Army Reserve to obtain the right to conduct training on BLM lands. Federal legislation could either be a withdrawal of the land, or special legislation that would allow the proposed RCTC use to periodically occur but shared use to be maintained.

6.1.1.7 Proposed: Ground Wave Emergency Network Relay Node Network Expansion

The following information was taken from the U.S. Air Force Ground Wave Emergency Network (GWEN) Narrative (Source: U.S. Air Force, 1989c).

The GWEN is a system of radio relay nodes with towers similar to those used by commercial broadcast station transmitters. GWEN is an essential part of the President's Strategic Modernization Program and provides a communications network to carry critical attack warning and force execution data that is immune to the effects of high-altitude electromagnetic pulse. A typical relay node site is located on approximately 11 acres of public land or acquired private lands. It contains a 299-foot LF transmitter tower, a back-up diesel generator, an antenna tuning unit, and a radio processor housed in three shelters. The shelter areas are fenced to provide safety and to inhibit unauthorized entry. A 4-foot high wire fence is installed around the perimeter of the ground plane to segregate the radio signal emission level hazardous zone inside the fence from the safe zone outside the fence.

GWEN operates intermittently in the LF band at 150 to 175 kilohertz (Khz), with peak broadcast power for each tower of 2,000 to 3,000 watts. GWEN transmissions (typically six seconds per hour) do not interfere with commercial television, radio broadcasts, amateur radio operations, garage door openers, or pacemakers.

Location of GWEN components would be determined by the location of GWEN users (the input/output terminals and receive-only terminals) and the requirement to maintain a minimum signal strength throughout the system. The overall network is defined in terms of geographic coordinates that represent the ideal operational locations for relay nodes.

Site Search Areas would be selected as part of the overall layout of the GWEN network. A Site Search Area encompasses the area within a 9-mile radius of each coordinate representing the ideal location. Four sites are proposed in (or near) Nevada as shown in Figure 6.2, and are centered in Austin (Central Nevada), Tuscarora (Northeastern Nevada), Amargosa Valley (Southern Nevada), and Cedarville, California (Northeastern California).

Once the candidate sites have been approved, land acquisition and preparation of NEPA environmental impact evaluations begin concurrently. The Final Operational Capability Final Environmental Impact Statement (FEIS) concluded that the potential for significant impacts exists in many resource areas, although in the areas of geology, air and water quality, noise, infrastructure, socioeconomics, health, and safety the probability of significant environmental impacts is unlikely. The National Academy of Sciences is currently reviewing the information and conclusions in the FEIS. It is anticipated that all potential significant impacts could be avoided through careful siting or through other mitigation measures. Based on the Electronic Systems Division Environmental Protection Committee of the Federal Government recommendations, the United States Government will approve the environmental analysis and determine which candidate GWEN sites qualify for a Finding of No Significant Impact (FONSI) which must be published by the Government prior to selecting a preferred GWEN site.

Selection of the candidate GWEN sites will be coordinated through the Interagency Intergovernmental Coordination for Environmental Planning (IICEP) process. After the completion of the IICEP and environmental coordination or consultation, the Government will decide which site to approve for implementation and authorize proceeding with final design.

6.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from activities associated with the land withdrawals discussed in this chapter. Sources of potential effects and analysis of effects on public health and safety are identified.

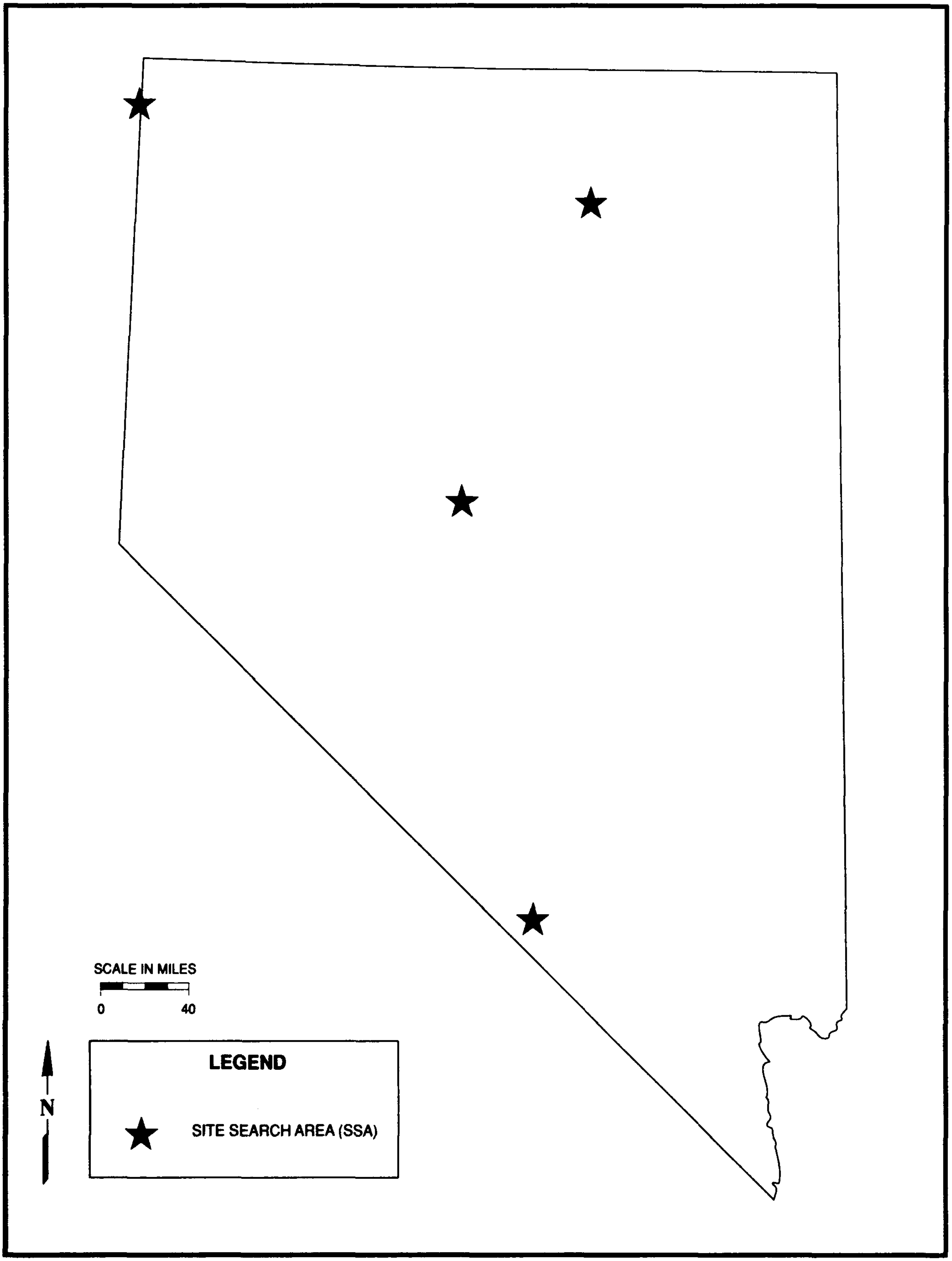


FIGURE 6.2 PROPOSED CANDIDATE GROUND WAVE EMERGENCY NETWORK SITE SEARCH AREAS (SSAs)

6.2.1 GROUND MOTION

Activities associated with the land withdrawals discussed in this chapter do not generate ground motion.

6.2.2 AIR QUALITY

There have been no ongoing operations at the Beatty Radar Site since 1978 (Source: U.S. Air Force, Regional Civil Engineer, 1988). Former activities resulted in a small amount of spilled fuel oil from the operations of generators, but the contaminated area is being cleaned up so the site can be returned to the BLM. Air emissions from the cleanup operations will likely consist of minor amounts of evaporative hydrocarbon losses and fugitive dust on a temporary basis as the contaminated soils are removed.

Air emissions from the Ely Radar Station consist of combustion emissions from standby diesel-fueled generators, propane-fueled space heating, and vehicle access. Approximately 500 gallons of diesel fuel are consumed annually to provide backup power; approximately 3,500 gallons of propane are consumed annually for space heating (Source: J. Wallace, HWAAP, personal communication, 1988). Since the station is manned by only three people on a weekday basis, vehicle exhaust emissions and fugitive dust from the dirt access road are minimal. The small amount of fuel consumed at the Ely Radar Station does not generate a significant amount of air emissions. The surrounding area is in attainment for all National Ambient Air Quality Standards (NAAQS) so no threats to public health and safety are evident. No substantial changes to the air emissions from Ely Radar Station are expected through the year 2000.

Air emissions from Halligan Mesa consist of exhaust emissions from helicopters, other aircraft, and surface vehicles, and fugitive dust generated by the infrequent vehicle travel on the dirt access road. Air emissions from Base Camp activities consist of vehicle exhaust and fugitive dust. The minor amounts of air emissions generated by activities at Halligan Mesa and Base Camp have not been quantified, but are not likely to cause any threat to public health and safety. The surrounding area is in attainment for all NAAQS. No substantial changes in air emissions are anticipated at these facilities for the year 2000.

The Las Vegas Army Reserve Training Center is located in the City of Las Vegas, and is used as a headquarters to recruit and train an Army Reserve component. This facility includes a headquarters building, a motor pool, and a maintenance area. As an Army Reserve training center, the facility is used only intermittently. Air emissions have not been quantified, but should be insignificant due to the low level of activity associated with the facility. There are no proposed changes in the activities at the training center for the year 2000.

No activities occur on land withdrawn in Nevada associated with Wendover AAF (UTTR). Therefore, there are no air emissions connected with this land withdrawal.

The information currently available for the proposed RCTC indicates that there could be locally significant air quality effects (Source: NMD, 1989). Air quality modeling has not been conducted to quantify the potential for, or significance of, such effects. The primary source of the effects would be fugitive dust caused by the operation of vehicles during maneuvers, and wind erosion from the areas of land disturbance associated with the operation of these vehicles. These particulate emissions could result in locally significant levels of respirable particulates (PM_{10}) in the town of Gabbs (under alternative A) or Tonopah (under alternative B). The arid character of the area could result in a long-term effect on particulate emissions resulting from land disturbance. Additionally, because of the extensive nature of the projected land disturbance, the effects may not be readily mitigated (Source: NMD, 1989).

The information currently available for the proposed GWEN relay node expansion indicates that there will be minimal air emissions associated with this project. Once GWEN is operational, there will be only limited activity associated with each network node site. Since the proposed sites are located with a spacing of 150 to 200 miles, air quality effects will be insignificant.

6.2.3 WATER QUALITY AND FLOOD HAZARD

Surface water runoff from the Beatty Radar Site and Ely Radar Station has a very slight probability of creating flood hazards or of transporting contaminants to a location where they could impair a current public water supply or endanger public health and safety. At Ely Radar Site, the only possibility for flood hazard derives from the potential for the access road to concentrate and increase flood flows into an agricultural area. At Beatty Radar Station, a fuel spill is in the process of remediation. Given the topography of the areas and the current land uses, these withdrawals do not affect water quality and flood hazard.

Surface water runoff from the Base Camp and Halligan Mesa sites will not transport contaminants to a location where they could impair either current or potential public ground water or surface water supplies. The nearest water well used for public domestic supply is over 10 miles away, and the closest irrigation wells are one to three miles southeast of Base Camp. These withdrawals have no effect on public health or safety, in relation to water quality or flood hazard, given the topography of the area and current land uses.

The Las Vegas Army Reserve Training Center, given its location within the metropolitan area of Las Vegas, poses no adverse effects on water quality. This withdrawal does not result in adverse effects to public health and safety as a consequence of potential flooding.

The IRP program conducted by Hill AFB identified no potential hazardous waste sites on the Wendover AAF (UTTR), and thus, there apparently are no sites which represent a potential source of materials for ground water contamination or dispersement with flood waters. However, another IRP effort is again looking at Wendover, though there are no results currently available. Given the topography of this area and current land uses, this withdrawal does not result in effects to public health and safety as a consequence of potential flooding.

The proposed Hawthorne RCTC would increase water consumption at the HWAAP and in the town of Hawthorne. At HWAAP, water would be used for domestic purposes and washing and maintenance of the maneuver equipment. Because HWAAP and the town of Hawthorne have historically supported far larger populations than they support currently, there is probably a sufficient supply of surface and ground water. If the Hawthorne RCTC is developed in accordance with current laws, rules, and regulations, water quality effects should be minimal and controlled. Flood hazards cannot be evaluated on the basis of existing information.

Although the specific GWEN sites have yet to be identified, the siting process should preclude any potential detrimental effects on water quality, or adverse effects as a consequence of potential flooding.

6.2.4 IONIZING RADIATION

Activities associated with the land withdrawals discussed in this chapter do not result in ionizing radiation.

6.2.5 NON-IONIZING RADIATION

Electromagnetic radiation hazards discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible light radiation. Systems producing RF/microwave radiation include radio and television transmitters, microwave ovens, radar systems, microwave communication systems, sterilization systems used for medical supplies, welding equipment, and medical equipment. Microwave ovens, sterilizing equipment, welding equipment, and medical equipment are not considered further in this section because of their very low potential hazard to the public due to low emission levels or stringent emission controls.

Activities associated with the land withdrawals discussed in this chapter do not use lasers. Thus, laser radiation is not discussed.

The only source of non-ionizing radiation is the surveillance and tracking type of radar at the Ely Radar Station. The Ely Radar Station is subject to the specific procedures that govern non-ionizing radiation use at Nellis AFB (Section 2.2.5). The station operates within parameters that preclude any effect to public health and safety. The station also operates within assigned frequencies, which should preclude electromagnetic interference to other systems.

6.2.6 SOLID AND HAZARDOUS WASTE

The Las Vegas Army Reserve Training Center generates some amounts of wastes (mostly recyclable petroleum products and spent solvents from motor pool operations). They are disposed of through the Nellis AFB Defense Reutilization and Marketing Office (DRMO) facility discussed in Section 2.2.6 (Source: Capt. Keith, personal communication, 1988). The remaining sites generate negligible quantities of waste.

The proposed RCTC would produce two types of waste, domestic trash from the troops engaged in the maneuvers and industrial wastes from the maintenance of vehicles and equipment. The domestic-type trash consisting of food wastes, packaging, paper, plastics, glass, metals, and wood, would be buried in the existing HWAAP sanitary landfill (see Section 4.2.6 of this report), which has been approved by the State of Nevada Division of Environmental Protection. This landfill could adequately support the additional waste generated by the proposed RCTC activities. The industrial waste oils, solvents and other substances generated by maintenance of the RCTC vehicles would be consolidated and removed to a licensed waste disposal facility under the existing HWAAP operation. HWAAP also has an ongoing monitoring and testing program for contamination from hazardous materials/wastes in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA) (U.S. Army, Corps of Engineers, 1989), which would apply to the Hawthorne RCTC.

6.2.7 NOISE AND SONIC BOOM

None of the activities occurring on existing land withdrawals discussed in this chapter generate aircraft noise or sonic boom.

Nearly all the activities that would occur as part of the proposed Hawthorne RCTC would increase noise levels in the area. Helicopters and jet aircraft would be the noisiest, affecting the entire area, particularly the areas around the Hawthorne Airport. Firing of weapons could produce noise that could annoy residents of Hawthorne. Unlike the other maneuver-related activities associated with the proposed Hawthorne RCTC, which would occur only periodically, firing of weapons would occur at least once a month. Ground vehicles participating in maneuvers would also produce noise, although at levels far lower than aircraft or weapons firing. Annoyance could result from the noise.

6.2.8 FACILITY ACCIDENTS

Very small quantities of munitions, fuels, and other HAZMAT are used or stored on the other land withdrawals discussed in this chapter. There are no effects on public health and safety now and there should be no effect for the year 2000.

The vehicles and aircraft that would be used in maneuvers associated with the proposed Hawthorne RCTC consume large amounts of fuel. An M-60 tank goes approximately .8 miles on a gallon of diesel fuel. The standard Army 2-1/2 ton truck gets approximately 10 miles per gallon of diesel fuel. A full armored division includes approximately 3,000 tracked vehicles and 5,700 wheeled vehicles; thus very large quantities of fuel would be consumed. Additional fuel storage facilities would need to be constructed on HWAAP in order to store sufficient quantities of fuel for the maneuvers. The fuel would most likely be delivered via rail tank cars. No effects on public health and safety are likely to result from storage of these materials at HWAAP (Section 4.2.8).

6.2.9 AIRCRAFT MISHAPS

Aircraft are not regularly used in activities associated with existing withdrawals discussed in this chapter. Therefore, there are no effects to public health and safety. No changes are anticipated for the year 2000. The level of aircraft use associated with the

Hawthorne RCTC is unknown at this time. Consequently, no assessment of effects on public health and safety is possible.

6.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

Aircraft are not regularly used in activities associated with existing withdrawals discussed in this chapter. Therefore, there are no effects on public health and safety. No changes in effects are anticipated for the year 2000.

6.3 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

There are no measurable effects on public and private property in local economies from the existing small land withdrawals discussed in this chapter. Any employment and population effects are considered in the context of statewide cumulative effects, which are discussed in Chapter 8. Sufficient planning information related to economic characteristics of the Hawthorne RCTC is not available in existing studies.

6.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

The inactive Beatty Radar Site is small in surface area and is located in a region that has been subject to considerable land disturbance from mining and prospecting activities. Effects on plants and wildlife resources from this site result primarily from surface disturbance of the area itself. However, land disturbance is localized and of limited extent. No known effects on plants and wildlife resources occur as a result of this withdrawal.

The Ely Radar Station is located in an area that has been subject to considerable land disturbance from mining and prospecting activity as well as activities related to the Station. However, land disturbance is localized and of limited extent. No known effects on plants and wildlife resources occur as a result of this withdrawal.

The use of Base Camp as a support area has resulted in local land disturbance and human presence in areas surrounding the withdrawal. Ground surface effects may extend into surrounding areas. Halligan Mesa is a relatively small withdrawal operating as an electronics and communication facility. Effects on wildlife populations from the operation of either site may include local depletion, although the existence of these effects cannot be determined with existing studies.

Operation of the Las Vegas Army Reserve Training Center has had no known effects on plants and wildlife populations because of its urban location.

Withdrawn land associated with Wendover AAF (UTTR) is inactive. The area is primarily salt desert shrub and includes some rocky cliffs and caves. Wildlife that may be present on the site include pronghorn antelope, chukar, raptors, coyotes, badgers, bobcats, small mammals and birds The effects of past activities on wildlife populations is unknown.

Analysis of effects from the proposed Hawthorne RCTC is limited to an evaluation of information provided in the environmental assessment (EA) that describes impacts of the proposed action on biological resources (Source: NMD, 1989). The vegetation of the proposed alternative sites for the Hawthorne RCTC is characterized by typical Great Basin Desert basin and range type vegetation associations. Characteristic shrub species found on the lower elevation portions of these sites include winterfat (*Ceratoides lanata*), greasewood, and shadscale. Sagebrush and rabbitbrush are common dominants above 5,500 feet, and pinyon and juniper frequently occur in association with sagebrush. Populations of threatened and endangered plant species are not known to exist in either proposed area. Three sensitive plant species discussed in the EA for the proposed action are classified as Candidate Category 3, indicating that these taxa are no longer under consideration for listing as threatened or endangered. A range-overlap analysis has not been conducted for the proposed sites. Both alternatives are described in the EA as rich in wildlife species. The endangered Hiko White River spring fish (*Crenichthys baileyi grandis*) inhabits a spring in the Pilot Mountains of the Alternative B area. Notable game and other important species known from these areas include chukar, California quail, mule deer, bighorn sheep, pronghorn antelope, and wild horses.

High levels of disturbance to vegetation resources are anticipated with implementation of the Hawthorne RCTC proposal, particularly in areas of concentrated tracked and wheeled vehicle activity. Anticipated effects include destruction of existing vegetation, soil compaction which could impede seedling germination, and disturbance of existing native vegetation, providing a competitive advantage for invasive non-native annual species. Many desert plant species are slow to recover from unnatural disturbance, and there is evidence to indicate that dramatically disturbed desert environments may not be able to recover to natural conditions (Source: Wallace et al., 1980). The proposed activities could also affect wildlife habitats and populations. Effects on wildlife habitats would be a function of vegetation destruction and disturbance, soil compaction, noise disturbance, and inadvertent harassment by the encroachment of large numbers of humans and motorized vehicles in wildlife habitat. The EA for this proposed action concluded that the overall effect of the maneuvers is a "lowering of diversity and balance" in wildlife populations.

6.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

Construction of the Beatty Radar Site, inactive during the last ten years, disturbed most of the mountaintop on which it is located. The fertile Oasis Valley below the mountain top, with its numerous springs, was heavily used by Western Shoshone people, and prehistoric sites probably abound in the region (Source: Steward, 1938). Although no cultural resources surveys have been conducted in the immediate vicinity of the Beatty Radar Station, this mountaintop overlooks Oasis Valley and may have contained prehistoric cultural resources. Even though most prospecting and mining activities occurred to the south of this site, populations were large during the early twentieth century, and historic activities may have occurred on the mountaintop. Since pre-activity surveys were not conducted, construction of the Beatty Radar Site could have impacted cultural resources that may have existed at the site.

The Ely Radar Station is situated at 9,240 feet atop Kimberly Mountain in the Egan Range about six miles west of Ely. The Station covers about 10 acres, virtually all of which have been disturbed. No cultural resource surveys have been conducted on the withdrawal, although the cultural resources in the general area around the town of Ely are numerous (Source: Fowler, 1966; Tuohy, 1974) and have been summarized in a cultural resources overview of the Elko and Ely BLM districts (Source: James, 1981). Because pre-activity surveys were not conducted, construction of the Station could have impacted cultural resources at the site.

Two cultural resources studies have been conducted in the general vicinity of Base Camp and Halligan Mesa, and one cultural resources survey of approximately 265 acres has been performed directly within the Halligan Mesa withdrawal. Six sites were recorded that had been partially impacted by land-disturbance; none of the sites were considered to be eligible for nomination to the National Register of Historic Places. Because pre-activity surveys did not precede most land disturbance at Base Camp and Halligan Mesa and because cultural resources are known to occur in the general area, activities on the withdrawals probably has had an impact on cultural resources. The extent of this impact, however, cannot be determined with existing studies.

The Las Vegas Army Reserve Training Center is used as a Centroid and a headquarters to recruit and train Army Reserves. The withdrawal covers five acres in a densely populated urban setting, and facilities include a motor pool, maintenance area and headquarters building. Construction of the facilities and most land disturbance in the surrounding area occurred prior to surveys for cultural resources, and it is not possible to ascertain what sort of cultural resources, if any, might have been impacted.

Land withdrawn in Nevada associated with Wendover AAF (UTTR) was covered by Pluvial Lake Bonneville and would have been rich in resources when prehistoric peoples first entered the area during evaporation of the lake. The BLM has prepared an overview of the prehistory, ethnohistory, and history of eastern Nevada, which incorporates the area occupied by this withdrawal (Source: James 1981). The analysis conducted for this report indicated that four cultural resource surveys have been conducted on this withdrawal, but reports concerning those surveys are not available. (Source: Nevada State Museum records) Seven cultural resources sites are recorded, but only 2.4 percent of the area has been examined for cultural resources. Six of these sites have experienced extensive impacts and the extent to which one site had been impacted is unknown. Four of the sites were considered to be not eligible for nomination to the National Register of Historic Places, the eligibility of two sites was not determined, and one site was collected. Because pre-activity surveys were not conducted on the withdrawal, the impacts on cultural resources from military activities cannot be determined from existing studies. However, because of its setting adjacent to a pluvial lake and immediately south of areas (Silver Island Mountains) known to contain National Register of Historic Places quality archaeological sites, it is likely that the withdrawal contains additional cultural resources that may have been impacted by past defense-related activities. The Air Force recently met with the SHPO and is currently preparing a program agreement for protection of cultural resources.

Approximately 100 cultural resources surveys, covering roughly 3,500 acres, have been conducted in the area proposed for Alternative A of the proposed Hawthorne RCTC

(Source: NMD, 1989). These surveys recorded more than 40 cultural resources, but they do not reflect a representative sample of the kinds or density of cultural resources that may exist in the alternative. Approximately 30 cultural resources surveys covering roughly 13,000 acres have been completed in the region proposed as Alternative B (Source: NMD, 1989). All of the activities associated with the proposed Hawthorne RCTC have a potential to impact cultural resources. However, the existing cultural resource data are not sufficient to either assess the complete nature of these impacts or to indicate which alternative would result in the least impact to properties eligible for nomination to the National Register of Historic Places. This assessment would be required for compliance with Section 106 of the National Historic Preservation Act. Likewise, information is not available to assess the impacts of this activity on the Native American religious freedom and compliance with the American Indian Religious Freedom Act would require formal consultation with affected Native Americans.

6.6 EFFECTS ON RECREATIONAL RESOURCES

The Beatty Radar Site has been inactive for over 10 years, and will be turned over to BLM administration in the future. The small size of the site and lack of notable recreational features in the area suggest that this facility has not had an effect on the recreational resources of Nevada.

The small area of land withdrawn for the Ely Radar Station, lack of recreational facilities in the general area, and proximity to other facilities indicate that the recreational potential of this withdrawal is low.

The environmental assessment for the withdrawal of Base Camp and Halligan Mesa (Source: BLM, Base Camp/Halligan Mesa, not dated) does not address the recreational potential of the area. Base Camp is entirely surrounded by grazing lands and does not contain unique recreational features. Halligan Mesa may have limited opportunities for chukar hunting, however, more suitable habitat is located in the immediate vicinity.

The inner-city location and small size of the Las Vegas Army Reserve Training Center preclude any effect on recreational values.

The recreational potential of the withdrawn land associated with Wendover AAF (UTTR) has not been evaluated in previous studies. The withdrawal is located in an area that does not contain outstanding or unique recreational opportunities, however, off-road vehicle use, hunting, and environmental studies could be conducted in this area.

The environmental assessment for the proposed Hawthorne RCTC evaluated potential impacts of the proposed action on biological resources (Source: NMD, 1989). Recreational activities that occur in these remote areas include hunting, off-road vehicle (ORV) use, sight-seeing, hiking, and camping. The proposed action would affect these recreational resources by damaging biological resources (i.e., wildlife, vegetation) that provide attractive features for recreationists (Section 6.4).

6.7 EFFECTS ON WILDERNESS RESOURCES

The nearest BLM Wilderness Study Area (WSA) to the Beatty Radar Site is the Grapevine Mountains, located approximately 50 miles north of the site. The nearest U.S. Forest Service (USFS) wilderness is Mt. Charleston, located more than 50 miles south of the site. The eastern boundary of proposed wilderness in Death Valley is more than 15 miles from the Beatty Site. The nearest BLM WSA to the Ely Radar Station is Granite Springs, located approximately 50 miles east of the site. The nearest USFS wilderness is Mt. Moriah, which is also located 50 miles east of this withdrawal. The small size of each of these facilities, their proximity to towns and other developments, and absence of wilderness resources in the surrounding lands, indicate that neither site has an effect on wilderness resources in Nevada.

Base Camp and Halligan Mesa are completely surrounded by BLM lands. Several BLM WSAs are located relatively close to Base Camp and Halligan Mesa. Rawhide Mountain, is located approximately three miles west of Base Camp. Palisade Mesa is located approximately five miles east of Halligan Mesa, and five miles east of Base Camp. The nearest USFS wilderness is Quinn Canyon, located about 30 miles southwest of the withdrawals.

Wilderness evaluation of withdrawn lands is not legally required. The 1985 EA prepared for the official withdrawal of Base Camp and Halligan Mesa stated that the withdrawal action essentially precluded other uses of the land (Source: BLM, Base Camp/ Halligan Mesa, not dated). Although evaluation of wilderness resources for these sites has not been conducted, suitable wilderness characteristics on the withdrawals, if formerly present, were eliminated by the construction of roads and facilities.

Because of its location in the City of Las Vegas, the Las Vegas Army Reserve Training Center does not have an effect on wilderness resources in Nevada.

There are three Nevada BLM WSAs near the Wendover AAF (UTTR). These are the Bluebell WSA, approximately 5 miles to the west, the Goshute Peak WSA, approximately 7 miles southwest of the site, and the South Pequop WSA, approximately 15 miles to the west of this withdrawal.

Alternative A of the proposed Hawthorne RCTC would overlap with portions of the Gabbs Valley WSA in the Walker Resource Management Area. This WSA could be affected by low-level aircraft overflight, noise, and dust from surrounding lowland maneuver areas, and the possibility of large numbers of military personnel and motorized vehicles entering the area. Alternative B would not directly affect any wilderness areas. The USFS Arc Dome Wilderness is located 10 miles north of the proposed area. Indirect effects on this wilderness by the proposed action cannot be determined with existing studies.

6.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

The Beatty Radar Site occupies 19 acres at the summit of a peak several miles northwest of Beatty. The overall mineral and energy-resource potential of this region is described in Section 2.8 of this document, under the Nellis Air Force Range, and Section 5.8 under the Nevada Test Site. Although the area comprising the Beatty Radar Site is favorable for metals, the mineral potential of the site is considered to be low because the probability is remote that so small a tract of land would contain commercial quantities of base- and precious-metals at depth. It is concluded that this withdrawal has had no effect on the mining or petroleum industries in Nevada.

The Ely Radar Station occupies 10 acres atop Kimberly Mountain 9 miles northwest of Ely. Although the overall area comprising the withdrawal is favorable for metals, the mineral potential of the site is considered to be low because the probability is remote that so small a tract of land would contain commercial quantities of base- and precious-metals at depth. It is concluded that this withdrawal has had no effect on the mining or petroleum industries in Nevada.

Base Camp is entirely underlain by Quaternary alluvium, while the Halligan Mesa site is located within Tertiary volcanic rock of the Pancake caldera complex (Source: Kleinhampl and Ziony, 1985). The potential for development of base metal resources is assessed as very low for both areas. Precious-metals potential is assessed as very low for the Base Camp area. The volcanic rocks present at Halligan Mesa are similar to rocks which have provided favorable host sites for precious-metals mineralization in other areas of Nye County. Lacking more definite information on this area, however, the precious-metals resource potential of Halligan Mesa is assessed to be low.

There are no thermal springs or wells within or near Base Camp or Halligan Mesa. However, the Hot Creek Canyon thermal area is only about 15 miles northwest of Base Camp and about 10 miles west of Halligan Mesa. It is possible that thermal waters could be developed in the subsurface beneath either of the two withdrawals. Consequently, the geothermal resource potential of these two areas is assessed to be moderate.

Pre-Tertiary bedrock bordering and presumably underlying Quaternary alluvium and Tertiary volcanic rocks at Base Camp and Halligan Mesa is similar to the bedrock in Railroad Valley, to the east, where five oil fields have been discovered to date (Source: Weimer, 1988). The area is considered to be favorable for small oil pools in Tertiary and Paleozoic rock, similar to the geologic setting in Railroad Valley.

Most of the alluvial material underlying Base Camp is pediment and valley-fill deposits that were deposited at some distance from their original source. Sand and gravel resources may exist within the boundary of the Base Camp area; the volcanic rocks at the Halligan Mesa site could contain resources of clays, pumice, zeolites, and rock suitable for construction materials. Deposits of these materials from either area, however, would not have any unique value over similar materials occurring in other areas in central Nevada that are closer to potential users. The industrial minerals and materials potential of Base Camp and Halligan Mesa is therefore assessed as very low.

Sand and gravel are the only commodities with any potential for development at the site of the Las Vegas Army Reserve Training Center. These deposits, however, do not present a unique or particularly important resource because sand and gravel resources are available widely in the Las Vegas Valley.

The withdrawal associated with Wendover AAF (UTTR) consists of 15,137 acres of land, most of which is covered by thick lake deposits and playa silt associated with regional expansions and contractions of the Great Salt Lake in Utah (Source: Coats, 1987). Volcanic rocks, chiefly rhyolite and dacite (Source: Coats, 1987), crop out over an area of about two square miles at the southern end of Wendover. The metallic mineral potential of the Wendover withdrawal is considered to be very low.

The Wendover AAF (UTTR) withdrawal lies within the Wendover mining district as defined by Smith (1976). Several patented lode claims exist a few miles north of Wendover, but production has not been recorded from these claims or from the district (Source: Smith, 1976). The base and precious-metals potential of the district is considered to be very low.

No thermal springs or thermal wells exist within or near the Wendover AAF (UTTR) withdrawal. On the basis of State-wide data compiled by Garside and Schilling (1979) and Trexler et al., (1983), the geothermal potential of the Wendover AAF (UTTR) withdrawal is considered to be very low.

Two exploratory wells were drilled approximately six miles southwest of the southern border of the Wendover AAF (UTTR) withdrawal in 1951 and 1953 (Source: Garside and Schilling, 1977). Both wells had reported oil and gas shows but were later abandoned (Source: Garside and Schilling, 1977). The Wendover area is considered to be favorable for small oil pools in Tertiary and Paleozoic rocks, similar to the small oil fields in Railroad Valley. Moreover, shallow pockets of methane in subcommercial quantities could exist in the Quaternary sediments, similar to the methane accumulations in the Carson Desert basin (see Section 2.9). It is nevertheless concluded that the withdrawal at Wendover has had no effect on the petroleum industry in Nevada.

Decorative stone has been quarried from the volcanic rocks at the southern end of the Wendover AAF (UTTR) withdrawal (Source: Smith, 1976). Had the area not been withdrawn, a market for this material might have been developed for the fast-growing town of Wendover.

The potential for other industrial minerals and materials at the Wendover AAF (UTTR) withdrawal, such as barite, fluorite, specialty clays, diatomite, evaporites and brines, zeolites, and gypsum, is considered to be low based on regional studies by Papke (1970; 1972; 1975; 1976; 1979; 1984; and 1987).

The effects of the proposed Hawthorne RCTC on mineral exploration and development depend on the nature of the congressional authorization that the Army receives for use of the public lands, as well as the actual and estimated mineral potential of the area selected. The largest effects to the mining industry would occur if a withdrawal is granted and the public lands are excluded from further mineral exploration and development. Effects would be much less if the lands were only temporarily closed to the public during military maneuvers.

If the proposed Hawthorne RCTC were to be placed on either of the two parcels of land near the HWAAP, and if these lands were withdrawn from mineral exploration and development, effects to the mineral industry in Nevada could be substantial. Both areas encompass numerous mining districts. Exploration within both areas is currently very active, especially for gold. Recent discoveries of ammonium-bearing deposits (Source: Krohn, 1989) in one of the alternative locations suggest a high potential for gold and silver deposits (along the west side of the Cedar Mountains). Additionally, both alternatives contain major reserves of tungsten and silver, as well as good potential for fluorite, turquoise, copper, molybdenum, barite, mercury, and a variety of industrial minerals and materials. The potential for energy resources (oil, gas, and geothermal) is considered to be relatively low, and similar to that described in Section 2.8 for the Nellis Air Force Range and in Section 4.8 for the Hawthorne Army Ammunition Plant.

6.9 EFFECTS ON WATER RESOURCES

The Beatty Radar Site is located on the hydrographic boundary east of Sarcobatus Flat and west of Oasis Valley. The withdrawal encompasses about 19 acres of high desert environment which is a small recharge area for the basins on both sides. There are no springs or streams within the immediate area. Some ephemeral streams exist in the surrounding foothills due to localized, high intensity thunderstorms. Precipitation averages from less than 4 inches per year, to greater than 15 inches per year, some of which is snowfall. Water development in these two basins is mostly through wells for irrigation, stock, and domestic use. There is no water development associated with the withdrawal for the Beatty Radar Site. There are no known effects to water resources in Nevada from this withdrawal.

The Ely Radar Station encompasses approximately 10 acres of land in mountainous terrain between the Jakes Valley and Steptoe Valley hydrographic basins. Precipitation averages between 6 and 20 inches per year mostly in the form of snow. Approximately 85,000 acre-feet per year (AFY) of water flows from the mountains towards the basins. There are no springs or streams located in the withdrawal area, but several are found in the surrounding area. While there is extensive water development in Steptoe Valley, there is almost none in Jakes Valley and none associated with the withdrawal for the Ely Radar Station. There are no known effects to water resources in Nevada from this withdrawal.

The regional hydrologic environment of Base Camp and Halligan Mesa is shown in Figure 5.13 in Section 5.9. Base Camp is situated on the valley floor where the water table is shallow, but there are no nearby springs or perennial streams. The closest private irrigation well is approximately one mile to the south. At Halligan Mesa, the water table is expected to be very deep. There are no wells, springs, or streams on the Mesa; the closest spring is approximately two miles south at Rattlesnake at the base of Palisade Mesa. Water rights status in Hot Creek Valley is described in Section 5.9. The Air Force has 43 AFY of ground water rights associated with Base Camp, but none at Halligan Mesa. Base Camp uses only a few acre-feet of ground water annually for domestic supply, minor industrial purposes, and construction. Drinking water is trucked in to Halligan Mesa. There are no known activities at Halligan Mesa that would result in ground water impairment. At Base Camp, accidental disposal of petroleum products or other solvents could impair ground water, because of the shallow water table. This potential, however, cannot be determined with existing studies. Any such contamination would represent only a very minor resource impairment. The withdrawals do not affect water resources in Nevada, and are not expected to affect these resources in the future.

There are no streams or springs in the immediate vicinity of withdrawn land associated with Wendover AAF (UTTR) and local ground water is too saline for domestic or other purposes. As a consequence, water supplies for Wendover AAF and the towns of Wendover, Nevada and Wendover, Utah have been developed in Nevada to the north and west of Wendover. The water system is owned and managed jointly by West and East Wendover (Nevada and Utah, respectively) through the Wendover Pipeline Company. Wendover AAF facilities are connected to the East Wendover water distribution system. The Air Force, in 1976, quit-claimed the water-delivery system to East Wendover with the provision that ownership incrementally be shared with West Wendover such that by 1999 the communities would own equal shares. When the Air Force quit-claimed a portion of the water supply, it retained the right to take water needed for Wendover AAF. Current levels of water consumption at the airfield are unknown.

There is no indication that land withdrawn in Nevada associated with Wendover AAF has any affect on water resources in Nevada. Past effects have been beneficial in that the Goshute Valley water supply system was given to the community of Wendover.

The Las Vegas Army Reserve Training Center obtains all of the necessary water from the Las Vegas Valley Water District. In 1988 this facility used 1.8 million gallons. No record of waste water discharge is available; however, based on a valley wide estimate, approximately 40 percent of this water was consumptively used. The training center does not affect water resources in Nevada.

Alternative A of the proposed Hawthorne RCTC incorporates portions of the Walker Lake Valley, East Walker Area, Gabbs Valley, and Fairview Valley hydrographic basins. The hydrologic characteristics of the Walker Lake Valley and East Walker Area are discussed in Section 4.9 under Hawthorne Army Ammunition Plant, and Fairview Valley is discussed in Section 3.9 under Naval Air Station, Fallon. About 30 wells and springs are known to exist in the proposed Alternative A location outside of the existing HWAAP withdrawal (Source: NMD, 1989). At least 24 of these are in the Gabbs Valley Range. At Rawhide on the west edge of Alternative A location, water was recently obtained at approximately 500 feet below the ground surface. In general, very little is known about ground-water resources in the Gabbs Valley hydrographic basin. Alternative B of the proposed Hawthorne RCTC incorporates a portion of the Monte Cristo Valley hydrographic basin and a portion of the Tonopah Flat sub-basin of the Big Smokey Valley hydrographic basin. No information is available on wells or springs in the Monte Cristo Valley hydrographic basin or the Tonopah Flat hydrographic sub-basin.

Water rights information regarding the Walker Lake, East Walker, and Fairview Valley hydrographic basins is discussed in Sections 4.9 and 3.9. The estimated perennial yields and amounts of ground water in storage in the upper 100 feet of saturated alluvial material are: Gabbs Valley, 5,000 AFY perennial yield, 1,600,000 AF storage; Monte Cristo Valley, 400 AFY perennial yield, 720,000 AF storage; and Tonopah Flat, 6,000 AFY perennial yield, 7,000,000 AF storage (Source: State Engineer's Office, 1971).

Water diversions and consumptive use in the Walker Lake, East Walker, and Fairview Valley hydrographic basins are contained in Sections 4.9 and 3.9.

Activities on the proposed Hawthorne RCTC may affect water resources in Nevada. The operation of approximately 8,700 (Source: NMD, 1989) motorized vehicles in RCTC-related training would provide opportunities for the inadvertent release of hazardous and/or toxic materials. The potential for inadvertent release of these substances cannot be determined with existing studies. The establishment of maintenance areas to repair vehicles during the maneuvers and the potential use of pit toilets in the maneuver area would also have the potential for impairing water resources. An increased domestic demand on water supply in the town of Hawthorne and at the HWAAP would also result from RCTC-related employees and Army Reserve personnel. The effect of increased demand on the water supply systems, either in the town of Hawthorne or on HWAAP, cannot be determined with existing studies. However, if there were a significant demand on the town water supply, ground water quality might deteriorate in response to migration of wastes from HWAAP identified IRP sites. The effects of increased wastewater discharge also cannot be evaluated with the information currently available.

6.10 SUMMARY

This chapter has identified effects and possible effects resulting from activities associated with other lands withdrawn in Nevada for defense-related purposes. These effects are summarized in Chapter 8, as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of these effects is also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 7

OTHER AIRSPACE OVER NEVADA USED FOR DEFENSE-RELATED PURPOSES

7.1 OTHER EXISTING AND PROPOSED DEFENSE-RELATED AIRSPACE

The airspace areas discussed in this chapter are the Reno, Hart, and Paradise Military Operations Areas (MOAs), Utah Test and Training Range (UTTR), Military Training Routes (MTRs), Aerial Refueling Routes (ARs), and Slow Speed Low Altitude Routes (SRs). SRs are discussed in the MTR section although they are not formally part of the MTR system. Figure 7.1 shows the location of the MOAs and UTTR airspace. The UTTR airspace includes Lucin A MOA, Lucin C MOA, and Gandy MOAs, and Restricted Areas R-6404 and R-6405. Figure 7.2 shows the location of MTRs and SRs.

7.1.1 HART MILITARY OPERATIONS AREA

The southern half of the Hart MOA and its overlying Air Traffic Control Assigned Airspace (ATCAA) extend into Washoe County in the northwestern corner of Nevada. Approximately 982 square miles of the Hart MOA are within Nevada. The MOA extends from 11,000 feet mean sea level (MSL) up to, but not including, flight level (FL) 180 with an overlying ATCAA up to FL 500. The Hart MOA/ATCAA is used for air combat training and general flight maneuvers primarily by the Oregon Air National Guard (ANG) stationed at Kingsley Field, Oregon. During 1988, the Hart MOA averaged 87 sorties per month, all of which were flown by F-4 aircraft during daylight hours. Approximately 50 aircraft per year fly at supersonic speeds but only above FL 300 (Source: Oregon Air National Guard, 1988). No change in the control, boundaries, or mission of the Hart MOA is anticipated by the year 2000. The number of sorties is likely to increase by 20 percent, to approximately 104 sorties per month. F-16 aircraft are likely to replace the F-4 aircraft.

7.1.2 PARADISE MILITARY OPERATIONS AREA

The southern portion of the Paradise MOA and its overlying ATCAA extend over Humboldt County and Elko County. Approximately 3,128 square miles of the Paradise MOA are over Nevada. The MOA extends from 14,500 feet MSL up to, but not including, FL 180, with an overlying ATCAA up to FL 280. The Paradise MOA/ATCAA is used for air-to-air combat training and general flight maneuvers. During 1988, the Paradise MOA averaged 387 sorties per month, of which 68 percent were flown by EF-111 aircraft, 31 percent by RF-4C aircraft, and 1 percent by KC-135 aircraft. No supersonic operations are conducted in the Paradise MOA (Source: U.S. Air Force, 1988a).

7.1.3 RENO MILITARY OPERATIONS AREA

The Reno MOA and its overlying ATCAA are located 40 miles north of Reno. Covering approximately 1,380 square miles, the Reno MOA overlies the Smoke Creek Desert, Winnemucca Lake, and part of Black Rock Desert. The MOA is above the towns

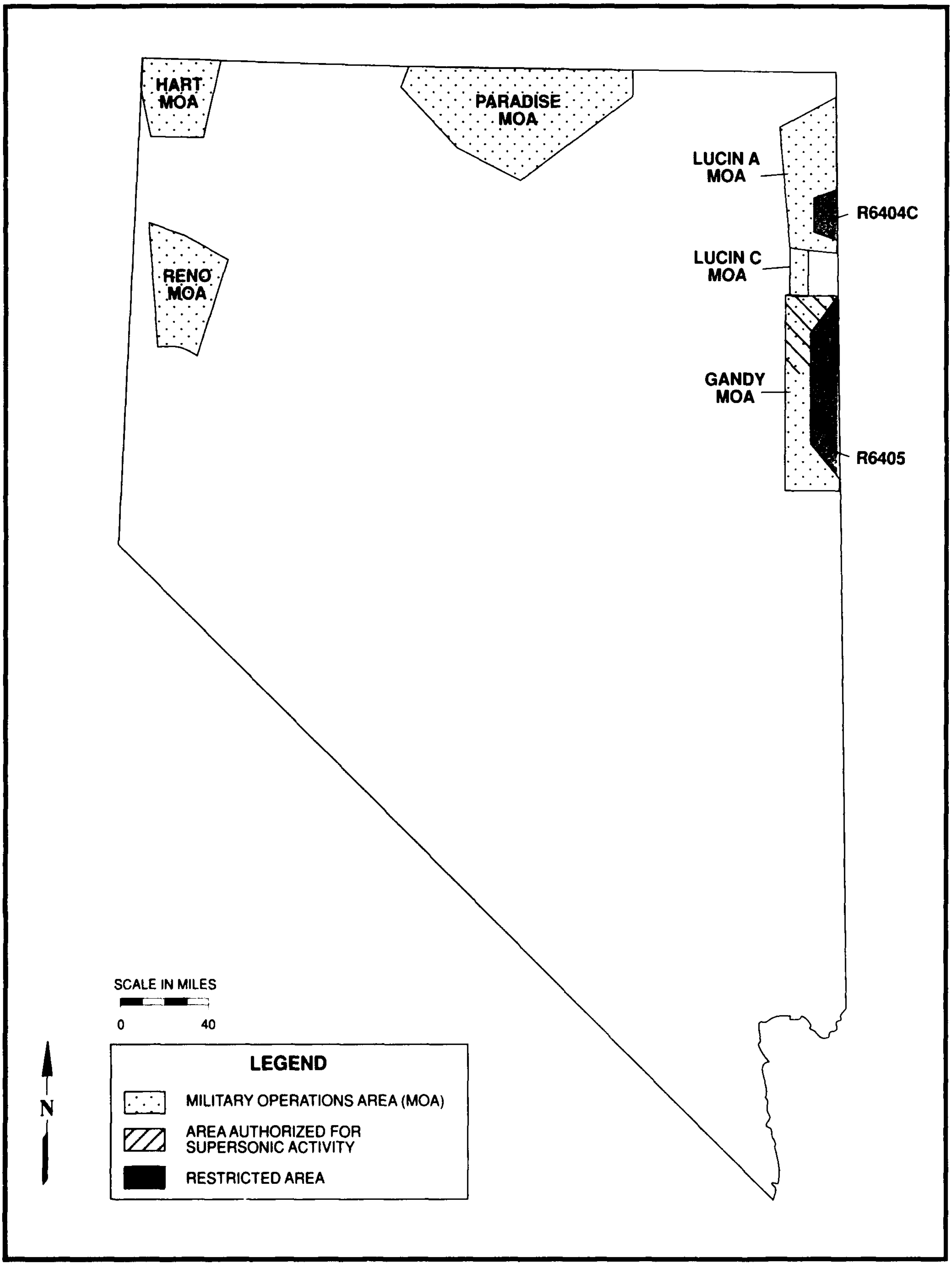


FIGURE 7.1 OTHER AIRSPACE IN NEVADA USED FOR DEFENSE TRAINING

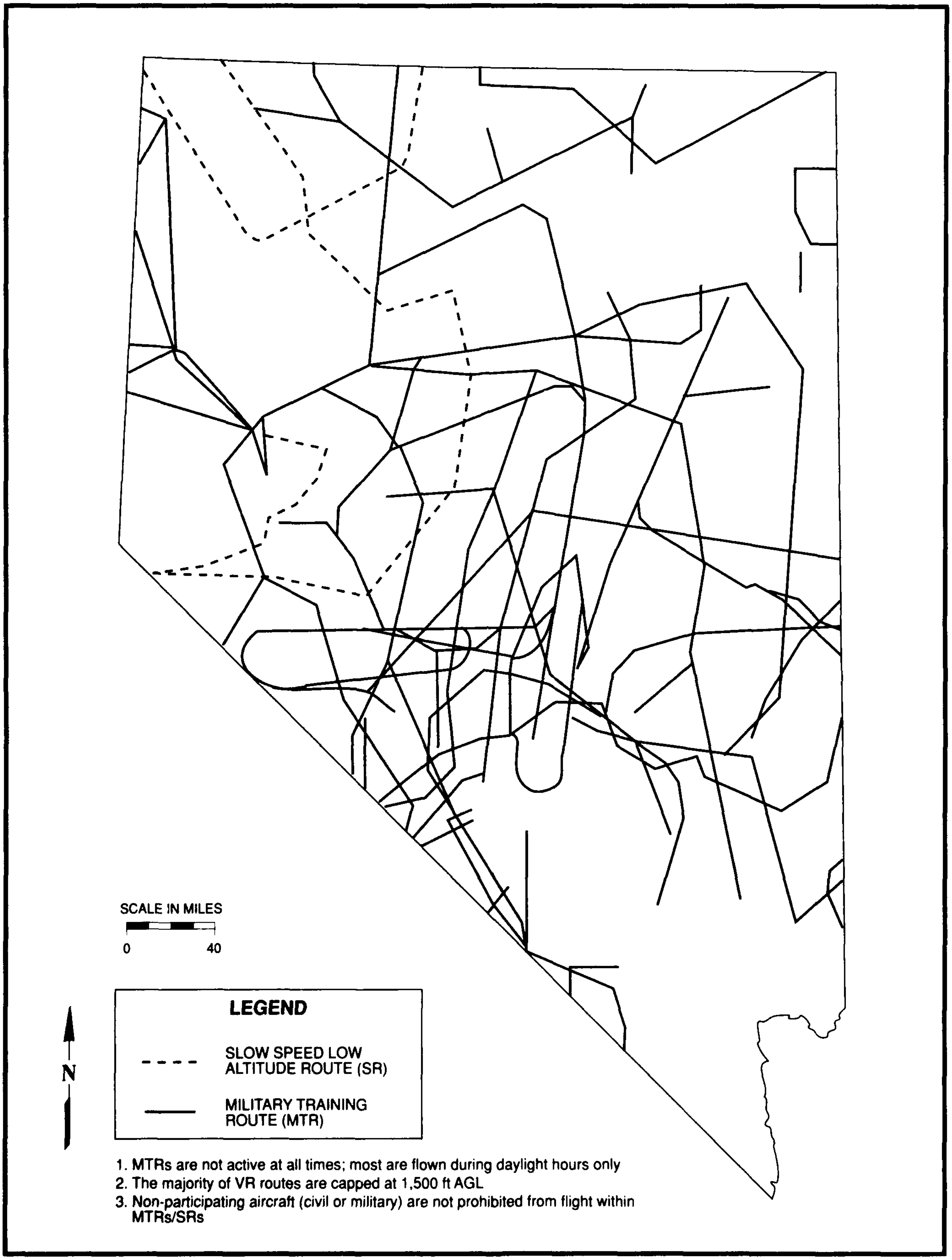


FIGURE 7.2 MILITARY TRAINING ROUTES AND SLOW SPEED LOW ALTITUDE ROUTES TRANSITING NEVADA

of Empire and Gerlach, and extends from 13,000 feet MSL up to, but not including, FL 180, with an overlying ATCAA up to FL 310. The Reno MOA/ATCAA is used for reconnaissance training, air combat training, air refueling, instrument training, flight testing, and proficiency training. Supersonic operations are not permitted, except above FL 300. This MOA is used primarily by the Nevada ANG at Reno. During 1988, the Reno MOA averaged 283 sorties per month, of which 94 percent were flown by RF-4C aircraft and 6 percent were flown by C12J aircraft for proficiency training and transport of passengers (Source: Nevada Air National Guard, not dated). Changes in control of the Reno MOA are not expected by the year 2000. The number of sorties are projected to increase by 20 percent to approximately 340 per month. The RF-4C aircraft will be replaced by the F-16 aircraft. The number of sorties by aircraft-type will remain proportionately about the same (Source: Nevada Air National Guard, not dated).

7.1.4 UTAH TEST AND TRAINING RANGE AIRSPACE

Three MOAs with overlying ATCAAs and two restricted areas over Nevada are used for defense-related activities as part of the UTTR (Figure 7.1). The Gandy MOA and its overlying ATCAA are over eastern portions of Elko and White Pine counties and contain about 1,149 square miles of airspace. The Gandy MOA extends from 100 feet above ground level (AGL) up to but not including FL 180, with an overlying ATCAA up to FL 580. Approximately half of the Lucin A MOA (1,181 square miles) and all of the Lucin C MOA (160 square miles) are over Nevada. The Lucin A and C MOAs extend from 100 feet AGL to 9,000 and 6,500 feet MSL, respectively. The three MOAs are used for flight maneuvers and air-combat training, as well as approaching and departing targets located in the adjacent UTTR restricted areas. Lucin C MOA is also used as a corridor between the north and south ranges of the UTTR (Source: UTTR, 1988).

Restricted Area R-6404C is part of the northern range of UTTR and consists of 198 square miles of airspace over Nevada. It is used in conjunction with other portions of R-6404 for air-to-air training using no ordnance. Restricted Area R-6405 includes 715 square miles of airspace over eastern Nevada and is used for air-to-air combat maneuvering. R-6405, along with other restricted areas in the UTTR, are also used for high-speed drone launch and recovery. R-6404C and R-6405 extend from 100 feet AGL to FL 280 and FL 580, respectively.

The UTTR airspace in which supersonic flights occur extends into Nevada overlying northern portions of Restricted Area R-6405 and the northern part of the Gandy MOA. This area is used for supersonic air-to-air operational missions by aircraft moving into and out of ground-target and air-combat training areas within the inner portions of the UTTR. All supersonic flights are conducted under visual flight conditions and during daylight only (Source: U.S. Air Force, Hill AFB, 1985). The average monthly supersonic sorties, most of which are by F-16 aircraft, number approximately 200.

In total, the Gandy, Lucin A, and Lucin C MOAs, and Restricted Areas R-6404C and R-6405 average about 400 sorties per month, most of which are by F-16 aircraft (Source: UTTR, 1988).

The proposed beddown of the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system at Hill AFB will result in LANTIRN activity on the UTTR. There will be no additional takeoffs or landings at Hill and no additional use of the Utah Test and Training Range (UTTR) associated with the beddown of the LANTIRN system. As a result of LANTIRN, there will be an increase in the number of after dark sorties during some mon ths of the year.

The proposed action will result in a shift of some of the existing daytime operations to after dark, which will increase the number of low-level flights after dark by 20 percent. LANTIRN involves no change to existing aircraft operations other than the shift of some 388 Tactical Fighter Wing (TFW) operations from daytime to after dark and a 20 percent increase in low-level (1,100 feet or less AGL) 388 TFW after dark sorties.

Nevertheless, noise impacts in the UTTR are related to existing conditions and will not change as a result of LANTIRN.

7.1.5 MILITARY TRAINING ROUTES

Planners of MTRs try to align routes so that disturbance to people and property is minimized (Source: U.S. Department of Transportation, 1988). In addition, each MTR is defined by segment in Department of Defense (DOD) Flight Information Publication AP/1B (Source: Defense Mapping Agency, 1988) and has special operating instructions regarding avoidance of airports and specified safety or noise-sensitive towns, populated areas, and some wildlife habitat areas. Since many of these routes are directed to or from MOAs or training ranges, overflight of some residential land, farms or ranches unavoidably occurs.

Procedures in Federal Aviation Administration (FAA) Handbook 7610.4 (Source: Department of Transportation, 1988) that outline the design and use of MTRs are directed toward the safe use of these low-level training routes. MTRs must be limited to the extent practicable to support operational requirements while accommodating the maximum number of users and activities on the same route. They are designed to avoid charted, uncontrolled airports by 3 nautical miles or 1,500 feet AGL. If these avoidance criteria are impractical, procedures are established to minimize conflict with airport traffic. Routes are also aligned so that disturbance to persons or property on the ground is minimized.

Each MTR is charted and described in Flight Information Publications. These descriptions include any route or altitude restrictions associated with airfields, obstacles, populated areas, etc. Procedures require military scheduling agencies to confirm with the tie-in FAA Flight Service Station (FSS) the planned use of each route at least two hours prior to use. Schedule changes or cancellations are required to be communicated to the tie-in FSS. The FAA is required to post route depiction charts in FSS flight briefing areas, publicize the MTR program through letters to airmen and pilot briefings, and distribute appropriate aeronautical charts depicting MTRs.

Fifty-nine MTRs and four SRs overlying Nevada are controlled, scheduled, and used by various components of the Air Force and Navy. The locations of the routes are published in Sectional Aeronautical Charts published by the U.S. Department of Commerce, and detailed descriptions of the routes are provided in DOD Flight Information Publication AP/1B (Source: Defense Mapping Agency, 1988). Figure 7.2 depicts the MTRs and SRs in Nevada. Times of use may be obtained from FAA Flight Service Stations. Table 7-1 summarizes the scheduler of the routes, the number of Visual Routes (VRs), Instrument Routes (IRs), SRs, and the typical aircraft using the routes. Table 7-2 indicates the average frequency of use for each MTR overlying Nevada.

MTRs are generally used for low-level tactics and navigation training. Seven IRs in Nevada are occasionally used for unmanned aerospace vehicle operations (escorted, unarmed cruise missiles). IRs and VRs permit aircraft speeds in excess of 250 knots while SRs are flown at airspeeds of 250 knots or less. Non-participating aircraft are not prohibited from flying within an MTR. The following general information applies to all MTRs within Nevada: all segments are generally flown; most operations are flown within 500 feet of the lowest published altitude for each route segment; power settings average 90 percent with airspeeds ranging between 360 to 550 knots for high performance jet aircraft, and 220 to 325 knots for large cargo and bomber jet aircraft; supersonic flights are not flown on MTRs; most VRs and SRs are flown between 7:00 a.m. and 10:00 p.m.; and less than 10 percent of IRs are flown between 10:00 p.m. and 7:00 a.m.

There are few proposed changes to the existing MTRs in Nevada. Nellis Air Force Base (AFB) proposes to reroute segments of VR-1225 and add two new exit points, and to lower the floor of one segment of IR 286 from 500 to 100 feet AGL (Section 2.1.5.2).

There is a Navy mission requirement to provide target acquisition training in a dense radar/visual environment. The Hawthorne Army Ammunition Plant (HWAAP) provides an airborne radar presentation that simulates such an environment and is within the tactical range of Naval Air Station (NAS) Fallon. An on-site survey of HWAAP has been completed. As a result of the survey, plans have been initiated to develop two overlapping IR routes to provide low-altitude, high-speed ingress/egress runs to and from HWAAP and NAS Fallon Range Training Complex (FRTC) (Section 3.1.5) (Source: U.S. Navy, NAS Fallon, 1987).

7.1.6 AERIAL REFUELING ROUTES

AR routes consist of tracks or racetrack pattern anchors that are used during transfer of fuel from a tanker aircraft to various types of receiving aircraft during flight. The air refueling track is the arrangement preferred by operators of heavy (bomber and airlift) receiver aircraft. These less maneuverable aircraft are better suited to the track operation, which minimizes the number of turns required while the tanker and receiver aircraft are in formation. Often, a combination of power limitations, aerodynamic limitations, and aircrew training requirements will permit only one or two major turns during an hour long air refueling. An anchor is used for more maneuverable fighter aircraft and consists of a pattern of parallel legs and wide turns. The flight pattern is nominally 20 by 50 miles within

Table 7-1. Military Training Routes/Slow Speed Training Routes with Flight Segments in Airspace Over Nevada.

Command/Scheduler	Number of Routes IR	VR	SR	Typical Aircraft
SAC/HQ	12	0	0	B-52, FB-111, B-1
TAC/Nellis AFB	1	2	0	F-16, F-15, A-7, A-4
TAC/George AFB	4	1	0	F-111, F-4, F-16
TAC/Mountain Home AFB	5	0	0	F-111, F-4, F-16
TAC/Edwards AFB	7	1	0	Cruise Missile, F-4 (IRs); B-1, FB-111, F-15/16 (VRs)
TAC/Hill AFB	2	0	0	F-16
ANG/Boise	1	2	0	RF-4, F-111, B-52 (IR)
COMSTRKFIGHTWINGPAC/ NAS Lemoore	1	15	0	F-4, A-7, F/A-18, F-111, A-6
COMMATVAQWINGPAC/ NAS Whidbey	0	2	0	A-6, EA-6, F-4, F-111
MCAS/El Toro	2	0	0	F-14, F-4, A-6, F/A-18
MAC/Travis AFB	0	0	4	C-141, C-5, C-130 Slow Speed Helicopters
TAC/Norton AFB	0	1	0	C-141
TOTAL	35	24	4	

Table 7-2. Military Training Route Summary (Based on 1988 data and projections).

MTR(1)	Average Monthly Flights Present	Average Monthly Flights 2000	Aircraft
HQ SAC			
IR126	69	83	B-1 B-52 FB111
IR264	1	2	B-52 FB111
IR266	3	4	B-52 FB111
IR275	39	47	B-52 B-1 FB111
IR279	3	4	B-52 FB111 B-1
IR285	1	1.5	B-52 FB111
IR290/ IR290A	38	46	B-52 FB111
IR293	29	35	B-52 B-1 FB111
IR300/ IR300A	260	312	B-52 FB111
IR310	4	5	B-52 FB111

Table 7-2. Military Training Route Summary (continued).

MTR[1]	Average Monthly Flights Present	Average Monthly Flights 2000	Aircraft
Nellis AFB, 57 FWW			
IR286	219	197	A-4 A-7 F-16
VR1225	420	504	A-7 AV8,A6 F-16 F-15
VR1406	8	10	A-4 A-7 F-16
George AFB, 35 TTW[2]			
IR204	20	5	F-4
IR233	6	1	F-4
IR256	15	5	F-4
IR298	30	5	F-4
VR1214	50	5	F-4 B-1 F111
Mountain Home AFB, 366 TFW			
IR280	24	29	F111
IR281	28	34	F111 F-4
IR282	12	14	F111 F-16

Table 7-2. Military Training Route Summary (continued).

MTR[1]	Average Monthly Flights Present	2000	Aircraft
Mountain Home AFB, 366 TFW (continued)			
IR303	198	237	F111 F-4 A-6
IR304	205	246	F111 F-4
Edwards AFB, AFFTC			
IR200	10	12	F-4 A-6 for Cruise missile escort
IR206	0	.25	A-3, F-4, A-7 for Cruise missile escort
IR234	5	6	F-4 for Cruise missile escort
IR235	5	6	F-4 for Cruise missile escort
IR237	.2	.3	F-4 for Cruise missile escort
IR238	7	8	F-4 for Cruise missile escort

Table 7-2. Military Trainin̲g Route Summary (continued).

MTR[1]	Average Monthly Flights Present	2000	Aircraft
Edwards AFB, AFFTC (continued)			
IR425	.5	.6	F-4 for Cruise missile escort
VR1205	16	19	B-1 F111 F15/16
Hill AFB, 299 RCS			
IR261	49	59	F-16 various fighters & bombers
IR265	49	59	F-16 various fighters & bombers
Boise ANG, 124 TRG			
IR302	97	116	B-52, A-6 RF-4 F111
VR1300	112	134	F111 RF-4
VR1304	12	14	F111 RF-4

Table 7-2. Military Training Route Summary (continued).

MTR(1)	Average Monthly Flights Present	Average Monthly Flights 2000	Aircraft
NAS Lemoore COMSTRKFIGHTWINGPAC			
IR207	23	25	F111 T38 F-4 Others
VR201	202	222	F-4 A-7 F/A-18 Others
VR202	55	60	F/A-18 A-7 F-4 F-4 Others
VR208	107	117	F-4 A-7 EA/A6 F/A-18 Others
VR1250	74	81	A-7 F-4 Others
VR1251	30	33	F-4 A-7 F111 Others
VR1252	29	32	A-7 A-4 F-14 A-6

Table 7-2. Military Training Route Summary (continued).

MTR(1)	Average Monthly Flights Present	2000	Aircraft
NAS Lemoore COMSTRKFIGHTWINGPAC (continued)			
			F-8 S-3 Others
VR1253	12	14	F111 F/A-18 A-7 F-4 F-16 Others
VR1254	83	91	F-4 Others
VR1255	68	75	F-4 F/A-18 A-4 Others
VR209	19	22	A-7 F111 A-6 F-4 Others
VR1259	64	70	F-4 Others
VR1260	21	23	A-7 F/A-18 F-4 A-6 F-8 Others

Table 7-2. Military Training Route Summary (continued).

MTR[1]	Average Monthly Flights Present	2000	Aircraft
NAS Lemoore COMSTRKFIGHTWINGPAC (continued)			
VR1261	35	39	A-7 F-4 F/A-18 A-4 F111 E/A6 Others
VR1262	35	39	A-7 F111 F-14 B1B F-4 Others
VR1264	45	50	A-7 F-4 A-6 A-7 F/A-18 Others
El Toro MCAS			
IR213	21	24	F-14 F-4
IR217	126	138	A-6 F/A-18 F-4 A-4 F-14 Others

Table 7-2. Military Training Route Summary (continued).

MTR[1]	Average Monthly Flights Present	Average Monthly Flights 2000	Aircraft
NAS Whidbey Island COMMATVAQWINGPAC			
VR1352	50	55	A/EA6 F111 F-4 Others
VR1353	25	28	A/EA6 F111 RF4
Travis AFB			
SR300/SR301	30	150	C141 C-5 C130
SR381/SR312	5	6	C-141 C-5
Norton AFB[2]			
VR299	30	36	AV-8 C141 Others

(1) 4-digit identifier indicates that all flight segments are below 1,500 ft Above Ground Level (AGL); 3-digit identifier indicates routes that have some segments above 1,500 ft AGL.

(2) George AFB and Norton AFB are scheduled to close no later than 1995. Disposition of the associated MTRs is unknown. The MTRs have been maintained in the analysis for year 2000.

an assigned airspace area of 28 by 84 miles. Often, the anchor will be served by a military radar unit, who will direct the tanker-receiver rendezvous. A track is typically operated in airspace controlled by an FAA ARTCC, and the tanker and receiver conduct their own rendezvous. Each AR is defined in DOD Flight Information Publication AP/1B (Source: Defense Mapping Agency, 1988).

There are 14 individual ARs in Nevada as shown in Figure 7.3. Table 7-3 shows the average number of refueling missions per month for each AR, the agency to which the AR is assigned, and projected refueling missions in the year 2000. There are no major proposed changes to the control, boundaries, or patterns in aerial refueling routes within Nevada with the exception of those identified in Table 7-3 as supporting the SR-71 aircraft, which are now retired from service. Future disposition of those routes will be determined by Headquarters, Strategic Air Command (HQ SAC). Air Force refueling missions are expected to increase 20 percent by the year 2000 as other airspace usage in Nevada increases; Navy refueling missions are expected to increase 10 percent by the year 2000.

FAA Handbook 7610.4 establishes criteria for the design and use of Aerial Refueling Tracks and Anchors which provide for the safe and efficient refueling operations in airspace, with a minimal effect on the air traffic system. The conduct of refueling operations is based on the strict requirement that participating aircraft remain within specifically designated airspace. Since AR airspace is nonrestrictive and refueling operations are normally conducted at or above 18,000 feet MSL, they do not pose any conflicts for VFR traffic. IFR aircraft are provided separation by air traffic control from aircraft engaged in refueling operations.

7.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

This section describes effects on public health and safety that result from the defense-training use of airspace discussed in this chapter. Sources of potential effects and analysis of effects on public health and safety are identified.

7.2.1 GROUND MOTION

Defense-related use of the airspace discussed in this chapter does not result in ground motion.

7.2.2 AIR QUALITY

Emissions from military aircraft are excluded from regulation under the Clean Air Act. Nevertheless, the amount of pollutants from aircraft emissions and the extent to which these pollutants contribute to deterioration of air quality were estimated. The National Ambient Air Quality Standards (NAAQS) developed by the Environmental Protection Agency (EPA) are presented in Table 1-3, in Section 1.4.1.2.

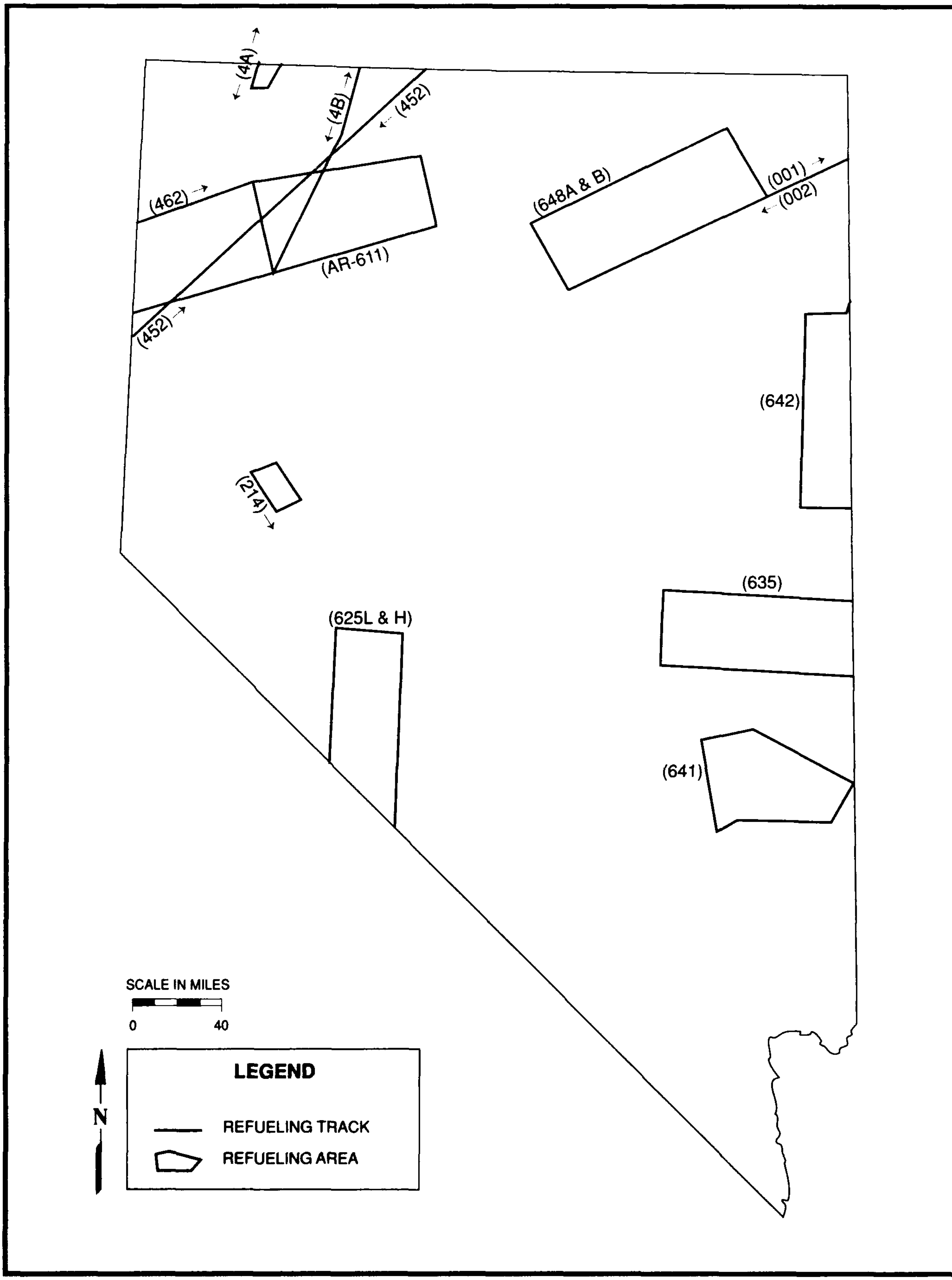


FIGURE 7.3 AERIAL REFUELING TRACKS AND REFUELING AREAS

Table 7-3. Summary of Aerial Refueling Routes Over Nevada.

AR Number (Agency)	Altitude[1]	Average Monthly Refueling Mission Present	Projected (2000)
001 (Castle)	FL 280-310	20	24
002 (Castle)	FL 240-260	12	14
AR 4A/B (Fairchild)	FL 280-310	(4A) 30 (4B) 20	36 24
AR 214 (NAS Fallon)	15,000-17,000	20	22
AR 452[2] (Beale)	FL 240-260	6	7
AR 462[2] (Beale)	FL 250-270	4	5
AR 611[2] (Beale)	FL 250-270	4	5
AR 625 Low/High[3] (George)	FL 180-210(L) FL 230-250(H)	84	100
AR 635 (Nellis)	FL 190-260	9	11
AR 641 (Nellis)	12,000-FL 230	6	7
AR 642 (Hill)	17,000-FL 280	42	50
AR 648A/B (Salt Lake ANG.)	FL 190-230	16	18

[1] All altitudes represent feet above near sea level; Flight Level (FL) is used in the aviation venacular for expressing altitudes of 18,000 and above, based on aircraft use of a standard altimeter setting at these altitudes.

[2] These aerial refueling routes were designed to support the SR-71 which has now been retired from service. Future disposition of these routes has not yet been determined by Headquarters, Strategic Air Command.

[3] George AFB is scheduled to close no later than 1995. Disposition of these routes has not yet been determined.

Aircraft activities in the MOAs discussed in this chapter generate a small quantity of air pollutants over Nevada. Based on the flight track and profile data for these areas, emission estimates were developed for the present use and for the projected use in the year 2000. Table 7-4 summarizes the emissions data by MOA under the column labeled "Emission Rate (tons/year)." The methods used to estimate the amount of pollutants from aircraft emissions provided a conservative (i.e., health protective) somewhat better than worst case result.

A widely-used approach was employed to estimate the effects of aircraft emissions in the MOAs on ambient air quality. All military aircraft emissions within a given airspace were assumed to be contained within the lateral dimensions of the airspace and within a vertical dimension equal to the mean afternoon mixing height of approximately 8,000 feet AGL. By dividing the mass of pollutants emitted on a typical day by the volume of airspace, a typical daily concentration generated by aircraft was estimated for each pollutant. The results, summarized in Table 7-4 under the column labeled "Concentration ($\mu g/m^3$)" for both the present year and for the year 2000, compared to NAAQS for each pollutant, indicate the extremely small effect on air quality by military aircraft in the MOAs.

Flight tracks and profiles for the MTRs and estimated MTR activity factors were applied to the air pollution emission characteristics for each aircraft type on each MTR for both the present use and the projected year 2000 use. The aircraft emission data were taken from the Air Force Aircraft Engine Emissions Estimator (Source: U.S. Air Force, 1985), assuming that each aircraft uses the full-throttle setting. Each sortie is assumed to cover the full length of the MTR, so each aircraft's length of time in the MTR was calculated by dividing the MTR length by the typical aircraft speed (for each type of aircraft) at the full-throttle setting. The total annual emissions generated by each type of aircraft for each MTR was computed by multiplying the annual number of sorties times the length of time in the MTR times the engine emission rate (at full throttle) for each pollutant of concern. The annual emission rates for each pollutant for each type of aircraft were then summed to give a total emission rate for each MTR.

Table 7-5 summarizes the MTRs that had the smallest and largest emission rates and pollutant concentrations for the present and the year 2000. The concentration amount shown in Table 7-5 is an estimate of the air quality effect from the aircraft emissions. These estimates were made under the same assumptions specified for the MOAs. The largest concentration calculated for any MTR is for IR 300A, with the results much less than one percent of the corresponding NAAQS for each pollutant. These results indicate the minimal effect of military aircraft using MTRs on the ambient air quality of Nevada.

Air emissions associated with ARs consist of engine emissions from the tanker and receiving aircraft, and evaporative losses during fuel transfer. Since refueling activities are associated with aircraft sorties previously discussed in the airspace analyses, the air quality effects due to engine emissions from receiving aircraft have already been considered. Actual emissions during refueling operations are lower due to the use of lower power settings. The effects due to engine emissions from tanker aircraft are summarized in Table 7-6. These emissions are much less than for MTR traffic because of the much lower frequency of

Table 7-4. Summary of Aircraft Exhaust Emissions and Estimated Ambient Air Quality Impacts (Concentrations) for Other MOAs in Nevada.

Airspace	Area (mi^2)	Year (P/F)[2]	Emission Rate (tons/year) CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]	Concentration ($\mu g/m^3$)[1] CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]
GANDY	1,308	P	46.50	8.41	380.81	22.15	20.79	0.0203	0.0036	0.1664	0.0096	0.0090
		F	55.78	10.09	456.82	26.58	24.95	0.0243	0.0044	0.1996	0.0116	0.0109
HART	982	P	55.80	1.09	113.57	9.83	9.50	0.0324	0.0006	0.0661	0.0057	0.0055
		F	6.28	0.65	187.04	2.35	6.15	0.0036	0.0003	0.1089	0.0013	0.0035
LUCIN	1539	P	46.50	8.41	380.81	22.15	20.79	0.0172	0.0031	0.1414	0.0082	0.0077
		F	55.78	10.09	456.82	26.58	24.95	0.0207	0.0037	0.1697	0.0098	0.0092
PARADISE	3,128	P	94.28	4.75	615.88	23.05	36.56	0.0172	0.0008	0.1125	0.0042	0.0066
		F	31.74	3.64	802.39	12.64	39.37	0.0058	0.0006	0.1466	0.0023	0.0071
RENO	1,381	P	164.70	3.38	371.71	29.46	29.34	0.0681	0.0013	0.1539	0.0121	0.0121
		F	20.32	2.14	596.18	7.78	19.91	0.0084	0.0008	0.2468	0.0032	0.0082

[1]Micrograms per cubic meter
[2]P = Present; F = Future (year 2000)
[3]Carbon Monoxide
[4]Hydrocarbons
[5]Oxides of Nitrogen
[6]Particulate Matter
[7]Oxides of Sulfur

Table 7-5. Extreme Cases of Aircraft Exhaust Emission Rates and Concentrations of Pollutants that Affect Air Quality for Nevada MTRs.

Extremes	Year (P/F)[1]	Items	CO[2]	HC[3]	NO_x[4]	PM[5]	SO_x[6]
EMISSION RATE (Tons/Year)							
Smallest		MTR	IR237	IR237	IR237	IR237	IR237
	P	Rate	0.03	0.00	0.05	0.00	0.00
	F		0.05	0.00	0.11	0.01	0.01
Largest		MTR	IR300A	IR300A	IR300A	IR300A	IR300A
	P	Rate	97.82	34.54	582.27	99.58	51.20
	F		127.20	37.52	619.20	104.51	56.60
DAILY CONCENTRATION (Micrograms/Cubic Meter)							
Extremes	Year (P/F)[1]	Items	CO[2]	HC[3]	NO_x[4]	PM[5]	SO_x[6]
Smallest		MTR	IR282, IR285 IR206, VR1406	IR264, IR285 IR282, IR200	IR425, IR237 IR206	IR282, IR425 IR238, IR206	IR264, IR285 IR282, IR425
	P	Amount	0.00	0.00	0.00	0.00	0.00
	F		0.00	0.00	0.00	0.00	0.00
Largest		MTR	IR300A	IR300A	IR300A	IR300A	IR300A
	P	Amount	0.031	0.011	0.188	0.032	0.016
	F		0.041	0.012	0.200	0.034	0.018

(1) P = Present; F = Future (year 2000)
(2) Carbon Monoxide
(3) Hydrocarbons
(4) Oxides of Nitrogen
(5) Particulate Matter
(6) Oxides of Sulfur

Table 7-6. Summary of Aircraft Exhaust Emissions and Estimated Ambient Air Quality Impacts (Concentrations) for Aerial Refueling Tracks.

Airspace	Year (P/F)[2]	Emission Rate (tons/year)					Daily Concentration ($\mu g/m^3$)[1]				
		CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]	CO[3]	HC[4]	NO_x[5]	PM[6]	SO_x[7]
AR 214	P	3.57	0.36	39.58	1.21	2.51	0.0012	0.0001	0.0142	0.0004	0.0009
	F	3.91	0.39	43.41	1.33	2.74	0.0014	0.0001	0.0156	0.0004	0.0009
AR 452	P	3.94	1.81	68.32	3.75	21.16	0.0005	0.0002	0.0098	0.0005	0.0030
	F	4.53	2.17	81.49	4.46	24.90	0.0006	0.0003	0.0117	0.0006	0.0035
AR 459	P	3.94	1.81	68.32	3.75	21.16	0.0007	0.0003	0.0135	0.0007	0.0041
	F	4.53	2.17	81.49	4.46	24.90	0.0008	0.0004	0.0161	0.0008	0.0049
AR 462	P	2.63	1.21	45.55	2.50	14.11	0.0004	0.0001	0.0070	0.0003	0.0021
	F	3.28	1.51	56.94	3.13	17.63	0.0005	0.0002	0.0087	0.0004	0.0027
AR 611	P	2.63	1.21	45.55	2.50	14.11	0.0004	0.0002	0.0082	0.0004	0.0025
	F	3.28	1.51	56.94	3.13	17.63	0.0005	0.0002	0.0102	0.0005	0.0031
AR 625	P	54.73	25.80	968.96	53.09	297.74	0.0071	0.0033	0.1265	0.0069	0.0388
	F	65.17	30.69	1,152.9	63.17	354.38	0.0085	0.0040	0.1505	0.0082	0.0462
AR 635	P	5.85	2.78	104.26	5.71	31.96	0.0014	0.0006	0.0250	0.0013	0.0076
	F	7.16	3.38	127.04	6.96	39.01	0.0017	0.0008	0.0305	0.0016	0.0093
AR 641	P	3.95	1.88	70.46	3.86	21.60	0.0007	0.0003	0.0129	0.0007	0.0039
	F	4.53	2.17	81.49	4.467	24.90	0.0008	0.0003	0.0149	0.0008	0.0045
AR 642	P	32.83	15.43	579.67	31.77	178.29	0.0060	0.0028	0.1065	0.0058	0.0327
	F	32.59	15.35	576.46	31.59	177.19	0.0059	0.0028	0.1059	0.0058	0.0325
AR 648	P	10.45	4.89	183.97	10.09	56.64	0.0019	0.0008	0.0338	0.0018	0.0104
	F	11.76	5.50	206.75	11.34	63.69	0.0021	0.0010	0.0379	0.0020	0.0117

(1)Micrograms per cubic meter
(2)P = Present; F = Future (year 2000)
(3)Carbon Monoxide
(4)Hydrocarbons
(5)Oxides of Nitrogen
(6)Particulate Matter
(7)Oxides of Sulfur

tanker activity and the higher altitude of the operations. Operational practice and mechanical safeguards prevent any significant amounts of fuel spillage during aerial refueling, thereby minimizing evaporative hydrocarbon losses. The relatively low frequency of refueling missions, combined with the high altitude of the operations, does not result in air pollution concentrations that would affect public health and safety.

7.2.3 WATER QUALITY AND FLOOD HAZARD

Defense-related use of airspace discussed in this chapter has no effect on water quality and flood hazard.

7.2.4 IONIZING RADIATION

Defense-related use of airspace discussed in this chapter does not result in ionizing radiation.

7.2.5 NON-IONIZING RADIATION

Electromagnetic radiation hazards discussed in this section are only those that result from radio frequency (RF) radiation or microwave radiation. Emissions from RF/microwave generating sources are lower in energy than those of ionizing or visible (light) radiation. Systems producing RF/microwave radiation include radio transmitters, radar systems, and microwave communication systems.

Military aircraft using the airspace discussed in this chapter have on-board radar systems. Because of their low energy these systems pose no hazard to the general public, nor should they cause electromagnetic interference with other electronic systems. Radio frequency radiation (RFR)-related biological hazards do not exist and electromagnetic interference is controlled through the use of Air Force and Navy frequency assignments.

Lasers are not used in the airspace discussed in this chapter, therefore, there are no hazards to public health and safety. No changes in effects are anticipated for the year 2000.

7.2.6 SOLID AND HAZARDOUS WASTE

Defense-related use of airspace discussed in this chapter does not result in solid or hazardous waste.

7.2.7 NOISE AND SONIC BOOM

7.2.7.1 Military Operations Areas

The Hart, Paradise, and Reno MOAs are normally used for high-altitude flight training at subsonic flight speeds, and aircraft noise is not known to affect public health and safety on overflown land areas.

The only noticeable incidence of aircraft noise and sonic boom in the Gandy, Lucin A, and Lucin C MOAs is caused by aerial combat training in the supersonic flight area of the UTTR. This area was addressed by the Air Force in Environmental Impact Statement (EIS) documents in 1983 (Source: U.S. Air Force, Hill AFB, 1985a) and 1985 (Source: U.S. Air Force, Hill AFB, 1985b). In these documents, the entire area authorized for supersonic flight was estimated to accommodate 1,050 sorties per month that would include supersonic events. In 1988, an estimated 200 supersonic sorties per month occurred in this area over Nevada.

L_{Cdn} contours for the supersonic portion of UTTR airspace in Nevada are illustrated in Figure 7.4, based on estimates of 1988 supersonic sorties. The Nevada segments of these ellipses consist of approximately 640 square miles within the L_{Cdn} 45 dB contour, 320 miles within the L_{Cdn} 50 dB contour, and 60 square miles within the L_{Cdn} 60 dB contour. The portion of Nevada lying under these contours has very few, if any, permanent residents. The number of recreationists using this land cannot be quantified with existing studies. If any recreational use occurs, recreationists may be annoyed periodically by noise and startle effects associated with sonic booms.

7.2.7.2 Military Training Routes

Studies of low-level Strategic Air Command (SAC) and Tactical Air Command (TAC) routes and the resulting noise impingement on overflown land (Source: U.S. Air Force, ARML, 1987) have shown that cumulative noise exposure under the routes depends on aircraft type, power, altitude, and lateral spread of the actual flight paths relative to the route centerline or the mean (average) flight path used. IR flights track closely to route centerlines and result in a greater concentration of noise exposure immediately under the mean flight path, whereas VR flights tend to be more dispersed (due to tactical maneuvering) and have a wider distribution of noise exposure at ground level. These characteristics have been included in a ROUTEMAP computer program developed for the Air Force to predict noise exposure from low-level MTRs. This type of environmental noise analysis has been previously performed for SAC low-level routes in New Mexico (Source: U.S. Air Force, HQ SAC, 1989) and, in a more general manner, for TAC and SAC routes in other states.

Table 7-7 summarizes the land areas and resident populations estimated to be noise impacted by the MTRs controlled by each command/scheduler. An estimate of the numbers of residents who would be expected to be "highly annoyed" by the aircraft noise exposures is also tabulated. Estimates of highly annoyed populations are based on the relationship between L_{dn} and annoyance discussed in Section 1.4.1.7 and illustrated in Figure 1.7. These estimates are based on rural township population densities and avoid double counting of population under route segments shared by more than one MTR.

The noise analysis of each MTR showed that approximately 93 percent of the total noise exposure, in terms of the numbers of people residing within the L_{dnmr} 60 dB contour, is attributable to 10 MTRs. These 10 routes are shown in Figure 7.5. The number of people residing within the L_{dnmr} 60 dB contour for each of these MTRs is shown in Figure 7.6.

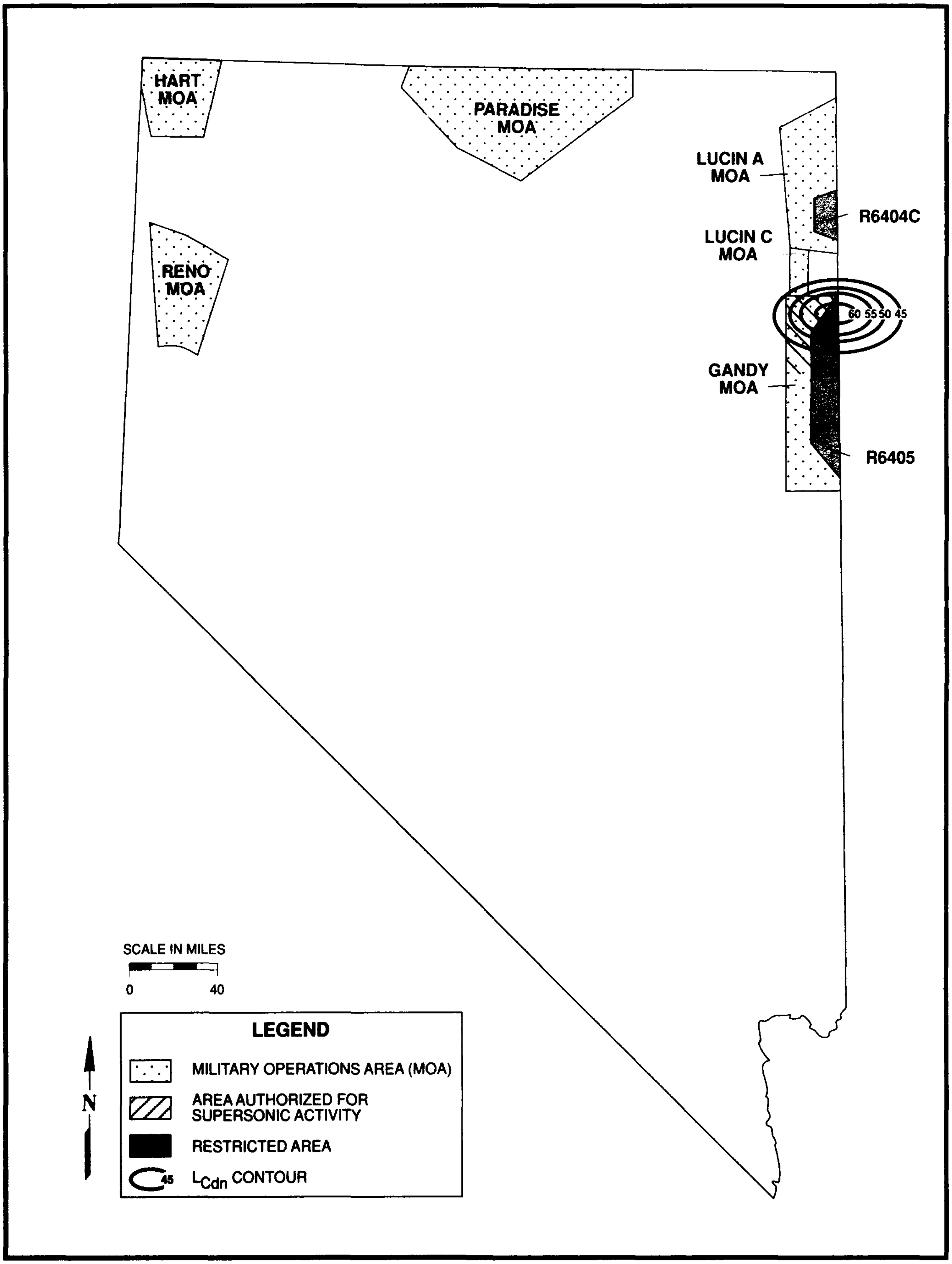
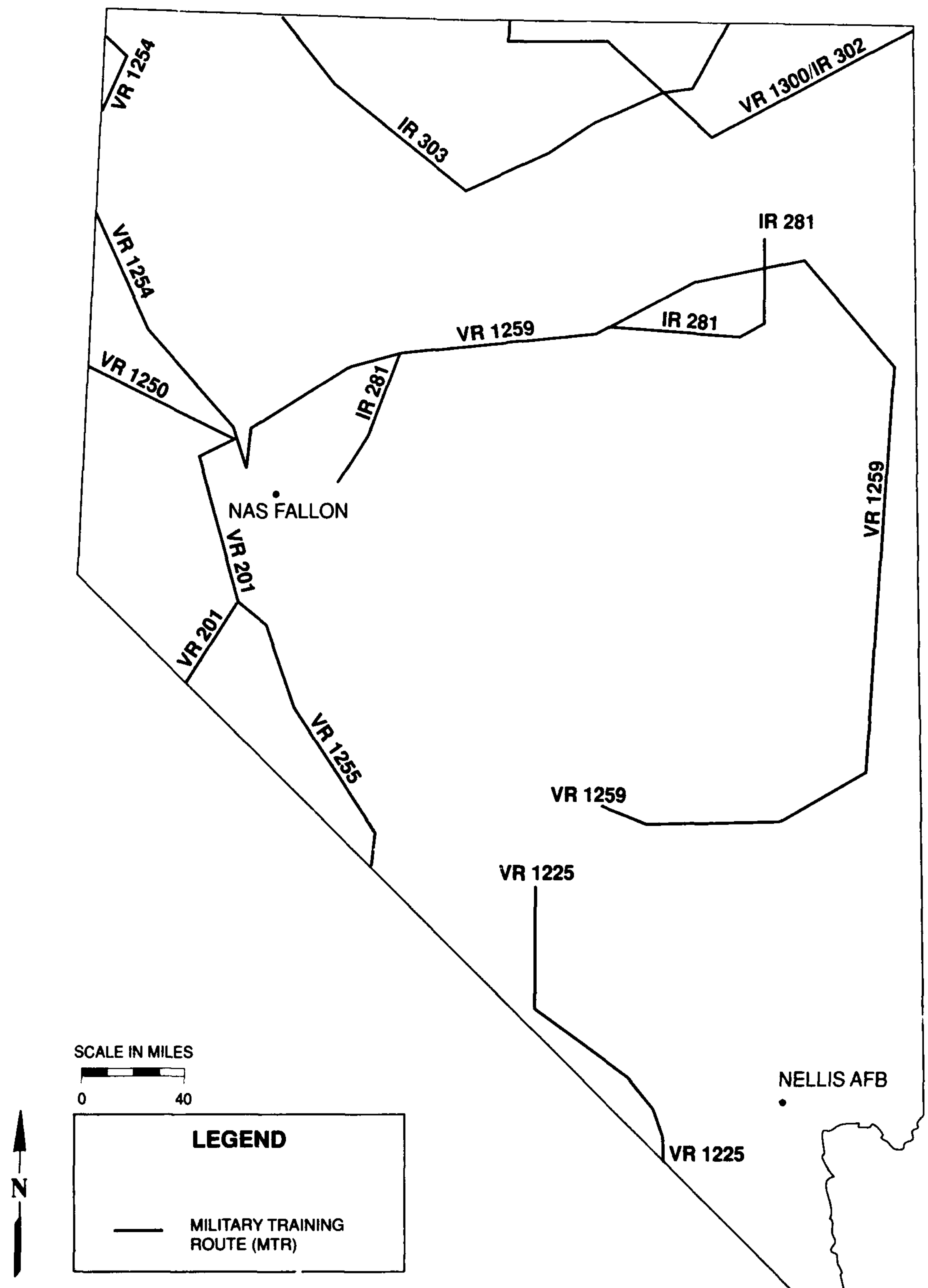


FIGURE 7.4 L_{Cdn} CONTOURS FOR THE UTAH TEST AND TRAINING RANGE (UTTR) SUPERSONIC OPERATING AREA

Table 7-7. Summary of Estimated Land Areas and Populations in Nevada Within 60 dB Contours of Military Training Routes.

Command/ Scheduler	Land Areas (sq. miles) Total[(1)]	Land Areas (sq. miles) Within L_{dnmr} 60 dB[(2)]	Populations Within L_{dnmr} 60 dB[(3)]	Populations Highly Annoyed[(4)]
SAC/HQ	16,834	266	112	11
TAC/Nellis	6,900	688	260	32
TAC/George	3,233	524	150	15
TAC/Mtn Home	8,733	1,439	753	111
TAC/Edwards	7,628	0	0	0
TAC/Hill	322	0	0	0
ANG/Boise	3,334	1,133	709	97
COMSTRKFIGHTWINGPAC/ Lemoore	27,075	4,596	8,085	925
COMMATVAQWINGPAC/ Whidbey	2,422	171	161	16
MCAS/El Toro	325	46	17	2
MAC/Travis	5,662	0	0	0
TAC/Norton	12	0	0	0
TOTALS	82,480	8,863	10,247	1,209

(1) Total land area under MTR airspace (length x width). Coincidental route segments were only counted once.
(2) Total land area within L_{dnmr} 60 dB contour area.
(3) Estimated total population within L_{dnmr} 60 dB contour area.
(4) Estimate of number of people "highly annoyed" based on population exposed at L_{dnmr} 60 dB, 65 dB, and 70 dB.



1. MTRs are not active at all times; most are flown during daylight hours only
2. The majority of VR routes are capped at 1,500 ft AGL
3. Non-participating aircraft (civil or military) are not prohibited from flight within MTRs/SRs

FIGURE 7.5 TEN MOST NOISE EFFECT-PRONE MILITARY TRAINING ROUTES IN NEVADA

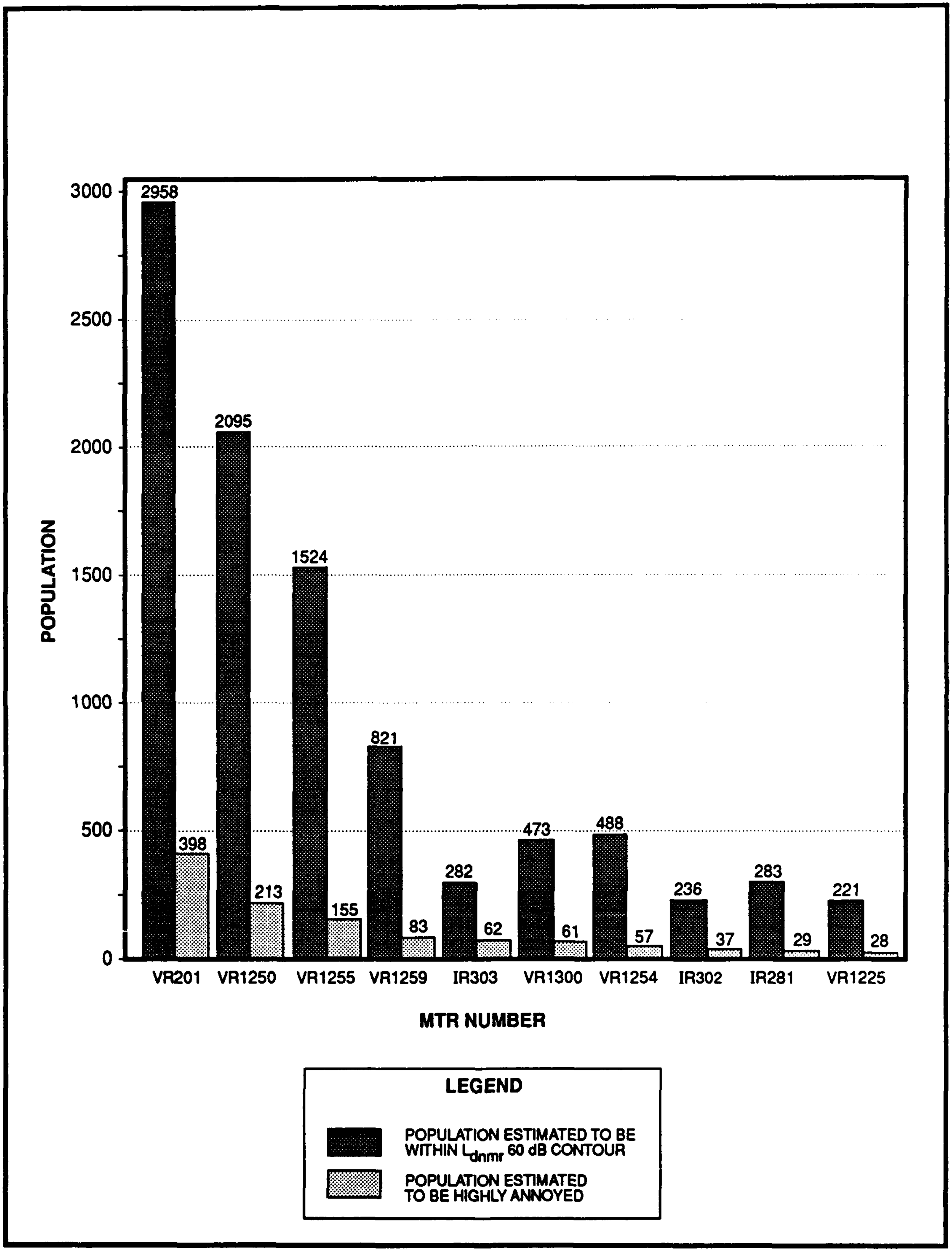


FIGURE 7.6 POPULATIONS ESTIMATED TO RESIDE WITHIN NOISE EXPOSURE CONTOURS FOR TEN MOST NOISE EFFECT-PRONE LOW-LEVEL MTRs IN NEVADA

Noise generated by low-altitude overflights on the 10 busiest MTRs may cause annoyance for a number of people. These overflights may also cause startle reactions in some people.

7.2.8 FACILITY ACCIDENTS

Facility accidents potentially resulting from munitions handling and storage, fuel storage, and hazardous material bulk storage do not result from training activities in airspace discussed in this chapter.

7.2.9 AIRCRAFT MISHAPS

7.2.9.1 Military Operations Areas

Safety of flight in the MOAs discussed in this chapter is governed generally by DOD directives and by regulations and safety programs implemented by the respective using agencies. Accident prevention focuses on remaining within the boundaries of the MOAs during all flight maneuvers, being vigilant for any civil aircraft transiting through the MOAs, and receiving radar traffic advisories from the controlling air traffic or range control agency.

Use of the Reno-Cannon International Airport and the Reno MOA by the 152nd Tactical Reconnaissance Group (TRG) is governed by TAC Regulation 55-4, Volume II (Source: Nevada Air National Guard, Aircrew Operational Procedures, not dated). This regulation includes the designation of a controlled bailout area over Winnemucca Dry Lake in the event a pilot must eject in the Reno vicinity. It also places limitations on practice approaches at Reno-Cannon Airport. Procedures are established in Operational Plan 355-1 (Source: U.S. Air Force, TAC, not dated) for responding to an aircraft accident involving a 152nd TRG aircraft.

The lack of historical mishaps in these MOAs does not mean there is zero risk to the people and property of Nevada. The risk, however, is believed to be lower than the risk estimated for airspace related to Nellis AFB (Section 2.2.8) and NAS Fallon (Section 3.2.9) because of the lack of bombing and gunnery ranges, which have the highest mishap rates. Therefore, potential aircraft accidents in these MOAs do not represent an unreasonable risk to public health and safety. No changes in effects are anticipated for the year 2000.

One aircraft mishap occurred along the transit route between the Reno MOA and the Reno-Cannon Airport. A jet aircraft (RF-4C) crashed in a rural area approximately 10 nautical miles north of Reno-Cannon Airport in transit to the Reno MOA. The Nevada ANG has estimated one mishap per 25,000 sorties. The Nevada ANG flies about 3,200 sorties annually, so the estimated accident rate is one accident every 7.8 years.

The transit route from Reno-Cannon Airport to the Reno MOA is approximately 50 miles long and 10 miles wide. About eight miles of its length is over the urban population zone of Sparks. The population under this flight path was estimated for the years 1988 and 2000 to be 27,630 and 41,440, respectively. The area where the public could be most affected by an accident equals 500 square miles (the area under the transit route). The data suggest that aircraft mishaps do not represent an unreasonable risk to public health and safety in Nevada. No change in effects is anticipated for the year 2000.

7.2.9.2 Military Training Routes

Only one military aircraft mishap is known to have occurred while flying along an MTR (VR 202) in Nevada. The overall low frequency of mishaps along MTRs results in negligible risks to the public from this activity.
No changes in effects are anticipated for the year 2000.

7.2.9.3 Aerial Refueling Routes

Specific procedures are contained in applicable military directives and technical orders which describe the safety techniques used during actual refueling operations. No military aircraft-related mishaps have occurred along aerial refueling routes within Nevada. Risk to the public is considered to be negligible from this activity, and no change is anticipated for the year 2000.

7.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

7.2.10.1 Military Operations Areas

An inadvertent dropped object is the most likely incident which could affect people and property under MOA airspace. The number of dropped objects is assumed to be 1.5 drops per 1,000 sorties (equal to Nellis AFB and Nellis Air Force Range (NAFR), Section 2.2.10). The five MOAs discussed in this chapter have an areal extent in Nevada of approximately 8,000 square miles. Within this area the average population density is conservatively estimated at 9.91 people per square mile in 1988 and 15.37 people per square mile in 2000, yielding a computed population under the MOAs of 79,092 and 122,668 in 1988 and 2000, respectively. The number of sorties in these areas was 13,848 in 1988 with 16,620 sorties projected for the year 2000. Based on the analysis, the chance of personal injury or structural damage is infinitesimal. This analysis suggests that the potential for dropped objects from defense-related aircraft does not represent an unreasonable risk to public health and safety in Nevada. No change in effects is anticipated by the year 2000.

7.2.10.2 Military Training Routes

Release of ordnance along MTRs is prohibited. On routes where ordnance may be carried, master arming switches are maintained in a safe position until entering target areas within restricted airspace. This disarms the explosive devices and delivery systems to prevent any inadvertent drops along the MTRs. If any accidental drop of ordnance occurs or if any object is known to have fallen from an aircraft, directives require that it be reported and investigated as soon as possible. No explosive armaments are known to have been dropped by aircraft while on MTRs or refueling tracks. Nonexplosive dropped objects are assumed to have the same frequency of occurrence as the frequency estimated for NAFR (Section 2.2.10), which is 1.5 drops per 1,000 flights. Land area in Nevada underlying MTRs is approximately 83,000 square miles. A total of 38,792 flights in 1988 occurred on MTRs in Nevada. It is projected that over 44,000 MTR flights could occur by the year 2000. The estimated number of dropped objects along these MTRs is 58 in 1988 and 67 in the year 2000. Based on the probabilistic analysis, the chance of personal injury or structural damage (using 1988 data) is extremely remote. No changes in effects are anticipated for the year 2000.

7.2.10.3 Aerial Refueling Routes

Ordnance may be carried by aircraft during refueling operations, however, all arming systems remain deactivated and any accidental drop of ordnance or aircraft parts would be reported. The probabilistic analysis conducted indicates that there are no unreasonable risks to public health and safety and none are projected for the year 2000.

7.2.10.4 Air Transit Routes

Arming systems are not activated while on any transit routes and reporting requirements for any dropped objects would apply. The probabilistic analysis conducted indicates that there are no unreasonable risks to public health and safety, and none are projected for the year 2000.

7.3 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

Effects on civil and commercial aviation resulting from the defense-related use of airspace are discussed from a statewide perspective in Chapter 8.

7.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

7.4.1 HART MILITARY OPERATIONS AREA

The southern half of the Hart MOA overlays the western portion of the Sheldon National Wildlife Refuge (NWR) and Range. This Refuge and Range complex is characterized by high, semi-desert table lands and rolling hills bisected by narrow valleys and canyons, and interspersed with alkaline lakes, marshes and meadows. This diverse region provides wildlife habitat for many species, including 13 species of raptors, pronghorn antelope, mule deer, sage grouse, chukar, California quail, and many species of waterfowl. Nearly 11 percent of the Nevada range of the western screech owl is located under this airspace. The use of this MOA for approximately 50 supersonic flights annually may affect wildlife in the area, but the operational restriction of FL 300 for supersonic flight lessens the potential effect. There are also a number of low altitude flight paths entering and leaving this area. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight on Hart MOA.

7.4.2 PARADISE MOA

The Paradise MOA overlays portions of the Nevada range of various species of raptors including the Cooper's hawk (4%), prairie falcon (4%), flammulated owl (5%), and sawwhet owl (5%), as well as portions of the Nevada ranges of sage grouse (8%) and blue grouse (5%). The Nevada Department of Wildlife (NDOW) reintroduced bighorn sheep beneath the Paradise MOA in recent years. Nineteen percent of mountain quail range in Nevada is located under the Paradise MOA, as well as 12 percent of Nevada's intermediate-quality waterfowl habitat. Because the minimum altitude for aircraft operations in this MOA is 14,500 feet MSL, its potential for effects on wildlife is slight, although the potential cannot be determined based on existing information. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight on Paradise MOA.

7.4.3 RENO MOA

Lands beneath the Reno MOA provide habitat for 17 raptor species and 8 game species. In particular, eight percent of the Nevada range of the Cooper's hawk is located under the Reno MOA. Bighorn sheep have been reintroduced beneath this MOA. The 13,000 feet MSL minimum altitude for aircraft operations in the Reno MOA lessens many potential effects to wildlife. However, white pelicans (*Pelicanus erythrorhynchos*) may be vulnerable to bird-aircraft strikes within and around this MOA. The largest white pelican rookery in North America occurs on Anaho Island in Pyramid Lake. Flight paths in this area traverse flight areas commonly used by these birds. Low altitude transit in and out of the Reno MOA may have effects on these birds and other waterfowl using Pyramid Lake and other wetlands in northwestern Nevada. Although Anaho Island is not located beneath the Reno MOA, there is reportedly a high incidence of overflight of the island (Source: Ed Tilzey, BLM, personal communication, 1990). Some of these flights may be in transit to or from the Reno MOA. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight on Reno MOA.

7.4.4 UTTR AIRSPACE

UTTR airspace within Nevada is over a portion of the known historic range of the endangered peregrine falcon, and 6 percent of the range of the Endangered bald eagle. North-south trending mountain ranges on the eastern border of Nevada have recently been determined to be important migratory "funnels" for most raptors that pass through the state (Source: Steve Hoffman, personal communication, 1988). Defense-related overflight in this airspace may affect movements along this migratory route, although the potential for effects cannot be determined based on existing information.

This airspace overlies portions of the Nevada range of several game species: elk (5%), mule deer (2%), pronghorn antelope (8%), mountain lion (5%), bighorn sheep, and sage grouse (5%). The NDOW reintroduced bighorn sheep to lands located beneath Restricted Area R-6404C. Use of the area authorized for supersonic flight operations may affect wildlife in the vicinity, although the 11,000 feet MSL minimum altitude for these operations lessens many of the potential effects of sonic booms. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight in the UTTR MOAs.

7.4.5 MILITARY TRAINING ROUTES

The number of linear miles of overlap of wildlife ranges with MTRs indicates the amount of exposure to aircraft noise that wildlife species might encounter in their habitats. Many wildlife habitats are overflown by aircraft using MTRs. Sources of noise on MTRs are from low altitude flying operations. Supersonic operations are not conducted on these routes. Primary effects potentially result from noise, and to a lesser extent from bird-aircraft collisions. The extent of effects depend on operating schedule, altitude, and proximity to important habitat features. Proposed changes for new MTRs add little to the existing area of defense-related airspace. These increases would not affect particularly sensitive habitat. Projected increases in overflight to the year 2000 on existing MTRs may increase the level of exposure of wildlife to noise.

7.4.6 AERIAL REFUELING ROUTES

ARs occupy relatively high altitude airspace and do not involve supersonic flight activities. There is a very low probability of an accidental release of fuel into the environment, and an even lower probability that this fuel would come in contact with wildlife. Projected increases in activities on the ARs are not anticipated to increase the level of effect on wildlife.

7.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

Cultural resources may be impacted by long-term exposure to vibrations resulting from overflight activities and high-intensity sonic booms from supersonic flights (Sources: Ellis, 1987; King, Algermissen and McDermott, 1985; Konon and Schuring, 1985; Hershey, Kevala and Burns, 1975; Witten, not dated). Although defense-related airspace activities may impact cultural resources, the degree to which impacts occur cannot be determined with existing studies.

Concerns from Native Americans (Inter-Tribal Council of Nevada, Shoshone Joint Housing Authority, and Confederated Tribes of the Goshute Reservation) were received during the environmental impact analysis process for the establishment of the Gandy Range Extension (Source: U.S. Air Force, Hill AFB, 1985b). The Navy consulted with the Walker River Paiute Tribe concerning IR 205/IR 210; however, consultations regarding the impact of overflights on traditional cultural and religious practices of other Native Americans have generally not been conducted. Whether military aircraft have impacted religious and cultural practices of Native Americans cannot be determined with existing studies beyond the mentioned exceptions.

7.6 EFFECTS ON RECREATIONAL RESOURCES

Table 7-8 indicates the recreation areas located beneath Hart, Paradise, Reno, and UTTR airspace. Sections 7.6.1 through 7.6.5 provide additional information on these recreational resources.

Table 7-8. Major Recreation Resources Located Beneath Other Military Operation Areas in Nevada.

Recreation Resource	Area[1] (acres x 1000)	1990[1] Visitor Use (# people x 1000)	Airspace[2,3]	Total Area Beneath Airspace (acres x 1000)
National Forest Management Areas (MAs) and Campgrounds				
Humboldt National Forest				
Mountain City MA	479.2	90.0	Paradise (30)	143.8
Santa Rosa MA	268.5	42.0	Paradise (60)	161.1
- Lye Creek			Paradise	
TOTAL	747.7	132.0		304.9
National Wildlife Refuge				
Sheldon NWR	537.0	14.3	Hart (20)	107.4
BLM Extensive Recreation Mgmt Areas (ERMAs) and Special Recreation Mgmt Areas (SRMAs)				
Surprise ERMA			Hart (20)	
- High Rock SRMA				
Eagle Lake ERMA			Reno (40)	
Elko ERMA	3115.2	667.9	Paradise (25)	778.8
- Wilson Reservoir SRMA	5.4	15.4	Paradise	5.4
- S Fork Owyhee R SRMA	3.5	0.4	Paradise	3.5
Paradise-Denio ERMA	3857.0	114.0	Paradise (20)	771.4
Schell ERMA	4239.0	48.0	Gandy (15) R6405 (15)*	1271.7
Sonoma-Gerlach ERMA	4414.0	114.8	Reno (15)	662.1
Wells ERMA	4132.5	45.8	Lucin A (20) Lucin C (5) Gandy (5) R6404C (5)* R6405 (5)*	1653.0
TOTAL	19733.7	1006.3		5137.0
Other				
Sheep Creek Reservoir	NA	NA	Paradise	NA
Pyramid Lake	NA	NA	Reno (20)	NA
TOTAL				

1 Data not available for all areas; visitor use data do not indicate number of people exposed to overflights because: 1) not all areas are completely located beneath the airspace; and 2) not all visitors will be exposed to overflights.

2 Figures in parentheses represent percentage of recreation area located beneath airspace; assume 100 percent if not indicated otherwise.

3 * indicates percentage of recreation area located beneath airspace used for supersonic operations; assume 100 percent if not indicated otherwise.

7.6.1 HART MOA

The southern half of the Hart MOA is located over approximately 630,000 acres of BLM and U.S. Fish and Wildlife Service (USFWS) lands in northwestern Nevada. Sheldon NWR provides seasonal opportunities to hunters, campers, fishermen, wildlife observers, and wilderness users. Approximately 75,000 acres of the western portion of the Sheldon NWR is located under the Hart MOA. The NWR receives 15,000 to 20,000 visits per year from recreational users, primarily during the period May through November. The effect of Hart MOA overflights above the NWR has not been studied. Aircraft overflight in the area is reportedly a common occurrence, and NWR personnel consider the presence of these aircraft a source of annoyance for visitors and wildlife (Source: Barry Reisweig, Sheldon NWR, personal communication, 1988). A portion of the BLM Surprise Extensive Recreation Management Area (ERMA) containing recreational resources for wilderness use, camping, hiking, and nature study, is located under the Reno MOA. Overflights in the Hart MOA may affect recreational opportunities in these recreation areas. Possible effects on recreation are discussed in Sections 8.7 and 8.8. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight on Hart MOA.

7.6.2 PARADISE MOA

The southern portion of the Paradise MOA is located over approximately 2 million acres of BLM lands. Recreational features located beneath the Paradise MOA include the Humboldt National Forest Mountain City and Santa Rosa Management Areas, Sheep Creek Reservoir on the Duck Valley Indian Reservation, and portions of the BLM Elko and Paradise-Denio ERMAs; which include the Wilson Reservoir and the 5 Fork River Owyhee Special Recreation Management Areas (SRMAs), as well as four BLM WSAs, described in Section 7.7.2. Overflights in the Paradise MOA may affect recreational opportunities in these recreation areas. Possible effects on recreational opportunities are discussed in Sections 8.7 and 8.8.

7.6.3 RENO MOA

The Reno MOA is located over approximately 883,000 acres of public lands. Portions of Eagle Lake and Sonoma-Gerlach ERMAs, which include the northern portion of Pyramid Lake, the Smoke Creek Desert, Winnemucca Lake, and the western portion of the Black Rock Desert are located under this MOA as well as six BLM WSAs described in Section 7.7.3. Overflights in the Reno MOA may affect recreational opportunities in these recreation areas. Possible effects on recreational opportunities are discussed in Sections 8.7 and 8.8. Effects to the year 2000 will be a function of the projected 20 percent increase of overflight on Reno MOA.

7.6.4 UTTR AIRSPACE

UTTR airspace (Gandy and Lucin MOAs, and R6405 and R6405C) is located over portions of the Schell and Wells ERMAs, as well as three Nevada WSAs and the only BLM designated Wilderness Area in Nevada (discussed in 7.7.4). The Great Basin National Park is located south of the Gandy MOA. National Park Service (NPS) personnel have documented numerous occurrences of military aircraft overflight of the Park. These overflights are considered a source of annoyance by park personnel, and may decrease the quality of recreational experiences in the park. Defense-related overflights of the Lehman Creek drainage are of particular concern to Park personnel since three highly used campgrounds and the visitor center are located in this area (Source: Bruce Freet, NPS, personal communication, May 11, 1990). The NPS is conducting a national study of all aircraft overflight effects on the recreational visitor in the National Park System, however, the results of this investigation are not yet available. The UTTR MOAs may affect the recreational use of some wilderness resources as a result of overflight of three BLM WSAs and one BLM wilderness contiguous to Mt. Moriah. There are no projected changes in UTTR airspace to the year 2000.

7.6.5 MILITARY TRAINING ROUTES

Table 7-9 indicates major recreation features located beneath MTR centerlines and corridors. These areas include 7 state parks, 16 National Forest Management Areas, including 16 National Forest campgrounds, 4 National Wildlife Refuges, 2 Wildlife Management Areas, and portions of all 16 ERMAs, including 9 SRMAs and several other BLM established recreation sites; and 4 "other" recreation sites. Wilderness areas overflown by aircraft on MTRs are described in Section 7.7.5. Recreation sites located beneath the MTR centerline are most likely to be overflown. Average monthly overflights are provided in Table 7-9. The greatest number of overflights will occur over sites located beneath MTR centerlines, however some recreation sites may be located beneath the boundaries of MTRs, but not beneath the centerline. Overflights of these sites will typpically occur less frequently than those located beneath the centerlines. Some sites are located beneath MTR boundaries, but not beneath the centerline. Possible effects on recreational opportunities by MTR overflights are discussed in Sections 8.7 and 8.8. Effects to the year 2000 will be a function of the projected 20 percent increase in MTR flights.

7.6.6 AERIAL REFUELING ROUTES

Since there are a small number of refueling missions on most of the ARs and they are conducted at high altitudes, defense-related activities on ARs are not likely to disturb recreationists below. Aerial refueling events generally occur at altitudes of 18,000 feet MSL and above, and noise occurrence, if detectable from the ground, is not likely to cause annoyance to many recreationists with the possible exception of wilderness users (Section 7.7.6).

7.7 EFFECTS ON WILDERNESS RESOURCES

Table 7-10 lists the wilderness resources and the percent of each area that is located beneath MOAs discussed in this chapter. Table 7-11 lists wilderness resources in Nevada and MTRs/SRs, and indicates the wilderness areas where a portion of the area lies beneath an MTR. Figure 7.7 shows the locations of wilderness resources and MTRs in Nevada. This section examines the effects of the MOAs/SRs on wilderness lands. The effects on recreational use of these lands is discussed in Section 7.7.

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada.

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	2000[1]	MTR[2] Boundary
State Parks				
Belmont Courthouse				X
Berlin-Ichthyosaur	VR1252	29	32	
	VR1264	45	50	
	TOTAL	74	82	
Echo Canyon				X
Lahontan Reservoir	VR201	202	222	
	VR1255	68	75	
	TOTAL	270	297	
Rye Patch Reservoir	SR300/301	30	150	
Walker Lake	VR1255	68	75	X
Wild Horse	IR303	198	237	X
National Forest Management Areas (MAs) and Campgrounds				
Humboldt National Forest				
Mountain City MA	IR302	97	116	
	IR303	198	237	
	VR1300	112	134	
	VR1304	12	14	
	TOTAL	419	501	
- Jack Creek				X
- Wild Horse Crossing				X
- Big Bend	IR303	198	237	
East Humboldt MA				X
Ruby Mountains MA	IR281	28	34	X
	VR1259	64	70	
- Ruby Lake				
- Thomas Creek				X
Jarbidge MA				
- Jarbidge				X
Mt. Moriah MA				X

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	2000[1]	MTR[2] Boundary
Schell MA	VR1258	19	22	
- Berry Creek				X
- Cleve Creek				X
Ward MA	VR1258	19	22	
- Ward Mountain				X
White Pine MA	IR290/290A	38	46	
	IR293	29	35	
	VR1258	19	22	
	TOTAL	86	103	
- White River	IR290/290A	38	46	
	IR293	29	35	
	TOTAL	67	81	
Quinn MA	VR1260	21	23	X
- Cherry Creek	VR1260	21	23	
Santa Rosa MA	IR300/300A	260	312	
- Lye Creek				X
Toiyabe National Forest Bridgeport P-J MA	IR275	39	47	
	VR201	202	222	
	TOTAL	241	269	
Paradise-Shoshone MA	SR300/301	30	150	X
Toiyabe MA	IR275	39	47	X
	VR208	107	117	
	VR1258	19	22	
	VR1253	12	14	
	TOTAL	177	200	
- Big Creek				X
- Bob Scott	VR1253	12	14	X
- Kingston	VR208	107	117	
	VR1253	12	14	
	TOTAL	131	145	
- Peavine Creek				X

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	Average Monthly Flights 2000[1]	MTR[2] Boundary
Toquima MA	IR275	39	47	X
	IR280	24	29	
	IR282	12	14	
	VR1258	19	22	
	VR1253	12	14	
	TOTAL	106	126	
- Pine Creek				X
Monitor MA	IR237	0.2	0.3	X
	IR238	7	8	
	IR264	1	2	
	IR275	39	47	
	IR280	24	29	
	IR282	12	14	
	IR286	219	197	
	VR1258	19	22	
	TOTAL	321.2	319.3	
Mt. Charleston MA				X
National Parks				
Great Basin	VR1258	19	22	X
- Lehman Creek		19	22	
- Wheeler Park		19	22	
Death Valley	IR204	20	5	
	IR233	6	1	
	IR286	219	197	
	VR1214	50	5	
	TOTAL	295	208	
National Wildlife Refuges				
Sheldon NWR	SR300/301	30	150	X
	VR1253	12	14	
	TOTAL	42	164	
Ash Meadows NWR	IR286	219	197	X
	VR1214	50	5	
	VR1225	420	504	
	TOTAL	689	706	
Stillwater NWR	SR381	5	6	
Desert NWR	IR286	219	197	X

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	Average Monthly Flights 2000[1]	MTR[2] Boundary
Wildlife Management Areas				
Humboldt WMA				X
Kirch WMA				X
BLM Extensive Recreation Management Areas (ERMAs); Special Recreation Management Areas (SRMAs); and Other Recreation Sites				
Caliente ERMA	IR126	69	83	
	IR200	10	12	
	IR266	3	4	
	IR286	219	197	
	IR425	0.5	0.6	
	VR1258	19	22	
	VR1253	12	14	
	TOTAL	332.5	332.6	
Surprise ERMA	IR300	260	312	
	VR1251	30	33	
	VR1253	12	14	
	VR1254	83	91	
	SR300/301	30	150	
	TOTAL	415	600	
- High Rock SRMA	IR300	260	312	
Eagle Lake ERMA	IR207	23	25	
	VR1254	83	91	
	VR1261	35	39	
	TOTAL	141	155	
Egan ERMA	IR234	5	6	
	IR235	5	6	
	IR290/290A	38	46	
	IR293	29	35	
	VR1253	12	14	
	VR1260	21	23	
	TOTAL	110	130	
- Loneliest Highway SRMA	IR234	5	6	
	IR235	5	6	
	IR290/290A	38	46	
	IR293	29	35	
	TOTAL	77	93	

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	Average Monthly Flights 2000[1]	MTR[2] Boundary
Elko ERMA	IR275	39	47	
	IR280	24	29	
	IR282	12	14	
	IR303	198	237	
	VR1300	112	134	
	VR1304	12	14	
	TOTAL	397	475	
- S. Fork Canyon SRMA				X
- S. Fork Owyhee River SRMA	IR302	97	116	
	VR1300	112	134	
	VR1304	12	14	
	TOTAL	221	264	
- Wild Horse SRMA	IR303	198	237	X[4]
Lahontan ERMA	IR206	0	0.25	
	IR264	1	2	
	IR280	24	29	
	IR281	28	34	
	IR205/2103	NA3	NA3	
	SR381	5	6	
	VR201	202	222	
	VR1252	29	32	
	VR1255	68	75	
	VR1264	45	50	
	(VR202)	(55)	(60)	
	(VR1250)	(74)	(81)	
	(VR1251)	(30)	(33)	
	(VR1254)	(83)	(91)	
	(VR1255)	(68)	(75)	
	(VR1259)	(64)	(70)	
	(VR1261)	(35)	(39)	
	TOTAL	402	450.25	
	(TOTAL)	(811)	(899.25)	
- Churchill County SRMA	SR381	5	6	
Paradise-Denio ERMA	IR300/300A	260	312	
	IR303	198	237	
	SR300/301	30	150	
	VR1252	29	32	
	VR1352	50	55	
	TOTAL	567	786	

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	2000[1]	MTR[2] Boundary
- Pine Forest SRMA	IR303	198	237	
Schell ERMA	IR200	10	12	
	IR285	1	1.5	
	IR290/290A	38	46	
	IR293	29	35	
	(IR234)	(5)	(6)	
	(IR235)	(5)	(6)	
	(IR286)	(219)	(197)	
	VR1258	19	22	
	VR1253	12	14	
	VR1259	64	70	
	VR1406	8	10	
	(VR1260)	(21)	(23)	
	TOTAL	181	210.5	
	(TOTAL)	(431)	(442.5)	
Shoshone-Eureka ERMA	SR300/301	30	150	
	IR264	1	2	
	IR275	39	47	
	IR280	24	29	
	IR281	28	34	
	IR282	12	14	
	(IR237)	(0.2)	(0.3)	
	(IR238)	(7)	(8)	
	VR208	107	117	
	VR1252	29	32	
	VR1253	12	14	
	VR1254	83	91	
	VR1259	64	70	
	VR1260	21	23	
	TOTAL	450	623	
	(TOTAL)	(457.2)	(631.3)	
Sonoma-Gerlach ERMA	SR300/301	30	150	
	IR207	23	25	
	IR300/300A	260	312	
	(IR281)	(28)	(34)	
	VR1251	30	33	
	VR1254	83	91	
	VR1259	64	70	
	VR1260	21	23	

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	Average Monthly Flights 2000[1]	MTR[2] Boundary
Sonoma-Gerlach ERMA (cont.)	VR1261	35	39	
	VR1352	50	55	
	(VR201)	(202)	(222)	
	(VR202)	(55)	(60)	
	(VR1250)	(74)	(81)	
	(VR1255)	(68)	(75)	
	TOTAL	596	798	
	(TOTAL)	(1023)	(1270)	
- Black Rock Desert SRMA	IR300/300A	260	312	
	SR300/301	30	150	
	VR1253	12	14	
	TOTAL	302	476	
Stateline ERMA	IR286	219	197	
	VR1214	50	5	
	VR1225	420	504	
	(VR1258)	(19)	(22)	
	TOTAL	708	728	
- Clark County SRMA	(VR1225)	(420)	(504)	
- Spring Mountain SRMA	IR286	219	197	
	VR1225	420	504	
	TOTAL	639	701	
Tonopah ERMA	IR200	10	12	
	IR206	0	0.25	
	IR234	5	6	
	IR235	5	6	
	IR237	0.2	0.3	
	IR238	7	8	
	IR264	1	2	
	IR275	39	47	
	IR279	3	4	
	IR280	24	29	
	IR282	12	14	
	IR286	219	197	
	IR293	29	35	
	IR425	0.5	0.6	
	(IR204)	(20)	(5)	
	(IR233)	(6)	(1)	
	VR208	107	117	
	VR1258	19	22	

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	2000[1]	MTR[2] Boundary
Tonopah ERMA (cont.)	VR1214	50	5	
	VR1252	29	32	
	VR1253	12	14	
	VR1255	68	75	
	VR1260	21	23	
	VR1264	45	50	
	VR1406	8	10	
	(VR1225)	(420)	504)	
	(VR1259)	(64)	(70)	
	TOTAL	713.7	709.15	
	(TOTAL)	(1223.7)	(1289.15)	
Walker ERMA	IR275	39	47	
	(IR264)	(1)	(2)	
	IR205/2103	NA	NA	
	SR300/301	30	150	
	SR381	5	6	
	VR201	202	222	
	VR1255	68	75	
	(VR1252)	(29)	(32)	
	(VR1264)	(45)	(50)	
	TOTAL	344	500	
	(TOTAL)	(419)	(584)	
- Walker Lake SRMA	VR1255	68	75	
	IR205/2103	NA	NA	
	TOTAL	68	75	
Wells ERMA	IR261	49	59	
	IR265	49	59	
	IR281	28	34	
	IR290/290A	38	46	
	IR302	97	116	
	TOTAL	261	314	
<u>Other</u>				
Sheep Creek Reservoir	IR302	97	116	
	VR1300	112	134	
	VR1304	12	14	
	TOTAL	221	264	
Pyramid Lake	IR207	23	25	X
	VR202	55	60	

Table 7-9. Major Recreation Resources Located Beneath MTR Routes in Nevada (continued).

Recreation Resource	MTR[1] Centerline	Average Monthly Flights Present[1]	2000[1]	MTR[2] Boundary
Pyramid Lake (cont.)	VR1251	30	33	
	VR1254	83	91	
	TOTAL	191	209	
Sheckler Reservoir				X
Carson Lake				X

[1] Numbers in parentheses indicate number of overflights on MTRs present over only a small portion of recreation area.

[2] Indicates recreation sites located within MTR boundaries (but not beneath MTR centerline unless indicated otherwise).

[3] Proposed route, data not available.

[4] Wild Horse SRMA is particularly susceptible to off-centerline transit.

Table 7-10. Wilderness Resources Beneath Other Military Operations Areas Over Nevada Used for Defense-Related Purposes.

Wilderness Resource (Resource Area/District)	Total Area (Acres)	Percent Under Airspace	Estimated Area Under Airspace (acres)	Airspace
Bluebell WSA (Wells)	55,665	50%	27,833	Lucin MOA
Goshute Peak WSA (Wells)	69,770	75%	52,328	Gandy MOA(2)
Marble Canyon/Granite Springs WSA(1) (Wells)	19,150	40%	7,660	Gandy MOA
Sheldon WSA (Cedarville, CA)	23,700	100%	23,700	Hart MOA
Massacre Rim WSA (Cedarville, CA)	101,290	100%	101,290	Hart MOA
Sheldon National Wildlife Refuge and Range Proposed Wilderness (USFWS)	277,200	25%	69,300	Hart MOA
South Fork Owyhee River WSA (Owyhee)	7,842	100%	7,842	Paradise MOA
Owyhee Canyon WSA (Owyhee)	21,875	100%	21,875	Paradise MOA
Little Humboldt River WSA (Owyhee)	42,213	55%	23,217	Paradise MOA
N. Fork Little Humboldt River WSA (Winnemucca)	69,683	100%	69,683	Paradise MOA
Poodle Mountain WSA (Winnemucca)	142,050	100%	142,050	Reno MOA
Fox Range WSA (Winnemucca)	75,404	100%	75,404	Reno MOA
Pole Creek WSA (Winnemucca)	12,969	100%	12,969	Reno MOA
Selenite Mountains WSA (Winnemucca)	32,041	40%	12,816	Reno MOA
Buffalo Hills WSA (Cedarville, CA)	46,435	50%	23,218	Reno MOA
Twin Peaks WSA (Cedarville, CA)	67,285	50%	33,643	Reno MOA
TOTAL	1,064,572	66%	704,828	

(1) An 8,000 acre portion of the Marble Canyon (Granite Springs) WSA was designated wilderness in conjunction with the designation of the USFS Mt. Moriah Wilderness.

(2) The Goshute Peak WSA is located beneath the UTTR supersonic flight area, however, the sound levels and overpressures resulting from these flight activities do not normally affect the whole land area.

Table 7-11. Wilderness Resources in Relation to Military Training Routes and Slow Speed Routes Over Nevada.

BLM District & Number	WSA	Acres(1)	MTR(2)/SR	Average Monthly Flights Present	Average Monthly Flights 2000
ELKO					
010-027	Bluebell	55,665	IR261, IR265	49, 49	59, 59
010-033	Goshute Peak	69,770	IR261, IR265	49, 49	59, 59
010-035	South Pequop	41,090	VR1259	64	70
010-088	Cedar Ridge	10,009	IR280, IR282	24, 12	29, 14
010-091	Red Spring	7,847	IR280	64	70
010-103a	South Fork Owyhee River	7,842			
010-106	Owyhee Canyon	21,875	IR280, IR282	24, 12	29,14
010-132	Little Humboldt River	42,213	IR303	198	237
010-151	Rough Hills	6,685			
010-184	Bad Lands	9,426			
WINNEMUCCA					
020-066a/ 020-914(CA)	East Fork High Rock Canyon	44,650			
020-007	High Rock Lake	61,902			
020-008/ 020-913 (CA)	Little High Rock Canyon	50,560	IR300/300A	260	312
020-012/ 020-618/ 621 (CA)	Poodle Mountain	142,050	VR1251	30	33
020-014	Fox Range	75,404			
020-014a	Pole Creek	12,969	VR1251	30	33
020-019	Calico Mountains	67,647	IR300/300A	200	312
020-200	Selenite Mountains	33,041			
020-201	Mount Limbo	23,702			
020-406p	China Mountain	10,358	SR300/301	30	150
020-406q	Tobin Range	13,107			
020-600	Blue Lakes	20,508	IR303	198	237
020-600d	Alder Creek	5,142	IR303	198	237
020-603	South Jackson Mountains	60,211			
020-606	North Jackson Mountains	2,645			
020-620	Black Rock Desert	319,594	IR300/300A, VR1353, SR300/301	260, 12, 30	312, 14, 150
020-621	Pahute Peak	57,529			
020-622	North Black Rock Range	30,791			

Table 7-11. Wilderness Resources in Relation to Military Training Routes and Slow Speed Routes Over Nevada (continued).

BLM District & Number	WSA	Acres(1)	MTR(2)/SR	Average Monthly Flights Present	Average Monthly Flights 2000
020-642	Pueblo Mountains	600			
020-827	North Fork Little Humboldt River	69,683			
020-859	Disaster Peak	13,200			
CARSON CITY					
030-102	Clan Alpine Mountains	196,128	IR281, IR264, VR1264	28, 1, 45	34, 2, 50
030-104	Stillwater Range	94,607	VR1264	45	50
030-108	Augusta Mountains	89,372	IR281, VR1260	24, 21	29, 23
030-110	Desatoya Mountains	51,262	VR208	107	117
030-127	Job Peak	90,209	SR381	5	6
030-407	Gabbs Valley Range	79,600	SR300/301	30	150
030-525a	Burbank Canyon	13,395	SR300/301	30	150
ELY					
040-015	Goshute Canyon	35,594	IR234, IR235	5, 5	6, 6
040-086	Marble Canyon Granite Springs(3)	19,150			
040-154	Park Range	47,268	IR237, IR238	0.2, 7	0.3, 8
040-166	Riordan's Well	57,002	VR1406	8	10
040-168	South Egan Range	96,916	VR1406	8	10
040-169	Mount Grafton	73,216			
040-172	Far South Egans	53,224	VR1406	8	10
040-177	Fortification Range	41,615	VR1406, VR1259	8, 64	10, 70
040-197	Table Mountain	35,958			
040-202	White Rock Range	24,065	IR200, IR425	10, 0.5	12, 0.6
040-206	Parsnip Peak	88,175			
040-242	Worthington Mountains	47,633	IR200, IR286, IR425, VR209, VR1259	10, 219, 0.5, 16, 64	12, 197, 0.6, 22, 70
040-246	Weepah Spring	61,137	VR1253	12	14
LAS VEGAS					
050-132	South Pahroc	28,600	VR1253	12	14
050-139	Clover Mountains	84,935			
050-156	Meadow Valley Mountains	185,744	VR209, VR1253	19, 12	22, 14
050-161	Mormon Mountains	162,887	VR209	19	22
050-166	Tunnel Springs	5,400			

Table 7-11. Wilderness Resources in Relation to Military Training Routes and Slow Speed Routes Over Nevada (continued).

BLM District & Number	WSA	Acres(1)	MTR(2)/SR	Average Monthly Flights Present	Average Monthly Flights 2000
050-177	Delamar Mountains	126,257	VR1253	12	14
050-201	Fish & Wildlife #1	11,090			
050-215	Arrow Canyon Range	38,853			
050-216	Fish & Wildlife #2	17,242			
050-217	Fish & Wildlife #3	22,002			
050-229	Muddy Mountains	96,170			
050-231	Lime Canyon	34,680			
050-233	Million Hills	21,296			
050-235	Garret Buttes	11,835			
050-236	Jumbo Springs	3,466			
050-401	Mount Stirling	69,650	IR286	219	197
050-411	Quail Spring	12,145			
050-412	LaMadre Mountains	56,967			
050-414	Pine Creek	24,000			
050-423	El Dorado	12,290			
050-425	North McCullough Range	47,166			
050-435	South McCullough Range	56,623			
050-438	Ireteba Peaks	14,994			
050-460	Resting Springs	3,850	IR1214	50	5
050-IR-16 A,B,C	Evergreen	2,694			
050-4R-15 A,B,C	Nellis	5,718			
BATTLE MOUNTAIN					
060-019	Kawich	54,320	IR425, IR286	0.5, 219	0.6, 197
060-059	Rawhide Mountain	64,360	IR200, IR279, VR1253	10, 3, 12	12, 4, 14
060-112	South Reveille	106,200	IR200, IR425 VR1209, VR1259, VR1260	10, 0.5, 9, 64, 21	12, 0.6, 22, 70, 23
060-142/162	Palisade Mesa	99,500	IR234, IR235, IR425, IR237 IR238	5, 5, 0.5, 0.2, 7	6, 6, 0.6, 0.3, 8
060-158/199	Blue Eagle	59,500			
060-163	The Wall	38,000	VR1406	8	10
060-190	Fandango	40,940	IR275	39	47
060-191	Morey Peak	20,120			
060-231/241	Antelope Range	87,400	IR237, IR238, IR275	0.2, 7, 39	0.3, 8, 47
060-338	Silver Peak Range	33,900	VR1205, VR1255	16, 68	19, 75

Table 7-11. Wilderness Resources in Relation to Military Training Routes and Slow Speed Routes Over Nevada (continued).

BLM District & Number	WSA	Acres(1)	MTR(2)/SR	Average Monthly Flights Present	Average Monthly Flights 2000
060-350	Pigeon Spring	3,757			
060-354	Queer Mountain	81,550	VR1214	50	5
060-355	Grapevine Mountain	66,800	VR1214	50	5
060-428	Simpson Park	49,670			
060-541	Roberts Mountain	15,090			
SUSANVILLE					
020-609	Five Springs	1,360			
020-612	Skedaddle Mountain	160			
020-615	Dry Valley Rim	76,065	IR207	23	25
020-619	Buffalo Hills	46,435	VR1254, VR1261	83, 35	91, 39
020-619a	Twin Peaks	67,285	VR1254, VR1261	83, 35	91, 39
020-805	Wall Canyon	45,790	VR1251	30	33
020-913a	Yellow Rock Canyon	13,050	IR300/300A	260	312
020-913b	High Rock Canyon	33,985	IR300/300A	260	312
020-1012	Sheldon Contiguous	23,700			
020-1013	Massacre Rim	101,290	IR300/300A VR1254	260, 83	312, 91

Wilderness Areas	Administering Agency	Acres(1)	MTR(2)	Average Monthly Flights Present	Average Monthly Flights 2000
USFS					
Currant Mountain	Humboldt NF	36,000			
East Humboldt	Humboldt NF	36,900			
Jarbidge	Humboldt NF	64,000			
Jarbidge Additions	Humboldt NF	48,500			
Quinn Canyon	Humboldt NF	27,000	VR1260	21	23
Ruby Mountains	Humboldt NF	90,000	IR281, VR1259	28, 64	34, 70
Grant Range	Humboldt NF	50,000	VR1260	21	23
Mt. Moriah	Humboldt NF	82,000			
Santa Rosa	Humboldt NF	31,000	IR300/300A	260	312
Boundary Peak	Inyo NF	10,000			
Alta Toquima	Toiyabe NF	38,000			

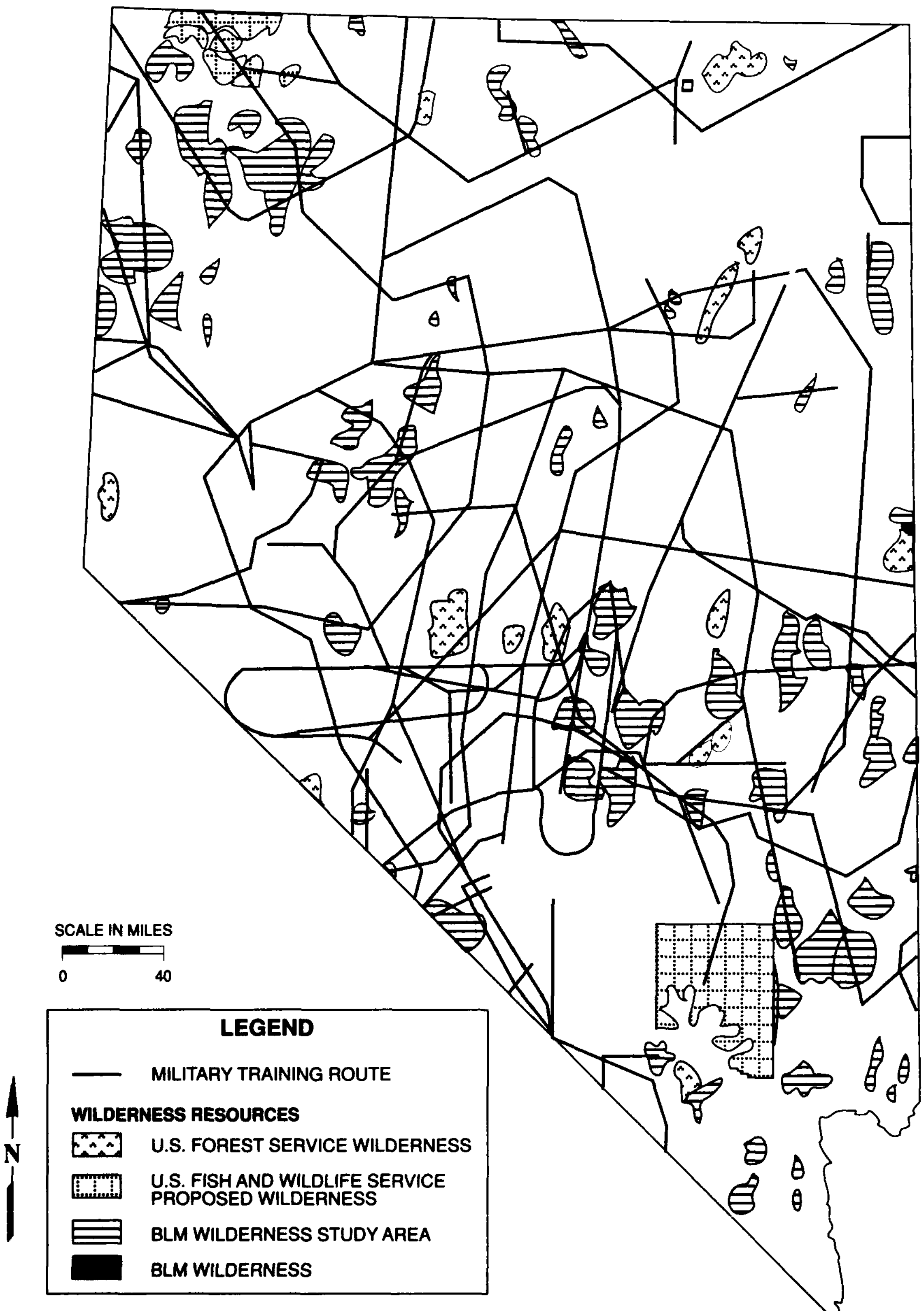
Table 7-11. Wilderness Resources in Relation to Military Training Routes and Slow Speed Routes Over Nevada (continued).

Wilderness Areas	Administering Agency	Acres(1)	MTR(2)	Average Monthly Flights Present	2000
Arc Dome	Toiyabe NF	115,000	VR209	19	22
Mount Rose	Toiyabe NF	28,000			
Mount Charleston	Toiyabe NF	43,000			
Table Mountain	Toiyabe NF	98,000	IR237,IR238, VR1253	0.2, 7, 12	0.3, 8, 14
NPS (Proposed)					
Death Valley National Monument	NPS	40,000	IR204, IR233	20, 6	5, 1
USFWS (Proposed)					
Desert NWR	USFWS	1,433,000	IR286	219	197
Sheldon NWR	USFWS	277,200	VR1353	25	28
Anaho Island NWR	USFWS	6,000			

(1) Indicates acreage in wilderness area. Not all of this acreage is beneath an MTR.

(2) 4-digit identifier indicates that all flight segments are below 1,500 ft Above Ground Level (AGL); 3-digit identifier indicates routes that have some segments above 1,500 ft AGL.

(3) An 8,000 acre portion of the Marble Canyon (Granite Springs) WSA was designated wilderness in conjunction with the designation of the USFS Mt. Moriah Wilderness.



1. MTRs are not active at all times; most are flown during daylight hours only
2. Non-participating aircraft (civil or military) are not prohibited from flight within MTRs/SRs

FIGURE 7.7 WILDERNESS RESOURCES IN RELATION TO MILITARY TRAINING ROUTES OVER NEVADA

7.7.1 HART MOA

Approximately 69,300 acres of the USFWS proposed wilderness for the Sheldon NWR are located beneath the Hart MOA, including portions of the Long Valley, Mule Mountain, Round Mountain, Horse Heaven, and Catnip Mountain Wilderness units. The activities of the Hart MOA include overflight of two BLM WSAs totalling nearly 125,000 acres. There are no known overflights of U.S. Forest Service (USFS) wilderness. The closest USFS wilderness to the Hart MOA is the Santa Rosa area, located nearly 100 miles away. There are no projected changes to the Hart MOA airspace to the year 2000.

7.7.2 PARADISE MOA

Acreage in the four BLM WSAs beneath the Paradise MOA total 122,617 acres, or approximately 2.5 percent of the total WSA acreage in Nevada. The closest USFS wilderness is the Santa Rosa area, located southwest of the Paradise MOA. Overflight of the North Fork of the Little Humboldt River is described as "periodic" by the BLM Winnemucca District. There are no projected expansions in the Paradise MOA airspace to the year 2000.

7.7.3 RENO MOA

The 6 BLM WSAs beneath the Reno MOA comprise over 300,000 acres, or approximately 6 percent of the total WSA acreage in Nevada. The closest USFS wilderness is Mt. Rose, located 50 miles south of the Reno MOA. The BLM Winnemucca District EIS describes overflight of the Fox Range and Pole Creek as "occasional." Overflight of the other WSAs is not described by BLM. There are no projected expansions in the Reno MOA airspace to the year 2000.

7.7.4 UTTR AIRSPACE

Flight maneuvers and air combat training activities in the Gandy and Lucin MOAs occur over more than 35,000 acres of the Bluebell and Marble Canyon WSAs. Almost all of the Goshute Peak WSA lies beneath this airspace, some of which is used for supersonic operation. The southeastern part of the WSA is located beneath restricted airspace. In total, approximately 91,115 acres of WSA lands in the Wells Resource Area are located beneath these MOAs. This acreage constitutes over two percent of the total WSA acreage in Nevada. Supersonic operations occur over 0.1 percent of all WSAs in Nevada. Low level military training flights over the Bluebell and Goshute Peak WSAs are an on-going problem. Noise associated with these low level missions severely diminishes the solitude experience within the WSAs. The Gandy MOA overlies land located adjacent to and north of the USFS Mt. Moriah Wilderness. Eight thousand acres of the Marble Canyon (Granite Springs) WSA, located under the Gandy MOA, were designated as BLM wilderness in conjunction with Mt. Moriah. While Great Basin National Park is not located under UTTR airspace, military flyovers have been documented by NPS personnel (Source: Bruce Freet, NPS, personal communication, May 11, 1990). There is no wilderness in Great Basin National Park at this time, however, a resource management plan is being prepared which will address the park's wilderness resources. There are no projected changes in UTTR airspace to the year 2000.

7.7.5 MILITARY TRAINING ROUTES

Table 7-12 indicates that, located beneath 1 or more MTR(s) are portions of 52 percent and 43 percent, respectively, of all BLM WSAs and USFS wilderness areas; portions of 2 of the 3 USFWS proposed wilderness areas; and portions of the 1 proposed NPS wilderness in Nevada. Table 7-11 shows the occurrence and frequency of overflight of wilderness resources in Nevada by military aircraft using MTRs. Twenty-one BLM WSAs are exposed to more than 50 overflights per month. Fourteen WSAs are exposed to overflights more than 100 times per month and 8 WSAs are exposed to overflights more than 200 times per month. Six USFS wilderness areas are exposed to overflight 19 to 64 times per month. The USFS wilderness area most exposed to MTR overflight is the Santa Rosa Wilderness, which is subject to an average of 260 overflights per month. Overflight of these areas by aircraft flying within the boundaries, but not on the centerlines of other MTRs may increase the average monthly overflight estimates for a number of areas. These data were not estimated for this report, however, Table 7-11 indicates areas that may be located within MTR boundary widths. Projected increases in aircraft activity on the MTRs by the year 2000 may result in increased overflight of wilderness areas.

Table 7-12. Summary of Wilderness Resources Located Beneath Military Training Routes and Slow Speed Routes in Nevada.

Wilderness Resources	Total Resources Acreage	Total Number	Number Beneath MTRs/SRs	Summary and Type of MTR/SR Occurring Over Wilderness			
				IR	VR	SR	Total
BLM WSA	4,862,400	102	53	46	26	6	78
USFS	798,067	14	6	3	4	0	7
USFWS (proposed)	1,726,200	3	2	1	1	0	2
NPS (proposed)	40,000	1	1	2	0	0	2

7.7.6 AERIAL REFUELING ROUTES

Overflight activity in the ARs may occur over 19 WSAs, 3 USFS wilderness areas, and the USFWS Sheldon NWR proposed wilderness (Table 7-13). Most AR routes and anchors are located in the northwest portion of Nevada, overlying many proposed wilderness areas in the BLM Susanville and Winnemucca Districts. Because refueling events may occur anywhere along the track or anchor area, the number of events over the wilderness areas cannot be quantified. Table 7-13 indicates the projected increase in average monthly refueling missions for each AR, based on a projected 20 percent increase in other airspace usage. The presumed effect of the projected increase would be a similar increase in the number of refueling activities over wilderness areas.

Table 7-13. Wilderness Resources Located Beneath Aerial Refueling Routes in Nevada.

Aerial Refueling Routes [1]	Average Monthly Refueling Mission: Present	Average Monthly Refueling Mission: Projected 2000	Wilderness Resource Area: BLM	Wilderness Resource Area: USFS	Wilderness Resource Area: USFWS
001/002	32	38			
4A	30	36			Sheldon
4B	20	24	Pueblo Mountain		
214	20	22			
452	6	7	Black Rock Desert		
			Fox Range		
			North Jacksons		
			South Jacksons		
462	4	5	High Rock Lake		
			Pahute Peak		
			No. Black		
			Calico Mountains		
			Rock Desert		
			North Jacksons		
			South Jacksons		
611	4	5	Paiute Peak		
			Black Rock Desert		
			South Jacksons		
625 L/H	84	100		Boundary Peak	
			Gabbs Valley Range		
			Silver Peak		
635	9	11	So. Egan Range	Currant Mountain	
			Far South Egans	Table Mountain	
			Mt. Grafton		
			Fortification Range		
			Blue Eagle		
			Riordin's Well		
641	6	7	Weepah Spring		
642	42	50	C.anite Spring		
			Goshute Peak		
648 A/B	16	18			

(1) Aerial refueling generally occurs at altitudes of 18,000 ft MSL and above.

7.8 EFFECTS ON MINERAL AND ENERGY RESOURCES

Defense-related use of airspace discussed in this chapter does not affect mineral and energy resources in Nevada.

7.9 EFFECTS ON WATER RESOURCES

Defense-related use of airspace discussed in this chapter does not affect water resources in Nevada.

7.10 SUMMARY

This chapter has identified effects and possible effects resulting from the use of other airspace in Nevada for defense-related purposes. These effects are summarized in Chapter 8, as they contribute to the cumulative effects in the State of Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. Possible mitigation of these effects are also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 8

DEFENSE-RELATED STATEWIDE CUMULATIVE EFFECTS

8.1 EXISTING, PROPOSED, AND ENVISIONED ACTIVITIES

Figure 8.1 shows the locations of all existing and proposed land withdrawals for defense-related uses in Nevada and the lands acquired for defense-related uses which are contiguous to those withdrawn lands. Approximately 13.3 percent of all Department of Defense (DOD) managed land is in Nevada. This represents approximately 4.7 percent of the total land area in Nevada. Refer to Tables 8-1 and 8-2 for comparisons. Although this is a significant land area within the state, there is also a corresponding significant investment in facilities.

	Real Property	
	Initial Cost	Current Replacement Value
Air Force	$331,431,000	$1,178,449,000
Navy	117,816,000	N/A
Army	146,414,000	508,868,000

The land area associated with the ranges is an essential factor in protecting the value of the facilities at the military installations in Nevada. Figure 8.2 shows the locations of airspace currently used and proposed to be used for defense-related purposes over Nevada. Figure 8.3 depicts the locations of lands envisioned to be withdrawn in Nevada for defense-related purposes. Figure 8.4 shows the locations of additional airspace envisioned to be used for defense-related purposes over Nevada. Figure 8.5 is a combination of Figure 8.1 and Figure 8.3. The specific missions of all existing, proposed, and envisioned land withdrawals and airspace are described in Chapters 2 through 7. The site-specific effects of mission-related activities on withdrawn lands and within airspace are also described in these chapters. This chapter describes the cumulative effects of these activities in Nevada and potential future effects based on mission projections.

8.2 EFFECTS ON PUBLIC HEALTH AND SAFETY

8.2.1 GROUND MOTION

Ground motion results from underground nuclear testing at the Nevada Test Site (NTS), as part of the nuclear weapons testing mission of the U.S. Department of Energy (DOE). Underground nuclear testing programs, conducted in accordance with the Threshold Test Ban Treaty limitations of 150 kt or less, are not likely to result in structural damage to buildings in Nevada or to mines located near the NTS. When tests are conducted that are large enough to sway tall buildings, they are announced in advance, and construction crews and others are warned of possible swaying.

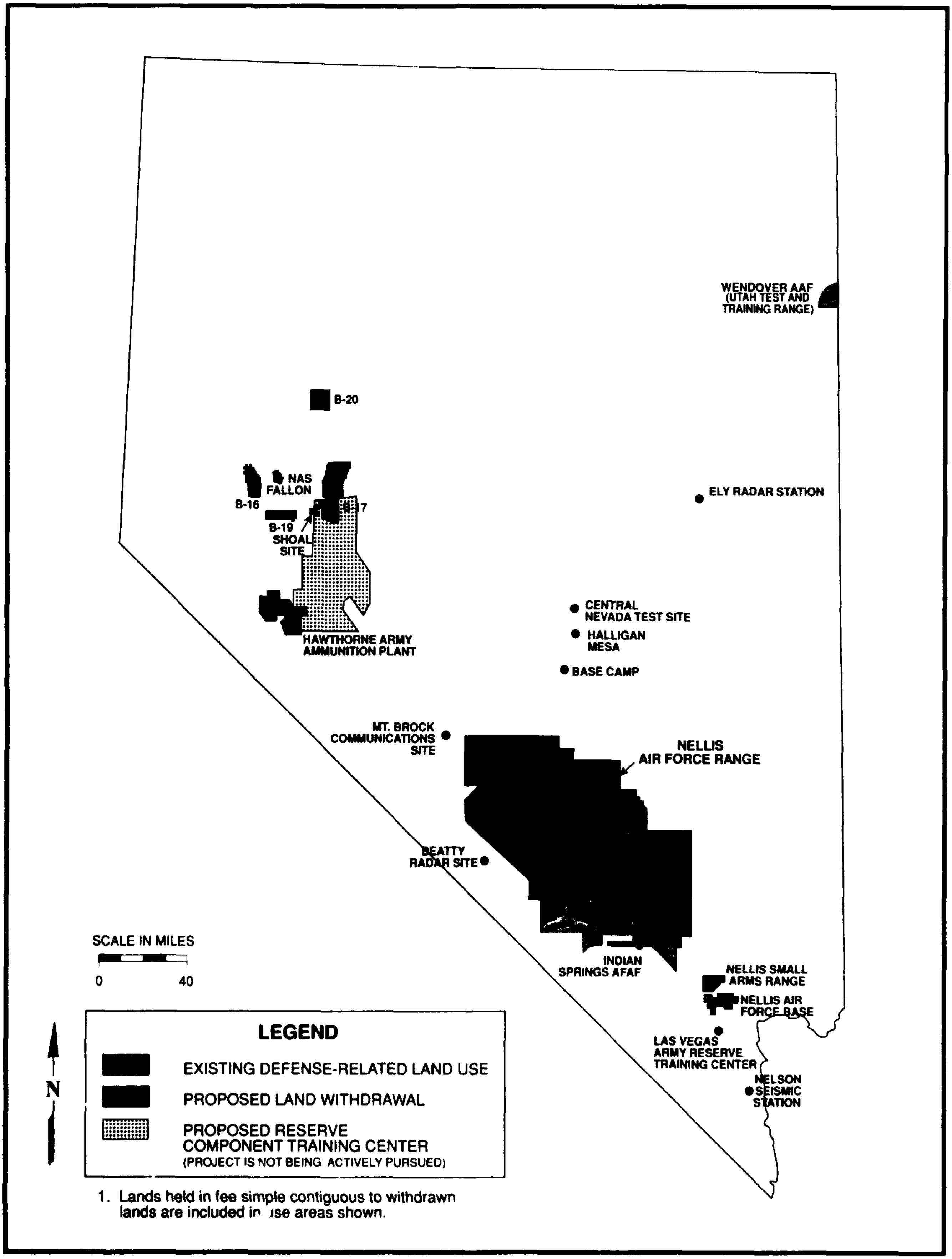


FIGURE 8.1 EXISTING AND PROPOSED DEFENSE-RELATED LAND USES/WITHDRAWALS IN NEVADA

Table 8-1. Land Area Comparisons for Nevada.

	DOD Land Area in Acres (Nevada)	Percent of Nevada Total
Air Force	3,072,918	4.3
Navy	105,023	0.15
Army	147,436	0.21
DOD Total	3,325,377	4.7
Nevada Total	70,745,600	100.0

Table 8-2. Land Comparisons U.S. Totals.

	Total DOD Lands in Acres		
	U.S. Total[1]	Nevada Total	Percent of Nevada Total
Air Force	9,616,654	3,072,918	32.0
Navy	3,642,522	105,023	2.9
Army	11,767,878	147,436	1.3
DOD Total	25,027,054	3,325,377	13.3

[1] Sources:
- Statistical tables of military real property, Navy NAVFAC P-319 September 1990.
- Report on real and personal property and selected assets, HQ USAF RCS: DD-Comp(A)741, September 1990.
- Military real property controlled at installations by state, land area controlled in acres, Department of the Army, 30 September 1990.

8.2.2 AIR QUALITY

Air emissions from DOD and DOE activities within the individual geographical regions of Nevada do not result in significant air quality effects within those regions, using the National Ambient Air Quality Standards (NAAQS), source permit compliance, and total emissions data as the measures of significance. Air emissions from DOD and DOE activities are low and are released over large areas, so that the resulting increases in pollutant concentrations are extremely low.

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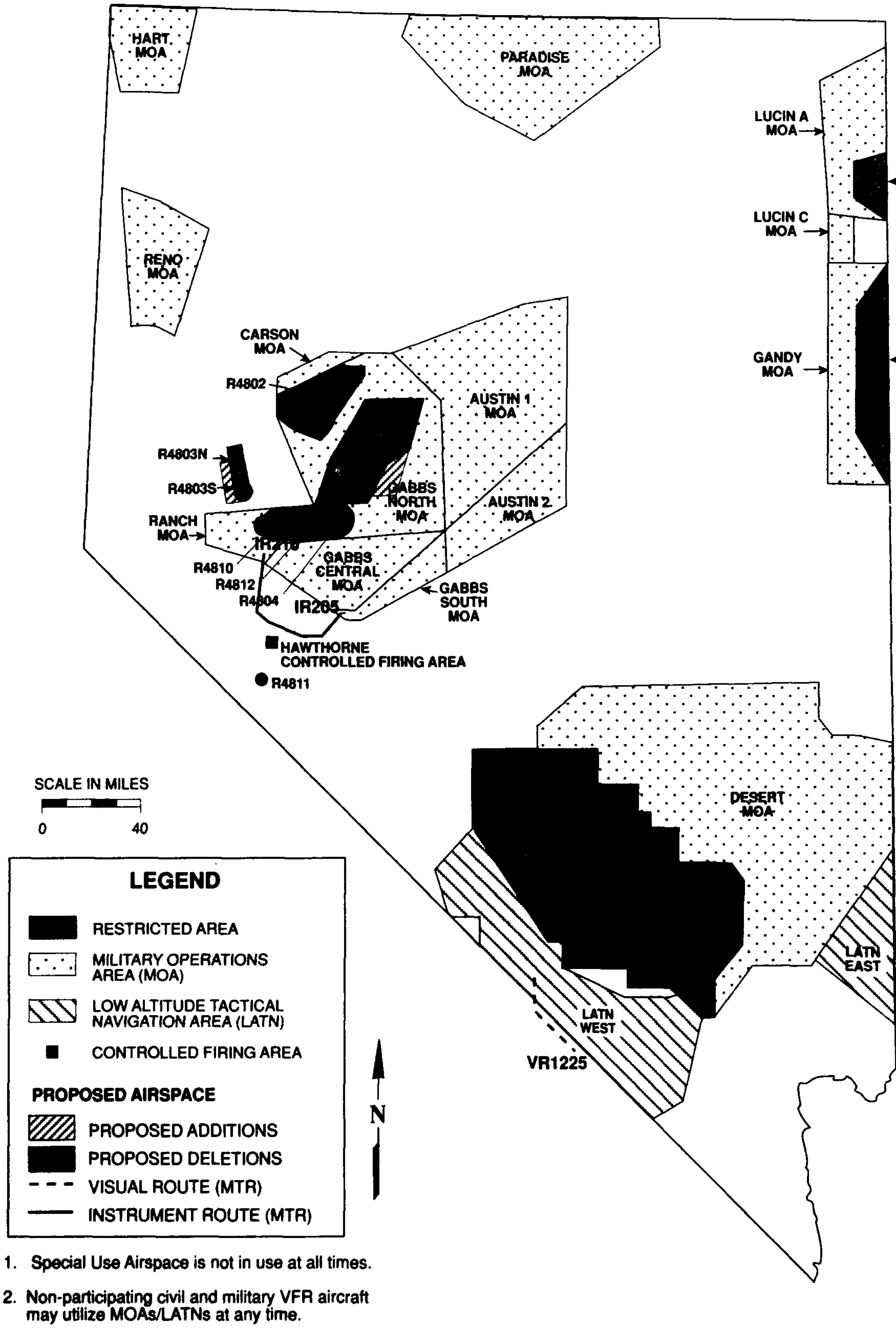


1. Special Use Airspace is not in use at all times.
2. Non-participating civil and military VFR aircraft may utilize MOAs/LATNs at any time.

FIG. 8.2 EXISTING AND PROPOSED AIRSPACE USED FOR DEFENSE-RELATED PURPOSES

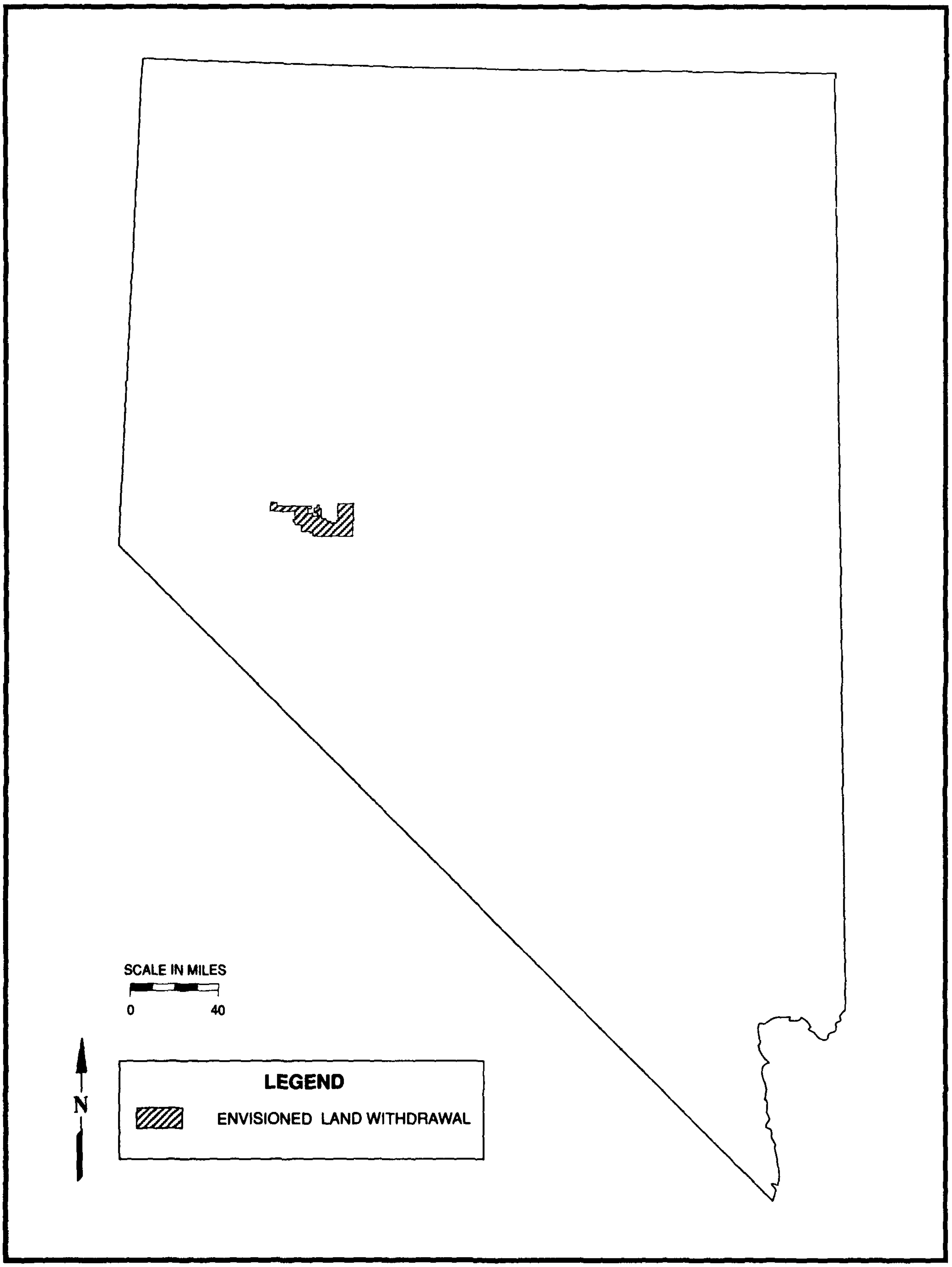


FIGURE 8.3 ENVISIONED LAND WITHDRAWALS IN NEVADA

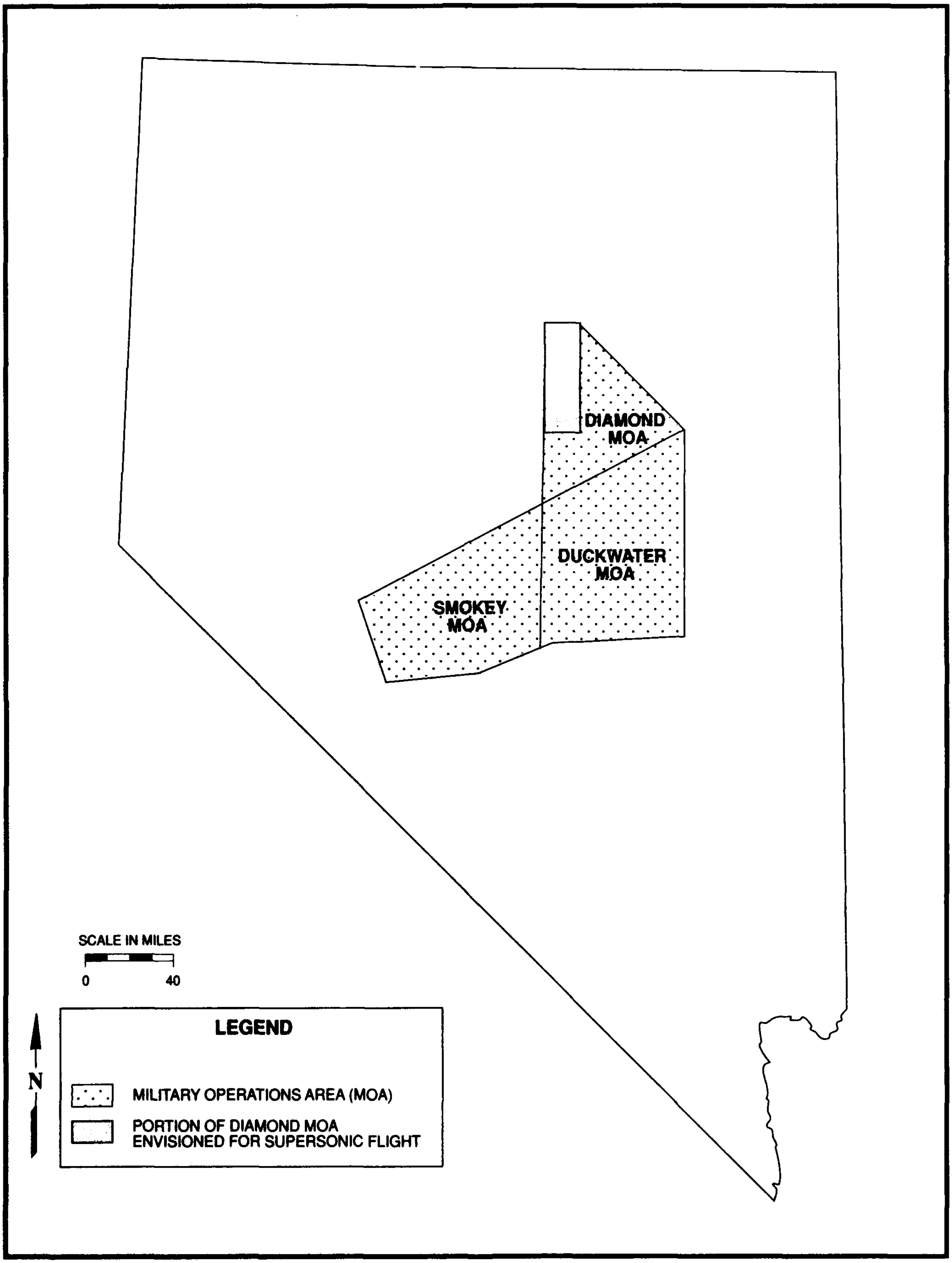


FIGURE 8.4 LOCATIONS OF AIRSPACE OVER NEVADA ENVISIONED FOR DEFENSE-RELATED PURPOSES

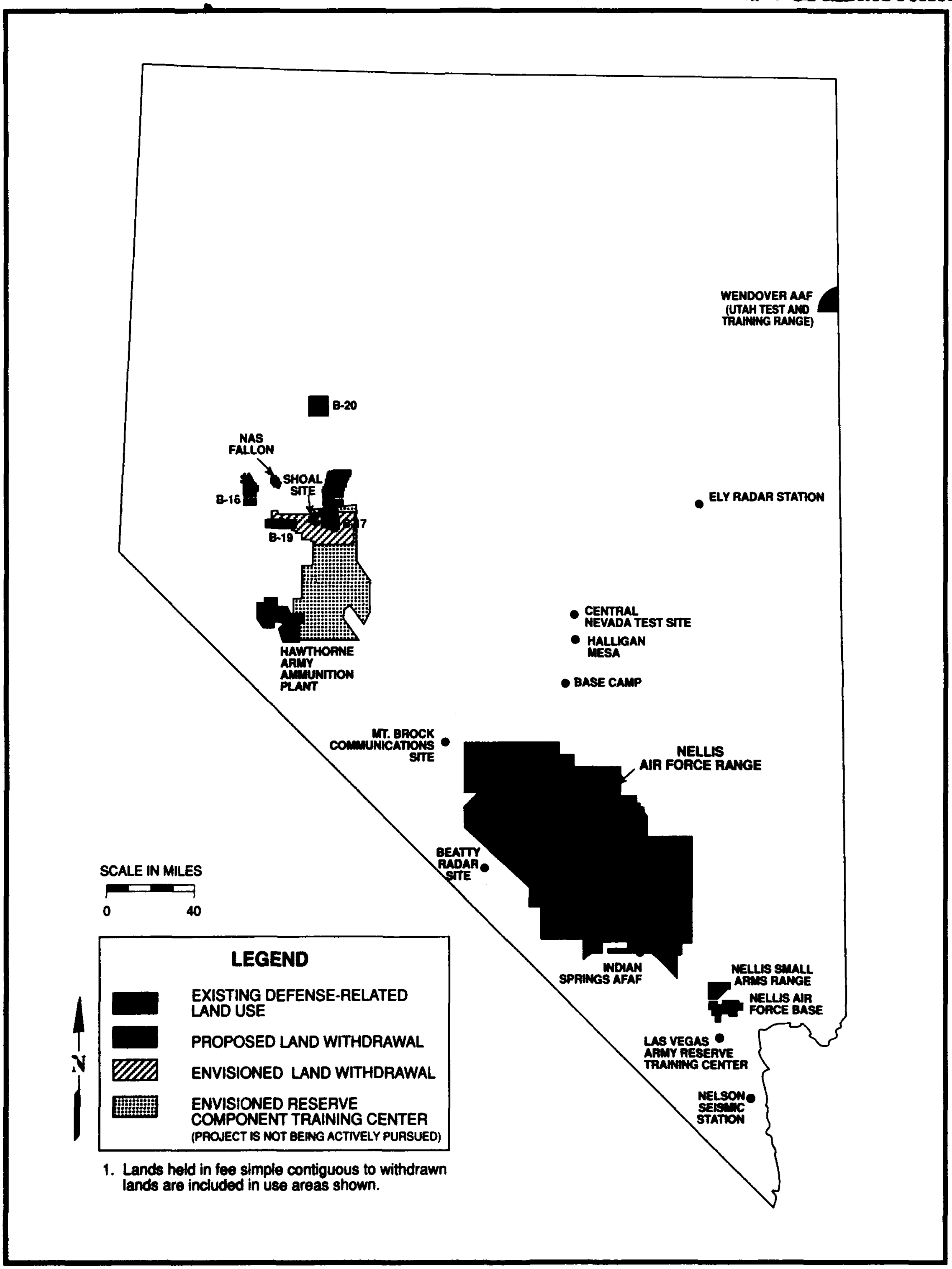


FIGURE 8.5 EXISTING DEFENSE-RELATED LAND USE AND PROPOSED AND ENVISIONED LAND WITHDRAWALS IN NEVADA

The only significant air quality problems in Nevada are confined to the urban areas of Reno and Las Vegas. The DOD activities near Las Vegas do not contribute substantially to the NAAQS nonattainment problems there.

It can be concluded, then, that the statewide effect of DOD and DOE activities on Nevada's air resources is also negligible.

8.2.3 WATER QUALITY AND FLOOD HAZARD

Activities related to the missions of Nellis Air Force Base (AFB), Naval Air Station (NAS) Fallon, Hawthorne Army Ammunition Plant (HWAAP), and DOE have resulted in some contamination of water resources, primarily as a result of past hazardous and toxic wastes disposal practices. Preliminary studies conducted in accordance with the Defense Environmental Restoration Program of water-resource contamination have been completed; additional studies are being performed; or remedial action is being taken as required. The potential for contamination of public water resources on lands withdrawn for the NAS Fallon Range Training Complex (FRTC) and Nellis Air Force Range (NAFR) is significantly less than for Nellis AFB, Indian Springs Air Force Auxiliary Field (AFAF), NAS Fallon, and HWAAP, because the ranges are isolated from public water resources and range equipment maintenance activities do not generate as much hazardous waste as the installations. In general, agencies responsible for these installations are now in substantive compliance with current federal and state regulations and those procedures governing disposal of hazardous and toxic waste, which is the principal potential contaminant at these installations.

Some possibility exists for the transport of contaminants by surface water to publicly accessible areas as a result of activities at Nellis AFB and the Small Arms Range, HWAAP, and NAS Fallon. While this possibility has not been quantified, it is considered remote. No reasonable possibility exists for the transport of contaminants by surface water to publicly accessible areas near the NAFR and FRTC because of hydrogeologic conditions and the relative isolation of the ranges.

Some possibility exists that public health and safety could be affected due to the concentration or diversion of surface water run-off, or flooding as a result of activities at Nellis AFB and the Small Arms Range, HWAAP, and NAS Fallon. Such possibility, which could result from construction of artificial barriers or diversions that alter the natural flow of surface water, has not been quantified, but it is considered remote at NAS Fallon based on flood plain mapping.

8.2.4 IONIZING RADIATION

DOE activities are the major contributor of ionizing radiation in Nevada. The potential radiation dose for members of the general public resulting from routine DOE activities on the NTS is typically less than one millirem per year. This dose level does not represent an effect on public health and safety. A worst-case credible accident (the venting of a nuclear weapons detonation) could result in ionizing radiation doses to members of the general public equivalent to three times the natural background radiation. Risks to public health and safety are not believed to be associated with this dosage level. DOE is pursuing a policy of decontaminating certain areas previously used for the nuclear testing program. As a result of this decontamination program, levels of ionizing radiation in the environment will be reduced in the future. In summary, ionizing radiation resulting from current DOE activities does not represent an effect on public health and safety in Nevada.

8.2.5 NON-IONIZING RADIATION

The specific regulations governing the use of RF/microwave radiation systems and lasers are contained in the sources cited in the preceding chapters. Electronic warfare emitters are the highest power RF/microwave radiation systems used in Nevada. Adherence to controlling regulations ensures that there is no risk to the public from routine exposure.

Lasers are used for target designation and air-to-ground ranging by DOD agencies in Nevada. These devices are capable of delivering sufficient energy or power in the beam of light to damage the human eye. Lasers are used for construction purposes at NTS by the DOE. These devices are capable of delivering sufficient energy or power in the beam of light to damage the human eye or skin, but under these uses are not considered to be lethal. The major concern is associated with the human eye where retinal damage can occur in uncontrolled settings. All of these systems are subject to government and site-specific regulations that ensure that their use does not affect public health and safety.

8.2.6 SOLID AND HAZARDOUS WASTE

Nellis AFB, NAS Fallon, NTS, and HWAAP qualify as large-quantity generators of solid and hazardous wastes under the Resource Conservation and Recovery Act (RCRA) of 1976 and subsequent amendments. These installations have implemented formal hazardous waste management programs to ensure that such wastes are handled and disposed of in accordance with applicable regulations. The basic concept of operation involves the proper collection and containerization of the waste at satellite accumulation sites near the points of generation. The waste is then transferred to a central on-site temporary storage area where it is picked up by a licensed transporter and delivered to a commercial, Environmental Protection Agency (EPA)-approved Treatment, Storage, and Disposal facility for ultimate disposition. At Nellis AFB and NAS Fallon, arrangements for the transportation and final disposition are made by a Defense Reutilization and Marketing Office (DRMO) in accordance with Defense Logistics Agency directives. Similar procedures, but without the support of a DRMO, are followed at NTS, HWAAP, and other sites for non-radioactive and non-explosive waste. Radioactive and mixed waste at NTS, and explosive waste at HWAAP, are treated and disposed of on-site. State of Nevada approval of RCRA Permit applications for NTS and HWAAP is pending.

All of these facilities are routinely inspected by EPA, State of Nevada Division of Environmental Protection (NDEP), and environmental officials from DOD and DOE. In general, current operations are in compliance with applicable regulations and there is no effect on public health and safety. Continued compliance with regulations will ensure that public health and safety is not affected by solid and hazardous waste in the future.

Prior to the development of EPA regulations governing hazardous and toxic waste disposal, past hazardous waste disposal practices at some installations resulted in ground water contamination, or other environmental effects. Programs are in affect at Nellis AFB, NAS Fallon, HWAAP, and NTS to identify such sites, evaluate the magnitude of any contamination, and remediate identified hazards.

8.2.7 NOISE AND SONIC BOOM

Noise from low altitude aircraft at subsonic speeds and sonic booms from high altitude aircraft at supersonic speeds occur over specific portions of Nevada land.

Noise from low altitude flights occurs under flight paths associated with airfield operations (landings, takeoffs and touch-and-go training patterns), and low-level Military Training Routes (MTRs) which traverse Nevada and are used for Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) navigation training, range operations (which include bombing and strafing target ranges) and Low Altitude Tactical Navigation (LATN) areas adjacent to the NAFR. The primary effect regarding these noise activities is that of annoyance to resident populations who are subjected to high levels of noise exposure, either through sporadic occurrences of very high single-event noise levels or through repetitive occurrences of moderate-to-high single-event levels. The latter mainly under MTRs or near airfields. A total of approximately 31,000 (2.8 percent) Nevada residents are estimated to reside in areas affected by noise from military aircraft. Of these, it is estimated that a total of approximately 3,200 (0.29 percent) residents may be expected to be "highly annoyed" by aircraft noise exposures.

Sonic boom occurs mainly under airspace for which supersonic flight has been approved, although inadvertent occurrences of sonic booms do occur elsewhere in Nevada. The airspace approved for supersonic flight activity is in the NAFR, the FRTC, and the Utah Test and Training Range (UTTR). The greatest portions of these supersonic areas are above rural land areas with sparse population. The total number of Nevada residents expected to be affected by sonic boom exposures is approximately 1,000 (0.09 percent), of whom it is estimated that about 30 (.002 percent) would be expected to be "highly annoyed" by sonic boom occurrences. The potential for damage to buildings by sonic boom, mainly through breakage of windows, is real, but of low probability. Past occurrences of damage to buildings have been settled by the Air Force and Navy through an established claims procedure. Effects of sonic boom on cultural resources and wildlife are not sufficiently understood at this time to be quantified on a local or a state-wide basis. However, various studies are either ongoing or planned for these effects.

The potential for damage to buildings by sonic boom, except window breakage or bric-a-brac, is real, but extremely low in probability. For example, the Air Force and Navy have awarded a total of 95 claims for approximately $31,000 from 1988 to the present for sonic boom damage. A review of these claims indicates that over 90 percent are for window breakage or bric-a-brac damage (vase falling from shelf). It should be noted that one event, the Caliente incident, on 28 February 1990, resulted in substantial window damage; 48 claims for $14,000 were paid. (The Caliente incident accounts for approximately 50 percent of all claims). These as well as any other occurrences of damage are settled by the Air Force and Navy through an established claims procedure.

Other impulsive noise from military operations is caused by live ordnance bombing and gunnery practice at the ranges. The activities are well removed from populated areas and have no significant affect on Nevada residents.

8.2.8 FACILITY ACCIDENTS

Large quantities of hazardous materials such as munitions, explosives, fuels, and chemicals are used, handled, or stored at DOE and DOD installations. The probability of a catastrophic accident involving these materials and causing injuries or property damage in off-site (public) areas is a function of the type of material involved, the magnitude of the event, the proximity of the public area, and the effectiveness of facilities and activities designed to contain the event.

DOD and DOE agencies have implemented comprehensive programs designed to prevent accidents at each of their concerned facilities. Compliance with these programs provides protection to employees and to the general public in surrounding areas. For example, DOD Explosive Safety Standards require a safety buffer zone around every facility in which explosives are stored. This safety zone is large enough to protect surrounding facilities and public areas in the event of an inadvertent detonation. Such standards have also been adopted by DOE.

In general, activities involving hazardous materials at Nevada DOD and DOE installations are in compliance with applicable standards as evidenced from inspections by local, State, and Federal health and safety officials. No mishaps have affected the health and safety of the general public. Facility accidents are not considered to be a serious threat to public health and safety.

8.2.9 AIRCRAFT MISHAPS

Despite the high number of military flight operations conducted over Nevada, historical data indicate that only three mishaps per year have occurred off-range (outside of withdrawn lands or a military airfield). Based on current and future operations, the likelihood of aircraft mishaps affecting public health and safety is considerably less than that of a natural phenomenon (such as lightning) causing injury or damage to the people and property of Nevada.

Figure 8.6 shows the probabilities of some aircraft-related incidents discussed in this section and in Section 8.2.10 which could result in death, personal injury, or property damage in Nevada. Based on this analysis, it is concluded that defense-related aircraft mishaps do not represent an unreasonable risk to public health and safety in Nevada nor are they expected to in the future.

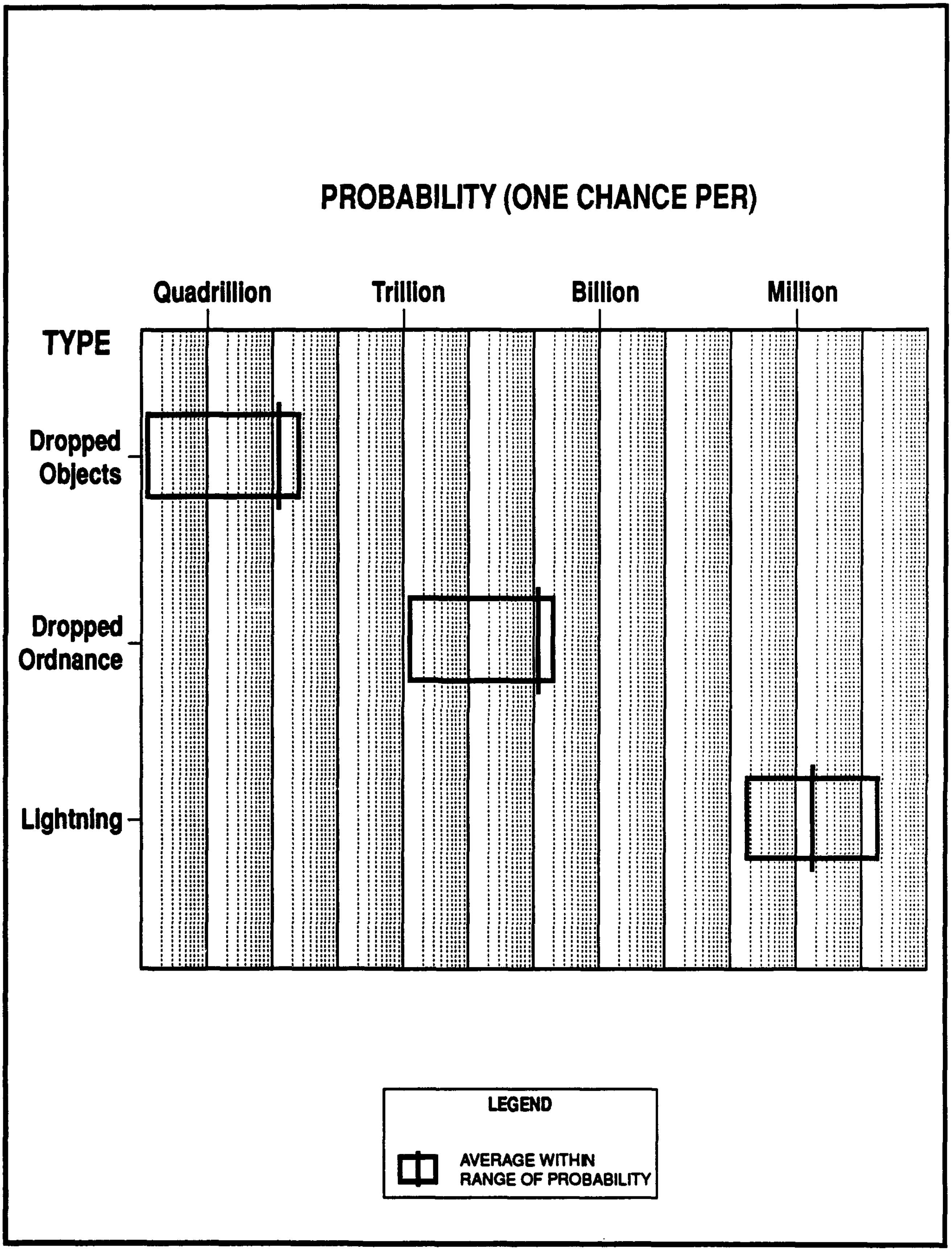


FIGURE 8.6 PROBABILITY OF DEFENSE-RELATED AIRCRAFT INCIDENTS RESULTING IN INJURY, DEATH, OR PROPERTY DAMAGE

8.2.10 OBJECTS AND ARMAMENTS DROPPED FROM AIRCRAFT

Aircraft parts have been accidentally dropped on public lands in Nevada. Nellis AFB and NAS Fallon have specific procedures designed to prevent the release of dropped parts over public lands and to investigate any incidents which should accidentally occur. Based on current and projected future aircraft operations, the probability of accidentally dropped aircraft parts affecting public health and safety is considerably less than the probability of a natural phenomenon (such as lightning) causing injury or damage to the people and property of Nevada.

Armaments have accidentally been dropped on public lands in Nevada. Nellis AFB and NAS Fallon have specific operational procedures designed to minimize the likelihood of armaments being accidentally dropped on public lands as discussed in previous chapters. Having smaller ranges, NAS Fallon has implemented enhanced procedures, in consultation with the Bureau of Land Management (BLM) and the State of Nevada, to minimize the likelihood of accidentally dropped armaments on public lands and to safeguard the public health and safety in the event an accidental drop does occur.

Crashed cruise missiles have been reported as falling on public lands twice within the Elko District BLM in the past three years near the Wendover UTTR. The Elko District Office has a MOU with Hill AFB on investigation and clean-up procedures for accidents on public lands outside of the Wendover UTTR.

Figure 8.6 shows the probabilities of some aircraft-related incidents discussed in this section which could result in death, personal injury, or property damage. Figure 8.7 puts these probabilities into perspective by comparing them to the probabilities associated with other events affecting public health and safety. Based on this comparison, it is concluded that the possibility of dropped objects and armaments affecting the public health and safety in Nevada does not currently, and is not expected to represent an unreasonable risk in the future.

8.2.11 TRANSPORTATION OF HAZARDOUS MATERIALS

The major classes of defense-related hazardous materials (HAZMAT) shipped into or out of Nevada are explosives, flammable liquids (fuels), and radioactive materials. Table 8-3 summarizes defense-related shipments of HAZMAT and reflects these shipments as a percentage of all HAZMAT shipments in Nevada. Fuel shipments by pipeline represent the largest component of defense-related HAZMAT shipments, followed by truck shipments and rail shipments. Defense-related shipments of explosives account for 99 percent of all such highway shipments in Nevada, and defense-related highway shipments of radioactive materials accounts for 84 percent of all those highway shipments in the state. In total, these major defense-related HAZMAT shipments total approximately 1,738 tons per day, primarily fuel, which represents 3.7 percent of all HAZMAT shipments in Nevada.

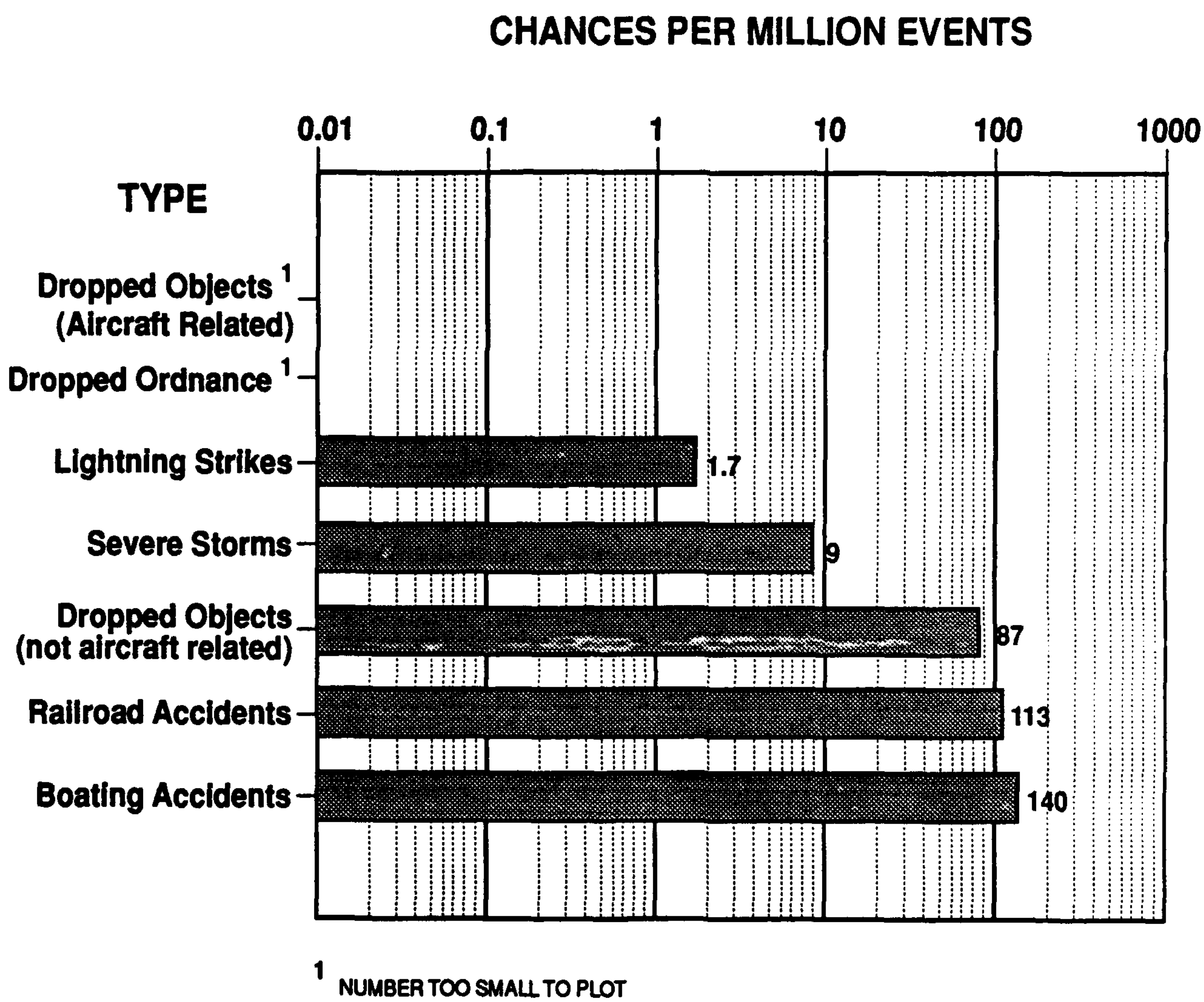


FIGURE 8.7 DEFENSE-RELATED AIRCRAFT INCIDENTS IN PERSPECTIVE

Table 8-3. Defense-Related Contribution to Total Nevada HAZMAT Transportation.

HAZMAT & U.N. Class	Highway Tons/Day	Highway % of NV	Rail Tons/Day	Rail % of NV	Pipeline Tons/Day	Pipeline % of NV	Total Tons/Day
1 - Explosives	206(1)	99(2)	73	35	N/A(3)		279
3 - Flammable Liquids (Fuels)	240	4	0	N/A(3)	1,132	10	1,372
7 - Radioactive Materials	87	84	0	N/A(3)	N/A(3)		87
1-9 TOTAL(4)	533	5	73	0.2	1,132	10	1,738

1 Defense-related, in tons per day
2 % = defense-related in tons per day ÷ total Nevada in tons per day
3 N/A does not apply
4 Total defense compared to total Nevada (for major classes)

The major highway links used for defense-related HAZMAT shipments are shown in Figure 8.8. Explosives are shipped on U.S. Highway 93 (Hoover Dam to Las Vegas), U.S. 95 (Las Vegas to I-80), U.S. 50 (California to U.S. 95), and I-80 (U.S. 95 to Utah). Fuels are shipped on U.S. 95 (Las Vegas to Tonopah). Radioactive materials are shipped on U.S. 93 (Hoover Dam to Las Vegas), I-15 (Utah to Las Vegas), U.S. 95 (Las Vegas to I-80), U.S. 93 (I-80 to Idaho), and I-80 (U.S. 95 to U.S. 93). The only rail route used to transport defense-related HAZMAT is the mainline Southern Pacific (between Reno and Wendover), and the Mina branchline, from the mainline at Hazen to the HWAAP.

The two pipelines used to transport defense-related HAZMAT are the CAL-NEV Pipeline and the Southern Pacific Pipeline, both of which carry jet fuel and enter Nevada from California. The CAL-NEV Pipeline terminates at a tank farm in North Las Vegas, from where tanker trucks distribute the jet fuel to Nellis AFB, Indian Springs AFAF, and the Tonopah Test Range (TTR). The Southern Pacific Pipeline terminates at Sparks, Nevada, and has a dedicated pipeline to NAS Fallon.

The U.S. Department of Transportation computer data base that supports the Hazardous Materials Incident Report indicates that 152 HAZMAT accidents occurred in Nevada from 1985 through 1989. These accidents consisted of the following: highway (130 accidents), railroad (18 accidents), air (3 accidents), industrial handling (1 accident). No

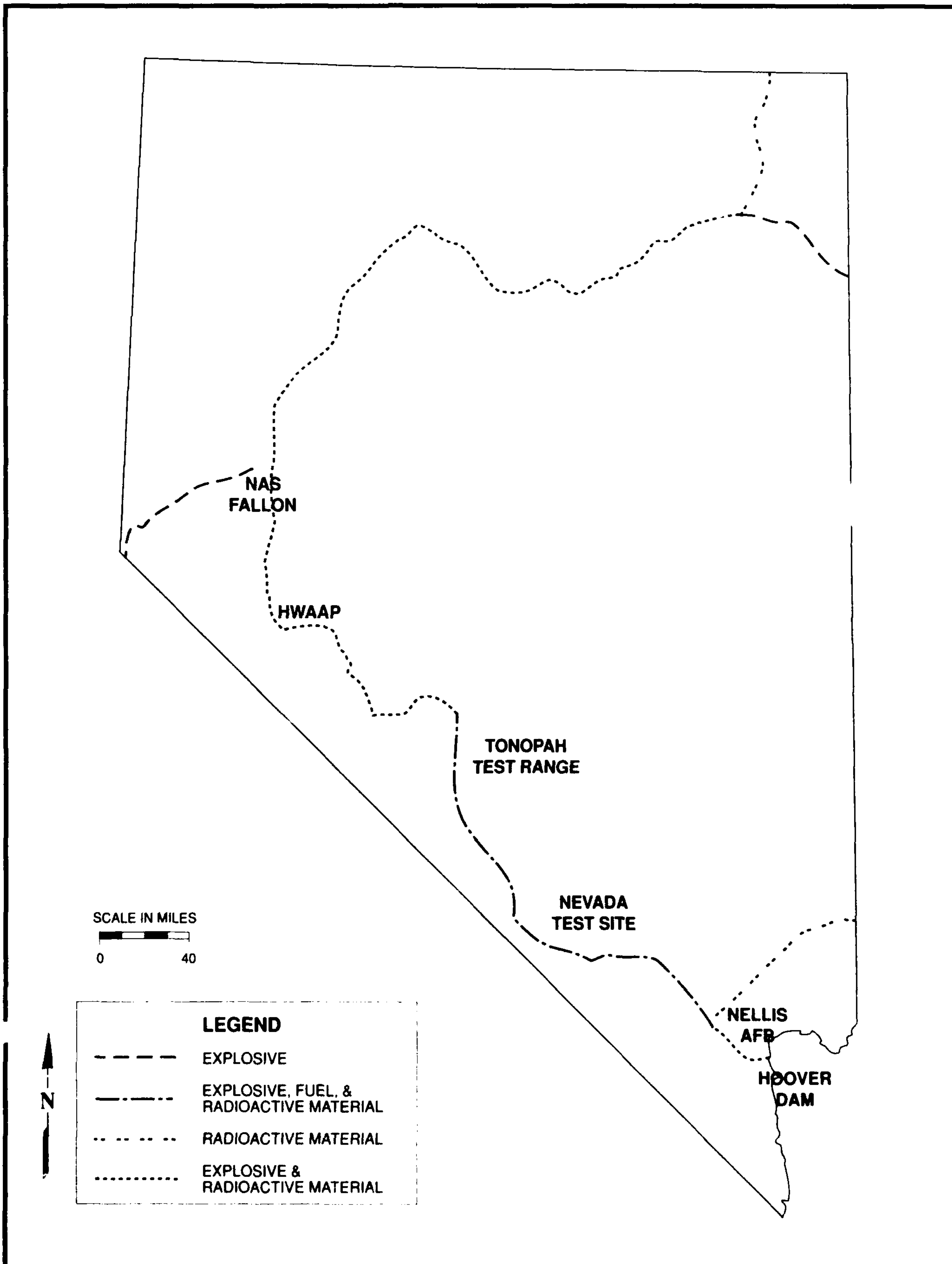


FIGURE 8.8 HIGHWAY ROUTES USED FOR THE MAJORITY OF DEFENSE-RELATED HAZARDOUS MATERIALS SHIPMENTS

pipeline accidents occurred during this period. As indicated in Table 8-3, defense-related HAZMAT shipments account for 3.7 percent of all HAZMAT shipments in Nevada. Based on this percentage, it would be expected that 6 of the 152 accidents are defense-related shipments. In actuality, defense-related shipments accounted for only 3 of the 152 accidents (1.9 percent of total HAZMAT accidents), and none of those 3 resulted in any personal injury or death.

The analysis indicates that defense-related transportation of hazardous materials in Nevada does not represent a disproportional effect on public health and safety. The analysis shows that defense-related shipments had 50 percent less accidents than the number expected, based on the amount of HAZMAT shipped. This lower than expected rate may be attributable to the stringent shipping and handling criteria used by DOD and DOE.

8.2.12 CHAFF AND FLARES

The use of chaff does not present a known risk to the public health and safety. This is due to: 1) limited areas where deployment is allowed, 2) restrictions on the type of chaff used (i.e., rope chaff is not used), 3) coordination of usage with the FAA and restrictions during severe weather conditions, 4) low ambient-concentrations of chaff, and 5) its constituents which are not toxic. The long-term cumulative effects of chaff are unknown.

There are several restrictions on the use of flares, all designed to prevent fires as described in Chapters 2 and 3. Nevertheless, fires do occur, one consumed 35,000 acres in 1987.

Although the dud rate of flares is low, a potential exists for severe injury if a flare is found and improperly handled. This effect is less likely to occur than fires, based on known historic accident rates.

No changes in effects are anticipated for the year 2000.

8.2.13 SUMMARY

Current military activities do not cause unreasonable risks to the health, safety, and property of the citizens of Nevada. Existing residential land uses adjacent to Nellis AFB and NAS Fallon are, however, incompatible with noise resulting from the air operation at those facilities. Low-altitude overflights and sonic booms will result in annoyance and possible startle effects to some of the people exposed to such events.

Past practices regarding storage and disposal of HAZMAT does present a possible risk to public health. Nellis AFB, NAS Fallon, HWAAP, and the NTS all contain Installation Restoration Program (IRP) sites. In many cases the extent of any problems associated with these sites is unknown; however, all these agencies have on-going programs aimed at characterizing and remediating these problems.

Analysis of the information available leads to the conclusion that there will be no degradation of health and safety in the year 2000 except in the area of noise and the use of flares. With the population and aircraft operational in the areas projected by the year 2000, approximately 30 percent more people will be living in areas deemed to be incompatible with projected noise levels surrounding the airfields.

The potential for fires associated with the use of flares does present a real concern. Personnel injury due to handling of dud flares presents less of a concern.

8.3 EFFECTS ON PUBLIC AND PRIVATE PROPERTY

Effects discussed in this section are those associated with employment, economics, population, housing, community services, public finance, and land and airspace uses. The statewide effects on public and private property are not the simple additive sum of the effects indicated in Chapters 2 through 7, due to the interaction of local economies with the statewide economy and larger regional and national economies.

8.3.1 ECONOMIC AND DEMOGRAPHIC EFFECTS

Indicators of economic and demographic effects in 1988 and 2000 are specified in Table 8-4.

Total direct employment is the sum of military and non-military employment associated with Nellis AFB, NAS Fallon, HWAAP, NTS, TTR, and Las Vegas Army Reserve Training Center. In 1988, direct employment resulting from activities related to these installations (24,900 jobs) represented 3.8 percent of all employment in Nevada. Considering indirect employment generated by direct workers spending their wages and salaries, and the procurement of materials and services (17,250 jobs), more than 6 percent of the total employment in Nevada may be attributable to activities associated with defense-related withdrawals.

Purchases associated with defense-related withdrawals contributed more than $1.4 billion to the gross regional product (GRP) of Nevada in 1988. This amount represents more than 5 percent of total GRP in the State. Activities associated with the withdrawals added almost $900 million to personal disposable income (PDI) available to Nevada residents, which is approximately 5 percent of all PDI in Nevada.

Direct employees associated with defense-related land withdrawals, and their dependents, comprise about 5.4 percent of Nevada residents (59,580). When the indirect population is considered, 8 percent of the residents (87,100 persons) are estimated to result from direct and indirect employment generated by activities at these installations.

The direct school-age population (more than 8,300 persons) is estimated to account for nearly 5 percent of public school enrollment in Nevada, assuming all of the school-age population were enrolled in public schools. When school-age dependents of indirect workers are considered (also assuming all enrollment in public schools), over 7 percent of school enrollment (nearly 12,500 persons) may be represented by dependents of direct and indirect workers in the State.

Table 8-4. Indicators of Economic and Demographic Effects in Nevada Resulting from Defense-Related Activities, 1988 and 2000.

	1988	2000
Total Employment in State[1]	685,440	989,460
Total Population in State	1,093,610	1,534,370
Employment from Withdrawals		
Direct Military	11,290	9,500
Direct Non-military	13,610	12,460
Total Direct Employment	24,900	21,960
Percent of State Total	3.8	2.2
Indirect Employment	17,250	17,100
Total Employment	42,150	39,060
Percent of State Total	6.1	3.9
Gross Regional Product (millions)	$1,425	$2,027
Percent of State GRP	5.2	4.1
Personal Disposable Income (millions)	$797	$1,352
Percent of State PDI	4.8	4.5
Population From Withdrawals		
Direct Military and Dependents	37,870	31,870
Non-military and dependents	21,710	19,160
Total Direct Population	59,580	51,030
Percent of State Total	5.4	3.3
Indirect Population	27,520	26,350
Total Population	87,100	77,380
Percent of State Total	8.0	5.0
School-Age Population		
Direct Military	5,080	4,280
Direct Non-military	3,260	2,880
Total Direct School-age	8,340	7,160
Percent of State Enrollment	4.7	2.9
Indirect School-age	4,130	3,950
Total School-age Population	12,470	11,110
Percent of State Enrollment	7.1	4.4

[1]Full and part-time employment (jobs) by place of residence.

Total employment and total population in Nevada are forecast to grow between 1988 and 2000. Direct employment associated with activities at defense-related installations is expected to decline from 24,900 jobs in 1988 to 21,960 jobs in 2000, primarily as a result of the potential move of the 37th Tactical Fighter Wing (TFW) from the TTR out of Nevada. The population related to this employment is forecast to decrease from 59,580 in 1988 to 51,030 in 2000. Indirect employment is forecast to decrease between 1988 and 2000, from 17,250 jobs to 17,100 jobs, respectively. Similarly, the indirect population induced by activities at the installations is forecast to decrease from 27,520 persons in 1988, to 26,350 persons in 2000.

Employment and population generated by activities at defense-related installations in Nevada are forecast to represent smaller percentages of total employment and population in 2000 than in 1988 because of the general employment and population growth in the State and the possible relocation of the 37th TFW. Nevertheless, activities associated with the installations are forecast to remain a substantial contributor to employment, with almost four percent of employment attributable directly or indirectly to these activities. Similarly, about five percent of the population in 2000 is forecast to result directly or indirectly from these activities.

By 2000, activities associated with the withdrawals are forecast to add more than $2.1 billion to GRP of Nevada, which represents over 4 percent of the total GRP forecast for the year 2000 in Nevada. Projections of PDI for the year 2000 indicate that approximately $1.4 billion could be added to statewide PDI by these activities, which represents over 4 percent of all PDI in the State.

The school-age population comprised of dependents of direct workers is estimated to be smaller in 2000 than in 1988 (7,160 persons and 8,340 persons, respectively). The percentage of statewide enrollment represented by this population is forecast to decline, from almost 5 percent in 1988 to nearly 3 percent in 2000, because of the increased public school enrollment in the school system and declines in defense-related employment. When the secondary population, ages 6 through 17, is considered in 2000, slightly more than 4 percent of enrollments would be represented by dependents of direct and indirect workers.

Table 8-5 reflects the economic and population characteristics for Nevada which are forecast to result in the year 2000 from an alternative land use compared to the continued withdrawal of land for defense-related purposes. An equivalent number of private sector jobs were assumed to replace employment at Nellis AFB, and mining and grazing were considered reasonable alternative uses of the NAFR, NAS Fallon, FRTC, HWAAP, and NTS.

Total employment in the State could be reduced by a range of 16,960 to 22,550 jobs under alternative uses of the withdrawn lands. Employment associated with alternative uses could be up to 2.3 percent of all employment in Nevada; whereas employment associated with lands withdrawn for defense-related purposes could be about 3.9 percent of statewide employment. The GRP could range from $154 million to $180 million less under the alternative use of land while total personal disposable income could range from approximately $407 million to $579 million less. Statewide population could also be less under an

Table 8-5. Projected Indicators of Economic and Demographic Effects Resulting from Defense-Related Activities and Alternative Land Use, 2000.

	Withdrawals	Alternative Use		Percent Difference	
		High	Low	High	Low
STATE OF NEVADA					
Total Employment [1]	989,460	972,500	966,900	(1.7)	(2.3)
Direct Employment	21,960	8,500	6,350		
Indirect Employment	17,100	13,570	10,130		
Total	39,060	22,070	16,480		
Percent	3.9	2.3	1.7		
Population	1,534,370	1,520,600	1,511,850	(0.9)	(1.5)
Gross Regional Product (millions)	$49,054	$48,900	$48,874	(0.3)	(0.4)
Personal Disposable Income (millions)	$30,185	$29,778	$29,606	(1.3)	(1.9)

[1]Full and part-time employment (jobs) by place of residence.

alternative use of the withdrawn land. In summary, while the GRP could increase under a high alternative use scenario, (which reflects the higher value added by the contribution of mining), statewide employment and other economic indicators would be less with the withdrawn lands used for alternative purposes than under their current use.

8.3.2 HOUSING

Effects on housing are specific to a local area around each withdrawal. Where an installation provides a substantial portion of the employment opportunities in a local area, (such as NAS Fallon in Churchill County and HWAAP in Mineral County), an effect on the supply of housing occurs. Housing builders and developers tend to be cautious about responding to apparent increases in demand because military employment may increase or decrease in response to political decisions, rather than in response to market decisions. Thus, the housing market in Churchill and Mineral Counties, and to a smaller degree in Nye County, is such that there are few available rentals, and the housing market is very tight as a result of the presence of land withdrawals and associated economic activities.

8.3.3 SERVICES

Public services are provided by communities and counties throughout Nevada, and the effects on such services are highly localized to the area near the withdrawal, as have been discussed in the appropriate sections of this report. Effects upon statewide services provided by state government, such as law enforcement, public safety, health care support, and education administration are related to the population served by these services. Thus, the state level effects associated directly and indirectly with the withdrawal-related population would be about 8 percent in 1988 and about 5 percent in 2000.

8.3.4 PUBLIC FINANCE

This section describes the components of general fund revenues and expenditures of Nevada state and local government in the aggregate. The purpose of a cumulative impact assessment such as presented here is to describe the magnitude of basic measures (general fund revenues and expenditures) of the fiscal system which serves the residents of Nevada and to determine the proportion of these measures which may be attributed to the defense-related activities on withdrawn lands. The revenue measure comparison represents the revenue attributable to the population resulting from direct employment by defense-related activities in the State. The expenditure measure comparison illustrates the dollar value of the effects on state-wide community services and facilities.

In general, both the general and defense-related population directly or indirectly contribute to public revenues through various taxes, fees, and other revenue generating measures. They also both receive the services provided by state and local government. The federal government portion of state and local government revenue is comprised primarily of revenues which are derived from general income and other population based taxes or distributed on various population formulas and therefore are included within the revenues attributed to the defense employment-related population.

There are a number of federal statutes providing financial assistance to states which are related to federal land holdings within the states and not distributed on a population basis. Federal Highway Construction and Forest Highway funds are the most significant programs distributed on the basis of federal land ownership which may, in the case of Defense Access Road (DAR) funds, have a defense-related component of the distribution formula. These funds are provided on a project basis. For example in 1988, Nevada received $3.4 million in DAR funds to assist in improving Craig Road near Nellis AFB. This represented 2 percent of Nevada's FY 88 highway construction program of $159 million (Source: NDOT, personal communication, 1990). Special program funds, such as those for DAR improvement, are not received on a regular basis and are not included in the general funds of Nevada state or local government. However, federal revenues in the general funds include special programs such as educational impact assistance funds and payment in lieu of taxes (PILT) which may be distributed using formulas that consider defense-related activities. These two components of the federal revenue contribution to the general funds in the State's fiscal system are also described in this section.

State of Nevada revenues for the fiscal year ending June 30, 1987 totaled $1,059,505,000. The sources of these revenues were as follows: sales tax ($191,310,000), gaming taxes ($250,565,000), other taxes ($155,214,000), federal ($292,896,000), charges for services and sales ($35,707,000), interest income ($32,068,000), licenses, fees and permits ($80,793,000) and other ($20,952,000). Of this revenue, about $85 million can be attributed to population associated with activities using withdrawn land and airspace for defense-related purposes.

State of Nevada expenditures for fiscal year ending June 30, 1987 were budgeted at $1,059,505,000. These were budgeted to the following functions: general government ($65,206,000), education and support ($234,644,000), health and social services ($230,856,000), law, justice and public safety ($98,930,000), regulation of business ($34,509,000), recreation and reserve development ($58,631,000), transportation ($204,030,000), and debt service ($40,591,000). As with the revenue, about $85 million may be attributed to activities associated with land withdrawals and use of airspace for defense-related purposes.

In 1988-89, counties, incorporated cities, and school districts in Nevada budgeted for combined total general fund resources of $1.24 billion and expenditures of $1.18 billion (Tables 8-6a through 8-6c) on a statewide basis. The effects of activities associated with withdrawn land and airspace on public finance general funds at the local level are about $100 million in revenue and $96 million in expenditures.

In 1976, federal law authorized "In Lieu of Tax Payments" (31 U.S.C.6901-6907) as amended in 1983 (P.L. 98-63); i.e., PILT, to provide payments to state and units of local government containing certain types of federally-owned lands. Section 6902 authorizes payments to local units of government (generally counties or the equivalent) based on the number of acres of "entitlement lands" within the county. "Entitlement lands" consist of lands in the National Forest System and the National Park System, lands administered by the BLM, and lands dedicated to the use of federal water resource development projects. Also included are dredge disposal areas under the jurisdiction of the U.S. Army Corps of Engineers, National Wildlife Reserve Areas withdrawn from the public domain, inactive and semi-active Army installations used for non-industrial purposes, and certain lands donated to the United States Government by state and local governments. The Act specifically prohibits payments for tax exempt lands (but not donated lands) acquired from state or local governments. Similarly, lands withdrawn under the Military Land Withdrawal Act of 1986 (Public Law 99-606) do not qualify as entitlement lands under the PILT program (Source: DOI, Office of the Solicitor, April, 1989).

8.3.5 LAND USE

Defense-related activities on withdrawn lands in Nevada are estimated to contribute $1,425 million to the state Gross Regional Product in 1988 and are projected to contribute $2,027 million to the state Gross Regional Product in the year 2000 (Table 8-4). The primary effect of land use restrictions on withdrawn land is to reduce agricultural, mining, and recreational opportunities.

Table 8-6a. General Fund Resources and Expenditures, FY 1988-1989[1].

Resources	COUNTIES Churchill	Clark	Lincoln	Mineral	Nye	Total all Counties Statewide
RESOURCES						
Ad Valorem	303,729	38,166,131	255,309	501,818	180,057	71,633,270
S.C.C.R.T.	905,416	50,545,538	478,623	1,089,296	2,429,609	101,030,145
Licenses, Permits, Fines & Fees	255,089	22,864,449	104,400	72,300	199,000	34,815,323
Gaming Revenues	22,051	14,771,301	6,000	27,600	32,000	19,340,352
Charges for Services	282,996	13,956,708	34,500	100,300	739,850	22,821,933
Interest Earned	112,186	6,435,500	35,000	50,000	45,000	9,900,186
Intergovernmental Revenue	998,800	6,626,938	261,990	568,528	1,425,400	27,499,940
Tranfer In	426,000	842,486	107,000	436,000	0	2,838,087
Grants	55,322	3,017,302	0	0	270,000	5,737,082
Other[2]	441,140	51,104,770	3,000	77,350	656,800	59,804,421
Total Other Resources	2,593,584	119,569,454	551,890	1,332,078	3,368,050	182,757,324
Total Resources[3]	4,495,395	234,076,730	1,533,581	3,132,446	7,211,848	398,810,868
EXPENDITURES						
Salary & Wages	2,132,894	75,529,128	715,903	1,530,271	3,676,982	157,020,927
Benefits	624,751	23,783,461	246,338	440,272	1,100,642	45,775,834
Services & Supplies	1,400,009	41,854,458	395,683	946,049	2,076,139	84,485,156
Capital Outlay	135,457	2,203,375	29,250	152,825	0	7,962,451
Other	0	0	0	6,029	205,613	2,748,935
Transfer Out	17,999	63,070,649	0	57,000	0	67,122,184
Debt - Repay: Principal	0	0	0	0	0	0
Interest	0	0	0	0	0	0
Total Expenditure	4,311,110	206,441,071	1,387,174	3,132,446	7,059,376	365,115,487

[1]Budgeted
[2]Includes Federal in lieu payments, dedicated revenues, and other
[3]Includes opening fund balances

Source: Local Financial Reporting Statewide Total Summary Report: Counties, Cities, Towns, Special Districts, and School Districts Revenues and Expenditures, Nevada Legislative Council Bureau, Comprehensive Counties; Fiscal Year 1976-77 - 1988-89, December 1988

Table 8-6b. General Fund Resources and Expenditures, FY 1988-1989[1].

	CITIES						
COUNTY	Churchill	Clark					
CITY	Fallon	Boulder City	Henderson	Las Vegas	Mesquite	North Las Vegas	Total all Cities Statewide
RESOURCES							
Ad Valorem	182,799	209,838	398,712	14,808,448	101,800	1,255,000	28,375,276
S.C.C.R.T.	289,123	997,520	3,823,161	19,645,955	233,623	1,758,000	41,432,454
Licenses, Permits & Fees	392,605	370,579	3,796,000	26,466,405	251,650	4,389,000	59,170,904
Intergovernment Revenue	694,498	1,839,179	7,996,500	33,559,855	454,449	10,556,000	78,174,293
Charges for Services	580,577	781,478	982,490	1,845,695	37,000	190,000	9,242,482
Other	139,200	1,236,385	290,000	3,200,000	176,500	2,050,000	10,819,331
Total Resources[2]	2,427,101	6,466,848	19,008,010	104,248,062	1,425,831	21,698,957	244,653,618
EXPENDITURES							
Salary & Wages	1,195,663	3,029,979	9,590,400	42,099,632	421,900	12,662,500	116,886,263
Benefits	385,428	970,235	2,752,895	12,409,527	103,300	3,663,300	35,135,839
Services & Supplies	677,273	1,408,230	4,384,676	41,131,645	456,334	3,767,000	71,878,106
Capital Outlay	42,920	148,750	578,232	981,265	327,150	0	4,619,995
Total Expenditures	2,301,284	5,557,194	17,306,203	96,622,069	1,309,684	20,092,800	228,520,203

[1]Budgeted
[2]Includes beginning fund balances

Table 8-6c. General Fund Resources and Expenditures, FY 1988-1989[1].

Resources	SCHOOL DISTRICT Churchill	Clark	Lincoln	Mineral	Nye	Total all School Districts Statewide
RESOURCES						
Ad Valorem	1,555,583	68,444,471	360,419	640,729	3,140,532	126,353,326
L.S.S.T.	1,354,084	94,531,221	132,105	425,000	1,934,414	155,587,417
State Distrib. School Fund	7,827,455	152,566,666	4,173,288	3,274,504	6,037,642	265,568,600
OTHER RESOURCES						
State Grants	60,000	0	21,600	6,135	6,135	701,705
Federal Grants	260,000	1,352,000	0	475,314	55,000	3,147,689
Franchise Fees	40,000	628,753	0	9,000	19,500	1,682,420
Motor Vehicle Tax	260,000	8,065,000	65,745	90,000	277,376	14,681,402
Transfer In	9,000	0	0	0	0	130,677
Interest Earned	0	2,750,000	0	0	30,000	4,046,000
Miscellaneous Revenue	6,000	629,750	160,200	13,200	55,000	3,189,538
Other[2]	0	65,000	0	4,000	1,500	149,700
Total Other Resources	635,000	13,490,503	247,545	597,649	444,511	27,729,131
Total Resources[3]	12,293,753	342,158,530	5,833,542	5,582,544	11,907,099	599,347,221
EXPENDITURES						
Salary & Wages	7,272,464	228,745,278	3,243,287	3,245,873	7,199,638	390,977,887
Benefits	1,892,215	56,168,729	748,066	851,054	1,928,759	95,874,530
Services & Supplies	1,497,868	30,769,815	569,133	878,421	1,529,171	63,705,857
Property	147,786	2,491,981	70,969	48,690	76,500	5,905,599
Other	11,600	307,906	5,500	8,237	16,500	989,397
Instruction & Non-inst.	10,821,933	318,483,709	4,636,955	5,032,375	10,750,568	557,453,270
Transportation	878,966	18,526,228	255,199	238,478	778,931	32,411,580
Total Expenditures[4]	11,775,899	337,253,038	4,957,154	5,354,853	11,682,099	591,142,040

[1]Budgeted
[2]Includes Estate Tax, Bond Proceeds, other
[3]Includes opening fund balances
[4]Includes transfers and beginning balances

The consequence of reducing agricultural activities on withdrawn land is minimal relative to the total economic contribution of agriculture in Nevada. The transfer of land from the defense-related withdrawals to public use which allows use by the private sector could result in an increase in Nevada of 4.1 million acres for grazing. The potential value-added through grazing on this land was estimated at $1.4 million dollars in 1988 or 0.005 percent of the Nevada Gross Regional Product (GRP). This value of grazing on withdrawn lands is also applicable to the year 2000 and, therefore, represents 0.003 percent of the Nevada GRP forecast for the high alternative use scenario ($48,900 million). Use of the land for agriculture purposes (primarily grazing) in Nye, Lincoln, Churchill, and Mineral Counties would probably increase somewhat, but the cumulative statewide increase in agricultural production and contribution to GRP would be relatively small.

The largest potential effect on mining from non-accessible withdrawn land is in Nye County as a result of the NAFR and NTS. This results from assumptions in the alternative land use scenario that the withdrawn area has economic potential for mining similar to that of other areas of Nye County and that market conditions in the year 2000 could be such that this potential would be economically feasible. The potential effects on mining from land withdrawals associated with NAS Fallon and HWAAP are slight when considered in the context of statewide development. The cumulative contribution of potential mining on withdrawn lands to the Nevada GRP forecast for the high alternative use scenario during the year 2000 ($48,900 million) could be up to $1,839 million (3.8 percent of GRP).

A 1980 special study for the Nevada Department of Recreation, Economic Impact of Outdoor Recreation in Nevada reports that outdoor recreation expenditures by Nevada residents contributed about $90 million dollars to the Nevada economy while visitors contributed another $55 million. Assuming outdoor recreation visitor and resident relationships to total state population remain the same as in 1979, outdoor recreation contributed $337 million (1988 dollars) to the Nevada economy. This represents 1.2 percent of the 1988 Nevada Gross Regional Product (GRP) which was estimated to be $27,400 million. The state has almost 71 million acres of which 4,145,039 are currently withdrawn and an additional 377,594 acres are proposed or envisioned for withdrawal. Thus, outdoor recreation contributed an estimated $5.09 per acre (excluding current withdrawn land). The potential value added by recreation on withdrawn land represents $32.3 million or 0.07 percent of the Nevada GRP forecast for the high alternative use scenario during the year 2000 ($48,900 million). The cumulative economic effect on statewide outdoor recreation is not substantial; the effects are contained within the local vicinity of each withdrawal.

8.3.6 ECONOMIC DEVELOPMENT

In general, the activities associated with land withdrawals throughout Nevada have had effects on the development of local economies. The levels of infrastructure in Churchill and Mineral counties that have been created as a result of NAS Fallon and HWAAP, respectively, are undoubtedly higher than would have been generated otherwise under alternative uses of the land. In Nye County, however, the economic contribution of land withdrawals is not so obvious. With mining as a viable alternative land use, economic development in Nye County may be constrained by the withdrawal of land for the NAFR and the NTS.

8.3.7 AIRSPACE

This section describes effects on civil and commercial aviation resulting from the use of airspace over Nevada for defense-related purposes. This airspace is considered as a whole rather than singling out specific areas of the state where MTRs, Aerial Refueling Routes (ARs), military operations areas (MOAs), and restricted areas are located. Figure 8.9 depicts restricted areas in the State and shows the relatively small amount of airspace which, when active, restricts access to non-participating military and civil aircraft due to the existence of hazards to aircraft. Authorization to transit joint-use designated restricted areas which are not active may be received from the controlling agencies. Sufficient information to estimate specific effects, such as the economic cost of flights being routed around defense-related airspace, as necessary, is not available in existing studies.

The Nevada Airport System Plan (Source: NDOT, 1987) indicates that in 1985 there were a total of 1,031,570 civil aircraft operations in Nevada. By the year 2005, civil aircraft movements are projected to increase 75 percent to a total of 1,800,740 operations. In 1985, there were 1,880 general aviation aircraft based at airports in Nevada, the locations of which are indicated in Figure 8.10; these aircraft are projected to increase 47 percent to a total of 2,755 by the year 2005. Table 8-7 summarizes the 1985 and forecast year 2005 aviation activity in Nevada.

Table 8-7. Civil Aviation Operations and Based Aircraft in Nevada.

	Operations 1985	Percent Overall	Operations 2005	Percent Overall	Based Aircraft 1985	Based Aircraft 2005
General Aviation	739,570	71.7	1,260,740	70.0	1,880	2,754
Air Carrier	215,000	20.8	391,000	21.7	----	----
Commuter	77,000	7.5	149,000	8.3	----	----
TOTAL	1,031,570	100.0	1,800,740	100.0	1,880	2,754

Source: Nevada Department of Transportation, Nevada Airport System Plan, 1987.

The possible socioeconomic effects upon civil aviation is keyed primarily to constraints that the existence of defense-related airspace may place on routes of flight. With

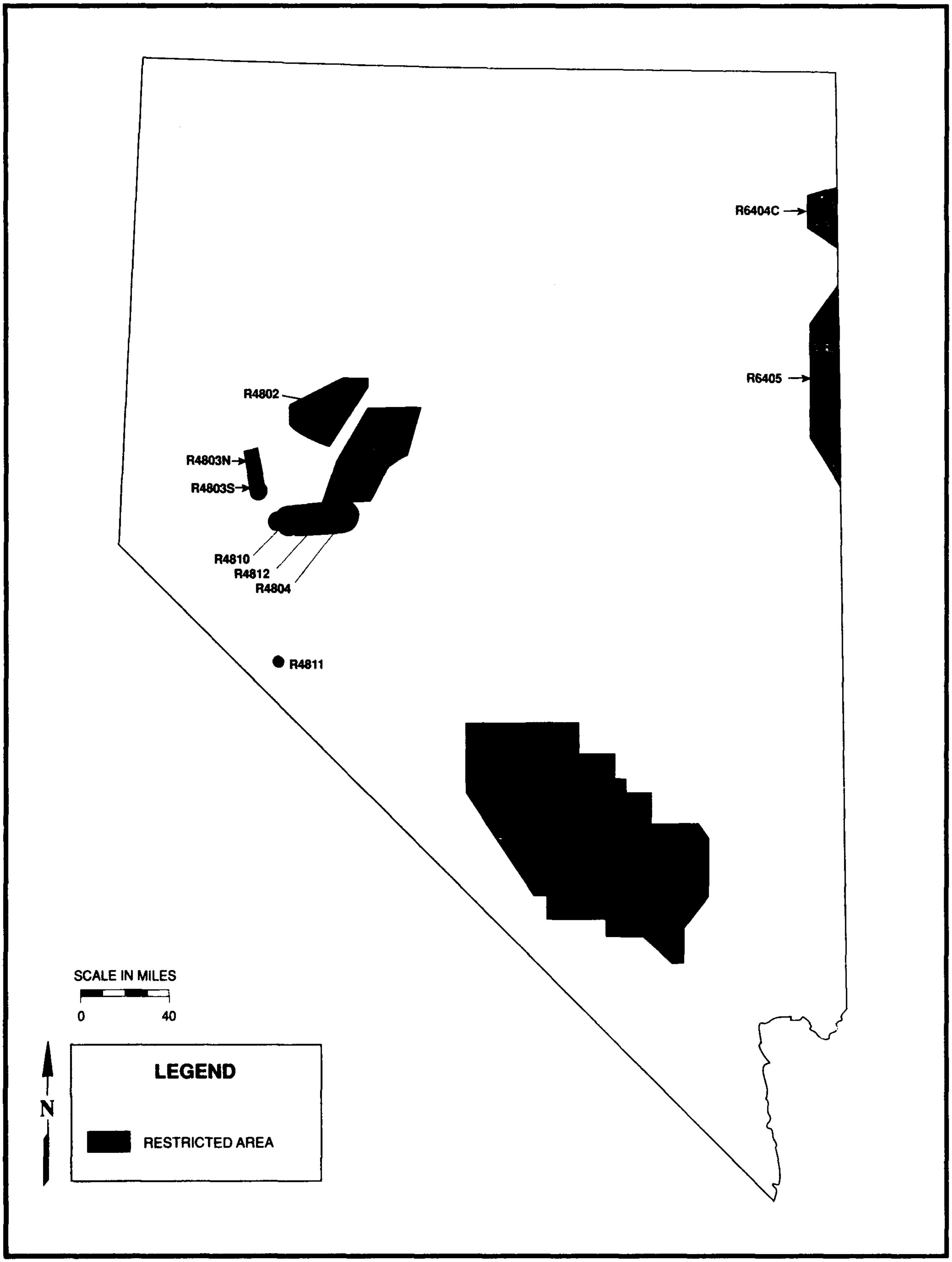
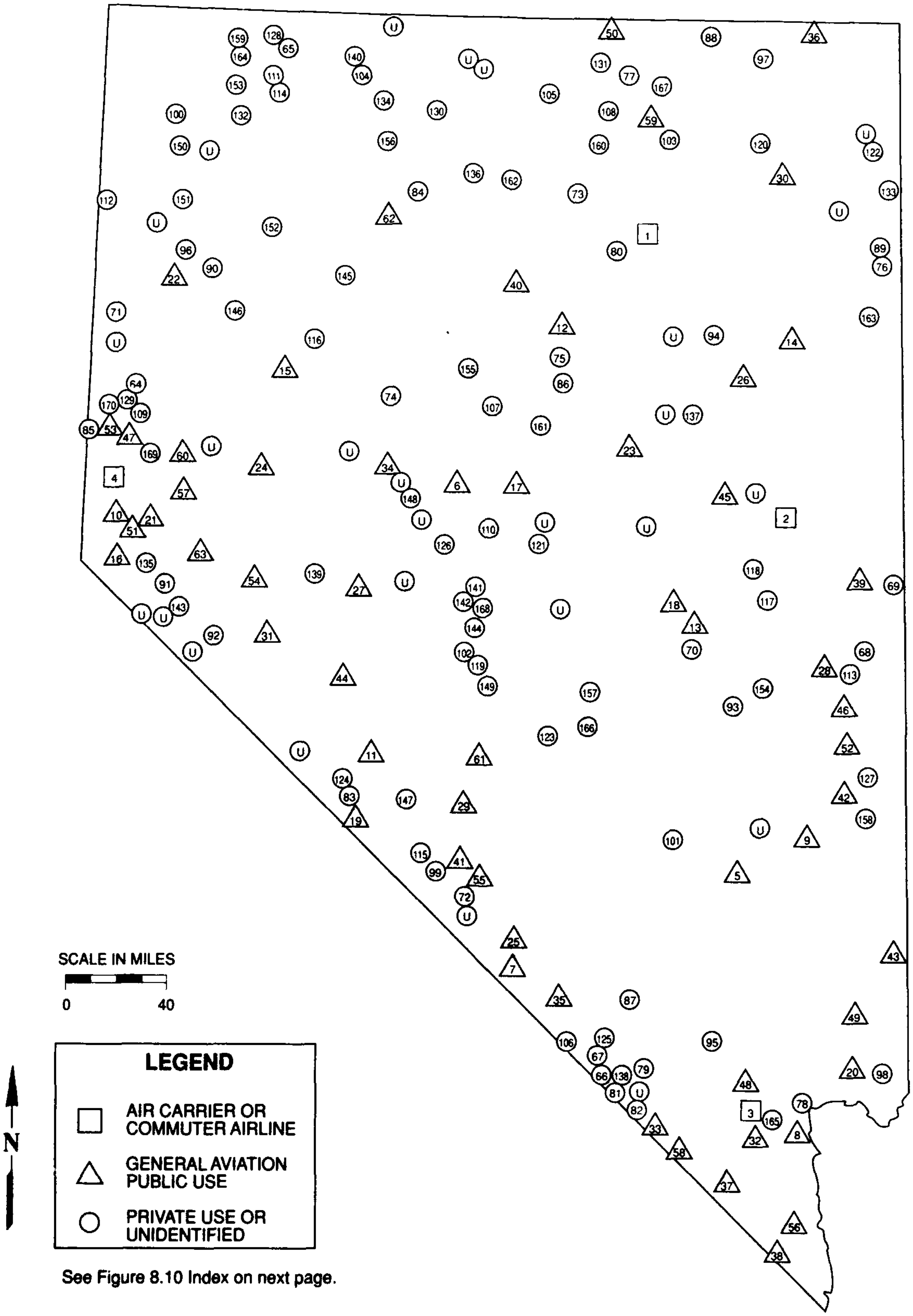


FIGURE 8.9 RESTRICTED AIRSPACE OVER NEVADA USED FOR DEFENSE-RELATED PURPOSES



See Figure 8.10 Index on next page.

FIGURE 8.10 COMMERCIAL, GENERAL AND PRIVATE AVIATION AIRPORTS AND AIRFIELDS

AIR CARRIER OR COMMUTER AIRLINE

1. ELKO MUNICIPAL / J.C. HARRIS FIELD
2. ELY AIRPORT / YELLAND FIELD
3. McCARRAN INTERNATIONAL
4. RENO CANNON INTL.

GENERAL AVIATION, PUBLIC USE AIRPORT

5. ALAMO LANDING FIELD
6. AUSTIN
7. BEATTY
8. BOULDER CITY MUNICIPAL
9. CALIENTE FLIGHT STRIP
10. CARSON CITY
11. COALDALE
12. CRESCENT VALLEY
13. CURRANT RANCH
14. CURRIE
15. DERBY
16. DOUGLAS COUNTY
17. DRY CREEK RANCH
18. DUCKWATER
19. DYER
20. ECHO BAY
21. ELDORADO LAKES AIRPARK
22. EMPIRE
23. EUREKA
24. FALLON MUNICIPAL
25. FRAN'S STAR RANCH
26. FT. RUBY RANCH AIRSTRIP
27. GABBS
28. GEYSER RANCH
29. GOLDFIELD
30. HARRIET FIELD
31. HAWTHORNE MUNICIPAL
32. HENDERSON SKY HARBOR
33. HIDDEN HILLS
34. HUDSON
35. JACKASS AEROPARK
36. JACKPOT
37. JEAN
38. KIDWELL
39. KIRKEBY RANCH
40. LANDER COUNTY
41. LIDA JUNCTION
42. LINCOLN COUNTY
43. MESQUITE
44. MINA
45. MOORMAN RANCH
46. MT. WILSON GUEST RANCH
47. NEVADA FLYERS
48. N. LAS VEGAS AIR TERMINAL
49. OVERTON
50. OWYHEE
51. PARKER
52. PIOCHE
53. RENO/STEAD
54. SCHURZ
55. SCOTTYS JUNCTION
56. SEARCHLIGHT
57. SILVER SPRINGS
58. SKY RANCH ESTATES
59. STEVENS CROSBY
60. TIGER FIELD
61. TONOPAH
62. WINNEMUCA MUNICIPAL
63. YERINGTON MUNICIPAL

PRIVATE USE OR UNVERIFIED LANDING STRIPS

64. AIR SAILING
65. ALDER CR RCH
66. ANACONDA
67. ASH MDWS
68. ATLANTA
69. BAKER
70. BLUE EAGLE RCH
71. BONHAM RCH
72. BONNIE CLAIRE
73. BOOT STRAP MINE
74. BOYER RCH
75. BUCKHORN MINE
76. BUSH LELAND
77. BYINGTON RCH
78. CALLVILLE BAY
79. CALVADA MEADOWS
80. CARLIN
81. CASS HAFEN
82. CHICKEN RCH
83. CIRCLE L RCH
84. CIRCLE BAR RCH
85. COLD SPRINGS
86. CORTEZ
87. DESERT ROCK
88. DIAMOND A RCH
89. DOVER
90. EMPIRE FARMS
91. FARIAS WHEEL
92. FLYING M RCH
93. FOREST MOON
94. GARDNER RCH
95. GEN REC PROD
96. GERLACH
97. GILMER RCH
98. GOLD BUTTE
99. GOLDPOINT
100. GRASS V RCH
101. GUNDERSON
102. HADLEY
103. HOLLAND RCH
104. HUMBOLDT HUNT CLUB
105. I-L RCH
106. IMVITE
107. IOWA CANYON
108. JACK CR RANCH
109. JUSTOVER
110. KINGSTON
111. KNOT CR RCH
112. LACKERMAN RCH
113. LAKE VALLEY
114. LEONARD CR RCH
115. LIDA
116. LOVELOCK AIRPARK
117. LUND
118. MAJORS PLACE
119. MANHATTAN
120. MARYS RIVER RCH
121. MONITOR RCH
122. MONTELLO
123. MORONI
124. NORTH VALLEY
125. NOVEMBER SCORPIO
126. O'TOOLE RCH
127. OXBORROW RCH
128. PAINTED HILLS MINE
129. PALOMINO
130. PARADISE V
131. PETAN RCH
132. PIAUTE MDW
133. PILOT CR
134. PINE GROVE
135. PINENUT HILLS
136. PINSON MINING CO.
137. PLACER ANNEX
138. PRECIOUS MAT
139. RAWHIDE
140. RIO KING
141. RO RANCH
142. ROGERS RCH
143. ROSASCHI DUSTERS
144. ROUND MTN
145. RYE PATCH ES
146. SAGE V
147. SILVER PEAK
148. SMITH CR RCH
149. SMOKY V MINE
150. SOLDIER MDW 1
151. SOLDIER MDW 2
152. SULPHUR
153. SUMMIT L
154. SUNNYSIDE KIRCH WILDLIFE MGT AREA
155. SWANSON RCH
156. TAYLORS AG
157. TEST SITE BASE CAMP
158. THOMPSON
159. THOUSAND CR
160. TUSCARORA
161. UNR GUND RCH
162. UPPER CLOVER RCH
163. VARDEN
164. VIRGIN V RCH
165. VOC TECH
166. WARM SPRINGS
167. WILD HORSE
168. WINE GLASS
169. WOFFORD
170. YOUNGBERG

U. UNKNOWN

respect to commercial aviation (certificated air carrier operations) enroute flight is generally conducted along the system of low and high altitude federal airways that are defined by radio navigational aids. In Nevada, the Federal airway (low altitude) and Jet Route (high altitude) systems either circumvent airspace used for defense-related purposes in a direct manner (Figures 8.11 and 8.12), or vertical separation is provided between military aircraft and the enroute traffic on these enroute systems. In general, since these systems provide access to and from major markets in Nevada served by commercial or commuter air carriers, the defense-related use of airspace only effects the flight path taken to serve these markets. The increased flying time between commercial airports within and outside of Nevada due to defense-related airspace restrictions represents a small element of the pricing formula used by most major airlines. As a result, defense-related use of airspace has little economic effect on commercial or commuter aviation. An exception may be the potential for commuter service between Las Vegas, Ely, and Elko. Skywest Airlines indicated such service has been considered but determined not to be economically feasible due, in a small part, to indirect airway routing around the Nellis Desert MOA.

General aviation basically consists of two categories of aircraft use. One category includes aircraft used for business or corporate air transportation, and the second category includes aircraft used for private, recreational, and flight-training activities. General aviation aircraft operate within the framework of the enroute airway system as well as within the uncontrolled airspace outside of the structured airway and terminal airspace. Much of the recreational flying occurs on weekends when airspace is not normally used for defense-related training.

The major portion of business general aviation aircraft operate within the enroute airway system (Source: National Business Aircraft Association, personal communication, 1989) which generally skirts airspace in Nevada used for defense-related purposes. Business aircraft that fly outside of the airway system (i.e., to transition between the airways and airports, or to fly between airports that are not served by any airway route segments), are usually flown by professional pilots or owner pilots with advanced training and experience. These more experienced pilots have a greater understanding of the operating limitations associated with flight in or near defense-related airspace and use their experience to minimize unnecessary diversions that increase operating costs.

Occasional diversions around defense-related airspace that increase flying distance and fuel consumption may occur. A review of available records indicated that 6.7 percent of civil aircraft requesting transit of Fallon restricted areas were rerouted, and that during the three-month study period, there were over 1,000 reported non-military users of this airspace. In the Nellis complex, there was an average of 5,600 non-military users of that airspace. These figure do not include those users who did not contact that airspace. These figures do not include those users who did not contact Nellis or Fallon air traffic control. From the above, it is apparent that there is a substantial number of non-military users of MOAs and restricted areas. One example of aircraft being diverted occurs at NAS Fallon when R-4803N and R-4803S are in use, it could be necessary for aircraft inbound to Fallon Municipal Airport from the west or departing Fallon toward the west to first fly north or south around the restricted areas. Diversions around restricted areas R-4803N and R-4803S occur (Source: LCDR Herman, personal communication, 1990) less than seven percent of

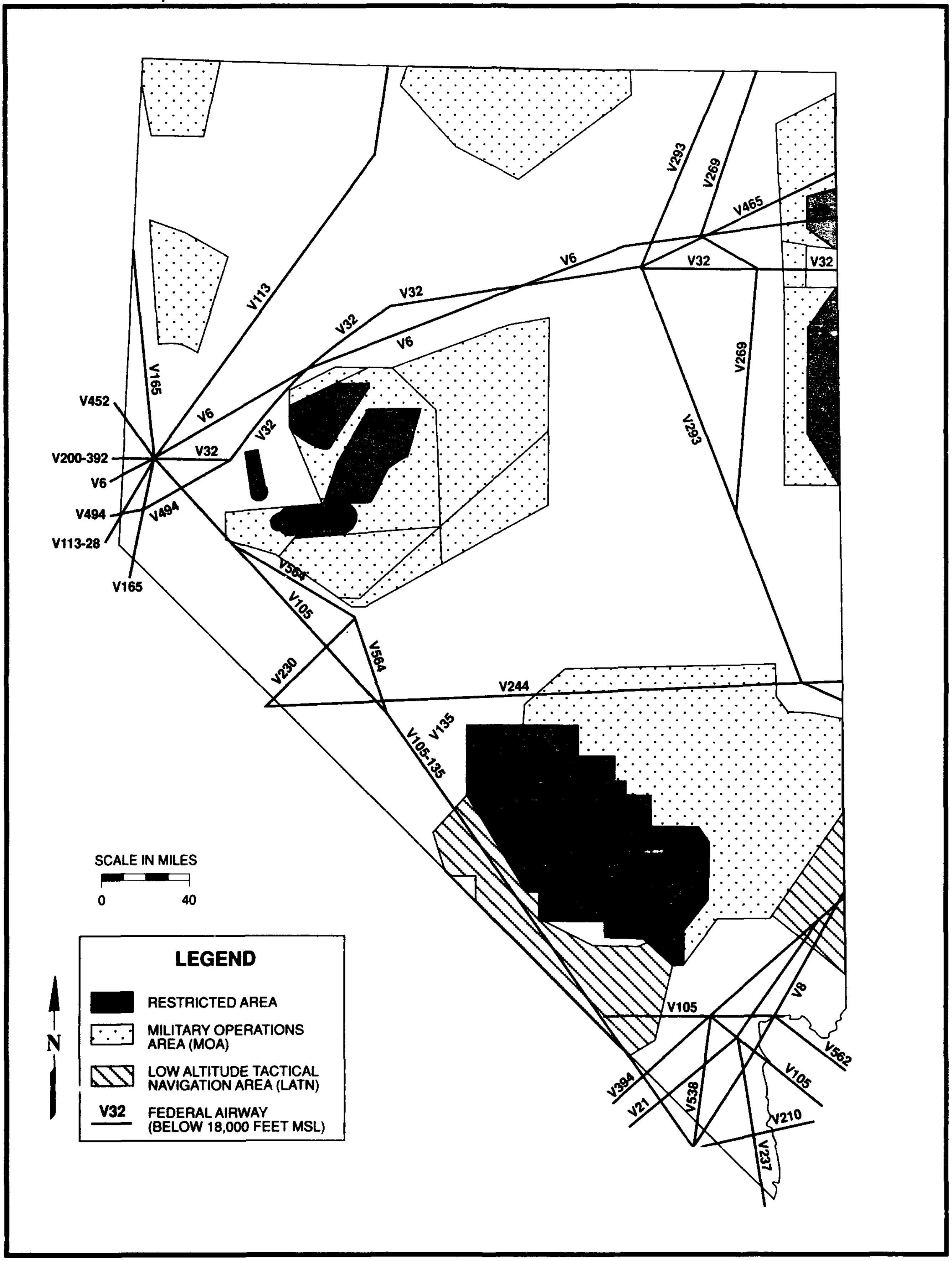


FIGURE 8.11 FEDERAL AIRWAYS IN NEVADA

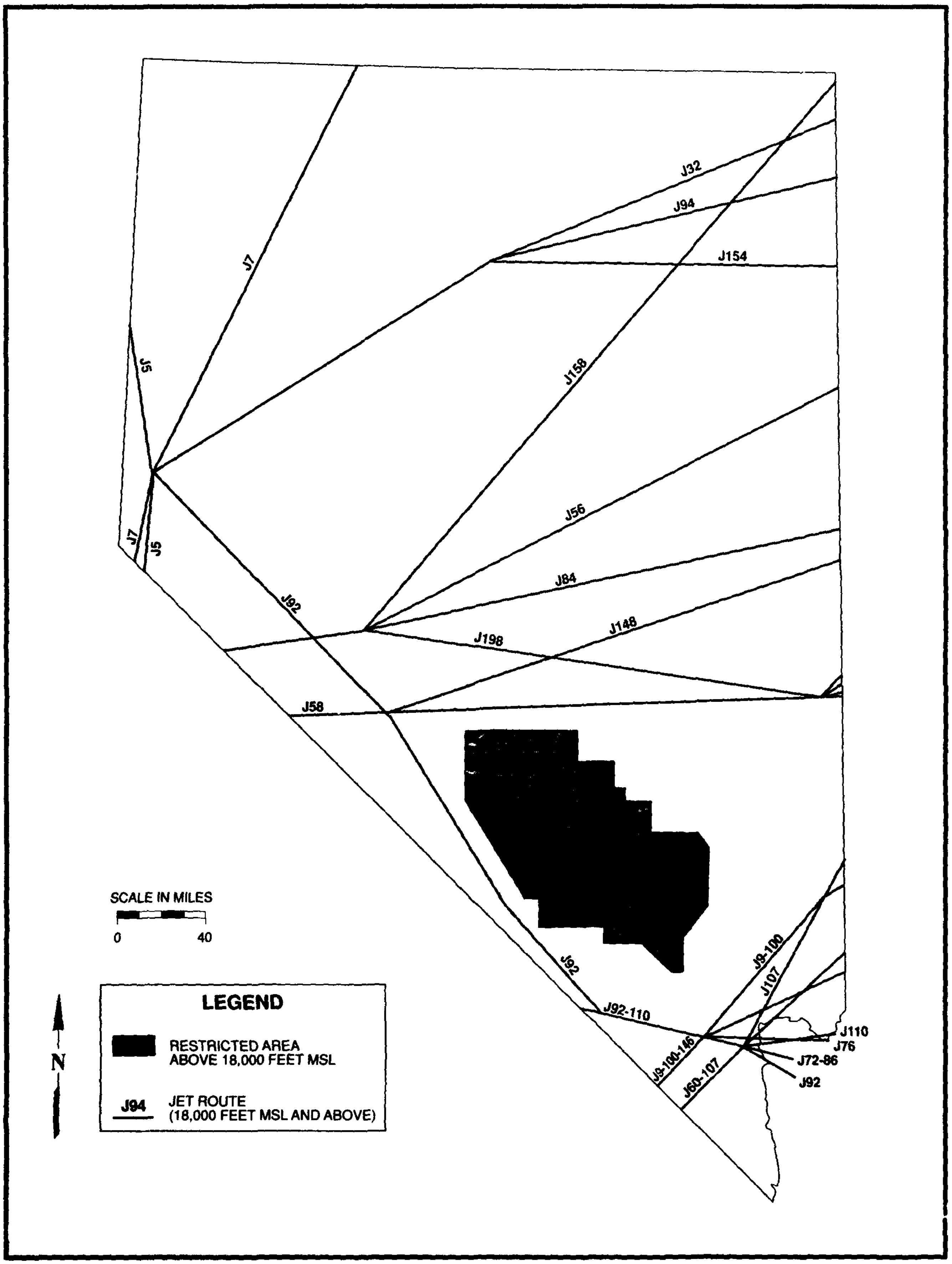


FIGURE 8.12 JET ROUTES IN NEVADA

the time, and, according to the National Business Aircraft Association (NBAA), such diversions and associated costs are generally accepted by the corporate aviation community.

The NBAA does not have information from its membership that permits quantification of potential economic effects of defense-related use of airspace on business aircraft. In summary, however, business aircraft operate most frequently within the structured airspace system that generally avoids airspace used for defense-related purposes over Nevada. These operating conditions result in circumstances that minimize interaction between corporate and military aircraft.

The greater potential for socioeconomic effects of defense-related use of airspace on civil aviation is related to general aviation aircraft. These aircraft normally operate off the airway structure between public and private airfields, ranches, and other points of interest (Figure 8.10). Direct routing between these points may involve transit through airspace being utilized for defense-related purposes. Airport operators indicated that pilot experience is one determining factor in the decision to transit this airspace. Pilots may avoid MOAs at the expense of time, convenience, and operating costs, despite the availability of air traffic control services or aircraft operating rules that could allow passage through this airspace. Civil pilots operating VFR are able to communicate with air traffic control agencies to determine if airspace is active and obtain radar service in transiting the area(s). Call signs and frequencies are published on sectional aeronautical charts for civil aviation use. Airport operators also indicated that the general presence of airspace used for defense-related purposes may discourage some participation in private aviation. This possibility and the socioeconomic effects associated with the private aviation sector cannot be quantified. These effects, while they may affect individual pilots, are considered minimal relative to the overall civil and commercial aviation industry in Nevada. This observation is based on discussions with airport operators at Elko, Ely, Tonopah, Reno, and Sky Harbor (Las Vegas) and the Nevada Department of Transportation.

The projected growth in civil aviation operations and based aircraft reflect substantial increases among the commercial, commuter, and general aviation sectors beyond the year 2000. Air carrier and commuter airline operations are projected to increase 84.9 percent (from 292,000 operations in 1985 to 540,000 operations in 2005), and general aviation operations could increase from 739,570 operations to 1,260,740 operations over the 20-year period. Commercial, commuter, and business aircraft are expected to continue to operate on airways and in controlled airspace environments that would generally provide separation from military aircraft. The FAA does not anticipate any major changes in the airway/jet route structure within Nevada during the next decade.

Increases in private and flight training general aviation operations can be expected to follow the same general flight trends that exist currently. An undetermined proportion of private pilots will continue to be affected as the individual experience level factors discussed above influence decisions to transit or circumvent airspace used for defense-related missions.

8.3.8 SOCIAL EFFECTS

No quantitative or qualitative field investigations related to community attitudes and lifestyles were undertaken for this report. However, document analysis of existing studies, public meeting transcripts, contact records of discussions conducted during data collection for other resource area studies for this report, as well as publications and news articles regarding defense-related activities in Nevada provide qualitative information regarding current attitudes and lifestyles of Nevada residents. The review of these documents was inductive in that the following indications of effects were derived from the patterns developed from this available body of literature.

One on-going study, "The Assessment of Environmental Impacts of Low Altitude Flying Operations on Social Impacts," addresses social effects of air operations in detail. The issue is addressed because of the frequency with which the issue of social impacts has been raised at public scoping meetings and through other scoping procedures. The following methods were used in the analysis of social impacts: 1) review of literature relevant to human responses to military low-altitude flying operations, 2) face-to-face interviews with people living and/or working under 11 different case study airspaces at 9 sites in the continental United States, and 3) telephone interviews with key informants in case study communities overflown. Five of the case studies were located in the West. The terrain overflown ranges from flat to mountainous and from desert to heavily wooded. The case studies described the sites in terms of four social variables: population density, the presence of households with young children, reported support for the military, and reported opposition to the military. These characteristics were evaluated in regard to social, noise, and exposure characteristics associated with awareness, impacts, attitudes, and actions.

Most households (over 700 respondents) surveyed were in areas less than the U.S. average population density (64 persons per square mile). Average population densities under the airspace ranged from 0.02 to 63.5 per square mile. About 17.2 percent of the households surveyed had at least one member under 5 years old. Approximately 80.2 percent of the households reported support for the military, while 19.8 percent reported no support for the military. The percent of households living under the airspaces reporting support for the military ranged from 71.7 percent to 100 percent. Of the respondents surveyed, 86.2 percent were aware of low altitude military flights in the vicinity. Annoyance with low altitude flights is made up of four measures: aircraft noise, aircraft presence, aircraft altitude, and the possibility of an aircraft crashing. Of the respondents surveyed, 32.3 percent were highly annoyed with at least one of these aspects of the flights. Nearly 20 percent of the respondents reported either sleep interruption or interruption of three or more non-sleep activities during the previous month. Of the respondents, 23.4 percent reported having made informal complaints to friends or family of which 5.6 percent had complained more than once a month. In addition, 26.1 percent of the local officials and newspapers had received complaints about the flights. Only a small percentage (2.4 percent) of the respondents had ever made a formal complaint about low altitude military flights. While no statistical inference from these results has been made to estimate quantitative effects in Nevada, due to the similarities of Nevada and its population with the rural western sites sampled in this study, much of the following discussion is based upon this study.

Concepts presented at two public forums during 1976 sponsored by the Nevada Humanities Committee and the Human Systems Center, Desert Research Institute, University of Nevada present a description of Nevada Lifestyles and Lands which is consistent with an available collection of less comprehensive publications and news articles on the subject published during the 1980's. "This is a collection of papers that attempts to reflect the lifestyles of Nevadans. It is said that the lifestyle of a people is the sum of their economic, social and ultra-mundane activities. The ideals and the realities of a lifestyle may be in disagreement. Ideals tend to be more visible and more frequently expressed, such as in literature. However, the realities may be more difficult to describe. This is particularly true for Nevada since it is such a sparsely populated region" (Source: Houghton and Nappe, Nevada Lifestyles and Lands, 1977).

Nevada has two large metropolitan areas, small rural incorporated towns, rural unincorporated population centers, and residents who live on farms and ranches throughout the unincorporated areas of each county. The metropolitan areas, Clark and Washoe Counties, are the residences of over 80 percent (approximately 922,000) of Nevada's 1988 population (1,093,600). About 40,000 of Nevada's population is in the incorporated cities and towns within each of the other 15 counties. A more rural population (130,000) is located in unincorporated communities and widely dispersed outside of these towns in each Nevada county.

Residents in the non-metropolitan areas of Nevada may live in these areas, in part, because they prefer small towns or isolated ranches and farms over metropolitan cities. Amenities they are likely to find beneficial include the natural quiet of rural areas, relatively free access to secluded public lands, and general lack of restrictions on travel across these lands. Recreational pursuits in rural areas, in general, are usually centered on outdoor activities, such as wilderness use, hunting, fishing, hiking, and off-road vehicles. Economic livelihoods are usually provided by mining, ranching, or farming, and by services related to these occupations. Lifestyles tend to revolve around occupation and family. In general, economic aspects (especially employment) associated with defense-related activities in Nevada, especially, in the non-metropolitan areas of the State, are considered beneficial by residents. Frequently, residents of small, relatively isolated communities express the belief that an increase in the number of jobs in their community will provide employment to children who would otherwise move to metropolitan areas to work. Other economic aspects often considered beneficial are improved community services and a stronger tax base. Many residents of small towns and rural areas, however, recognize that results of any project be it a new mine, power plant, or defense-related activity, on their lifestyles are neither all beneficial nor all adverse, but require trade-offs between beneficial economic aspects and the rural amenities that are presumably the reason they live in such areas (Sources: Nevada Department of Conservation and Natural Resources, Statewide Comprehensive Outdoor Recreation Plan, 1987; Nevada Public Affairs Review, "Rural Nevada: Survival and Development", 1986; Houghton and Nappe, Nevada Lifestyles and Lands, 1977; and BLM, Socioeconomics Technical Report No. 9, Mt. Hope Molybdenum Project, 1984).

Community attitudes regarding defense-related land withdrawals and airspace used for defense-related training missions reflect residents' perspective of how these withdrawals and associated activities may change their lifestyle. The social variables studied in "The

Assessment of Environmental Impacts of Low Altitude Flying Operations on Social Impacts" having the strongest relationship to individual impacts are: perceived altitude of aircraft overflight, support for the military, annoyance with the possibility of a crash, interrupted activities, and age of the respondent. Throughout Nevada, residents have voiced several major issues which reflect several of these variables. While different individuals and groups place different emphasis on their areas of concern, the collective concerns identified through the available documentation can be said to relate to effects on a rural, western, desert lifestyle. These lifestyle concerns center on five issues: access to and use of public lands, access to airspace, noise and sonic boom effects, socioeconomic effects, and public health and safety effects (Sources: Transcripts of Proceedings, Special Nevada Report Public Meetings, Written Comments to the Special Nevada Report, 1988; Various Newspaper and Magazine Articles, 1988-1990; U.S. Department of the Navy, Final Comprehensive Environmental Impact Statement for the Proposed Supersonic Operations Area and Other Proposed Actions at Naval Air Station, Fallon, Nevada, 1986; Department of Conservation and Natural Resources, Nevada Statewide Policy Plan for Public Lands, 1985; and U.S. Air Force, Final Environmental Statement for the TFWC Range Complex, 1974).

Access to and use of public lands. Comments contained in available documents, represented by those cited above, express some residents' concern over the total amount of withdrawn land and designation of defense-related airspace in Nevada and how it affects lifestyles. The withdrawal of land and designation of defense-related airspace has taken place primarily during the period since World War II, although some activities existed prior to the 1940's (e.g., HWAAP has been in existence since 1928). Defense-related activities have been prominent in Nevada since the 1940's. Concerns about changes in magnitude of airspace required for defense-related activities relate to the increased population and growth adjacent to what, at one time, were areas distant from the population centers as well as to the operational characteristics of the activity.

Access to airspace. Rural residents who use general aviation as a means of transportation may also be affected by the distances they may have to travel around restricted airspace to conduct their business or other activities as indicated in the analysis of effects on civil aviation in Nevada (Section 8.3.7).

Socioeconomic effects. In the case of residents of the Reno and Las Vegas metropolitan areas, indicators of effects on public and private property (population change, personal income, community service staffing, etc.) shows defense-related activities do not substantially alter the metropolitan lifestyle. Defense-related employment is also generally viewed as beneficial in metropolitan areas. In general, the socioeconomic analysis of these activities upon community services shows the effects are within the developed service capacity of the metropolitan communities. High growth, however, from other sectors of the Las Vegas economy is straining this community's public services.

Discussions with rural community officials and business leaders during research for this report indicate that employment effects are considered beneficial while population growth effects on community services are viewed as placing a strain on community resources in rural communities near the various land withdrawals; however, the levels of infrastructure that have been created are undoubtedly higher than they would have been without the withdrawals. Tonopah, Beatty, and Pahrump in Nye County are the residence of people associated with the NAFR, TTR, and NTS. The City of Fallon in Churchill County is the community adjacent to NAS Fallon and the City of Hawthorne in Mineral County is adjacent to HWAAP. As this report's discussion of the effects points out, these communities have the largest population effects associated with activities on withdrawn lands outside the Las Vegas metropolitan area.

Potential effects of airspace activities on financial characteristics, such as the value of property located under military flight paths, are a local concern pointed out in the transcripts of public meetings for this report. However, estimates of the financial effects are inconclusive due to the complexity of market factors affecting, and the limited data available concerning, the value of housing and agricultural land in rural Nevada. The effects of noise on residential property was discussed in the Environmental Assessment, F-15E Beddown, Luke AFB, Arizona, 1986. Studies conducted during the 1960's and 1970's have addressed the effects of noise levels on property values. The FAA concluded from these studies that "The bottom line is that noise has been shown to decrease the value of property by only a small amount . . . approximately one percent per decibel (LDN, above a level LDN of 55) . . . Because there are many other factors that affect the price and desirability of residence, the annoyance of aircraft noise remains just one of the considerations that affect the market value of a home." It is not possible to determine the applicability of these studies to defense-related airspace activities in Nevada. Experience of the Air Force at areas throughout the country does not support the application of this conclusion to areas near Air Force bases (Source: U.S. Air Force, EA, F-15 Beddown, Luke AFB, 1986). However, some reductions in property value may occur as a result of these airspace activities.

Where active flying facilities have existed for several years, property values in these areas reflect, to a great degree, valuation based on aircraft overflights, noise, crash potential, etc. Air Force experience at various military installations has not supported a loss of property value when a different type or larger number of aircraft has replaced existing aircraft (Source: U.S. Air Force, EA, F-15 Beddown, Luke AFB, 1986). In fact, property values generally continue to increase because of greater employment and demand for housing; however, the rate of appreciation in value may be somewhat lower than that of nonaffected properties.

On the basis of studies of MOAs, the Air Force has reason to believe that operations on the MTRs and within MOAs would not significantly affect the value of real property. These studies examined the assessed valuation of property and the development of real estate in areas below the MOAs and there was no indication of a deterrence to real estate development (Source: U.S. Air Force, EA, F-15 Beddown, Luke AFB, 1986).

Noise and sonic boom effects. The changes in aircraft and tactics used for military activities that have occurred over the past four decades may have changed one specific social effect - increased annoyance with noise levels from aircraft overflights. Changes in magnitude or frequency of these effects relate to the increased population and growth adjacent to what, at one time, were areas distant from the population centers as well as the operational characteristics of the activity. Given the annoyance possibilities identified in the noise and sonic boom analysis in this report, the effects of low-level flying activity over land areas with low population densities described in the "The Assessment of Environmental Impacts of Low Altitude Flying Operation on Social Impacts," and the effects described in this report regarding outdoor recreational opportunities, some people experience annoyance in their immediate environment. Aircraft overflights may also affect the amenities that attract some Nevada residents to live in rural locations away from communities adjacent to the primary ground location of a defense-related activity, without giving this group economic benefits in return.

Public health and safety effects. Concerns regarding public health and safety effects of defense-related activity are a component of lifestyle or social effects. These concerns are addressed throughout this report and addressed in a cumulative fashion in Section 8.2 of this report.

In summary, the five areas of concern described above and addressed throughout this report, when taken together, relate to the social effects on the lifestyles of Nevada residents. When the primary social effects issue (annoyance with aircraft noise) is considered together with the increases in population near the withdrawn areas and immediately adjacent to or under the defense-related airspace, there is an effect on the lifestyle of rural residents in these locations.

8.3.9 SUMMARY

Direct employment resulting from activities related to Nellis AFB. NAS Fallon, HWAAP, NTS, TTR, and Las Vegas Army Reserve Training Center represented 3.8 percent of all employment in Nevada during 1988 and is projected to be 2.2 during 2000. Employment and population generated by activities at defense-related installation in Nevada are forecast to represent smaller percentages of total employment and population in 2000 than in 1988 because of general employment and population growth in the State and a reduction in the direct and indirect employment associated with DOD installations.

Use of the land associated with Nellis AFB, NAFR, NAS Fallon and FRTC, HWAAP, NTS, and other DOE withdrawals for alternative economic purposes results in lower cumulative employment and other economic indicators than with the uses to which they are put currently. Housing effects are specific to the local area serving the major activity associated with each land withdrawal and do not contribute significantly to changes in the cumulative state-wide housing market. Public services and finance are provided by communities and counties throughout Nevada, and the effects associated with activities on land withdrawals also are highly localized. Effects upon services provided by state government and the related public finance are related to the population served which was approximately 8 percent in 1988 and would be about 6 percent in 2000. Relatively small amounts of public revenues are directly generated from withdrawn lands through programs such as payment-in-lieu-of-taxes, school assistance funds, and defense-related highway funds.

An undetermined proportion of private pilots will continue to be affected as the individual experience level factors discussed in Section 8.3.7 influence decisions to transit or circumvent airspace used for defense-related missions. When the social effects issues are considered together with the increases in population near the withdrawn areas and under or immediately adjacent to defense-related airspace, there are effects on the lifestyle of residents of these locations.

8.4 EFFECTS ON PLANTS, FISH, AND WILDLIFE RESOURCES

8.4.1 GROUND-BASED EFFECTS ON HABITAT

The vegetation of Nevada includes plant associations that are uniquely adapted to the arid environments of the warm and cold desert basin and range provinces. Vegetation functions at the base of the food chain, providing habitat for wildlife in Nevada, as well as protecting the soil from erosion, minimizing sediment discharge from wind and water erosion, and greatly reducing the occurrence and magnitude of floods. Vegetation also aids percolation of precipitation to ground water storage, builds desirable soil characteristics, and provides an aesthetic environment for recreation.

Studies conducted in the Mojave Desert have documented that activities which disturb the soil surface or vegetation, such as off-road vehicle travel, destabilize soils and increase wind and water erosion (Sources: Snyder et al., 1976; Eckert et al., 1979, Hinckley et al., 1983; Stull et al., 1979; Webb, 1983; Wilshire and Nagata, 1976; Iverson et al., 1981; Adams et al., 1982; and Dregne, 1983). The potential for long-term effects from soil disturbance is clear from observations that desert vegetation communities regenerate slowly (Sources: Webb et al., 1983; Elvidge and Iverson, 1983). For example, the impacts of tank maneuvers which took place from 1938 to 1942 remained apparent in the Mojave Desert for more than 36 years (Source: Lathrop, 1983a and b). Even relatively low intensity vehicular traffic produces significant detrimental effects on desert soils, causing increased vulnerability to erosion (Sources: Eckert et al., 1979; Hinckley et al., 1983; Iverson et al., 1981; Lathrop et al., 1983a). In affected areas having increased soil erosion there is decreased vegetation cover, decreased primary production, and fewer burrowing areas which causes declines in wildlife populations. In desert areas subjected to off-road vehicle traffic there are highly significant reductions in wildlife populations (Source: Bury et al., 1977).

8.4.2 OVERLAP ANALYSIS

The overlap between wildlife populations, habitat, and defense-related land withdrawals and defense-related airspace were examined to estimate the extent to which wildlife may come in contact with these defense-related activities, and the extent to which wildlife habitat is potentially subjected to land-disturbing or defense-related airspace activities. An analysis of the extent of overlap between the defense-related withdrawals and airspace, and the habitats of 58 wildlife species showed that overlaps varied widely. Individual land withdrawals and airspace areas utilized for defense-related purposes overlap small proportions of ranges of wildlife in Nevada. Cumulatively, however, there is a much larger extent of habitat overlap for some species.

Table 8-8 shows the extent to which habitat or populations of threatened and endangered species occurs within existing, proposed, or envisioned land withdrawals and airspace used for defense-related training missions. Fifty percent of the historic nesting distribution

Table 8-8. Percent of Nevada's Ranges (R) or Percent of Nevada's Populations (P) of Threatened and Endangered Species Occurring Within Existing, Proposed, and Envisioned Land Withdrawals and Defense-Related Airspace.

Area	(R) Peregrine Falcon	(R) Bald Eagle	(R) Desert Tortoise	(P) Cui-ui	(P) Lahontan Cutthroat Trout	(P) Desert Dace	(P) RR Valley Springfish	(P) White R. Springfish	(P) Hiko White R. Springfish
EXISTING									
Withdrawals	0.75	1.06	0	0	0	0	0	0	0
Airspace	44.61	26.72	21.16	X	X	0	0	100	67
Total	45.36	27.78	21.16	X	X	0	0	100	67
ENVISIONED/ PROPOSED									
Withdrawals	0.19	0.37	0	0	0	0	0	0	0
Airspace	4.57	7.03	0	0	0	0	87	33	0
Total	4.77	7.40	0	0	0	0	87	33	0
Grand Total	50.13	35.18	21.16	X	X	0	87	100	67

Area	(P) White R. Speckled Dace	(P) Big Spring Speckled Dace	(P) Moapa Dace	(P) Ash Meadows Speckled Dace	(P) Ash Meadows Pupfish	(P) Warm Springs Pupfish	(P) Devil's Hole Pupfish	(P) Pahrump Killfish	(P) Ash Meadows Naucorid
EXISTING									
Withdrawals	0	0	0	0	0	0	0	0	0
Airspace	0	100	100	100	100	100	100	33	100
Total	0	100	100	100	100	100	100	33	100
ENVISIONED/ PROPOSED									
Withdrawals	0	0	0	0	0	0	0	0	0
Airspace	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0
Grand Total	0	100	100	100	100	100	100	33	100

X: Indicates overlap, actual percentage unknown.

and migratory areas of the endangered peregrine falcon coincides with some type of defense-related use of land or airspace; however, the peregrine falcon is sighted only infrequently; and there are very few known falcon aeries in the State. Thirty-five percent of the endangered bald eagle's wintering areas, which are closely associated with wetland, lake, and riverine habitats, coincides with defense-related land or airspace. Twenty-one percent of the mapped range of the threatened desert tortoise coincides with defense-related airspace. This latter estimate, however, does not take into account tortoise habitats on the Nellis and NTS land withdrawals, which have not been mapped. Table 8-8 also shows that many endemic fish habitats, particularly in southern Nevada, overlap with defense-related activity, including airspace used for supersonic operations.

Table 8-9 shows ranges of raptors that occur within existing, proposed, or envisioned land withdrawals and airspace used for defense-related training missions. Of the 23 raptor species examined in this analysis, more than 25 percent of the Nevada ranges of 21 species are located in areas of defense-related activity. At least 50 percent of the ranges of 9 species overlap with defense-related activities; more than 75 percent of 2 species (the northern goshawk and flammulated owl) overlaps with these activities.

Table 8-10 shows the extent to which ranges of game species and other selected species overlaps with existing, proposed, or envisioned land withdrawals and airspace used for defense-related missions. At least 25 percent of the ranges of 12 species overlaps with these withdrawals or airspace; 50 percent of 8 species overlaps; more than 75 percent of 3 species (kit fox, gray fox, and mountain lion) overlaps with these withdrawals and airspace.

8.4.3 RELATIONSHIP BETWEEN DEFENSE RELATED ACTIVITIES AND WILDLIFE MANAGEMENT

Table 8-11 indicates Nevada's National Wildlife Refuges (NWRs) and Wildlife Management Areas (WMAs) and associated overflight restrictions. Overflight of NWRs and WMAs in the vicinity of Nellis Air Force Range is restricted to a 2000 ft ceiling (5000 ft for supersonic operations). A Memorandum of Understanding between the U.S. Navy and Department of the Interior provides for avoidance of overflight over Stillwater NWR below 3000 AGL where tactically feasible. MTR overflights of Ash Meadows NWR and Mason Valley WMA are also restricted.

In addition, Federal Aviation Administration Advisory Circular 91-36 recommends that all aircraft maintain a minimum altitude of 2000 ft AGL above National Wildlife Refuges and other sensitive areas. The Air Force and Navy follow these recommendations where tactically feasible.

A nation-wide study examining wildlife refuge manager opinions on threats to wildlife determined that 55 of the 444 National Wildlife Refuges are exposed to overflight by military aircraft. Of those refuges, 36 of 55 cases were viewed as harmful by the refuge manager, and 35 of 55 managers believed that those harmful uses should be discontinued (Source: GAO, 1989). Managers of the Cabeza Prieta National Wildlife Refuge in south-western Arizona believe that defense-related overflight is affecting desert bighorn sheep and Sonoran pronghorn antelope on the refuge, however studies have not been conducted which

Table 8-9. Percent of Ranges of Raptors Occurring Within the Existing, Proposed, and Envisioned Land Withdrawals and Defense-Related Airspace.

	Turkey Vulture	Northern Goshawk	Sharp-shinned Hawk	Cooper's Hawk	Red-tailed Hawk	Swainson's Hawk	Rough-legged Hawk	Fer-ruginous Hawk	Golden Eagle	Northern Harrier	Osprey	Prairie Falcon
EXISTING												
Withdrawals	0.52	0.99	0	0.71	0.43	0.38	0.14	0	0.04	0.15	0.63	0.09
Airspace	20.03	43.29	30.88	42.43	25.06	2.14	24.84	7.46	36.71	32.57	30.16	35.40
Total	20.54	44.28	30.88	43.05	25.49	2.52	24.98	7.46	36.75	32.72	30.79	35.50
ENVISIONED/ PROPOSED												
Withdrawals	0.67	0	0	0	0	0	0.14	0	0.58	0.13	0.22	0.03
Airspace	9.53	36.69	29.56	18.09	20.70	0	17.57	20.47	11.14	3.98	0.32	9.35
Total	10.20	36.69	29.56	18.09	20.70	0	17.71	20.47	11.75	4.11	0.54	9.38
Grand Total	30.74	80.96	60.44	61.14	46.19	2.52	42.69	27.92	48.47	36.83	31.34	44.87

	Merlin	American Kestrel	Barn Owl	Western Screech Owl	Flam-mulated Owl	Great Horned Owl	Burrowing Owl	Pygmy Owl	Long-eared Owl	Short-eared Owl	Northern saw-whet Owl
EXISTING											
Withdrawals	0.37	0.77	0.76	1.82	2.07	0.53	1.26	0	1.91	0.39	0.68
Airspace	43.28	42.79	35.02	49.83	69.41	28.69	37.46	41.46	34.89	14.13	38.10
Total	43.56	43.57	35.78	51.6	71.48	29.22	38.73	41.46	36.80	14.52	38.77
ENVISIONED/ PROPOSED											
Withdrawals	0.02	0.30	1.04	0.12	0	0.50	0.64	0	0	0	0
Airspace	6.64	6.81	3.59	0	20.16	8.70	11.10	0	15.41	0	0
Total	6.65	7.11	4.63	0.12	20.16	9.20	11.74	0	15.41	0	0
Grand Total	50.31	50.67	40.41	51.77	91.65	38.42	50.47	41.46	52.21	14.52	38.77

Table 8-10. Percent of Ranges of Game Species and Other Selected Species Occurring Within Existing, Proposed, and Envisioned Land Withdrawals and Defense-Related Airspace.

	Elk	Mule Deer	Pronghorn Antelope	Kit Fox	Red Fox	Gray Fox	Mountain Lion	Bighorn Sheep	Wild Horse	Burro	Sage Grouse
EXISTING											
Withdrawals	0	0.03	6.08	11.05	0.11	13.83	4.48	3.85	4	1	0.12
Airspace	34.93	39.53	51.20	64.45	4.71	37.80	54.77	46.35	32	29	29.31
Total	34.93	39.57	57.29	75.50	4.81	41.17	59.25	50.21	36	30	29.43
ENVISIONED/ PROPOSED											
Withdrawals	0	0.06	0	1.01	0.20	0.08	0.16	0	0	0	0
Airspace	0	16.36	7.68	4.79	12.63	6.59	18.70	8.17	13	0	16.47
Total	0	16.42	7.68	5.80	12.83	6.67	18.86	8.17	13	0	16.47
Grand Total	34.93	55.99	64.98	81.30	17.64	47.84	78.11	58.38	49	30	45.90

	Chukar	Blue Grouse	California Quail	Gambel's Quail	Scaled Quail	Mountain Quail	Raptor Migration	Waterfowl Migration	Waterfowl Habitat 1	Waterfowl Habitat 2	Waterfowl Habitat 3
EXISTING											
Withdrawals	4.20	0	0.25	0.25	0.23	0	9.13	0.31	1.42	1.06	0.43
Airspace	30.81	15.45	20.43	20.43	51.70	69.68	62.47	37.64	46.03	47.86	15.61
Total	35.01	15.45	20.68	20.68	51.93	69.68	71.60	37.95	47.45	48.74	16.04
ENVISIONED/ PROPOSED											
Withdrawals	0.33	0	0.04	0.04	0	0	0.97	0.12	0	2.82	0
Airspace	16.03	13.98	2.10	2.10	0	0	8.42	7.45	4.39	0	10.57
Total	16.37	13.98	22.82	22.82	0	0	9.39	7.57	4.39	2.82	10.57
Grand Total	51.38	29.43	43.50	43.50	51.93	69.68	80.99	45.52	51.84	51.56	26.62

Table 8-11. Restrictions on Defense-Related Overflight of National Wildlife Refuges (NWR) and Wildlife Management Areas (WMAs).

National Wildlife Refuges	Airspace Overlap	Restriction
Sheldon NWR	Hart MOA	-- None
	SR300/301	-- None
	VR1253	-- None
Stillwater NWR*	Gabbs N	-- MOU states avoidance below 3000 AGL where tactically feasible
	SR381	-- None
Pahranagat NWR	Desert (supersonic)	Avoid by 1 NM, overflight restricted to 2000; supersonic overflight restricted to 5000 agl.
Ash Meadow NWR	IR286	-- None
	VR1214	-- Avoid by 2 NM or 1500 ft
	VR1225	-- None
Desert NWR	Desert MOA	
	Nellis (supersonic)	-- Overflights in Desert MOA and Nellis AFR restricted to 2000 agl; supersonic overflight restricted to 5000 agl.
	IR286	-- None
<u>Wildlife Management Areas</u>		
Humboldt WMA	**	-- None
Mason Valley WMA	**	Avoid by 3 NM
Scripps WMA		
Key Pittman WMA	Desert (supersonic)	-- overflight restricted to 2000; supersonic overflight restricted to 5000 agl.
Kirch WMA	**	-- None
Railroad Valley WMA	Desert (supersonic)	-- overflight restricted to 2000; supersonic overflight restricted to 5000 agl.

* Stillwater NWR and Stillwater WMA are under joint management and considered as one wildlife refuge for purposes of this report.

** Indicates areas present within the MTR corridor but not directly beneath the MTR centerline.

Note: Ruby Lake, Moapa NWR and Alkali Lake, Fernley, Overton WMA have no airspace overlap.

indicate definitively that effects are occurring. Desert National Wildlife Range managers reported to the GAO that they believe flight activities over the area especially affect an isolated population of desert bighorn sheep. To determine the effects of overflight on bighorn, physiological and behavioral studies are presently being conducted on Desert National Wildlife Range (Section 8.4.5).

Although protective measures including altitude and avoidance restrictions are in place in some areas to protect wildlife populations and sensitive wildlife use areas, studies of overflight operations conducted by NDOW noted that absolute compliance with airspace agreements over the Stillwater NWR and other sensitive wildlife areas appeared to vary. A total of 27 incidents where military aircraft violated airspace limitations were reported by personnel during that study. BLM biologists working in the Carson Resource Area reported an incident in 1990 involving harassment of wild horses by a military helicopter. As a result of this incident, actions were taken to reprimand personnel and condemn this type of activity.

8.4.4 EFFECTS OF GROUND-BASED AND OVERFLIGHT ACTIVITIES ON WILDLIFE

Table 8-12 provides a list of examples of effects that could occur as a result of defense-related activities in Nevada. This list summarizes the existing literature addressing possible effects, however there are hundreds of additional studies that were not cited. In general, effects may be separated into ground-based and overflight effect. Ground-based effects are largely related to habitat disturbance discussed in 8.4.1. The desert tortoise is of particular concern with respect to habitat disturbance, however, the Nellis Air Force Range and the Nevada Test Site have both initiated programs in compliance with the Endangered Species Act which will minimize effects on this species.

Other ground-based effects include the effects of noise from off-road vehicles (ORVs). Elevated noise levels associated with intensive ORV use can produce hearing loss in small mammals and reptiles (Source: Brattstrom and Bondello, 1983). Ecological effects of hearing loss in these animals in unknown, but many species are especially dependent on hearing for detection of potential predators and prey. Other mammals (coyotes, deer, rabbits) have been observed to respond to various types of ground-based activities by expansions and contractions in home ranges, or in some cases, abandonment.

The results of field-based studies on the effects of overflight vary widely, ranging from no effects or habituation (becoming accustomed to noise; for example red-tailed hawk), to noticeable behavioral and physiological effects (Table 8-12). Studies involving helicopters often show negative responses to overflight, possibly because of the low frequency sounds or the slowness of this type of craft, compared to fixed-wing aircraft.

Many subjective conclusions have been reached based on the observations and opinions expressed by farmers which have attributed defense-related overflight to economic losses in swine, mink, cattle and other domestic livestock. Similarly, biologists and other individuals have observed responses ranging from apparent disregard, to panic fleeing. Possible results of aircraft activities that concern wildlife biologists include sound pressures

Table 8-12. Examples of Responses and Potential Effects to Wildlife by Defense-Related Activities in Nevada.

SPECIES	EFFECT
Threatened and <u>Endangered Species</u>	
Bald Eagle	Head turning, flying from perch in response to aircraft noise (Source: Fleischner and Weisberg, 1986).
Peregrine Falcon	Noticeable alarm in response to overflight, but negative responses brief and not productivity limiting (Source: Ellis, 1981).
Devils Hole Pupfish	Possible egg disturbance by wave-induced action by defense-related seismic activity (speculative, ERDA, 1977).
Desert Tortoise	Habitat disturbance and incidental take resulting from defense-related land disturbing activities in southern Nevada (offset by Endangered Species Act compliance activities).
<u>Birds</u>	
Raptors	Noticeable alarm, fleeing behavior in response to low-level overflight (Source: White and Sherrod, 1973, Ellis, 1981).
Red-tailed Hawk	Evidence suggests that red-tailed hawks can habituate to overflight disturbance (Source: Andersen, et. al., 1989).
Gyrfalcon	Nesting gyrfalcons exposed to spring helicopter overflight less likely than other gyrfalcons to reoccupy same site the following year (Source: Platt, 1977).
Prairie Falcons	Responded to construction blasting by flushing from nest; overall adverse effects on nesting were not observed, however investigator cautioned that birds in more remote areas might be more susceptible (Source: Holthuijzen, 1989).
Raven	Agitated calling, panic flight for more than 1 hour after sonic boom (Source: Davis, 1967).

Table 8-12. Examples of Responses and Potential Effects to Wildlife by Defense-Related Activities in Nevada (continued).

SPECIES	EFFECT
Herring Gull	More fighting linked to low altitude supersonic overflight, lower clutch size resulting from broken eggs during fighting bouts (Source: Berger, 1981).
Snow Goose	Fleeing response, reductions in flock size (Source: Salter and Davis, 1972).
Geese	Geese populations responded to helicopter overflight with flight response (Source: Ward, et. al., 1986).
Wading Bird Colonies	No demonstrated effect of low-level overflight on colony establishment or reproductive activity (Source: Black, et. al., 1984).
Ducks	Flight responses (Source: Gunn, 1974).
	Population reductions on small lakes in response to repeated overflight (Source: Schweinsburg, 1972).
Passerines	No evidence that sonic boom affected reproduction in mourning doves, mockingbirds, cardinals, or lark sparrows (Source: Teer and Truett, 1973).
<u>Mammals</u>	
Bighorn Sheep	17% reduction in foraging efficiency when helicopters were present (Source: Stockwell and Bateman, 1987).
Deer, Rabbits	Snowmobile noise did not cause deer or rabbits to leave area normally inhabited, however, animal movements within and near home ranges increased (Source: Soom, et. al., 1972).
Pronghorn Antelope	Fleeing in response to low altitude helicopters (Source: Luz and Smith, 1976).
Caribou	Running and panic in response to overflight of 200 ft or less (Source: Klein, 1973).

Table 8-12. Examples of Responses and Potential Effects to Wildlife by Defense-Related Activities in Nevada (continued).

SPECIES	EFFECT
Coyote	Expansion, contraction or abandonment of home range during ground military maneuvers (Source: Gese, et. al., 1989).
Desert Kangaroo Rat	Temporary threshold shift in hearing in response to ORV noise (Source: Brattstrom and Bondello, 1983).
Mice	Development of larger adrenal glands in response to low-level overflight (Source: Chesser, et al., 1975).
Small Mammals	Hearing loss associated with intensive ORV use (Source: Brattstrom and Bondello, 1983).
Fish	Alarm and startle response in populations of pacific herring subjected to noise (Source: Schwartz and Greer, 1984).
	Fish in laboratory experiment sensed passage of shock wave, but suffered no "ill effects" (Source: Wilkins, 1972).
	Sonic boom exposure caused no increase in egg mortality (Source: Rucker, 1973).
	Viability of eggs and resultant minnows decreased in noisier of two laboratory tanks (Source: Banner and Hyatt, 1973).
Reptiles	Hearing loss associated with intensive ORV use (Source: Brattstrom and Bondello, 1983).

generated by sonic booms, wildlife behavioral reactions to noise from low-flying aircraft or sonic booms, and death of embryos after panic causing abandonment of the colony or physical damage to eggs.

Laboratory results of studies on the effects of noise on animals show many responses such as hearing damage, weight loss, reduced reproduction, physiological stress (e.g., increased heart and respiration rates), secretion of hormones associated with increased urinary excretion, and adverse behavioral responses (Source: ORNL, 1988, Gladwin and Manci, 1988; Manci et al., 1988). The results of field based scientific studies of noise effects vary widely, ranging from determinations of no effect or habituation, to behavioral and physiological effects. Short term effects have been studied extensively, while long-term effects are relatively unstudied and unknown. Many field based studies of noise effects on wildlife have revealed inconclusive results or no impacts.

Apparently contradictory results of field and laboratory studies may be attributed to several factors. Laboratory animals may be overly sensitive due to pre-existing stress factors. Confinement of laboratory animals may enhance noise perception and stimulus strength because of the inability to flee, and noise used in laboratory studies may differ qualitatively or in intensity from noise levels in the wild. The lack of controlled field studies makes it difficult to evaluate the effects of noise on free-ranging populations.

Circumstantial evidence has resulted in many subsequent studies to determine whether an observed reaction resulted from defense-related activities. For example, the mass hatching failure of 40,000 breeding paris of sooty terns in the Dry Tortugas in 1969 was attributed to sonic booms (Source: Robertson, 1970). Because this report generated considerable controversy regarding the effects of sonic boom, a laboratory study was recently conducted to test the ability of eggshells and embryonic tissues to withstand pressures greater than those generated by sonic booms, to determine if the relationship between hatching failure and sonic boom was plausible. Based on a study of 60 chicken and quail eggs, researchers of the Hubbs Marine Research Center and Sea World Research Institute were unable to duplicate hatching failure and thus concluded that hatching failures due to physical effects of sonic booms are highly unlikely. The possibility of lowered reproductive success due to egg exposure resulting from "panic flights", was largely discounted because the original sooty tern observations indicated that most fleeing behavior was of such short duration that damage was unlikely (Source: Bowles, et al., 1991).

The effects of sonic boom events on animals continue to be of concern. Common reactions to sonic boom include slight startle response, raising of head, pricking of the ears, and scenting into the air (Source: Bell, 1978). Several studies have concluded that reproduction was not disturbed by sonic boom events. It is not known how behavioral reactions observed in the field relate to physiological response. Many researchers have concluded that more studies are required to fully understand the effects of sonic booms on wildlife (Source: Fletcher, 1978).

8.4.5 EFFECTS OF OVERFLIGHT ON WILDLIFE IN NEVADA

Few studies have been conducted in Nevada to determine the effects of overflight or ground-based activities on wildlife. There is some circumstantial evidence to suggest that effects may be present. For example, Nevada wild horse biologists observed a drop in the annual colt crop in Stone Cabin Valley from 15 percent to 8 percent during one year. This decrease is believed attributable to low-level helicopter overflights made over horse herds by biologists during fertility studies.

A study initiated in 1989 is being conducted by the Air Force in cooperation with the USFWS and University of Arizona on the Desert NWR to assess the effect of low-level overflight on bighorn sheep. This study includes both laboratory and field based observations. In the laboratory, animals are being exposed to simulations of 5 to 7 low-level aircraft per day while physiological responses are monitored. In the field, 12 adult bighorn sheep enclosed in a 1 square mile enclosure have been observed over the last year to determine habitat utilization characteristics. In June 1991, these sheep will be exposed to overflights as habitat utilization studies continue. The results of this study will be applied to a more comprehensive effort by the Noise and Sonic Boom Impact Technology (NSBIT), Advanced Development Program Office of the Air Force Systems Command, Human Systems Division, Wright-Patterson AFB, Ohio to develop a model evaluating noise effects on grazing animals.

Studies were conducted by Nevada Department of Wildlife (NDOW) in Churchill County, Nevada during the period 1988-1989 to determine the possible effects of wildlife resulting from overflight operations. The results of this study indicate that low-level and high-level overflight, and sonic booms resulted in various responses including no discernable reaction, minor behavioral response (head orienting, cessation of feeding, ear twitching or feather ruffling, alarm calling) and major reaction (fleeing or flushing). Table 8-13 provides the summary of results for the NDOW studies. General conclusions made by NDOW are that aircraft overflight had minor effects on the behavior of many of the species observed. Of those species, bald eagles, snow geese, migrating ducks, white-faced ibis, and long-billed dowitchers showed the greatest sensitivity to overflight. Recommendations made by NDOW based on the results of this study are primarily related to continued monitoring, collection of more sonic boom response data, and inclusion of wildlife population status and trend data in planning of training activities.

8.4.6 OVERALL FINDINGS

The findings of the Oak Ridge Laboratory literature review (Source: ORNL, 1988) summarize the current state of knowledge on the effects of low level aircraft on wildlife and are cited here:

"Wildlife responses to aircraft ranged from apparent disregard, to panic fleeing, and varied with season, reproductive status, previous exposure to aircraft, aircraft type, distance from aircraft, and other factors. In a few cases, wildlife exposed to relatively intense disturbance avoided the disturbed habitats or experienced some reproductive failure. Evidence for lack of significant effects included: 1) the apparently minimal effect of many aerial wildlife surveys with helicopter and light aircraft, 2) The abundance of some wildlife species and other low-level flight areas, 3) the lack of strong response of wildlife to relatively intense aircraft disturbance in several experimental studies, and 4) the observed habituation of wildlife to aircraft in several cases."

The literature indicates that sensitive wildlife can be adversely affected by low-flying aircraft in cases of relatively severe disturbance or at times when certain species are particularly sensitive to disturbance. On the other hand, wildlife in many cases apparently tolerated

Table 8-13. Summary of Results for Nevada Department of Wildlife Study of Wildlife Response to Overflight.

		REACTION												
		NO				MINOR[1]				MAJOR[2]				
Species	n	SB[3]	LL[4]	HL[5]	%	SB	LL	HL	%	SB	LL	HL	%	Observed Reactions[6]
BH sheep	29	--	8	13	73	3	2	2	24	--	1	--	3	Sonic booms and low-level overflight caused minor responses (head raising and orienting) in feeding and resting sheep
Mule deer	67	--	6	40	69	6	5	9	30	--	--	1	1	Sonic booms and low-level overflight caused minor responses in wintering mule deer
Chukar	16	1	5	3	56	1	3	--	25	--	--	3	19	Sonic booms and low-level overflight caused primarily minor responses; major (flushing) responses followed by apparent acclimation
G. Eagle	7	1	--	2	43	--	2	2	57	--	--	--	--	Head turning, alert posture in response to overflight
P. Falcon	2	1	--	1	100	--	--	--	--	--	--	--	--	No observed response
N. Goshawk	4	--	2	1	75	--	--	1	25	--	--	--	--	One minor response observed
B. Eagle	22	--	8	--	36	--	13	--	59	1	--	--	5	Wintering bald eagles exhibited minor responses to overflights; one major reaction observed
Sw. Hawk	54	--	27	7	63	--	15	1	30	1	3	--	7	Minor responses: consisted of watching the overflight; flushing from nest occurred on four occasions

Table 8-13. Summary of Results for Nevada Department of Wildlife Study of Wildlife Response to Overflight (continued).

		REACTION												
		NO				MINOR[1]				MAJOR[2]				
Species	n	SB[3]	LL[4]	HL[5]	%	SB	LL	HL	%	SB	LL	HL	%	Observed Reactions[6]
Snow goose	81	--	28	5	41	--	17	5	27	--	25	1	32	Minor responses (alert calling/posture) to 22 overflight occurrences; major flushing reactions to 26 overflights
Canada goose	92	1	66	--	73	--	25	--	27	--	--	--	--	Minor responses (alert calling/posture, rousing from sleep)
Ducks	328	--	224	9	71	--	52	1	16	1	39	2	13	Migrant ducks (pintail, green-winged teal, widgeon) exhibited minor responses (alert calling/posture, cessation of feeding) and major responses (flushing, circling, relanding) nesting species (cinnamon teal, gadwall, mallard) appeared less sensitive
Ibis	76	--	62	2	84	--	--	2	3	--	9	1	13	Major reactions consisted of feeding birds flushing and leaving immediate vicinity
Shorebirds	191	--	115	25	73	--	25	--	13	--	16	10	14	Minor reactions: changes in posture and/or vocalizations by feeding birds; major reactions: flushing, circling, relanding

[1] minor reaction: slight changes in body position; indications of awareness; small behavioral changes; e.g., head turning, ear twitching, ruffling feathers, alarm calling.
[2] major reaction: gross changes in behavior or body location, changes in posture to defensive position, exhibitions of panic or stress; e.g., flushing, fleeing.
[3] SB = sonic boom
[4] LL = low level
[5] HL = high level
[6] indicates observed reaction of individuals exhibiting minor or major response to overflight.

aircraft without adverse effect. No study showed that any wildlife populations were reduced as a result of low-flying jets or helicopters (Source: ORNL, 1988).

Major areas of uncertainty with regards to generalized noise effects on wildlife include: 1) the effects of long term exposure to moderate or intermittent noise, 2) the probability that wild animals experience the same adverse physiological effects of noise as laboratory animals, and 3) the ecological consequences of adverse physiological changes, masking (interference with communication and signal detection), and altered behavioral patterns (Source: EPA, 1980).

Several points should be noted when drawing conclusions about noise impacts: 1) laboratory studies do show adverse physiological responses to noise, 2) behavioral response does not indicate the full range of effects possibly being experienced, and 3) lack of an immediate response does not prove the absence of a long-term effect. It is reasonable to assume that for wildlife populations, negative effects are correlated with the intensity and frequency of noise events.

8.4.7 SUMMARY

It is difficult to quantify the effects of specific defense-related activities on wildlife and vegetation in Nevada based on the existing information. It is evident that these activities have had no widespread catastrophic effect on wildlife and vegetation in Nevada, but information is available that suggests that some wildlife populations exposed to defense-related activities have been and continue to be affected by defense-related land withdrawals, airspace use, and associated activities. However, other wildlife populations show no measurable response to defense-related land withdrawals, airspace use, and associated activities. The extent of effect is clearly a function of type and intensity of activity, wildlife species, population, or habitat type exposed to the activity, and the nature and duration of the interaction.

8.5 IMPACTS ON CULTURAL AND HISTORICAL RESOURCES

This section describes the cumulative impacts on known cultural and historical properties from defense-related activities associated with lands withdrawn in Nevada and use of airspace over Nevada for defense-related training purposes. Recorded archaeological and historical records were searched for this report, and summaries of previously conducted surveys and overviews are presented in Chapters 2 through 7.

Defense-related activities in the State of Nevada have impacted the cultural resources located on withdrawn lands. This is particularly true for withdrawals on which extensive land disturbing activities have not been preceded by cultural resources surveys and other studies designed to mitigate potential impacts. Table 8-14 indicates the extent of impacts on recorded, known cultural resource sites on withdrawn lands.

Table 8-14. Extent of Impacts on Recorded Archaeological Sites on Existing, Proposed, or Envisioned Land Withdrawals in Nevada(1).

Extent of Impacts	Recommended National Register Eligibility(2)							
	Eligible	%	Not Eligible	%	Undetermined	%	Total	%
Undisturbed	1,049	54.9	905	51.7	49	10.6	2,003	48.6
Partial	723	37.9	564	32.2	215	46.6	1,502	36.5
Extensive	81	4.3	148	8.5	29	6.4	258	6.2
Unknown	56	2.9	133	7.6	166	36.4	357	8.7
TOTAL	1,909	100.0	1,750	100.0	459	100.0	4,120	100.0
(%)		46.3		42.5		11.2	100.0	

(1) Impacts were considered to be "partial" if they have affected less than half the site area and "extensive" if they cover more than half the area occupied by the cultural resources.

(2) Recommendations on eligibility are those of professional archaeologists, not determinations of eligibility by the federal agency.

Activities in airspace used for defense-related training missions have a minimal potential to impact cultural resources. Nevertheless, long-term exposure to vibrations induced through overflight activities and sonic booms has the potential to impact standing historic structures, prehistoric structures, rock art localities, and rockshelter/caves with cultural deposits and increase the rate of their natural degradation (Sources: Ellis, 1987; Konon and Schuring, 1985; Hershey, Kevala and Burns, 1975). Of the studies accomplished on induced vibrations, most have focused on the short-term catastrophic impacts of overflights rather than the long-term cumulative impacts.

Defense-related agencies in Nevada have implemented steps to begin mitigating impacts on cultural resources. HWAAP and NAS Fallon have recently had cultural resources overviews prepared and have prepared historic preservation plans. Nellis AFB has arranged for the National Park Service (NPS) to assist in cultural resource management activities. Since 1978, DOE has conducted pre-activity surveys in advance of land-disturbing activities and has mitigated impacts to cultural resources by avoiding potentially impacted sites or conducting data recovery programs at those sites prior to disturbance. As these programs are continued impacts on cultural and historical properties should be minimized in the future. Currently, DOE has the approval of the Nevada State Historical Preservation Office. The other installations are in the coordination process.

Due to limited documentation of consultations with Native American spiritual and religious leaders, the effects of withdrawals and of airspace used for defense-related training purposes on cultural values and religious practices cannot be determined at this time. The DOE has recently initiated a program of consultation with Native American people to determine effects of NTS activities on cultural values and religious practices.

8.5.1 SUMMARY

In summary, past defense-related activities in the State of Nevada have affected cultural resources. However, all the Federal agencies now responsible for these defense-related activities have initiated policies and procedures that will help them to adequately assess and mitigate the impacts of their activities on cultural and historical resources in the future. The preparation of overviews are an initial step in this processes, and these overviews will be followed by field surveys as required to identify sites that may be impacted. These surveys will be followed by effective programs focused at the treatment of specific impacts. When treatment emphasizes avoidance, as is the case on most of the withdrawals, then the effectiveness of this avoidance policy should be continually assessed through a systematic monitoring program. Finally, the assessment of impacts to cultural values and religious freedoms of Native Americans can only be made through consultations with traditional spiritual and religious leaders. Consultations with the Nevada Division of Historic Preservation and Archaeology and the Advisory Council on Historic Preservation are an essential element in all steps of the above process.

8.6 EFFECTS ON SCIENTIFIC RESOURCES

Nevada is within the Basin and Range Physiographic Province, which is characterized geologically by a series of north-south trending mountain ranges and intervening valleys. Ecologically, the province is characterized by the Great Basin and Mojave Deserts and associated montague life zones. The central portion of this Province, which has no drainage to the ocean, is called the Great Basin. This physiography results from the region's geologic and geomorphic history and has strongly influenced both past and modern climatic conditions. The geologic processes leading to the current landforms created concentrations of minerals and elements that are of economic and technological importance to our society. Many of these geologic processes are on-going at both geologic and human time scales (e.g., volcanism, regional plate tectonism, geothermal activity, basin and range faulting, erosion, and deposition).

The Sierra Nevada Mountain Range, which defines the western edge of the Great Basin, dominantly influences the climate east to the Wasatch Mountains which is the eastern edge of the Great Basin. The Sierras create a rainshadow within the Great Basin by blocking moisture from Pacific Ocean frontal systems. As a consequence, Nevada is the Nation's most arid state, receiving a modern average of approximately nine inches per year of precipitation. However, the orographic precipitation process that blocks most Pacific moisture at the Sierras is repeated over each of the mountain ranges of Nevada. This leads to extreme differences in mean precipitation within the State, ranging from over 40 inches per year on the mountain summits to less than 4 inches per year on the floors of some intervening valleys in southern Nevada. Occurrence of vegetation and associated faunal communities are strongly influenced by the precipitation patterns and resultant runoff.

Subsequent to the last glacial maximum (approximately 18,000 years before present [B.P.]), many of the interior valleys in Nevada contained large lakes (e.g., Lake Lahontan) which reached their last largest extent about 13,000 years ago. Those lakes shrank rapidly over the ensuing 1,000 to 2,000 years; Pyramid, Walker, Mono, and Great Salt Lake are the last vestiges of those "inland seas." The rapid decline of those lakes isolated many fish species creating small relict populations throughout the province (e.g., Devil's Hole Pupfish, Pahrump Killifish, Moapa Dace).

Human occupation of the Great Basin began 10,000 to 12,000 B.P., before the large lakes began to recede in response to climatic change. As the environment changed, these early Americans adapted to the evolving deserts that exist today.

As a consequence of the evolution of the province to today's modern environment, the Great Basin represents a huge natural laboratory for study of ecology, archaeology, cultural resources, geology, hydrology and climate.

8.6.1 ECOLOGICAL STUDIES

There are numerous areas in Nevada that have been identified by the Federal and State land management agencies as areas to be managed for their unique ecological or geologic characteristics. These areas provide examples of significant natural ecosystems providing educational and research areas for ecological and environmental studies.

Research Natural Areas (RNAs) are small, undisturbed tracts of public land set aside for scientific and educational use. RNAs are not available for appropriation under the public land laws, but are protected for their unique botanical, geological, or zoological characteristics and their irreplaceable scientific and recreation resources. The 15 existing RNAs in Nevada are believed to contribute importantly to biological conservation and environmental monitoring (Source: Van Pelt, 1982).

The National Landmarks Program was established in 1963 to encourage the preservation of areas that illustrate the ecological and geological character of the United States; to enhance the educational and scientific resources of the areas thus preserved; to strengthen cultural appreciation of natural history; and to foster a wider interest and concern in the conservation of the Nation's natural heritage. In contrast to RNAs, National Landmarks are established from a national perspective, whereas RNAs have primarily regional importance. The Timber Mountain Caldera, located within the boundaries of the NAFR and the NTS is an established National Natural Landmark.

Areas of Critical Environmental Concern (ACECs) occur on BLM lands and are designated to conserve the unique features providing ecological, scenic, geologic, or historic values. ACECs were mandated by Federal Land Management Policy Act (FLMPA), to protect and prevent irreparable damage to important resources or features. There are seven

ACECs in Nevada. More than one hundred nominations for additional ACECs have been received from the public.

Table 8-15 lists the designated ACECs in Nevada and denotes overlaps with airspace used for defense-related purposes. Two of these areas, Soldier Meadows and Steamboat Hot Springs would not experience defense-related overflight. Osgood Meadow and Incandescent Mountain are located beneath military training routes. Stewart Valley is located beneath MTRs and the envisioned Smokey MOA. Overflight is not expected to affect the physical attributes of these ACEC resources, although visitors to those areas may be disturbed by noise. Potential effects of noise on recreational visitors are discussed in Section 8.7.

Table 8-15. Designated ACECs in Nevada.

ACEC	BLM Resource Area	Airspace Overlap
Salt Lake	Wells	UTTR (supersonic operations)
Osgood Mountain Milk Vetch	Paradise-Denio	IR303
Soldier Meadows Desert Dace	Sonoma-Gerlach	--
Incandescent Rocks Scenic Area	Lahontan	VR1250
Steamboat Hot Springs; Geyser Basin	Lahontan	--
Stewart Valley	Carson City	IR275, IR264, Smokey MOA

Salt Lake is located beneath an area used by UTTR for supersonic training. Approximately 6000 acres of this area were designated in 1986 as the Salt Lake ACEC to protect historic habitat of the peregrine falcon. This area currently provides habitat for other raptors, including the prairie falcon, golden eagles, and great-horned owls. Peregrine falcons will eventually be re-introduced in the Salt Lake ACEC. BLM has determined that "any use of the area that does not destroy or impair the aeries or other suitable habitat or disturb peregrine falcons while they are breeding, nesting, feeding, or using the area will be considered compatible. Many uses may be compatible during certain times of the year i.e., when peregrines are not present." (Source: BLM, 1986). If peregrine falcons are reintroduced to the Salt Lake ACEC, conflicts with defense-related overflight activities are possible as a result of the 100 AGL floor of the Gandy MOU and activities that occur there.

Other areas considered high in scientific research values are National Wildlife Refuges and Ranges, National Parks and Monuments, State Wildlife Management Areas, and State parks.

In 1982, the Nature Conservancy sponsored a workshop that addressed the gaps in the existing body of knowledge on Great Basin and Mojave Desert biological diversity. Recommendations made by the many resource managers and ecologists attending this workshop provided a comprehensive list of ecological research area needs that could be met by locating and designating suitable areas in Nevada for this purpose. Top research priorities determined for the Great Basin Desert Biome include: remnant or restricted grasslands at all elevations, especially those in moist situations; undisturbed or little-disturbed examples of shrublands, especially sagebrush-steppe variants in northern Great Basin and preferably in association with riparian situations or woodlands; examples of chaparral at mid-elevations in Great Basin mountain ranges; marshlands, springs, and desert streams harboring rare, listed, and obligate plant and animal species; and, alpine ecosystems in the western and eastern Great Basin.

Mojave Desert biome research needs were determined to include examples of: desert fishes habitats supporting isolated or singular populations; concentrations of endemic, rare, or restricted animal species, especially arthropods, birds, and mammals; associated unusual plant species; and high-altitude plant endemism in the Spring Mountains, including old age bristlecone pine stands.

Several of the lands withdrawn for defense-related purposes contain recognized and potential scientific resources. The Deadhorse, Hayford Peak, and Papoose lake RNAs are located within the Desert National Wildlife Range. These RNAs contain valuable examples of pinyon-juniper and mountain-mahogany woodlands; and blackbrush, saltbush-greasewood, and creosote-bursage shrublands. The extensive shrublands of the NAFR, where undisturbed, are also potentially valuable sites for the study of the Great Basin, Mojave, and transition deserts and associated biological features. The HWAAP may contain important examples of the Great Basin sagebrush shrubland in the Red Butte Canyon area. This shrubland type was identified as a key research natural area need by the 1982 Nature Conservancy workshop. The shrub communities of NTS, where undisturbed and safely accessible, are potentially valuable sites for the study of the Great Basin, Mojave, and transition deserts and associated biological features. DOE-funded research programs have provided much of our current knowledge about the ecology of these deserts (Sources: Beatley, 1976; O'Farrell and Emery, 1976).

8.6.2 CULTURAL RESOURCES

Information contained in prehistoric and historic cultural resources often provide the only source of empirical evidence concerning our National cultural heritage and the lifestyles and adaptations of these earlier peoples. The impacts of defense-related activities on this scientific resource is associated with the significance of the cultural resources located on withdrawn lands, restrictions to the scientific study of these resources, and the policies and procedures used to preserve the research values until they can be adequately addressed through scientific research. The Nevada Division of Historic Preservation and Archaeology (NDHPA) has had "An Archaeological Element" prepared for the Nevada Historic Preservation Plan that outlines various research domains, which may be used to evaluate the scientific value of cultural resources (Source: Lyneis, 1982). Although that document has been found to have several deficiencies and a new monograph is currently being considered by the NDHPA, it is used here together with the values of specific cultural resources known to occur on withdrawn lands to assess the overall scientific resources of those withdrawn lands (Source: Becker, 1986).

Archaeological resources found at historic sites are important in the formulation and testing of theories about cultural process for historical explanation and interpretation. Most historic cultural resources in Nevada pertain to one or more of five general themes: early exploration, mining, ranching or farming, urbanism, and Mormonism (Source: Lyneis, 1982). Early exploration in Nevada, although an important element of our Euroamerican National heritage, left few remains preserved in the archaeological record, and most information concerning this theme must be derived from existing records and diaries through traditional historic research. Consequently, any cultural resource that pertains to early exploration, such as the famous 1849 Death Valley expedition through the area now occupied by defense-related land withdrawals in the southern part of Nevada, provides a relatively rare opportunity to confirm and add to this existing and usually fragmentary historic documentation.

The history of Nevada is dominated by activities associated with locating, recovering and processing minerals and precious metals, but the written documentation of these activities is incomplete and subjective. Again, archaeological resources that pertain to this mining theme often provide the only avenue for verifying this documentation and filling out the details of daily life in the mining frontier, particularly in rural areas of Nevada. Important research opportunities offered by the cultural resources produced through mining activities include, but are not limited to, the study of the processes and consequences of technological development, the socio-political organization in frontier mining communities, and the effects of natural resources such as water supply and local plant and animal communities, as well as minerals, on settlement patterns and community development.

With the establishment of major markets following the emergence of mining towns and the building of railroads, ranching and farming began to flourish in Nevada. The nature of Nevada's arid environment, characterized by a winter precipitation pattern and short growing season, as well as the interdigitated pattern of farming and ranching localities at mining districts, heavily influenced the nature of these activities and gave a special flavor to ranching and farming in Nevada. Key research opportunities relative to cultural resources displaying a farming or ranching theme include the testing of competing models concerning the role of population pressure, technological development, industrialization, and social (ethnic), economic and natural environmental variability on the pattern of historic change.

Urbanism has not been a major theme in the history of Nevada; nevertheless, town life has been common enough to leave distinctive and often well-known cultural resources, such as Reno, Las Vegas, Ely, Fallon, Hawthorne, Tonopah, Goldfield, and Lovelock. Although most defense-related activities and withdrawals occur in rural Nevada, Nellis AFB, NAS Fallon, HWAAP, and the Reserve Army Training Center in Las Vegas are located in urban areas. The defense-related withdrawals in Nevada are also peripheral to most Mormon colonization. The Las Vegas Fort was established in 1855 as part of the Mormon Corridor and other early Mormon cultural resources occur in the Meadow Valley and Virgin drainages through Nevada. These and similar, or associated, cultural resources may provide information that, along with written documents, help scientists and others understand the hows and whys of both urban development and Mormon colonization.

Finally, as outlined in the Archaeological Element of the Nevada State Historic Plan, most cultural resources in Nevada pertain to prehistoric adaptations of hunters and gatherers and of horticulturalists (Sources: Lyneis, 1982; Becker, 1986). Important research questions regarding these adaptations include documenting and understanding past patterns of settlement and subsistence, the interrelationships between cultural adaptation and change and environmental variability, the processes of trade and exchange, the influence of belief patterns and ideology on cultural variability, evolution, and change. Because most adaptations were highly nomadic and tied to seasonally available resources, the cultural resources pertaining to these questions are often small and dispersed, and patterns of settlement may cover hundreds of square miles. Consequently, scientific research must incorporate a wide variety of cultural resources from a wide variety of contexts. In addition to DOD-sponsored studies, access to DOD lands may be obtained through the permitting process provided for in the Archaeological Resources Preservation Act.

8.6.3 PALEOENVIRONMENTAL AND BIOGEOGRAPHICAL STUDIES

The natural environment in Nevada has undergone phenomenal changes not only throughout the earth's history, but also during human presence in the region. Paleoenvironmental studies have demonstrated that as recently as 10,000 years ago many of the now dry playas contained extensive pluvial lakes, and areas now characterized by desert shrubs supported woodlands (Sources: Mehringer, 1977; Pippin, 1986). An understanding of processes and magnitude of these past changes in the environment is important to studies of past human adaptations and the processes of global climatic change, as well as for understanding past biogeographic distributions of plants and animals. Evidence pertinent to these studies comes from geological deposits and geomorphic formations; pollen, seeds and paleofaunas from these geological deposits and archaeological sites; macrobotanical remains from woodrat middens; and variability in the width of tree-rings. This evidence is scattered throughout the lands withdrawn for defense-related purposes. For example, the woodrat middens on the NTS and the NAFR have provided data that have allowed the most detailed reconstruction of paleoenvironment of southern Nevada (Source: Spaulding, 1985).

This evidence, much of which was obtained through DOE-funded programs, indicates that areas now characterized by Mojave Desert vegetation communities were covered by pinyon-juniper woodlands 9,000 years ago. Likewise, the study of Tephra layers in geological deposits on the FRTC have allowed researchers to reconstruct aspects of the chronology of Lake Lahontan and infer the responsible changes in past climates (Source: Davis, 1978).

8.6.4 GEOLOGICAL STUDIES

The success of mineral exploration often depends on the evaluation of large amounts of geologic data from a broad region. Synthesis of these data define smaller and smaller target areas eventually leading to exploratory drilling. The end product of this process is a mine, or several mines, contained within an original area that may have been a 1,000 square miles or more. If geologic data are not available because scientific access to the land is restricted, regional patterns, structures, and trends that could be critical to mineral discoveries may remain hidden. From a mineral-resource perspective, the geology of the withdrawn lands needs to be understood, even if these lands are unavailable for mineral exploration and development.

In Nevada, the DOD agencies have generally allowed geologic mapping to be conducted on withdrawn lands by the U.S. Geological Survey (USGS) and the Nevada Bureau of Mines and Geology. This information provides a broad, basic knowledge of the geologic setting of these withdrawn lands.

The need to examine in detail the geologic conditions of the NTS has had a beneficial impact on the level of knowledge about the geologic conditions and processes on the NTS and other areas. The NTS has been one of the most intensely studied areas in the desert southwest and, as a result of these studies, significant contributions to the knowledge of the region surrounding the test site have been made.

8.6.5 HYDROLOGY AND CLIMATIC STUDIES

Except for portions of NTS and a limited number of areas in the vicinity of major urban or agricultural development, water resources potential in Nevada is not known beyond a reconnaissance level of confidence. Streamflow records are sparse, and most are short duration (less than five years) periodic measurement records. Generally, 30 or more years of streamflow records are needed to establish meaningful statistical estimates of climatic and streamflow characteristics and extremes. While streamflow and springflow data are sparse throughout much of Nevada, they are less available for the lands withdrawn for defense-related activities. Development of such data, together with correlative precipitation records, would contribute to understanding of both runoff relationships and ground water recharge in those areas.

Ground water data (lithology, water chemistry, water level elevations, water level fluctuations) similarly are sparse and poorly distributed (spatially clumped). Ground water in Nevada represents the most extensive and reliable source of water, though neither its magnitude nor availability is known beyond a reconnaissance level of accuracy for most basins.

Better understanding of the hydrologic processes in Nevada is important to continued economic health, since water is an important resource. This hydrologic knowledge is needed to define the extent of developable resources and to define the environmental response to that development. Ground water resources have both a renewable (recharge) and non-renewable (storage) component. Little is known about the processes and controls on natural recharge, or how these relate to variable or changing climatic conditions. The diverse hydrologic environments on the withdrawn lands could serve as protected field laboratories to study these processes.

In the eastern and southern portions of Nevada, the ground water of many separate valleys is part of major regional flow systems connecting those hydrographic basins. Significant portions of those flow systems underlie the NAFR and NTS. The testing program at NTS has resulted in compilation and interpretation of extensive data related to the lateral flow regime portions of these flow systems. Limited data have been developed on the recharge regime portions of those systems within the NTS or NAFR. Data important to defining and understanding these flow systems can be obtained on the withdrawn lands only. The Air Force has provided access for exploratory wells in portions of the NAFR, but additional access will be needed.

Alluvial fans created by erosion and runoff from mountain ranges are dominant geo-morphological features throughout the desert southwest, representing nearly 30 percent of that land area. These features are the site of major urbanization. In many instances, aquifers created by these fans provide the primary source of ground water. These desert alluvial fans also constitute serious flood hazard zones due to the ferocity of flash floods that flow down them, often rapidly and unpredictably changing flow channels and flow directions. Study of undisturbed fans on the withdrawn lands could contribute to understanding of these fluvial processes in terms of frequency of extreme events and magnitude of flows and debris loads.

Equally as important to hydrological records, and as equally maldistributed, are good climatological records. Other than at NTS, NAS Fallon, and Nellis AFB, systematic climatic records are not kept for the withdrawn lands. Defense-related activities on these lands represent the opportunity to develop such records, which could be of utility to DOD and DOE agencies and would serve to fill major gaps in the climate record distribution. These climate data are critical to all hydrologic studies, and, in part, lack of these data creates much of the uncertainty related to water resources in Nevada, particularly in the central/southern portions of the State.

8.6.6 SUMMARY

The lands withdrawn for defense-related purposes within Nevada have been known to have substantial scientific resources. Some of these resources include paleoclimate woodrat middens; stands of undisturbed plants and plant communities; undisturbed cultural and historical resources; unique geological features and mineral deposits; and diverse hydrologic environments. These scientific resources have the potential to contribute significantly to climatic and ecological understanding, as well as to understanding of the prehistory, history, and mineral and water resources of Nevada. Procedures exist to allow scientists to request access for scientific study in some portions of the withdrawn lands such as at HWAAP. Access to withdrawals for the purpose of scientific study may be arranged with the installation Commanding Officer/Cognizant Manager. To the extent that the land withdrawals have preserved these scientific resources, they may have had beneficial effects. Because full access for scientific purposes is not possible, there has been a limiting effect on the development of scientific knowledge. However, this potentially limiting effect has been partially offset by the demonstrable beneficial effect of the increased data and knowledge that have been developed as a result of DOE-funded studies and testing at the NTS.

8.7 EFFECTS ON RECREATIONAL RESOURCES

8.7.1 LAND WITHDRAWALS AND RECREATIONAL RESOURCES

Table 8-16 lists the suitability of withdrawn lands in Nevada for recreational activities. The majority of these lands may have potential for recreational activities that are performed on other undeveloped arid lands of the Great Basin and Mojave Deserts. The larger land withdrawals (NAFR, NTS, FRTC, and HWAAP) may have potential for recreational activities such as hunting, camping, hiking, vehicle touring, horseback riding, rock hounding, or wilderness use. Most of these land withdrawals do not contain unique recreational activities that cannot be found elsewhere in Nevada.

Studies conducted by the State of Nevada have concluded that "The recreational facilities in the State are inadequate to meet the public needs for quality outdoor recreational opportunities" (Source: DCNR, 1987). The findings of a 20-year study culminating in the development of the Statewide Comprehensive Outdoor Recreation Plan (SCORP) have indicated that existing outdoor recreational facilities (ranging from nature-oriented recreational lands with little or no development to ball parks, golf courses, and tennis courts) are "deficient in both quality and quantity." Nevada Division of State Parks has determined that during the period 1987-1990, increasing numbers of Clark County residents visited Lincoln County's State Parks. Given the rapid rate of population growth in Nevada, particularly in southern Nevada, large withdrawals of land may be affecting the timely development of new recreational sites to meet the demands of increasing population, particularly for dispersed and primitive recreation.

8.7.2 DEFENSE-RELATED AIRSPACE AND RECREATIONAL RESOURCES

Table 8-17 lists 82 recreational sites considered in this analysis and 1990 visitor use for these sites (where available). Nevada's recreational areas include 22 State Parks; 2 National Forests (Toiyabe and Humboldt), including 18 National Forest Management Areas and 36 National Forest campgrounds; three National Parks managed areas (Lake Mead, Great Basin, and Death Valley), including 10 developed campgrounds; 7 National Wildlife Refuges (NWRs); 9 State Wildlife Management Areas (WMAs); 14 BLM Extensive Recreation Management Areas, including 16 Special Recreation Management Areas and other BLM recreation sites; and, at least 9 "other" recreation sites.

Table 8-16. Suitability of Withdrawn Lands for Popular Recreational Activities.

	Lake (1) Activities	Streams (2) Activities	Hunting (3) Activities	Vehicle (4) Activities	Snow (5) Activities	Environment (6) Activities
Nellis AFB						
Nellis Small Arms Range						
Nellis Air Force Range Complex			X	X		X
NAS Fallon			X			
NAS Fallon Range Training Complex			X	X		X
HWAAP	X	X	X	X	X	X
NTS			X	X		X
CNTS			X	X		X
Nelson Seismic Station						
Mt. Brock Communication Site						
Shoal Test Area						X
Wendover Range			X	X		X
Beatty Radar Station						
Ely Radar						
Base Camp						
Halligan Mesa			X	X		X
Las Vegas Army Reserve Training Center						

(1) Fishing, swimming, boating
(2) Fishing, boating
(3) Big game, small game, waterfowl hunting
(4) On and off-road travel; touring and sightseeing
(5) Downhill and cross country skiing, snowmobiling
(6) Camping, hiking, rock climbing, nature study, caving, rock hounding

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types.

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7]			
									M	S-M	S-P	P
State Parks												
Beaver Dam	2.2	8.7	X		X			X			X	
Belmont Courthouse	1 acre	3.3				X					X	
Berlin-Ichthyosaur	1.1	14.2						X			X	
Cathedral Gorge	1.6	39.8				X		X			X	
Cave Lake	1.2	84.0	X	X		X		X		X	X	
Dayton	0.2	55.1	X					X		X	X	
Echo Canyon Reservoir	0.9	47.0	X	X		X		X		X	X	
Floyd Lamb	2.0	320.6	X					X		X		
Fort Churchill	1.2	56.1				X					X	
Kershaw-Ryan	0.2	closed		X				X		X	X	
Lahontan Reservoir	30.4	258.7	X					X	X	X		
Lake Tahoe	14.2	861.2	X	X	X	X	X	X		X		
Mormon Station	2 acres	62.8				X				X		
Rye Patch Reservoir	20.2	46.7	X		X	X		X		X		
South Fork	3.9	76.2	X			X		X		X	X	
Spring Mountain Ranch	17.6	231.0				X				X		
Spring Valley	1.2	92.8	X			X		X		X	X	
Valley of Fire	34.9	242.5				X		X		X	X	
Walker Lake	0.3	52.8	X		X	X		X		X	X	
Ward Charcoal Ovens	0.7					X					X	
Washoe Lake	7.8	98.1	X		X	X		X		X	X	
Wild Horse	0.1	8.7	X	X	X	X	X	X			X	
TOTAL (22 parks)	**141.9**	**2660.3**										

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
National Forests												
Humboldt National Forest												
Mountain City MA	479.2	90.0	X	X	X	X	X	X		X	X	X
- Jack Creek			X	X	X	X	X	X			X	
- Wild Horse Crossing			X	X	X	X	X	X			X	
- Big Bend			X	X	X	X	X	X			X	
East Humboldt MA	62.2	NA	X	X	X	X	X	X		X	X	X
- Angel Creek			X	X	X	X	X	X			X	
- Angel Lake			X	X	X	X	X	X			X	
Ruby Mountains MA	258.0	NA	X	X	X	X	X	X		X	X	X
- Ruby Marsh			X		X	X		X		X	X	
- Thomas Creek			X	X	X			X			X	
Jarbidge MA	176.0	53.7		X	X	X	X	X		X	X	X
- Jarbidge				X	X	X	X	X			X	
Mt. Moriah MA	44.6	NA		X	X			X		X	X	X
Schell MA	281.5	NA	X	X	X			X		X	X	
- Berry Creek			X	X	X			X			X	
- Bird Creek			X	X	X			X			X	
- Cleve Creek			X	X	X			X			X	
- East Creek			X	X	X			X			X	
- Timber Creek			X	X	X			X			X	
Ward MA	39.8	NA			X			X			X	
- Ward Mountain					X			X			X	

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
White Pine MA	344.6	NA		X	X	X		X			X	
- Currant Creek				X	X	X		X			X	
- White River				X	X	X		X			X	
Quinn MA	165.5	NA		X	X			X			X	
- Cherry Creek				X	X			X			X	
Santa Rosa MA	268.5	42.0		X	X			X			X	
- Lye Creek				X	X			X			X	
TOTAL (10 MAs)	**2119.9**	**898.0[8]**										
Toiyabe National Forest												
Dog Valley MA	5.0	NA		X	X	X	X	X		X	X	
Carson Front MA	73.6	NA	X	X	X	X	X	X		X	X	X
- Mt. Rose				X	X	X	X	X		X		
- Nevada Beach			X			X		X		X		
Bridgeport P-J MA	454.0	NA		X	X	X	X	X		X	X	
- Desert Creek				X	X	X		X			X	
Paradise-Shoshone MA	267.8	NA		X	X	X	X	X		X	X	X
Toiyabe MA	541.0	NA		X	X	X	X	X		X	X	X
Big Creek				X	X	X	X	X			X	
- Bob Scott				X	X	X	X	X			X	
- Kingston				X	X	X	X	X			X	
- Peavine Creek				X	X	X	X	X			X	

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
Toquima MA	435.4	NA		X	X	X	X	X		X	X	X
- Pine Creek				X	X	X	X	X			X	
Monitor MA	728.5	NA			X	X	X	X		X	X	X
Mt. Charleston MA	58.0	1215.7				X	X	X		X	X	X
- Cathedral Rock						X	X	X		X		
- Deer Creek						X	X	X		X		
- Dolomite Camp						X	X	X			X	
- Fletcher View						X	X	X		X		
- Foxtail						X	X	X			X	
- Hilltop						X	X	X		X		
- Kyle Canyon						X	X	X		X		
- McWilliams						X	X	X		X		
- Mohagony Grove						X	X	X		X		
- Old Mill						X	X	X			X	
TOTAL (8 MAs)	2563.3	1469.98										
National Parks												
Lake Mead NRA	1500.0	8893.5	X		X	X		X	X	X	X	X
- Boulder Beach			X			X		X	X	X		
- Callville Bay			X			X		X	X	X		
- Cottonwood Cove			X			X		X	X	X		
- Echo Bay			X			X		X	X	X		
- Las Vegas Wash			X			X		X	X	X		
- Overton Beach			X			X		X	X	X		
Great Basin NP	76.8	66.8		X		X	X	X		X	X	X
- Baker Creek				X		X	X	X			X	

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
- Lehman Creek				X		X	X	X			X	
- Snake Creek				X		X	X	X			X	
- Wheeler Park				X		X	X			X		
Death Valley NM	105.0	NA				X		X			X	X
TOTALS	**1681.8**	**8960.3**										
National Wildlife Refuges												
Sheldon	537.0	14.3			X	X		X			X	X
Ruby Lake	36.6	56.0	X		X	X		X		X	X	
Stillwater	146.2	7.3	X		X	X		X			X	
Pahranagat	5.4	88.0	X		X	X		X		X		
Ash Meadows	23.4	69.0	X		X	X		X			X	X
Desert	1588.5	45.0			X	X		X			X	X
Moapa	0.03	Closed										
TOTAL (7 refuges)	**2337.1**	**279.6**										
Wildlife Management Areas												
Alkali Lake	3.5	NA	X		X			X		X		
Fernley	13.0	NA		X	X	X		X		X		
Humboldt	36.4	NA		X	X			X		X		
Mason Valley	12.0	11.4 [9]	X		X			X		X		
Scripps	2.7	NA	X		X	X		X		X		
Key Pittman	1.3	NA	X		X	X		X		X		
Kirch	15.5	10.8	X		X	X		X		X		
Overton	12.9	4.1	X		X	X		X		X		
Railroad Valley	14.7	NA				X		X				
TOTAL (9 areas)	**112.0**	**NA**										

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
BLM Extensive Recreation Management Areas (ERMAs) and Special Recreation Management Areas (SRMAs)												
Caliente ERMA	3416.4	68.8		X	X	X		X		X	X	X
Eagle Lake ERMA	236.2 [10]	71.0 [11]		X	X	X		X		X	X	X
Egan ERMA	3842.2	36.8		X	X	X	X	X		X	X	X
- Loneliest Hwy SRMA[12]	18.8	12.3				X						
Elko ERMA	3115.2	667.9	X	X	X	X	X	X		X	X	X
- S. Fork Canyon SRMA	3.4	3.6		X		X		X			X	
- S. Fork Owyhee SRMA	3.5	0.4		X	X	X		X			X	X
- Wilson Reservoir SRMA	5.4	15.4	X		X	X	X	X			X	
- Wild Horse SRMA	5.8	197.0	X	X	X	X	X	X		X	X	
- Zunino Reservoir SRMA	0.8	3.8	X			X		X		X	X	
Lahontan ERMA	2790.0	415.7		X	X	X		X	X	X	X	X
- Churchill Co. SRMA[13]	10.0	44.0		X	X	X		X	X	X	X	X
Paradise Denio ERMA	3857.0	114.0	X	X	X	X		X		X	X	X
- Pine Forest SRMA	19.0	2.3			X	X		X			X	X
Schell ERMA	4239.0	48.0	X	X	X	X	X	X		X	X	X
Shoshone-Eureka ERMA	4300.0	16.9	X	X	X	X		X		X	X	X
- Hickison Petro. Site						X		X			X	
Sonoma-Gerlach ERMA	4414.0	114.8	X	X	X	X	X	X		X	X	X
- Black Rock Des. SRMA	105.8	5.0			X	X		X		X	X	X

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
Stateline ERMA	1535.4	17.0			X	X		X		X	X	X
- Clark County SRMA	1310.1	41.0			X	X		X		X	X	X
- Cold Creek				X		X		X			X	
- Spring Mtn. SRMA	767.4	4.4				X	X	X		X	X	
- Red Rock Cyn SRMA	61.8	562.1				X		X		X	X	X
Surprise ERMA	1215.8 [10]	19.0 [11]	X	X	X	X	X	X		X	X	X
- High Rock SRMA	24.0	10.0	X	X	X	X		X				
Tonopah ERMA	6126.0	7.8		X	X	X		X		X	X	X
Walker ERMA	1920.0	155.3	X	X	X	X	X	X		X	X	X
- Walker Lake SRMA	64.0	82.7	X			X		X		X	X	
Wells ERMA	4132.5	45.8	X	X	X	X	X	X		X	X	X
- Salmon Ck Falls SRMA	2.2	1.7		X		X		X		X	X	
TOTAL (14 ERMAs)	**45139.7**	**2784.5**										
Other												
Sheep Creek Reservoir	NA	NA	X		X	X		X			X	
Topaz Lake	0.09	33.7	X		X	X		X		X	X	
Pyramid Lake	316.8	28.1 [14]	X			X		X		X	X	
Sheckler Reservoir	NA	0.7 [15]	X			X		X		X	X	
Carson Lake	7.5	0.1 [15]	X		X	X		X		X	X	
Bower's Mansion Park	0.046	150.9				X		X		X		
Davis Creek Park	0.200	123.5	X			X		X		X		

Table 8-17. Nevada's Major Recreation Resources, Visitor Use, and Recreation Opportunity Types (continued).

Recreation Resources	Acreage (x 1000)	1990 Visitor Use (# people x 1000)	Lake[1]	Stream[2]	Hunt[3]	St See[4]	Snow[5]	Env.[6]	Recreation Opportunity Category[7] M	S-M	S-P	P
Galena Creek Park	0.440	82.7				X	X	X		X		
Sportman's Park	0.026	6.0	X		X	X		X		X		
TOTAL (9 areas)	325.1 [16]	425.7 [17]										

[1] Lake-Related Activities: fishing, swimming, boating, and hunting.
[2] Stream-Related Activities: fishing, swimming, and boating.
[3] Hunting-Related: big game, small game, and waterfowl.
[4] Sightseeing-Related: on and off-road travel; touring and sightseeing.
[5] Snow-Related: downhill and cross-country skiing and snowmobiling.
[6] Environment-Related: camping, hiking, nature study, rock climbing, caving, and rock hounding.
[7] M: modern; S-M: semi-modern; S-P: semi-primitive; P: primitive.
[8] Visitor use data is tabulated by district only, therefore, individual figures for management areas are usually not available. Total does not include Dog Valley, Carson Front or Bridgeport PJ visitor use because these areas include portions of California which cannot be separated from Nevada visitor use. Data are expressed in Recreation Visitor Days (RVDs).
[9] Estimate is for total-use days.
[10] Acreage in Nevada.
[11] Visitor use in Nevada.
[12] Includes Pony Express Trail, Cold Creek, Illipah Reservoir, and Garnett Hill.
[13] Includes Grimes Point, Sand Mountain, and Cold Springs.
[14] Represents angler use only.
[15] Represents 10 year average for angler use.
[16] Does not include Sheep Creek Reservoir or Sheckler Reservoir.
[17] Does not include Sheep Creek Reservoir.

Overall visitor use is difficult to quantify given various agency methods of estimating usage at any given site. Table 8-17 provides available figures on recreation usage for FY 1990. Large numbers of recreationists are likely to utilize sites close-in to the major urban population centers of Reno and Las Vegas. As mentioned in 8.7.1, Nevada Division of State Parks has determined that large numbers of Clark County residents are seeking recreational opportunities in outlying areas, e.g. Lincoln County, suggesting that urban residents are seeking recreational opportunities away from the city. Visitor usage of Lahontan Extensive Recreation Management Area similarly suggests that Reno residents take advantage of neighboring rural recreational opportunities. Visitor usage of Elko Extensive Recreation Management Area is high due to its substantial fishing and hunting opportunities.

8.7.2.1 Recreational Opportunities and Visitation

Table 8-17 lists primary types of recreation activities conducted in each recreational area. Possible categories include lake activities (e.g. fishing, swimming, boating, and hunting), stream activities (e.g, fishing, swimming, boating), hunting (e.g big game, small game, waterfowl), sightseeing (e.g. on- and off-road touring and travel), snow-related (downhill and cross-country skiing; snowmobiling), and environment-related (e.g. camping, hiking, nature observation, rock climbing, rock hounding, caving).

The recreational opportunities categories previously described in 1.4.6 were used as the basis for classifying recreation resources in Nevada. Based on both type of recreational opportunity at each site, and the site's proximity to "civilization," each area was assigned to one or more recreation categories. Of 82 recreational sites, 3 (4 percent) offer modern opportunities, 64 (78 percent) offer semi-modern opportunities, 61 (74 percent) offer semi-primitive opportunities, and 30 (37 percent) offer primitive opportunities. (This analysis excluded sites located within a larger recreational area, e.g., BLM sites within the Extensive Recreation Management Areas, National Forest and National Park campgrounds, in order to avoid double-counting).

This analysis is cursory in nature and did not incorporate surveys or other types of primary data collection. However, it does provide an indication that Nevada's recreation potential is diverse, and provides multiple opportunities, particularly within larger recreation areas such as BLM Extensive Recreation Management Areas and National Forest Management Areas.

Visitor use of recreation areas is based on visitor collection fees, traffic counters, and estimates. Information is incomplete for some areas. Information compiled primarily for 1990 (some data is from 1989) indicates the following approximate visitation to recreation sites in Nevada: 2.6 million visitors to State parks, 2.3 million Recreation Visitor Days (RVDs) in National Forests, 8.9 million visitors to National Parks, 280,000 visitors to National Wildlife Refuges, and 2.7 million visitors to BLM Extensive Recreation Management Areas.

Table 8-18 indicates recreation areas located beneath airspace used for defense-related purposes. In total, 57 of the 82 (70 percent) recreation areas considered in this

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada.

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
<u>State Parks</u>					
Beaver Dam	Desert				
Belmont Courthouse		Smokey	*	*	
Berlin-Ichthyosaur	Gabbs S		74	82	
Cathedral Gorge	Desert		*	*	
Cave Lake					
Dayton					
Echo Canyon Reservoir	Desert				
Floyd Lamb					
Fort Churchill					
Kershaw-Ryan	Desert				
Lahontan Reservoir			270*	297*	
Lake Tahoe					
Mormon Station					
Rye Patch Reservoir			30	150	
South Fork					
Spring Mountain					
Spring Valley	Desert				
Valley of Fire					
Walker Lake			68*	75*	
Ward Charcoal Ovens					
Washoe Lake					
Wild Horse			198*	237*	
<u>National Forests</u>					
Humboldt National Forest					
Mountain City MA	Paradise (30)		419	501	
- Jack Creek	Paradise		*	*	
- Wild Horse Crossing	Paradise		*	*	
- Big Bend			198	237	
East Humboldt MA			*	*	
- Angel Creek					
- Angel Lake					
Ruby Mountains MA			92*	104*	
- Ruby Lake			*	*	
- Thomas Creek			*	*	
Jarbidge MA			*	*	
- Jarbidge			*	*	
Mt. Moriah MA			*	*	

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada (continued).

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
Schell MA			19	22	
- Berry Creek			*	*	
- Bird Creek					
- Cleve Creek			*	*	
- East Creek					
- Timber Creek					
Ward Mountains MA			19	22	
- Ward Mountain			*	*	
White Pine		Duckwater (80)	67	81	
- Currant Creek		Duckwater			
- White River		Duckwater	67	81	
Quinn	Desert		21	23	75%
- Cherry Creek			21	23	
Santa Rosa	Paradise (60)		260	312	
- Lye Creek	Paradise		*	*	
Toiyabe National Forest Dog Valley					
Carson Front					
- Mt. Rose					
- Nevada Beach					
Bridgeport P-J			241	269	
- Desert Creek					
Paradise-Shoshone	Gabbs N (<5)		30	150	<10%
	Gabbs S (30)				
	Gabbs C (20)				
	Austin 1 (<5)				
Toiyabe	Austin 2 (35)	Smokey	429	597	
	Austin 1 (15)				
- Big Creek	Austin 1		*	*	
- Bob Scott	Austin 1		12*	14*	
- Kingston		Smokey	131	145	
- Peavine Creek		Smokey	*	*	
Toquima	Austin 2 (20)	Duckwater (80)	87	104	
- Pine Creek		Duckwater	*	*	

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada (continued).

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
Monitor	Austin 2 (<5)	Diamond (<5) Smokey (60) Duckwater (20)	302	297	
Mt. Charleston	LATN W		*	*	
- Cathedral Rock	LATN W				
- Deer Creek	LATN W				
- Dolomite Camp	LATN W				
- Fletcher View	LATN W				
- Foxtail	LATN W				
- Hilltop	LATN W				
- Kyle Canyon	LATN W				
- McWilliams	LATN W				
- Mohagony Grove	LATN W				
- Old Mill	LATN W				
<u>National Parks</u>					
Lake Mead NRA					
- Boulder Beach					
- Callville Bay					
- Cottonwood Cove					
- Echo Bay					
- Las Vegas Wash					
- Overton Beach					
Great Basin NP			19	22	
- Baker Creek			*	*	
- Lehman Creek			19	22	
- Snake Creek					
- Wheeler Park			19	22	
Death Valley NM			295	208	
<u>National Wildlife Refuges</u>					
Sheldon	Hart (20)		42	164	
Ruby Lake					
Stillwater	Gabbs N (50)		5	6	
Pahranagat	Desert				100%
Ash Meadows	LATN W		689	706	

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada (continued).

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
Desert	Nellis	Desert	219	197	80%
Moapa	Desert				
<u>Wildlife Management Areas</u>					
Alkali Lake					
Fernley					
Humboldt			*	*	
Mason Valley					
Scripps					
Key Pittman	Desert				100%
Kirch			*	*	
Overton					
Railroad Valley	Desert				100%
<u>BLM</u>					
Caliente ERMA	Desert (85) LATN E (15)		313	311	50%
Surprise ERMA - High Rock SRMA	Hart (20)		415	600	
Eagle Lake ERMA	Reno (40)		556	755	
Egan ERMA		Diamond (10) Duckwater (30)	110	130	
- Loneliest Hwy SRMA[3]			77	93	
Elko ERMA	Paradise (25)		397	475	
- S. Fork Canyon SRMA			*	*	
- S. Fork Owyhee SRMA	Paradise		221	264	

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada (continued).

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
- Wilson Reservoir SRMA	Paradise				
- Wild Horse SRMA			198*	237*	
- Zunino Reservoir SRMA					
Lahontan ERMA	Gabbs C (10)		811	899	
	Gabbs N (40)				
	Ranch (5)				
- Churchill County SRMA[4]	Gabbs C (20)		5	6	
	Gabbs N (60)				
	Ranch (10)				
Paradise Denio ERMA	Paradise (20)		567	786	
- Pine Forest SRMA			198	237	
Schell ERMA	Desert (25)		162	189	35%
	Gandy (15)		(412)	(421)	
Shoshone-Eureka ERMA	R6405 (15)	Smokey (15)	457	623	20%
	Austin 1 (30)(20)*	Diamond (20)	(450)	(631)	
	Austin 2 (10)				
	Gabbs C (<5)	Duckwater (10)			
	Gabbs N (<5)				
	Gabbs S (<5)				
- Hickison Petro. SRMA	Austin 2				
Sonoma-Gerlach ERMA	Carson (<5)		596	798	
	Reno (15)		(1023)	(1270)	
- Black Rock Des. SRMA			302	476	
Stateline ERMA	Desert (<5)		689	706	
	LATN W (30)		(689)	(706)	
	LATN E (10)				
- Clark County SRMA	LATN W (30)		(420)	(504)	
- Cold Creek	LATN W				
- Springman SRMA	LATN W		639	701	
- Red Rock Cyn SRMA	LATN W (90)				
Tonopah ERMA	Desert (15)	Smokey (25)	616	647	15%
	Gabbs S (<5)	Duckwater (10)	(1126)	(1227)	
- Walker ERMA	Gabbs C (<5)	Smokey (<5)	344	500	
			(419)	(584)	

Table 8-18. Recreational Resources Located Beneath Defense-Related Airspace in Nevada (continued).

Recreation Resource	MOA Existing	Envisioned	# of MTR Overflights[1,2] Present	2000	Supersonic
Walker Lake SRMA			68	75	
Wells ERMA	Lucin A (20) Lucin C (5) Gandy (5) R6404C (5)* R6404 (5)* -		261	314	10%
Salmon Crk Falls SRMA					
<u>Other</u>					
Sheep Creek Reservoir	Paradise		221	264	
Topaz Lake					
Pyramid Lake	Reno (20)		191	209	
Sheckler Reservoir	R4803		*	*	
Carson Lake			*	*	
Bowers Mansion Park					
Davis Creek Park					
Galena Creek Park					
Sportman's Park					

1 * indicates recreation sites located beneath boundaries (but not beneath MTR centerline unless indicated otherwise).

2 Numbers in parenthesis indicate total number of overflights, including flights on MTRs present over only a small portion of recreation area.

3 Includes Pony Express Trail, Cold Creek, Illipah Reservoir, and Garnett Hill.

4 Includes Grimes Point, Sand Mountain, and Cold Spring.

analysis are located beneath defense-related airspace, including 11 of 22 (50 percent) state parks, 16 of 18 (89 percent) National Forest MAs, 2 of 3 (67 percent) National Parks, 6 of 7 (86 percent) National Wildlife Refuges, 4 of 9 (44 percent) wildlife management areas, 14 of 14 BLM Extensive Recreation Management Areas (100 percent), and 4 of 9 "other" recreation areas (44 percent). Table 8-19 summarizes recreation areas located beneath defense-related airspace. Recreation areas located under airspace used for supersonic operations (9 of 82; 11 percent) and areas that receive large numbers of overflight are likely to be most affected.

Table 8-19. Summary of Recreation Areas Located Beneath Defense-Related Airspace in Nevada.

		MOAs		MTRs			Total
	Total	Existing	Envisioned	Centerline	Boundary	Supersonic	Affected
State Parks	22	6	1	5	2	0	11 (50%)
National Forest MAs	18	8	4	13	4	1[1]	16 (89%)
National Parks	3	0	0	2	0	0	2 (67%)
National Wildlife Refuges	7	6	0	4	0	2	6 (86%)
Wildlife Management Areas	9	2	0	0	2	2	4 (44%)
BLM ERMAs	14	13	4	14	0	4[2]	14 (100%)
Other	9	3	0	2	2	0	4 (44%)
TOTAL	82	38	9	40	10	9	57 (70%)
		(86%)	(11%)	(48%)	(12%)	(11%)	

[1] Does not include Paradise-Shoshone MA, of which <10 percent is located beneath airspace used for supersonic operations.

[2] Does not include Wells ERMA, of which <10 percent is located beneath airspace used for supersonic operations.

Table 8-20 lists recreation areas probably most affected by overflights. For the most part, this list includes areas located beneath both MOAs and MTRs, and which receive at least 200 overflights per month on the MTRs. Not all flights on MTRs overfly the centerline for the full length of the route. They may overfly any lands beneath the borders of MTRs. As a result all lands within the borders of MTRs may be subject to overflight. Areas affected were identified by comparison with the centerline of MTRs. Thus, there are WSAs affected by overflight which are not identified.

Actual numbers of frequency of overflight, noise level, and amount of supersonic noise projected into these recreation areas were not readily predictable because not all flights in MOAs will occur over the recreation areas, and because type of aircraft, altitude, and climatic conditions will determine the level of noise occurring beneath any MTR. Calculation of actual numbers of individuals disturbed is not possible because: 1) it is not possible to predict the actual number of overflights of any area located beneath MOAs, 2) it is not possible to gauge the extent of disturbance of any given overflight, 3) number of overflights of any area will vary from day to day, and, 4) disturbance will vary based on individual opinion.

8.7.2.2 Social Benefits Derived from Primitive Recreational Opportunities

Several studies have categorized the social value of various recreation attributes obtained through primitive recreational opportunities. These studies generally indicate that enjoyment of unspoiled nature is a primary value of wilderness experience, and that solitude and quiet are particularly valued. The beauty of nature, a break from urban life, and opportunities for adventure and tranquility were rated highest among a list of 30 identified opportunities for wilderness recreation by 94 individuals surveyed (Source: Rossman and Ulehla, 1977).

The term "recreation" does not fully capture the richness of the intellectual valuations of wilderness, which include historical, cultural, ethical, religious, political, literary, scientific, educational, and aesthetic facets (Source: McCloskey, 1988). Wilderness, according to the Wilderness Act, retains its "primeval character and influence" and "has outstanding opportunities for solitude or a primitive and unconfined type of recreation." Wilderness is construed as a "form of privacy in a specific environmental setting where individuals experience an acceptable degree of control and choice over the type and amount of information they must process." Hammitt's survey of 109 wilderness users revealed that of 20 components of wilderness solitude, of most importance was the tranquility and peacefulness of the remote environment and an environment free of man-made noise.

Hummel (1980) describes wilderness as "A relatively primitive natural setting which affords both the feeling of solitude and the "sounds of silence", or quiet. A key feature of the above definition is the emphasis on quiet. Being away from the noises of civilization seems to be ultimately a therapeutic and enriching experience; and quiet is probably a necessary component of a wilderness experience."

The attributes of wilderness may be broken down into components: "ecological" wilderness and "sociological" or "philosophical" wilderness. Ecological wilderness includes the

Table 8-20. Most Noise-Prone Recreation Areas in Nevada.

RECREATION AREA	TYPE OF OVERFLIGHT
Lahontan Reservoir	MOA, MTR
Mountain City MA	MOA, MTR
Santa Rosa MA	MOA, MTR
Paradise-Shoshone MA	MOA, MTR, supersonic operations
Toiyabe MA	MOA (existing and envisioned), MTR
Toquima MA	MOA (existing and envisioned), MTR
Monitor MA	MOA (existing and envisioned), MTR
Death Valley NM	MTR
Pahranagat NWR	MOA, supersonic operations
Desert NWR	MOA, MTR, supersonic operations
Ash Meadows NWR	MTR
Stillwater NWR	MOA
Caliente ERMA[1,2]	MOA, MTR, supersonic operations
Surprise ERMA	MOA, MTR
Eagle Lake ERMA	MOA, MTR
Elko ERMA[3]	MOA, MTR
Wild Horse SRMA	MOA, MTR
Lahontan ERMA	MOA, MTR
Paradise-Denio ERMA	MOA, MTR
Schell ERMA	MOA, MTR, supersonic operations
Shoshone-Eureka ERMA	MOA, MTR, supersonic operations
Sonoma-Gerlach ERMA	MOA, MTR
Stateline ERMA	MOA, MTR
Tonopah ERMA	MOA, MTR, supersonic operations
Walker ERMA	MOA (existing and proposed), MTR
Wells ERMA	MOA, MTR, supersonic operations

[1] See Table 8-18 for overflights of SRMAs, which are located within the ERMAs.

[2] Virtually every ERMA is subject to large numbers of overflight because these areas encompass large portions of the state.

[3] Several SRMAs located within the Elko ERMA are overflown in large numbers; see Table 8-18.

ecological processes inherent in biological systems, which remain unmanipulated by man. Sociological wilderness pertains to the qualities of the wilderness that provide benefits to human visitors. Perceptions of wilderness are distinguishable across a continuum of user types, ranging from "wilderness-purist" to "urbanist" (Source: Hendee, et al., 1968). Wilderness purists are distinguishable from urbanists by their stronger affinity for natural environments devoid of human influence.

As to what motivates wilderness use, one study suggests that "wilderness visitation is motivated, in large part, as an escape from artificiality of contemporary environments into natural settings, untarnished by civilization, where the necessity for primitive means of existence yields various emotional benefits to the participant" (Hendee et al., 1968). This definition suggests that for some wilderness visitors, there is a desire to completely remove themselves from the imprint of human development.

8.7.2.3 Potential Effects of Overflight on Recreationists

A definition of what constitutes an effect from military overflight of recreation areas is not only a function of the duration, frequency, altitude, and sound level of any given occurrence, but also of the perception of the individual. It can be assumed that some portion of the recreationist population will enjoy observing overflights and will not be annoyed at all by the sound of overflight. Others may enjoy observing occasional aircraft overhead, but would be annoyed by more frequent overflight. Still others would be highly annoyed by any overflight. In general, it can be assumed that most individuals engaged in modern opportunity-type recreation will be less annoyed, or not annoyed at all by overflight, while those engaged in primitive-type recreation are more apt to be annoyed by interruptions of the tranquility of the primitive recreation setting.

Noise was cited as the most prevalent off-site problem affecting wilderness use, according to Forest Service district managers (Source: GAO, 1989). Based on their study of wilderness problems, GAO concludes that many legislatively authorized activities "appear to be damaging the wilderness and diminishing people's enjoyment of portions of these pristine undeveloped lands." Many managers also reported "experiencing problems with noise, especially from low-level military flights."

The results of surveys of wilderness users in Oregon and Washington in 1966 revealed that almost all wilderness users considered the use of helicopters in wilderness acceptable for management purposes, although the "wilderness purist" group objected to helicopters for any use (Source: Hendee, et al., 1966). Seventy-five percent did not feel that the use of helicopters was justified for visits by prominent people, however, helicopter usage was acceptable to this group provided that it resulted in direct benefit to the wilderness or its users (i.e. fire protection, maintenance, emergency use).

Studies of the Rawah Wilderness in Colorado indicated high user affinities among 264 individuals surveyed for being away from crowds, being where it is quiet, and the smells, sights, and sounds of nature (Source: Brown and Haas, 1980). A more extensive study, involving 791 recreationists in three wilderness areas indicated that the top three of 43 factors adding to the satisfaction of wilderness use were: 1) enjoying the sites and sounds of nature;

2) experiencing the peace and calm; and 3) enjoying the scenery (Source: Haas, Driver, and Brown, 1980). Hammitt's survey of 109 back-country users revealed that of 20 components of wilderness solitude, the most important was the tranquility and peacefulness of the remote environment, and an environment free of man-made noise.

The only study to date conducted in Nevada of recreationist perceptions of overflight concluded, based on a survey group of 722 individuals (604 hunters and 118 non-hunters), that some recreation values are being impacted by air operations (Source: NDOW, 1989). Upland game hunters were determined to be the most disturbed by aircraft activity, with over half annoyed by the sounds of overflight. Other conclusions indicated that over one third of deer hunters and less than one third of the water fowl hunters were annoyed by overflight. With the exception of ORV recreationists, over half of the non-hunters were annoyed by overflight noise. In total, 39 percent of all recreationists were annoyed or extremely annoyed by overflights, and 61 percent were either not negatively affected, or not affected at all by overflight. Twenty percent of the surveyed group felt that overflight disturbance experienced would influence their decision to return to the study area for recreation, while 80 percent indicated they would plan to return regardless of overflight.

Based on the information on visitor usage, types of recreational opportunities available throughout Nevada, and what is known about visitor appreciation of unspoiled nature, solitude, and quiet, it is concluded that overflights of the State's recreation sites will disturb a portion of recreationists. Overflights of wilderness will disturb many recreationists and other users of wilderness engaged in recreational activities classified as primitive activities, where sounds are typically restricted, and where unnatural, mechanical sounds are considered inappropriate. Opinions on the effects of defense-related airspace use on wilderness resources will vary between user types, i.e. "wilderness purists", "urbanists", and wilderness users that fall between these two extremes. However, the total number of wilderness users disturbed cannot be approximated because user data are not available for most wilderness areas.

State projections indicate that visitor usage of recreation sites is increasing as a function of the State's population growth. It is concluded that the number of individuals annoyed by the sounds of overflight will increase as Nevada's population increases. Finally, projected increases in defense-related activities to the year 2000 will result in additional impacts to Statewide recreational activity.

8.7.3 SUMMARY

Two types of effects on recreation were considered in this analysis: the effects of land withdrawals, and the effects of defense-related airspace. It is concluded that the withdrawal of large tracts of land may have an effect on Nevada's potential for recreational site development.

Recreational resources in Nevada include modern, semi-modern, semi-primitive, and primitive forms of recreation typically conducted on unpopulated lands administered by the BLM, USFS, FWS, NPS, and State of Nevada. Noise resulting from defense-related use of airspace above established recreational sites affects the experiences of a portion of recreationists in these areas. The effects of defense-related use of airspace in Nevada on recreation are not readily quantifiable. However, it is concluded that because many of Nevada's recreation areas are located beneath airspace used for defense-related purposes, a portion of recreationists using these areas are disturbed by overflights. Determination of the effects of defense-related use of airspace on recreational use throughout Nevada requires consideration of many variables, including frequency of occurrence, loudness (a function of altitude, climate, and type of aircraft), and perception of the individual recreationist.

8.8 EFFECTS ON WILDERNESS RESOURCES

There are two types of possible effects on wilderness resources: 1) the effects of land withdrawals; and 2) the effects of overflights. The former type of effect is easily recognized based on overlap analyses which illustrate possible conflicts between use of those lands for wilderness or defense-related purposes. Lands withdrawn for defense-related purposes prior to passage of the FLPMA have, by and large, not been evaluated for wilderness characteristics since they are exempt under the Act.

Determination of the effects of overflight on wilderness resources is more complex and requires multiple considerations. Several factors influence the determination of whether defense-related overflights in Nevada have an effect on the State's wilderness resources. The interpretation of the Wilderness Act (Section 1.4.7), and its definition of wilderness, has been a subject of controversy since its inception. Another concern pertains to public perception of wilderness and whether there is a need to protect it in its primitive state. Finally, there are questions pertaining to what constitutes a primitive state and what the effects of defense-related airspace use in Nevada are on the state.

8.8.1 SOLITUDE DEFINED

The word "solitude" is a controversial aspect to the Act. Solitude is popularly defined as the escape or complete isolation from all other people. Wilderness solitude is distinguished from solitude as an "escape from certain social structures and environments, rather that isolation from individual people" (Source: Hammitt, 1982). Wilderness areas by Hammitt's definition lack man-made intrusions and noises that inhibit individual freedom of choice, tranquility, and peace of mind.

8.8.2 PUBLIC PERCEPTION

With respect to public perception of wilderness, nationwide public attitudes about wilderness have not been extensively studied. However, the available information indicates strong support for wilderness. One survey found that "82 percent of those surveyed feel the government has a responsibility to protect large areas of land for wilderness and related environmental values'" (Source: Yankelovich, et al., 1978, in McCloskey, 1988). Another survey revealed that "only 7 percent of the public felt there was 'too much' wilderness" (Source: American Forest Institute, 1977, in McCloskey, 1988). Another indicator of national support is Congressional action. In the 1970s, Congress increased the size of units added to the National Wilderness Preservation System by 25 percent above what was recommended by the land management agencies. Data from the 1980s indicate that for National Forests, Congressional increases have been even higher (43 percent). The fact that none of the decisions has been reversed or even revisited suggests a high degree of social consensus about wilderness at the National level (Source: McCloskey, 1989).

These nationwide indicators are reflected in the data on Nevada. A 1986 Nevada Department of State Parks survey found that 74 percent of Nevadans surveyed supported the designation and protection of wilderness areas in the state (Source: DeWitt, 1986). Congressional actions on USFS wilderness designation in Nevada also reflected the National trend. Congress increased the size of the USFS wilderness proposal by about 75 percent.

Congress recognized potential impacts of overflights in the National Park Overflights Act of 1987 (P.L. 100-91) which requires the USFS and National Park Service to conduct studies of aircraft overflights on wilderness and park visitors or resources. Studies conducted under this Act acknowledge that National Parks and wilderness areas are managed to protect their natural resources, one of which is "natural quiet" (Source: U.S. Departments of Interior and Agriculture, 1990). A report which analyzes the effects of overflight will be issued to Congress in September 1991.

8.8.3 DEFENSE-RELATED OVERFLIGHT -- WHAT CONSTITUTES AN EFFECT?

Of concern to this analysis was the question of whether defense-related overflight affects wilderness. This question relates back to the problem of defining wilderness characteristics and how those characteristics may be affected.

Two different surveys of wilderness managers have recently been conducted. One involved 50 Park and Forest Service managers. Military operations, mainly overflights, was ranked as the most common threat to wilderness areas (Source: Peine, et. al., 1989). Another survey of 540 wilderness managers was conducted by the General Accounting Office. According to the study, noise was found to be the most common off-site problem. Noise, especially from low-level military flights, was noted as a problem at several wilderness areas surveyed (Source: U.S. GAO, 1989).

8.8.4 OVERLAP ANALYSIS

Table 8-21 summarizes existing, proposed, and envisioned land withdrawals in Nevada in terms of wilderness proposals within the land withdrawal boundaries. It should be noted that many of the lands were withdrawn prior to passage of the Wilderness Act of 1964. Additionally, since these lands were withdrawn for defense-related missions, Federal land policies requiring evaluation of public lands for wilderness potential are not applicable under FLPMA. Wilderness resources in relation to defense-related airspace areas are shown in Figure 8.13. Table 8-22 identifies the proportion of BLM, USFS, and FWS wilderness resources that lie beneath airspace used for defense-related training missions.

Table 8-21. Wilderness Resources in Nevada in Relation to Existing, Proposed, and Envisioned Land Withdrawals.

	Existing Acreage	Proposed (P) and Envisioned (E) Changes	Wilderness Proposal
Nellis			
Nellis Air Force Base	11,193		No
Nellis Small Arms Range	10,760	-5,789(P)	No
Nellis Air Force Range (including Indian Springs Auxiliary Airfield)	3,035,326		Yes[1]
TOTAL	3,057,279		
Fallon			
NAS Fallon	7,982	+400(P)	No
NAS Fallon Range Training Complex	97,041	+188,323(P) +202,000(E)	Yes[2]
TOTAL	105,023		
Hawthorne			
Hawthorne Army Ammunition Plant	147,431		No
TOTAL	147,431		
DOE			
Nevada Test Site	814,528		No
Central Nevada Test Site	2,560		No
Nelson Seismic Station	2.5		No
Mt. Brock Communication Site	11.3		No
Project Shoal Site	2,560		No
TOTAL	819,661.8		
Other			
Beatty Radar Site	19	-19(P)	No
Ely Radar Site	10		No
Halligan Mesa/Base Camp	600		No
Wendover Range	15,010	-321(E)	No
Las Vegas Army Reserve Training Center	5		No
Proposed Hawthorne Reserve Component Training Center	0	+586,000(P) [3]	Yes[4][5]
TOTAL	4,145,039	+384,594 0.53%	

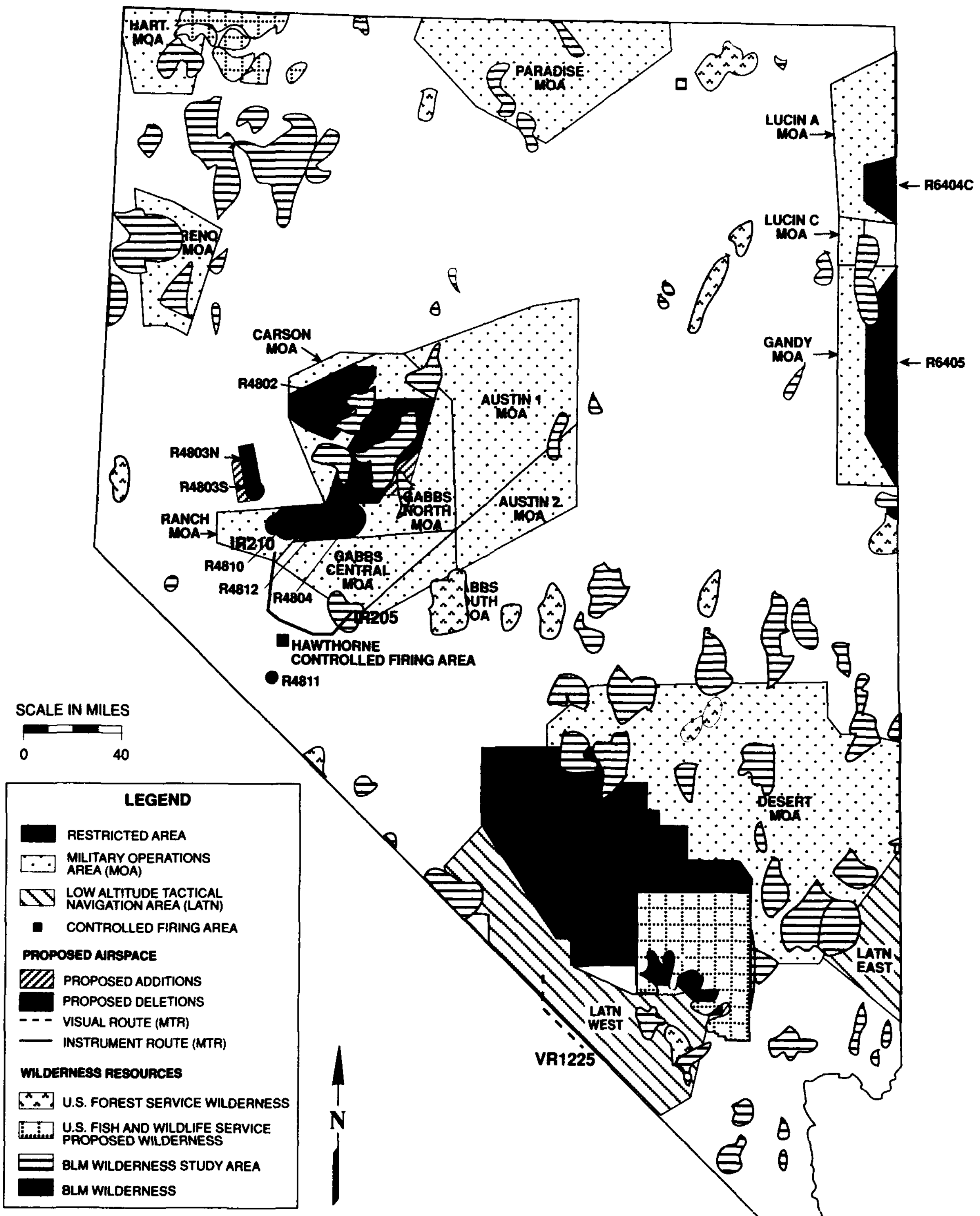
(1) Desert National Wildlife Range Proposed Wilderness.

(2) Job Peak WSA.

(3) Acreage for Alternative A of Proposed Action; Acreage for Alternative B of Proposed Action is 500,000 acres.

(4) The Proposed Hawthorne Reserve Component Training Center project is not being actively pursued at this time; acreage shown (+586,000) is not included in Proposed (P) and Envisioned (E) Changes TOTAL column.

(5) Gabbs Valley WSA (Alternative A).



1. Special Use Airspace is not in use at all times.
2. Non-participating civil and military VFR aircraft may utilize MOAs/LATNs at any time.
3. MTRs are not active at all times; most are flown during daylight hours only
4. Non-participating aircraft (civil or military) are not prohibited from flight within MTRs/SRs

FIGURE 8.13 WILDERNESS RESOURCES IN RELATION TO DEFENSE-RELATED AIRSPACE

Table 8-22. Wilderness Resources in Nevada in Relation to Existing and Proposed Airspace (MOAs and LATNs).

Airspace	Approximate Acres of Land Beneath Airspace	Wilderness (No. of Areas/Estimated Acreage) Beneath Airspace BLM	USFS	USFWS
EXISTING:				
NAFR				
Desert MOA	6,000,000	15/895,000	2/57,000	1/1,255,497
LATN East & West	2,600,000	5/140,000	1/43,000	0
Nellis Supersonic Activity Area (1)	7,000,000	14/732,000	0	1/1,010,170
FRTC				
Austin 1 & 2 MOAs	2,700,000	3/98,000	0	0
Carson MOA	120,000	0	0	0
Gabbs N, S & C MOAs	3,300,000	6/509,000	0	0
Ranch MOA	355,000	0	0	0
Fallon Supersonic Activity Area (2)	3,500,000	6/459,000	0	0
Wendover Ranges				
Gandy MOA	700,000	2/60,000(4)	0	0
Lucin A & C MOAs	900,000	1/28,000	0	0
UTTR Supersonic Area	500,000	1/70,000	0	0
Other MOAs				
Hart MOA	640,000	2/125,000	0	1/7,000
Paradise MOA	2,000,000	4/123,000	0	0
Reno MOA	836,000	6/277,000	0	0
ENVISIONED:				
FRTC				
Diamond MOA	2,200,000	4/330,000	0	0
Duckwater MOA	2,200,000	4/330,000	0	0
Smokey MOA	2,500,000	0	3/251,000	0
Supersonic Activity Area Expansion(3)	300,000	1/15,000	0	0

Table 8-22. Wilderness Resources in Nevada in Relation to Existing and Proposed Airspace (MOAs and LATNs) (continued).

Airspace	Wilderness (No. of Areas/Estimated Acreage) Beneath Airspace BLM	USFS	USFWS
TOTALS:			
Existing MOAs/LATNs	38/2,255,000	3/100,000	2/707,000
Existing Supersonic Activity Area	20/1,261,000	2/57,000	1/1,010,170
Envisioned MOAs	7/269,000	4/287,000	0
Envisioned Supersonic Activity Area	1,15,000		

(1) Coincident with portions of Desert MOA

(2) Coincident with portions of Gabbs North, Central and Austin 1 MOAs

(3) Coincident with a portion of Diamond MOA

(4) Includes the 8,000 acre designated BLM wilderness

8.8.4.1 U.S. Bureau of Land Management Wilderness Study Areas

The only designated BLM wilderness area in Nevada is an 8,000-acre parcel contiguous to, and designated with, the USFS Mt. Moriah Wilderness. Of approximately 47,000,000 acres of public lands in Nevada administered by BLM, approximately 5 million acres in more than 100 separate holdings have been identified as meeting the necessary criteria for potential designation as wilderness and are classified as wilderness study areas. This analysis examined all WSAs and BLM wilderness resources in relation to defense-related use of airspace over Nevada.

Of the 102 WSAs identified, all, or portions of, 40 WSAs (40 percent of all WSAs in Nevada) are located under MOAs, and all, or portions of, 23 WSAs (23 percent) are located beneath airspace in which supersonic operations occur (Table 8-15). The only designated BLM wilderness area is located under the Gandy MOA. All, or portions of, seven WSAs lie beneath envisioned realignments of airspace. MTR centerlines are present over all, or portions of, 55 WSAs (55 percent), and ARs are present over all, or portions of, 23 WSAs (23 percent). Not all flights on MTRs overfly the centerline for the full length of the route. They may overfly any lands beneath the borders of MTRs. As a result all lands within the borders of MTRs may be subject to overflight. Areas affected were identified by comparison with the centerline of MTRs. Thus, there may be WSAs affected by overflight which are not identified. In total, all or portions of approximately 70 percent of all WSAs in Nevada lie beneath airspace used for existing defense-related purposes, and all, or portions of, an additional 6 percent lie beneath envisioned expansions. In addition, a portion of the Job Peak WSA is located within a proposed land withdrawal, and a portion of the Gabbs Valley WSA is located within the proposed Hawthorne Reserve Component Training Center which is not being actively pursued.

8.8.4.2 U.S. Forest Service Designated Wilderness

Approximately 797,400 acres of USFS designated wilderness exist in Nevada. All of the USFS Quinn Canyon and Mt. Charleston Wilderness areas and approximately 60 percent of the Grant Range Wilderness, lie beneath airspace used for existing defense-related purposes. Quinn Canyon and the Grant Range are located beneath the northern portion of the Desert MOA. In total, 3 of the 14 USFS wilderness areas (12.5 percent of USFS wilderness acreage in Nevada) lie beneath MOAs. Portions of six additional USFS wilderness areas lie beneath MTRs.

A large portion of the Toiyabe National Forest would lie beneath proposed and envisioned realignment of airspace. The Currant Mountain Wilderness would be located beneath the envisioned Duckwater MOA. The Alta Toquima, Arc Dome, and Table Mountain Wilderness areas would be located beneath the envisioned Smokey MOA. In total, 4 of the 14 USFS wilderness areas in Nevada would lie beneath the envisioned airspace realignment associated with NAS Fallon, which represents approximately 36 percent of the USFS wilderness acreage in Nevada.

8.8.4.3 National Park Service and U.S. Fish and Wildlife Service Proposed Wilderness

There is one NPS proposed wilderness in Nevada, located in Death Valley National Monument. Portions of this area lie beneath two MTRs.

The FWS has wilderness proposals for three Federal wildlife refuges in Nevada: Sheldon NWR, Desert NWR, and Anaho Island. Portions of Anaho Island are located beneath a MTR. A portion of the Sheldon NWR lies beneath the Hart MOA, one MTR, and one AR. All of the Desert NWR lies beneath airspace used for supersonic operations by Nellis AFB.

8.8.5 SPECIAL PROVISIONS REGARDING OVERFLIGHT OF WILDERNESS

The Wilderness Act states that, "Within wilderness areas designated by this Act, the use of aircraft or motorboats, where these uses have already become established, may be permitted." The Act prohibits the landing of aircraft in wilderness areas.

The Federal Aviation Administration (FAA) Airmen's Information Manual (January 16, 1986) requests that all aircraft "maintain a minimum altitude of 2,000 feet above the surface of . . . National Parks, Monuments, Seashores, Lakeshores, Recreation Areas, and

Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges, and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service." The Air Force and the Navy guidelines are more stringent. They provide that "noise sensitive and wilderness areas shall be avoided when at altitudes of less than 3,000 feet AGL except when in compliance with an approved: a. Traffic or approach pattern, b. VR or IR route, or c. SUA." The Navy additionally adheres to its Memorandum of Understanding with the Department of Interior and the State of Nevada for FRTC SUA.

Resource management agency policies typically discourage overflight of designated wilderness. Where such overflights are a problem, wilderness management plans are intended to provide for liaison with proper military authorities and the FAA. Where the use of aircraft was established prior to designation as wilderness, continued use may be permitted.

8.8.6 NOISE EFFECTS ON WILDERNESS

There are a few instances of overlaps between wilderness resources and land withdrawn for defense-related purposes. Such overlaps present conflicts related to access. Other effects on wilderness will be a function in most cases of the effect of overflight on the wilderness users. Areas that are located beneath airspace in which supersonic flight is authorized are likely to be subject to considerable noise levels during some periods of operations.

A review of the literature suggests that recreationist use of wilderness is largely devoted to the pastime of an escape from civilization, of which non-natural noise is one component. The relationship between noise and recreation is discussed in detail in Section 8.7.

Opportunities for solitude are an important aspect part of the wilderness resource. An absence of man-made noise contributes to solitude. Low-level military overflights can intrude on solitude, but those intrusions do not destroy the wilderness aspect of an area. Over the majority of the wilderness resources, those intrusions are momentary. Accordingly, low-level military overflights do not preclude the designation of wilderness areas by Congress.

8.8.7 SUMMARY

There is one instance of land use overlap between wilderness resources and defense-related land use and potential for overlaps with proposed and envisioned land withdrawals. There are also many spatial overlaps between existing, proposed, and envisioned airspace and wilderness areas.

Based on various studies that cite the relationship between noise and wilderness, it appears that overflight of wilderness is perceived as a problem by many wilderness managers and users. Low-level military overflights can intrude on solitude, but those intrusions do not destroy the wilderness aspect of an area.

8.9 EFFECTS ON MINERAL AND ENERGY RESOURCES

The mining industry and, to a lesser extent, the petroleum and geothermal industries, are important contributors to the State's economy. The health of these industries depends to a large extent on the availability of land for exploration and development.

8.9.1 BASE AND PRECIOUS METALS

Prices and demand for base and precious metals have varied greatly during the time covered by the major defense-related withdrawals in Nevada. Wartime needs and postwar industrial uses created a favorable climate for mining lead, zinc, tungsten, copper, mercury, and molybdenum that extended from the 1940's into the early 1970's. During most of this time, a low, government-controlled gold price resulted in limited gold mining. Beginning in the mid-1970's, this situation reversed. Gold prices soared, and it became the favored commodity. Meanwhile, prices of other metals plummeted, and most base-metal mines closed. In regard to lands withdrawn for defense-related purposes, potential base-metal deposits in districts such as Papoose and Oak Spring may have been exploited in the 1940-50 era, and tungsten deposits could have been developed in the Oak Spring district, NTS, and in parts of NAS Fallon, during the 1950's. Porphyry molybdenum deposits possibly present in the Oak Spring district, NTS; the Cactus Springs district, Nellis North Range; and the Mt. Grant district, HWAAP might have been explored and developed during the late 1960's and into the 1970's. Gold and associated silver would have escaped interest until after 1962 when discoveries in northern Nevada revived interest in precious metals. Gold exploration has been intense, especially in the last 10 years, and no district within the withdrawn lands would have escaped scrutiny during the current exploration excitement. Areas of moderate to high precious-metals potential in districts within the NAFR, NTS, and FRTC would probably be active. Any of these areas may have supported one or two moderate to large precious-metals operations.

8.9.2 ENERGY RESOURCES

Nevada is not a major producer of energy resources, nor is it likely to become so during the next several decades. Areas in Nevada with the highest potential for oil and gas are generally not coincident with large defense-related land withdrawals. Geothermal potential in Nevada is distributed widely. The cumulative impact of all withdrawals on the development of geothermal resources is slight.

8.9.3 INDUSTRIAL MINERALS AND MATERIALS

Unlike base- and precious-metals deposits, most industrial mineral and material deposits are abundant and occur widely throughout Nevada. Deposits of these resources, including such commodities as sand and gravel, decorative stone, barite, fluorite, specialty clays, diatomite, zeolites, gypsum, and brines, surely occur within some of the defense-related land withdrawals. Lack of commercial exploitation of these resources on these lands, however, has probably not had an important effect on Nevada's economy or on the availability of these resources because these resources are so abundant and widespread.

8.9.4 SUMMARY

In view of Nevada's current role as the nation's leading producer of gold, silver and barite, the only state to produce magnesite and mercury, and Nevada's high potential for lead, zinc and copper, the availability of land for mineral exploration and development is a cornerstone to Nevada's mining industry. The three million acres of the NAFR are the largest area of lands withdrawn for defense-related purposes. The NAFR is the least studied and least documented of all defense-related withdrawals in Nevada with respect to mineral resources, but it is known to encompass a variety of geological terrains that are broadly favorable for several mineral commodities. With existing studies, however, it is impossible to assess with confidence the effects that this withdrawal has had, or might continue to have, on the mining industry in Nevada. For example, if mineral access to the NAFR and adjoining NTS had not been restricted for the past several decades, it is possible that current theories on mineral accumulations in Nevada would have developed sooner, that unrecognized mineral trends would have been identified, and that new theories on mineral accumulations would have been tested and perhaps developed. The cumulative impacts of current, proposed, and envisioned withdrawals have precluded mineral exploration and energy development on the withdrawals in the State of Nevada.

On the basis of existing studies, estimates have been made of the number and type of deposits that may exist on lands withdrawn in Nevada for defense-related purposes. These estimates are based on sparse data for most of the withdrawn acreage and should be viewed with caution. As additional data become available, and as new theories on mineral accumulations are developed, these estimates could require significant re-evaluation.

Lands withdrawn in Nevada for defense-related purposes could contain deposits of gold, molybdenum, tungsten, lead, zinc, copper, and silver, numerous small deposits of base and precious metals, and commercially viable geothermal reservoirs. Most of the defense-related withdrawals are deemed either unfavorable or marginally favorable for oil and gas. Virtually all of these lands contain some forms of industrial minerals and materials.

Defense-related land withdrawals in Nevada have excluded, and will continue to exclude, mining, petroleum, and geothermal industries from approximately 6 percent (4 million acres) of the total acreage in Nevada that would otherwise be available for exploration and development. Additional proposed withdrawals of 377,915 acres, and potential withdrawals of 500,000 to 600,000 acres, will have further effects on the mineral industry in Nevada.

8.10 EFFECTS ON WATER RESOURCES

In the arid climate of Nevada, water is a critical resource. While individually the effect of lands withdrawn for defense-related activities range from insignificant to significant, the cumulative effect of the withdrawals has the potential for constraining future growth and development.

8.10.1 WATER RESOURCES EFFECTS

The effects of the withdrawals are fourfold.

1) The consumptive use of water on the land withdrawals is small, but the greatest consumptive use occurs in the two most populous and rapidly growing areas of the state - the Las Vegas Valley and the Truckee-Carson River Basins. The consumptive use of water at HWAAP has also had an impact on the town of Hawthorne. The available data indicate that military and defense-related diversions of water, except some by DOE, are being made in accordance with Nevada water law. Some of DOE's diversions are made in accordance with the Doctrine of Federal Reserved Water Rights.

2) The land withdrawals in proximity to the Las Vegas, Fallon, and Hawthorne urban areas lack master drainage plans. Thus, the effects of these withdrawals on these urban areas from the viewpoint of flood hazard are unknown.

3) Current activities on the withdrawn land have impaired a volume of water that cannot be precisely calculated. While the contamination of these water resources poses only a minor risk to present public health and safety, some of the resource contamination in these areas may persist for thousands of years.

4) The withdrawal of land from public access and/or the purchase of water rights by DOD and DOE has the greatest potential for effects on Nevada. In southern Nevada, the withdrawn lands are in close proximity to the Las Vegas metropolitan area. The water resources associated with these lands could, if they exist and were available, play an important role in the continued growth of southern Nevada. The withdrawn lands also lie between the Las Vegas area and areas where Las Vegas is currently seeking additional water. The land withdrawals in the Truckee-Carson River Basins and other hydrographic basins in proximity to this area have also removed sources of water from access by the public sector.

There are two beneficial aspects of land withdrawals on water resources.

1) DOE-sponsored studies regarding the effects of nuclear testing have been the source of most of the current knowledge of the regional groundwater flow systems at NTS. The Air Force has provided access to portions of NAFR for studies of the regional carbonate aquifer system and is also participating with several other agencies in a study of land subsidence and groundwater pumpage in the Las Vegas Valley.

2) Community water supply assistance has been provided by the Air Force in Wendover and by the Army at Hawthorne. Given the size and financial resources of these communities, this water supply assistance has been important.

8.10.2 SUMMARY

The greatest effects of defense-related land withdrawals has been the removal from public appropriation large quantities of ground water resources and the impairment of the quality of some of those resources. In three areas the consumption/use of water for defense-related activities is, or may become, competitive to alternative public uses of those same resources, thus requiring, conservation and cooperation with local agencies.

On the positive side, DOD and DOE have sponsored some much valued research on Nevada hydrology, and DOD has bolstered some smaller community water supply systems.

8.11 SUMMARY

This chapter has identified effects, and possible effects, in Nevada resulting from lands withdrawn and airspace used for defense-related purposes in Nevada. These effects are summarized in Chapter 9. Possible mitigation of these effects are also described in Chapter 9 and are intended to serve as starting points in discussions with other federal agencies, the State of Nevada, counties, and communities that are affected by these activities, to develop appropriate, feasible, and mutually-acceptable mitigation of these effects.

CHAPTER 9

SUMMARY OF EFFECTS AND POSSIBLE MITIGATION

This chapter presents a summary of effects resulting from defense-related land withdrawals in Nevada and use of airspace over Nevada, and possible steps that could be taken to mitigate these effects. Table 9-1 contains this summary, and is organized in the format used throughout the Special Nevada Report: effects on public health and safety; public and private property; plants, fish, and wildlife resources; cultural and historical resources; scientific resources; recreational resources; wilderness resources; mineral and energy resources; and water resources.

The possible steps that could be taken to mitigate some of the effects of defense-related activities in Nevada are designed to serve as starting points in proposed discussions and consultations with appropriate federal, state, county, and local entities. These discussions and consultations, whether voluntary or required by law, are needed to establish an exchange of information among relevant parties and to develop effective, feasible, and mutually-acceptable mechanisms to protect or enhance public health and safety and the resources of Nevada.

The analysis and evaluation of possible mitigation presented in this chapter considered the following technical criteria adopted by the Council on Environmental Quality:

- Modification, limitations, or cessation of activities causing adverse effects.
- Direct actions to rectify adverse effects.
- Maintenance of activities to minimize and/or reduce adverse effects.
- Compensation via providing substitutes.

The selection and evaluation of specific mitigation measures were also sensitive to the following factors:

- Safety stemming from implementation of the mitigation measure.
- Minimization of any adverse effects the mitigation measure itself may cause.
- Timeliness in deployment of mitigation measure.
- Minimization of impacts on military activities.

All defense-related activities were analyzed to determine whether, individually or cumulatively, they created effects. In some cases, analyses of effects were constrained by a lack of conclusive information as was the case in the analyses of noise effects on human health, wildlife, domestic animals and structures. In resource areas where specified effects were identified in defense-related land withdrawals and airspace, possible measures were identified that would seek to mitigate those effects. Frequently, more than one or a combination of possible mitigation measures is required for a specific activity or effect, and participation by more than one agency is needed to reduce a specific effect.

Proposed discussions and consultations are premised on the recognition of two facts. An exchange of information related to ongoing activities and planned changes in activities is needed to effectively accomplish the missions of all parties. Second, activities essential to the mission of the Department of Defense and the Department of Energy are not contrary to mitigation of effects that may result from these activities, but may require guidance and planning to incorporate and institutionalize sensitivities to activities that could require mitigation. All parties must be able to plan their activities with the most complete information possible. An effective means of communicating plans is necessary in order to institutionalize the exchange of information required to complete these activities safely, without negatively affecting health and safety, and the environment.

The first category of effects in Table 9-1, entitled "Communication," was not addressed as a separate subject in the Special Nevada Report, but is an essential first step in mitigating effects of defense-related activities in Nevada. Successful communication is the cornerstone of successful mitigation. This category of effects recognizes that communicating plans among the various federal and state agencies has not always been successful. This category of effects also recognizes the need for communicating plans among all relevant parties so that they may initiate their activities with as much information as possible, thereby conserving their limited resources while protecting and enhancing the personal well-being in, and resources of, Nevada. Only through ongoing, open communication and exchange of information among appropriate parties can effective, feasible, and mutually-acceptable plans be incorporated into activities.

The possible mitigation measures listed in Table 9-1, have undergone an initial screening concerning their practicality. For example, a mitigation measure to stop all military flying in Nevada to eliminate noise impacts would not be considered practical and therefore, is not listed. Also, the reader should keep in mind that mitigation measures listed may not be feasible; when considering safety, budget restraints, existing public laws, environmental concerns, operational missions, other airspace users, etc. Many of the possible mitigation measures listed will require additional analysis if a decision is made to pursue them as a proposal. Also, the provisions of the National Environmental Policy Act (NEPA) must be followed prior to implementing many of these measures. Further analysis and NEPA requirements are considered beyond the scope of this report.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION.

Effects	Possible Mitigation
COMMUNICATION	
Federal agencies, either internal or external to the state, have not communicated with the state nor with each other in a manner that keeps the state either aware of or postured to plan for federal activities and their resultant effects.	1. Reemphasize/expand use of the existing Joint Department of Defense (DOD)/State Memorandum of Understanding (MOU) under Executive Order 12372 by: a. Modifying existing DOD MOU. b. Including a requirement for semi-annual joint DOD/DOE meetings to brief state agencies on proposed plans, programs, projects and changes which may affect lands within the State of Nevada or airspace over it. Other federal agencies such as BLM and USFWS are invited dependent upon anticipated agenda topics. Other meetings can be called by the federal agencies or the State of Nevada on a case-by-case basis as required. c. Senior Ranking Military Officer in Nevada should act as the chairperson of the joint Military Affairs Committee which will meet semi-annually.
PUBLIC HEALTH AND SAFETY	
<u>Water Quality and Flood Hazard</u>	
Water Resource contamination.	1. Continue groundwater monitoring and characterization programs. 2. Implement installation restoration programs if the need is identified through the characterization process.
Possible transport of contaminants off-site by surface water run off.	1. Specify containment methods in Resource Management Plans.
Flood hazard.	1. Assess potential for flood hazard. 2. Develop master drainage plans and flood protection programs as required. 3. Participate with appropriate local agencies in flood control studies and programs to alleviate off-withdrawal effects from withdrawn lands.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
Noise and Sonic Boom	
Annoyance and startle effects resulting from aircraft noise/sonic booms.	1. Regularly update aircrew preflight mission briefings to include current information on noise sensitive areas. 2. Continue existing noise abatement measures for low-level flight and noise sensitive areas. 3. Assess current evaluation program to consider operational changes to include relocation/realignment or modification of specific routes to avoid/reduce potential noise effects. 4. Generate a detailed land use data (mapping) base to assist in route planning, realignment or consolidation of MTRs over Nevada. 5. Review restrictions on supersonic flight activity and population avoidance areas. Modify or develop procedures where applicable. Review need for and capabilities of long-term sonic boom monitoring in sensitive land areas below airspace designated for supersonic operations. 6. Establish public affairs programs to educate the public on the need for and use of defense-related flying activities. 7. Consider implementation of Memoranda of Agreement (MOA) to address mitigation of noise annoyance effects, when applicable. 8. Accomplish a complete review of all DOD MTR routes within three years. Make route adjustments where possible to avoid areas which are environmentally and/or noise sensitive.
Residential areas close to airfields.	1. Continue noise abatement procedures. 2. Coordinate with local agencies on land use compatibility guidelines based on airport noise analyses [Air Installations Compatible Use Zones (AICUZ) studies]. 3. Encourage the State of Nevada to adopt Airport Land Use legislation similar to other states. 4. Participate in joint land use studies when requested.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
Facility Accidents	
Possible contamination through fuel spills and leaks.	1. Continue compliance with applicable Federal/State laws and regulations. 2. Emphasize prevention plans and programs. 3. Evaluate defense-related land withdrawals for potential health and safety threats.
Armaments Dropped from Aircraft	
Accidental release of armaments off-range.	1. Evaluate target locations within existing range boundaries. 2. Identify and study public lands formerly authorized for ordnance delivery by current land management agency.
Use of Chaff	1. Evaluate the cumulative impacts to public lands from the use of chaff.
Use of Flares	1. Develop an altitude buffer zone standard for drops, as a function of the fire hazard (i.e., the greater the hazard, the larger the buffer zone). 2. Insure larger buffer zones are employed for use over public lands. 3. In addition to the existing MOU with the BLM, enter into MOUs with any other appropriate fire fighting agencies for response to possible fires due to flare drops over public lands. MOUs should include agency approval for deployment, required fire fighting equipment and personnel, and financial responsibilities.
Safety hazards associated with dud flares.	1. Post warnings throughout deployment areas, if such areas are over public lands. 2. Restrict flare usage over public lands to most reliable flare types. 3. Establish, via a MOU with public safety agencies, a standard for sweeping public lands. The MOU should include frequencies of sweeps, reliability of results, and financial responsibilities.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
PUBLIC AND PRIVATE PROPERTY	
Housing	
Effect on housing market in rural areas.	1. Monitor residential patterns to facilitate coordination with county planning agencies/officials.
Land Use	
Effects on economic contribution from mining.	1. Reevaluate compatibility of mining with mission activities on appropriate portions of withdrawn land.
Removed from public use/limited access.	1. Develop Resource Management Plan for every proposed land withdrawal approved by Congress. 2. Provide fair market value compensation where private land adjustments are necessary. 3. Consider future land withdrawals in terms of potential suitability for eventual return to public use during the environmental impact analysis process. 4. Analyze combining the use of existing military lands and airspace as part of the National Environmental Policy Act process before proceeding with new or renewal withdrawal proposals. 5. Review current withdrawals as required by FLPMA of 1976 and make adjustments when warranted. 6. Allow multiple use when consistent with safety, mission requirements, and land management plans. 7. Declare excess lands for appropriate federal, state or local agency or private ownership when consistent with land management plans and policy.
Social Effects	
Annoyance with aircraft noise results in social effects.	See "Possible Mitigation Noise and Sonic Boom."

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
PLANTS, FISH, AND WILDLIFE RESOURCES	
Possible effects on some species of plants, fish, and wildlife as a result of land disturbance.	1. Enhance habitat on or off withdrawn lands for species whose habitat is substantially affected by land disturbance. 2. Improve resource management through implementation of comprehensive Resource Management Plans. 3. Relocate/modify operations, when feasible, to reduce or avoid effects on sensitive plants, fish, and wildlife. 4. Emphasize job-related training to address in more detail the environmental issues and responsibilities associated with the mission.
Possible effects on some species of wildlife due to aircraft noise.	1. Evaluate restrictions on defense-related overflights. 2. Continue monitoring programs. 3. Relocate/modify operations, when feasible, to reduce or avoid noise effects on sensitive wildlife. 4. Emphasize job-related training to address in more detail the environmental issues and responsibilities associated with the mission. 5. Coordinate with wildlife management agencies on all air-space, including expansions or other changes, to minimize future effects on wildlife introductions.
CULTURAL AND HISTORICAL RESOURCES	
Impacts to historic and archaeological resources.	1. Develop and implement cultural resources management plans in consultation with the State Historic Preservation Officer, the Advisory Council on Historic Properties and other interested parties. These management plans should be designed to fulfill both Section 106 and 110 of NHPA and should be implemented according to set timetables. 2. Implementation of such plans will require offices of qualified personnel at each defense-related agency to ensure adequate resources and proper identification and treatment of historic properties consistent with agency policy. 3. Develop procedures to visually monitor conditions and changes to conditions of identified archaeological and

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
Impacts to historic and archaeological resources (continued).	cultural resources due to natural or man-induced influences. The State Historic Preservation Officer (SHPO) should be included in these visual site surveys.
Impacts on Native American cultural values and religious practices.	1. Establish consultation with Native American political and religious leaders with traditional ties to the area to determine cultural values. 2. Consultations should be conducted by qualified persons who possess the types of professional expertise outlined in Appendix II of the Advisory Council's "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review."
SCIENTIFIC VALUES	
Effect on development of scientific knowledge through lack of full access for scientific purposes.	1. Provide access for scientific purposes as is possible and consistent with mission requirements.
RECREATIONAL RESOURCES	
Effect on recreational resources by lack of access.	1. Consider expanding public access, consistent with safety and mission requirements, to applicable withdrawn lands for recreational activities. 2. Establish interpretive displays and brochures. 3. Consider land adjustments and return of withdrawn lands when/where compatible with mission requirements. 4. Improve additional public or withdrawn lands for recreational use.
Effect on some recreational experiences by annoyance with noise.	1. Continue to assess annoyance and minimize by rescheduling or realignment of operations when consistent with mission requirements. 2. Emphasize job related training to address in more detail the environmental issues and responsibilities associated with the mission.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
WILDERNESS RESOURCES	
Effect on wilderness resources by closure of public access.	1. Coordinate with agencies to preserve undisturbed lands within the withdrawals consistent with mission requirements. 2. Explore possibility of providing seasonal public access and/or seasonal modification of military operations.
Effect on wilderness values by aircraft noise.	1. Consult, collaborate, and coordinate with resource management agencies. 2. Regularly update aircrew preflight mission briefings to include current information on noise sensitive areas. 3. Continue to evaluate relocation, realignment, and consolidation of MTRs when consistent with mission requirements.
MINERAL AND ENERGY/RESOURCES	
Current and future restrictions on access to military lands in nevada have had, and will continue to have, two primary effects in the area of mineral and energy resources: 1) Lost opportunities for the development of mineral and energy resources (unquantifiable economic impacts to the State). 2) Gaps in geologic knowledge over a large area of southern Nevada (chiefly the Nellis Air Force Range) that have caused unquantifiable effects on the evolution of geologic thought concerning mineral and energy resources in Nevada.	1. Develop a mineral inventory plan for existing and future withdrawals. Field investigations would be conducted by the U.S. Geological Survey, the U.S. Bureau of Mines, and the Nevada Bureau of Mines and Geology, with provisions for input from the mineral industry. Conduct reserve estimates in areas of significant mineral potential. Consider boundary adjustments to future withdrawals based on mineral potential. 2. Consistent with safety and mission requirements, develop a plan to permit controlled access by mineral interests to current and future military lands, and parts thereof. 3. Adjust military missions on current and future withdrawn lands, to the extent possible, to preserve areas with identified mineral resources from possible contamination by military activities.
WATER RESOURCES	
Lack of access to potentially developable water resources.	1. Provide access for water resources evaluation and development as is possible and consistent with mission requirements.

TABLE 9-1. SUMMARY OF CUMULATIVE EFFECTS AND POSSIBLE MITIGATION (Continued).

Effects	Possible Mitigation
Lack of access to potentially developable water resources (continued).	2. Assist in water resources evaluation on withdrawn lands. 3. Consistent with evaluation results and mission requirements, consider return of non-critical watershed portions to BLM. 4. Provide rights-of-way for water transmission facilities where such action would not limit, constrain, or deny the purpose of the withdrawal.
Resource consumption and competition.	1. Emphasize water conservation programs. 2. Consider opportunities to cooperate with local agencies to enhance water supply sources and programs.
UNIQUE EFFECT RELATED TO NELLIS AIR FORCE BASE AND POSSIBLE MITIGATION	
Water resource consumption.	1. Install measurement devices to record wastewater flows to *appropriate sanitation districts.*
UNIQUE EFFECT RELATED TO NAS FALLON AND POSSIBLE MITIGATION	
Accidental impacts of armaments on public lands surrounding NAS Fallon Training Ranges.	1. Commanding Officer continue overseeing of procedures specified in the Memorandum of Agreement (MOA) among the Navy, BLM, and State of Nevada (December 22, 1989).

GLOSSARY

Aerial Refueling Route (AR)	Routes which consist of tracks or racetrack-pattern anchors and are used to facilitate transfer of fuel from a tanker aircraft to receiving aircraft during flight. ARs have designed refueling altitudes. The air traffic control system provides separation for non-participating aircraft in the airspace whenever fueling operations are conducted.
Aircraft Operation	Air traffic control-related air activity and counted as follows: 1) count an arrival as one operation; 2) count a departure as one operation; 3) count aircraft touch and go landings as two operations; 4) count an approach followed by a waveoff as two operations, 5) count aircraft that transit the control area of jurisdiction and are provided ATC service as one operation; count formation flights as one operation except as provided in 6, and 6) count individual aircraft in a formation when that formation is operating to/from/within an airport traffic area or within Special Use Airspace (SUA).
Air Installations Compatible Use Zones (AICUZ)	A DOD program designed to protect air installations and their flying missions from encroachment and interference from incompatible off-base activities and land uses. Land use recommendations for protecting off base communities as well as bases are developed from aircraft noise and accident data along with general land use planning principles. These land use recommendations are provided to local governments which are encouraged to implement the recommendations through local planning and land use control ordinances.
Air Traffic Control Assigned Airspace (ATCAA)	Airspace of defined vertical/lateral limits assigned by ATC, for the purpose of providing air traffic separation between the specified activities being conducted within assigned airspace and other IFR air traffic. Procedures governing operations within these areas shall be specified in letters of agreement between local military authorities and the ATC facility.

Aquifer	An underground rock formation composed of material such as sand, soil or gravel that can store and supply ground water to wells and springs.
Carcinogen	A substance that causes cancer.
Centroid	A group of permanent structures located on a right-of-way granted by the Bureau of Land Management north of the Fallon Range Training Complex's Training Range Bravo 17 from which Electronic Warfare Range equipment/electronic warfare emitter u e is directed.
Chaff	Chaff is an airborne radar-detection countermeasure consisting of extremely fine fibers of aluminum coated fiberglass. Chaff is released by an aircraft as an "electronic smoke screen." The aircraft becomes obscured by the radar reflecting cloud of chaff. Numerous types of chaff are utilized by military activities. The differences in chaff are primarily that of fiber length and method of deployment. Fiber lengths (dipoles) vary from one to four inches depending upon the frequencies of radar against which they will be used. The minimum dimension of typical chaff fibers is 0.0003 inches. Chaff is ejected from the aircraft by either a blast of compressed air or by the detonation of a pyrotechnic device. Chaff ejected from aircraft by detonation of a pyrotechnic is considered to be a Class "C" explosive. A typical burst-chaff bundle of type RR170 (one of the more frequently used types) contains approximately 2.1 million dipoles or 1-inch-long strands of type-E glass fiber. The fibers are coated with aluminum of 99.0 percent purity with a second coating of stearic acid (an organic compound) to aid in dispersal. In the air, the initial burst forms a sphere 300 feet in diameter with a volume of approximately 10 million cubic feet (or approximately one fiber for each five cubic feet of air) which is invisible to the eye.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	The Federal law (PL 96-510), passed December 11, 1980 which provides a series of programs to address the cleanup of hazardous waste disposal and spill sites. This program is codified in 42 USC 9601 et. seq.; and 26 USC 4611, 4612, 4661, 4662, 4671, and 4672. It has been modified and

amended several times, most significantly in 1986 by the Superfund Amendments and Reauthorizations Act (SARA).

Controlled Firing Area (CFA)	An area approved by FAA wherein activities are conducted under conditions so controlled as to eliminate hazards to non-participating aircraft and to ensure the safety of persons and property on the ground.
Flare	Flares are normally used as a self protection device or as a means of illuminating ground targets at night. Self protection flares are ejected by aircraft to thwart the guidance systems of heat-seeking weapons (such as rockets) or other heat-sensitive equipment such as targeting systems. Flares are comprised primarily of magnesium which, when ignited, provides a more intense heat source than the aircraft engine(s). The heat-sensitive sensors are drawn to the more intense decoy infrared source allowing the aircraft to evade the threat. The initial release of a flare is by electrical detonation of a small charge (the squib), propelling the flare outward. Ignition of the flare can occur in one of several ways, depending upon type of flare and aircraft involved. In some cases the initial detonation of the squib ignites the flare pellet (parasitic units), and in other types of flares spring-loaded mechanical triggering devices ignite the flare upon its exit from the dispersal mechanism. The burn time for self protection flares varies with the type being used, ranging from 3 to 8 seconds. One of the more commonly used types, the M206, is consumed in 5 seconds and falls approximately 500 feet during that time interval. Flares that are used to illuminate targets at night vary in size, ignition techniques, and ejection procedures. Some are dropped by parachute to illuminate a large area for several minutes. All are considered Class B explosives.
Flight Level (FL)	A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, FL 250 represents a barometric altimeter indication of 25,000 feet.
Hazardous Substance	Any materials that pose a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive or chemically reactive.

Installation Restoration Program (IRP)

A program established by the Department of Defense to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and the Superfund Amendments and Reauthorization Act of 1986 which identifies, assesses, and cleans up or controls contamination from past hazardous waste disposal practices and hazardous material spills.

Ionizing Radiation

Radiation emitted from radioactive materials.

Military Operations Area (MOA)

Airspace of defined dimensions established outside the positive control area to separate/segregate military activities from instrument flight rules (IFR) traffic and to identify for visual flight rules (VFR) traffic where these activities are conducted.

Military Training Route (MTR)

A route developed for the high speed, low altitude training of tactical aircrews. IFR military training routes (IRs) are mutually developed by FAA and DOD. VFR military training routes are developed by DOD. MTRs are published on Aeronautical Charts.

The MTR program was designed in the late 1970's and replaced the previous Training Route (TR) system.

Each MTR has it's own unique number consisting of either three or four digits. Three digits indicate that at least one segment of the route is above 1,500 feet AGL and four digits indicate that the entire route is at or below 1,500 feet AGL. The number is preceded by either IR or VR, specifying IFR and VFR MTR, respectively. Since routes are one-way, the same route, flown the opposite direction will have a separate, distinct number.

Monitoring Wells

Special wells drilled at specific locations on or off a hazardous waste site where ground water can be sampled at selected depths and studied to determine such things as the direction in which ground water flows and the types and amounts of contaminants present.

Newlands Reclamation Project

A project of the Bureau of Reclamation which was begun in 1902 and was completed in 1915 that provides water for irrigation in the Lahontan Valley and hydroelectric power to the communities of Fernley, Hazen, and Fallon and the Fallon Paiute-Shoshone Indian Reservation.

No Drop Bomb Scoring

An electronic system using ground sensors and aircraft equipped with special electronic instrumentation which records probable impact sites of electronically simulated ordnance delivery from aircraft and enables the evaluation of the accuracy of ordnance delivery techniques and pilot skill.

Noise and Sonic Boom Impact Technology Program Office

The Noise and Sonic Boom Impact Technology (NSBIT) Program Office was created to develop methodologies and metrics of the effects of aircraft noise and sonic booms on humans, animals, and structures and incorporate these metrics into usable tools for environmental planners.

Non-Ionizing Radiation

Radiation emitted from lasers and electromagnetic sources such as radar.

Nonrule Making Action

FAA decisions or activities affecting airspace for which a rule, regulation or order is not normally issued. These include actions such as establishment or discontinuance of FAA or military air navigational aids and establishment of airports, and establishment of warning areas and MOAs.

Remedial Action (RA)

The actual construction or implementation phase that follows the remedial design of the selected cleanup alternative at a site.

Resource Conservation and Recovery Act (RCRA)

The Federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new, uncontrolled hazardous waste sites.

Restricted Area

Airspace designated under FAR Part 73 within which the flight of aircraft, while not wholly prohibited, is subject to restriction.

Restricted Areas shall be designated when determined necessary to confine or segregate activities considered to be hazardous to non-participating aircraft.

Joint-Use Restricted Areas are made available to the controlling agency for ATC use during periods when not required by the using agency.

Rule Making — Procedures whereby FAA assigns, modifies, or rescinds airspace and regulates its use by rule, regulation, or order.

Sonic Boom — Sonic boom is an impulsive shock wave pattern generated by an aircraft flying at speeds greater than the speed of sound. When propagated to ground level, a sonic boom is typically heard as a "double-bang" and travels across land creating a carpet of sonic boom exposure under the aircraft flight path. Highly localized sonic booms, known as focus booms, can occur due to aircraft maneuvers or accelerations. Focus boom amplitudes can be greater than those caused by steady, level supersonic flight (carpet booms).

Sortie — One mission by a single aircraft.

Special Use Airspace (SUA) — Airspace of defined dimensions identified by an area on the surface wherein activities must be confined because of their nature, and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities, or both. Categories of special use airspace are: restricted areas, prohibited areas, warning areas, alert areas, controlled firing areas, and military operations areas.

The vertical limits of special use airspace are measured by designated altitude floors and ceilings expressed as flight levels or as feet above mean sea level. Unless otherwise specified, the word "to" (an altitude or flight level) means "to and including" (that altitude or flight level).

The horizontal limits of special use airspace are measured by boundaries described by geographic coordinates or other appropriate references that clearly define there perimeter.

The period of time during which a designation of special use airspace is in effect is stated in the designation.

Stand-Off Weapons — Self-propelled weapons that can be air launched/released at distances removed from the target which reduce the risk to aircrews and aircraft.

Superfund Amendments and Reauthorization Act (SARA) — PL 99-499. Modifications to CERCLA enacted on October 17, 1986.

Treatment, Storage, and Disposal Facility (TSD)	Any building, structure or installation where a hazardous substance has been treated, stored, or disposed. TSD facilities are regulated by EPA and States under the Resource Conservation and Recovery Act.
Wilderness Study Area	A road-less area or island under management of the BLM that has been inventoried and found to have wilderness characteristics as described in Section 603 of the Federal Land Policy and Management Act of 1976 and Section 2(c) of the Wilderness Act of 1964.

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APPENDIX A

PUBLIC LAW 99-606 (H.R. 1790);

November 6, 1986

WITHDRAWALS OF PUBLIC LANDS

FOR

MILITARY PURPOSES

PUBLIC LAW 99–606 [H.R. 1790]; November 6, 1986

WITHDRAWALS OF PUBLIC LANDS FOR MILITARY PURPOSES

An Act to withdraw certain public lands for military purposes, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. WITHDRAWALS.

Defense and national security. Mines and mining.

(a) BRAVO-20 BOMBING RANGE.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the lands referred to in paragraph (2) of this subsection, and all other areas within the boundary of such lands as depicted on the map specified in such paragraph which may become subject to the operation of the public land laws, are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws). Such lands are reserved for use by the Secretary of the Navy for—

(A) testing and training for aerial bombing, missile firing, and tactical maneuvering and air support; and

(B) subject to the requirements of section 3(f), other defense-related purposes consistent with the purposes specified in this paragraph.

Nevada.

(2) The lands referred to in paragraph (1) of this subsection are the public lands comprising approximately 21,576.40 acres in Churchill County, Nevada, as generally depicted on the map entitled "Bravo-20 Bombing Range Withdrawal—Proposed", dated April 1986, and filed in accordance with section 2.

Flood control.

(3) This section does not affect the withdrawals of July 2, 1902, August 26, 1902, and August 4, 1904, under which the Bureau of Reclamation utilizes for flooding, overflow, and seepage purposes approximately 14,750 acres of the lands withdrawn and reserved by this subsection.

(b) NELLIS AIR FORCE RANGE.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the public lands described in paragraph (2) of this subsection are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws). Such lands are reserved for use by the Secretary of the Air Force—

(A) as an armament and high-hazard testing area;

(B) for training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and

(C) subject to the requirements of section 3(f), for other defense-related purposes consistent with the purposes specified in this paragraph.

Nevada.

(2) The lands referred to in paragraph (1) of this subsection are the lands comprising approximately 2,945,000 acres of land in Clark, Nye, and Lincoln Counties, Nevada, as generally depicted on the map entitled "Nellis Air Force Range Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2.

(c) BARRY M. GOLDWATER AIR FORCE RANGE.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the lands described in paragraph (2) of this subsection are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws). Such lands are reserved for use by the Secretary of the Air Force for—

(A) an armament and high-hazard testing area;

(B) training for aerial gunnery, rocketry, electronic warfare, and tactical maneuvering and air support; and

(C) subject to the requirements of section 3(f), other defense-related purposes consistent with the purposes specified in this paragraph.

Arizona.

(2) The lands referred to in paragraph (1) of this subsection are the lands comprising approximately 2,664,423 acres in Maricopa, Pima, and Yuma Counties, Arizona, as generally depicted on the map entitled "Luke Air Force Range Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2.

(d) MCGREGOR RANGE.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the public lands described in paragraph (2) of this subsection are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws). Such lands are reserved for use by the Secretary of the Army—

(A) for training and weapons testing; and

(B) subject to the requirements of section 3(f), for other defense-related purposes consistent with the purposes specified in this paragraph.

New Mexico.

(2) The lands referred to in paragraph (1) of this subsection are the lands comprising approximately 608,384.87 acres in Otero County, New Mexico, as generally depicted on the map entitled "McGregor Range Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2.

(3) Any of the public lands withdrawn under paragraph (1) of this subsection which, as of the date of enactment of this Act, are managed pursuant to section 603 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1782) shall continue to be managed under that section until Congress determines otherwise.

Alaska.

(e) FORT GREELY MANEUVER AREA AND FORT GREELY AIR DROP ZONE.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the lands described in paragraph (2) of this subsection are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws), under an Act entitled "An Act to provide for the admission of the State of Alaska into the Union", approved July 7, 1958 (48 U.S.C. note prec. 21), and under the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.). Such lands are reserved for use by the Secretary of the Army for—

(A) military maneuvering, training, and equipment development and testing; and

(B) subject to the requirements of section 3(f), other defense-related purposes consistent with the purposes specified in this paragraph.

(2) The lands referred to in paragraph (1) of this subsection are—

(A) the lands comprising approximately 571,995 acres in the Big Delta Area, Alaska, as generally depicted on the map entitled "Fort Greely Maneuver Area Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2; and

(B) the lands comprising approximately 51,590 acres in the Granite Creek Area, Alaska, as generally depicted on the map entitled "Fort Greely, Air Drop Zone Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2.

(f) FORT WAINWRIGHT MANEUVER AREA.—(1) Subject to valid existing rights and except as otherwise provided in this Act, the public lands described in paragraph (2) of this subsection are hereby withdrawn from all forms of appropriation under the public land laws (including the mining laws and the mineral leasing and the geothermal leasing laws), under an Act entitled "An Act to provide for the admission of the State of Alaska into the Union", approved July 7, 1958 (48 U.S.C. note prec. 21), and under the Alaska Native Claims Settlement Act (43 U.S.C. 1601 et seq.). Such lands are reserved for use by the Secretary of the Army for— Alaska.

(A) military maneuvering;

(B) training for artillery firing, aerial gunnery, and infantry tactics; and

(C) subject to the requirements of section 3(f), other defense-related purposes consistent with the purposes specified in this paragraph.

(2) The lands referred to in paragraph (1) of this subsection are the lands comprising approximately 247,951.67 acres of land in the Fourth Judicial District, Alaska, as generally depicted on the map entitled "Fort Wainwright Maneuver Area Withdrawal—Proposed", dated January 1985, and filed in accordance with section 2.

SEC. 2. MAPS AND LEGAL DESCRIPTIONS.

(a) PUBLICATION AND FILING REQUIREMENT.—As soon as practicable after the date of enactment of this Act, the Secretary of the Interior shall—

(1) publish in the Federal Register a notice containing the legal description of the lands withdrawn and reserved by this Act; and Federal Register. publication.

(2) file maps and the legal description of the lands withdrawn and reserved by this Act with the Committee on Energy and Natural Resources of the United States Senate and with the Committee on Interior and Insular Affairs of the United States House of Representatives.

(b) TECHNICAL CORRECTIONS.—Such maps and legal descriptions shall have the same force and effect as if they were included in this Act except that the Secretary of the Interior may correct clerical and typographical errors in such maps and legal descriptions.

(c) AVAILABILITY FOR PUBLIC INSPECTION.—Copies of such maps and legal descriptions shall be available for public inspection in the offices of the Director and appropriate State Directors of the Bureau of Land Management; the office of the commander, Bravo-20 Bombing Range; the offices of the Director and appropriate Regional Directors of the United States Fish and Wildlife Service; the office of the commander, Nellis Air Force Base; the office of the commander, Barry M. Goldwater Air Force Base; the office of the commander, McGregor Range; the office of the installation commander, Fort Richardson, Alaska; the office of the commander, Marine Corps Air Station, Yuma, Arizona; and the office of the Secretary of Defense. Alaska. Arizona.

(d) REIMBURSEMENT.—The Secretary of Defense shall reimburse the Secretary of the Interior for the cost of implementing this section.

SEC. 3. MANAGEMENT OF WITHDRAWN LANDS.

National Wildlife Refuge System.

(a) MANAGEMENT BY THE SECRETARY OF THE INTERIOR.—(1) During the period of the withdrawal, the Secretary of the Interior shall manage the lands withdrawn under section 1 (except those lands within a unit of the National Wildlife Refuge System) pursuant to the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.) and other applicable law, including the Recreation Use of Wildlife Areas Act of 1962 (16 U.S.C. 460k et seq.), and this Act. Lands within the Desert National Wildlife Range and the Cabeza Prieta National Wildlife Refuge shall be managed pursuant to the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.) and other applicable law. No provision of this Act, except sections 4, 11, and 12, shall apply to the management of the Desert National Wildlife Range or the Cabeza Prieta National Wildlife Refuge.

(2) To the extent consistent with applicable law and Executive orders, the lands withdrawn under section 1 may be managed in a manner permitting—

(A) the continuation of grazing pursuant to applicable law and Executive orders where permitted on the date of enactment of this Act;

(B) protection of wildlife and wildlife habitat;

(C) control of predatory and other animals;

(D) recreation; and

(E) the prevention and appropriate suppression of brush and range fires resulting from nonmilitary activities.

(3)(A) All nonmilitary use of such lands, other than the uses described in paragraph (2), shall be subject to such conditions and restrictions as may be necessary to permit the military use of such lands for the purposes specified in or authorized pursuant to this Act.

(B) The Secretary of the Interior may issue any lease, easement, right-of-way, or other authorization with respect to the nonmilitary use of such land only with the concurrence of the Secretary of the military department concerned.

Safety. Defense and national security.

(b) CLOSURE TO PUBLIC.—(1) If the Secretary of the military department concerned determines that military operations, public safety, or national security require the closure to public use of any road, trail, or other portion of the lands withdrawn by this Act, the Secretary may take such action as the Secretary determines necessary or desirable to effect and maintain such closure.

(2) Any such closure shall be limited to the minimum areas and periods which the Secretary of the military department concerned determines are required to carry out this subsection.

(3) Before and during any closure under this subsection, the Secretary of the military department concerned shall—

(A) keep appropriate warning notices posted; and

(B) take appropriate steps to notify the public concerning such closures.

(c) MANAGEMENT PLAN.—The Secretary of the Interior (after consultation with the Secretary of the military department concerned) shall develop a plan for the management of each area withdrawn under section 1 during the period of such withdrawal. Each plan shall—

(1) be consistent with applicable law;

(2) be subject to conditions and restrictions specified in subsection (a)(3) of this section;

(3) include such provisions as may be necessary for proper management and protection of the resources and values of such areas; and

(4) be developed not later than three years after the date of enactment of this Act.

(d) BRUSH AND RANGE FIRES.—The Secretary of the military department concerned shall take necessary precautions to prevent and suppress brush and range fires occurring within and outside the lands withdrawn under section 1 as a result of military activities and may seek assistance from the Bureau of Land Management in the suppression of such fires. The memorandum of understanding required by subsection (e) shall provide for Bureau of Land Management assistance in the suppression of such fires, and for a transfer of funds from the Department of the Navy, Army, or Air Force, as appropriate, to the Bureau of Land Management as compensation for such assistance.

(e) MEMORANDUM OF UNDERSTANDING.—(1) The Secretary of the Interior and the Secretary of the military department concerned shall (with respect to each land withdrawal under section 1) enter into a memorandum of understanding to implement the management plan developed under subsection (c). Any such memorandum of understanding shall provide that the Director of the Bureau of Land Management shall provide assistance in the suppression of fires resulting from the military use of lands withdrawn under section 1 if requested by the Secretary of the military department concerned.

(2) The duration of any such memorandum shall be the same as the period of the withdrawal of the lands under section 1.

(f) ADDITIONAL MILITARY USES.—(1) Lands withdrawn by section 1 (except those within the Desert National Wildlife Range or within the Cabeza Prieta National Wildlife Refuge) may be used for defense-related uses other than those specified in such section. The Secretary of Defense shall promptly notify the Secretary of the Interior in the event that the lands withdrawn by this Act will be used for defense-related purposes other than those specified in section 1. Such notification shall indicate the additional use or uses involved, the proposed duration of such uses, and the extent to which such additional military uses of the withdrawn lands will require that additional or more stringent conditions or restrictions be imposed on otherwise-permitted nonmilitary uses of the withdrawn land or portions thereof.

SEC. 4. SPECIAL WILDLIFE RULES.

(a) NELLIS AIR FORCE RANGE.—(1) Neither the withdrawal under section 1(b) nor any other provision of this Act shall be construed to amend—

(A) the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.) or any other law related to management of the National Wildlife Refuge System; or

(B) any Executive order or public land order in effect on the date of enactment of this Act with respect to the Desert National Wildlife Refuge.

(2) Neither the withdrawal under section 1(b) nor any other provision of this Act shall be construed to amend any memorandum of understanding between the Secretary of the Interior and the Secretary of the Air Force regarding the administration and joint use of a portion of the Desert National Wildlife Range. The provisions of the memorandum of understanding between the Secretary of the Interior and the Department of the Air Force regarding Air Force operations on the Desert National Wildlife Range in effect on March 15, 1986, shall not be amended sooner than 90 days after the Secretary of the Interior has notified the Committee on Interior and Insular Affairs of the House of Representatives, the Committee on Energy and Natural Resources of the Senate, the Committees on Armed Services of the Senate and the House of Representatives, the Committee on Merchant Marine and Fisheries of the House of Representatives, and the Committee on Environment and Public Works of the Senate of any proposed amendments to such provisions.

(b) BARRY M. GOLDWATER AIR FORCE RANGE.—(1) Neither the withdrawal under section 1(c) nor any other provision of this Act shall be construed to amend—

(A) the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.) or any other law related to management of the National Wildlife Refuge System; or

(B) any Executive order or public land order in effect on the date of enactment of this Act with respect to the Cabeza Prieta National Wildlife Refuge.

(2) Neither the withdrawal under section 1(c) nor any other provision of this Act shall be construed to amend any memorandum of understanding between the Secretary of the Interior and the Secretary of the Air Force regarding the administration and joint use of a portion of the Cabeza Prieta National Wildlife Refuge. The provisions of the memorandum of understanding between the Secretary of the Interior and the Department of the Air Force regarding Air Force operations on the Cabeza Prieta National Wildlife Refuge in effect on March 24, 1975, shall not be amended sooner than 90 days after the Secretary of the Interior has notified the Committee on Interior and Insular Affairs of the House of Representatives, the Committee on Energy and Natural Resources of the Senate, the Committees on Armed Services of the Senate and the House of Representatives, the Committee on Merchant Marine and Fisheries of the House of Representatives, and the Committee on Environment and Public Works of the Senate of any proposed amendments to such provisions.

SEC. 5. DURATION OF WITHDRAWALS.

(a) DURATION.—The withdrawal and reservation established by this Act shall terminate 15 years after the date of enactment of this Act.

(b) DRAFT ENVIRONMENTAL IMPACT STATEMENT.—(1) No later than 12 years after the date of enactment of this Act, the Secretary of the military department concerned shall publish a draft environmental impact statement concerning continued or renewed withdrawal of any portion of the lands withdrawn by this Act for which that Secretary intends to seek such continued or renewed withdrawal. Such draft environmental impact statement shall be consistent with the requirements of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) applicable to such a draft environmental impact statement. Prior to the termination date specified in subsection (a), the Secretary of the military department concerned shall hold a public hearing on any draft environmental impact statement published pursuant to this subsection. Such hearing shall be held in the affected State or States in order to receive public comments on the alternatives and other matters included in such draft environmental impact statement.

Nevada.

(2)(A) For purposes of such draft environmental impact statement published by the Secretary of the Navy, the term "lands withdrawn by this Act" shall be deemed to include lands withdrawn by public land orders 275, 788, 898, and 2635 and lands proposed for withdrawal as specified in the draft environmental impact statement for the proposed master land withdrawal, Naval Air Station, Fallon, Nevada.

(B) For purposes of this subsection, lands withdrawn by section 1(b) shall be deemed to include lands withdrawn by Public Law 98-485. 98 Stat. 2261.

(c) EXTENSIONS OR RENEWALS.—The withdrawals established by this Act may not be extended or renewed except by an Act or joint resolution.

SEC. 6. NEVADA REPORT.

Health and medical care. Safety.

(a) SPECIAL NEVADA REPORT.—No later than five years after the date of enactment of this Act, the Secretary of the Air Force, the Secretary of the Navy, and the Secretary of the Interior shall submit to Congress a joint report. In addition to the other matters required by this section, the report shall include an analysis and an evaluation of the effects on public health and safety throughout Nevada of—

(1) the operation of aircraft at subsonic and supersonic speeds;

(2) the use of aerial and other gunnery, rockets, and missiles; and

(3) the uses specified in section 1.

(b) EVALUATION OF CUMULATIVE EFFECTS OF CONTINUED OR RENEWED WITHDRAWAL.—Each of the military departments concerned and the Secretary of the Interior shall, in the report required by this section, evaluate the cumulative effects of continued or renewed withdrawal for military purposes of the military department concerned of some or all of the lands withdrawn by sections 1(a) and 1(b) on the environment and population of Nevada. In performing this evaluation, there shall be considered—

(1) the actual and proposed withdrawal for military and related purposes of other lands in Nevada, including (but not limited to)—

(A) lands withdrawn by sections 1(a) and 1(b) of this Act and by Public Law 98-485 (98 Stat. 2261);

(B) lands withdrawn by Public Land Orders 275, 788, 898, and 2635;

(C) lands proposed for withdrawal as specified in the draft environmental impact statement for the proposed master land withdrawal, Naval Air Station, Fallon, Nevada; and

(D) lands withdrawn or being considered for withdrawal for use by the Department of Energy; and

Real property. Defense and national security.

(2) the cumulative impacts on public and private property in Nevada and on the fish and wildlife, cultural, historic, scientific, recreational, wilderness, and other values of the public lands of Nevada resulting from military and defense related uses of the

lands withdrawn by sections 1(a) and 1(b) and the other lands described in paragraph (1) of this subsection.

(c) MITIGATION MEASURES.—The report required by this subsection shall include an analysis and an evaluation of possible measures to mitigate the cumulative effect of the withdrawal of public lands in Nevada for military and defense-related purposes, and of use of the airspaces over public lands in Nevada for such purposes, on people and property in Nevada and the fish and wildlife, cultural, historic, scientific, wilderness, and other resources and values of the public lands in Nevada (including recreation, mineral development, and agriculture).

SEC. 7. ONGOING DECONTAMINATION.

(a) PROGRAM.—Throughout the duration of the withdrawals made by this Act, the Secretary of the military department concerned, to the extent funds are made available, shall maintain a program of decontamination of lands withdrawn by this Act at least at the level of cleanup achieved on such lands in fiscal year 1986.

President of U.S.

(b) REPORTS.—At the same time as the President transmits to the Congress the President's proposed budget for the first fiscal year beginning after the date of enactment of this Act and for each subsequent fiscal year, each such Secretary shall transmit to the Committees on Appropriations, Armed Services, and Energy and Natural Resources of the Senate and to the Committees on Appropriations, Armed Services, and Interior and Insular Affairs of the House of Representatives a description of the decontamination efforts undertaken during the previous fiscal year on such lands and the decontamination activities proposed for such lands during the next fiscal year including:

(1) amounts appropriated and obligated or expended for decontamination of such lands;

(2) the methods used to decontaminate such lands;

(3) amount and types of contaminants removed from such lands;

(4) estimated types and amounts of residual contamination on such lands; and

(5) an estimate of the costs for full decontamination of such lands and the estimate of the time to complete such decontamination.

SEC. 8. REQUIREMENTS FOR RENEWAL.

(a) NOTICE AND FILING.—(1) No later than three years prior to the termination of the withdrawal and reservation established by this Act, the Secretary of the military department concerned shall advise the Secretary of the Interior as to whether or not the Secretary of the military department concerned will have a continuing military need for any of the lands withdrawn under section 1 after the termination date of such withdrawal and reservation.

(2) If the Secretary of the military department concerned concludes that there will be a continuing military need for any of such lands after the termination date, that Secretary shall file an application for extension of the withdrawal and reservation of such needed lands in accordance with the regulations and procedures of the Department of the Interior applicable to the extension of withdrawals of lands for military uses.

(3) If, during the period of withdrawal and reservation, the Secretary of the military department concerned decides to relinquish

all or any of the lands withdrawn and reserved by this Act, such Secretary shall file a notice of intention to relinquish with the Secretary of the Interior.

Hazardous materials.

(b) CONTAMINATION.—(1) Before transmitting a notice of intention to relinquish pursuant to subsection (a), the Secretary of Defense, acting through the military department concerned, shall prepare a written determination concerning whether and to what extent the lands that are to be relinquished are contaminated with explosive, toxic, or other hazardous materials.

(2) A copy of such determination shall be transmitted with the notice of intention to relinquish.

Federal Register, publication.

(3) Copies of both the notice of intention to relinquish and the determination concerning the contaminated state of the lands shall be published in the Federal Register by the Secretary of the Interior.

(c) DECONTAMINATION.—If any land which is the subject of a notice of intention to relinquish pursuant to subsection (a) is contaminated, and the Secretary of the Interior, in consultation with the Secretary of the military department concerned, determines that decontamination is practicable and economically feasible (taking into consideration the potential future use and value of the land) and that upon decontamination, the land could be opened to operation of some or all of the public land laws, including the mining laws, the Secretary of the military department concerned shall decontaminate the land to the extent that funds are appropriated for such purpose.

(d) ALTERNATIVES.—If the Secretary of the Interior, after consultation with the Secretary of the military department concerned, concludes that decontamination of any land which is the subject of a notice of intention to relinquish pursuant to subsection (a) is not practicable or economically feasible, or that the land cannot be decontaminated sufficiently to be opened to operation of some or all of the public land laws, or if Congress does not appropriate a sufficient amount of funds for the decontamination of such land, the Secretary of the Interior shall not be required to accept the land proposed for relinquishment.

(e) STATUS OF CONTAMINATED LANDS.—If, because of their contaminated state, the Secretary of the Interior declines to accept jurisdiction over lands withdrawn by this Act which have been proposed for relinquishment, or if at the expiration of the withdrawal made by this Act the Secretary of the Interior determines that some of the lands withdrawn by this Act are contaminated to an extent which prevents opening such contaminated lands to operation of the public land laws—

Public information.

(1) the Secretary of the military department concerned shall take appropriate steps to warn the public of the contaminated state of such lands and any risks associated with entry onto such lands;

(2) after the expiration of the withdrawal, the Secretary of the military department concerned shall undertake no activities on such lands except in connection with decontamination of such lands; and

Reports.

(3) the Secretary of the military department concerned shall report to the Secretary of the Interior and to the Congress concerning the status of such lands and all actions taken in furtherance of this subsection.

(f) REVOCATION AUTHORITY.—Notwithstanding any other provisions of law, the Secretary of the Interior, upon deciding that it is in the public interest to accept jurisdiction over lands proposed for relinquishment pursuant to subsection (a), is authorized to revoke the withdrawal and reservation established by this Act as it applies to such lands. Should the decision be made to revoke the withdrawal and reservation, the Secretary of the Interior shall publish in the Federal Register an appropriate order which shall—

Federal Register, publication.

(1) terminate the withdrawal and reservation;

(2) constitute official acceptance of full jurisdiction over the lands by the Secretary of the Interior; and

Mines and mining.

(3) state the date upon which the lands will be opened to the operation of some or all of the public lands laws, including the mining laws.

SEC. 9. DELEGABILITY.

(a) DEFENSE.—The functions of the Secretary of Defense or of a military department under this title may be delegated.

(b) INTERIOR.—The functions of the Secretary of the Interior under this title may be delegated, except that an order described in section 7(f) may be approved and signed only by the Secretary of the Interior, the Under Secretary of the Interior, or an Assistant Secretary of the Department of the Interior.

SEC. 10. WATER RIGHTS.

Nothing in this Act shall be construed to establish a reservation to the United States with respect to any water or water right on the lands described in section 1 of this Act. No provision of this Act shall be construed as authorizing the appropriation of water on lands described in section 1 of this Act by the United States after the date of enactment of this Act except in accordance with the law of the relevant State in which lands described in section 1 are located. This section shall not be construed to affect water rights acquired by the United States before the date of enactment of this Act.

National Wildlife Refuge System.

SEC. 11. HUNTING, FISHING, AND TRAPPING.

All hunting, fishing, and trapping on the lands withdrawn by this Act shall be conducted in accordance with the provisions of section 2671 of title 10, United States Code, except that hunting, fishing, and trapping within the Desert National Wildlife Range and the Cabeza Prieta National Wildlife Refuge shall be conducted in accordance with the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd et seq.), the Recreation Use of Wildlife Areas Act of 1962 (16 U.S.C. 460k et seq.), and other laws applicable to the National Wildlife Refuge System.

SEC. 12. MINING AND MINERAL LEASING.

Federal Register, publication.

(a) DETERMINATION OF LANDS SUITABLE FOR OPENING.—As soon as possible after the enactment of this Act and at least every five years thereafter, the Secretary of the Interior shall determine, with the concurrence of the Secretary of the military department concerned, which public and acquired lands (except as provided in this subsection) described in subsections (a), (b), (d), (e), and (f) of section 1 of this Act the Secretary of the Interior considers suitable for opening to the operation of the Mining Law of 1872, the Mineral Lands Leasing Act of 1920, as amended, the Mineral Leasing Act for Acquired Lands of 1947, the Geothermal Steam Act of 1970, or any one or more of such Acts. The Secretary of the Interior shall publish a notice in the Federal Register listing the lands determined suit-

17 Stat. 91.
30 USC 181.
30 USC 351 note, 1001 note.
Federal Register, publication.
National Wildlife Refuge System.

able pursuant to this section and specifying the opening date, except that lands contained within the Desert National Wildlife Range in Nevada or within the Cabeza Prieta National Wildlife Refuge in Arizona shall not be determined to be suitable for opening pursuant to this section.

(b) OPENING LANDS.—On the day specified by the Secretary of the Interior in a notice published in the Federal Register pursuant to subsection (a), the land identified under subsection (a) as suitable for opening to the operation of one or more of the laws specified in subsection (a) shall automatically be open to the operation of such laws without the necessity for further action by either the Secretary or the Congress. Federal Register, publication.

(c) EXCEPTION FOR COMMON VARIETIES.—No deposit of minerals or materials of the types identified by section 3 of the Act of July 23, 1955 (69 Stat. 367), whether or not included in the term "common varieties" in that Act, shall be subject to location under the Mining Law of 1872 on lands described in section 1. 30 USC 611. 17 Stat. 91.

(d) REGULATIONS.—The Secretary of the Interior, with the advice and concurrence of the Secretary of the military department concerned shall promulgate such regulations to implement this section as may be necessary to assure safe, uninterrupted, and unimpeded use of the lands described in section 1 for military purposes. Such regulations shall also contain guidelines to assist mining claimants in determining how much, if any, of the surface of any lands opened pursuant to this section may be used for purposes incident to mining.

(e) CLOSURE OF MINING LANDS.—In the event of a national emergency or for purposes of national defense or security, the Secretary of the Interior, at the request of the Secretary of the military department concerned, shall close any lands that have been opened to mining or to mineral or geothermal leasing pursuant to this section. Defense and national security.

(f) LAWS GOVERNING MINING ON LANDS WITHDRAWN UNDER THIS ACT.—(1) Except as otherwise provided in this Act, mining claims located pursuant to this Act shall be subject to the provisions of the mining laws. In the event of a conflict between those laws and this Act, this Act shall prevail.

(2) All mining claims located under the terms of this Act shall be subject to the provisions of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.).

(g) PATENTS.—(1) Patents issued pursuant to this Act for locatable minerals shall convey title to locatable minerals only, together with the right to use so much of the surface as may be necessary for purposes incident to mining under the guidelines for such use established by the Secretary of the Interior by regulation.

(2) All such patents shall contain a reservation to the United States of the surface of all lands patented and of all nonlocatable minerals on those lands.

(3) For the purposes of this section, all minerals subject to location under the Mining Law of 1872 are referred to as "locatable minerals".

(h) REVOCATION.—Notwithstanding any other provision of law, the Secretary of the Interior, if the Secretary determines it necessary and appropriate for the purpose of consummating an exchange of lands or interests therein under applicable law, is hereby authorized and directed to revoke the Small Tract Act Classification S.T.049794 in Clark County, Nevada. Nevada.

SEC. 13. IMMUNITY OF UNITED STATES.

The United States and all departments or agencies thereof shall be held harmless and shall not be liable for any injuries or damages to persons or property suffered in the course of any mining or mineral or geothermal leasing activity conducted on lands described in section 1 of this Act.

Military Lands Withdrawal Act of 1986.

SEC. 14. SHORT TITLE.

Sections 1 through 15 of this Act may be cited as the "Military Lands Withdrawal Act of 1986".

SEC. 15. REDESIGNATION.

Arizona.

The Luke Air Force Range in Arizona is hereby redesignated as the "Barry M. Goldwater Air Force Range". Any reference in any law, regulation, document, record, map, or other paper of the United States to the Luke Air Force Range shall be deemed to be a reference to the "Barry M. Goldwater Air Force Range".

16 USC 460ff-1.

SEC. 16. BOUNDARY ADJUSTMENT TO CUYAHOGA VALLEY NATIONAL RECREATION AREA.

Section 2 of the Act entitled "An Act to provide for the establishment of the Cuyahoga Valley National Recreational Recreation Area", approved December 27, 1974 (16 U.S.C. 460ff et seq.), is amended as follows:

(1) In subsection (a), strike out "numbered 655-90,001-A and dated May 1978" and insert "numbered 644-80,054 and dated July 1986".

(2) At the end of subsection (a), insert the following:

"The recreation area shall also comprise any lands designated as 'City of Akron Lands' on the map referred to in the first sentence which are offered as donations to the Department of the Interior or which become privately owned. The Secretary shall revise such map to depict such lands as part of the recreation area.".

(3) In subsection (b), after the first sentence, insert the following:

State and local governments.

"The Secretary may not acquire fee title to any lands included within the recreation area in 1986 which are designated on the map referred to in subsection (a) as 'Scenic Easement Acquisition Areas'. The Secretary may acquire only scenic easements in such designated lands. Unless consented to by the owner from which the easement is acquired, any such scenic easement may not prohibit any activity, the subdivision of any land, or the construction of any building or other facility if such activity, subdivision, or construction would have been permitted under laws and ordinances of the unit of local government in which such land was located on April 1, 1986, as such laws and ordinances were in effect on such date.".

Approved November 6, 1986.

LEGISLATIVE HISTORY—H.R. 1790:

CONGRESSIONAL RECORD, Vol. 132 (1986):
Oct. 17, considered and passed House.
Oct. 18, considered and passed Senate.