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FINAL
ENVIRONMENTAL IMPACT STATEMENT OF THE PROPOSED GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT
WHITE SANDS MISSILE RANGE NEW MEXICO

January 1987

Prepared by:

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Title of Proposed Action: Ground Based Free Electron Laser Technology Integration Experiment

Affected Jurisdiction: White Sands Missile Range
Socorro, Lincoln, Sierra, Otero and Dona Ana Counties, New Mexico

Prepared under supervision of: U.S. Army Corps of Engineers
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Approved by: James F. McNulty
Colonel, U.S. Army
Project Manager, Ground Based Laser Program

Document Designation: Final EIS

Abstract: Three sites were considered as alternative locations for the Ground Based Free Electron Laser Technology Integration Experiment. All three sites are located completely within the existing boundaries of White Sands Missile Range, New Mexico. The EIS contains a generic description of the facilities required for both a low and high power phase of testing and discusses those impacts associated with the experiment which would occur at each site. The EIS also identifies impacts to cultural resources, vegetation, wildlife and groundwater resources associated with the selection of any site. In comparing all these differing impacts between sites, it has been determined that selection of the Orogrande site would have the least environmental impact and is not anticipated to have any adverse impacts on the White Sands National Monument, any Federal or State environmentally sensitive areas or any Federally listed threatened or endangered species. In consideration of site specific environmental impacts, estimated construction schedules and costs, experimental and operating factors, and White Sands Missile Range program and schedule conflicts, the U.S. Army Strategic Defense Command has identified the Orogrande site as its preferred alternative.

Deadline for receipt of comments: 2 March 1987

SUMMARY SHEET FOR FINAL ENVIRONMENTAL IMPACT STATEMENT

Ground Based Free Electron Laser Technology Integration Experiment
White Sands Missile Range, New Mexico

(   ) Draft   (X) Final

U.S. Army Corps of Engineers
Fort Worth District
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1. Type of Action: (X) Administrative Action
( ) Legislative Action

2. Project Description

This Environmental Impact Statement was prepared by the U.S. Army Corps of Engineers in response to a request from the proponent, the U.S. Army Strategic Defense Command under the authority of the Strategic Defense Initiative Organization. The purpose of the project would be to test and evaluate the propagation of a ground based free electron laser beam through the atmosphere to diagnostic targets without significant reductions in the beam's quality and energy levels.

The proposed project would be located at one of three sites at White Sands Missile Range, New Mexico. The site west of the Orogrande Range Camp is the proponent's preferred alternative. The proposed project would be conducted in two phases, a low power phase and a high power phase. Construction of the low power laser facility would begin in early 1987 and be completed within two to three years. Modification of this facility would commence in the early 1990s depending upon results of the low power tests. Up to 2,000 personnel would be required during the peak construction activities assuming phase II follows directly after phase I; 250 to 500 workers would be employed during the operational phase.

Approximately 280 tests would be expected to be conducted in a typical year; although more tests may be required, about 840 tests per year would be the absolute maximum number that could be conducted. These tests would be conducted at various times during the day and night, and would use various ground, air and space targets. Duration of each test would be a maximum of 60 seconds. Automatic safety mechanisms would abort test firings of the laser if any object greater than 1.0 centimeter in diameter is detected near the laser beam.

Ancillary facilities that may be required to support the test and evaluation program include industrial and domestic wastewater treatment systems, stand-by power generation, power and/or water transmission lines, roads, and a possible railroad spur. Power generation and/or storage devices may be required to meet the instantaneous power demands during the second phase.

3. Summary of Major Environmental Impacts

Depending upon the site selected, direct adverse environmental impacts would include fugitive dust and noise during construction activities; complete loss of 2,600-3,000 acres of various habitat types, primarily mesquite-sand dunes, due to actual facility construction; reduction of available habitats for large mammals (e.g., pronghorn and gemsbok) of about 15,500 to 17,200 acres; and potential disturbance of desert bighorn sheep, Baird's sparrow, McCown's longspur and Swainson's hawk. Significant effects to archeological/cultural resources could occur; the magnitude of these effects would depend upon the site selected as well as the effectiveness of the mitigation plan to be developed. Ambient air quality would return to pre-project conditions shortly after cessation of construction activities; normal operation of the laser facility would not significantly affect the region's ambient air quality.

The potential impacts associated with the most cost effective water supply alternatives at each site has been identified. An aquifer in the Soledad Canyon area would be developed to provide the water supply for the GBFEL-TIE at the Orogrande site. This aquifer is expected to be able to satisfy the project requirements without significant detrimental effects to the aquifer. Withdrawal from aquifer(s) south of the Jornada Reserve Headquarters for the North of NASA site may adversely affect ongoing programs at the Jornada Experimental Range. Withdrawal of water from the Rio Grande alluvium for the Stallion site would not significantly affect local users or wildlife since the water would be replaced by water from the San Juan-Chama Project.

Indirect effects are related to accidental fires or spills which could destroy additional terrestrial habitats, as well as cultural resources. Reductions in the prey base would also indirectly affect birds of prey, some snakes and large predators (e.g., coyote, gray fox).

The major beneficial effect would be increases in employment and income in the region. Implementation of the proposed project may induce economic development, including higher land values, construction/renovation of schools and recreational facilities, as well as residential and commercial development. The magnitude of these effects would depend upon the actual number of workers required and the duration of the construction activities.

Indirect adverse socioeconomic effects would relate to increased demands on schools, law enforcement, recreational facilities, and the emigration of workers from the region after completion of the construction activities. Gravity and allocation models as well as discussions with officials from affected communities indicate that the local communities could adequately accommodate these needs, with the possible exception of a housing deficit in Socorro.

Mitigation measures which are required by White Sands Missile Range and those that would be committed to the proposed project are discussed in Section V, Mitigation Measures.

4. Summary of Alternatives Considered

In consideration of the 1972 Anti-Ballistic Missile Treaty between the United States and the Soviet Union, the Ground Based Laser project would be located at White Sands Missile Range (WSMR), New Mexico.

Although WSMR is a large area (over 10,256 square km), the range is already extensively used. Over 80 programs of the Department of Defense and other government agencies presently use WSMR. Existing major activities and facilities therefore prevent siting of the laser facility in certain areas of WSMR.

Moreover, not all of the land area within WSMR boundaries is freely usable for construction of major new facilities. For example, the White Sands National Monument is located within WSMR. Therefore, no consideration was given to siting the laser facility in such areas. Of the remaining portions of WSMR, many areas are too mountainous for the proposed facility.

A total of 14 sites on WSMR were initially selected as potential locations for the laser facility and were rated according to numerous criteria. Several of these sites were eliminated from further consideration due to inadequate land area with the required terrain features. Several others were eliminated from further consideration because of their proximity to gypsum deposits which could severely affect the laser's optics system. Of the remaining sites, three, representing the reasonable range of alternatives, were carried forward for detailed evaluation.

The No Action alternative would preclude all adverse and beneficial environmental and economic impacts.

5. Preferred Alternative

Orogrande has been identified as the environmentally preferred alternative as well as the USASDC's recommended site. Some habitat disruption at the Stallion site, and impacts on desert bighorn sheep and archeological resources at the North of NASA site were the major environmental factors. There appears to be no essential difference in the estimated construction costs associated with siting the experiment at any of the three sites. The history of seismic activity in the Socorro area indicates that siting the experiment at Stallion could cause a delay in gathering experimental data due to the necessity to periodically realign and calibrate optical equipment. In the area of program and schedule conflicts at White Sands, substantially higher impacts would accrue to existing and future programs at the Stallion site as compared to the other two sites. At the Stallion site, these program conflicts affect all three military services and, in the opinion of White Sands personnel, would severely limit future operational capabilities of the national range thereby making Stallion significantly inferior to the other two sites.

The final site decision will be made by LTG James A. Abrahamson, Director, SDIO, after consideration of the public comments to the U.S. Army's recommendation.

6. Permits

This Final EIS was prepared in accordance with and is in compliance with the Council on Environmental Quality's (CEQ) Regulations for Implementing National Environmental Policy Act (NEPA), Army Regulations (AR) 200-2 (with Change No. 1), Fish and Wildlife Coordination Act, the National Historic Preservation Act of 1966, the Endangered Species Act of 1973, the Clean Air Act, the Clean Water Act, and Executive Orders 11988 and 11990. The permits that may be required for various project components are provided below; some of these would not be required during the low power phase but may be required during the high power phase.

Potential Permit Requirements for GBFEL-TIE

Type of Permit	Process Requiring Permit
PSD (EPA)	Any process (Power generation) generating 100 tons/year of specified pollutants
NESHAP (EPA)	Any process (mirror coating, static firing of rocket motor for power generation) that could produce hazardous emissions (e.g., beryllium, selenium, radionuclides)
Air Quality (State)	Any of processes described above; need to apply for each emission source and allow state to provide "no emission" permit, if appropriate
Section 404 (CoE); Section 10 (CoE); 401 Certification; (State)	Required only if pipelines/powerlines/roads traverse wetlands and/or navigable streams (.e.g, water withdrawal from Elephant Butte Reservoir)
NPDES (EPA)	New sewage lagoons
RCRA (EPA) and State Solid Wastes	New landfills; may have to amend WSMR's permit to accommodate new loadings if existing landfill is utilized
RCRA (EPA) Hazardous Wastes	For generation, disposal, or storage (greater than 90 days) of hazardous materials (e.g., mirror coating materials, radioactive materials, hazardous gases)
FERC	Power generation plant; transmission lines, particularly off-base, may require permit
Well drilling (State)	All wells drilled in the State of New Mexico require: (1) to have or appropriate water rights; and (2) a well drilling permit from the State Engineer
ROW Reservation (BLM)	Distribution/Transmission Lines, pipelines, other access of Public Land needs

In addition to the formal permits above, compliance with Water Quality Control Commissions Regulations will be required including: Section 1-201, Notice of Intent; Section 1-202, Filing of plans and specifications; Section 1-203, Reporting and handling of spills and Approval of wastewater discharge plan; and Part 4, Utility operator certification.

7. Comments

Copies of the Final EIS have been sent to the following agencies and organizations as well as interested individuals.

FEDERAL AGENCIES

U.S. Environmental Protection Agency, Region VI
U.S. Department of the Interior
- Fish and Wildlife Service, Region II
- National Park Service
- U.S. Geological Survey
- Bureau of Indian Affairs

U.S. Department of Agriculture
- U.S. Forest Service
- Soil Conservation Service

U.S. Army Corps of Engineers
- Fort Worth District
- Albuquerque District
- Southwestern Division
- Huntsville Division

U.S. Department of the Army
U.S. Department of the Air Force
U.S. Department of the Navy
National Aeronautics and Space Administration
U.S. Department of Transportation
- Federal Highway Administration
- Federal Aviation Administration

U.S. Department of Housing and Urban Development
Advisory Council on Historic Preservation
U.S. Department of Health and Human Services
U.S. Public Health Service
U.S. Department of Energy
- Federal Energy Regulatory Commission

NEW MEXICO STATE AGENCIES

Honorable Garrey Carruthers (Governor, New Mexico)
New Mexico State Historic Preservation Office
New Mexico Department of Game and Fish
New Mexico Department of Health and Environment
New Mexico Department of Parks and Recreation
New Mexico Department of Transportation
New Mexico Department of Agriculture
New Mexico Office of the State Engineer

TEXAS STATE AGENCIES

Honorable Bill Clements (Governor, Texas)

SENATORS AND REPRESENTATIVES

Honorable Jeff Bingaman (U.S. Senator, New Mexico)
Honorable Pete V. Domenici (U.S. Senator, New Mexico)
Honorable Lloyd M. Bentson, Jr. (U.S. Senator, Texas)
Honorable Phil Gramm (U.S. Senator, Texas)
Honorable Manuel Lujan, Jr. (U.S. Representative, New Mexico)
Honorable Bill Richardson (U.S. Representative, New Mexico)
Honorable Joe Skeen (U.S. Representative, New Mexico)
Honorable Ronald Coleman (U.S. Representative, Texas)
Honorable Harold Foreman (New Mexico State Senator)
Honorable Toots Green (New Mexico State Representative)
Honorable William Vandergriff (New Mexico State Senator)
Honorable Ike Smalley (New Mexico State Senator)
Honorable Fernando Macias (New Mexico State Senator)
Honorable James L. Martin (New Mexico State Senator)
Honorable Ellen Lively Steele (New Mexico State Senator)
Honorable Maurice Hobson (New Mexico State Representative)
Honorable Larry Scheffield (New Mexico State Representative)
Honorable Ruben A. Smith (New Mexico State Representative)
Honorable Leonard Scheffield (New Mexico State Representative)
Honorable J. Paul Taylor (New Mexico State Representative)
Honorable Ralph Hartman (New Mexico State Representative)
Honorable Mary Thompson (New Mexico State Representative)
Honorable G.X. McSherry (New Mexico State Representative)
Honorable H. Tati Santiesteban (Texas State Senator)
Honorable Nancy McDonald (Texas State Senator)
Honorable Jack Vowell (Texas State Senator)
Honorable Arves Jones (Texas State Representative)
Honorable Paul Moreno (Texas State Representative)
Honorable Nick Perez (Texas State Representative)
Honorable Bill Sims (Texas State Representative)

LOCAL ORGANIZATIONS

Sierra Club
National Wildlife Federation
National Audubon Society
Environmental Defense Fund
New Mexico State Heritage Program
El Paso Chamber of Commerce
Las Cruces Chamber of Commerce
Alamogordo Chamber of Commerce
Socorro Chamber of Commerce
Albuquerque Chamber of Commerce

8. EIS Milestones

The Draft EIS was filed with the U.S. Environmental Protection Agency (EPA) on 23 September 1986. A Notice of Availability was published in the Federal Register on 3 October 1986, which began the 45-day public review and comment period. Comments on the Draft EIS were accepted until 21 November 1986, or made orally at the public hearings. Responses to these comments are presented in Section VI, Public Involvement, of the FEIS.

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PURPOSE AND NEED

I. PURPOSE AND NEED

A. Introduction

The U.S. Army Strategic Defense Command (USASDC) is proposing to construct and operate a Ground Based Free Electron Laser Technology Integration Experiment (GBFEL-TIE) at White Sands Missile Range, New Mexico. The proposed GBFEL-TIE would be divided into two stages (i.e., low power and high power phases). The purpose of this document is to assist in the selection of a site which would be used for both phases. Like many large military projects, the GBFEL-TIE will require a sequence of decisions, with the results of the early decisions providing input for the later decisions. In this project, the initial decision is the selection of the optimum site for the facility; once that decision is made, then informed site-specific design choices can be made, such as the optimum choices regarding electrical power and other utilities. After the results from the initial (low power) experiments are available, informed choices can be made on the detailed design of the high power experiments. Therefore, a "tiered" environmental analysis approach has been adopted as allowed by the Council on Environmental Quality's regulations for situations such as this (40 CFR 1502.20). The initial tier, represented by this EIS, provides input to the site selection decision, which will not be finalized until this EIS is completed. In order to provide for an adequately informed decision, this EIS compares the potential environmental impacts of both project phases at each of three alternative sites. As part of the comparison of the three sites, the potential impacts of various utility and road access corridors at the three sites are also compared. Once the site selection has been made, however, a second "tier" of environmental analysis, along with more detailed design engineering work, will focus on those project aspects which are then ripe for decisions, such as identifying the optimum utility and access alignments at the selected site.

B. Background

White Sands Missile Range (WSMR) is located in south central New Mexico approximately 45 miles north of El Paso, Texas and 20 miles east of Las Cruces, New Mexico. WSMR encompasses about 4,000 square miles (i.e., 100 miles long x 40 miles wide) and is oriented in a north-south direction (Figure I-1). The range was established in 1945 as White Sands Proving Ground, but was later (1958) renamed White Sands Missile Range(1).

WSMR supports test and development programs for the Army, Navy, Air Force, other U.S. Department of Defense (DOD) agencies. NASA and foreign governments. WSMR presently supports over 80 such programs which include research and development of defense systems as well as limited field training exercises. Contained within the WSMR boundary are the White Sands National Monument and the San Andres National Wildlife Refuge (NWR), both of which are operated by the U.S. Department of the Interior. A portion of the Jornada Experimental Range, operated by the U.S. Department of Agriculture, is co-used with WSMR (Figure I-2).

C. Purpose and Need

1. Need

The President's Strategic Defense Initiative (SDI) is an extensive research program that investigates potential strategic defense technologies that would intercept and destroy enemy missiles. The proposed project is one experiment

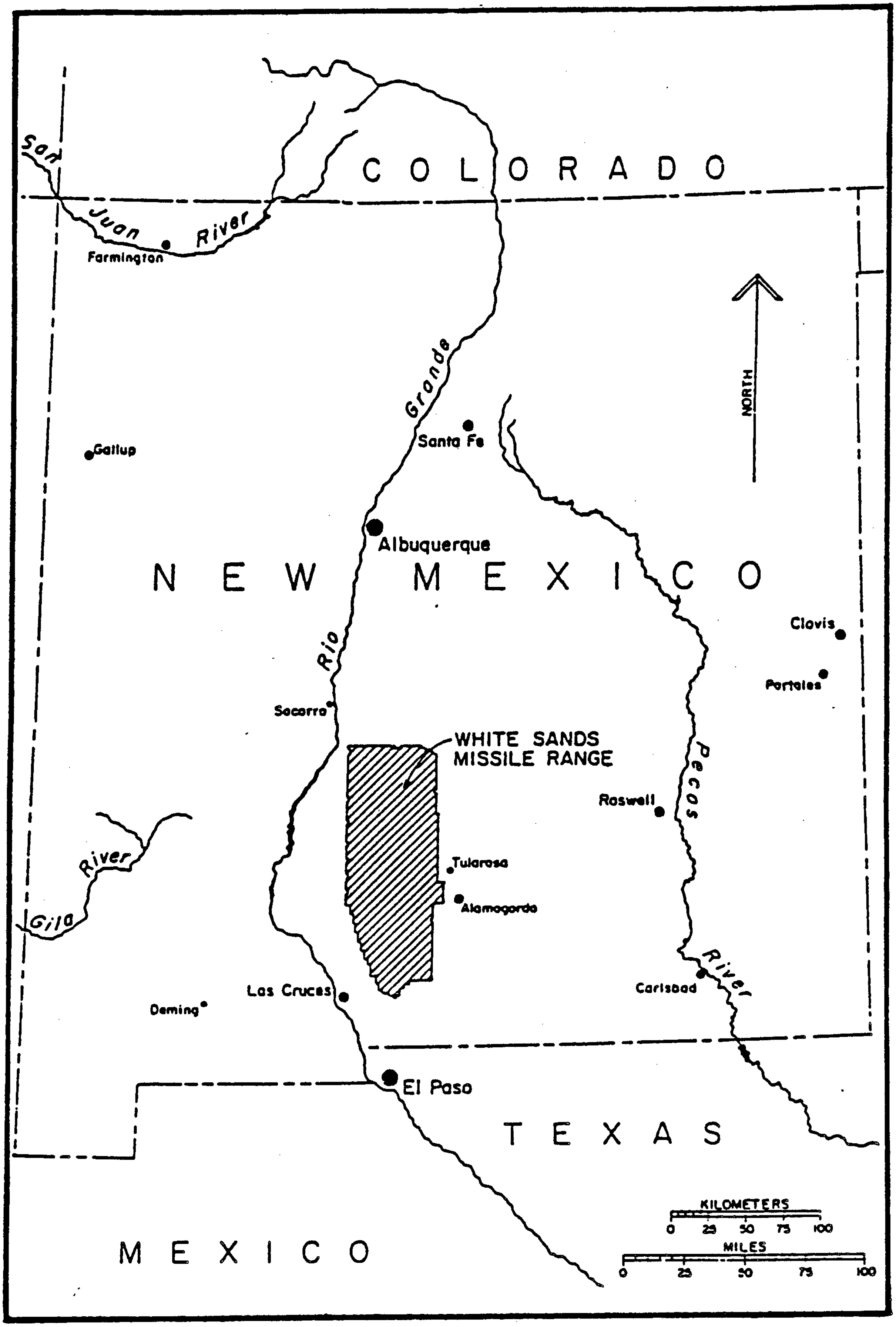


Figure I-1. Location of White Sands Missile Range (WSMR).

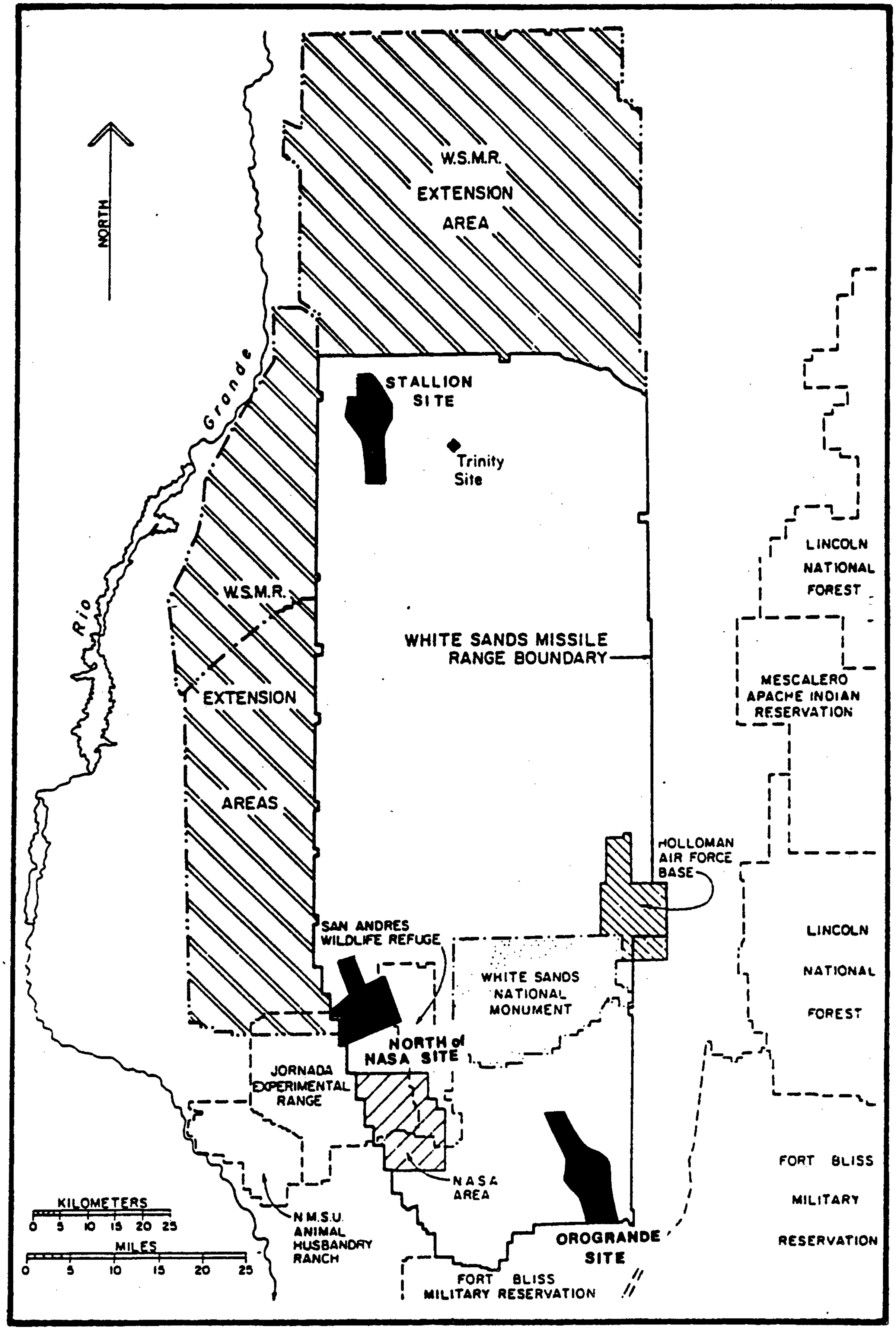


Figure I-2. WSMR and Associated Co-Use Areas.

contained in the overall SDI program. Successful results from the GBFEL-TIE would be used to develop laser technologies for potential use in future defense systems. These and other similar experiments will provide data to a future Congress and a future President to assist in a decision as to the feasibility of a strategic defense.

2. Purpose

The term laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Because light energies produced by laser devices travel at nearly uniform frequencies and wavelengths, the beam remains uniform for long distances and can be focused onto a specific point with enormous intensity.

Generally, lasers contain a material (e.g., crystal, liquid, or gas) which is excited to an altered state, causing the material to emit particles of light (i.e., photons). However, in order to achieve the high power desired for the proposed experiments, a free electron laser (FEL) is required, which produces photons by manipulating electrons rather than exciting a crystal or other material. FELs work by decelerating pulses of electrons in the presence of an intense beam of light. As the electrons are decelerated, they lose energy in the form of photons. These energies are transferred to the existing beam of light, thereby increasing its intensity.

The GBFEL-TIE would demonstrate the generation and control of the propagation of a laser beam in the near infrared spectrum with extremely high energies(2).

The ultimate objective of this project is to successfully demonstrate that a short wavelength, high energy laser beam can be propagated from a ground based facility and then directed through the atmosphere to diagnostic test targets without significant reductions in the beam quality and energy levels. Three interim technical goals would be achieved in order to meet this objective. These goals are discussed in more detail in the following paragraphs.

a. Goal 1. Develop an Understanding of Atmospheric and Laser Physics

Three atmospheric conditions which present problems in designing and operating ground based laser systems are: (1) atmospheric turbulence, (2) thermal blooming and (3) Stimulated Raman Scattering (SRS). These effects can be either beneficial or adverse depending upon the laser's energy levels, wavelength, or pulse length. The combined relationship of these three phenomena is not well understood and, in some cases, the individual effect is not completely understood.

Atmospheric turbulence is controlled by wind, temperature, humidity and many other factors. Turbulence effects on a propagating laser beam are presently difficult to predict, but they are known for certain to have a strong effect on the laser's energy as it passes through the atmosphere.

Thermal blooming is the rapid heating of the air due to the deposition of laser energy during propagation. Thermal blooming could redirect some of the laser's energy away from the desired path. This effect is also presently difficult to correct because the corrective measures may cause more heating in different strata of the air which, in turn, may cause aberrations that would require further corrections.

Stimulated Raman Scattering (SRS) is produced when energy from the laser beam is absorbed by the atoms in the air and re-radiated in several wavelengths and directions. The amount of scattering is dependent upon the absorbing medium, as well as the intensity and wavelength of the laser beam.

The first interim goal would be to develop a better understanding of the ways these phenomena affect propagation of the laser beam.

b. Goal 2. Develop and Refine Technology for Adaptive Optics

Optics (e.g., mirrors, lens, telescopes, etc.) and sensors would be incorporated to the GBFEL-TIE to determine the atmospheric degradation effects on the laser beam prior to directing the beam through the atmosphere and to compensate or adjust the beam to overcome these effects. The proposed GBFEL-TIE would develop and refine adaptive optic components and methodologies required to adequately correct or adjust the beam. Specifically, technologies would be investigated in the areas of deformable mirrors, wave front sensing, and control systems that would be able to withstand extreme energies and rapidly provide the required adjustments.

c. Goal 3. Develop and Refine Technology for High Power Laser Systems

Turbulence, thermal blooming and other associated factors described above affect only high power lasers; thus, a high power laser is required to investigate these and other potential effects.

Results from this experiment would provide an indication of the physical, economic and technical limitations of a ground based laser concept. In addition, designs and construction techniques could be further refined.

D. Project Description

1. Project Location

Three sites were considered as potential locations for the proposed laser facility: (1) north of the NASA White Sands Test Facility, (2) south of the Stallion Range Camp and (3) west of the Orogrande Range Camp. These sites are located within the boundaries of WSMR as depicted in Figure I-3. The sites were selected from a total of 14 potential sites. The criteria used in this selection process are discussed in the following section, Comparison of Alternatives. The proposed laser facility and associated security areas, ancillary structures, etc. would generally encompass an area approximately 3.2 km wide and 16 km long. A ground target range would require an additional area of about 8.8 km x 2.0 km. The orientation of the facilities at each potential site is illustrated in Figures I-4, I-5 and I-6, respectively.

2. Project Schedule

The GBFEL-TIE is presently scheduled to commence construction by mid-1987. Construction is anticipated to require two to three years for Phase I, and approximately four years for Phase II. The experiments would begin in the early 1990s. The experiments would be divided into low power and high power phases, as described below. Figure I-7 illustrates the proposed schedule for construction and operation of the GBFEL-TIE.

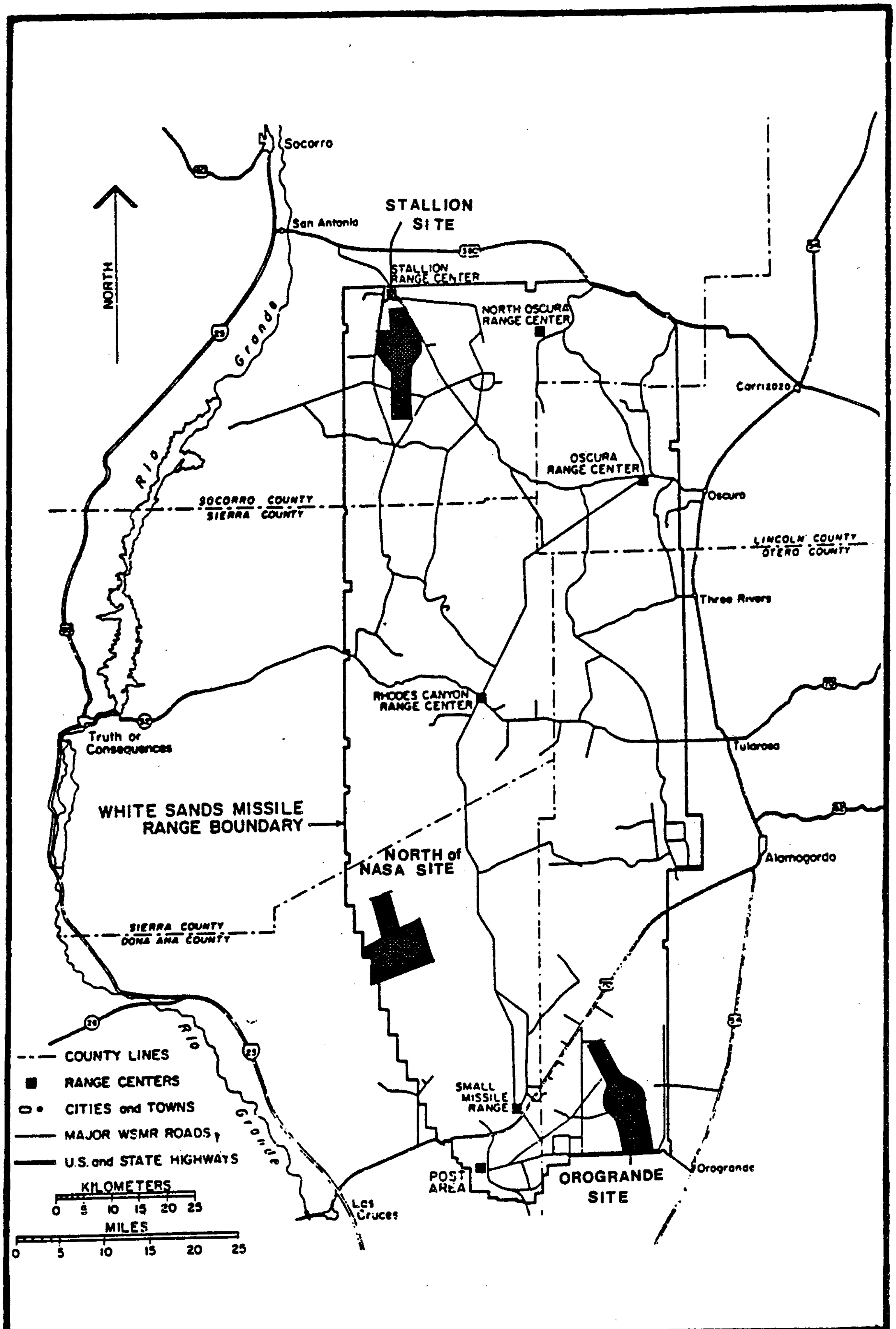


Figure I-3. Location of Alternative Sites for Proposed Laser System.

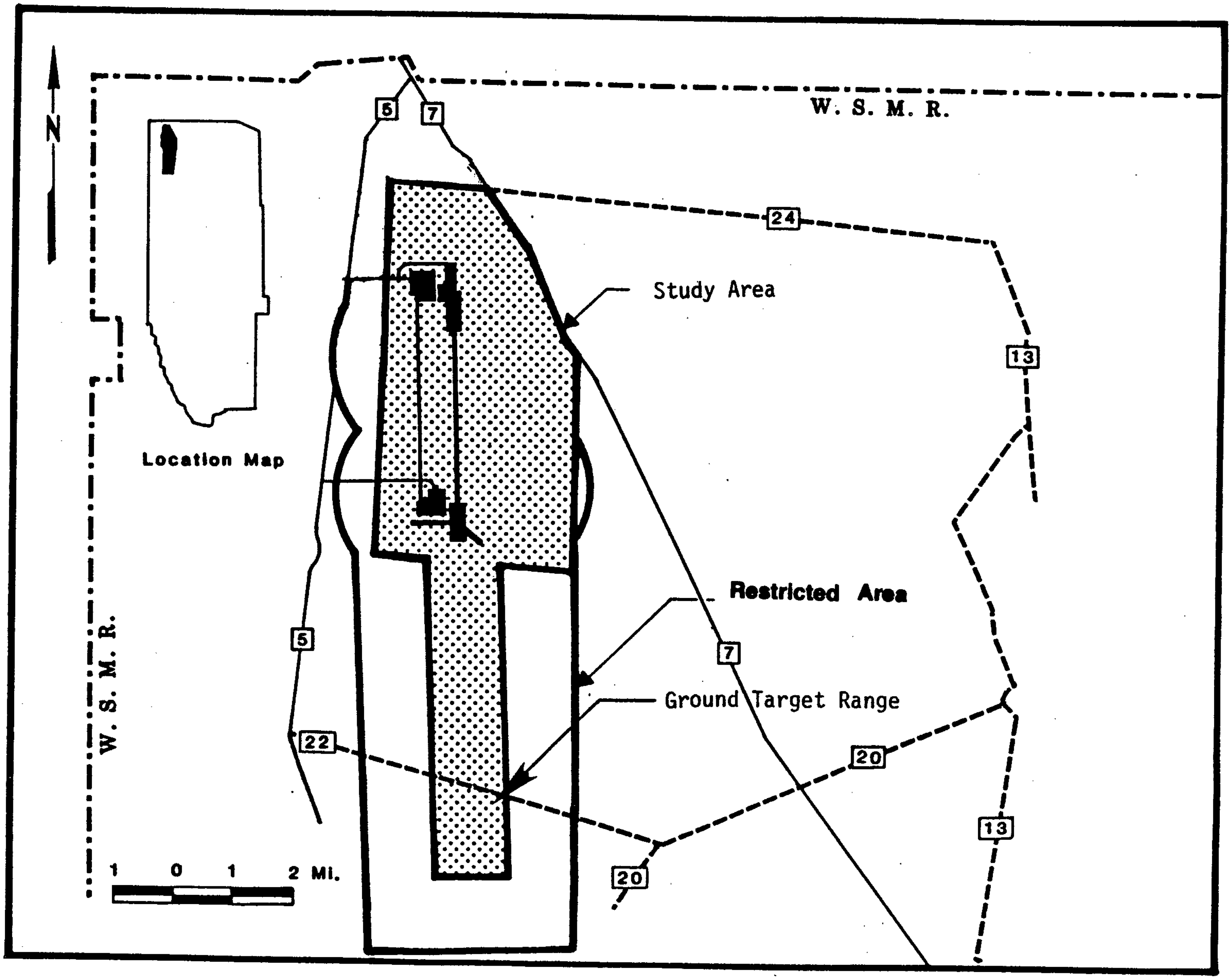


Figure I-4. GBFEL-TIE Facility Orientation at Stallion Candidate Site.

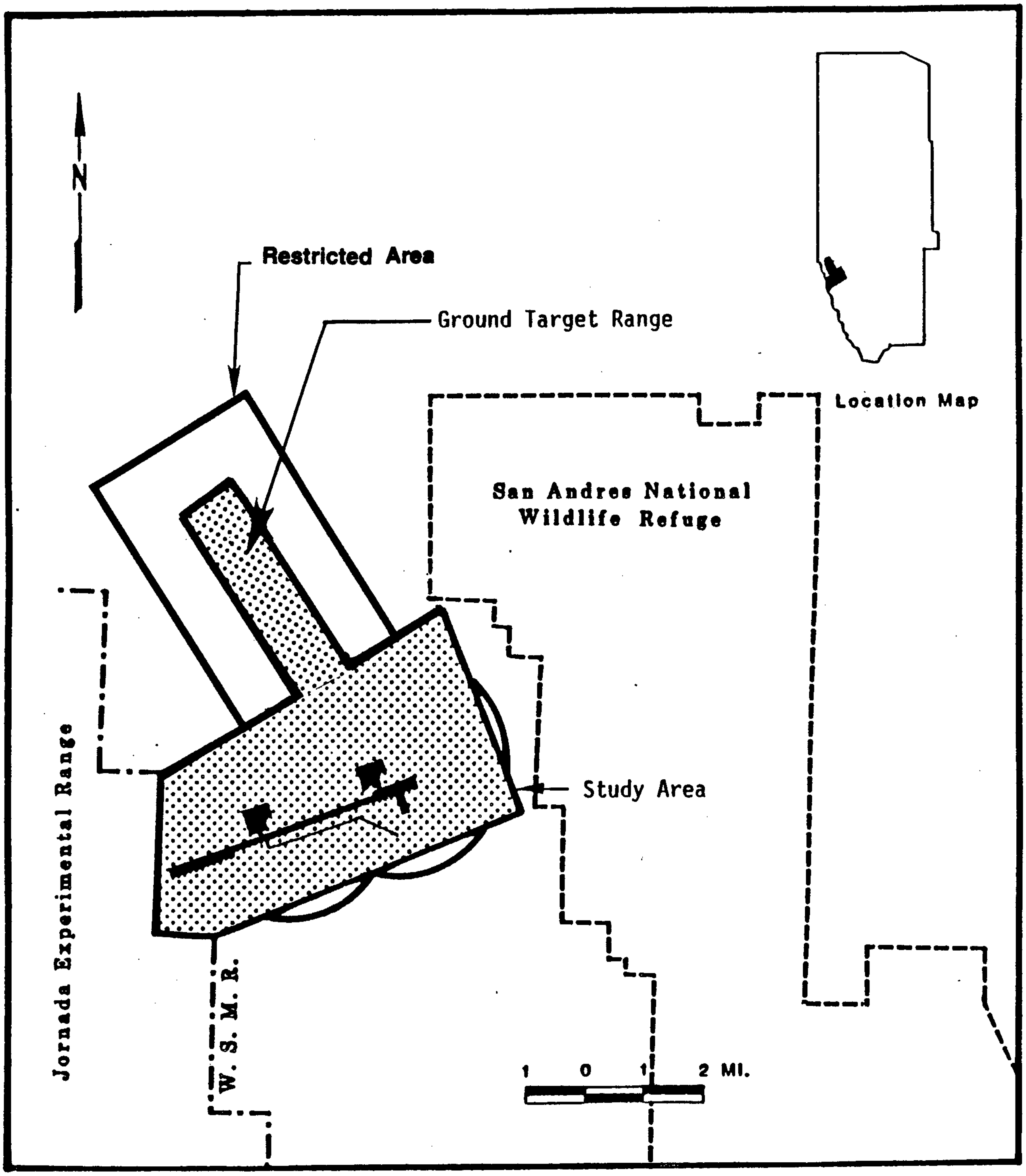


Figure I-5. GBFEL-TIE Facility Orientation at North of NASA Candidate Site.

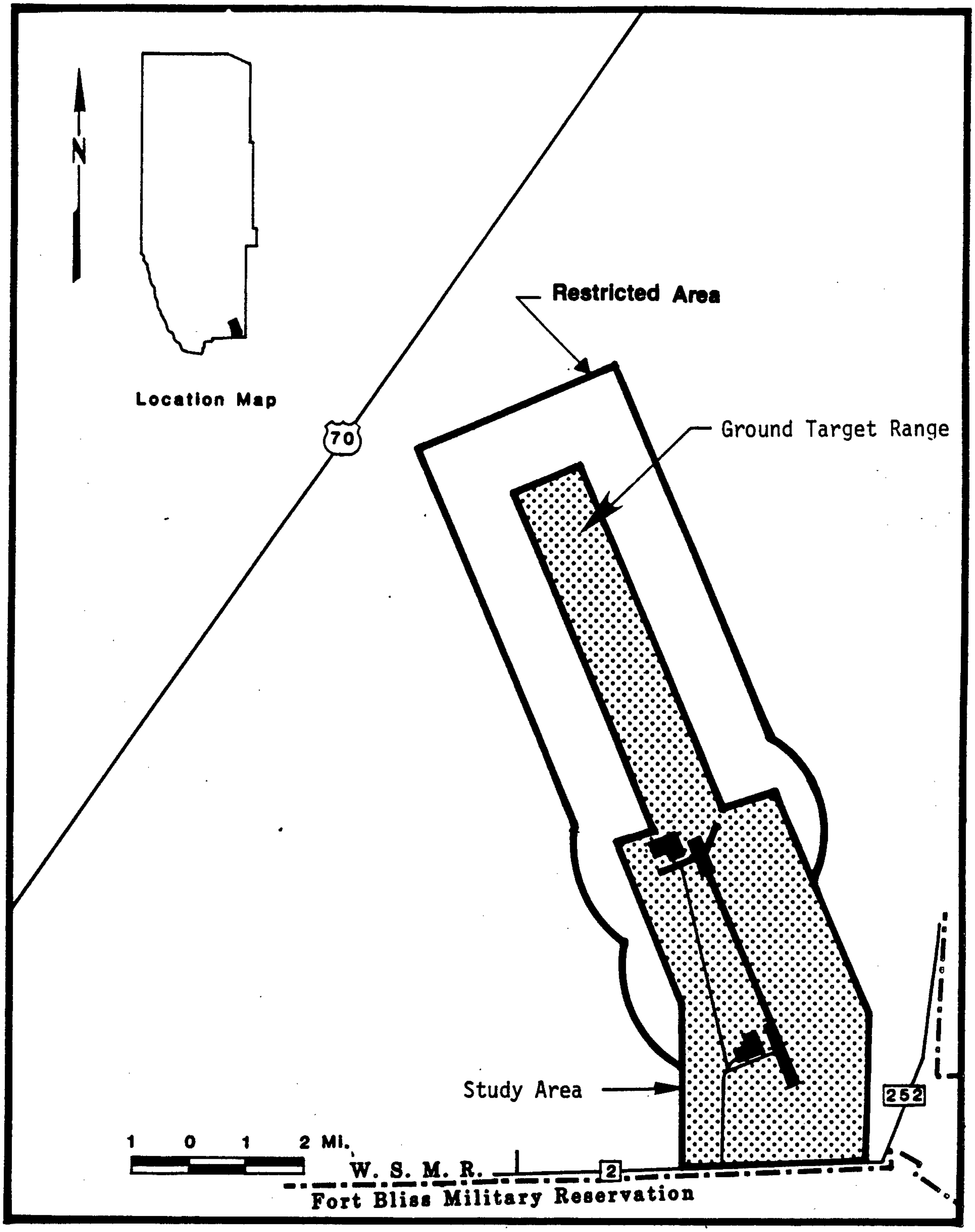


Figure I-6. GBFEL-TIE Facility Orientation at Orogrande Candidate Site.

GROUND BASED LASER SCHEDULE

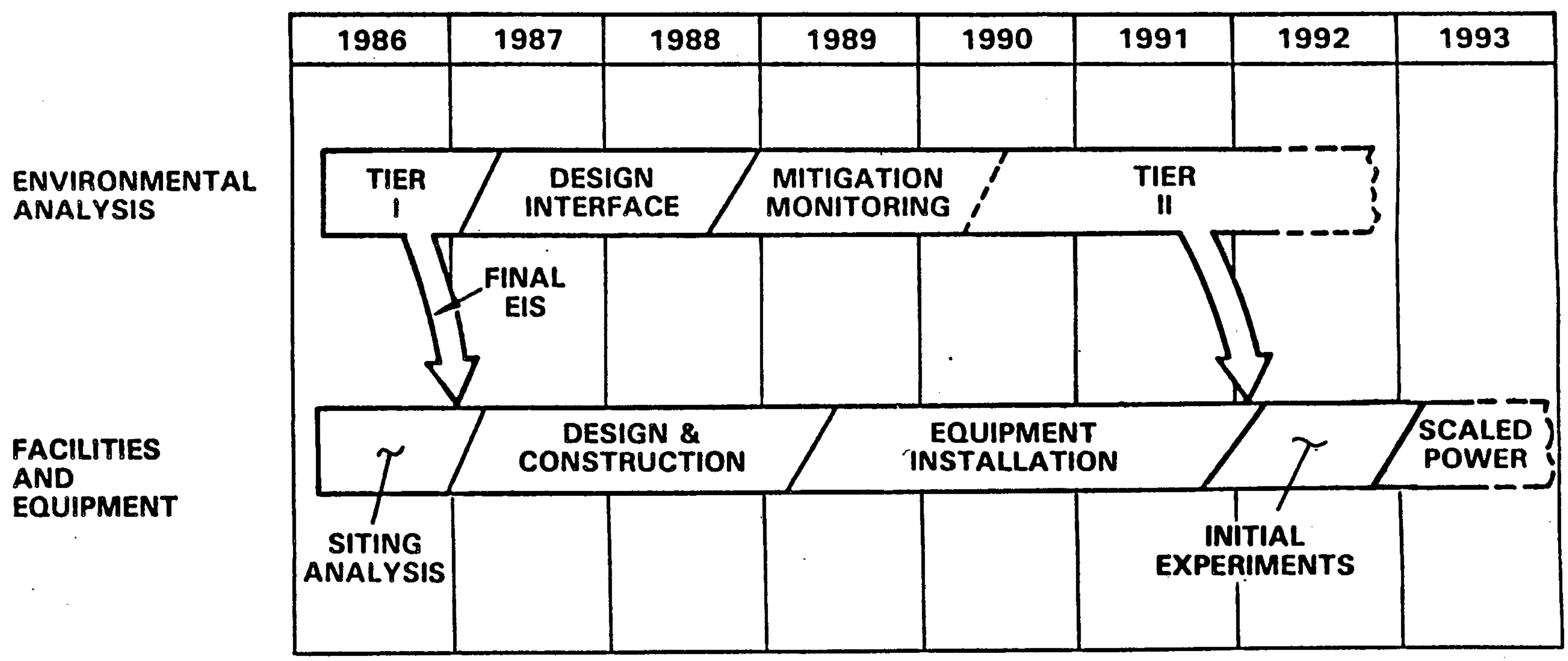


Figure I-7. Proposed Schedule for Construction and Operation of GBFEL-TIE.

a. Low Power

The goal of the first phase of the proposed program would be to accomplish initial "uplink" experiments; that is, directing the beam to an atmospheric test platform to measure and demonstrate the laser's capabilities. Experiments would be conducted during this phase to investigate solutions to key atmospheric effects such as turbulence, thermal blooming and SRS. This phase would also investigate the concerns associated with mirrors and optics technology, pulse duration, as well as control of the adaptive optics components. The results of these tests would be used to determine the need for and potentially guide the development of the second, high power phase of the experiment.

b. High Power

The second phase in the proposed GBFEL-TIE program would demonstrate high power atmospheric propagation of the laser beam. The existing low power laser facilities would be upgraded to meet the requirements of the high power experiment. A larger beam director would be developed and incorporated to provide optics compatible with the higher power laser. The beam control system would also be scaled and upgraded to accommodate the higher energies and greater number of control subapertures needed for atmospheric correction of the new system. A new high power beam control facility would be constructed to house the new beam director and beam train consistent with the overall GBFEL-TIE facility design. These components of the laser system are described in detail under Laser Description.

The principal experiment to be conducted during this testing phase would be the demonstration of all the functions and equipment required to produce and successfully propagate a high power laser beam through a turbulent atmosphere to a specified target. While this EIS identifies and evaluates the impacts of both phases in as much detail as the present state of project design allows, environmental analyses will be a continuing effort during the design of the high power phase. Appropriate additional environmental documentation will be prepared to assist decision making regarding Phase II.

3. Laser Description

An artist's conception of the layout of the GBFEL-TIE is presented in Figure I-8. The facility can be divided into two major components, the laser and the beam control system. The laser is further divided into five subcomponents: (1) electron injector, (2) linear accelerator, (3) wiggler, (4) energy recovery/electron beam dump and (5) resonator/diffraction tunnel. The beam control system consists of the adaptive optics and beam director. Each of these subcomponents is described in detail in the following paragraphs.

a. Electron Injector

The electron injector provides free electrons to the laser system by driving electrons from a hot plate called a cathode. A high voltage pulse heats the cathode. At the same time the cathode is charged, another plate called the anode is also pulsed with a high voltage. The anode attracts the electrons from the cathode, causing the electrons to discharge. This discharge of electrons is then focused into a beam using magnets. The beam exits the injector and enters the linear accelerator.

GBFEL TIE FACLITY

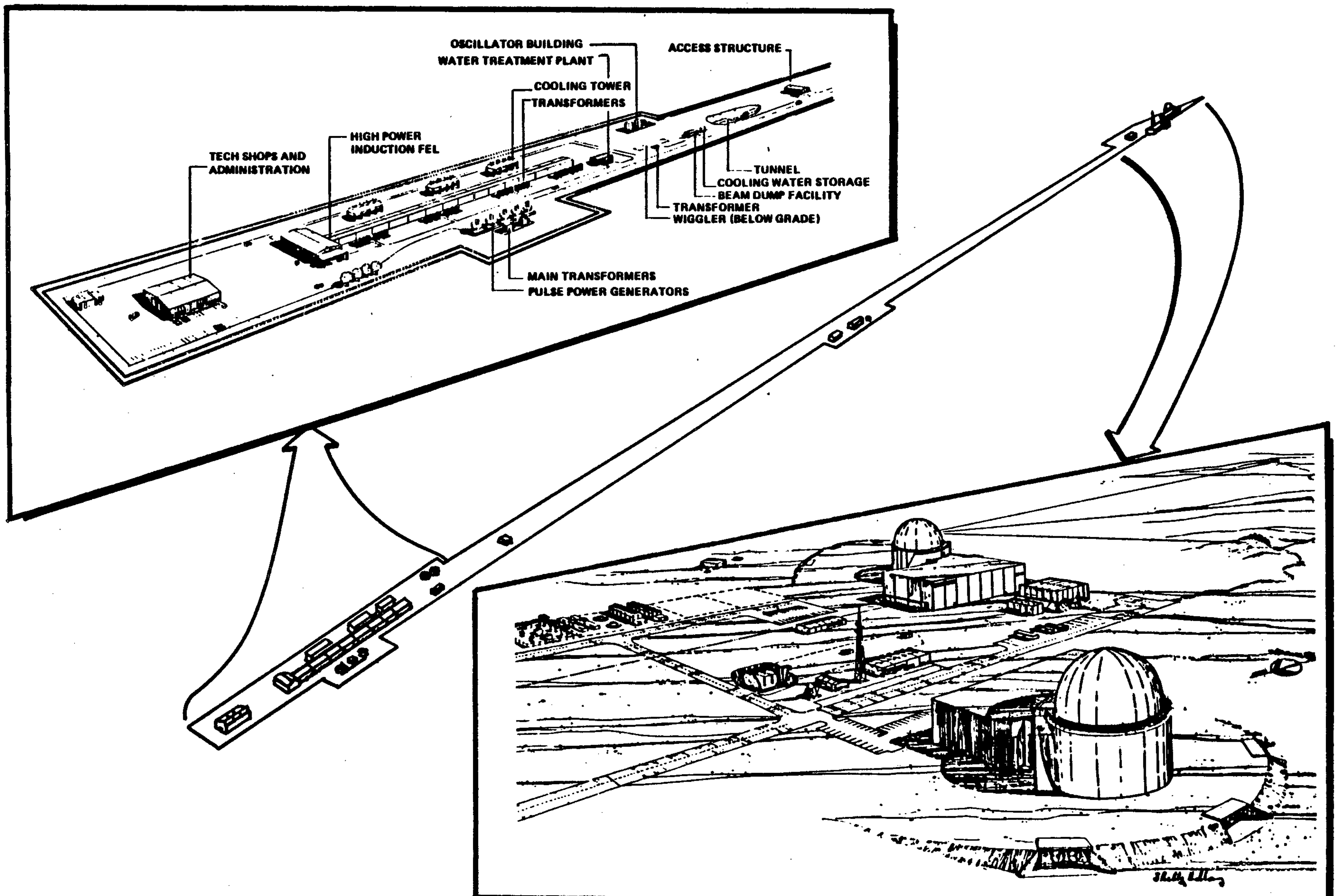


Figure I-8. Artist's Conception of GBFEL-TIE Facility.

b. Linear Accelerator

There are two types of accelerators which are being considered for use in the GBFEL-TIE -- a radio frequency linear accelerator and an induction linear accelerator. The two types produce different effects for a few parameters, as highlighted below under the individual descriptions of the two types of accelerators.

(1) Radio Frequency Linear Accelerator

In the Radio Frequency linear accelerator (RF linac) radio frequency electromagnetic fields are applied to a specially designed cavity. These electromagnetic fields interact with pulsed bunches of electrons from the injector resulting in acceleration and focusing of the electrons through the cavity. By putting many of these cavities in line the process can be repeated and additional velocity added to the electron beam.

RF linacs provide a small beam current when compared to the Induction Linear Accelerators, but it is a steady stream (there are many hundreds of millions of short pulses one billionth of a second long). This produces a low gain laser and requires the use of an optical resonator (mirrors) to increase the laser power.

The resonator is a feedback system which increases the intensity of the beam produced in the RF linac. The beam output of the wiggler (described later) is directed by parabolic and hyperbolic mirrors back to the input of the wiggler, at the end of the RF linac. The "feedback" beam reenters the wiggler along with the next pulse of electrons from the RF linac. At each pass more energy in the form of photons would be added. The result would be a high intensity output beam.

(2) Induction Linear Accelerator

The Induction linear accelerator (Induction linac) receives its electrons from the electron injector and proceeds to increase the electrons' velocity. A series of electrical magnets which lie in a special cavity (i.e., cell) pull the electrons through the accelerator tunnel, increasing the electrons' velocity as they travel down the cell. Prior to the electrons entering the cell, the magnets are turned on to produce electromagnetic fields. At the moment the electrons enter the cell, a high voltage generated by specially designed pulse transformers is applied across the cell. At first, the high magnetic fields prevent a large electron beam current from flowing. While the voltage is still impressed across the cell, the magnetic field is reduced, causing the beam current to increase. When the fields are at a minimum, the electron beam attains its highest acceleration. By aligning many of these cells into modules and providing variable voltages at the right time, the beam of electrons increases its velocity as it travels through the accelerator.

In addition to the magnets whose fields vary with time, static magnets are located along the accelerator length to guide the beam from one cell to the next.

A master oscillator/power amplifier (MOPA) is situated at the end of the Induction linac and is used to increase the intensity of the laser beam. The MOPA is a relatively small laser whose light is amplified in the wiggler.

The beam of light from the master oscillator is mixed with the electron beam from the Induction linac before they enter the wiggler. The photon energy produced by the electron beam adds to the photon stream as they both travel through the wiggler. Thus, the net effect is the intense light beam at the output of the wiggler, discussed below.

c. Wiggler

In order to release radiation (light) from the beam of electrons, it is necessary to perturb their motion. The accelerated electrons enter a device called a wiggler (or undulator) where magnets cause the electrons to move back and forth (i.e., wiggle). This transverse movement causes the electrons to lose energy in the form of photons. The wavelength (color) and efficiency of the electron energy conversion can be controlled by manipulating strength and spatial period of the magnetic field.

d. The Electron Beam Dump

The output beam exiting the wiggler is a mixture of electrons and photons. The beam directed through the atmosphere must consist of only photons; thus, the electrons in the beam must be removed. These electrons are separated out by bending magnets and routed down a short tunnel under vacuum to the electron beam dump. The beam dump will be encased in concrete and consist of a heavy block of material such as graphite or lead which can handle the heat caused by the bombarding electrons. The designs proposed for electron beam dumps consist of large cylindrical steel or aluminum tanks. The tank is attached to the beam transport tube by a vacuum tight flange at one end. It is isolated from the vacuum in the laser and electron beam tube by a thin sheet of beryllium. Typical beam dump dimensions depend on the amount of energy which must be absorbed and can range to 10 or more feet in diameter with lengths of 15 or more feet. Inside the tank, on the other side of the beryllium window is the electron energy absorption material, typically sheets of graphite several inches thick and thin sheets of aluminum which separate the graphite sheet from water which flows around each layer of aluminum clad graphite. The water cools the graphite blocks.

The beam dump is mounted off to the side of the accelerator. This location may be a room with added shielding and will contain the beam dump cooling water circulation system. This cooling system is a closed loop system with filter and ion exchange resins to remove any material dissolved in the water. These resins become radioactive after a time because of the radioactive components produced in the beam dump. The room around the beam dump must be large enough for maintenance and must have adequate space to remove the beam dump if this ever becomes necessary. The electron beam energies are absorbed by the dump. In some applications (i.e., RF linac) the electron beam energy is recovered and reused for an increase in laser efficiency. The remaining photon beam then passes through to the diffraction tunnel discussed below.

e. Diffraction Tunnel

The beam leaving the wiggler of the induction type laser is no larger than the diameter of a pencil. In order to produce a safe energy density on the optics, the beam's diameter would be enlarged by allowing it to naturally expand through a long shielded diffraction tunnel. The induction linac would require a diffraction tunnel approximately five km long and approximately two meters in diameter. The beam tube in the tunnel would be operated in a vacuum. Access points for maintenance/repair of the tunnel would also be constructed at various locations along the diffraction tunnel. The RF linac would not require a diffraction tunnel since it uses a resonator which produces a beam with a larger diameter.

f. Adaptive Optics

Adaptive optics are required in order to correct for atmospheric effects (e.g., turbulence, thermal blooming, etc.). The adaptive optics correct the beam by changing the laser's light to have properties opposite to the distortions the air would have on the beam. In optical terms this is called "phase conjugation".

To make these corrections, the Adaptive Optics System measures the distortion in the path between it and the target, such as a rocket, using the light from a beacon (Figures I-9 and I-10). The beacon light which travels down the beam path is received at the laser and the distortion caused by its trip is measured with a wave front sensor. A computer calculates the reverse of these distortions and gives commands to a mirror which can change its shape (i.e., deformable). When the laser light reflects off the deformable mirror it picks up the reverse distortions it will encounter on its trip through the atmosphere. As the laser beam goes through the atmospheric distortions, its reverse distortions are removed and the beam emerges at the top of the atmosphere with the greatest amount of coherence.

g. Beam Director

The beam director contains the mirrors and lenses which receive the laser beam from the adaptive optics and transmit the beam to air, ground, or space diagnostic targets. The beam director for the low power experiment is a few meters in diameter, but the diameter of the high power beam director may be several times larger.

4. Test Scheduling

It is anticipated that one to two tests per day would be conducted; however, a maximum of six per day may be performed with a maximum of about 840 tests per year. Duration of laser beam generation for each test would be no more than 60 seconds. Each test series may require up to two weeks, followed by an analysis period during which time the results of each test would be analyzed and any maintenance and/or adjustments to the system would be performed. This analysis period would require from one to six weeks. The actual number of test series conducted each year would depend upon climatic conditions, the ability of the beam control system mirrors to withstand the intense energies, and results from previous tests which could indicate that system adjustments/modifications are required. However, it is presently anticipated that five to 10 test series would be conducted within a typical year (approximately 280 tests per year).

5. Diagnostic Targets

The proposed GBFEL-TIE would utilize diagnostic targets at ground level and subsequently, airborne and space orbiting targets. Each of the target types is discussed below.

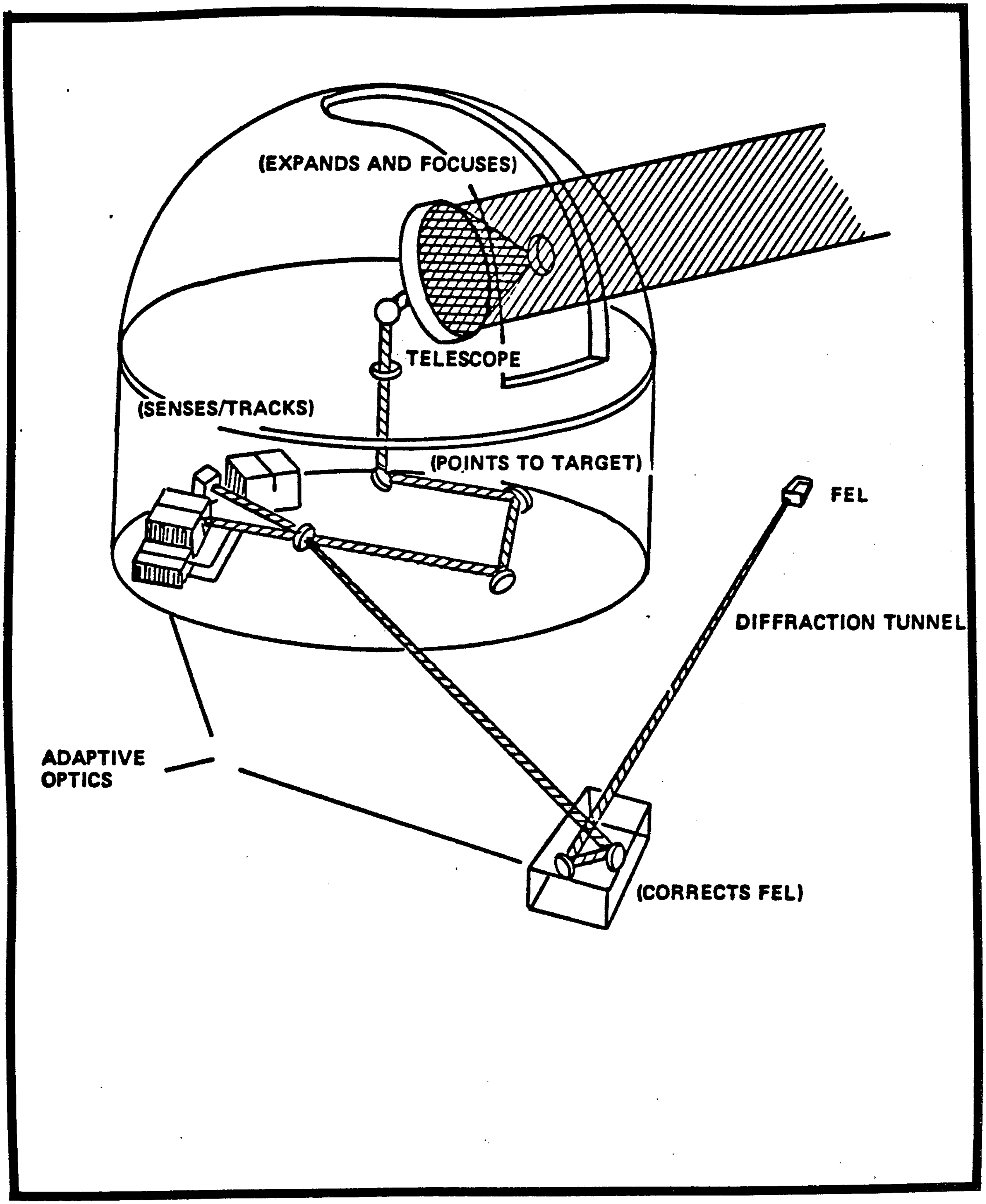


Figure I-9. The Beam Control System.

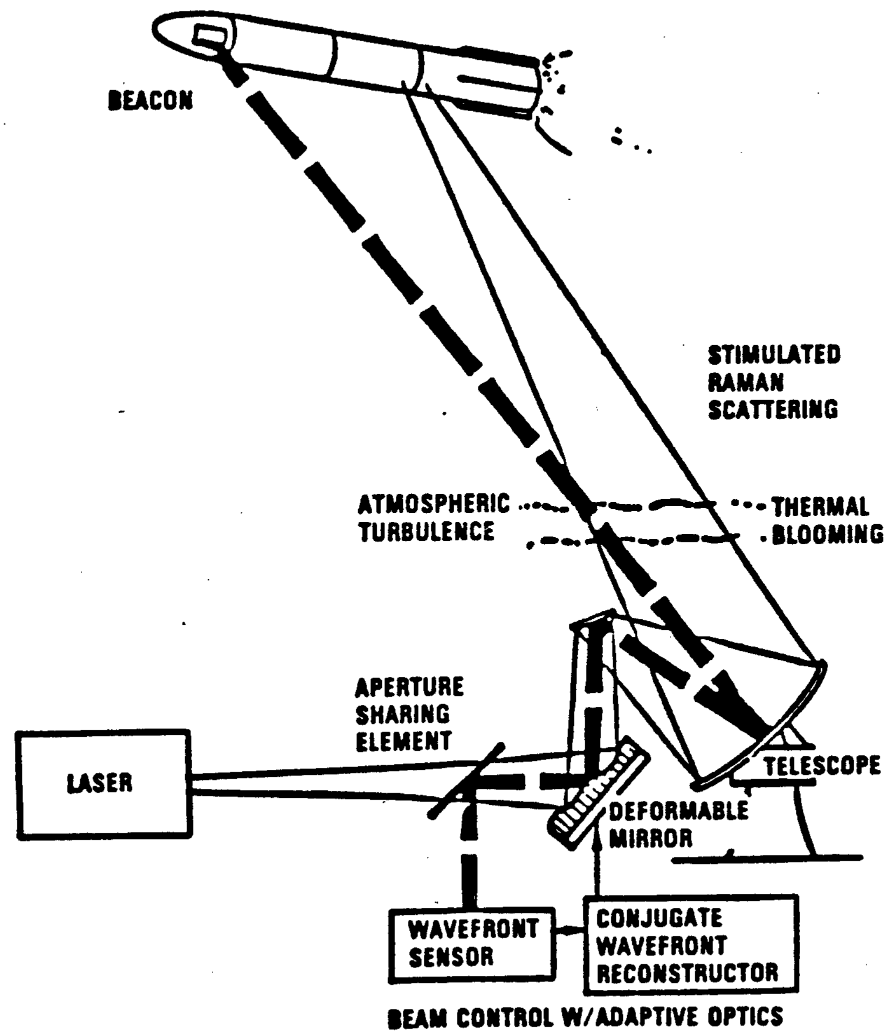


Figure I-10. The Adaptive Optics.

a. Ground Targets

During tests requiring ground targets, the beam director would aim the laser beam horizontally. The ground target test range would occupy an area of about 2 x 9 km, which would contain several beam receiver (target) sites located at various distances from the beam director. Each receiver site would contain a target board and a backstop to prevent emission of stray light beyond the receiver site. The target boards would be mounted to a stationary test stand.

The backstop and large sections of the target boards would consist of a material such as carbon cloth or graphite blocks. These structures would absorb the beam energy and convert it to heat. A building would be constructed around each target to contain any energy scattered by the targets. An aperture in the face of this building would be large enough to collect 99.9 percent of the beam; the remainder would be absorbed by the face of the building. The depth of the building would be designed to prevent 99.9 percent of the scattered light from the target or backstops from exiting the building. The small amount of scattered energy that escapes the building would be well below the maximum permissible exposure threshold for eye safety outside the one km safety zone. The entire test range would be surrounded by a fence.

The GBFEL-TIE laser beam would produce only thermal effects, and no residual ionizing radiation or ionization to the ground targets, backstops, or surrounding air would be expected. Disposal of target boards or other equipment damaged by overheating would be conducted in accordance with the approved solid waste plan.

b. Airborne Targets

Airborne targets may utilize balloons, drones, or small probe rockets. The probe rockets would have a beacon pointed toward the GBFEL-TIE site. The rocket would have a line array of detectors down its side to measure the beam intensity. The target board would be pointed at the GBFEL-TIE by the inertial navigation system of the rocket. The target board payload would be recovered by parachute after the test. The GBFEL-TIE would fire only when the rocket is above an angle of 45 degrees to the local horizon. Many of these tests would be conducted with the GBFEL-TIE at less than full power to prevent damage to the recoverable payload.

Each test would be scheduled through WSMR's National Range (NR) Directorate to insure that proper airspace restrictions are implemented. In addition, launch sites and impact areas would be coordinated through and approved by NR, as well as the systems designed to terminate or recover airborne targets.

c. Space Targets

The space target would consist of a circular target board mounted onto a satellite or a large flat carbon cloth plate mounted on the end of a boom projecting from a satellite. The satellite would orbit at an altitude of 300 to 500 km with an orbital inclination of 35 to 40 degrees. As in the case of the airborne targets, airspace would be restricted and controlled through WSMR NR. The beam would leave the controlled airspace at a minimum altitude of 60,000 feet above mean sea level (MSL).

6. Test Sequence

The proposed test sequence would begin with numerous system checks conducted on various components to assure that all safety, communication, thermal, mechanical and electrical elements are operating properly. Once the system checkout is completed, ground target tests would commence at less than full power and increase in a series of steps during subsequent tests as the ability of the optics to correct for atmospheric aberrations and control of the beam energies improves. Ground testing and the necessary refinements of the adaptive optics and beam director could require six to eight months.

Upon successful completion of the ground target tests, the airborne target test series would start. These series would initially consist of demonstrating the beam director's ability to passively track (i.e., no FEL beam energy) a slow moving, airborne target (e.g., balloon, remote controlled drone, etc.). Once this ability is successfully demonstrated, the test series would begin to evaluate the ability to actively track various target types with a low power level beam and progressively increase the beam energy levels as well as the target's speeds and distances through sequential successful tests. Airborne targets are not presently expected to contain live munitions or explosives.

The final test series would utilize space satellite targets to measure and evaluate the equipment performance. Ground targets would first be used to check various components and subsystems immediately prior to satellite flyover. During the first few passes of the satellite, the beam director would only passively track the target and then begin to illuminate it with a low energy laser beam. The power of the beam would be increased in a step series as each sequential test successfully demonstrated the ability to propagate the beam through the atmosphere.

7. Power Requirements

Power requirements for base facility load and pre-test conditions would be approximately 60-100 megawatts for both the low and high power phases. This base load would be provided from the existing commercial transmission power grid.

Instantaneous peak pulse power requirements for the low and high power phases of the proposed GBFEL-TIE are not yet precisely known. Phase I peak pulse power requirements are expected to be between 300 and 600 megawatts, and studies conducted to date indicate that this requirement can be handled by the commercial power grid. Phase II peak pulse power requirements are more difficult to define at present, but could range from 500 to 1,000 megawatts.

Present planning would call for use of grid power in phase I. Phase II pulse power requirements would be supplied from the grid, on-site energy storage systems, on-site power generation systems, or a combination of the three.

A stand-by system for on-site power generation may be necessary to prevent damage to system components in the event of a power failure during a lasing experiment. The best current estimate indicates an initial load of 20 megawatts to ensure orderly shutdown of the system. Four 5-megawatt generators would be operational only during experimental testing runs and/or diagnostic test of subsystems.

8. Personnel Requirements

As can be seen from Table I-1, there are two distinct construction peaks predicted. The larger of the two would occur in 1992, assuming Phase II is undertaken. The number of laborers, including electricians, masons, construction equipment operators, carpenters, etc., is predicted to rise, fall and rise again before completely falling off at the end of the project. The majority of construction labor personnel are expected to come from local sources until the fifth year (Phase II) of the project, after which about half is predicted to be local and half non-local. The estimated socioeconomic effects of the influx of these non-local workers are presented in Section IV of this report.

The number of operations personnel required is predicted to increase steadily to a plateau of 400-500 workers by 1992. Most of these would be highly technical personnel with expertise in laser and optics design and operation.

9. Water Requirements

During the operational phase, the total water requirement would be about 1,000 gallons per minute (gpm) of water, not exceeding 700 parts per million (ppm) total dissolved solids (tds).

This represents a maximum demand of 1,400 acre-feet per year and includes industrial (cooling) as well as domestic (drinking/sanitary) needs. Cooling water requirements could be reduced if an air cooling system is used on those days/nights when ambient air temperatures drop below 75°F. The total water demand during the high power phase, however, may increase if a power generation plant is required to meet the peak power demands during this phase.

10. Construction Materials Requirement

The following is a list of construction materials and amount, by type, that are estimated to be required by the proposed GBFEL-TIE.

(1) 75,000 tons of aggregate
(2) 78,000 cubic yards of concrete
(3) 34,000 tons of asphaltic concrete
(4) 4,000 tons of structural steel
(5) 16,000 tons of rebar
(6) 42 acres of metal roofing and siding
(7) 9,000 concrete masonary blocks (8x8x16)
(8) 31,000 linear feet of elliptical corrugated steel

All of these materials are available from local contractors and/or distributors. A quarry may be required at the North of NASA site. It should be noted that these data are estimates of the requirements for the actual facility only and do not include material requirements for parking lots and access roads. Materials that are excavated during the construction of the beam tunnel, etc., may be used for construction of ancillary facilities (e.g., parking lots, sewage lagoons) or used in landscaping surrounding areas.

Table I-1

Manpower Profile Estimate

	FY87	PHASE I FY88	FY89	FY90	PHASE II FY91	FY92	FY93
Construction	100-130	1060-1200	800-1000	330-410	1410-1760	1600-2000	1200-1500
Operations	25-50	100-150	200-300	250-350	300-400	400-500	400-500
Total	125-180	1160-1350	1000-1300	580-760	1710-2160	2000-2500	1600-2000

11. Ancillary Facilities

a. Sewage Treatment

Two potential sources of industrial wastewater and one source of domestic sewerage would occur at the GBFEL-TIE project site. These sources and the proposed treatment systems are described in the following paragraphs.

(1) Industrial Wastewater

An evaporative cooling system consisting of multiple induced or forced draft cooling towers (typically 10 m x 5 m x 10 m each) would be used to produce cool water for use in heat exchangers to cool the accelerator, electrical transformers and optical system. Wastewater from the evaporative cooling system would be produced at a rate of 75 gpm; stabilized chlorine would be added as a biocide at a rate of one pound per 10,000 gallons. The wastewater would be discharged to an evaporation pond and would require no additional treatment. The pond would be approximately 18 acres in size and would be lined, according to EPA regulations. Any discharge would be required to comply with New Mexico Water Quality Control Commission Regulations.

The other potential source of industrial wastewater is the closed loop heat exchanger system required to cool the accelerator, electrical transformers and optical system. Approximately 3,000 parts per million (ppm) benzotriazole and 1,500 ppm benzoic acid would be added as biocides to the cooling water in the optics heat exchange. This cooling system would be a non-contact closed system and thus would not generate industrial wastewater except during routine maintenance and/or inadvertent leaks or spills. During these situations the wastewater would be discharged into a separate evaporation pond. This pond would be approximately two acres in size and would be lined according to EPA regulations. Residues from the pond would be removed periodically and disposed of in accordance with the approved WSMR solid waste management plan.

A high grade, PCB-free transformer oil would also be used to cool the accelerator and electrical transformers. This oil could mix with the cooling water if a seal within the heat exchanger malfunctions. The water/oil mixture would then be discharged into storage tanks for proper treatment and disposal.

None of these industrial wastewaters will contain radioactive materials.

(2) Domestic Wastewater

During the initial construction phase, portable latrines would be provided. These latrines would be routinely maintained and serviced by approved and licensed contractor(s). All sewerage waste would be disposed off-site in accordance with State of New Mexico regulations.

During the operation of the GBFEL-TIE project, a maximum of 500 people would be on-site and thus would produce daily up to 25,000 gallons (50 gallons per person per day) of domestic wastewater. Commercially available treatment package plants would be installed to treat this wastewater, if required by EPA or New Mexico Environmental Improvement Division (EID).

b. Solid Wastes

WSMR presently maintains a 50-60 acre landfill which is expected to reach its capacity, under current fill rate, within 50 years. Construction wastes (e.g., scrap lumber and concrete) from the proposed GBFEL-TIE would significantly reduce this capacity; therefore, such wastes would be buried on-site at a landfill constructed within suitable soil types. The landfill would be closed out, covered and reseeded upon completion of construction activities. No hazardous or toxic wastes (e.g., oil filters) would be discarded in the landfill; toxic wastes generated during construction activities would be properly disposed of in accordance with EPA and State of New Mexico regulations. Excavated materials, as mentioned previously, would be used on-site for construction of ancillary facilities and landscaping, where practical.

Solid wastes generated during the operation and maintenance of the proposed project would be collected and disposed of by approved and licensed contractor(s) in accordance with State of New Mexico regulations.

c. Water Treatment

It is presently envisioned that no treatment facilities would be required, except for chlorination for drinking water and a possible deionization system that would be used for the closed loop cooling system as discussed previously.

d. Power Generation/Storage

The peak pulse power demand for both the low and high power phases would be assessed for the potential of supplying these demands from the existing commercial power grid within the region. Consideration would be given to on-site generation and/or energy storage devices to provide all the necessary power or to supplement the deficiency of the existing power grid.

Possible methods of generation/energy storage devices presently being evaluated include, but are not limited to: super-conducting magnetic storage devices, batteries, fuel cells, diesel/gas fired turbines, fossil fuel generation plant and flywheels. Nuclear power is not being considered as a viable generation alternative. Four 5-megawatt generators may be operated during each test for stand-by emergency power to prevent damage to certain laser components.

A separate environmental analysis of the power generation/energy storage devices would be conducted.

e. Power Transmission Lines

As discussed previously, the power demand for the low and high power phases could possibly be met from the existing grid of power transmission lines. Existing lines large enough (i.e., 345 kv) to adequately supply the required power for Phase I are depicted in Figure I-11. Construction of transmission lines from this grid to the selected site would be required, however. Potential corridors for power lines to each site are discussed in Section II, Comparison of Alternatives.

f. Road and Railroad Requirements

Roads would have to be constructed to each site to allow adequate and controlled access as well as accommodate freight and shipping lines. In addition, railroad spurs may also have to be constructed to accommodate shipping of heavy equipment. A discussion of potential road and railroad

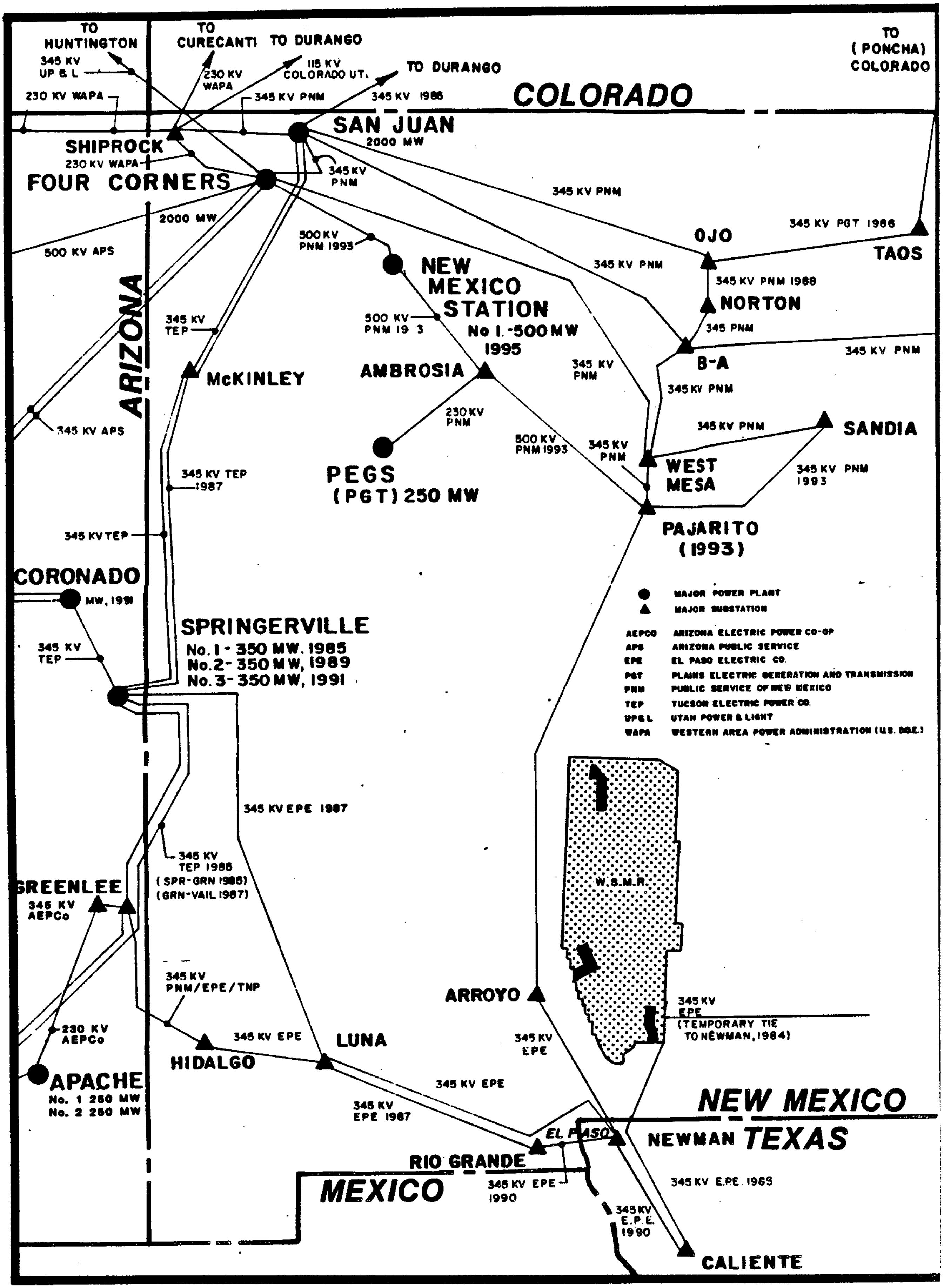


Figure I-11. Existing Area Power Line Grid.

corridors for each site are presented in Section II, Comparison of Alternatives.

g. Communication Cables

Communication cables would be required to each site. It is presently expected that these lines would be constructed immediately adjacent to the access roads in order to avoid developing additional rights-of-way.

E. Potential Program Conflicts

Potential conflicts with other existing and proposed WSMR programs could occur at all three sites upon implementation of the proposed GBFEL-TIE. The U.S. Air Force (USAF) is currently investigating the possibility of deploying the Small Intercontinental Ballistic Missile (SICBM) program to WSMR. Each of the proposed sites under consideration for the GBFEL-TIE is also a portion of the deployment area proposed for the SICBM. The USAF has recently (November 1986) prepared a Legislative EIS to address the proposed deployment.

1. Stallion

The Stallion site and surrounding areas are frequently used as impact areas for long range and strategic missile firings (e.g., Pershing). This area is frequently used for missile firings that utilize large dispersion areas, requiring evacuation and use of lands adjacent to the northwestern boundary of WSMR. These missile firings require the closure of range roads 5 and 7. Long range trajectories (from firing sites on Green Mountain, Utah and Mt. Home, Idaho) overfly the proposed site. Although not currently in use, these trajectories are a unique WSMR asset. The Defense Nuclear Agency (DNA) utilizes an area approximately 16 km southeast of the Stallion site as a permanent high explosive area to simulate blast effects for various research and development projects. Holloman Air Force Base (AFB) and Kirtland AFB also use the same general area as DNA as an aircraft training range. These programs may require scenario modification or be eliminated, reduced or required to move to other areas if GBFEL-TIE were located at Stallion. In addition, U.S. Army Missile Command's Multiple Launch Rocket System (MLRS) program is presently attempting to obtain approval to use the Stallion Warhead Impact Target (WIT) area, located at the southern end of the Stallion site, for missile firings from a launch area under construction approximately 5.6 km southwest of Stallion Range Center. Some of the missiles launched by the MLRS would contain live munitions. The Stallion WIT is also used for LANCE missile tests but from other firing sites.

Radio frequency (RF) and electromagnetic (EM) emissions could possibly conflict with the National Radio Astronomical Observatory Very Large Array (VLA) facility located west of Socorro, New Mexico, although studies to date show that proper design and installation of RFI and EMI shielding of GBFEL-TIE facilities will preclude interference to the VLA.

Additionally, the USAF currently conducts air combat maneuver training in the Stallion area. Potential effects on operations utilizing Air Combat Maneuvering Instrumentation (ACMI) include loss of approximately 20 percent of the WSMR areas used approximately 10 percent of the normal range time. Approximately 850-900 sorties per year could be affected by either being moved to adjacent areas or by being subjected to additional scheduling constraints.

Use of Stallion site could also conflict with NASA's high altitude sounding rocket program in terms of requiring additional risk to be taken by GBFEL-TIE for certain NASA launches. A new SDI program, EXCEDE III, proposes use of a launch site which overflies the Stallion site. Field training exercises are also periodically conducted in the Stallion vicinity and would probably have to be relocated.

2. North of NASA

The North of NASA site has several potential conflicts in the immediate area. There would be a possibility of interference with NASA's Telemetry Data Relay Satellite System (TDRSS) with radio frequency (RF) and electromagnetic emissions (EM) from GBFEL-TIE. Present indications are that RFI and EMI generated will be contained on-site by proper shielding built into the facilities. Use of this site would also conflict with two on-going missile programs. One of these is the U.S. Navy Vandal missile and the other is NASA's high altitude sounding rocket program. Further, the North of NASA site lies within the YONDER aerial gunnery training range, used by U.S. Air Force for training from Holloman Air Force Base. Increased airspace restrictions caused by the GBFEL-TIE could lead to an adverse impact on this defense training operation.

Over 12,000 acres (approximately half) of Jornada Experimental Range's Pasture 19 would be encompassed by the North of NASA site and thus eliminated from future grazing and other research programs. In addition, the North of NASA site may cause conflicts with the San Andres National Wildlife Refuge by further limiting air and land access to the refuge.

3. Orogrande

An area just west of the Orogrande site is overflown by Pershing 1A missiles during test firings. Although no direct impact is expected, there is reduced reaction time for flight safety personnel and potential for premature destruction of a missile should it appear to stray toward the GBFEL-TIE.

The area encompassed by the proposed GBFEL-TIE Orogrande site is used for field training exercise conducted by the U.S. Readiness Command and other agencies. Such exercises in this area would possibly be precluded or limited if the Orogrande site is selected. Firings at various launch sites along Nike Boulevard require the road to be closed for periods ranging from one to two hours. These closures occur frequently, often more than once daily. Such closures may interfere with construction and operation of the proposed GBFEL-TIE. The Office of the Test Directorate (OTD) uses a laser range near the Orogrande site for tests involving laser sensors and infrared investigations. The RFI and EMI provided by the GBFEL-TIE could conflict with OTD's programs. Also, NASA has expressed a concern that laser propagation tests at Orogrande could interfere with their TDRSS operations. However, recent studies indicate that the proper design and installation of RFI and EMI shielding would preclude interferences with OTD and mission scheduling with NASA would preclude possible interference with the TDRSS program.

The Vulnerability Assessment Laboratory (VAL) programs include sensitive electronic equipment that EMI and RFI from GBFEL-TIE could possibly hinder. Again, proper design and installation of shielding should preclude interference with VAL programs.

Restrictions of airspace for GBFEL-TIE have the potential to conflict with commercial aviation activities around WSMR. Additional restricted airspace, if required, will be addressed in other environmental documentation and approved by the Federal Aviation Administration (FAA). During the public comment period, a concern was expressed about the Alamogordo-El Paso flight corridor. Preliminary indications are that flights above 10,000 feet MSL may have to be restricted, but only during periods of testing involving aerial and extra-atmospheric targets. Should this or any other airspace need to be restricted, it would be done on an as-needed, call-up basis similar to that employed at the present time on the western and northern boundaries of White Sands Missile Range.

On 10 January 1987, officials of WSMR stated that for present operations, Stallion site was significantly inferior to North of NASA and Orogrande. For foreseeable future operations, several programs could not be accomplished at Stallion if that site were chosen.

F. Controversial or Unresolved Issues

The unresolved issues concerning this proposed project include:

- power and water transmission line, road and potential railroad spur routes
- power generation/energy storage devices

General analyses of the impacts of such rights-of-way are included in this document insofar as they are pertinent to selection of a project site. The specific routes of the various facilities would be identified at a later date after identification of specific sources and further design choices are made. More investigations will be required concerning the best transmission line route to use considering environmental, engineering and economic resources.

Data generated during the low power phase would aid in the determination of peak power demands and the power generation/storage requirements for the high power phase. As indicated above, this component of the proposed project would be addressed in a subsequent environmental analysis.

Controversial issues may arise concerning rights-of-way and easements that would be required from private and/or other public (i.e., USDI, USDA) agencies for transmission lines, roads and possible railroad spurs. Potential conflicts with other existing and/or proposed programs on WSMR and adjacent USDA and USDI lands would also have to be resolved.

It is the intent of USASDC to proceed with the GBFEL-TIE as described in this document, subject to the approval and support by the U.S. Congress and the Administration. As in any major Federal program, part of the success of the project is dependent upon adequate appropriations of funds. If funds were eliminated by Congress after construction of the proposed project had commenced, adverse socioeconomic effects could result. Such effects would depend on the extent and timing of the project curtailment and the mitigation measures and means available.

COMPARISON OF ALTERNATIVES

II. COMPARISON OF ALTERNATIVES

A. Background

1. Treaty Considerations

In consideration of the 1972 Anti-Ballistic Missile (ABM) Treaty between the United States and the Soviet Union, the Ground Based Laser project would be located at White Sands Missile Range, New Mexico.

2. WSMR Constraints

As mentioned previously, WSMR currently supports over 80 Department of Defense and other governmental programs. These existing activities and facilities preclude using certain WSMR areas. Also, significant portions of lands contained within the boundaries of WSMR, such as White Sands National Monument and San Andres NWR, are not freely usable for major new facilities or activities.

Initially, four criteria were used to identify potential GBFEL-TIE project sites on WSMR: (1) WSMR location in reference to support facilities, (2) compatibility with existing facilities and missions, (3) compatibility with present and/or projected land use, and (4) topographic/areal acceptability.

As a result of these considerations, 14 areas within which the proposed GBFEL-TIE could potentially be located were identified, as shown in Figure II-1.

These potential sites were then screened and evaluated against 14 detailed criteria, presented below:

1. Land Area
2. Gypsum Deposits
3. Atmospheric Conditions
4. Experimental Issues
5. Program Conflicts
6. Safety
7. Environmental Considerations
8. Water Availability
9. Electrical Power Availability
10. Geology/Soils
11. Terrain Characteristics
12. Constructability
13. Security
14. Facility Support

These criteria were given a weighting factor and each potential site was evaluated against each criterion(4). The Landfill, Small Missile Range and North Oscura Peak sites were eliminated from further consideration because of inadequate land area. Proximity to gypsum deposits eliminated the Three Rivers, Test Track, HELSTF and Monument sites from further consideration. Of the remaining sites, the Stallion, North of NASA, and Orogrande sites represented the most reasonable range of alternatives and were carried forward for detailed analyses. Evaluations of the three potential sites are summarized in the following paragraphs and described in detail in Section III, Affected Environment, and Section IV, Environmental Consequences.

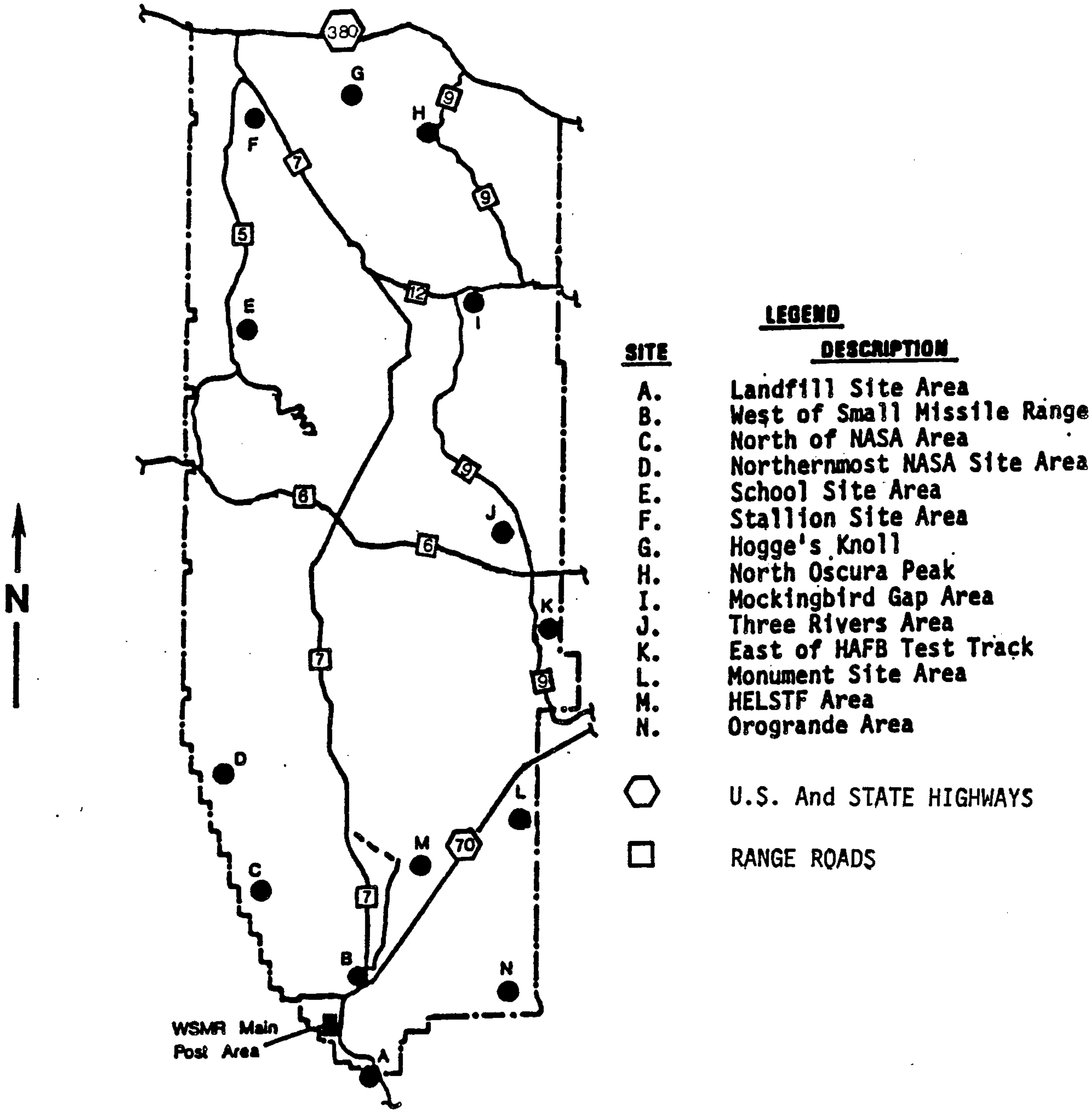


Figure II-1. Location Map of 14 Preliminary Sites.

B. WSMR Alternative Sites Still Considered Viable

This subsection describes the potential impacts that would occur as a result of constructing and operating the proposed GBFEL-TIE. For comparison purposes, these discussions are presented in matrix form for the major resource groups and provide only brief statements concerning the anticipated consequences. Detailed evaluations of each parameter at each site are contained in Section III, Affected Environment and Section IV, Environmental Consequences. Policies and measures that are employed by WSMR or that would be implemented in order to mitigate or obviate adverse consequences are discussed in Section V, Mitigation Measures.

1. Physical Resources

For the purpose of this presentation, climate, soils, geology, and air quality are grouped as physical resources. Potential impacts to these parameters at each site are summarized in Table II-1. As can be seen from this table, existing climate and air quality at each of the sites is in the acceptable range of the proposed GBFEL-TIE requirements with no one site being more favorable under normal conditions. The sites are all geologically acceptable from an engineering/construction standpoint. The Stallion site is in a risk three seismic zone, which is in a greater risk zone than the other two sites. North of NASA site is in a risk two zone and Orogrande is on the zone one/zone two border. Soils at the Stallion site exhibit a hazard for wind erosion. Soils at Orogrande and North of NASA sites have a greater hazard for wind erosion than at Stallion. Soil leveling and resurfacing associated with roads, pipelines, powerlines and railroads would impact a minimum of 800 acres at the Stallion site. The North of NASA and Orogrande sites would impact a about 740 acres and 260 acres, respectively.

2. Biological and Cultural Resources

Potential impacts to biological and cultural resources at each site are briefly discussed in Table II-2. Approximately 2,500 acres of various habitat types would be destroyed at any of the sites due to construction of the laser facility, parking lots, sewerage lagoons, etc. Additional acreage would also be restricted at each site due to fences. The acreage that would be enclosed would be about 17,200 (Stallion); 15,500 (North of NASA); and 16,000 (Orogrande). More habitats would also be destroyed or altered at the Stallion site than at the other two sites due to construction requirements for transmission lines, roads and possible railroad spurs. Consequent effects would occur on wildlife in proportional magnitudes. Elimination of grasslands at the Stallion site would adversely affect pronghorn; existing suitable habitat at Orogrande would be made unavailable to gemsbok. There is a greater potential to adversely affect threatened or endangered species (Federal and State of New Mexico) at the Stallion and North of NASA sites. Siting of the GBFEL-TIE at the North of NASA site would adversely affect the desert bighorn sheep, in particular.

The cultural impact is a function of both the areas disturbed and the density of archeological sites involved. Based on sample data indicating densities of cultural sites, impacts to cultural resources were estimated. Table II-2 presents impacts that would be expected from the facility and the minimum lengths required by the utility ROWs. Again, additional impacts would occur within the ground target test range but are not quantified here since the exact dimensions and positions are not presently known and the facilities to be constructed within the range have not been identified; however, the

Table II-1

Potential Impacts to Physical Resources

Parameters	Stallion	North of NASA	Orogrande	No Action
Climate	No impact	No impact	No impact	No impact
Geology	Seismic Risk Zone 3. Seismic intensity VIII and higher.	Seismic Risk Zone 2. Seismic intensity VII.	Seismic Risk Zone 1 and 2 border. Seismic intensity up to VII.	No impact
Soils	Soil leveling and resurfacing of project areas, minimum additional 800 acres for new roads, pipelines and transmission lines right-of-ways. Transportation of soils due to construction	Soil leveling and resurfacing of project construction areas, minimum additional 740 acres for new roads, pipelines and transmission lines right-of-ways. A greater probability for crossing and disturbing drainage areas. Transportation of soils due to construction. Hazard for wind erosion.	Soil leveling and resurfacing of project construction areas, about 260 additional acres for new roads, pipelines and transmission lines right-of-ways. Transportation of soil due to construction. Hazard for wind erosion.	Many of the soil associations at WSMR exhibit moderate to high hazard for wind erosion and some are constantly shifting. Wind erosion and gully formation would continue at present rate, but may be accelerated due to existing on-going construction activities.
Air Quality	Short-term air quality effects during construction; no significant air quality effects from dust and heavy equipment generations. No significant air quality effects from pollutants emitted during operation of FEL project.	Same as Stallion.	Same as Stallion.	Climatic conditions and remoteness of area, in combination with a relative lack of industrial emissions, would allow continued attainment of good air quality.

Table II-2

Potential Impacts to Biological/Cultural Resources

Parameter	Stallion	North of NASA	Orogrande	No Action
Vegetation	800 acres grassland and sagebrush/yucca habitats altered by transmission lines, roads and railroads; about 7,800 acres of grasslands and 9,420 acres of other habitat types (mostly sagebrush/yucca) within site would no longer be available to pronghorn. Annual vegetation biomass loss of about 5,500 tons.	740 acres of various habitats (mostly mesquite-sand dunes) altered or destroyed by transmission lines, roads, and railroads; habitat within site (about 15,500 total acres) made unavailable to gemsbok and mule deer; annual vegetative biomass loss of about 1,300 tons.	260 acres of various habitats (mostly mesquite-sand dunes) altered or destroyed by transmission lines, roads and railroads; habitat within the site (about 16,000 total acres) would no longer be available to gemsbok; annual vegetative biomass loss about 900 tons.	Vegetation at Orogrande and Stallion probably altered to some extent by on-going and/or future projects (e.g., BorderStar, Pershing, etc.). Effects from grazing and aerial spraying at North of NASA due to continued use by Jornada Experimental Range presently not known.
Fish	No impact.	No impact.	No impact.	
Reptiles and amphibians	Approximately 11,200 lizards displaced or lost, with consequent effects to some mammals, raptors, and other birds, due to utility and access facilities; probable impacts to yellow box turtle, WSMR's only turtle species.	Approximately 10,360 lizards displaced or lost; with consequent effects to some mammals, raptors, and other birds, due to utility and access facilities; possible impacts to barred tiger salamander in eastern portion of site.	Approximately 3,640 lizards displaced or lost, with consequent effect to some mammals, raptors, and other birds, due to utility and access facilities.	Alterations of vegetation at each site from on-going activities have consequent effect on herpetofauna.
Birds	About 16,000 birds lost or displaced due to GBFEL facility; about 720 birds displaced or lost due to utility and access facilities; indirect effects include additional losses to larger predators (raptors and mammals) due to reduced prey base, entanglement/electrocutions in power lines, and greater potential of contact with with laser energies due to birds high motility.	About 14,500 birds lost or displaced due to GBFEL facility; about 660 birds displaced or lost due to utility and access facilities; indirect effects same as Stallion site.	About 14,500 birds lost or displaced due to GBFEL facility; about 240 birds lost or displaced due to utility and access facilities; indirect effects same as Stallion site.	Alterations of vegetation at each site from on-going activities have consequent effect on birds.
Mammals	About 280 small mammals displaced or lost due to utility and access facilities; consequent effect to larger carnivores and raptors; additional displacement of pronghorn (i.e., about 19,400 acres made unavailable).	About 220 small mammals displaced or lost with consequent effects to larger carnivores and raptors due to utility and access facilities; additional potential losses to bats; no game mammals affected with possible exception of mule deer (total displacement of about 15,500 acres).	About 60 small mammals displaced or lost with consequent effects to larger carnivores and raptors due to utility and access facilities; additional displacement of gemsbok (i.e., about 16,000 acres made unavailable).	Effects to mammals similar to birds and herpetofauna; intensive management of large game mammals would probably increase their numbers.
Threatened or Endangered Species	Potential impacts to Swainson's hawk, Baird's sparrow, and McCown's longspur; bald eagle and whooping crane may fly over during migration seasons; probable impacts to cranes from powerline construction across river valley; possible peregrine falcon nests in Oscura Mountains; Potential effects on interior least tern if Rio Grande alluvium is used for water supply.	Potential impacts to desert bighorn sheep, Trans-pecos rat snake, and gray vireo; bald eagle and whooping crane may fly over during migration seasons; probable impacts to cranes from powerline construction across river valley; potential peregrine falcon habitat in San Andres. No impact to bald eagle or peregrine would be expected. Potential effects on interior least tern if Rio Grande alluvium is used for water supply.	Little or no probability of impacts to state listed species except Swainson's Hawk; bald eagle reported within 19 km of site; peregrine falcon reported at Lake Holloman; no impact to these species would be expected however.	Intensive management of bighorn sheep would probably increase population slightly; no other surveys or management plans for threatened or endangered species that would be affected by GBFEL-TIE are currently proposed. On-going actions could possibly have adverse affects on threatened and endangered species, particularly plants, without adequate inventories.
Archeological/Cultural Resources	The facility would impact at least 50 acres of archeological sites; Utility rights-of-way would impact an estimated 17.0 additional acres of archeological sites.	The facility would impact at least 550 acres of archeological sites; Utility rights-of-way would impact an estimated 160 additional acres of archeological sites.	The facility would impact at least 50 acres of archeological sites; Utility rights-of-way would impact an estimated 6.0 additional acres of sites.	On-going activities may impact unidentified cultural resources; some artifacts lost due to private collectors, particularly at North of NASA; no knowledge gained due to lack of inventory/evaluation studies.

significance of resources in this area are expected to be consistent with the degree of cultural impacts already identified for each site. The combined impact area for the Stallion site would be about 65 acres. The North of NASA site would be about 660 acres, while the Orogrande site would impact about 55 acres. The variation within each site is a function of the alternative method of water supply. In any case, the North of NASA site's potential adverse impact is an order of magnitude greater than would be expected at the other two sites.

3. Water Resources

Eight alternatives have been identified for potential water supply at the three sites. Each alternative would provide 1,400 acre-feet per year of water. However, local ground water at both Stallion (Alternative 1A) and at Orogrande (Alternative 6) would require desalinization to meet the projected water quality criterion.

- Stallion:
  - Alternative 1 -- surface water from Elephant Butte Reservoir
  - Alternative 1A-- ground water from Rio Grande Alluvium
  - Alternative 2 -- ground water locally
- North of NASA:
  - Alternative 3 -- ground water from Jornada Del Muerto
  - Alternative 4 -- "surface" water from Rio Grande Valley
- Orogrande:
  - Alternative 5 -- ground water from Soledad wells (new line to site)
  - Alternative 6 -- ground water locally
  - Alternative 7 -- ground water from Soledad wells through WSMR post headquarters

The most cost effective water supply source at the Stallion site would be ground water from the Rio Grande alluvium. The pipeline would be approximately 43 km long, and would be contained within the corridor shown in Figure II-2.

The most cost effective source of water for the North of NASA site is a new well field to be developed south of the Jornada Reserve Headquarters (see Figure II-3). This approach would require a pipeline approximately 10-23 km in length, as shown in Figure II-3.

The most cost effective source of water for the Orogrande site would be a new well field in the Soledad Canyon aquifer, located approximately 16 km south of the White Sands Headquarters area. Two methods of water delivery are under consideration. One involves connection to the post headquarters water supply system, requiring the construction of 16 km of new pipe, and the renovation of 26 km of existing pipe. The other choice would be a new pipeline direct to the Orogrande site, approximately 32 km in length. Potential corridors are shown in Figure II-4.

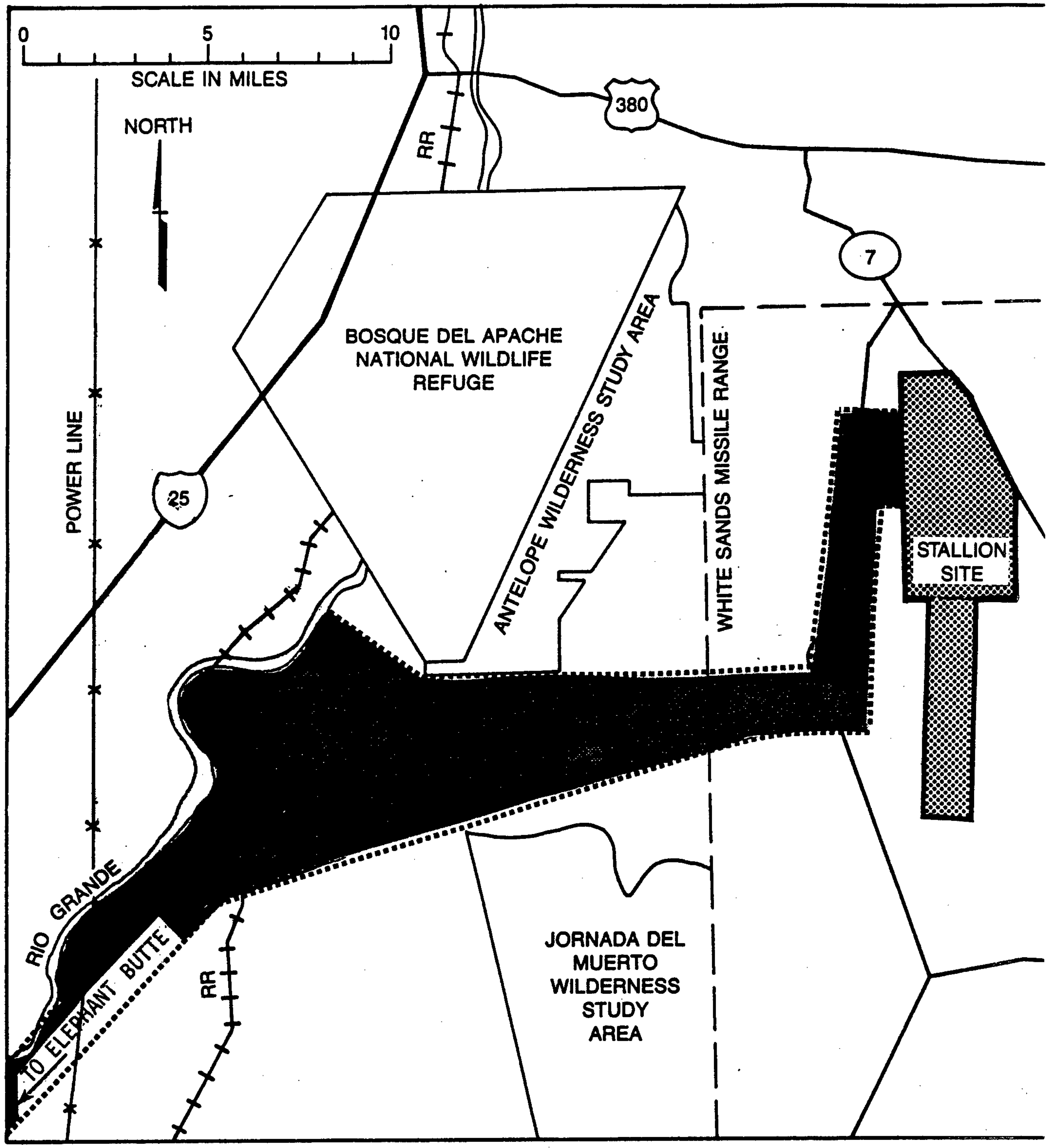


Figure II-2. Water Line Access Corridor for Stallion Site for Water Supply Alternatives 1, 1a and 2.

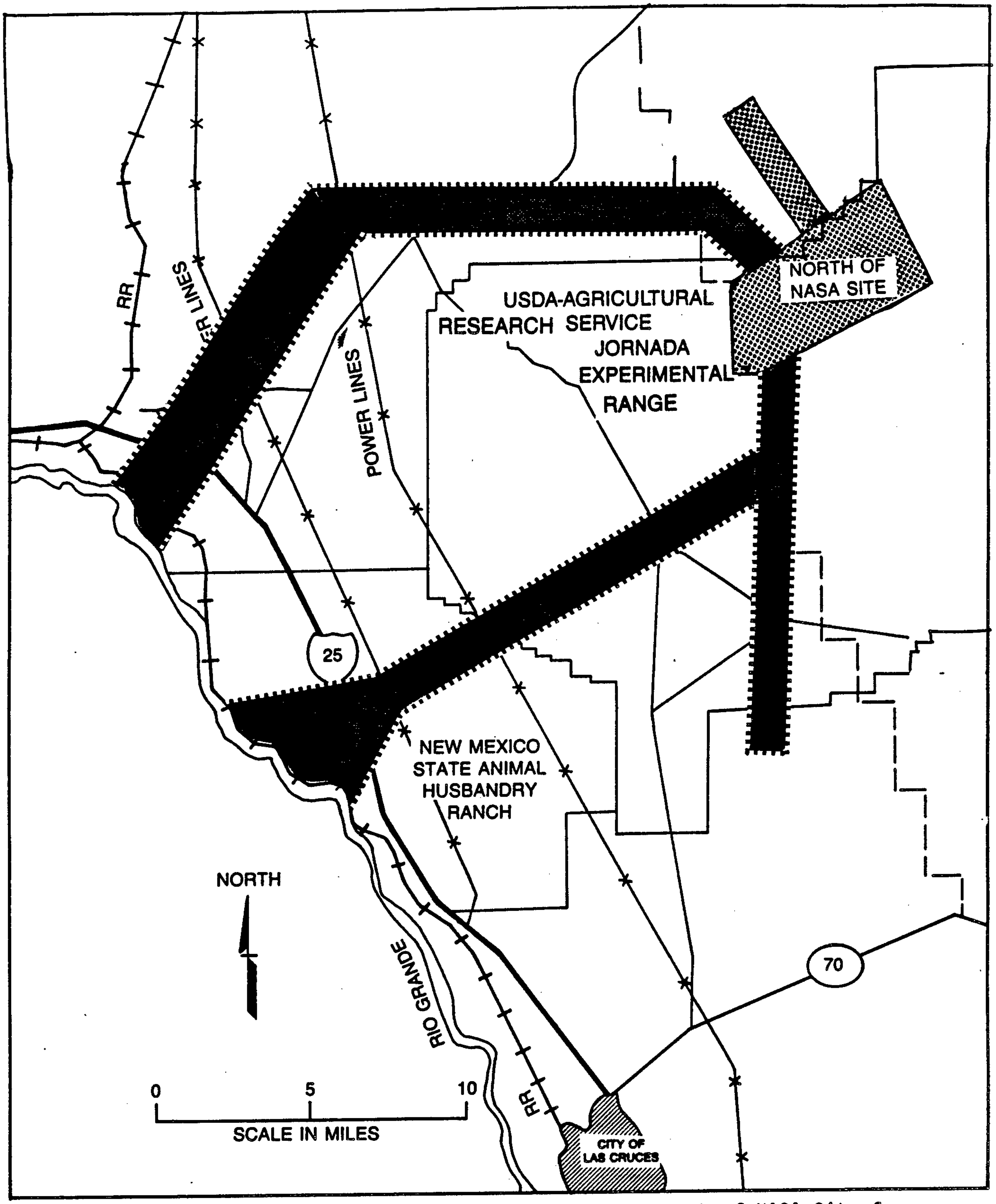


Figure II-3. Water Line Access Corridors for North of NASA Site for Water Supply Alternatives 3 and 4.

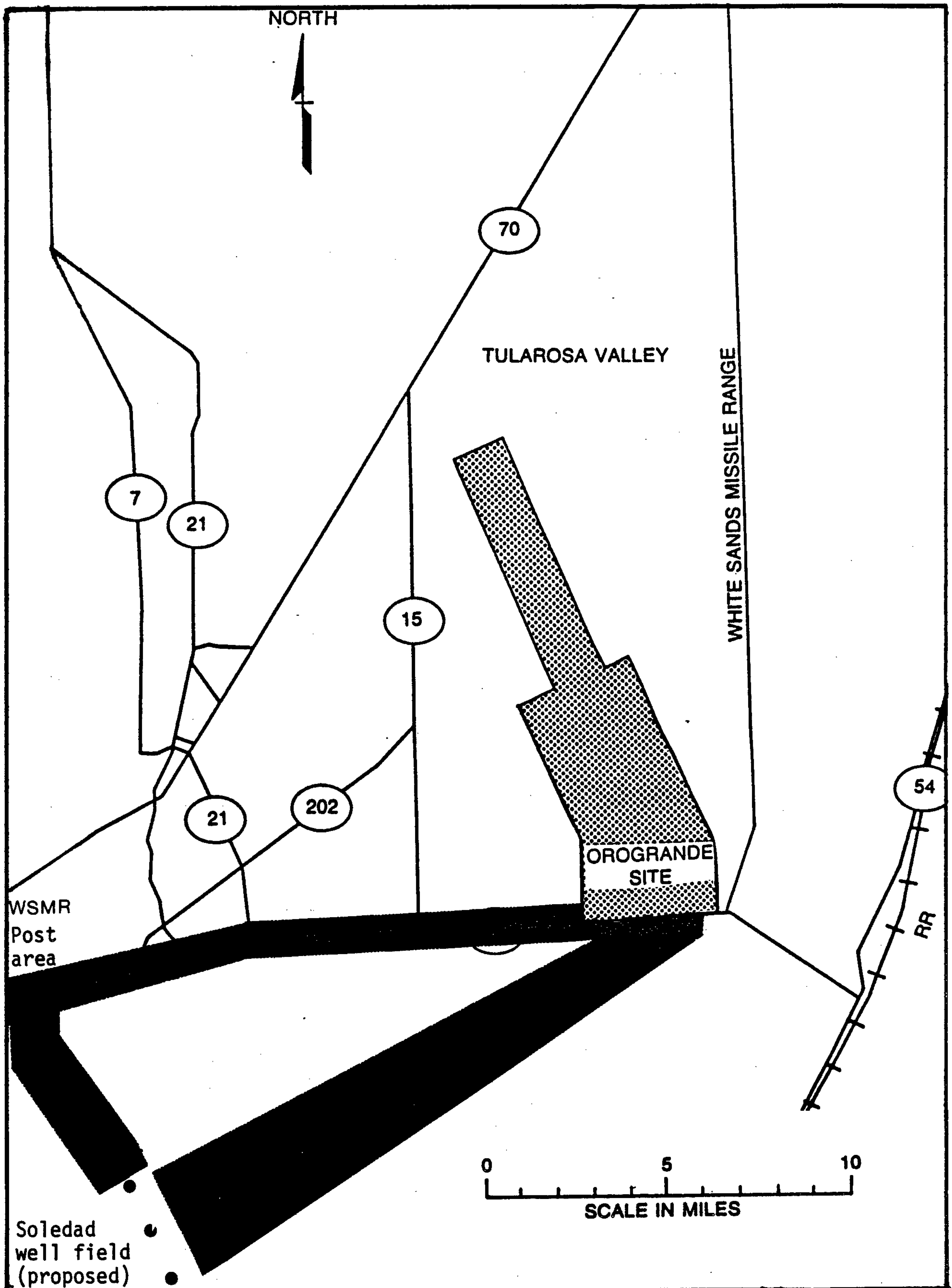


Figure II-4. Water Line Access Corridors for Orogrande Site for Water Supply Alternatives 5, 6 and 7.

Capital costs and yearly operations and maintenance costs have been estimated for each alternative, and are shown in Table II-3. None of the preferred water supplies requires desalinization, therefore there are no desalinization costs included in these figures. It can be seen that, with the exception of the Orogrande (renovated pipeline) alternative, capital costs for development of a water source are relatively similar at all three sites, with the North of NASA alternative being the cheapest. Orogrande, on the other hand, has the lowest O&M costs. The option to renovate the pipeline for the Orogrande site, while clearly the most expensive, has been retained in the analysis because it could provide substantial benefits to the WSMR installation, which would not occur under any of the other scenarios.

4. Electrical Power Availability

Electrical power required for the GBFEL-TIE project could potentially be satisfied from the existing power transmission line grid. Although existing lines are large enough for Phase I, construction of hookup lines would be required to connect the selected site to this grid. Figures II-5 through II-7 present possible Phase I power line transmission corridors for the three alternative sites. Table II-4 presents, by site, each possible powerline corridor, lengths of powerline and the entities controlling the land through which the powerline would cross. Although the exact routes are not known at present, it is anticipated that the new transmission lines would parallel existing lines to the maximum extent practical. Construction of a power transmission line may require a separate environmental analysis to assess potential impacts from construction as well as operation and maintenance of the transmission line(s). It should also be noted that even the shortest routes available to the North of NASA and Stallion sites would require that the transmission lines traverse other public (e.g., USDA, USDI) and/or private lands(3). The Orogrande site transmission line corridor as shown in Figure II-7 is contained within land controlled by the U.S. Department of the Army.

5. Road and Railroad Spur Requirements

The precise routes of the roads and potential rail spurs to any of the proposed sites are not presently specified. However, Figures II-8 through II-10 present possible railroad and road corridors for Stallion, North of NASA and Orogrande sites, respectively. Table II-5 presents, by site, possible corridor and the lengths of the railroad spur or road and the controlling land entities. Access roads to the Stallion and Orogrande sites would be relatively short (i.e., less than two km) and would be contained entirely within WSMR; therefore, they are not illustrated in Figures 8 and 10. Additionally, improvements to the existing WSMR road network may be required.

6. Socioeconomic Resources

The estimated impacts to the area's socioeconomic resources that would be expected to occur upon implementation of the proposed GBFEL-TIE are presented in Table II-6. Labor force availability is approximately even for each site; therefore, the projected number of incoming workers is the same for each. Projected service demands are the same for each site. In the event that Orogrande or North of NASA is selected, service demands are judged to be within the capacities of the local systems. Construction of the GBFEL-TIE at Stallion site would result in a predicted housing deficit (approximately 270 units) in the Socorro and Valencia Counties. The Socorro County school system would have to accommodate a projected 12 percent increase in one year.

Table II-3

Potential Impacts and Estimated Costs of Water Supply Alternatives for GBFEL-TIE Candidate Sites

	Water Supply Impact	Habitat Losses (acres)	Cultural Resource Losses (acres)	Estimated Costs (millions of 1986 $) Construction	Annual Operations
STALLION SITE					
Alternative 1 Surface Water from Elephant Butte	No significant impact since water would be supplied by Rio Grande system	130	3	9.9	0.9
Alternative 1A Ground Water from Rio Grande alluvium	No signficant impact since water would be supplied by Rio Grande system	87	2	6.2	0.7
Alternative 2 Ground Water Locally	Potential lowering of ground-water table. Risk to non-DOD operations moderate.	<5	<1	6.2	1.5
NORTH OF NASA SITE					
Alternative 3 Ground Water from Jornada del Muerto	Potential lowering of ground-water table. Risk to non-DOD operations moderate.	89	20	5.4	0.6
Alternative 4	No significant impact since water would be supplied by Rio Grande system.	46	10	8.0	0.8
OROGRANDE SITE					
Alternative 5 Ground Water from Soledad Wells	Potential lowering of ground-water table. Risk to non-DOD operations moderate.	64	<2	6.2	0.5
Alternative 6 Ground Water Locally	Potential lowering of ground-water table. Risk to non-DOD operations moderate.	<5	<1	9.5	1.4
Alternative 7 Ground Water from Soledad Wells through Post Headquarters	Potential lowering of ground-water table. Risk to non-DOD operations moderate.	32	<1	9.9	0.5

The water supply options are address in more detail in Sections III and IV.

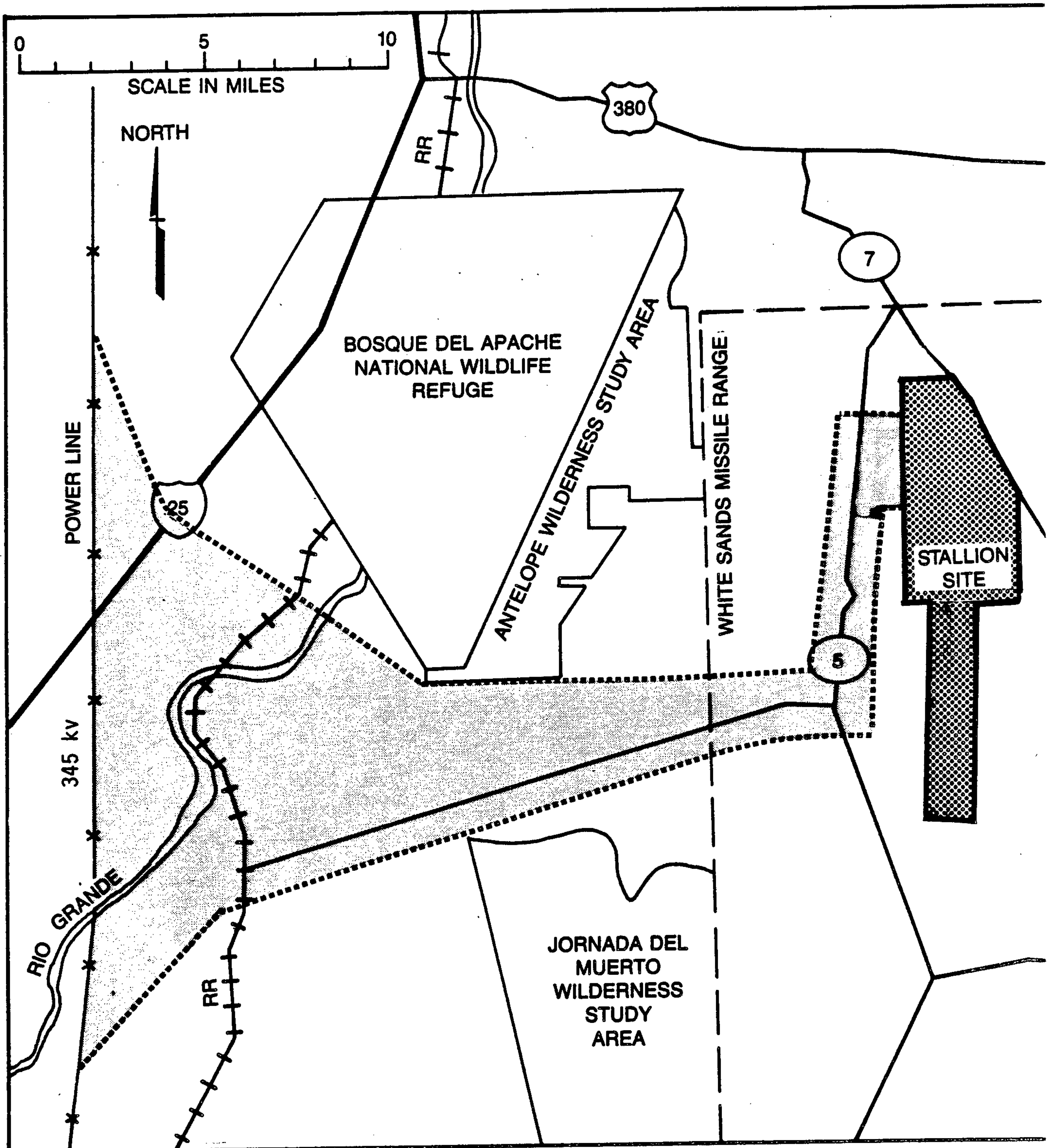


Figure II-5. Power Line Access Corridor for Stallion Site.

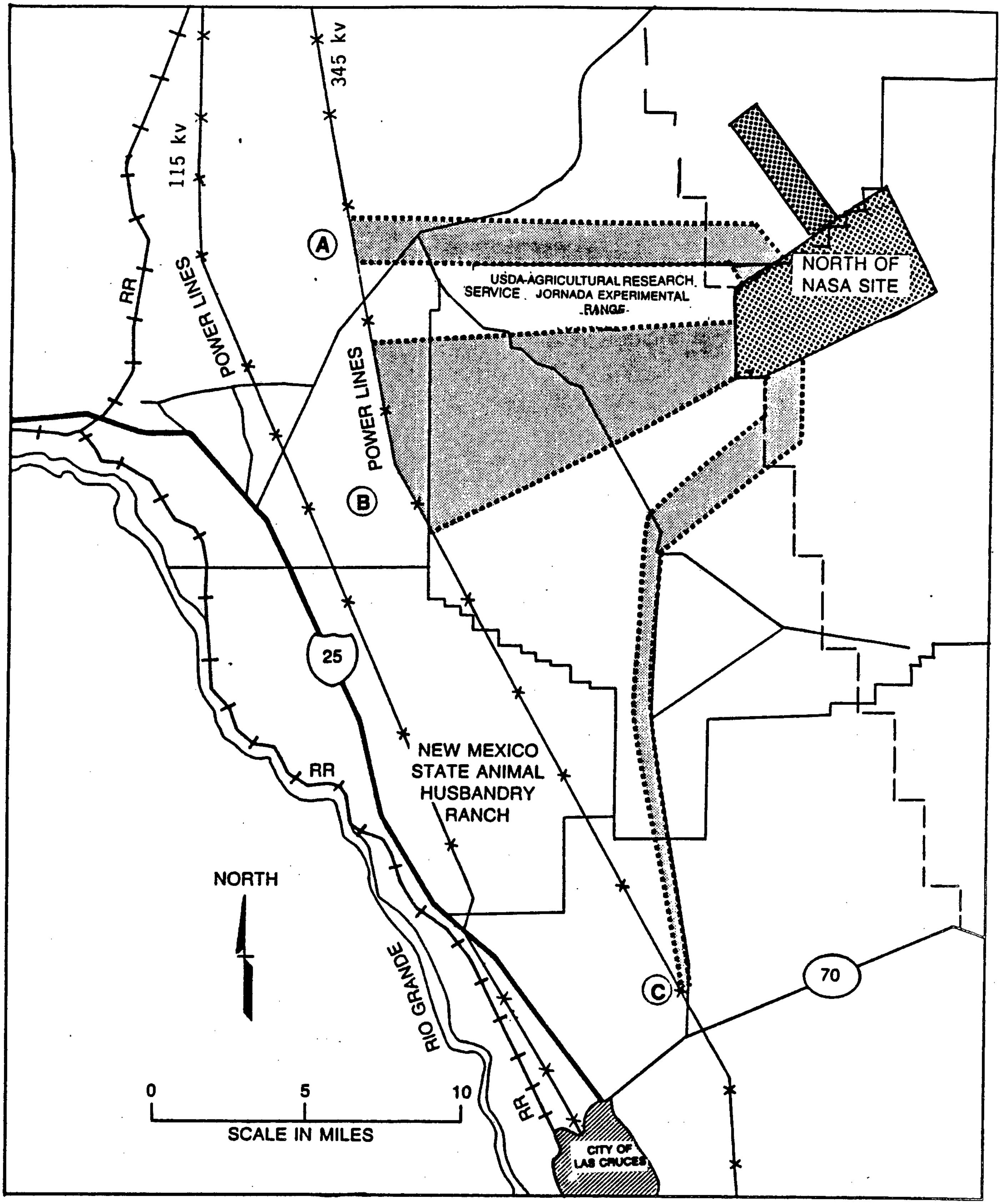


Figure II-6. Power Line Access Corridors for North of NASA Site.

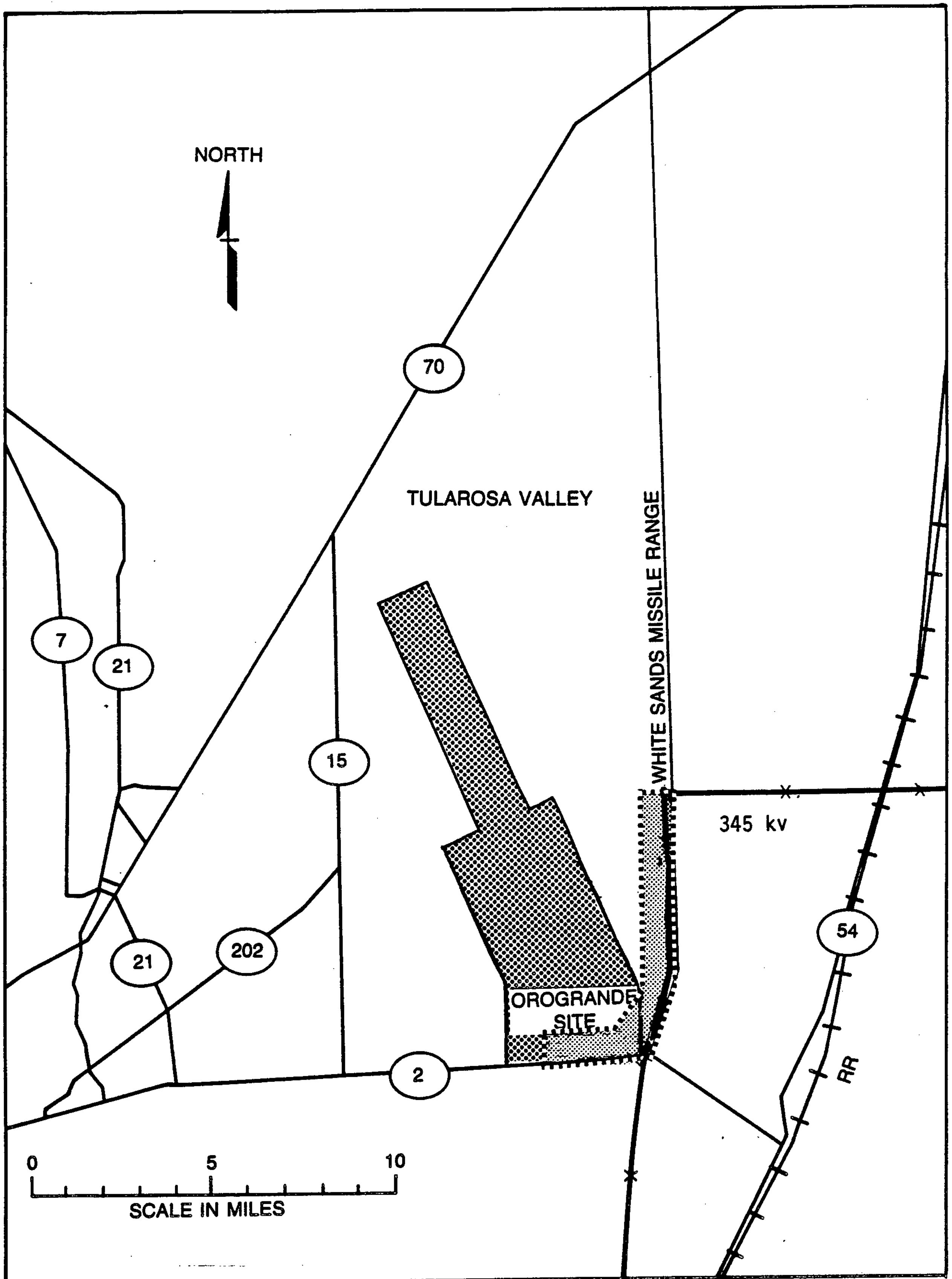


Figure II-7. Power Line Access Corridor for Orogrande Site.

Table II-4

Possible Power Transmission Corridors, by Site

STALLION SITE

	Length (km)	Controlling Entity
Corridor A	3.2	New Mexico
	17.4	Pedro Almendaris Grant
	8.4	BLM
	21.4	DOD
Total	50.4	

NORTH OF NASA SITE

	Length (km)	Controlling Entity
Corridor A	0.8	New Mexico
	17.5	BLM
	3.5	USDA/DOD (co-use)
	3.5	DOD
Total	25.3	
Corridor B	2.1	BLM
	16.7	USDA
	1.3	USDA/DOD (co-use)
Total	20.1	
Corridor C	4.8	Private Land
	3.2	BLM
	23.5	USDA
	7.7	USDA/DOD (co-use)
Total	39.2	

OROGRANDE SITE

	Length (km)	Controlling Entity
Corridor A	16.1	DOD
Total	16.1	

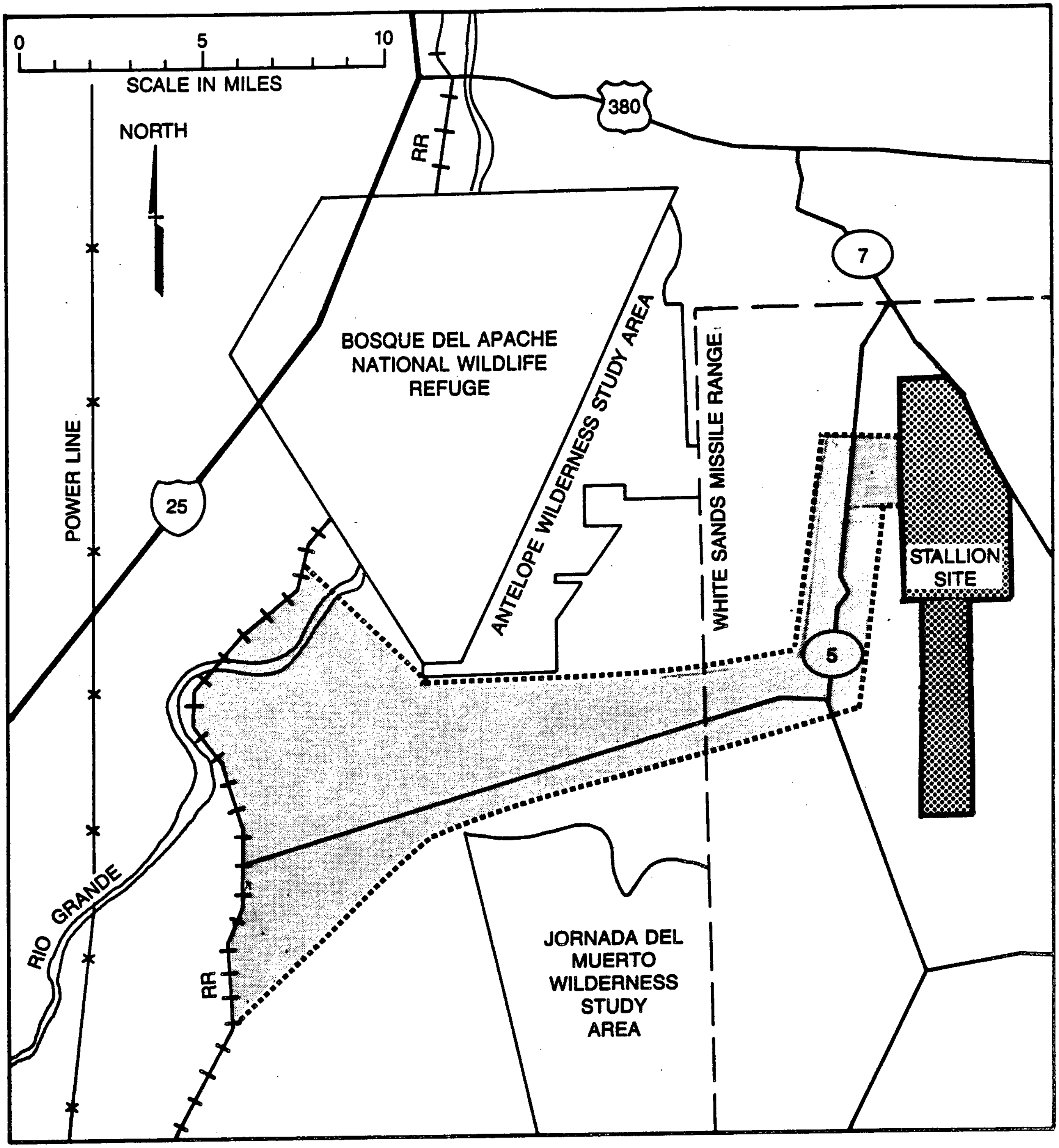


Figure II-8. Railroad Spur Access Corridor for Stallion Site.

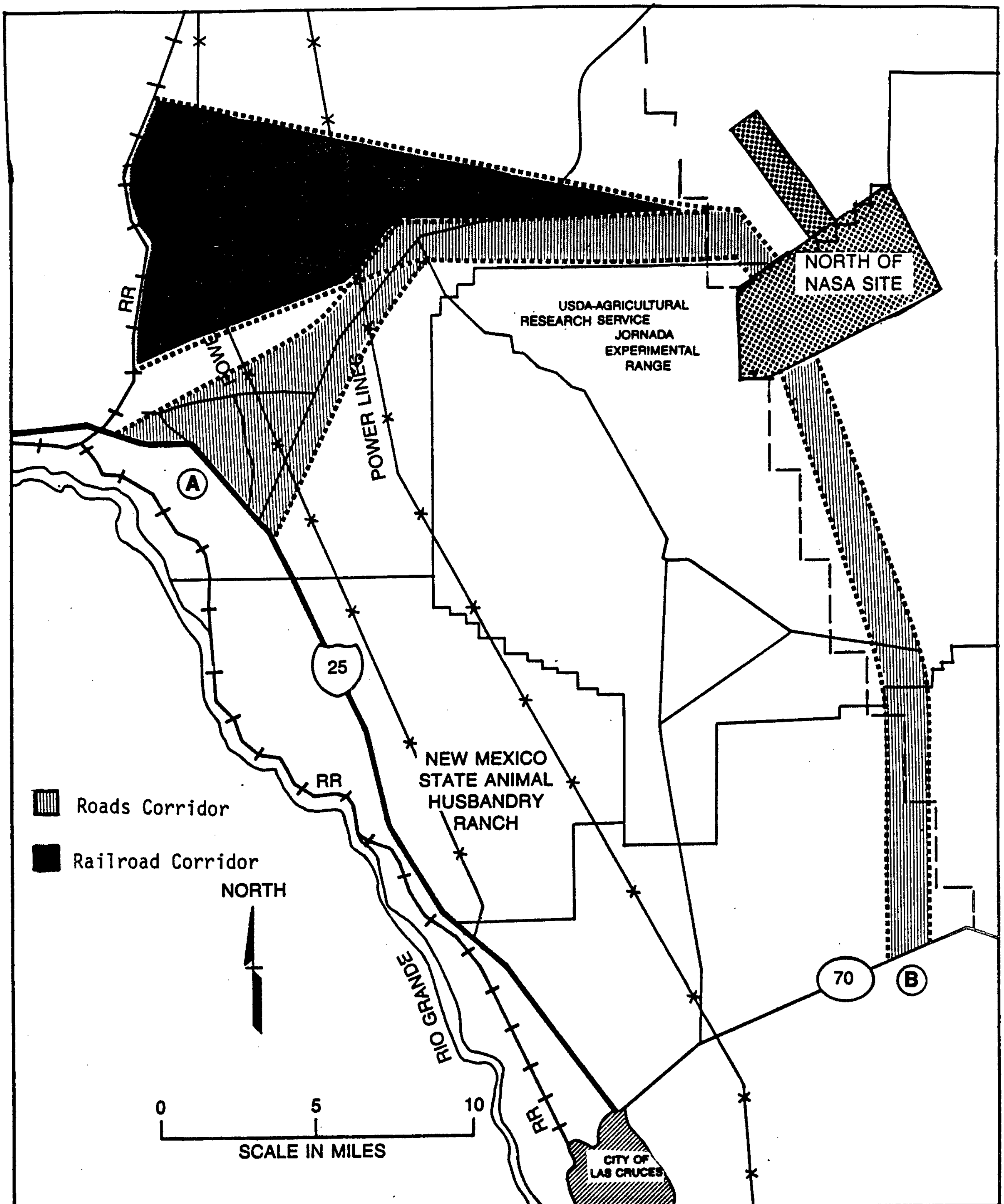


Figure II-9. Road and Railroad Spur Access Corridors for North of NASA Site.

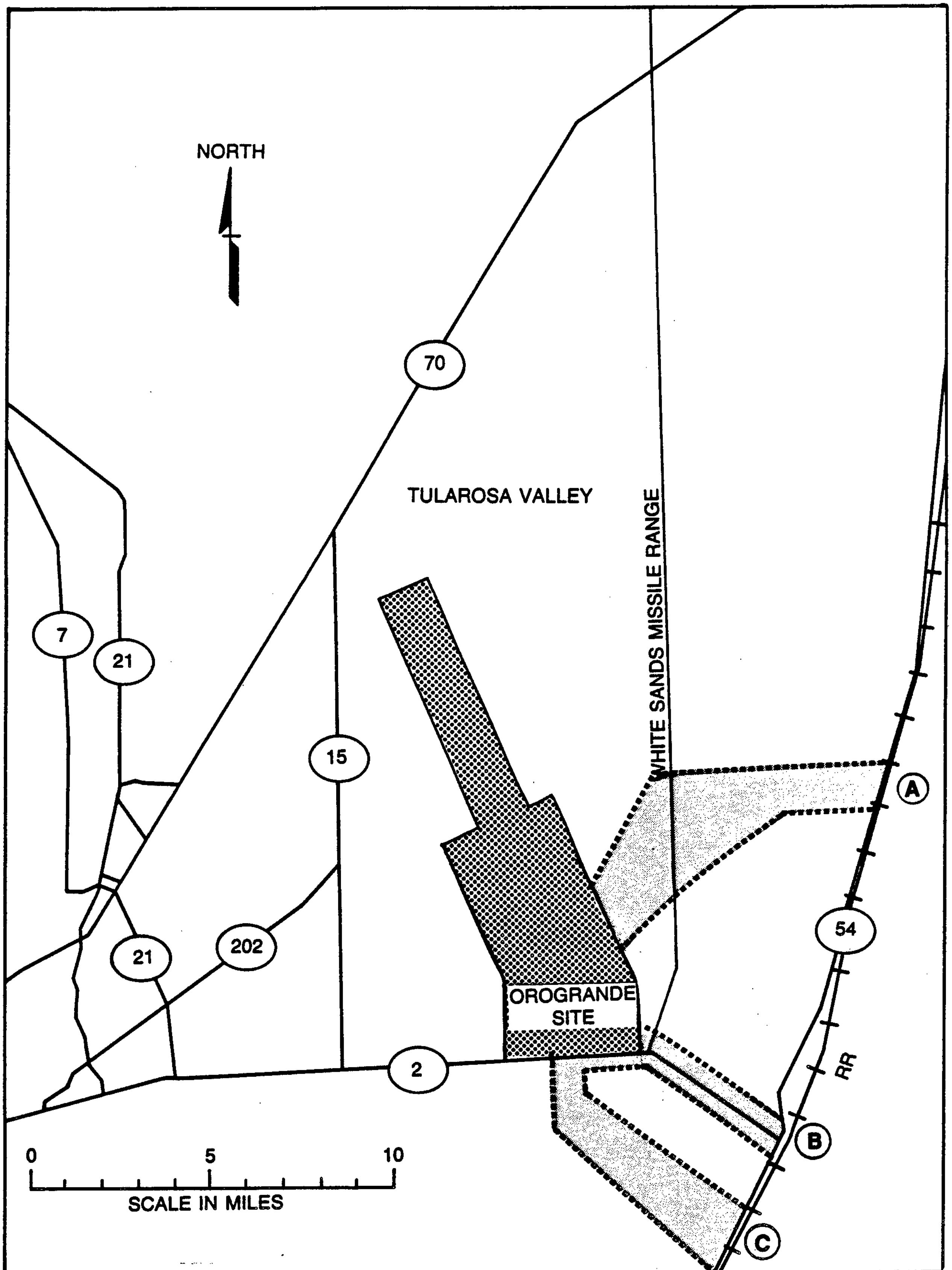


Figure II-10. Railroad Spur Access Corridor for Orogrande Site.

Table II-5

Possible Railroad Spur and/or Road Corridor Alternatives by Site

	Approximate Length (km)	Controlling Entity
	STALLION SITE	
Railroad	9.8	Pedro Almendaris Grant
	8.4	BLM
	3.2	New Mexico
	21.4	DOD
Total	42.8	
	NORTH OF NASA SITE	
Railroad	3.2	New Mexico
	25.9	BLM
	3.1	USDA/DOD (co-use)
	3.3	DOD
Total	35.5	
	Corridor A	
Roads	1.6	New Mexico
	29.3	BLM
	4.0	USDA/DOD (co-use)
	2.7	DOD
Total	37.6	
	Corridor B	
Roads	6.9	Existing Right-of-Way
	6.4	DOD
	20.1	USDA/DOD (co-use)
Total	33.4	
	OROGRANDE SITE	
	Corridor A	
Railroad	9.5	BLM
	9.2	DOD
Total	18.7	
	Corridor B	
Railroad	2.3	Private Land
	4.5	BLM
	2.3	New Mexico
	1.4	DOD
Total	10.5	
	Corridor C	
Railroad	10.9	DOD
	2.7	BLM
Total	13.6	

Table II- 6

Potential Impacts to Socioeconomic Resources

Parameters	Stallion	North of NASA	Orogrande	Study Area without Action
Population	Local construction labor force able to meet 60% of manpower requirements; large relative (7%) population increases for Socorro.	Labor force similar to Stallion No significant impacts.	Labor force similar to Stallion. No significant impacts.	Expected to increase 50% by year 2000.
Housing	Preponderance of demands projected for Albuquerque. Socorro area expected to have a housing deficit.	Demand accommodated by Las Cruces and El Paso.	Demand accommodated by Las Cruces, Alamogordo and El Paso.	Expected to be able to accommodate increased population, particularly in Las Cruces, Alamogordo, Albuquerque and El Paso areas.
Public Services	Socorro public schools would face up to a 12% enrollment increase in one year. Substantial actual demand in Albuquerque.	Substantial actual, but small (1-3%) relative increases in school enrollment.	Substantial actual, but small (1-3%) relative increases in school enrollment.	Would increase proportionately with population but may lag behind in implementation of such services.
Transportation	Local congestion at peak hours. No other significant impact.	Local congestion at peak hours. Inadequate access on WSMR. No other significant impact.	Local congestion at peak hours. No other significant impact.	Expected to be able to accommodate increased population. Upgrade is and would be required in some areas by the year 2000. Some (e.g., Alamogordo, Las Cruces) presently upgrading.
Public Safety	Negligible danger of eye damage to observer beyond the one kilometer safety zone.	Same as Stallion	Same as Stallion	Safety factors would still be a consideration with on-going and future programs at WSMR.

Impacts in other public service areas would not be severe for any area. Transportation impacts would be roughly equivalent for each site, during the construction phase.

7. Existing Programs

The potential impacts to currently existing programs and operations at WSMR were determined for each site. Proposed programs which potentially impact site areas were also evaluated. On 10 January 1987, officials of WSMR stated that for present operations, Stallion was significantly inferior to North of NASA and Orogrande. For foreseeable future operations, several programs could not be accomplished at Stallion if that site were chosen. These potential conflicts were discussed previously in Section I - Purpose and Need.

C. Environmentally Preferred Alternative

As shown in Tables II-1 through II-3, II-6 and summarized in Table II-7, the Orogrande site would have the least environmental impacts. Therefore, it is the environmentally preferred site; this is one of several factors bearing on USASDC's identification of its preferred site, as discussed below.

D. Agency Preferred Alternative

USASDC began the EIS process with no preference as to the site to be chosen. The information on environmental impacts, developed during the preparation of this EIS, was one of the major inputs into the identification of the preferred alternative.

In this project, USASDC's objective was to identify the site which best satisfied several goals simultaneously:

- provide best experimental and operational conditions;
- initiate research testing program as soon as feasible;
- minimize interference from and with other WSMR test programs;
- minimize adverse environmental impacts.

From the beginning, USASDC recognized that no one site was likely to achieve all of these goals. USASDC recognized that "the best" site might not necessarily be the least expensive, nor the most environmentally preferable. This also meant that the "environmentally preferred alternative" might not be the overall most preferable choice when other factors are also considered. Instead, because of these multiple goals, the preferred site must represent USASDC's judgement as to the best available compromise among these goals.

In order to determine which site best met the combination of objectives, a number of studies were carried out simultaneously with the environmental studies. These studies include:

- atmospheric characteristics;
- water and utilities availability;
- seismic factors;
- topography;
- electric power;

Table II- 7

Overall Evaluation of Environmental and Socioeconomic Concerns

Parameter	Stallion	North of NASA	Orogrande
Physical Resources	Most heavily impacted Physical Resource site. Heavily impacted by soil disturbance-site susceptible to some wind erosion and hazard of gypsum to concrete, potential for seismic activity greater. Effects on playas which are termination of some drainages.	Most heavily impacted by soil disturbance, moderate hazard for wind erosion. Less potential for seismic activity. Greatest potential for effects on drainage patterns. Possible need for development of a quarry.	Least impacted Physical Resource Site. Least impacted by soil disturbance, moderate hazard of wind erosion. Less potential for seismic activity. Little or no effects on drainages.
Biological/Cultural Resources	Moderate to heavy impacts associated with this site; elimination of grassland habitat; potential impact upon antelope and threatened or endangered species. Potential effects on cultural resources greater than at Orogrande primarily due to utility rights-of-way.	Moderate to heavy impacts associated with habitats lost due to construction requirements for transmission lines and other ROW. Potential impacts on several endangered and threatened species. Significant archeological impacts both directly and indirectly through construction or transmission corridors.	Least biological/cultural impacts associated with the site. Habitat loss less severe at Orogrande than other two sites. No probability of impact to Federal threatened or endangered species; less probability of impacts to state species than at other two sites. Impact on archeological/cultural resources less severe than other sites.
Water Supply	Most cost effective source would have no significant effect on local water supplies.	Most cost effective source would have potential adverse effects on JER programs.	Most cost effective source would have no significant adverse effect on other local users.
Socioeconomic	Greatest estimated increase in population; housing deficit in Socorro and Valencia Co.; greatest increase in school enrollment but should be able to accommodate new students; may require access roads to be improved; minor problems with increased traffic.	Population and housing could be accommodated by Las Cruces and El Paso. Slight increase in school enrollment; would require access roads to be constructed; minor problems with increased traffic.	Population and housing would be accommodated by Las Cruces, Alamogordo and El Paso; slight increase in school enrollment; may require access roads to be improved; minor local traffic problems.

- construction resources;
- electromagnetic interference;
- hazardous waste;
- WSMR program interference.

Several of these studies provided information to the EIS; others dealt with site selection factors beyond the scope of the EIS. The results of these studies, plus the results of the environmental studies, were all used by USASDC in its identification of a preferred alternative.

Although many topics were studied, the differences among the sites could be expressed in terms of how well the site would meet the cost, schedule, research and test operations, and environmental goals. For example, topographic differences among sites were translated into construction cost differences. Where environmental impacts could be effectively mitigated, the cost and the time that would be required were estimated. The remaining, unavoidable impacts were also considered. The comparative comprehensive evaluation of sites was therefore done on the basis of these key factors (cost, schedule, research and test operations and environmental goals and WSMR program conflicts).

Some habitat disruption at the Stallion site, and impacts on desert bighorn sheep and archeological resources at the North of NASA site were the major environmental factors. There appears to be no essential difference in the estimated construction costs associated with siting the experiment at any of the three sites. The history of seismic activity in the Socorro area indicates that siting the experiment at Stallion could cause a delay in gathering experimental data due to the necessity to periodically realign and calibrate optical equipment. In the area of program and schedule conflicts at White Sands, substantially higher impacts would accrue to existing and future programs at the Stallion site as compared to the other two sites. At the Stallion site, these program conflicts affect all three military services and, in the opinion of White Sands personnel, would severely limit future operational capabilities of the national range thereby making Stallion significantly inferior to the other two sites.

In consideration of the above, the USASDC has identified Orogrande as its preferred site alternative.

E. No Action

This alternative would preclude all impacts, beneficial and adverse, of the proposed project. However, the purpose and need of the project would not be satisfied. It should also be noted that selection of this alternative would not preclude impacts from occurring at or near WSMR as a result of current or other proposed activities, as indicated in Tables II-1 through II-6.

AFFECTED ENVIRONMENT

III. AFFECTED ENVIRONMENT

A. Climate

1. General

Much of the following information on climate was primarily obtained from the Department of the Army, White Sands Missile Range Installation Environmental Assessment 1985(1).

The climate at WSMR is typical of the desert southwest--warm, dry and occasionally dusty. On an annual basis, maximum and minimum temperatures average 77°F and 46°F, respectively. Annual precipitation ranges from seven to 11 inches. Over 50 percent of this precipitation occurs during the summer months when the prevailing southeasterly flow permits a continuing intrusion of moist tropical air from the Gulf of Mexico--a marked contrast to the dry, westerly winds which prevail during the remainder of the year. The highest wind speeds are observed in spring, while the lowest occur during the fall. Low visibilities are uncommon and are primarily associated with windborne dust during the spring.

Figure III-1 shows the locations of the Stallion, A Station (closest available data nearest to North of NASA site) and the WSD (near Orogrande site) weather stations. The climatological data presented in Table III-1 represent a digest of the meteorological data for these three stations. The period of record for these stations ranges from 11 to 25 years.

2. Wind

Prevailing wind direction during the fall, winter and spring is from the west; during summer the prevailing wind direction becomes southeasterly. Although the mean annual wind speed at A Station is only seven miles per hour (mph), wind speeds in excess of 87 mph have been observed. The frequency distribution of wind speeds at A Station is shown in Table III-1. Spring is the windiest period. The high winds are usually associated with a low pressure area over the southwestern United States. Strong westerly winds keep minimum temperatures high at night and maximum temperatures down during the day. The westerly winds are strongest immediately to the lee (east) of the Organ and San Andres Mountains; thus the wind speed at A Station is consistently higher than over the floor of the basin. High winds may also be associated with strong downwash gusts from thunderstorms.

At night, drainage winds may be observed. These winds are light and variable and flow down from the Organ and San Andres Mountains toward the east over the western half of the range and from the Sacramento Mountains toward the west over the eastern half of WSMR.

3. Precipitation

Annual amounts of total precipitation over WSMR vary from 7 to 11 inches, with 55 percent of the precipitation occurring between June and September. Table III-1 shows the mean precipitation by month (and annual mean) for A Station, WSD and Stallion weather stations and the mean snow depth by month and annual mean for A Station. April is the driest month, whereas July and August are the wettest. Precipitation is significantly higher on the mountain peaks and averages over 20 inches annually. The greatest 24-hour rainfall (5.3 inches) occurred at the White Sands National Monument on 21-22 September 1941. The

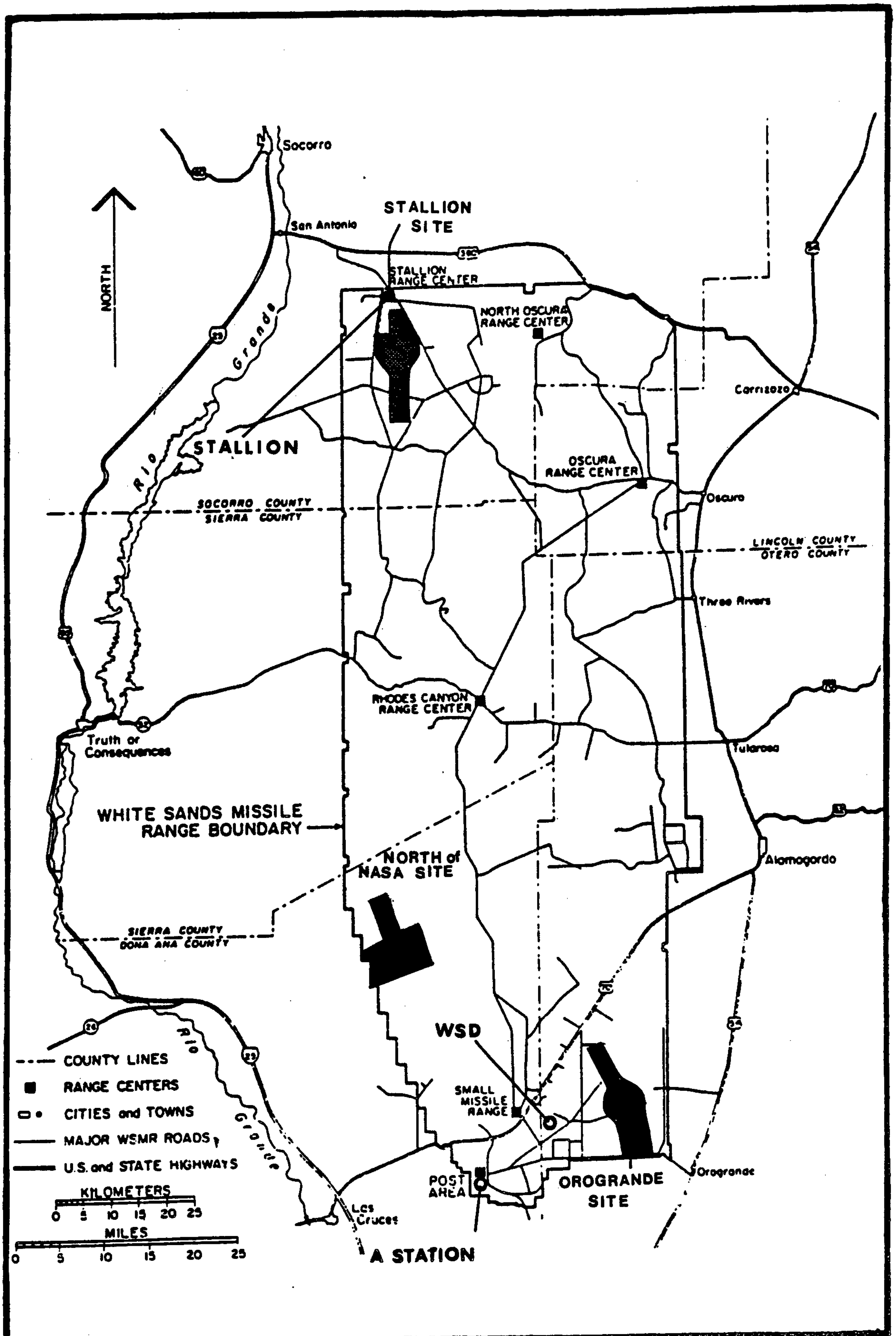


Figure III-1. Location of the Stallion, A Station and WSD Weather Stations.

Table III-1

Summary of Climatological Data - Selected Weather Stations*

Month	Mean Maximum Temperature (°F)			Mean Minimum Temperature (°F)			Mean Precipitation (in.)			Mean Snow Depth (in.)	Mean Thunderstorms
	A Station	WSD	Stallion	A Station	WSD	Stallion	A Station	WSD	Stallion	A Station	Days
Jan.	56	57	51	34	25	21	0.48	0.29	0.12	1.3	0
Feb.	60	61	56	38	29	26	0.57	0.40	0.19	1.5	0
Mar.	66	69	63	43	36	31	0.52	0.25	0.29	0.5	1
Apr.	75	78	72	52	46	39	0.22	0.14	0.10	-	1
May.	84	87	82	60	53	48	0.23	0.15	0.30	-	4
Jun.	93	94	90	69	62	57	0.89	1.39	0.97	-	6
Jul.	93	95	92	70	67	64	2.29	1.94	1.71	-	13
Aug.	91	92	89	69	64	61	1.86	2.06	2.13	-	11
Sep.	86	87	82	63	58	50	1.29	1.39	1.27	-	5
Oct.	76	78	74	53	45	43	1.06	0.75	0.96	trace	2
Nov.	64	76	61	41	33	32	0.42	0.37	0.25	0.8	0
Dec.	56	57	51	35	27	23	0.76	0.47	0.52	2.3	0
Annual	75	77	72	52	45	41	10.59	10.20	8.80	6.4	43

FREQUENCY DISTRIBUTION OF WIND SPEED AT A STATION

Speed	Frequency (%)
22 mph or less	80
22-32 mph	10
33-43 mph	5
44-54 mph	4
55 mph or more	1

MEAN ANNUAL FREQUENCY OF OCCURRENCE OF SKY COVER FOR WSMR

Sky Cover	Frequency (%)
Clear	35
Scattered (0.1-0.5)	30
Broken (0.6-0.9)	20
Overcast (1.0)	15

*Period of Record: 25 years for A Station; 13 years for WSD; 11 years for Stallion greatest 24-hour rainfall at A Station was 4.2 inches in August 1959. On the average, A Station has 85 days per year with a trace or more of precipitation and 47 days per year with measurable precipitation. Annual precipitation at A Station has varied from 3.9 inches in 1956 to 19.7 inches in 1958. A Station has gone as long as 128 consecutive days without even a trace of precipitation, and each year has at least 20 consecutive days without even a trace. The average probability of precipitation at WSMR is only 20 percent. WSMR averages 43 thunderstorm days per year (Table III-1).

Thunderstorms produce highly localized rainfall amounts and, while one station may receive only a trace, another range station may become locally deluged. Thunderstorm activity is more frequent in the afternoon and evening hours up to midnight. Hail is quite rare (due to the high freezing level in summer) and is found mostly in the higher elevation of the mountains. When hail does occur its average diameter is 0.25 inches. Tornadoes are very rare and only a few have been spotted throughout the range's history.

Snow occurring on the range usually does not last beyond two days. Annual snowfall amounts at A Station have varied from a trace to 18.2 inches. The synoptic weather pattern most favorable for snowfall is an upper air low pressure area to the west feeding moist southwesterly flow over cold air at the surface of the Tularosa Basin, the cold air having resulted from an incursion of polar air from the east.

4. Cloud Cover

Mean annual 24-hour sky cover for WSMR is 36 percent and ranges from a minimum of 25 percent in October to a maximum of 48 percent in July, which is the cloudiest month due to convective shower activity. Most of this cloudiness occurs from noon to midnight and is of the middle and high varieties. Table III-1 shows the mean frequency of the sky coverage.

5. Visibility

Visibility is generally excellent at WSMR, averaging 48-80 km and even greater at times. Strong northeast winds lasting at least six hours may cause a considerable amount of gypsum particles to be carried from the White Sands National Monument and transported south-southwestwardly, causing the prevailing visibility to be lowered to 10 to 15 km in the main post area.

In general a westerly wind clears the air of haze particles. However, during periods of strong west winds, considerable blowing dust may occur (particularly during the dry season) and may temporarily reduce local visibility to less than two km. Visibility is usually lower in the late night and early morning hours when surface inversion develops, thereby trapping atmospheric particulates in the resultant stable layer. By late morning this inversion breaks, allowing good atmospheric dispersion and subsequent visibility improvement. WSMR averages 35 days per year when these winds cause visibility to be less than 10 km.

Restriction of the prevailing visibility due to fog is rare at WSMR and usually any ground fog in the Tularosa Basin is patchy rather than a general blanket of fog. Fog nearly always occurs from 0300-0900 Mountain Standard Time (MST) over a precipitation-soaked ground (or snow cover) immediately following partial clearing of the skies.

6. Dust

Blowing dust occurs on the average of 13 times per year with the highest probability of occurrence (4%) in the later afternoon hours of spring. Windborne dust is twice as likely to occur at Holloman Air Force Base (AFB) than at A Station, due to Holloman's location to the leeward site of the White Sands National Monument. Dust storms (defined as storms causing dust to reduce the prevailing visibility to under one km) occur on the average of one per year at A Station and six per year at Holloman; the probability of blowing dust lasting at least two hours at Holloman and A Station is 50 percent.

Samples of atmospheric dust have been collected from near the floor of the Tularosa Basin and from Salinas Peak and Mule Peak (approximately 98 km and 75 km, respectively, from A Station). Spectroscopic analysis of these samples has revealed that the composition of the dust is a function of particle size. Particles greater in size than 1.0 micrograms (ug) are principally the clay minerals montmorillonite, kaolinite and illite. Secondary constituents include calcite, quartz, nitrate and hydrocarbons. Particles less than 1.0 ug and greater than 0.1 ug in size appear to be principally ammonium sulfate. Little is known about the composition of the fraction of the dust less than 0.1 ug. The relative composition of dust greater than 1.0 ug exhibits annual and seasonal variations attributable to meteorological conditions.

7. Relative Humidity

Mean annual relative humidity at WSMR is 35 percent. On a daily basis, the relative humidity reaches a maximum of 50 percent at 0600 MST and a minimum of 27 percent around 1500-1600 MST. During very dry westerly winds, the relative humidity often drops below 10 percent.

B. Geology

Much of the following information concerning geology and water resources was obtained from the U.S. Army Corps of Engineers, Fort Worth and Albuquerque Districts(5,6).

1. Physiography and Regional Geology of WSMR

a. Physiography

White Sands Missile Range (WSMR) is located in the southeasternmost part of the Basin and Range physiographic provinces, an area consisting of generally north-trending elongated mountain ranges and high mesas separated by wide, very gently sloping basins.

The east and northeastern portions of WSMR occupy the Tularosa Basin. The San Andres Mountains lie on the western side of the range and form a continuous chain with the Oscura Mountains in the north-central part of WSMR separating the Tularosa Basin from the Jornada Del Muerto Basin on the west. Figures III-2 and III-3 show the major physiographic features in the WSMR area.

b. Regional Geology

WSMR is located within the geologic feature known as the Rio Grande Rift. The Rio Grande Rift is a complexly faulted, elongated strip of land extending from the State of Colorado southward into Mexico. The rift, which varies in width from 200 to 280 km, is a structural geologic feature produced by tensional

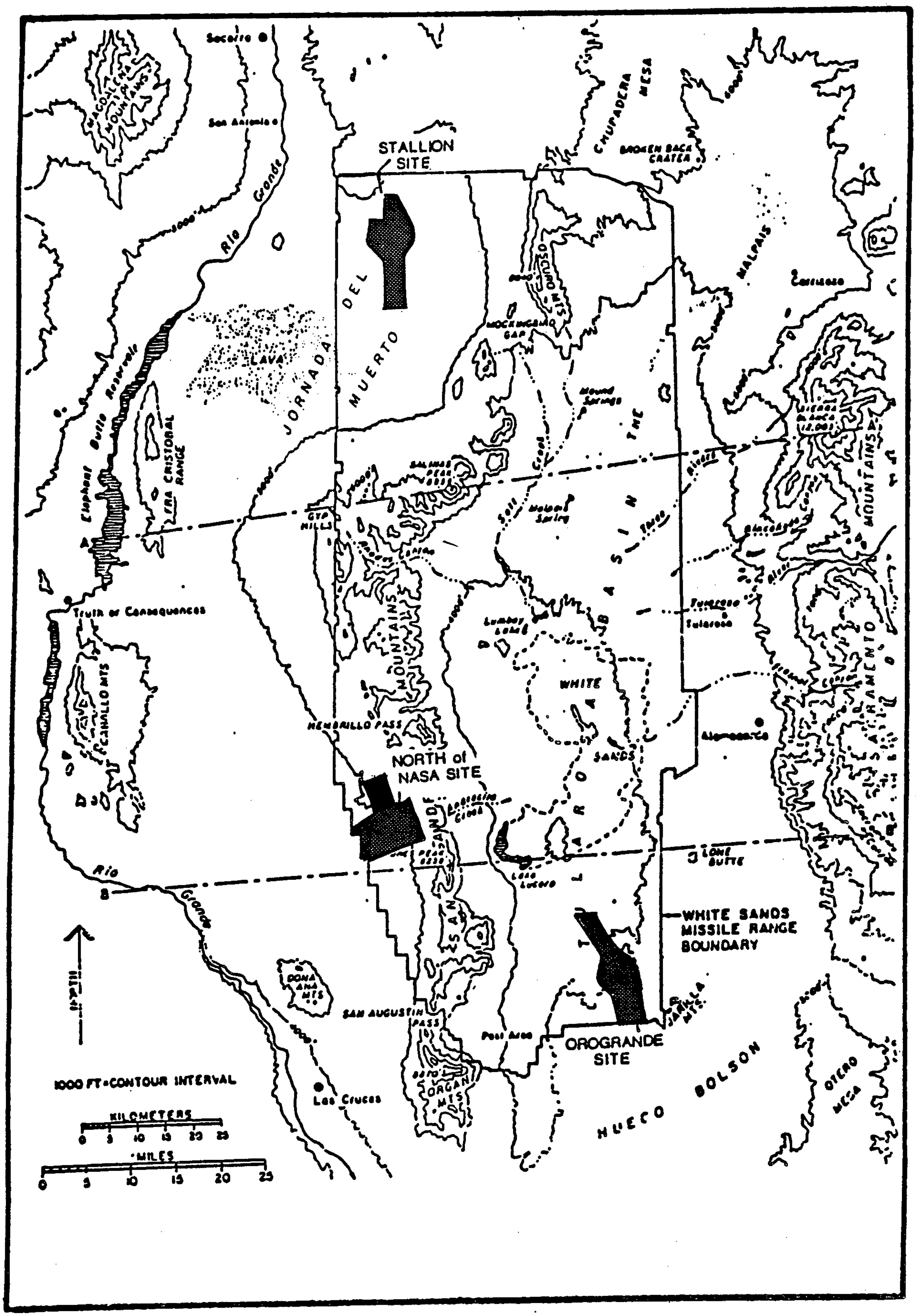


Figure III-2. WSMR Area Physiographic Map.

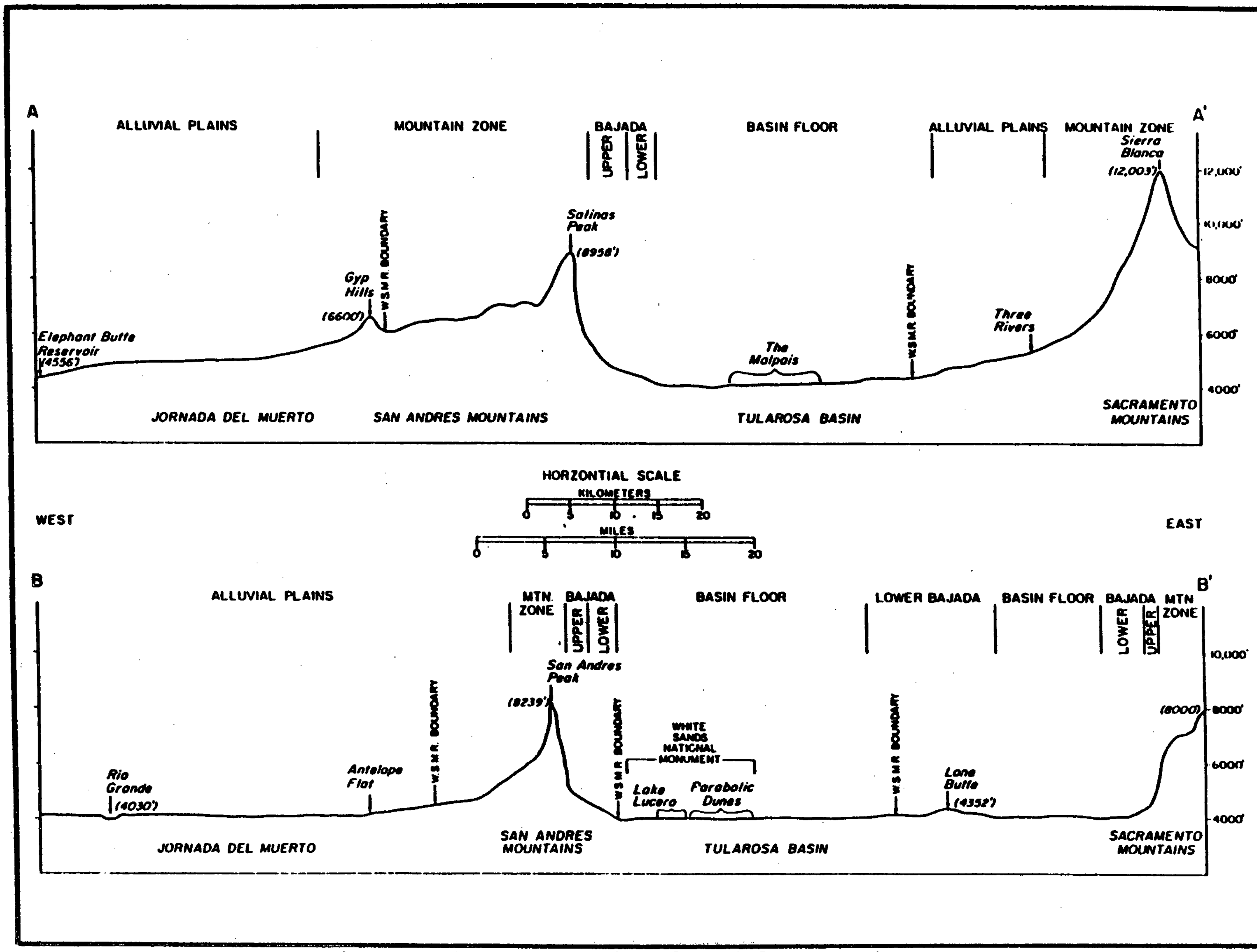


Figure III-3. Cross Section of the Tularosa Basin.

forces in the earth's crust. Pulling apart of the crust along the rift produced a number of long, relatively narrow, mountain-sized tilted blocks of layered sedimentary rock; most of the block boundaries are delineated by faults. Some of the fault blocks were tilted and raised to high elevations, forming mountain ranges, while other fault blocks were depressed and subsequently filled with great thicknesses of deposits derived from erosion of the adjacent mountains. WSMR is located in the southern portion of the rift where the elongated fault block mountains are composed of layered sedimentary rock from Cambrian to Miocene age, and the intermontane basins are characterized by gently sloping alluvial fan deposits adjacent to the mountain ranges, and flat-lying alluvial plain deposits in the central portions of the basins, all Quaternary in age. A few scattered masses of volcanic rock extrusives are exposed where they reached the earth's surface.

2. Geology of the GBFEL-TIE Candidate Sites

a. Stallion Site

The Stallion site is located in the northwest corner of WSMR near the center of the Jornada Del Muerto Basin. The relatively flat, featureless basin floor in the vicinity of this site is interrupted only by a low volcanic intrusive mass which is exposed a few kilometers southwest of the site. The volcanic intrusive mass, known as the Cerro Colorado, is Eocene to early Miocene age, and has scattered peaks of basaltic porphyries that rise a maximum of 91.4 meters above the basin floor. The Stallion site is underlain by Quaternary alluvial material consisting of heterogeneous mixtures of sand, clay and silt. The materials are generally very fine grained, very dense, and often interspersed with gypsum crystals and carbonate materials (caliche). Bedrock was not encountered in borings to 61 meters. No significant structural anomalies, such as faulting, were detected in the vicinity of the Stallion site.

b. North of NASA Site

The North of NASA site is located in the southwestern part of WSMR in the Jornada Del Muerto Basin. The site is situated on the western flank of the San Andres Mountains, a prominent mountain range about 136 km long and 10 to 27 km wide, separating the Jornada Del Muerto Basin from the Tularosa Basin to the east. Within 16 km east of the site, San Andres Peak rises to an elevation of 1,597 meters above sea level; however, within a short distance from the crest of the San Andres mountains the rocks pass beneath the Jornada Del Muerto Basin floor, a desert plain that resembles the floor of the Tularosa Basin. The North of NASA site is partially underlain by Quaternary aged alluvial deposits consisting of unconsolidated to semi-consolidated sedimentary material eroded from the adjacent mountains. The gentle slope of the site away from the mountains suggests that the site is situated on an alluvial fan-type deposit. Alluvial fan deposits generally consist of poorly sorted, gravelly, silty sand or sandy silt, with generally coarser sediments found nearer the source area. Scattered isolated remnants of sedimentary bedrock (sandstone and limestone) are exposed at the ground surface in the eastern portion of the site near the base of the adjacent mountains. Abrupt changes in the surface exposures indicate the presence of local faulting within the exposed bedrock strata.

c. Orogrande Site

The Orogrande site is located in the southeast corner of WSMR about 13 km northwest of the village of Orogrande. The geomorphic setting of the site is within the Tularosa Basin, a 320 km long by 40-96 km wide alluvial-filled intermontane basin. A short distance to the east of the Orogrande site an isolated, low range of mountains known as the Jarilla Mountains protrude abruptly through the basin floor rising a maximum of about 366 meters above the surrounding desert floor. The Jarillas are only about 16 km long and 10 km wide trending generally north-south. The Orogrande site is underlain by generally unconsolidated Quaternary-age alluvial deposits consisting predominantly of heterogeneous layers of sand, clay, and occasionally silt, all of which were transported from the adjacent mountain ranges and deposited on the basin floor. These materials are generally fine-grained, dense, poorly to moderately cemented, and contain varying amounts of calcium in the form of gypsum crystals or scattered pockets of caliche. Bedrock was not encountered in borings to 61 meters in depth. Some of the alluvial materials locally cemented with carbonate materials (caliche) or silica are well developed and have the characteristic of a weak bedrock. The only significant structural anomaly of the Orogrande site is the suspected presence of deep-seated faulting beneath the alluvial sediments. The significance of this faulting, if present, will be discussed below under seismic considerations.

At the turn of the century, the Orogrande Mining District was formed with limited mining development. The district is located within two km of the eastern boundary of WSMR and five to eight km east of the Orogrande site. Mining activities in this district produced primarily gold, silver, copper, lead, iron and turquoise. Production in this district peaked in 1916; no production has occurred since 1966.

3. Seismic Considerations

a. General

Seismic waves are normally generated by abrupt slippages along faults in the crust and/or the mantle of the earth. Earthquakes are seismic waves produced for varying lengths of time. Risk of seismically-caused damage is usually expressed as zonal areas, numbered to show degree of risk. The risk zones of each alternative site are illustrated in Figure III-4. This figure delineates zones of differing maximum damage which can be expected to result from individual future earthquakes. This figure makes no prediction of the frequency with which future earthquakes will occur; it merely indicates the maximum damage to be expected throughout the mapped area. The zonal values shown are based upon the intensity of quakes, which is a measurement in terms of the effects quakes produce. The zones are defined by the Modified Mercalli Intensities experienced in the mapped area and obtained from historical records. Figures III-5 and III-6 delineate the horizontal component of acceleration caused by earthquakes, expressed as a percent of the acceleration of gravity. While these maps are not seismic risk maps in the same sense as that of Figure III-4, they nevertheless relate to seismic risk by exhibiting the property of acceleration which influences the amount of damage which will result from any earthquake. Figure III-5 best depicts regional conditions throughout the State of New Mexico and beyond. It shows relative seismic risk when comparing one site with another and generally confirms the risk values shown on Figure III-4. Because of the contouring style used, Figure III-6 is regarded here as the best of the three figures for indicating that portion of New Mexico in which strong seismic activity presently originates.

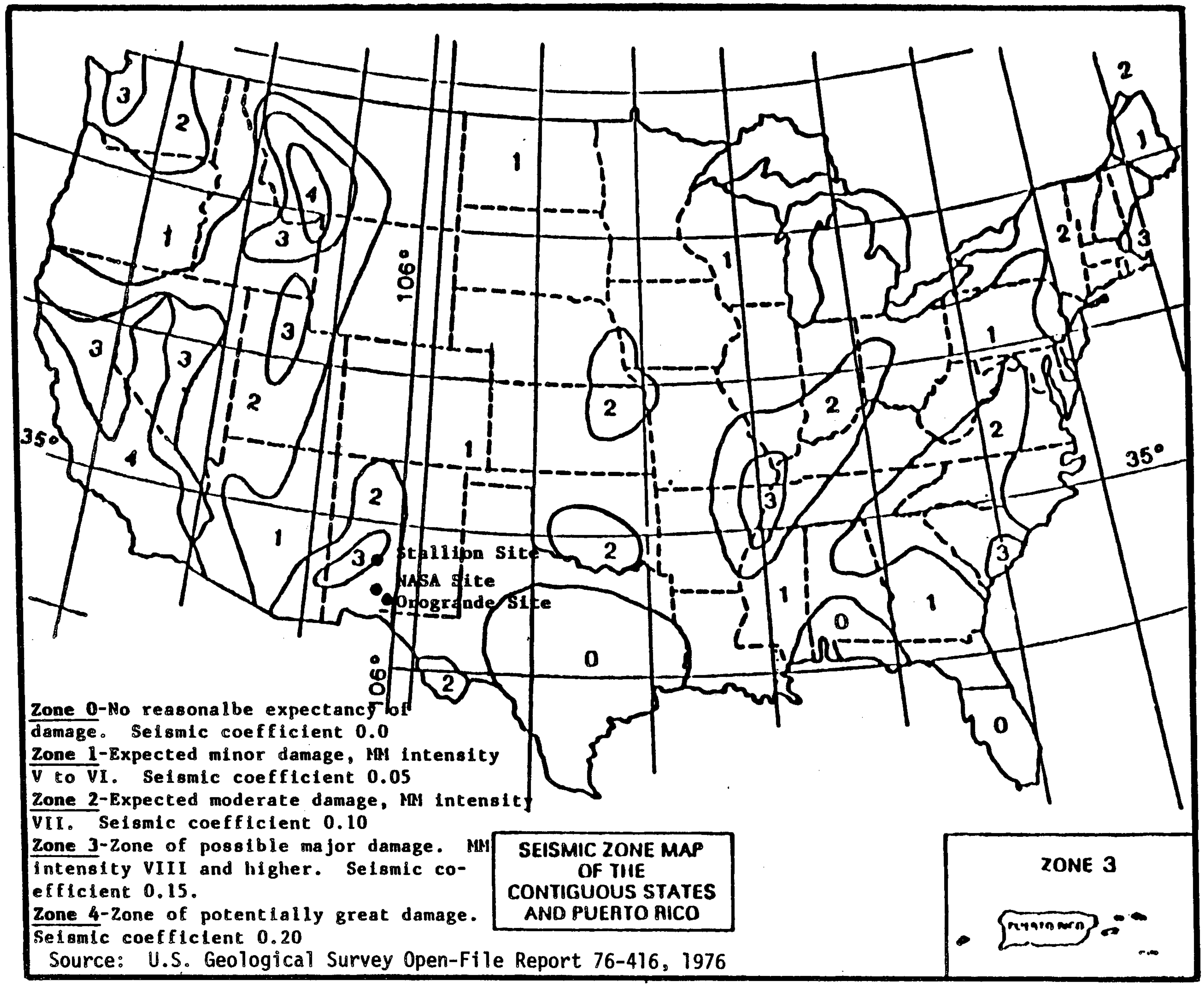
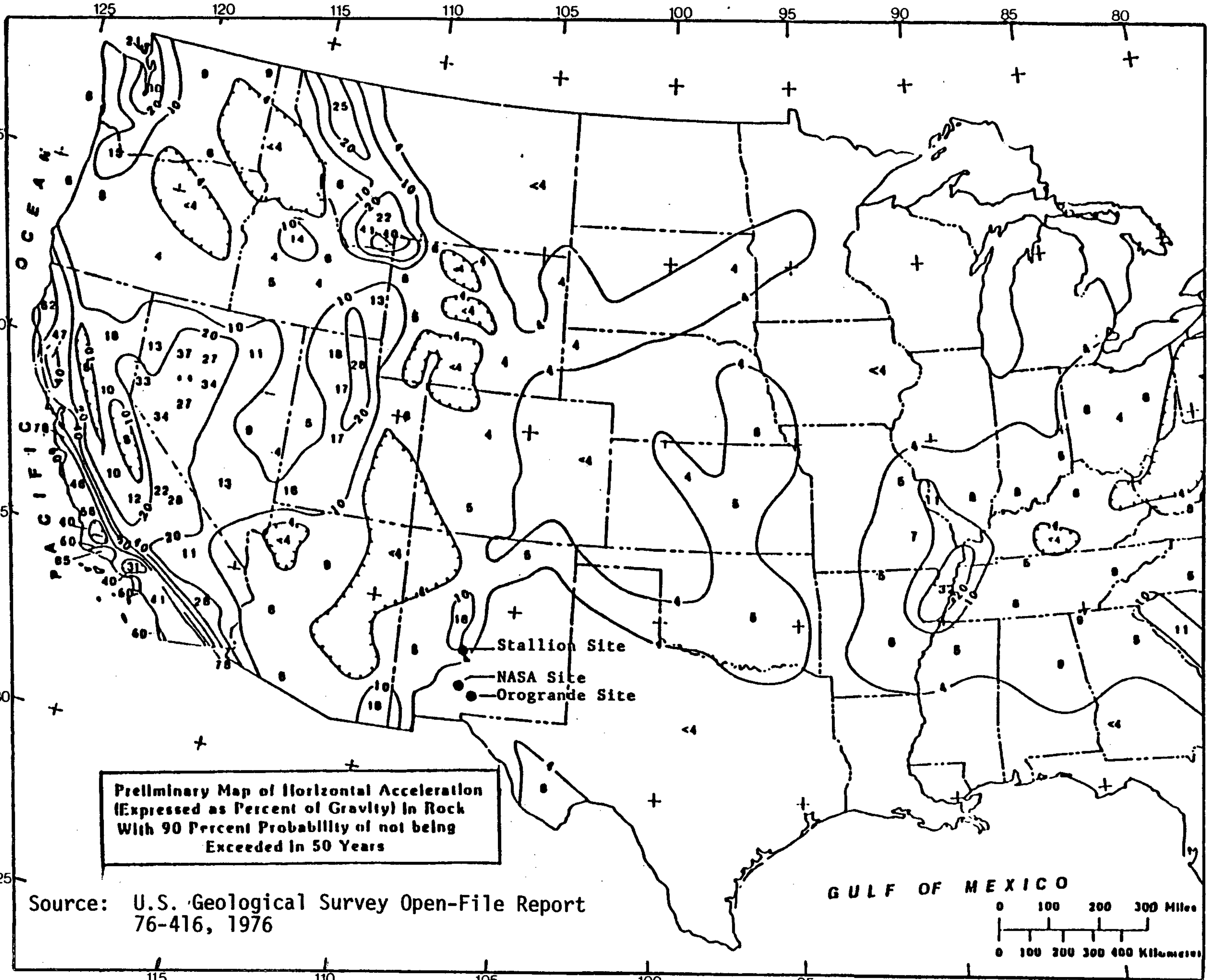


Figure III-4. U.S. Seismic Risk Zonal Areas.



Source: U.S. Geological Survey Open-File Report 76-416, 1976

Figure III-5. Horizontal Components of Acceleration Caused by Earthquakes.

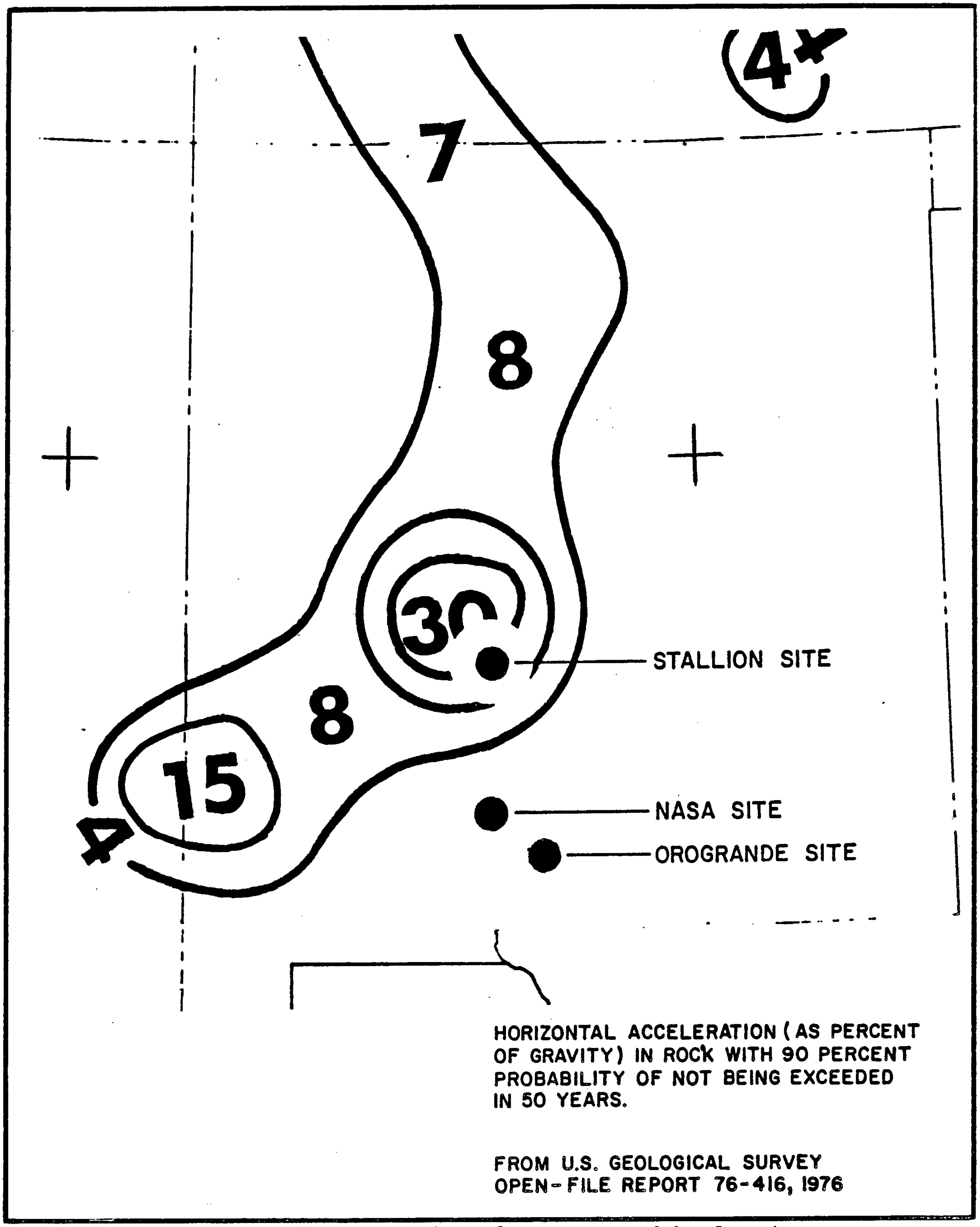


Figure III-6. Site Area Horizontal Components of Acceleration Caused by Earthquakes.

b. Stallion Site

The Stallion site lies on the southeastern outer edge of seismic risk zone 3 (Figure III-4). Zone 3 is an area in which Modified Mercalli Intensity VIII earthquake effects can be expected. Intensity VIII earthquake effects are defined as: "Damage slight in specially designed structures; considerable in ordinary, substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed(5)." As depicted in Figure III-5, Stallion site is located immediately southeast of the 10 percent (of gravity) contour. It is located on the boundary of the area of 30 percent acceleration (Figure III-6). No fault, either known or inferred, has been indicated beneath the site(5). Therefore, Stallion site could at some time in the future be impacted by seismic waves; but, it appears probable that little to no damage would be expected to occur to well designed structures at the site.

c. North of NASA site

The North of NASA site is situated in seismic risk zone 2 (Figure III-4). Seismic risk zone 2 indicates that earthquake effects experienced in this zone will have maximum Modified Mercalli Intensities of VII. Intensity VII earthquakes are defined as follows: "Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; felt by people in some motor cars(5)." North of NASA site is located in an area in which horizontal acceleration from earthquakes can be expected to be less than four percent of that due to gravity. This site is located approximately 64 km distant (southeast) from the four percent contour. No known or inferred faults beneath the North of NASA site have been indicated(5). It appears probable that very little to no damage would be expected to occur to well designed structures at the site due to seismic activity.

d. Orogrande Site

The Orogrande site is also located in seismic risk zone 2 within a few miles of the border between risk zone 2 and risk zone 1 to the east. It should be noted that the boundary between seismic risk zones 1 and 2 is not easily discerned on Figure III-4. The boundary is oriented north-south along the meridian of 106°W longitude through all but the northern part of the State of New Mexico. The defined characteristics of Intensity VII earthquakes were described previously under B.3.c., North of NASA site. The Orogrande site is situated in an area in which horizontal accelerations expected to occur from earthquakes would be less than four percent of the acceleration of gravity (Figure III-5). The site is located approximately 106 km southeast from the nearest four percent of gravity contour. Figure III-6 demonstrates that, of the three sites, the Orogrande site is located the farthest from this class of gravity contour. An inferred fault beneath the Orogrande site has been indicated(5). This fault, if it is actually present, does not indicate locally increased seismicity purely due to its presence. To impact the area, such a fault must experience active movement in the future. No historical earthquakes of notable intensity have been recorded in this area. However, the facility would be designed to withstand Intensity VIII earthquakes.

C. Soils

The United States Department of Agriculture, Soil Conservation Service completed a soil inventory as part of the technical assistance furnished to WSMR(7,8). The purpose of the survey was to determine the location of the different soil types, identify uses and limitations of each type and generally interpret the significance of each association.

Table III-2 identifies and describes the eight soil types found within the three alternative sites. Soils that have similar profiles are categorized into a series. All of the soils on one series have major horizons that are similar in thickness, arrangement, and other important characteristics.

Figures III-7 through III-9 represent the site areas and their soil types. Table III-3 provides the percentage of soil types for each site area. Table III-4 presents the soil suitabilities and limitations for various activities for each soil type that occurs at the three sites.

According to Figures III-8 and III-9, the dune land soil type is dominant at both the Orogrande and North of NASA sites. This soil type, as evident from Table III-4, is not conducive to surface water storage such as sewage lagoons due to its rapid permeability. Pond liners would be required to overcome this problem. Shallow excavation for foundations and pipelines would encounter severe sidewall instability and potential cave-in as well.

The three dominant soils at the Stallion site (Onite loamy fine sand, Yesum Holloman fine sandy loam and Berino sandy loam) all have rapid permeability or solubility requiring mitigating measures for surface water storage. However, these soils have good capacity for shallow excavations and building foundations with the exception of the severe hazard of gypsum to concrete in the Yesum soil type.

D. Air Quality

1. General

The quality of the air at WSMR is very good relative to established ambient air quality standards, with no significant difference in ambient air quality at any of the three sites. The major portion of the main range is located in State of New Mexico Air Quality Control Region 6, with the northern portion of WSMR in Region 8. New Mexico Air Quality Control Region 6 includes the North of NASA and Orogrande sites while the New Mexico Air Quality Control Region 8 includes the Stallion site(9). Regional boundaries are shown in Figure III-10 in comparison with WSMR boundaries. All air quality regions in the state are identified as to whether they meet Ambient Air Quality Standards for five criteria pollutants which are: total suspended particulates (TSP), sulfur oxides (SO_x), carbon monoxide (CO), nitrogen oxides (NO_x) and ozone (O_3). New Mexico Ambient Air Quality Standards are as set forth in Regulation Number 201 of the "Ambient Air Quality Standards and Air Quality Control Regulations". Federal Ambient Air Quality Primary and Secondary Standards are provided by the National Ambient Air Quality Standards (NAAQS) as established by the U.S. Environmental Protection Agency (USEPA). Federal annual standards and all state standards are not to be exceeded, while Federal short term standards are not to be exceeded more than once a year.

Volume 40 of the Code of Federal Regulations (CFR) defines the Federal ambient air quality primary and secondary standards as follows: "National primary

Table III-2

Soil Types Found at the Three Sites

Map Symbol	Name	Description	Permeability in/hr	Soil pH	Shrink-Swell Potential
BD	Berino Sandy Loam	Deep, well drained, coarse to medium texture soils occupying gently rolling areas slightly above the Dona Ana soils.	2-6.3	7.4-8.4	Low
DU	Dune Land	Consists of blowouts and wind-shifted active sand dunes that are bare or nearly bare of vegetation. The dunes are 4 to 20 ft. high. Slopes range from 5 to 75%.	6.3-20	7.4-8.4	Low
GR	Gilland Rock Outcrop	Moderately deep, well drained, stony loams occurring on rolling hills and steep sloping desert mountains, slopes range from 5% to 55%.	0.63-2.0	7.9-8.4	Low
LR	Lozier Stony Loam	Shallow, well drained, stony loam soils on rolling hills and desert mountains with slopes of 5% to 55%.	0.63-2.0	7.4-8.4	Low
NT	Nickel Gravelly Fine	Moderately deep and deep, well drained, very gravelly loams on gently sloping to sloping mountain front alluvial fans, sloping range from 3% to 9%.	0.63-2.0	7.4-8.4	Low
OB	Onite Loamy Fine Sand	Deep, well drained, moderately coarse textured soils in eolian deposits on nearly level to undulating slopes, slopes range 0% to 3%.	2.0-20	6.6-8.4	Low
RL	Rock Land, Warm	Consists of steep and rough topography on sedimentary and igneous rock formations. Basalt.	Too Stony and Variable to Classify		
YH	Yesum Holloman Fine	Shallow, well drained, medium to moderately coarse textured soils high in gypsum and underlain by gypsum beds to depths of 60 in. or more, slopes range 0% to 5%.	2.0-6.3	7.9-8.4	High

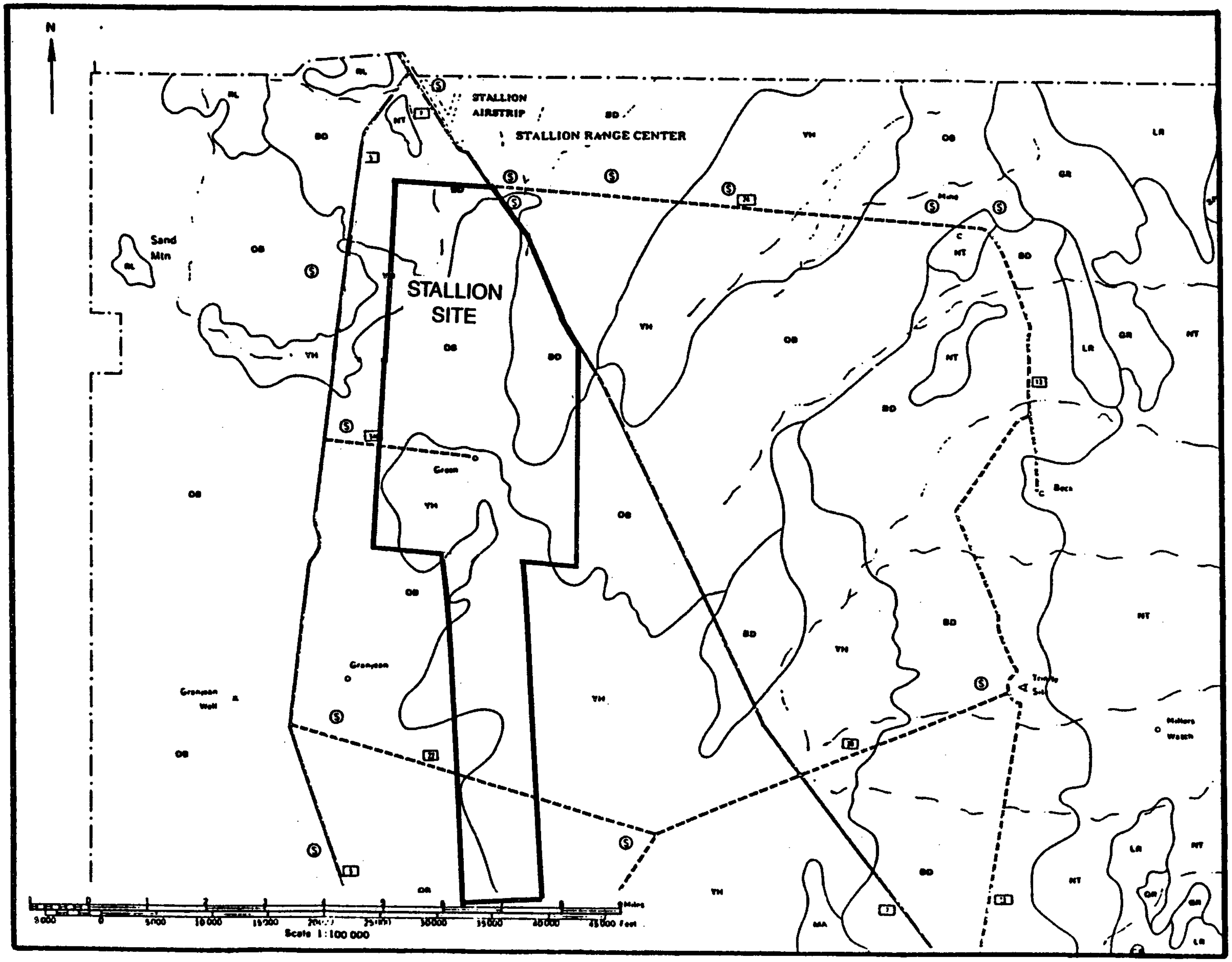


Figure III-7. Stallion Soil Types.

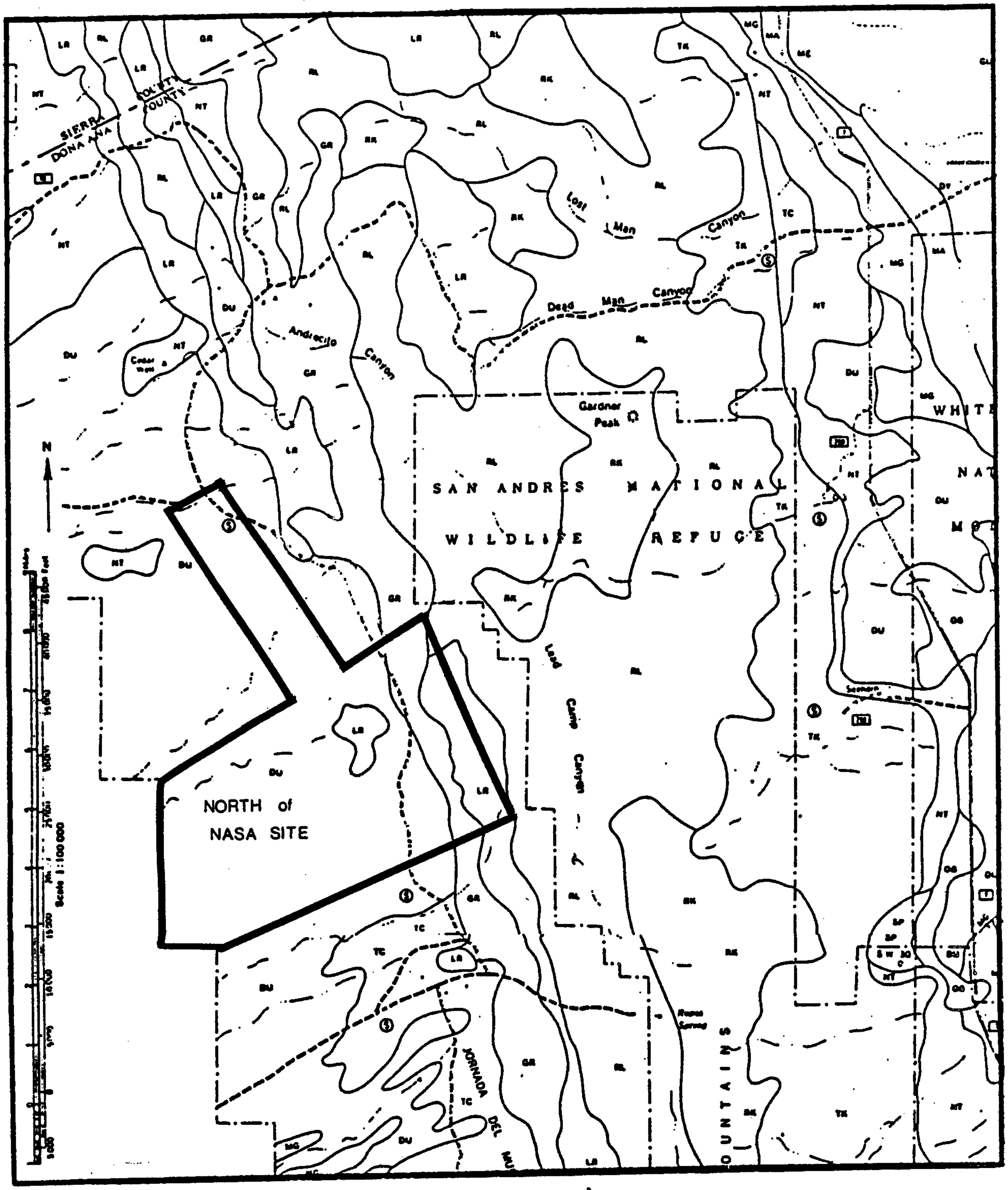


Figure III-8. North of NASA Soil Types.

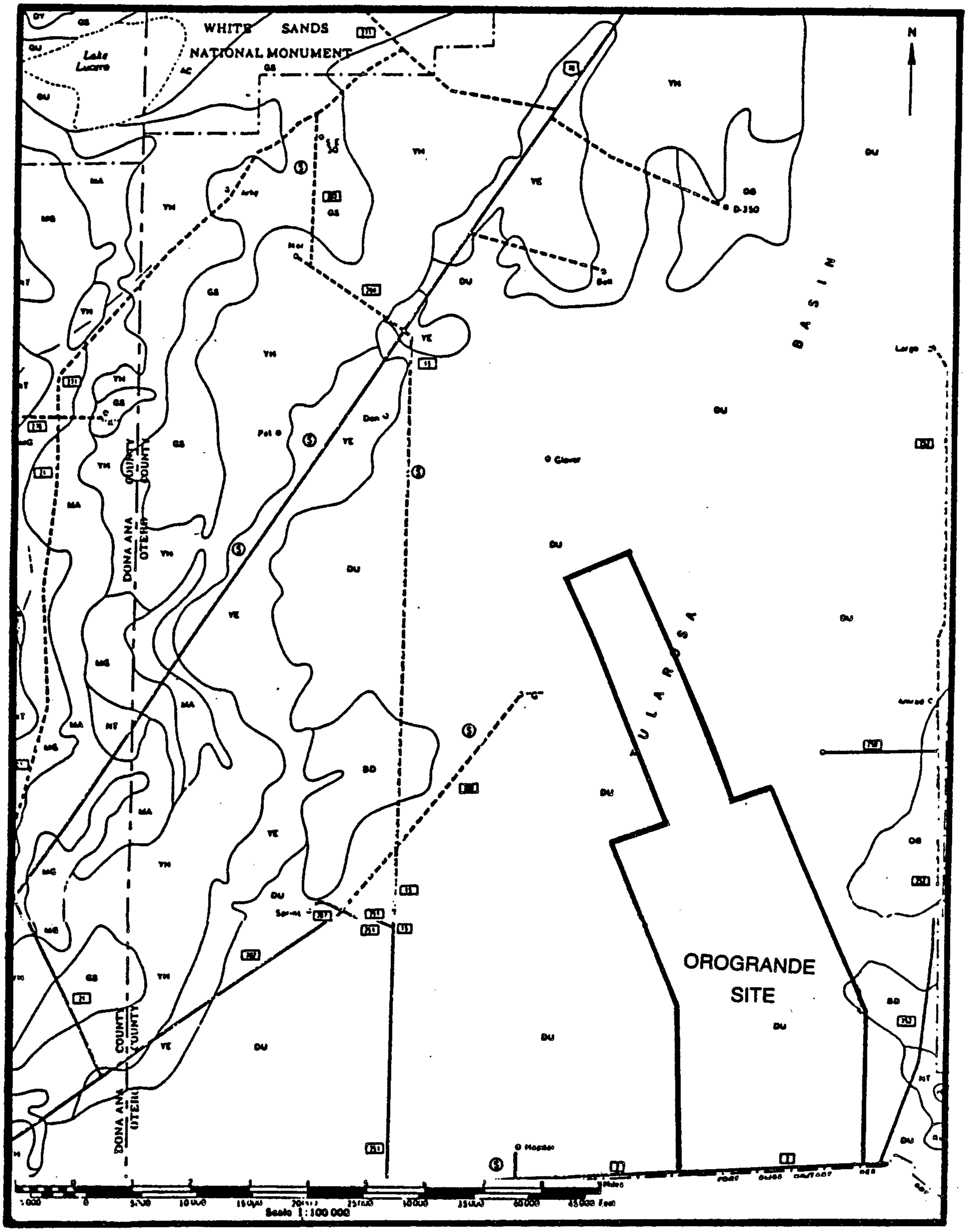


Figure III-9. Orogrande Soil Types.

Table III-3

Acreage and Percentage of Soil Types by Site Area

Site	Soil Type	Acreage	Percent*
Orogrande	Dune Land (DU)	15,951	99.8
	Berino Sandy Loam (BD)	40	0.2
	Total Acreage	15,991	
North of NASA	Dune Land (DU)	12,928	83.3
	Lozier Stony Loam (LR)	1,483	9.6
	Rocky Land, Warm (RL)	42	0.3
	Gilland Rock Outcrop (GR)	1,060	6.8
	Total Acreage	15,513	
Stallion	Yesum Holloman Fine Sandy Loam (YH)	6,450	37.4
	Onite Loamy Fine Sand (OB)	7,323	42.5
	Berino Sandy Loam (BD)	3,454	20.0
	Total Acreage	17,227	

*May not equal 100 due to rounding.

Source: U.S. Army, 1985(1) and Geo-Marine, Inc.

Table III-4

Soil Suitabilities - White Sands Missile Range

Soil Series and Map Symbols	Degree and Kind of Limitation for:						Soil Features affecting:			
	Septic Tank Absorption Fields	Sewage Lagoons	Shallow Excavations	Foundations for low Buildings without Basements	Sanitary Landfill	Local Roads and Streets	Pond Reservoir Areas	Embankments Dikes and Levees	Drainage	Irrigation
Berino: BD	Slight	Severe: moderately rapid permeability below a depth of 22 inches	Slight	Slight	Severe: moderately rapid permeability below a depth of 22 inches	Slight	Moderate permeability in subsoil	Medium shear strength: medium compacted permeability; medium piping hazard	Well drained	Moderate available water capacity; severe hazard of soil blowing; moderate permeability
Dune Land: DU	Slight	Severe: rapid permeability	Severe: sidewall instability	Slight: hazard of soil blowing	Severe: rapid permeability; sidewall instability	Severe: hazard of soil blowing; high gypsum to concrete in DY	Rapid permeability	Medium shear strength & compacted permeability; high piping hazard	Excessively drained	Very low available water capacity; hazard of soil blowing; rapid permeability
Gilland: GR	Severe: bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Severe: bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Moderate to severe: bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Moderate to severe: slope of 5 to 35%	Severe: stony; bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Severe: stony; slope of 5 to 35%	Stony: bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Stony: bedrock at a depth of 20 to 30 in.; slope of 5 to 35%	Well drained	Stony: bedrock at a depth of 20 to 30 inches; slope of 5 to 35%
Lozier: LR	Severe: bedrock at a depth of less than 20 in.; slope of 5 to 35%	Severe: bedrock at a depth of less than 20 in.; slope of 5 to 35%	Severe: bedrock at a depth of less than 20 in.	Severe: bedrock at a depth of less than 20 in.; slope of 5 to 35%	Severe: stony; bedrock at a depth of less than 20 in.; slope of 5 to 35%	Severe: bedrock at a depth of less than 20 in.; slope of 5 to 35%	Stony: bedrock at a depth of less than 20 in.; slope	Bedrock at a depth of less than 20 in.	Well drained	Stony: bedrock at a depth of less than 20 in.; slope of 5 to 35%

Table III-4 (cont'd)

Soil Suitabilities - White Sands Missile Range

Soil Series and Map Symbols	Degree and Kind of Limitation for:						Soil Features affecting:			
	Septic Tank Absorption Fields	Sewage Lagoons	Shallow Excavations	Foundations for low Buildings without Basements	Sanitary Landfill	Local Roads and Streets	Pond Reservoir Areas	Embankments Dikes and Levees	Drainage	Irrigation
Nickel: NT	Severe: moderately slow permeability; slope of 1 to 55%	Severe: slope of 1 to 55%; coarse fragments	Severe: very gravelly; slope of 1 to 55%	Slight if slope is 3 to 8%, moderate if 8 to 15%, severe if 15 to 55%	Slight if slope is less than 15%, moderate if 15 to 25%, severe if more than 25%	Slight if slope is less than 8%, moderate if 8 to 15%, severe if more than 15%	Moderately slow permeability; gravelly; slope of 1 to 55%	Medium compacted permeability; medium piping hazard	Well drained	Slope of 1 to 35%; gravelly; low available water capacity; easily eroded
Onite: OB	Slight	Severe: moderately rapid permeability	Slight	Slight	Severe: moderately rapid permeability	Slight: hazard of soil blowing in places	Moderately rapid permeability; severe hazard of soil blowing	Medium shear strength; medium compacted permeability; high piping hazard	Well drained	Moderate available water capacity; severe hazard of soil blowing; moderately rapid permeability
Rock Land, Warm: RL	Severe: bedrock at a depth of 20 in.; slope	Severe: bedrock at a depth of less than 20 in.; slope	Severe: bedrock at a depth of less than 20 in.; slope	Severe: bedrock at a depth of less than 20 in.; slope	Severe: bedrock at a depth of less than 20 in.; slope	Severe: bedrock at a depth of less than 20 in.; slope	Bedrock at a depth of less than 20 in.; slope	Bedrock at a depth of less than 20 in.; slope	Bedrock at a depth of less than 20 in.	Bedrock at a depth of less than 20 in.; slope
Yesum: YH	Severe: severe hazard of gypsum to concrete	Severe: solution of gypsum causes leakage	Slight	Severe: severe hazard of gypsum to concrete	Severe: solution gypsum causes leakage	Slight: severe hazard of gypsum to concrete	Moderate permeability; high in gypsum content	Medium shear strength; medium compacted permeability; high piping hazard	Well drained	Saline

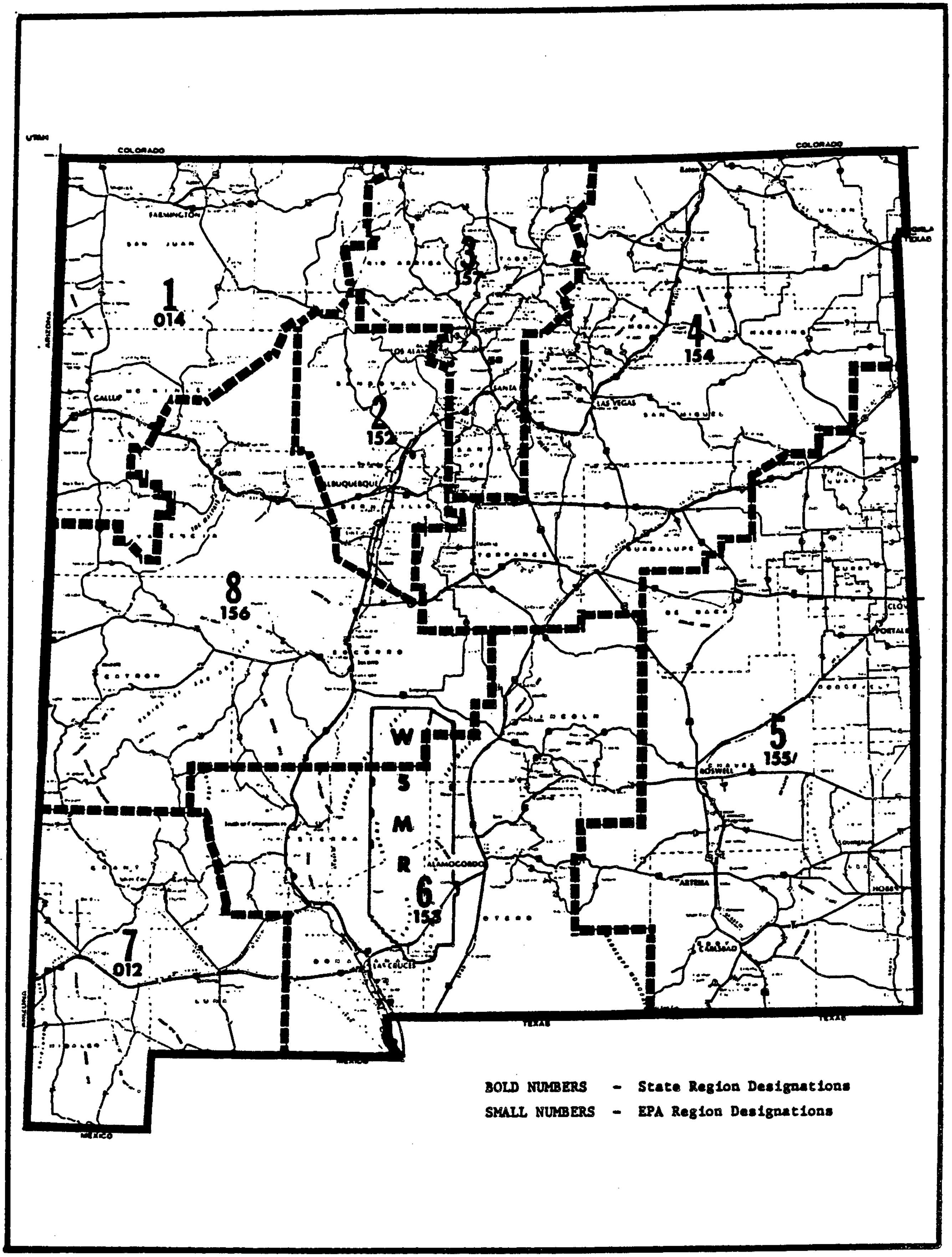


Figure III-10. State of New Mexico and the USEPA Regional Boundaries.

ambient air quality standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health. National secondary ambient air quality standards define levels of air quality which the Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant"(10).

The State and Federal standards are displayed in Table III-5. WSMR is within an attainment area for all pollutants, meaning that pollutants do not exceed the designated air quality standards. Particulates, primarily from blowing dust, are generally the only air pollutants of any concern in the WSMR area. High levels do occur temporarily during periods of high winds. Due to the remote nature of the range, heavy commuter traffic in and out of the post area during rush hours can also be a source of temporary air pollution. In general, however, the low concentrations of air pollutants in the WSMR area can be attributed to the absence of any major, continuous emissions and good atmospheric dispersion conditions. Good atmospheric dispersion is related to wind speeds and mean maximum mixing depths (MMD).

The MMD is the height at which the unstable air mixes. In the absence of radiosonde observations, the MMD may be estimated as being the height of the bottom of the low altitude cloud layer. The MMD varies during the day as well as from season to season. Variations are also dependent upon the topographical features (e.g., mountains). Vertical dispersion of pollutants is limited by the ground and the MMD; therefore, mixing depths are essential in estimating the amount of vertical diffusion of pollution in the atmosphere. Figure III-11 shows the MMD for the United States. It can be seen from this figure that WSMR lies in a region of high MMD in comparison to the rest of the United States. Computed MMD for the WSMR vicinity varies from 580 meters (1900 ft) above ground surface in December to about 3,100 meters (10,200 ft) in May.

Data from the state network of monitoring stations on pollutants and criteria for New Mexico are displayed in Table III-6. The contributions of WSMR to air pollutant levels for these parameters are small(1).

2. Prevention of Significant Deterioration

The purpose of USEPA's Prevention of Significant Deterioration (PSD) program is to assure that areas in attainment continue to remain within standards. Under the PSD program, all lands are divided into one of three classes. Class I areas have air that is pristine, such as national parks and wilderness areas, and almost no increase in air contaminant level is allowed. Within New Mexico, eight wilderness areas and one national park are the only Mandatory Class I areas, as illustrated in Figure III-12. The Stallion site is within 18 km of the Bosque del Apache NWR and the San Pascual Wilderness Area is contained within the Bosque del Apache NWR(9).

Class II areas allow moderate development and Class III areas allow extensive growth. All of the candidate sites are Class II areas. In New Mexico there are no Class III areas. Table III-7 contains the allowable increments of air pollutants by class.

E. Noise

At WSMR, sources of potentially hazardous occupational noise have been surveyed by the U.S. Army Environmental Hygiene Agency (USAEHA) in 1973, 1976

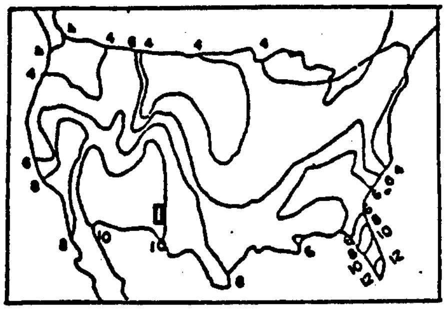
Table III-5

Ambient Air Quality Standards

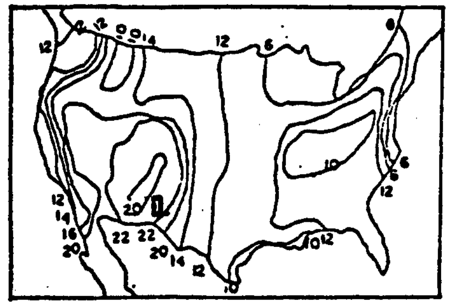
	New Mexico Standard	Federal Primary Standard	Federal Secondary Standard
Total Suspended Particulates (TSP)			
24-hour Average	150 ug/m3*	260 ug/m3	150 ug/m3
Annual Geometric Mean	60 ug/m3	75 ug/m3	60 ug/m3
Sulfur Dioxide (SO_2)			
24-Hour Average	0.10 ppm**	0.14 ppm	365 ug/m3
Annual Arithmetic Mean	0.02 ppm	0.03 ppm	--
3-Hour Average	--	--	0.50 ppm
Carbon Monoxide (CO)			
8-Hour Average	8.7 ppm	9.0 ppm	9.0 ppm
1-Hour Average	13.1 ppm	35.0 ppm	35.0 ppm
Ozone (O_3)			
1-Hour Average	0.06 ppm	0.12 ppm	40,000 ug/m3
Nitrogen Dioxide (NO_2)			
24-Hour Average	0.10 ppm	--	--
Annual Arithmetic Mean	0.05 ppm	0.05 ppm	100 ug/m3
Lead (Pb)			
Calendar Quarterly Arith. Ave.		1.50 ug/m3	1.50 ug/m3

*ug/m3 - data in micrograms per cubic meter
**ppm - data in parts per million by volume

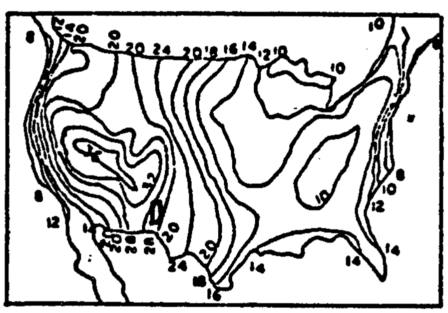
Source: New Mexico Health and Environment Department, 1983 and 1984(9) and Geo-Marine, Inc.



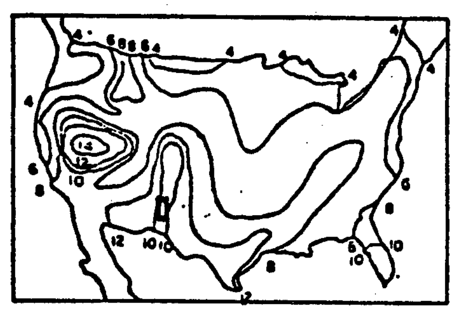
(A) Mean Maximum Mixing Depth in Hundreds of Meters Above Surface During Winter (Dec, Jan, Feb)



(B) Mean Maximum Mixing Depth in Hundreds of Meters Above Surface During Spring (Mar, Apr, May)



(C) Mean Maximum Mixing Depth in Hundreds of Meters Above Surface During Summer (Jun, Jul, Aug)



(D) Mean Maximum Mixing Depth in Hundreds of Meters Above Surface During Fall (Sep, Oct, Nov)

Figure III-11. Mean Maximum Mixing Depth (MMD) for the United States.

Table III-6

TOTAL SUSPENDED PARTICULATE (TSP)
DATA IN MICROGRAMS PER CUBIC METER (ug/m^3)
24 HOUR AVERAGE
1981 1982 1983 1984

Federal Primary Standards
24 Hour - 260 ug/m^3
Annual Geo. Mean - 75 ug/m^3

State Standards and Federal Secondary Standards
24 Hour - 150 ug/m^3
Annual Geo. Mean - 60 ug/m^3

SITE	SITE NO.	HIGH 24 HR. AV.				2ND HIGH 24 HR. AV.				NUMBER OF SAMPLES												ANNUAL GEO. MEAN			
										TOTAL				> 260				> 150							
		81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84
REGION 6																									
Las Cruces	6B	231	167	194	174	166	157	169	165	60	57	61	60	0	0	0	0	6	2	3	2	79	67	69	71
Anthony	6C	470	369	268	287	349	344	261	256	58	57	60	60	7	6	2	1	26	16	18	15	122	107	97	100
Hatch	6E	168	241	211	169	146	182	160	156	61	56	60	59	0	0	0	0	1	4	3	3	66	60	58	60
Anapra S.P.	6F	313	365	271	193	183	262	201	187	59	56	61	60	1	2	1	0	10	9	5	3	98	84	78	78
T or C	6H	191	137	117	142	144	111	114	117	60	58	60	60	0	0	0	0	1	0	0	0	72	53	54	47
Tularosa	6S	232	374	222	247	215	217	216	235	61	57	59	57	0	1	0	0	9	4	3	4	81	73	81	72
Alamogordo	6ZB	229	366	537	185	210	251	263	140	61	56	60	58	0	1	2	0	9	2	5	1	83	70	74	73
Anapra B.L.	6ZC	364	297	341	252	260	280	199	243	61	56	62	59	1	2	1	0	19	10	8	11	122	99	83	107
REGION 8																									
Kerr McGee	8B	301	278	297	86	208	127	175	77	58	51	57	31	1	1	1	0	7	1	3	0	76	43	28	30
Paguate	8D	269	257	160	137	199	105	129	101	52	48	55	52	1	0	0	0	4	1	1	0	56	35	40	36
Socorro	8E	137	144	95	145	118	143	84	100	58	57	60	60	0	0	0	0	0	0	0	0	54	50	47	48
United Nuclear	8G	617	170	*	*	581	126	*	*	56	30	*	*	3	0	*	*	9	1	*	*	93	45	*	*
San Mateo	8H	323	71	*	*	174	69	*	*	58	27	*	*	1	0	*	*	4	0	*	*	53	34	*	*
Anaconda	8J	110	60	*	*	96	58	*	*	54	35	*	*	0	0	*	*	0	0	*	*	37	25	*	*
Blue Water	8K	311	192	*	*	230	125	*	*	56	37	*	*	1	0	*	*	10	1	*	*	85	59	*	*
Milan	8L	438	315	316	292	353	306	310	225	52	55	60	33	7	2	2	1	25	14	16	9	150	93	102	101

Federal Primary Standard
24 Hour Average - 0.14 ppm
Annual Arithmetic Mean - 0.03 ppm

Federal Secondary Standard
3 Hour Average - 0.50 ppm

SULFUR DIOXIDE (SO_2)
DATA IN PARTS PER MILLION BY VOLUME (ppm)
1 HOUR AVERAGES (CONTINUOUS)
1981 1982 1983 1984

State Standards
24 Hour Average - 0.10 ppm
Annual Arithmetic Mean - 0.02 ppm

	SITE NO.	HIGH 24 HR. AV.				2ND HIGH 24 HR. AV.				HIGH 3 HR. AV.				2ND HIGH 3 HR. AV.				NUMBER OF SAMPLES				ANNUAL ARITHMETIC MEAN			
		81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84
REGION 6																									
La Union	60	.02	.04	.03	.02	.02	.04	.03	.02	.10	.21	.11	.12	.10	.11	.10	.11	7864	8019	7924	8072	0	0	0	0
Anapra B.L.	6ZC	.14	.11	.11	.11	.12	.11	.10	.10	.37	.35	.26	.29	.35	.35	.26	.26	8043	8079	8015	8062	.02	.02	.02	.02

*Data Not Available

Table III-6 (cont'd)

CARBON MONOXIDE (CO)
DATA IN PARTS PER MILLION BY VOLUME (ppm)
1 HOUR AVERAGE (CONTINUOUS)
1981 1982 1983 1984

Federal Standards
8 Hour Average - 9 ppm
1 Hour Average - 35 ppm

State Standards
8 Hour Average - 8.7 ppm
1 Hour Average - 13.1 ppm

SITE	SITE NO.	HIGH 8 HR. AV.				2ND HIGH 8 HR. AV.				HIGH 1 HR. AV.				2ND HIGH 1 HR. AV.				NUMBER OF SAMPLES			
		81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84
REGION 1																					
Farmington	1Z	6.5	6.9	4.8	4.2	6.1	6.8	4.7	4.1	15.5	20.0	10.0	9.0	13.0	16.5	9.0	8.0	8485	8559	8476	8311
REGION 2																					
Albuquerque	2E	11.3	10.1	11.0	10.0	10.3	10.0	9.0	9.0	19.0	18.0	16.0	18.0	17.0	15.0	15.0	17.0	8713	8602	8727	8669
Albuquerque	2Z	12.9	13.5	11.0	11.0	10.1	11.8	9.0	10.0	18.0	19.0	18.0	18.0	18.0	16.0	16.0	15.0	8703	8740	8687	8709
Albuquerque	2ZE	13.9	18.6	14.0	13.0	13.6	14.1	12.0	12.0	27.0	24.0	25.0	19.0	21.0	24.0	24.0	18.0	8688	8662	7908	8754
Albuquerque	2ZH	3.9	7.6	4.0	*	3.8	5.0	4.0	*	8.0	9.0	7.0	*	7.0	9.0	7.0	*	8274	8644	4934	*
Albuquerque	2ZK	*	19.8	18.0	16.0	*	19.6	17.0	15.0	*	32.0	26.0	24.0	*	30.0	26.0	21.0	*	8735	8702	8184
REGION 3																					
Santa Fe	3Y	6.8	6.5	6.1	7.8	4.7	5.8	5.8	7.6	15.5	12.0	17.0	14.0	13.0	12.0	13.0	12.0	8610	8646	8518	8434
REGION 6																					
Las Cruces	6ZE	*	*	3.5	7.3	*	*	3.3	4.0	*	*	8.0	18.0	*	*	8.0	12.0	*	*	8382	8382
Las Cruces	6ZF	10.0	11.6	9.3	9.0	9.0	9.0	7.1	7.6	15.0	15.0	15.0	13.0	15.0	15.0	11.0	11.0	6505	8481	8203	8409

*Data Not Available

OZONE (O_3)
DATA IN PARTS PER MILLION BY VOLUME (ppm)
1 HOUR AVERAGE (CONTINUOUS)
1981 1982 1983 1984

Federal Standard
1 Hour Averages - 0.12 ppm

State Standard
1 Hour Average - 0.06 ppm

SITE	SITE NO.	HIGH 1 HR. AV.				2ND HIGH 1 HR. AV.				NUMBER OF SAMPLES				NUMBER OF DAYS WITH VALUES > 0.12				NUMBER OF DAYS WITH VALUES > 0.06			
		81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84	81	82	83	84
REGION 2																					
Albuquerque	2R	.076	.087	.090	*	.073	.082	.090	*	8140	8152	8358	*	0	0	0	*	**105**	**228**	**190**	*
Albuquerque	2Z	.112	.104	.100	.090	.109	.100	.100	.090	8734	8681	8595	8406	0	0	0	0	**354**	**163**	**181**	**183**
Albuquerque	2ZF	.108	.103	.100	.100	.106	.101	.100	.090	8734	8628	8310	8399	0	0	0	0	**270**	**210**	**208**	**249**
Albuquerque	2ZH	.100	.100	.110	.080	.098	.095	.090	.080	8274	7708	7100	8734	0	0	0	0	**298**	**230**	**186**	**215**
Albuquerque	2ZI	.108	.109	.100	.110	.108	.109	.090	.100	7829	8380	8622	8773	0	0	0	0	**359**	**248**	**210**	**228**
Bernalillo	2ZJ	.090	.110	.110	.110	.090	.100	.090	.100	6700	8191	7969	7414	0	0	0	0	**147**	**111**	**39**	**55**
REGION 6																					
Las Cruces	60	.140	.100	.100	.120	.110	.100	.090	.110	7650	8288	8426	8629	1	0	0	0	110	79	55	50
Las Cruces	6ZF	.090	.070	.080	.090	.090	.070	.080	.080	6924	8331	8628	8663	0	0	0	0	94	67	22	17

Bolded Numbers - The City of Albuquerque provided figures showing the number of hours with values greater than 0.05 ppm rather than number of days with values greater than 0.06 ppm

*Data Not Available

Table III-6 (cont'd)

Federal Primary Standard
Calendar Quarterly - 1.5 ug/m^3
Arithmetic Averages

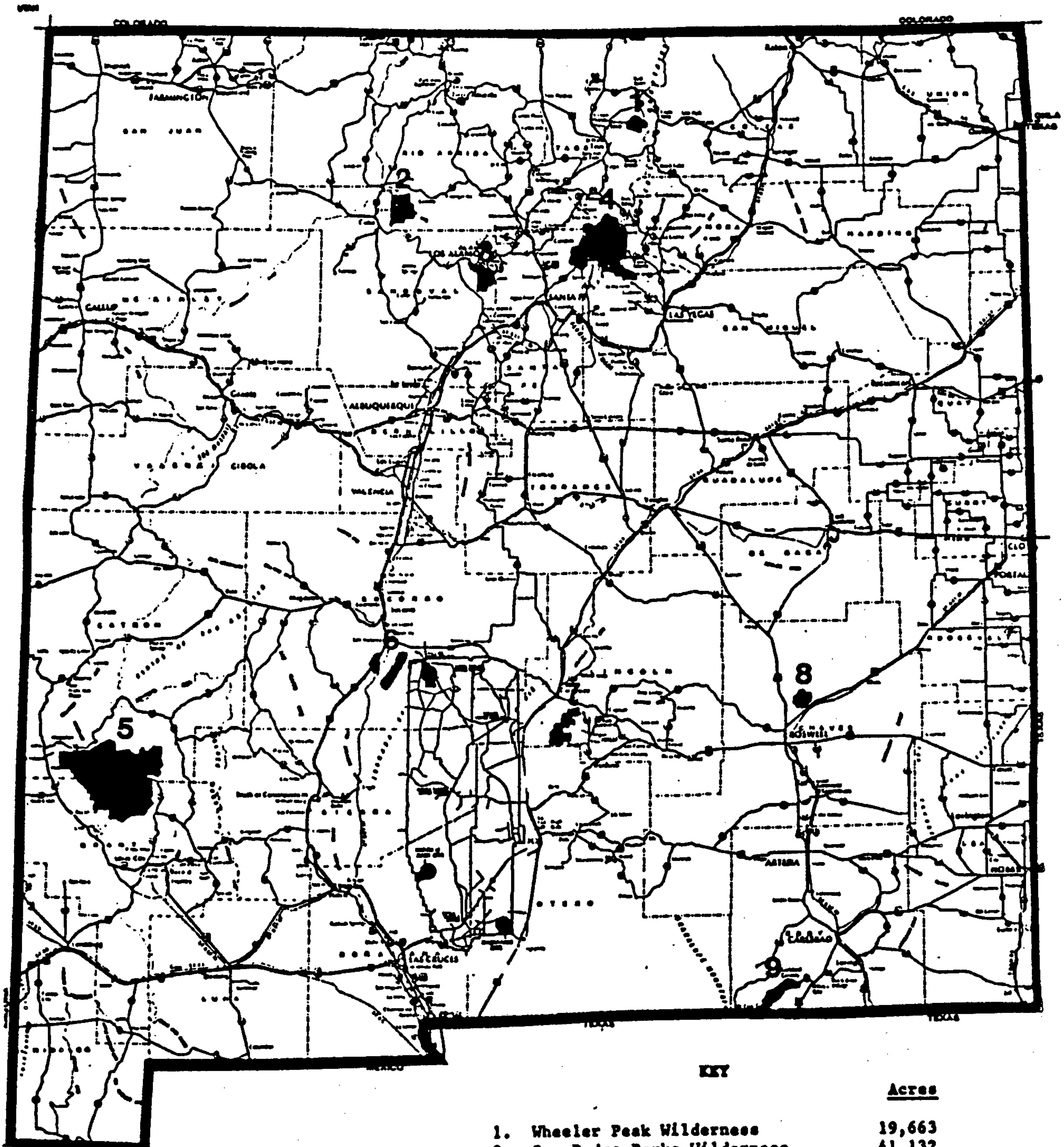
LEAD (Pb)
DATA IN MICROGRAMS PER CUBIC METER (ug/m^3)
1981 1982 1983 1984

SITE	SITE NO.	1981				1982				NUMBER OF SAMPLES	
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1981	1982
REGION 2											
Albuquerque	2ZE	*	*	*	*	*	.24	.35	.66	*	27
Albuquerque	2ZK	*	*	*	*	*	*	*	*	*	*
REGION 6											
Anapra S.P.	6F	1.35	.90	2.25	1.31	.75	.76	.59	.76	59	66
Anapra B.L.	6ZC	2.03	1.23	3.52	1.97	1.31	1.26	.79	1.34	61	66
REGION 7											
Silver City	7A	.19	.12	.16	.20	.16	.13	.14	.18	60	67
Bayard	7B	.14	.10	.13	.15	.14	.12	.13	.21	60	68
Hurley	7C	.18	.14	.14	.10	.08	.07	.06	.10	61	68

SITE	SITE NO.	1983				1984				NUMBER OF SAMPLES	
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1983	1984
REGION 2											
Albuquerque	2ZE	.50	.30	.23	.42	.38	.19	.16	.40	58	59
Albuquerque	2ZK	.95	.64	.68	.73	.71	.47	.52	.78	59	59
REGION 6											
Anapra S.P.	6F	.59	.39	.64	.73	.40	.42	.59	.67	61	60
Anapra B.L.	6ZC	.94	.55	.70	1.01	.85	.72	1.00	.84	62	59
REGION 7											
Silver City	7A	.20	.11	.11	.28	.13	.14	.15	.15	47	61
Bayard	7B	.21	.12	.16	.12	.10	.09	.11	.11	46	61
Hurley	7C	.05	.14	.15	.06	.06	.06	.05	.08	45	59

*Data Not Available

MANDATORY CLASS I AREAS



KEY

		Acres
1.	Wheeler Peak Wilderness	19,663
2.	San Pedro Parks Wilderness	41,132
3.	Bandelier Wilderness	23,267
4.	Pecos Wilderness	223,333
5.	Gila Wilderness	569,792
6.	Bosque del Apache Wilderness	40,948
7.	White Mountain Wilderness	48,873
8.	Salt Creek Wilderness	9,621
9.	Carlsbad Caverns National Park	46,435

Figure III-12. New Mexico Mandatory PSD Class I Areas.

Table III-7

Allowable PSD Increments
Micrograms per cubic meter (ug/m3)

Parameter	Class I	Class II	Class III
Sulfur Dioxide			
Annual	2	20	40
24-Hour*	5	91	182
3-Hour*	25	512	700
Total Suspended Particulate Matter			
Annual	5	19	37
24-Hour*	10	37	75

*Not to be exceeded more than once a year

Source: New Mexico Health and Environment Department, 1983 and 1984(9)

and 1980(1). Identified sources from these surveys, with data from local surveys, have provided an inventory of noise sources which is presented in Table III-8. The majority of these sources includes shop tools, generators, heavy equipment, woodworking tools, climatic environment machinery, radar equipment and missile systems tests on the main post and range areas, which generate occupational noise in excess of 85 decibels on the A-weighted scale (dB[A]). Weapons firings and supersonic air operations produce peak noises in excess of 146 dB(A). At times, these noise sources can be heard in areas off the range.

No site specific noise data are available for the three proposed alternative sites. Due to the remoteness of the areas, no major noise sources other than from overflying aircrafts and "sonic booms" are presently expected to occur in these areas. The Stallion and Orogrande sites experience some noises from motor vehicle traffic.

F. Biological Resources

For clarity, the biological resources discussion is further divided into the following seven parameters: (1) vegetation, (2) reptiles and amphibians, (3) fishes, (4) birds, (5) mammals, (6) threatened and endangered species and (7) other unique and/or environmentally sensitive areas. Where appropriate, site specific data concerning these resources are provided for each of the proposed project sites.

1. Vegetation

Data gleaned from interpretation of recent (1985) color infrared aerial imagery (scale 1:24,000) and from recent helicopter and preliminary field reconnaissance surveys of the three areas were used to delineate and describe the habitat types at each site. The area surveyed and mapped also included the surrounding areas that would be restricted for use for eye safety purposes. Visual observations were made from the helicopter and several stops were made within various habitat types for ground truthing. Point intercept

Table III-8

Occupational Noise - WSMR

Location	Branch Element	Noise Source	Noise Level (db[A])
		Facilities Engineering Directorate:	
1531	Sanitation	Pulverizer	102
1737	Precision Machine	Small and Large Bandsaw	90-99
1740	Heavy Equipment	Grader, Crane, Tractor	99-108
1741	Refrigeration, Heating and Plumbing	Compressor	96
1742	Paint	Paint Booth	87-89
		Metal Bandsaw	91-96
1751	Welding and Sheet Metal	Arc Welder and Local Exhaust Hood	92
1754	Carpentry	Woodworking Tools	110
1764	Preventive Maintenance	Metal Cutting Saw Skillsaw	100
30740	Carpentry and Heavy Equipment	Various Saws, Grader and Tractors	90-108
34230	Heavy Equipment	Grader, Tractors, Earthmovers	95-108
34244	Carpentry	Various Saws	90-108
		Logistics Directorate:	
TE 1644	Electronic Maintenance	Machinery, Various Saws Ultrasonic Cleaner, Paint Booth	85-106
TM 1753	Heavy Equipment Maintenance	Vehicular Noise, Pneumatic Tools	90-108
1783	Paint	Ventilation System	97
1784	Paint	Ventilation System	87
1788	Tire Shop	Pneumatic Tools, Vehicular Noise	99-118
1789	Body Repair	Pneumatic Tools	95-125
1790	Generator and Fast Automotive	Generators, Pneumatic Tools, Vehicular Noise	85-110
1794	General Vehicle Maintenance	Vehicular Noise, Pneumatic Tools	90-104
30735	Heavy Vehicle Maintenance	Vehicular Noise	110
34240	Heavy Vehicle Maintenance	Vehicular Noise	110
34250	Heavy Vehicle Maintenance	Vehicular Noise	110
ST1785	POL	Vehicular Noise	95
1827	Warehouse	Forklift	95
1837	Warehouse	Forklift	95
21547	Liquid Propellant	Vehicular Noise	95
WS-00025	Solid Propellant	Vehicular Noise	95
30725	POL	Vehicular Noise	95
34210	POL	Vehicular Noise	95
SR680	Commissary	Meat Saws	96
TT1848	Packing and Crating	Various Saws	90-118
		Personnel and Community Activities:	
1338A	Morale Support	Golf Course Maintenance and Equipment	88-93
		Troop Command:	
Firing Range	S4	Weapons Firing	156 peak
143	S4	Power Tools	104
418	S4	Power Tools	104

Table III-8 (cont'd)

Occupational Noise - WSMR

Location	Branch Element	Noise Source	Noise Level (db[A])
	Army Material Test & Evaluation Directorate:		
1534	Dynamics	Environmental Shake Table	91-105
19447	Dynamics	Diesel Generators, Hydraulic Pump	91-105
20836	Dynamics	Diesel Generators, Hydraulic Pump	91-105
20849	Dynamics	Diesel Generators, Hydraulic Pump	91-105 91-105
20850	Dynamics	Diesel Generators, Hydraulic Pump	91-105
1544	Climatic Environment	Machinery, Compressor and Vehicular	88-103
21130	Climatic Environment	Conrad Climatic Chamber	85-93
21562	Climatic Environment	Conrad Climatic Chamber	85-93
21564	Climatic Environment	Conrad Climatic Chamber	85-93
27104	Climatic Environment	Conrad Climatic Chamber	85-93
27188	Climatic Environment	Conrad Climatic Chamber	85-93
LC-33	Land Combat	Weapons Firings	87 in cab
SMR	Land Combat	Weapons Firings	185 peak
LC-32	Air Defense	Weapons Firings, Generators, Radar	90-103
LC-38	Air Defense	Weapons Firings, Generators, Radar	90-102
LC-50	Air Defense	Weapons Firings	146 peak
	Army Air Directorate:		
HAFS	Army Air Operations	Aircraft	93-115
HAFS	Holloman AFS Operations	Aircraft	143-146
N. Range		Sonic Boom	peak
	USA Communications Command:		
1408	Support	Ultrasonic Cleaner	92
King I	Operation & Control	1000 Cycle Tone	92-103
Rhodes Canyon	Operation & Control	1000 Cycle Tone	92-103
Clark Site	Operation & Control	1000 Cycle Tone	92-103
Oscura Range Camp	Operation & Control	1000 Cycle Tone	92-103
J-9	Operation & Control	1000 Cycle Tone	92-103
Andre	Operation & Control	1000 Cycle Tone	92-103
Salinas Peak	Operation & Control	1000 Cycle Tone	92-103
Stallion	Operation & Control	1000 Cycle Tone	92-103
	Atmospheric Science Laboratory:		
1623	Computer	Computer	87
21925	Electronic	Radar	92
	Electronic Warfare Laboratory:		
1624	Air Defense	Electronic Jammers	88
23638	Technology & Advanced Concepts	Vehicular and Equipment Noise	85-100
Field	Air Defense	Generators	85-104
Transmitter Vans	Air Defense	Transmitter Vans	95

transects were made at various locations to obtain plant species composition and an indication of density. The transects consisted of 200 paces, and a plant was identified and recorded when the basal area intercepted a mark on the right toe. Voucher specimens of several species were collected for further verification. The various communities identified during this task are described below. Since the visual observations and ground truthing were made at the North of NASA site, the orientation of the target range and the restricted use zone were rotated to the southwest. This rotation changed the range from a rugged more mountainous terrain toward a basin desert plain terrain and provided additional displacement from the San Andres NWR. Vegetation types in this replacement area were established strictly from photo interpretation of the color infrared aerial imagery and are without benefit of ground truthing.

a. Stallion Site

The landscapes at the Stallion site comprise nearly level to undulating low dunelike areas. Slight depressions and poorly defined drainageways are intermingled throughout the area. For the most part the vegetative communities on a specific landscape are relatively homogeneous. As can be seen from Figure III-13, four major habitat types are within the Stallion site. The sand sagebrush-soaptree yucca community occupies the undulating low dunelike areas. Sand sagebrush (Artemisia filifolia) and soaptree yucca (Yucca elata) characterizes this plant community. Other predominant species include giant dropseed (Sporobolus giganteus), mesa dropseed (Sporobolus flexuosus), sand dropseed (Sporobolus cryptandrus) and black grama (Bouteloua eriopoda). Threeawn (Aristida spp.) is a common associate; however, this species also occurs extensively in a small area immediately south of Stallion airstrip. Other common associates include broom snakeweed (Xanthocephalum sarothrae), four-wing saltbush (Atriplex canescens), Mormon tea (Ephedra torreyana) and Broompea (Dalea scoporia).

The smaller sand sagebrush communities that occur south and southeast of the Stallion site's north boundary are comprised of similar species; however, mesquite (Prosopis juliflora) is common on low dunes and sand sagebrush is more abundant. Other associate species occur less frequently except for bush mulhy (Muhlenbergia porteri) which increases in this community.

The alkali sacaton-tobosa grasslands occur on the nearly level landscapes, drainageways and depressions. Predominant species in this community are alkali sacaton (Sporobolus airoides), tobosa (Hilaria mutica), burrograss (Schlkeropogon brevifolius), bush muhly, Ear muhly (Muhlenbergia arenacea), fluffgrass (Tridens pulchellus) and mesa dropseed. Other common associates that are included in the site are four-wing saltbush, broom snakeweed and scattered plants of Mormon tea, verbena (Verbena spp.), globemallow (Sphaeralcea subhastata) and broompea. The ground cover of the alkali sacaton-tobosa site is typically patchy and in places up to 85 percent bare ground may be exposed. The grassland communities are the most productive habitat types that occur at WSMR and support numerous important game and non-game species.

The inert areas illustrated in Figure III-13 are Warhead Impact Target (WIT) areas. These areas are periodically cleared and graded so that the majority of the time the ground is barren and biologically nonproductive.

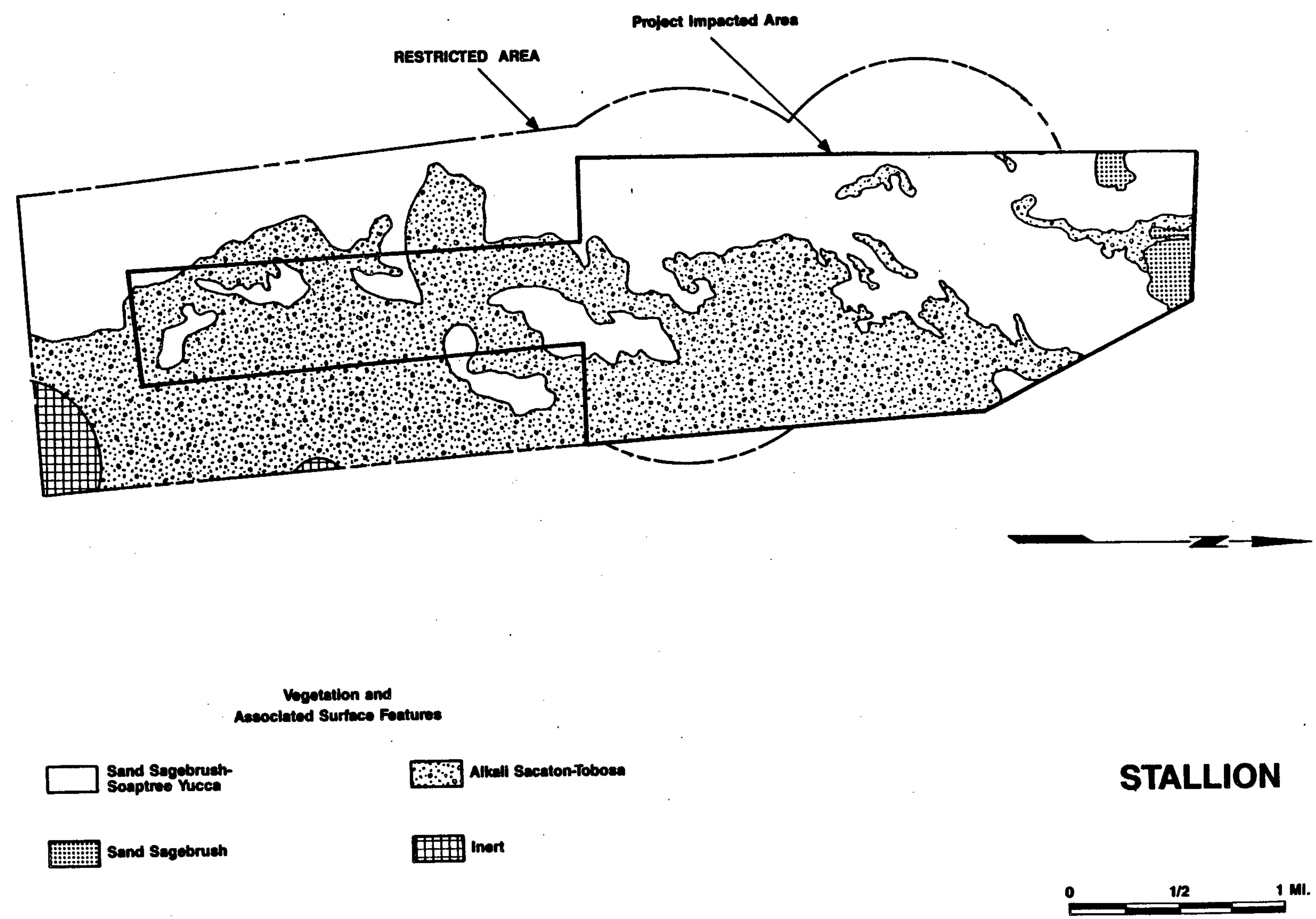


Figure III-13. Vegetation Types of the Stallion Site.

b. North of NASA Site

The North of NASA site is comprised primarily of mesquite-sand dune habitat and hills-grassland habitat. About 50 percent of the mesquite sand dune area is covered by coppice dunes formed by the drifting sand around mesquite. Four-wing saltbush, Mormon tea and soaptree yucca occur in the outer margin of a few dunes. Broom snakeweed and broompea occur in the interdune area. Other plants that are widely scattered within the interdune area include sand sagebrush (Reverchonia arenaria) and Rumex sp. Grasses are nearly eliminated due to the strong competition of the mesquite for available moisture; however, in places some of the interdune areas will include a few plants of giant dropseed, mesa dropseed and plains bristle grass (Setaria macrostchya).

The hills-grassland area occupies the foot hills and steep slopes along the eastern part of the North of NASA site. Approximately 50 to 60 percent of the area is bare rock-outcrop. The principal grass community consists of black grama, side-oats grama (Bouteloua curtipendula), mesa dropseed and threeawn. Other plants include tobosa, fluffgrass, American tarbush (Flourensia cernua), broom snakeweed, cresotebush (Larrea tridentata), four-wing saltbush, ocotillo (Fouquieria splendens) and century plant (Agave parryi).

As can be seen in Figure III-14 smaller plant communities also occur sporadically throughout the North of NASA area. The shrub-grassland areas are on low hills in the central part of the area. Vegetation is sparse and is dominated by shrubs that include cresotebush, American tarbush, broom snakeweed, rubber bush (Parthenium incanum) and to a lesser extent ocotillo, soaptree yucca and narrow leaf coldenia (Coldenia hispidissima). Black grama, fluffgrass, bush muhly and burrograss are the principal grasses growing on this site. Bare rock outcrop comprises 25 to 45 percent of the shrub grassland areas.

The juniper-sand habitat occurs in the northern part where deep sands have formed a landscape in small valleys that are surrounded by steep hills. Juniper trees (Juniperus monosperma) that reach a height of more than five meters characterize the site. The remaining plant community consists of four-wing saltbush, broom snakeweed, mesquite, walkingstick cholla (Opuntia imbricata), little leaf sumac (Rhus microphylla) and groundsel (Senecio sp.). Due to wind erosion, barren sands comprise 30 to 60 percent of the area. In areas somewhat protected from the wind, scattered grasses are growing and include sand dropseed, mesa dropseed, bush muhly and threeawn.

Arroyo-riparian habitat occurs along the Horse Camp Draw and tributaries in the northern part of the North of NASA site. The trees and shrubs that are common in this habitat include mesquite, rubber rabbitbush (Chrysothamnus nauseosus), white desert willow (Chilopsis linearis) and Apache plume (Fallugia paradoxa). Grasses growing in this habitat are sand dropseed, mesa dropseed, black grama, bush mulhy and threeawn. Other arroyo riparian habitats are common along New Well Draw and smaller drainages; however, these communities are not delineated due to their narrow, linear shape.

Near the eastern end of the project area, several small (<1-2 acres) stands of oak trees exist, particularly near the base of larger hills. The western scrub oak (Quercus turbinella) and little leaf sumac were the dominant species in these communities. Unfortunately, because of their small areal

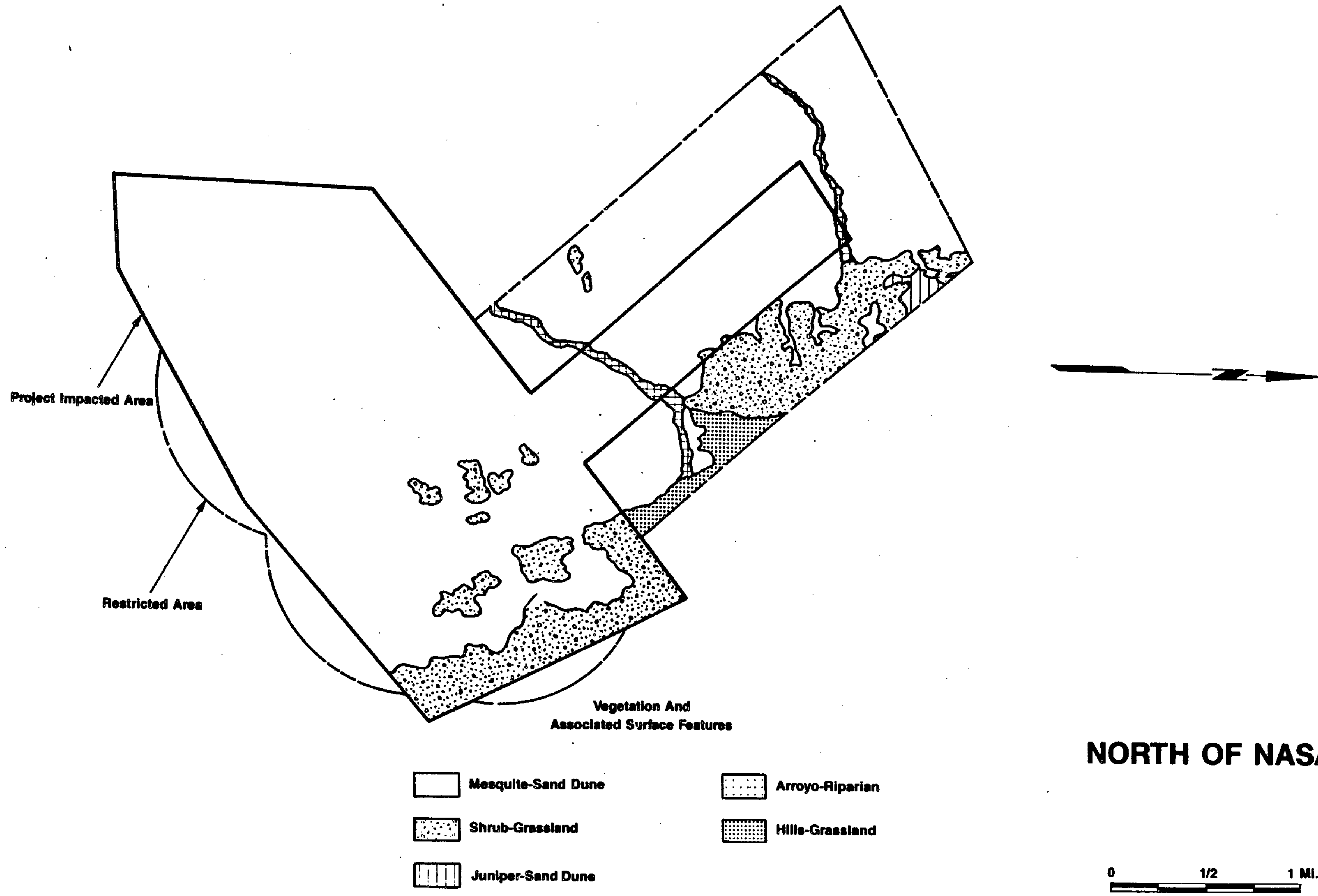


Figure III-14. Vegetation Types of the North of NASA Site.

extent and sporadic occurrence, these communities could not be delineated on Figure III-14.

The western section of the range and restricted use zone is primarily mesquite-sand dune vegetation. Interpretation of aerial imagery seems to indicate an occasional influx of creosote bush and American tarbush into this habitat. As stated earlier, this indication was not visually verified.

c. Orogrande site

The majority of the Orogrande site is comprised of mesquite-sand dune habitat. Sand dunes attaining heights of up to five meters have formed around mesquite plants and make up to 50 percent of the habitat. Associates that occur sporadically in the sand dunes or their outer margins include four-wing saltbush, sand sagebush, soaptree yucca and Mormon tea. Soaptree yucca becomes more common in the northern part of the area. The interdune areas are barren except for scant amounts of vegetation. The dominant plants within the interdune area consist of broom snakeweed, sand dropseed, mesa dropseed and plains yellow flax (Linum aristatus var. australe). A significant amount of seasonal forbes may grow in the interdune area following periods of summer rainfall.

Scattered at various locations throughout the Orogrande site are sand sagebrush communities. The largest area of this habitat occurs near the southern boundary as shown in Figure III-15. Other than sand sagebrush, the few other sporadic associates that occur on this site include mesquite, soaptree yucca, broom snakeweed, sand dropseed, mesa dropseed, desert marigold (Baileya multiradiata) and Russian thistle (Salsa kali).

All habitats may contain a few scattered plants of creosotebush;, however, near the southwest corner of the Orogrande site two areas consist predominantly of creosotebush. Broom snakeweed is a close associate with the creosotebush. Other associates that are scattered throughout the site include mesquite, soaptree yucca and sand sagebrush.

Small areas that are predominantly broom snakeweed also may occur in all habitats. Most of these areas are too small to show on Figure III-15. In addition to broom snakeweed, other plants in this habitat include four-wing saltbush, mesquite and mesa dropseed.

Numerous small playas (depressions) occur in the northern part of the Orogrande site and support grassland communities. Most of the areas are too small to show on Figure III-15. The dominant grasses are vine mesquite (Panicum obtusum), tobosa, alkali sacaton and bush muhly. Common associates include broom snakeweed and scattered plants of four-wing saltbush and mesquite. Horse nettle (Solanum eleagnifolium) and milkweed (Asclepias sp.) also occur in some areas.

2. Reptiles and Amphibians

Since amphibians normally require water or extreme moisture during the early stages of their life cycle and surface water resources on WSMR are limited, amphibian populations on WSMR are also restricted. The U.S. Army(1) listed only one salamander, the barred tiger salamander (Ambystoma tigrinum marvortium), that may inhabit WSMR. This salamander requires stock tanks or temporary ponds and pools in the mountains or lowlands. Potential habitat for the barred tiger salamander probably exists in the eastern portion of the

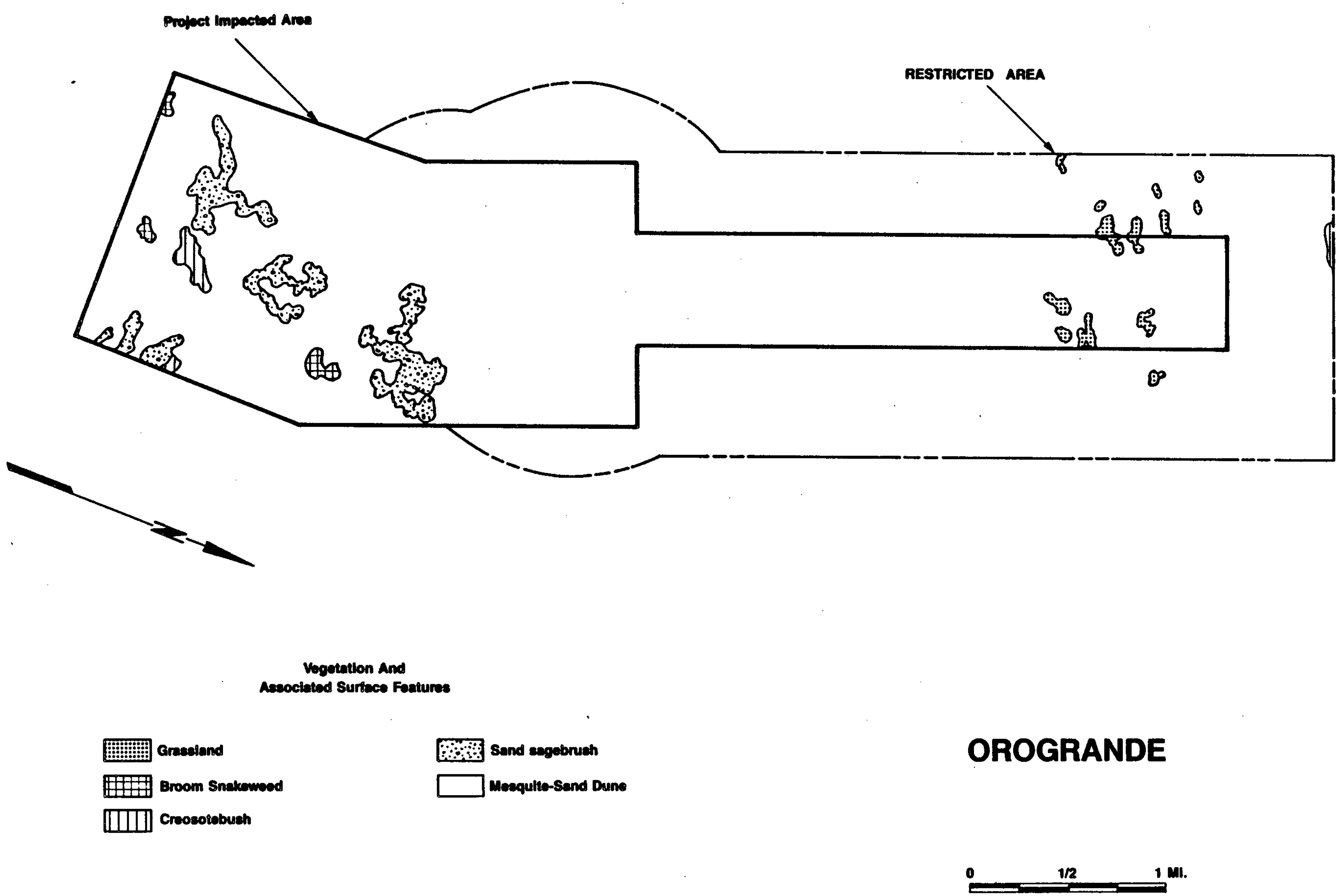


Figure III-15. Vegetation Types of the Orogrande Site.

North of NASA site; however, it is unlikely that suitable habitat occurs at the other two sites, based upon a recent reconnaissance of the three sites.

The only other amphibians listed by the U.S. Army(1) as commonly occurring were Couch's, western and plains spadefoot toads (Scaphiopus couchi, S. hammondi, S. bombifrons, respectively). Potential habitat for each species occurs at all three sites.

Reptiles, on the other hand, comprise a very abundant and diverse group of wildlife. Table III-9 presents those reptilian species presumed to be common within WSMR, as well as their potential to occur at each site based upon each species' habitat needs. As can be seen from this table, the North of NASA site has the greatest potential to support a diverse population of reptiles, primarily because of the variety of habitats that occur in this area.

3. Fishes

The only fish reported to occur within WSMR is the White Sands pupfish (Cyprinodon tularosa). This small fish is endemic to the Malpais and Mound springs and Salt Creek drainage basin, and has recently been rediscovered in Lost River(11,12,13). The Orogrande site which is about 47 km south of Lost River, is the closest of the three alternative sites to any of the potential White Sands pupfish habitat. In addition, the Stallion and North of NASA sites are separated from potential pupfish habitat by mountain ranges.

4. Birds

Although no specific survey for birds has been conducted for WSMR, a total of 312 species is presumed to occur within the range(1). This large number of species is due primarily to the very diverse habitat types that occur within WSMR. Common passerine birds that are expected to occur at the Stallion and Orogrande sites include the northern mockingbird; Chihuahuan raven; cactus, rock and Bewick's wrens; curve-billed thrasher; loggerhead shrike; rufous-sided and brown towhees; white-crowned, vesper, blackthroated and sage sparrows; lark bunting; and house finch. In addition to these species, the North of NASA site also probably supports the scrub and pinon jays; canyon wren; Virginia's, yellow-rumped and Wilson's warblers; green-tailed towhee; and rufous-crowned sparrow.

Insectivorous birds common to each alternative site include ladder-backed woodpecker, Say's phoebe, ash-throated flycatcher, western kingbird, horned lark and lesser nighthawk. The common nighthawk also probably occurs at the Stallion site. The North of NASA site contains suitable habitat for the following additional insectivorous species: (1) common poor-will; (2) northern flicker; (3) Cassin's flycatcher; (4) violet-green swallow; (5) blue-gray gnatcatcher; and (6) western bluebird.

The northern harrier and red-tailed hawk are the two raptors that commonly occur near the Orogrande site. In addition to these two, the Stallion and North of NASA sites provide suitable habitat for ferruginous hawk, golden eagles and American kestrels. Swainson's hawk occurs at each of the sites; however, this is a rare species and is presently being reviewed by the U.S. Fish and Wildlife Service (USFWS) for potential listing as a threatened or endangered species. Additionally, falcon eyries have recently been discovered along the Oscura Mountains near the Stallion site, although it is presently

Table III-9

Reptiles that Commonly Occur within WSMR

Species	Habitat Use Areas	Potential Occurrence at Each Site* Stallion	NASA	Orogrande
Yellow box turtle (Terrapene ornata luteola)	treeless, rolling grassland and areas of scattered shrubs in sandy soil	3	0	0
Lesser earless lizard (Holbrookia maculata)	washes sandy streambanks, and sand dunes in short grass prairie and mesquite deserts	1	3	3
Collared lizard (Crotaphytus collaris)	canyons, rocky gullies, mountain slopes, hillsides in sparse vegetation	0	2	0
Long-nosed leopard lizard (Crotaphytus wislizenii wislizenii)	aird and semi-arid plains in scattered alkalibush, sagebrush, creosote and mesquite on hardpan, gravel or sand	2	2	2
Twin-spotted spiny lizard (Sceloporus magister himaculosus)	plains and lower slopes of mountains in creosote, mesquite and pinoned and in moist areas with willow and cottonwood	1	2	0
Desert side-blotched lizard (Uta stanishuriana stejnegeri)	sand, rock, hardpan, or loam with grass, bushes, and scattered trees, especially along sandy washes with rocks and low-growing bushes	2	2	2
Tree lizard (Urosaurus ornatus)	in mesquite, oak, pine, juniper, cottonwood and tamarisk, especially in riparian areas	0	2	0
Texas horned lizard (Phrynosoma cornutum)	open cactus, juniper, acacia, mesquite land with sand, loam, hardpan, or rock and loose soil for burrowing	1	2	1
Round-tailed horned lizard (Phrynosoma modestum)	sandy or gravelly soil of plains, desert flats, and washes often in ocotillo, oak, mesquite, or creosote	2	2	2
Little striped whiptail (Cnemidophorous inornatus)	grassland into grassy pinon-juniper especially on sandy, silty, or gravelly elevated plains or alluvial flatlands	1	2	0
Checkered whiptail (Cnemidophorous tesselatus)	creosote desert to pinon mountains, hardpan, sandy, or rocky soil with scant vegetation	2	2	2
Western coachwhip (Masticophis flagellum testaceus)	desert, brushland, and woodland in sparse vegetation on flat or hilly, sandy or rocky soil	2	2	3
Painted desert glossy snake (Arizona elegans phillipi)	open areas in chaparral and grassland, light brushy to barren desert, sagebrush flats, and woodland on sandy or loamy soils with rocks	2	2	1

Table III-9 (cont'd)

Reptiles that Commonly Occur within WSMR

Species	Habitat Use Areas	Potential Occurrence at Each Site* Stallion	NASA	Orogrande
Sonoran gopher snake (*Pituophis melanoleucus affinis*)	lowlands to high mountains, especially common in grassland and open brushland on sand, loam, rock or hardpan	1	2	1
Texas long-nosed snake (*Rhinocheilus lecontei tessellatus*)	deserts, prairies, and brushland	2	2	2
Mexican black-headed snake (*Tantilla planiceps atriceps*)	variety of habitats, especially in association with mesquite, sotol, agave, yucca, creosote, ocotillo, and oak in rocky areas	2	2	1
Plains black-headed snake (*Tantilla nigriceps nigriceps*)	shortgrass prairie, brushland, and woodland under rocks, etc. on damp soil	2	2	1
Texas night snake (*Hypsiglena torquata texana*)	deserts to lower slopes of mountains in rocky or sandy areas	1	2	2
Western diamondback rattlesnake (*Crotalus atrox*)	desert, grassland, brushland, woodland, wet areas, rocky canyons, and lower mountain slopes	2	2	3
Prairie rattlesnake (*Crotalus viridis viridis*)	grassland, brushland, woodland, and forest, especially in rocky areas	2	2	1

*0 = No chance of occurrence
1 = Unlikely but possible chance of occurrence
2 = good chance of occurrence due to suitable habitat
3 = observed during recent reconnaissance trips

Source: U.S. Army, 1985(1) and Geo-Marine, Inc.

not known which species of falcons (i.e., peregrine or prairie) constructed the nests(14).

Semi-permanent water exists seasonally at Orogrande and Stallion sites in playa lake beds which fill seasonally. A variety of waterfowl (i.e., dabbling ducks and coots) may be observed during spring migration.

Gambel's and scaled quail are common resident upland game species that are presumed to occur at all three sites. The scaled quail is probably more abundant near the Stallion site, however, since it prefers arid grasslands. The mourning dove is also an upland game species which occurs at each proposed site, although the doves frequent WSMR only during the summer months. The extreme eastern portion of the North of NASA site may provide suitable habitat for the wild turkey. Although this species is known to breed and nest within WSMR, turkeys are infrequently observed and are considered by the U.S. Army(1) to be rare.

5. Mammals

A total of 104 mammalian species is known or presumed to occur at WSMR, five of which have been introduced by man: house mouse (Mus musculus), Norway rat (Rattus norvegicus), domestic horse (Equus caballus), Barbary sheep (Ammotragus lervia) and gemsbok (Oryx gazella). The remaining 99 species represent approximately 69 percent of the mammals which have been recorded from the State of New Mexico(1,12,13,15,16).

The majority of mammals (in both numbers and number of species) is comprised of smaller rodents and insectivorous mammals. These species largely comprise the basis of the food supply for larger carnivores, including the raptors discussed previously. Numerous species, such as Ord's and Merriam's kangaroo rats (Dipodomys ordii and D. merriami, respectively), black-tailed jackrabbit (Lepus californicus), desert cottontail (Sylvilagus audubonii) and cactus mouse (Peromyscus eremicus eremicus), occur in or near each alternative site. However, the densities of such species vary greatly among habitats and appear to reach a maximum within sand grasslands such as those that occur at the Stallion site. Other small mammals that presumably occur within the three sites are presented in Table III-10.

The bobcat (Lynx rufus), coyote (Canis latrans) and kit fox (Vulpes macrotis) are common large predators found at each site. The mountain lion (Felis concolor) and gray fox (Urocyon cinereoargenteus scottii) are other large predators that probably occur within or near the North of NASA site; however, the mountain lion is extremely secretive and, thus, infrequently observed. The New Mexico Department of Game and Fish is currently conducting a multi-year study on the ecology of the mountain lion population in the San Andres Mountains. This study involves monitoring of mountain lions, mule deer and bighorn sheep by radio telemetry and aerial reconnaissance and is currently funded through 1991.

All three sites also provide potentially suitable habitat for two other carnivores: badger (Taxidea taxus berlandieri) and striped skunk (Mephitis mephitis varians).

Pronghorn (Antilocarpa americana) occur at the Stallion site; gemsbok (oryx) are common at the Orogrande and Stallion sites. To a lesser extent, gemsbok also occur at the North of NASA site. Both of these species are large game mammals that are hunted within special hunt areas at WSMR. Pronghorn and

Table III-10

Bats and Rodents Commonly Occurring at WSMR

Species	Habitat Use Areas	Sites Containing Suitable Habitat* Stallion	NASA	Orogrande
California myotis (Myotis californicus)	mine tunnels, loose rocks, hollow trees, buildings, bridges	N	X	N
Hoary bat (Nycteris cinerea cinerea)	wooded areas	N	?	N
Townsend's big-eared bat (Plecotus townsendii pallescens)	caves, mine tunnels, buildings	N	X	N
Pallid bat (Antrozous pallidus pallidus)	caves, mine tunnels, crevices in rocks, buildings, trees	N	X	N
Brazilian freetail bat (Tadarida braziliensis mexicana)	caves, crevices in rocks	N	X	N
Spotted ground squirrel (Spermophilus spilosoma marginatus)	open forests, scattered brush, grassy parks, mainly in sandy soil	X	X	?
Rock squirrel (Spermophilus varigatus grammurus)	rocky canyons, boulder-strewn slopes, lava beds	N	X	N
Southern pocket gopher (Thomomys umbrinus)	varied, valleys and mountain meadows, oaks and pines, sandy, loamy, clayey, gravelly, or rocky soils	X	X	?
Plains pocket mouse (Perognathus flavescens apache)	open areas with sparse vegetation and sandy soil, also pinon-juniper	X	X	X
Desert pocket mouse (Perognathus penicillatus eremicus)	open, sandy desert floor, sparse vegetation	N	?	X
Banner-tailed kangaroo rat (Dipodomys spectabilis baileyi)	arid or semi-arid grassland with scattered brush, mesquite, or juniper	X	X	X
Deer mouse (Peromyscus maniculatus blandus)	all habitat types	X	X	X
White-footed mouse (Peromyscus leucopus tornillo)	woody or brushy areas preferred, sometimes open areas	?	X	?

Table III-10 (cont'd)
Bats and Rodents Commonly Occurring at WSMR

Species	Habitat Use Areas	Sites Containing Suitable Habitat* Stallion	NASA	Orogrande
Brush mouse (_Peromyscus_ _boylei_ _boylei_)	chaparral areas in arid and semi-arid regions, rocky situations	N	X	N
Pinon mouse (_Peromyscus_ _truei_ _truei_)	rocky areas in pinon-juniper	N	?	N
Southern plains wood rat (_Neotoma_ _micropus_ _canescens_)	semi-arid brushlands, cacti, mesquite, thornbush, low valleys and plains	X	X	X
White-throated wood rat (_Neotoma_ _albigula_ _albigula_)	brushland and rocky cliffs with shallow caves, lava beds	X	X	X
Mexican wood rat (_Neotoma_ _mexicana_ _scopulorum_)	rocks, cliffs and mountains	N	?	N

*X = probable occurrence of suitable habitat
? = questionable whether suitable habitat occurs
N = no suitable habitat known or expected to occur

Source: U.S. Army 1985(1) and Geo-Marine, Inc.

gemsbok hunts, however, are conducted only in years of good production. A limited number of permits are granted to applicants, which are selected through a lottery system. Ten pronghorn permits were granted in 1985 and about 20 for the 1986 season(13). Gemsbok permits are also granted through a lottery system. A total of 75 permits was granted in 1985, all but two of which were filled; the permits granted for the 1986 season increased to 100(13).

Mule deer (Odocoileus hemionus) and black bear (Ursus americanus) are large game species with previously healthy populations within WSMR(1,15). Due to reduced populations, however, mule deer hunts within WSMR have not been allowed since 1982. Black bear populations have been so drastically reduced that black bears are now considered rare and only a transient species(1,13,15). Suitable habitat for these two species occurs in the Oscura Mountains east of the Stallion site and in the San Andres Mountains east of the North of NASA site. Presently, healthy (but not harvestable) populations of mule deer occur in both mountain ranges.

6. Threatened and Endangered Species

Information concerning threatened or endangered species which could potentially be affected by the proposed GBFEL-TIE project was requested from the U.S. Fish and Wildlife Service (USFWS) in Albuquerque and the New Mexico Department of Game and Fish (Santa Fe). Responses to these letters are contained in Appendix A, Correspondence.

Seven species listed by the USFWS as threatened or endangered were reported to occur in or near WSMR. These seven are the Lloyd hedgehog cactus (Echinocereus lloydii), Sneed pincushion cactus (Corypantha sneedi var. sneedi), whooping crane (Grus americana), bald eagle (Haliaeetus leucocephalus), American peregrine falcon (Falco peregrinus anatum), Aplomado falcon (Falco femoralis septentrionalis) and interior least tern (Sterna antillarum athalassos)(17,18).

The Lloyd hedgehog cactus inhabits limestone and granite outcrops along dry rocky hills and slopes at an elevation of about 1,500 meters MSL. It has been reported from the Jarilla Mountains near Orogrande, at the southeastern corner of WSMR(13).

The whooping crane uses the middle Rio Grande Valley as a wintering area(17,18). Whooping cranes often flock with sandhill cranes, which have been observed over WSMR. Consequently, it is possible that whooping cranes may fly over WSMR during their fall and spring migrations, but it is improbable that the whooping cranes would utilize any of the proposed sites. If this species would occur at any of the sites, the Stallion site would have the highest probability due to the extensive playas/grasslands that occur at this site.

The bald eagle requires large rivers and lakes since fish is its primary prey item. Consequently, Lake Lucero occasionally attracts bald eagles, although Lake Lucero does not provide a food source for the eagles. These individuals, therefore, are only transient and sporadic.

The American peregrine falcon prefers areas with rocky, steep cliffs especially near water with high bird concentrations, which is its primary food source. Peregrine falcons are presumed to occur in the Organ, San Andres and

Oscura mountains, and would forage over the wide basin areas. Peregrine falcons may, therefore, occur in or near the Stallion and North of NASA sites.

It is unlikely, however, that any of the remaining species occur within or near any of the alternative sites. The Sneed pincushion cactus occurs in the Franklin Mountains south of the main post area. The Aplomado falcon is currently not found in New Mexico although the USFWS is currently considering reintroducing this species. The interior least tern has been observed at the Bosque del Apache NWR, approximately 18 km from the Stallion site, but because of its preference for sandy beaches along streams, rivers and lakes, it is unlikely that it would occur at any of the sites(17).

In addition, the last remaining population of desert bighorn sheep is located within the San Andres NWR, just east of the North of NASA site. Current population of this state protected species is estimated to be less than 30(1,25). Breeding habitats of the sheep are primarily located on the east side of the San Andres Mountains, although the entire mountain range may be used as foraging habitat.

Table III-11 lists those species known or presumed to occur near any of the proposed sites and which are considered endangered by USFWS and/or the New Mexico Department of Game and Fish. The North of NASA site has the greatest potential for supporting protected species, as can be seen from this table.

7. Unique and Environmentally Sensitive Resources

Because of the limited water supply and the soil associations found in the Chihuahuan Desert, the entire desert ecosystem is itself a fragile and sensitive resource. Consequently, the intermittent springs and seeps which exist in the San Andres foothills east of the North of NASA site provide a valuable water supply during certain times of the year. The areas around these seeps and springs also support a diverse group of wildlife by providing feeding and nesting habitat. New Well, which is an operating windmill and stock tank, occurs within the North of NASA site near the east central border of the site. This water tank provides a valuable water supply and is heavily used by wildlife, particularly gemsbok.

The various playas that occur within and near the Stallion site present an even greater sensitivity to man-induced changes such as overgrazing and erosion. Small playas also occur sporadically in the vicinity of the Orogrande site. Grasslands around the playas also provide valuable habitat for numerous wildlife species. As grassland acreage declines, so do wildlife populations that depend upon the communities for cover and/or food (e.g., pronghorn). WSMR has initiated a plan to conduct a habitat mapping and wildlife management project that would locate, identify and delineate such environmentally sensitive communities. The proposed GBFEL-TIE program is presently scheduled to commence prior to completion of this project. Recent field reconnaissance indicates extensive grasslands occur within and near the immediate Stallion project area, however.

The U.S. Bureau of Land Management (BLM)(24) identified two areas as potential Wilderness Study Areas (WSA) which are contiguous with WSMR's western boundaries near the Stallion site. The Antelope WSA is located approximately seven kilometers (km) from the Stallion site and encompasses 20,710 acres. The Antelope WSA is being considered by the BLM for potential inclusion in the National Wilderness Preservation System (NWPS) because of its visual

Table III-11

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status* USFWS	Status* NMGF	Habitat	Occurrence** Stallion	Occurrence** NASA	Occurrence** Orogrande	Comments
FISHES							
Family - Cyprinodontidae: Killifishes							
White Sands pupfish (Cyprinodon tularosa)	Category 2	Group 2	Salt Creek and its tributaries, Malpais Spring	0	0	0	Restricted to Salt Creek, Lost River and tributaries
REPTILES							
Family - Colubridae: Colubrids							
Trans-pecos rat snake (Elaphe subocularis)		Group 2	rocky areas with shrubby vegetation	1	2	1	Possibly occurs in foothills of San Andres Mountains
BIRDS							
Family - Threskiornithidae: Ibises							
White-faced ibis (Plegadis chihi)	Category 2		freshwater marshes, irrigated land	0	0	0	May fly over all three sites
Family - Phalacrocoracidae: Cormorants							
Olivaceous cormorant (Phalcrocorax olivaceus)		Group 2	large open bodies of water with dead trees or snags	0	0	0	Possible in Elephant Butte Reservoir
Family - Gruidae: Cranes							
Whooping crane (Grus americana)	Endangered		freshwater streams and marshes	1	1	1	May fly over all three sites with groups of sandhill cranes, but probably would not use any site for resting or feeding
Family - Charadriidae: Plovers							
"Western" snowy plover (Charadrius alexandrinus nivosus)	Category 2		alkali flats, sand flats	0	0	0	Possible transient occurrence north of Lake Lucero

Table III-11 (cont'd)

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status*		Habitat	Occurrence**			Comments
	USFWS	NMGF		Stallion	NASA	Orogrande	
Mountain plover (Charadrius montanus)	Category 2		semi-arid grasslands, plains, plateaus	1	1	0	Possible habitat in foothills of San Andres and grasslands at Stallion
Family - Scolopacidae: Snipe, Sandpipers, Phalarops							
Long-billed curlew (Numenius americanus)	Category 2		high plains, rangeland, salt marshes	0	0	0	Possible transient near Malpais Spring
Family - Laridae: Gulls and Terns							
Interior least tern (Sterna antillarum athalassos)	Endangered	Group 2	beaches, sandbars	0	0	0	Has been sighted at Bosque del Apache NWR
Family - Accipitridae: Hawks and Eagles							
Bald eagle (Haliaeetus leucocephalus)	Endangered		lakes, rivers	1	1	1	Has been observed over Lake Lucero near HELSTF (12 miles from Orogrande site)
Ferruginous hawk (Buteo regalis)	Category 2		arid plains, open woodlands	1	1	0	
Swainson's hawk (Buteo swainsoni)	Category 2		dry plains, open foot-hills, rangeland, open forest, sparse trees	3	3	3	Has been observed at all three sites; recent observation of nesting near Stallion site
Mississippi kite (Ictinia mississippiensis)		Group 1	riparian woodlands, and planted groves	1	0	0	Possible along Rio Grande
Common black hawk (Buteogallus anthracinus)		Group 2	riparian habitat	0	0	0	Possible along Salt Creek but unlikely
Family - Falconidae: Falcons							
Aplomado falcon (Falco femoralis septentrionalis)	Endangered		arid brushy prairie, yucca flats	1	1	1	Has not been recently reported from New Mexico, but potential habitat exists
American peregrine falcon (Falco peregrinus anatum)	Endangered	Group 1	mountains, open country	2	2	1	Potential nesting habitat in Oscura and San Andres Mountains Mountains; has been reported from Lake Holloman

Table III-11 (cont'd)

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status* USFWS	Status* NMGF	Habitat	Occurrence** Stallion	Occurrence** NASA	Occurrence** Orogrande	Comments
Family - Cuculidae: Cuckoos							
Western yellow-billed cuckoo (Coccyzus americanus occidentalis)	Category 2		river thickets, willows, mesquite	0	1	0	Possible suitable habitat in San Andres foothills
Family - Strigidae: Owls							
Southern spotted owl (Strix occidentalis lucida)	Category 2		heavy forest, conifer, wooded canyons	0	1	0	Possible suitable habitat in foothills of San Andres Mountains
Family - Vireonidae: Vireos							
Bell's vireo (Vireo bellii)		Group 2	dense riparian habitat yucca flats	0	0	0	Possible in Elephant Butte Reservoir
Gray vireo (Vireo vicinor)		Group 2	bushy mountain slopes mesas, scrub oak, juniper	0	2	0	Potential habitat in San Andres Mountains
Family - Fringillidae: Sparrows, Finches							
Baird's sparrow (Ammodramus bairdii)		Group 2	long grass prairie	2	1	1	Possible in playas and grasslands at Stallion
McCown's longspur (Calcarius mccowni)		Group 2	plains, prairies	2	1	1	Possible in playas and grasslands at Stallion
MAMMALS							
Family - Vespertillionidae: Vesper Bats							
Little brown bat (Arizona Myotis) (Myotis lucifugus occultus)	Category 2		buildings, mine tunnels beneath bridges, rock crevices	1	1	0	Potential habitat in San Andres Mountains
Southwestern cave bat (Myotis velifer brevis)	Category 2		caves, mine tunnels,	1	1	0	Potential habitat in San Andres Mountains
Spotted bat (Euderma maculatum)	Category 2		arid country, occasionally in buildings and caves	1	1	0	Potential habitat in San Andres foothills

Table III-11 (cont'd)

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status* USFWS	Status* NMGF	Habitat	Occurrence** Stallion	Occurrence** NASA	Occurrence** Orogrande	Comments
Family - Sciuridae: Squirrels							
Organ Mountains chipmunk (Eutamias quadrivittatus australis)	Category 2	Group 2	mountain woodlands	0	2	0	Potential habitat in San Andres
Black-tailed prairie dog (Cynomys ludovicianus arizonensis)	Category 2	Group 2	dry upland prairies	0	0	0	Limited to Otera Mesa southeast of WSMR
Family - Geomyidae: Pocket gophers							
White Sands pocket gopher (Geomys arenarius brevirostris)	Category 2		grasslands, roadsides, White Sands	0	0	0	Limited to White Sands National Monument
Family - Muridae: Rats and Mice							
White Sands woodrat (Neotoma micropus leucophae)	Category 2		White Sands	0	0	0	Limited to White Sands National Monument
Family - Zapodidae: Jumping mice							
Meadow jumping mouse (Zapus hudsonius luteus)	Category 2	Group 2	near streams, lush growth	1	1	0	Reported from Bosque del Apache NWR
Family - Bovidae: Sheep							
Desert bighorn sheep (Ovis canadensis)		Group 1	mountain slopes with sparse tree growth	0	3	0	Limited to San Andres Mountains
PLANTS							
Family - Cactaceae							
Lloyd's Hedgehog Cactus (Echinocereus lloydii)	Endangered		dry, rocky hills, slopes limestone and granite outcrops at approximately 5,000 feet elevation	1	0	1	Reported from Jarilla Mountains
Sneed Pinchushion Cactus (Coryphantha sneedii var. sneedii)	Endangered		limestone ledges from 4,300 to 5,400 feet elevation in the desert and grasslands	1	1	0	Occurs in Franklin Mountains south of main post area

Table III-11 (cont'd)

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status* USFWS	Status* NMGF	Habitat	Occurrence** Stallion	Occurrence** NASA	Occurrence** Orogrande	Comments
Scheer's Pincushion Cactus (Coryphantha scheeri)		Group 2	open plains and flats often in alluvial soils, at about 3,000 to 5,000 feet	1	2	2	Has been reported from similar habitat on Ft. Bliss
Sand prickly pear (Opuntia arenaria)		Group 2	on and among sandy dunes or on sandy floodplains in Arroyos at about 3,600 feet	1	2	2	Has been reported from similar habitat on Ft. Bliss
Grama grass cactus (Pediocactus papyracanthus)	Category 2		variety elevations and habitats	2	0	2	Grama grass cactus is category 2 species because of habitat loss associated with cattle grazing and overcollection. WSMR does not forsee problem mitigating this species.
Family - Scrophulariaceae							
Alamo beard tongue (Penstemon alamosensis)	Category 2		Black Mountains, Bear Canyon, little known of habitat preference	0	0	0	
Family - Gramineae							
Curleaf needlegrass (Stipa curvifolia)	Category 2		rocky, limestone, outcrops, possible in San Andres Mountains	1	1	0	Possible in San Andres foothills
Family - Martyniaceae							
Dune unicorn plant (Proboscidea sabulosa)	Endangered		deep sandy soils, not in gypsum soils	2	1	0	Sandy soils at NASA and Orogrande mostly gypsum
Family - Onagraceae							
Organ Mountain Evening Primrose (Oenothera organensis)	Category 2		igneous rocks, in canyons with springs	0	0	0	Unlikely but possible in higher elevations of San Andres Mountains
Family - Compositae							
Nooding cliff daisy (Perityle cernua)	Endangered		crevices of limestone caprock mesas	1	1	0	Possible in foothills of Oscura and San Andres Mountains

Table III-11 (cont'd)

Threatened or Endangered Species Known or Presumed to Occur near Proposed Sites

Species	Status* USFWS	Status* NMGF	Habitat	Occurrence** Stallion	Occurrence** NASA	Occurrence** Orogrande	Comments
Gypsum scalebroom (<u>Lepidospartum burgessii</u>)	Category 2		base of buildings, potential habitat may exist in WSMR, not reported	0	0	2	Potential habitat at Orogrande Range Camp and other buildings in area
Family - Crucifereae							
Gray sibara (<u>Sibara grisea</u>)	Category 2		talus slopes of base of cliffs, possible occurrence in Oscura Mountains	1	0	0	Possibly in Oscura Mountains

*USFWS - Category 2 includes those species for which current information indicates that proposing to list as endangered or threatened may be appropriate, but for which conclusive biological data are not currently available to support proposed rules

NMGF - Group 1 includes those species whose prospects of survival or recruitment within the state are in jeopardy
Group 2 includes those species whose prospects of survival or recruitment within the state are likely to become jeopardized in the foreseeable future

**Occurrence indicates the likelihood of encountering a species in a site.
0-remote chance of occurrence
1-unlikely but possible chance of occurrence
2-good chance of occurrence due to suitable habitat
3-known to occur in site area

Sources: U.S. Fish and Wildlife Service, 1984, 1986(17,18); New Mexico Department of Game and Fish, 1985(19); Taylor, 1986(14,20); New Mexico Native Plant Protection Advisory Committee, 1984(21); Spellenberg, 1986(22); U.S. Army 1985(1,11); Avco, 1986(13); Oberholser, 1974(23); Geo-Marine, Inc.

attributes, naturalness, and overall environmental quality. Several plant species considered as species of special concern by the New Mexico State Heritage Program are presumed to occur within the Antelope WSA.

The Jornada del Muerto WSA is situated approximately 15 km southwest of the Stallion site adjacent to WSMR's western boundary. The Jornada del Muerto WSA consists of the eastern half of an extensive basalt (lava) flow formed during the Quarternary Age. This area is being considered for inclusion in the NWPS because of its outstanding opportunities for solitude and recreation; diverse ecosystems and natural phenomena (e.g., melanism in snakes, lizards and rodents); and unique geologic features. The American peregrine falcon may utilize the area for feeding or resting.

The Bosque del Apache NWR is located along the Rio Grande approximately 18 km west of the Stallion site and contiguous with the Antelope WSA, described above. The Bosque del Apache NWR provides critical habitat for the whooping crane(18) and supports numerous other species protected by the USFWS and/or State of New Mexico(18,19). Wetlands along the river also provide valuable resting and feeding habitat for a variety of shorebirds and waterfowl.

The proposed North of NASA site is situated adjacent to the San Andres NWR which is located within the San Andres Mountain range. Public access to the refuge is presently limited to managed hunts for mule deer which are conducted periodically in cooperation with the New Mexico Department of Game and Fish (NMGF). The San Andres NWR was established primarily to protect the desert bighorn sheep.

The White Sands National Monument is located approximately 19 km northwest of the proposed Orogrande site. This area is managed by the National Park Service and protected because of unique geology (i.e., world's largest gypsum dunes desert) and its diverse ecosystem. Numerous subspecies of flora and fauna are endemic to the park area. The western half of the White Sands National Monument is a zone of cooperative use and is frequently used by WSMR for missile impacts, drone flyovers, and aircraft training exercises(1).

G. Historical Resources

1. Regional Culture History

In the southern New Mexico region three major human adaptational shifts have occurred during the last 10-12,000 years before present (bp). The first shift, was to a great extent, forced upon the Paleoindians by environmental changes which began to occur near the beginning of the Pleistocene age (approximately 1.8 million bp). After the Paleoindian and Archaic Periods (12,000-9,000 years bp) early man shifted from a large-mammal hunting base to one of greater dependence on wild plants and forage. This diversification of economies was to set the stage for the second adaptational shift, the development of agriculturally based economies. In the American southwest broad regional similarities occurred, especially in regard to adaptational and developmental shifts. These shifts involved trends toward increased population densities; decreased mobility; technological and social changes; and an increased dependence on agricultural commodities.

This second shift was noticeable in both the Anasazi and Jornada Mogollan region. The Basketmaker and Pueblo phases refer to this trend in the Anasazi region whereas in the Jornada Mogollon region it is termed the Formative period. Domesticated corn and beans were present as early as 3,000 years bp, even though most archaeologists consider agriculture to be only of minimal importance to man at that time. In the Jornada Region this gradual shift towards an agricultural based economy is progressively obvious during the Early Mesilla Phase (AD 1-750), the late Mesilla Phase (AD 750-1100), Dona Ana (AD 1100-1200) and later the El Paso Phase (AD 1200-1400). It was during the El Paso phase that man in the Jornada Region is traditionally viewed as having achieved his most complex period with the greatest dependence on agricultural food production.

The abandonment of adobe pueblos and virtually all agricultural practices marks the end of the El Paso Phase and the Formative Period. This also signifies the third adaptational shift.

The third shift (AD 1400-1450) followed the collapse of broad agricultural practices and a general population movement towards major river valleys by some of the agriculturally dependent populations. Additionally, the influx of historically documented hunter-gatherer groups such as the Mescalero Apache further marks this shift.

2. Site Specific Archeological/Cultural Resources

Both the Stallion and North of NASA sites were surveyed in 1986, using a 14 percent sample, for archeological/cultural resources. The survey report, a description of the methodologies, results and recommendations, is contained in Appendix B of the DEIS. The Orogrande area was surveyed in 1984 during the conduct of the Border Star 85 Environmental Assessment(11). This survey utilized a non-site approach while recording 100 percent of all items in 2 meter wide transects spaced 33 meters apart. Features and artifacts between swaths were noted but not recorded in detail. The survey methodology resulted in a very detailed picture, but one that lacks a complete characterization of the smaller sites. A brief discussion of the archeological/cultural resources identified during each of these field surveys is presented below for each alternative site.

a. Stallion Site

A total of 29 archeological sites were recorded during survey of the Stallion site area. Most of the sites date either wholly or partially to Pre-Formative, or Archaic times. Although no Paleoindian sites were discovered in the sample area, materials diagnostic of this period were found on three sites along with Archaic materials. Two Folsom projectile point bases, indicative of Paleoindian use of the area between 9,500-10,500 years bp and broken during use rather than manufacture, were found at the sites. Six sites (21 percent) dated to the the Archaic period on the basis of diagnostic artifacts and debris; 12 sites (41 percent) were classified as Lithic Unknown, but may also date to that period. In addition, nine of the 10 multicomponent sites contain materials attributable to the Archaic period.

Archaic, or Pre-Formative sites in the Stallion area are generally large with low artifact densities. These sites have an average size of 9,922 square meters (m2) for Archaic properties and 2,871 m2 for Lithic Unknown sites. Maximum artifact density averages between 0.04 and 0.09 items per m2. Archaic and Multicomponent sites average just over 60 centimeters (cm) in maximum estimated depth, while Lithic Unknown sites are shallower with a mean maximum depth of 24 cm. Most Pre-Formative sites contain the remains of fire-using facilities, stone tools, manufacturing debris and grinding implements. Overall, the pattern of site size, content and structure within the sample suggests that, during the Pre-Formative period, the Stallion area was the focus of short-term residential use probably for the seasonal exploitation of local plant and animal resources.

No archeological sites could confidently be dated to the Formative Period in the Stallion sample. Eight of the ten Multicomponent sites did, however, contain small amounts of ceramic material indicating use during the Mesilla, Dona Ana or El Paso Phases. It is believed that the basic pattern of land use in the Stallion area remained unchanged from Archaic times through the Formative Period. A single historic site--an early 20th century homestead--was also recorded, and two Multicomponent sites contained small amounts of historic period materials.

b. North of NASA Site

Sixty-six archeological sites were recorded during survey of the North of NASA site sample. No evidence of Paleoindian use was found. Eight sites (19%) date to the Archaic Period, with an additional four Lithic Unknown sites perhaps associated with this period. Twelve of the 28 Multicomponent sites (43%) contain Archaic components. These sites' average size was 6,236 m2, and have artifact densities between 0.04 and 0.36 artifacts per m2. Estimated maximum depth ranges from 10 to 150 cm. Archaic and Lithic Unknown site assemblages generally contained fire-cracked rock or intact hearths or pits, lithic tools and debris showing an emphasis on bifacial tool manufacture and use, and grinding implements. Based on general impressions of site size, structure and assemblage content, Archaic period use of the North of NASA area was probably similar to that of the Stallion area. However, the proximity of higher altitude resources (especially leafy succulents and large mammals) and springs along the base of the San Andres Mountains are expected to have attracted Archaic populations.

Most of the North of NASA sites contained evidence of Formative period occupation, during the Dona Ana and El Paso Phases. A total of 66 components distributed among 40 sites are affiliated with the Formative Period. Although only 12 single component Formative sites were recorded (eight El Paso Phase and four Dona Ana Phase), all of the 28 Multicomponent sites contained ceramic evidence of occupation during the three Formative Period divisions. All of the sites were occupied during the Dona Ana and/or El Paso Phases. Only nine sites contained Mesilla phase components without later occupations.

Formative Period sites in the North of NASA area are generally quite extensive. One site, which was not completely defined, covered an entire survey unit (500 x 500 m) and half of an adjacent unit. This probably cannot be considered a single site but is best thought of as a continuous site area containing a large number of similar components largely due to reoccupation. This same site area appears to continue in an elevational zone on the alluvial fan for at least four km across and south of the North of NASA area. Formative sites also contain large amounts of material. The average density of artifacts on the 28 Multicomponent sites is over two artifacts per m2 with a maximum of almost 12 items per m2. All of these dense sites probably contain substantial architectural features, although such features were not observed directly in the majority of cases. Many of these sites are probably eligible for the National Register of Historic Places.

These Formative Period sites reflect a pattern of subsistence and land use documented in other parts of the Jornada Mogollon Region and were the focus of intensive agricultural activities involving the construction of substantial adobe pueblos.

c. Orogrande Site

Estimates of site density for the Orogrande alternative site were drawn from an area slightly larger (59 square kilometers) than the specified size of the study alternative and based on inventory data gathered during an archeological survey for Border Star 1985 (BS-85), conducted in 1984(11). This survey provided a 100 percent survey of transects through the proposed GBFEL-TIE Orogrande site. A total of 724 archeological sites are known in that portion of the BS-85 survey area. The majority of these (426 or 58 percent) were classified as Lithic Unknown. Many of these sites may represent the Archaic period, but cannot be assigned as a group to that period since some may also contain ceramics. Only 27 properties (4 percent) were judged to be Archaic on the basis of collected projectile points.

About 35 percent (253) of the total sites identified was considered to be from the Formative Period. Twelve sites are considered to be Mesilla Phase, one site is considered to be Dona Ana, and 32 sites are considered to be El Paso Phase. The remainder (208) of the Formative Period sites were assigned to the "Unknown Formative" category. Added to this group are ceramic sites which were classified as Multicomponent.

Portions of the BS-85 project area being considered for the proposed GBFEL-TIE contain archeological remains believed to reflect a land use pattern involving seasonal exploitation of basin floor resources throughout the Archaic Period and into the Mesilla Phase. The majority of sites are believed to be residential, with their areal extent, assemblage size and diversity reflecting differences in group size, length of occupation and number of reoccupations. Recent excavations of small basin floor sites suggest that many of the medium to large Formative Period sites will contain small huts or pithouses along with exterior pits and hearths.

H. Socioeconomic Resources

1. Study Area Definition

For purposes of this analysis, specific areas of probable impact of the proposed action must be defined. The analysis to follow is directed to these areas of New Mexico and Texas:

Counties	Cities
Bernalillo	Albuquerque
Dona Ana	Las Cruces
Lincoln	
Otero	Alamogordo
Sierra	Truth or Consequences
Socorro	Socorro
Torrance	
Valencia	
El Paso (Texas)	El Paso (Texas)

These counties surround and encompass WSMR, and the cities represent the major concentrations of population, commerce and industry in the immediate area

(Figure III-16). It is expected that the major impacts of the proposed action, if any, would be contained in this geographic region.

The socioeconomic factors that will be examined in the following text include:

- population history and projections
- population age distribution
- population sex distribution
- available housing units
- labor force
- employment
- income
- highways
- rail transportation
- bus transportation service
- air passenger and freight service
- religion
- education
- health care
- police and fire protection
- recreation

2. Population History and Projections

Population history and projections for the nine-county area containing, surrounding and supporting WSMR and the proposed sites are given in Table III-12. These figures do not include the effects of the proposed action, and projections of future populations presented should be considered the baseline without-project populations.

The study area (including El Paso, Texas) contains and will contain a number of people equal to approximately half of the population of the State of New Mexico. Major concentrations of population in the immediate area are the cities of Albuquerque, Alamogordo, Las Cruces, Socorro, and Truth or Consequences, New Mexico; and El Paso, Texas.

By the end of the century, 1.7 million people are projected to reside in the study area, an approximate 50 percent increase over current levels of population. Bernalillo, Dona Ana, and El Paso counties experienced major growth in the period 1910 to 1980. The remaining counties exhibited steady increases or maintenance-level population growth.

3. Age Distribution

The age distribution of the area population, by county, is given in Table III-13. The under five and 5 to 17 years age groups have the greatest impact on public schools and other community facilities. The 18 to 64 years age group contains those persons in the productive years from which the labor force is drawn. The 65 plus age group indicates additional needs for community services and facilities, health care, social activity and a number of requirements that serve this growing age group.

The counties in the study area exhibit similar age distributions with the exception of Sierra, which reflects the large number of retired persons in the Truth or Consequences area. Rural counties also tend to have somewhat smaller proportions of children and greater proportions of elderly than do urban counties.

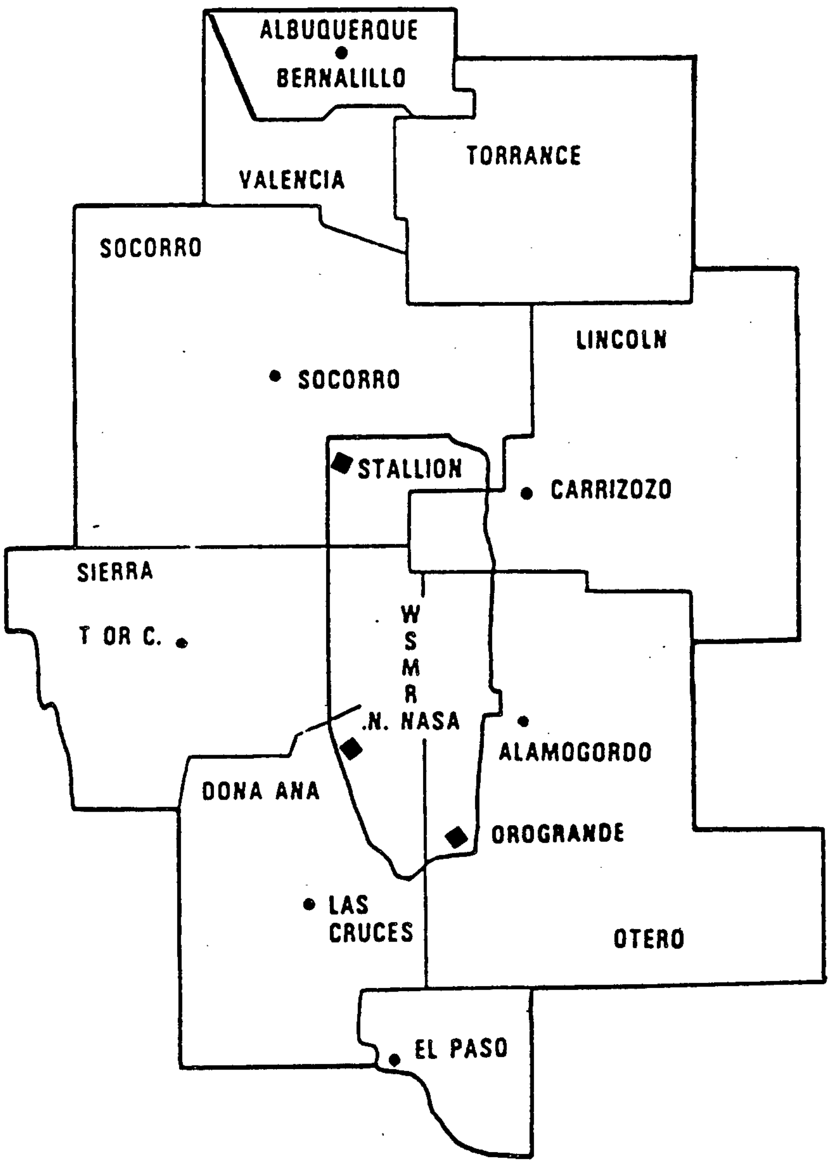


Figure III-16. Counties and Cities Surrounding WSMR.

Table III-12

Population History and Projections
Study Area and State of New Mexico, 1910-2005

					Counties					
Year	Bernalillo	Dona Ana	Lincoln	Otero	Sierra	Socorro	Torrance	Valencia	El Paso	Total
1910	23,606	12,893	7,822	7,069	3,530	14,761	10,199	13,320	52,599	108,873
1920	29,855	16,548	7,823	7,902	4,619	14,061	9,731	13,795	101,877	162,561
1930	45,430	27,455	7,198	9,779	5,184	9,611	9,269	16,186	131,597	200,093
1940	69,391	30,411	8,557	10,522	6,962	11,422	11,026	20,245	131,067	209,967
1950	145,673	39,557	7,409	14,909	7,186	9,670	8,012	22,481	194,968	281,711
1960	262,199	59,948	7,744	36,976	6,409	10,168	6,497	39,685	314,070	441,812
1970	315,774	6,877	7,560	41,097	7,189	9,763	5,290	40,576	359,291	437,067
1980	421,500	97,100	11,100	44,900	8,473	12,700	7,524	*30,900	479,899	1,114,096
1985	465,900	115,800	14,400	51,000	9,078	15,000	8,370	36,200	565,000	1,280,748
1990	525,800	131,300	17,700	58,500	9,420	16,800	9,212	40,900	615,000	1,424,632
1995	575,800	145,000	20,300	63,300	9,682	18,100	10,037	45,100	685,000	1,572,319
2000	614,800	158,300	22,300	71,700	9,837	19,200	10,856	48,700	735,000	1,690,693
2005	652,100	171,400	24,100	77,800	9,935	20,300	11,703	52,300	785,000	1,805,138

*Valencia County was divided into Valencia and Cibola Counties in 1981
Population projections were made for years 1985-2005
Source: New Mexico Health Systems Agency, Albuquerque, New Mexico
Bureau of Business and Economic Research, University of New Mexico, Albuquerque, New Mexico

Table III-13

Age Distribution (%) of the Population

County	Under 5	5 to 17	18 to 64	65+	Median Age	Total
Bernalillo	7.7	21.3	62.9	8.1	28.2	419,700
Dona Ana	8.7	23.7	60.4	7.2	24.8	96,340
Lincoln	7.1	21.4	59.3	12.2	32.1	10,997
Otero	9.3	23.5	60.6	6.6	25.6	44,665
Sierra	4.8	17.3	48.4	29.5	49.4	8,454
Socorro	9.4	24.1	57.7	8.8	25.3	12,566
Torrance	8.8	24.0	55.2	12.0	30.0	7,491
Valencia	10.5	25.7	56.4	7.4	25.5	30,900
El Paso	9.4	25.9	58.1	6.6	25.0	479,899
Total New Mexico	8.8	23.3	59.0	8.9	27.4	1,302,894

Source: County and City Data Book, 1983(47); U.S. Census, 1983(48)

These tendencies are also exhibited by the median ages in the study area counties. Urban counties have lower median ages; rural counties tend to have higher median ages, and Sierra's is the highest in the state.

4. Sex Distribution

The distribution of males and females in the study area population is evenly distributed by sex (Table III-14). The number of males and females differs only slightly.

5. Available Housing Units

The 1980 census gives a background inventory and view of the available housing stock in the study area. Table III-15 presents the distribution of housing units in the study area and in selected cities within the area.

The study area contains approximately 420,000 housing units, according to the 1980 census. Approximately one-third were rental units. The urban areas, however, have added units to the aggregate stock since 1980. Between 1980 and 1984, the City of El Paso added approximately 20,000 new units to its local markets. Albuquerque, Las Cruces and Alamogordo have shown similar trends. The basic housing stock in the study area is currently estimated to contain over a half million units.

A review of the current availability data from local sources was conducted to identify that portion of the housing stock that would be available for occupancy by new workers. Table III-16 indicates the status of the housing market in the urban centers within the study area as of August, 1986.

Currently, there are approximately 7,000 homes for sale in the study area and approximately 8,000 apartments available for rent. There are no significant numbers of single family homes available for rent. According to local realtors, mobile homes are only a small segment of the rental housing market. People tend to buy mobile homes and rent available spaces.

Table III-14

Distribution of the Population, by Sex, 1985
Counties and State of New Mexico

County	1985 Population	Sex Distribution Males	% Males	Females	% Females
Bernalillo	465,900	227,359	48.80	238,541	51.20
Dona Ana	115,800	57,205	49.40	58,594	60.60
Lincoln	14,400	7,546	52.40	6,854	47.60
Otero	51,000	24,837	48.70	26,163	51.30
Sierra	9,078	4,684	51.60	4,394	48.40
Socorro	15,000	7,215	48.10	7,785	51.90
Torrance	8,370	4,218	50.30	4,152	49.70
Valencia	36,200	17,774	49.80	18,426	50.20
El Paso	565,000	277,150	49.10	276,850	50.90
New Mexico	1,308,764	645,221	49.30	663,548	50.70

Source: New Mexico Health Systems Agency(49); Bureau of Business and Economic Research, University of New Mexico(50)

Table III-15

Available Housing Units, 1980

County/City	Total Units	Number Occupied
Bernalillo	162,126	151,037
Dona Ana	33,944	30,402
Lincoln	21,083	18,947
Otero	17,951	14,608
Sierra	5,392	3,745
Socorro	4,636	4,026
Torrance	3,309	2,465
Valencia	22,353	19,113
El Paso	147,964	134,368
Total (Counties)	418,758	378,711
Albuquerque	132,788	124,032
Alamogordo	9,495	8,629
Las Cruces	17,714	16,165
Socorro	2,659	2,404
Truth or Consequences	3,167	2,487
El Paso	134,368	134,265
Total (Cities)	300,191	287,982
New Mexico	507,513	441,466

Source: U.S. Census of Population and Housing, 1980(48)

Table III-16

Housing Availability, 1986

City	Homes For Sale	Average Home Price	Apartments Available	Median Rent	Apartment Vacancy	Total Units Available
Albuquerque	650	$93,000	2500	$400	10-15%	3150
Alamogordo	600	55,000	300	300	5-15%	900
Socorro	60	70,000	150	400	<10%	210
Las Cruces	863	67,000	1400	300	<5%	2263
Truth or Consequences	450	42,000	250	300	10-40%	700
El Paso	4058	88,000	3500	310	10-15%	7558
Total	6681	69,000	8100	342	10-15%	14,781

Source: Chambers of Commerce; Boards of Realtors; Local Realtors

6. Labor Force

The portion of the population that is included in the labor force is normally those persons that are available for work and aged 16 to 64 years. Table III-17 shows the number and percent of these persons in the labor force, by county, in 1980. Estimated labor force of the State of New Mexico has increased to approximately 620,000 as of 1985.

7. Employment

Retail trade, construction and manufacturing dominate employment in the area, followed by agriculture, forestry and fisheries. Wholesale and service trades are a significant secondary portion of employment. Estimates of the local construction labor force available to each proposed site are presented in Table III-18.

8. Income

The 1980 income levels for the study area, which are the most recent published data available, are given in Table III-19. The highest median incomes for the study area occur in Bernalillo County and the lowest in Sierra County.

9. Transportation Systems

The study area is well served with land and air based transportation facilities. Area highways, railroads and airports appear to be adequate. These facilities are described further in the following paragraphs.

a. Highways

WSMR and the immediate area are served by a network of interstate, Federal and state highways.

Interstate Highway 10 connects Las Cruces, New Mexico and El Paso, Texas to points east and west. Interstate 25 originates at Las Cruces and crosses I-40

Table III-17

Labor Force, 1980
Counties and New Mexico

County	Persons 16-64	In Labor Force	% Aged 16-64 In Labor Force
Bernalillo	260,551	224,795	86.3
Dona Ana	62,176	45,918	73.9
Lincoln	6,750	5,613	83.2
Otero	28,941	22,223	76.8
Sierra	4,333	2,722	62.8
Socorro	7,685	5,694	74.1
Torrance	4,421	3,150	71.3
Valencia	19,456	14,334	73.7
El Paso	329,296	217,202	65.9
New Mexico	723,609	541,651	74.9

Source: U.S. Census of Population and Housing, 1980(48)

at Albuquerque. These interstate highway facilities carry a major portion of intermarket and interstate commerce to and from the study area.

The Federal or U.S. highway system in the area is a network of six major routes that serve the major portion of the WSMR and immediate area. U.S. Highways 54, 70, 80, 82, 85 and 380 form an interregional access network to service facilities in the area.

The state highway system in the area consists of State Highways 28, 33, 51 and 52. These facilities are the primary responsibility of the State of New Mexico, and they provide access to local markets and urban areas.

In addition, there are numerous roads within the WSMR. These roads serve activities within the range and are primary circulation routes within the facility. U.S. 70 connects Las Cruces and Alamogordo, New Mexico and bisects the southern portion of the range. This highway is a primary route between urban areas and areas within the range. Road closures commonly occur (about four times per week) on U.S. 70 due to various activities (e.g., missile firings) at WSMR. Closures last no longer than one hour.

b. Rail Transportation

The study area is served by three major railroads. To the east of WSMR lie the north-south tracks of the Southern Pacific Railroad that connect El Paso, Alamogordo and markets to the north.

To the west of WSMR the Atcheson, Topeka and Santa Fe Railroad connects El Paso to Socorro and markets to the north. El Paso is also served by the Union Pacific/Missouri Railroad.

Table III-18

Estimated Available Construction Labor

County	(A) 1980 Population	(B) 1980 Employed in Construction	(C) 1985 Estimated Population	(D) 1985 Estimated Employed in Construct.	(E) 1985 Estimated Experienced in Construct.	(F) 1985 Estimated Available
			OROGRANDE SITE			
Dona Ana	96,340	3,026	115,800	3,637	4,547	364
Lincoln	10,997	570	14,400	746	933	75
Otero	44,665	905	51,000	1,033	1,292	103
Sierra	8,454	149	9,078	160	200	16
El Paso	479,899	10,318	565,000	12,147	15,185	1,215
Totals	640,355	14,968	755,278	17,723	22,157	1,773
			NORTH OF NASA SITE			
Dona Ana	96,340	3,026	115,800	3,637	4,547	364
Otero	44,665	905	51,000	1,033	1,292	103
Sierra	8,454	149	9,078	160	200	16
El Paso	479,899	10,318	565,000	12,147	15,185	1,215
Totals	629,358	14,398	740,878	16,977	21,224	1,698
			STALLION SITE			
Bernalillo	419,700	13,355	465,900	14,825	18,531	1,483
Lincoln	10,997	570	14,400	746	933	75
Sierra	8,454	149	9,078	160	200	16
Socorro	12,566	410	15,000	489	612	49
Torrance	7,491	299	8,370	334	418	33
Valencia	30,900	1,015	36,200	1,189	1,486	119
Totals	490,108	15,798	548,948	17,743	22,180	1,775

The ratio of Total Population (1980) to Employed in Construction (1980) was applied to 1985 Estimated Population and adjusted using a and b below.

Formula = $\frac{B}{A} \times C = D \times 1.25 = E \times .08 = F$

a. The ratio of employed in construction to experienced in construction for 1980 for New Mexico and El Paso MSA. (a= 1.25)
b. The average general unemployed rate for the study area, August, 1986. (b = 0.08)

Sources: U.S. Department of Commerce, General Population Characteristics, 1980(48); Detailed Population Characteristics, 1980(42); Bureau of Business and Economic Research, University of New Mexico, Las Cruces, 1975(50); and New Mexico Department of Employment Security(28)

Table III-19

Area Income Levels, 1980
Counties and New Mexico

County	Median Income ($) Per Household	Per Family	Per Capita
Bernalillo	16,239	19,294	7,136
Dona Ana	12,362	14,914	5,284
Lincoln	13,425	15,817	6,368
Otero	13,416	14,711	5,379
Sierra	7,959	10,350	4,634
Socorro	10,910	12,219	4,469
Torrance	10,830	11,978	4,691
Valencia	16,178	17,832	5,850
El Paso	11,404	12,222	3,529
New Mexico	14,655	16,930	6,120

Source: U.S. Census of Population and Housing, 1980(48)

c. Bus Transportation Service

Passenger and small package bus service in the study area is considered adequate for the population densities and distances between urban areas. Bus service is provided from 14 points within the study area to nation-wide locations. Service is provided from El Paso, Las Cruces, Alamogordo, Socorro and Truth or Consequences. Continental Trailways and Greyhound Bus Lines offer services to major points in the study area, and interregional companies provide local connections and service to those lines.

d. Air Passenger and Freight Service

Air passenger service is available in the area at Albuquerque, Las Cruces, Alamogordo and El Paso. A total of 11 air carriers provides passenger service from these airports. Other airports in the area are primarily for private flying and no passenger flights are available. Las Cruces International and Alamogordo Airports provide connecting flights to Albuquerque and El Paso.

10. Public Services and Social Institutions

The following section describes the availability of existing facilities in the areas of religion, education, health care, law enforcement and recreation.

a. Religion

There are over 700 churches in the study area, located primarily in the six major urban areas. Most major denominations are represented.

b. Education

Over 250 public schools are located in the six urban areas surrounding WSMR. Additional schools are located in outlying regions. Table III-20 shows the distribution of urban area schools.

Table III-20

Public School Facilities, 1986

City	Elementary	Junior High	High School
Albuquerque	73	23	10
Alamogordo	9	1	1
Las Cruces	17	4	2
Socorro	4	1	1
Truth or Consequences	1	1	1
El Paso	83	19	15
Total	187	49	30

c. Health Care

Generally accepted planning standards (New Mexico Health Systems Agency, 1986)(49) call for approximately 150 physicians and 400 hospital beds available per 100,000 resident population. As can be seen from Table III-21 below, only Bernalillo County (Albuquerque) meets or exceeds the standard recommended for physicians. Four counties exceed the standard for hospital bed availability. Rural areas generally have a deficit in both physicians and hospital services. Rural residents usually travel to the urban centers for extensive or specialized health care.

Table III-21

Medical Facilities Available within the Project Counties

County	Physicians Number	Physicians Rate (per 100,000)	Hospitals Number	Hospital Beds Number	Hospital Beds Rate (per 100,000)
Bernalillo	1061	252.8	14	2289	545.4
Dona Ana	85	88.2	1	183	190.0
Lincoln	11	100.0	1	42	381.9
Otero	34	76.1	3	122	273.1
Sierra	6	71.0	1	115	1360.3
Socorro	5	39.8	1	42	334.2
Torrance	2	26.7	0	0	0
Valencia*	12	39.3	2	237	774.0
El Paso (Texas)	613	127.7	17	2535	528.2

*Figures for Valencia County are estimates. Valencia County was divided into Valencia and Cibola Counties in 1981.

Source: U.S. Census County and City Data Book, 1983(48)

d. Police and Fire Protection

Police and fire protection are public safety services provided by municipal and county police and fire departments, volunteer fire departments, state highway patrols and state and Federal control agencies. WSMR has its own security and fire departments which provide service on the WSMR grounds. Present levels of protection are apparently adequate to meet the perceived needs of the various local populaces.

e. Recreation

New Mexico has millions of acres of wild lands available for outdoor recreation such as hunting, fishing, hiking and camping. Within the study area are 15 state parks, two national monuments, three national wildlife refuges and seven national forests. Carlsbad Caverns National Park is within a three hour drive of the WSMR facility. Municipal parks and recreation facilities are present in adequate numbers in all of the urban areas: El Paso (81); Las Cruces (26); Alamogordo (15); Socorro (2); Truth or Consequences (3); and Albuquerque (197). Additionally, there are approximately 15 public and private golf courses in the area.

I. Water Supply and Quality

1. New Mexico Water Law

"New Mexico water law is founded upon and governed by the doctrine of prior appropriation, i.e., 'first in time -- first in right', and beneficial use is the basis, the measure and the limit of the right to the use of water". -- Article XVI, Sections 2 and 3, New Mexico State Constitution.

a. Surface Water Legislation

Appropriations of surface water are governed by the Surface Water Code found in Chapter 72, Article 5 of the New Mexico Statutes Annotated (NMSA), 1978. Under this code, adopted in 1907, surface water in New Mexico may not be appropriated without application to and a permit from the State Engineer. Permits are issued only after published notice, and public hearing if required, and a determination by the State Engineer that there is unappropriated water available for the benefit of the applicant. Following such a determination, a permit may be issued prescribing the time within which the construction shall be completed and within which water shall be applied to beneficial use. However, there remains little, if any, unappropriated surface water in the various drainage basins in the state of New Mexico.

b. Groundwater Legislation

In the absence of a declared and defined underground basin, groundwater may be appropriated without need for a permit from the State Engineer. However, the State Water Code in Section 72-12-1, NMSA 1978 provides that waters of underground streams, channels, artesian basins, reservoirs or lakes having reasonably ascertainable boundaries are declared to be public waters and are subject to appropriation for beneficial use. The State Engineer is empowered to determine the boundaries and declare a basin. Once a part of a declared basin, water may be appropriated as in the case of surface waters only upon application and permit from the State Engineer. Upon such an application being filed, the State Engineer again must provide for public notice and hearing to assist in determining if water is available for appropriation and assure that the rights of the other appropriators from the same basin are not impaired.

c. Recent Water Legislation

Legislation approved during the 1983 New Mexico Legislative Session has introduced new requirements into the public interest review and determination made by the State Engineer on all applications for water appropriations. These include findings that the proposed appropriation is not contrary to conservation of water within the State and is not detrimental to the public welfare of the State.

It must be further noted that changes in points of diversion or place of use of either surface or groundwater must be approved by the State Engineer prior to making such change. If not so approved following application and notice, the vested rights to the use of water are subject to forfeiture and loss.

2. Water Resources

a. General

With an average annual rainfall of about 10 inches at WSMR, persistent surface water is a rare commodity. As previously discussed, virtually all surface water throughout the region is already appropriated and consequently, wells (groundwater) are the primary water sources. Much of the well water is in excess of 1,000 ppm total dissolved solids (tds) which may be in excess of the quality requirements of the GBFEL-TIE.

Surface waters from the Colorado River Basin are presently being diverted into the Rio Grande Basin by the U.S. Bureau of Reclamation's San Juan-Chama Project and could be made available to WSMR. All San Juan-Chama water diverted into the Basin is currently contracted for or committed to potential contracts to various entities within the state; but, in most cases this exceeds their needs for the near future, making this surplus water available for purchase. The city of Albuquerque is one possible source of San Juan-Chama water(51).

The specific water availability and water quality presented below as a function of the three proposed sites was extracted from an in-house Corps of Engineers document involving geology and water (geotechnical) considerations at WSMR(5).

b. Stallion Site

The chemical quality of the ground water in the northwestern part of WSMR is predominantly poor because of the high sulfate content. Small amounts of water of good to fair quality are present at six localities in the northern WSMR area. These localities are: (1) Fite Ranch wells, about eight km to the west; (2) Hardin Ranch well near Rhodes Pass, about 62 km to the south; (3) Murray well, 35 km to the southeast; (4) Trails Canyon well, 30 km east-southeast; (5) Baca well, 35 km east-southeast; and (6) small springs issuing from Pennsylvanian rocks on the back slope of the Sierra Oscura Mountains about 32 km to the southeast. Over the last 30 years, efforts to increase the potable water production of these wells have been unsuccessful.

Two wells at Fite Ranch Headquarters were tested by the U.S. Geological Survey (USGS) in 1956. The wells are about eight km east of the Stallion site. Water levels in these wells were 123.1 and 128 meters below the surface and the water contained 240 and 218 ppm tds. Water in these two wells is potable, apparently because recharge is mainly by runoff from the volcanic hills of the Cerro Colorado, to the northeast. The Cerro Colorado is an isolated mountainous area of porphyritic intrusive rocks rising to elevations above 91.4 meters, and comprising an area of about 15 km2.

The water in these two wells is from the Baca and Datil Formations of Tertiary age. The well, designated "Fite P.W.", was pump tested at 12 gallons per minute (gpm). A transmissibility of about 170 gallons per day (gpd) per foot was indicated and the specific capacity was calculated to be no more than 0.1 gpm per foot of drawdown. Low transmissibilities of this and other wells in the area were ascribed partially to cementation of the materials. It is concluded that appreciable quantities of potable ground water are not present in the northwestern part of WSMR.

Stallion Range Camp, at the northern end of the proposed GBFEL-TIE Stallion site, is supplied by two nonpotable water wells, SRC-1 and SRC-2, located about 183 meters and 335.3 meters, respectively, from SRC headquarters. Pumping test data for SRC-1 at a depth of 228.6 meters showed 200 gpm with a drawdown of 37.5 meters or 5.3 gpm per meter of drawdown. The SRC-2 well at 243.8 meters yielded 141 gpm with a drawdown of 53.3 meters or 2.7 gpm per meter of drawdown. Considering that the pumping tests were of relatively short duration, these rates were probably near maximum dependable yield. The winter 1984 water level readings were 64.4 meters below land surface in SRC-1 and 65.6 meters in SRC-2. The summer 1984 readings were 64.0 meters in SRC-1 and 65.4 meters in SRC-2. The tds ranged from about 3,100 to 3,300 ppm. A desalinization plant with a capacity of 100,000 gpd reduces the tds to about 550 ppm. Total production in 1984 was 9,659,000 gallons or about 26,000 gpd.

During the period from 1963 to 1967, seven test wells were drilled in the Rio Grande River floodplain at the Bosque del Apache NWR. Shallow zones in wells B-1, B-5 and B-7 contained water of fair quality. The deeper zones of these three wells and the four other wells yielded poor water quality. Pumping tests were performed for eight hours on these wells with results as follows: (1) well B-1, 150 gpm pump rate with 9.1 meters drawdown (i.e., 16.5 gpm per meter of drawdown); (2) well B-5, 300 gpm pump rate with 5.8 meters drawdown (i.e., 51.8 gpm per meters of drawdown); and (3) well B-7, 320 gpm pump rate with 9.1 meters drawdown (i.e., 35.0 gpm per meters of drawdown). Development of four supply wells in this area would be expected to satisfy the proposed GBFEL-TIE water supply requirements but may not be of acceptable quality.

Most surface water rights in the State of New Mexico have been appropriated; however, many entities have rights in excess of their needs and this water could be made available for purchase. One possible source would be water from the Colorado River Basin which is presently being diverted into the Rio Grande Basin by the U.S. Bureau of Reclamation's San Juan-Chama Project. All San Juan-Chama water diverted into the Basin is currently contracted for, or committed to potential contracts to various entities within the state; but, in most cases, exceeds their needs for the near future, making this surplus water available for purchase. The same type of purchase agreement would be required whether it be surface water withdrawal from Elephant Butte Reservoir or ground water from a well field in the vicinity of the Bosque Del Apache NWR. A determination would have to be made as to the amount of water which would have to be released into the Rio Grande to compensate for any potential to flow. In the case of ground water withdrawals, a well permit would have to be obtained from the State Engineer. Easements, permits and clearances would be required for a pipeline to the Stallion site. Existing water rights can be purchased and transferred for the duration of the project after obtaining the required permits from the State Engineer.

c. North of NASA Site

Wells to the west of the North of NASA site, in the Jornada del Muerto Basin, contain water which is unconfined or semiconfined from permeable beds of sand and gravel in the bolson deposits. The bolson deposits and the saturated zone within the deposits thin toward the mountains; thus, the probability of obtaining an adequate supply of water decreases with nearness to the mountains.

Only a few low-capacity wells operate in the immediate area of the site. Two springs occur near the site: Cottonwood Spring about 1.4 km south of the site and Ropes Spring about 6.4 km to the southeast. "New Well" is situated in the north-central area of the candidate site. The ground elevation of the well is 1,573 meters above MSL. Water level measurements in the early 1970s varied between 35.5 and 36.6 meters below ground surface. The well is wind-mill powered and water is piped to a tank to water stock.

Efforts were made in 1962 to obtain potable ground water for the National Aeronautics and Space Administration (NASA) Apollo Propulsion System Development facility, 13 km to the south of the proposed site. Six test wells were drilled at the NASA site. Four of the wells apparently did not penetrate a sufficient thickness of saturated bolson deposits to yield the required quantity of water and as such, were not developed further. The two wells, I and J, which were sited further down the slope away from the mountains, penetrated 208 meters and 183.5 meters, respectively, of saturated bolson deposits. Both wells I and J were tested at 1,000 gpm for 24 hours. The water level in well I was lowered from a depth of 97 meters to 119.2 meters. The specific capacity was 44.9 gpm per meter of drawdown. The level in well J was lowered from a depth of 102.7 meters to 118.3 meters with a specific capacity of 64.3 gpm per meter of drawdown. Semi-log plots of recovery versus time indicated a coefficient of transmissibility of 14,783 gpd per meter for well I and 24,293 gpd per meter for well J. USGS personnel who supervised the drilling and testing of these two wells concluded that the coefficients of transmissibility are on the order of those expected for bolson deposits, and the relatively small drawdown of water levels indicates that the wells are in good hydraulic connection with the aquifer.

Another potential water source would be the Rio Grande Valley. A purchase agreement would be required to withdraw ground water from wells in the Rio Grande alluvium downstream from Elephant Butte Reservoir. If new supply wells are drilled, a permit from the State Engineer would be required. A determination would have to be made as to the amount of water to be released from Elephant Butte Reservoir to offset ground water withdrawals. Easements, permits and clearances would be required for a pipeline to the North of NASA candidate site. Existing water rights can be purchased and transferred for the duration of the project after obtaining the required permits and approval.

Three domestic supply wells are situated between wells I and J and the candidate site, at about the same distance as the I and J wells from the mountains. The "Taylor" well, about five km north of the I and J wells, was drilled to a depth of 122 meters. Two wells at Jornada Reserve Headquarters, about eight km northwest of the Taylor well and 15 km southwest of the center of the candidate site, provide potable water.

d. Orogrande Site

The most important aquifer in the Tularosa Basin is the valley fill. In the mid-basin the valley fill is several thousand feet in thickness. Near the periphery of the basin, the rock outcrop slopes steeply into the basin. With very few exceptions, the only potable water in the basin is encountered in these peripheral areas, usually within 1.6 to 4.8 km from the mountain front and usually associated with alluvial fan deposits. Little recharge capacity is noted for this basin.

Ground water at the Orogrande Range Camp, situated at the southeastern corner of the proposed GBFEL-TIE Orogrande site, is higher in tds and chlorides content than the ground water at Stallion Range Camp. Total dissolved solids range from 2,000 to 3,700 ppm. Wells drilled near the site encountered water at 228.6 meters. As many as 20 supply wells may be required to provide water in the quantities required for the GBFEL-TIE project.

The Orogrande Range Camp is presently supplied by a pipeline from the WSMR headquarters well field, approximately 24 km to the west. The water flows by gravity from the well field to a 250 gpm capacity booster station at Launch Complex 38 which is 11 km west of the Range Camp. The 24 km of pipeline ranges from 20.3 to 30.5 cm in diameter. The pipes are old, and vary in composition, including cement-asbestos, cast iron and steel. Use of this pipeline for the project would require improvements and renovation.

The Post headquarters well field consists of 10 wells located in an area north of the headquarters area called the re-entrant. Pumpage in the early seventies declined from about 940 million gallons (MG) in 1971 to about 660 MG in 1976. The well field was experiencing a steady decline in water levels during this period. Water levels dropped from about 172.2 meters below surface in 1970 to about 176.8 meters below the surface in 1976. Pumpage from 1977 to 1984 has ranged from about 638 MG to about 715 MG per year, but the water levels have continued to decline at an average rate of about 0.61 meters per year. Water is being mined presently at the pumping rate of approximately 648 MG per year. Current recharge rate for this field is approximately 425 MG per year.

The quality of the water is unusually good. From analyses in 1984, tds generally ranged from 200 to 270, except in supply wells 11, 13 and 20. The average tds for these three wells was 420 ppm. However, higher water production would accelerate the falling water table and increase the potential saltwater intrusion.

The Post headquarters well field, which had a production of 1.78 mgd in 1984, can be supplemented by utilizing the reserves of the Soledad Canyon aquifer, which is located on Army-owned land roughly 11 km southeast of the WSMR post area. WSMR water resource planners and the United States Geological Survey have identified the Soledad Canyon aquifer as the most economical source of increased water reserves for the installation, and the threat of saltwater intrusion into the headquarters well field can be mitigated by balancing water withdrawals between the Soledad and headquarters aquifers and proper well spacing and pump rates.

Two proposed alternatives involve the Soledad well field. One would specify a direct pipeline from the field to the candidate site; the other would require a two million gallon storage tank at Post headquarters and a 50.8 cm line from it to the well field. Renovation of the existing main from Post headquarters to the site would also be required.

Recharge to the headquarters well field represents about 65 percent of annual pumpage. Recharge is about 1,300 acre feet/year; pumpage was 2,000 acre feet in 1984. Based on the fact that the well field is not positioned to intersect all of the ground water flow in the re-entrant (post) watershed, and that the wells are only pumped for 12 hours each day, it has been estimated that only about 33 percent of the recharge is effectively being used. The amount of water being mined was about 1,567 acre feet in 1984, or 78 percent of the pumpage.

Recharge in the Soledad watershed is estimated at 750 acre feet/year. Since two wells, pumping 750 gpm each, could exceed the requirements for the GBFEL-TIE project, it is anticipated that part of the production could be dedicated to other uses. One well would probably be pumped 12 hours per day, or less. Total annual production would be about 3,000 acre feet. Assuming that conditions are similar to those in the headquarters watershed, about 56 percent of the recharge would be captured, or about 420 acre feet per year. Approximately 2,580 acre feet per year, or 86 percent of the production, would be mined water. If the production in the Soledad well field is managed properly, indications are that the estimated recoverable resource, 2.3 million acre feet, would have a life expectancy of almost 900 years. Because of this extensive supply, this source would be the most cost effective alternative water supply.

Comments on the Draft EIS indicated that water could be made available to the Orogrande site from wells at McGregor Range, under the jurisdiction of Fort Bliss Military Reservation. Three wells identified on range maps as abandoned oil wells do, in fact, contain water. However, based on the classification of the basin fill materials in this area, it is probable that the alluvium is saturated with saline water which would not meet the GBFEL-TIE criterion. In addition, this area is further from the site than the Soledad Canyon aquifer, and would therefore have higher pumping costs.

J. Air Access

Restricted airspace is provided at WSMR to facilitate the range mission by controlling aircraft for safety and containment of potentially hazardous research and development operations(1). The restricted airspace also aids in reducing the possibility of security problems with classified programs in progress. Program planning must include airspace use considerations to ensure maximum utilization of the airspace and to preclude violations of its purpose.

The restricted airspace directly over the main range area, plus the extension areas (previously illustrated in Figure I-2), exist from the surface to unlimited altitudes. Figure III-17 represents the airspace boundaries with respect to each site. Restricted airspace areas immediately surrounding the range have also been established with varying altitude restrictions. This additional restricted area provides airspace needed for specific programs, and is only activated at specified times which are coordinated through WSMR National Range Directorate (NR). Depending on test scenarios and site selection, more restricted air space than presently exists may be needed to

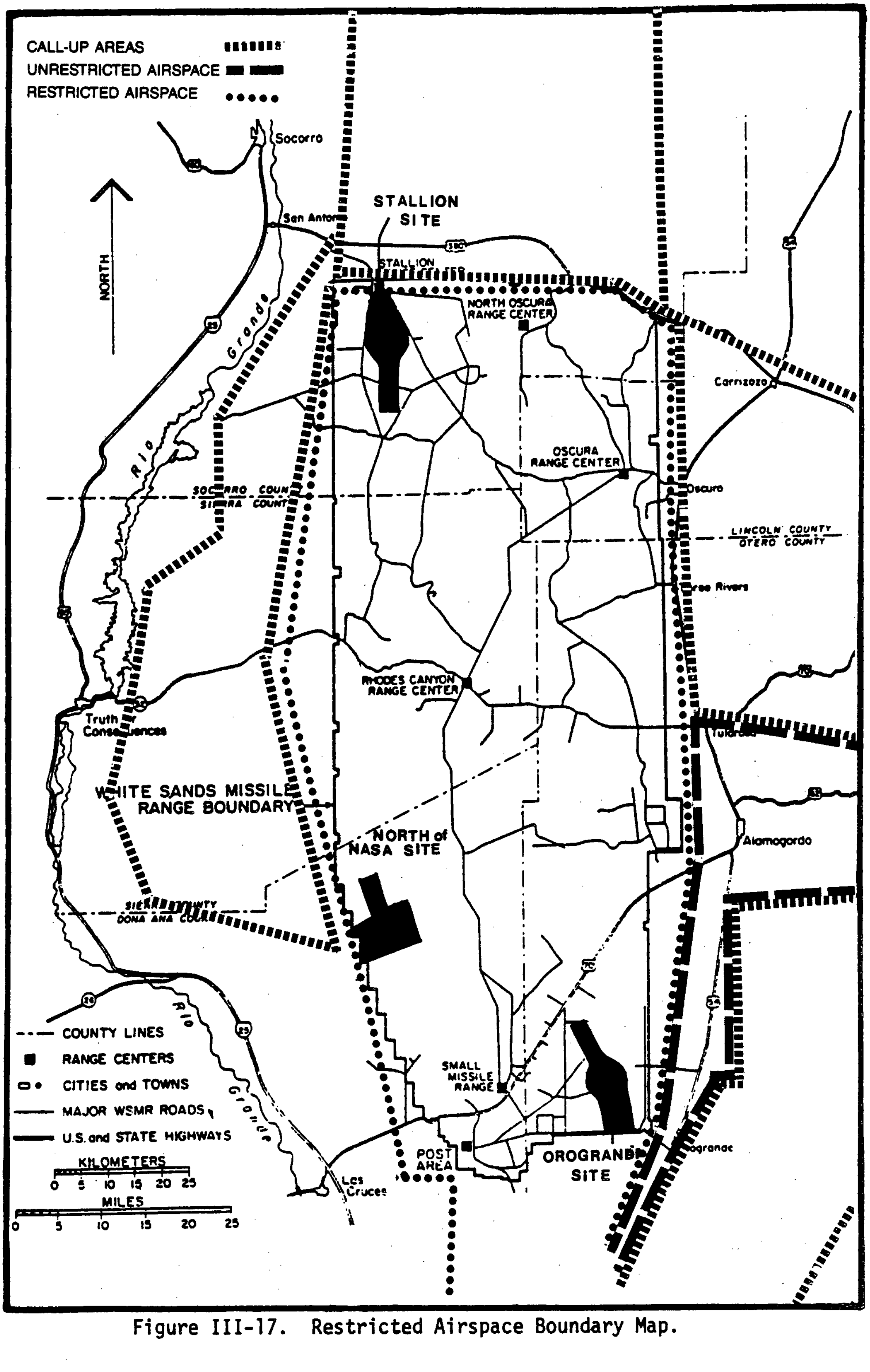


Figure III-17. Restricted Airspace Boundary Map.

insure that the laser beam exits restricted airspace above 60,000 feet MSL during space or airborne firing, as required by Federal Aviation Administration (FAA) Regulations. This airspace would be restricted on an as-needed call-up basis only during tests utilizing space or airborne targets.

The WSMR Deputy for Air Force Operations acts as executive agent for WSMR in requesting restricted area airspace designations from FAA and acts as overall airspace manager. Mission Control at Holloman AFB provides real-time control of the airspace for WSMR. WSMR, through Mission Control, is the approving authority to grant clearance for airspace penetration and overflights of the restricted areas.

While non-participating aircraft normally are not allowed access into restricted airspace, they may request permission from WSMR to fly into restricted areas. Such flights, when authorized, are closely controlled.

ENVIRONMENTAL CONSEQUENCES

IV. ENVIRONMENTAL CONSEQUENCES

A. Climate

Construction and operation of the GBFEL-TIE facility would have no measurable impact on the area's climate at any of the sites.

The climate, particularly local weather conditions, would affect the operation of the facility. Excessive winds, particulates, precipitation, clouds, etc. and any other disturbance within the atmosphere, depending upon the severity, could cause temporary cancellation of laser testing.

B. Geology

The GBFEL-TIE project would have little to no impact on the geology of WSMR. There would, however, be impacts on the soil and surface features which are discussed below under soils.

Geology and seismicity do affect the choice of facility orientation, construction and operation. Surface geology defines the existing soil types, including gypsum deposits which would be a deterrent to facility operation. While the seismic difference among the sites is a factor in site selection due to its potential effects on sensitive optical equipment, seismic risk is also a factor in the required design and construction of the facility to prevent damage from seismic activity. The potential degree of disruption to experimental equipment is not analyzed in this document.

The effect of any physical damage to the environment, should seismic waves occur, would most likely be confined to the effects of any liberated hazardous substances present at the site or fires produced by explosion. Seismic risks are greater at Stallion than at the other two sites, as discussed in Section III.

It is presently unknown whether a railroad spur would be necessary. However, this is the only utility right-of-way at any of the sites that would potentially interfere with mining activities.

If a railroad spur right-of-way is required for the Orogrande site, it may have to traverse lands within the Orogrande Mining District. This would restrict mining activities within the immediate area of the right-of-way. However, due to the relatively minimal amount of land that would be required, the effect would be insignificant. Coordination with the Orogrande Mining District during design and selection of the route would assure the minimum interference with mining activities. The distance from any of the proposed sites to any mining district would attenuate any potential effects that mining activities (e.g., blasting, rock crushing, etc.) may have on the proposed GBFEL-TIE. No problems are foreseen in coordinating GBFEL-TIE operations with construction, blasting, and heavy equipment movement associated with mining operations. No competition for water is anticipated since construction water would be supplied from existing lines to WSMR headquarters well field and operational water would be supplied from a new field on the Fort Bliss reservation.

C. Soil

Construction of the GBFEL-TIE facility would cause some leveling and/or resurfacing of the soils in the affected area. The affected surface area would be about 2,500 acres. Dust and affected soil would be transported by winds during construction activities. It is expected, however, that this effect would be local and the amount of soil transported by winds would be slight, particularly when mitigated by the application of spray mist water on sensitive areas. Extensive excavation for placement of the underground beam tunnel would also be required. The specific topography and orientation/location at each site as well as the excavation depth would determine the actual volume of earth moved.

Excavation and embankment quantities for grading of the GBFEL-TIE facilities and support items such as roads and utilities will be governed by final design features such as gradients, flow lines, construction techniques, amount of unsuitable material, etc. Project design efforts will utilize a balancing of earthwork quantities, but may dictate a need for borrow pits and/or spoil sites.

There could also be alterations of the natural surface drainage. Orientation of the proposed GBFEL-TIE facility at each site is the result of consideration of all potential impacts (soils, biological and cultural resources and drainage). From a soils and drainage standpoint, an orientation parallel to the natural surface features would minimize the drainage and erosion impact. Other more important constraints may result in a choice of less than ideal orientation for drainage. Figures IV-1 through IV-3 illustrate major drainage channels and preferred facility orientations at the Stallion, North of NASA and Orogrande sites, respectively.

No significant impacts on drainage would result from the proposed GBFEL-TIE at the Orogrande site. The proposed facility, if located at the Stallion site, would be near the terminus of a drainage system. Several drainages could be affected, particularly within the ground target range, if the North of NASA site is selected. Proper engineering design and construction could mitigate adverse impacts (e.g., drainage impediment, increased erosion) to any of the drainages at either Stallion or North of NASA.

The Orogrande and North of NASA sites would be constructed primarily on dune land terrain. Although not truly a soil type, dune lands have limitations and features similar to those of soils. They have a severe hazard of blowing (affecting foundations and roads/streets), severe excavation sidewall instability, and high hazard for pipeline construction. The proposed construction site for the Stallion alternative is composed predominantly of Yesum Holloman fine sandy loam and onite loamy fine sand soils. These two soils present little hazard of soil blowing. The onite is highly suitable for foundations and roads but the Yesum is high in gypsum with severe hazard to concrete. The hazard to concrete could be mitigated by using a specially fortified mixture. The extreme permeability of all these soils indicates that sewage lagoons may require lining.

Operation of the facility should have no impact on the soils in the vicinity of the exposed optical system (mirrors, etc.). Natural or artificial ground cover would be used to minimize atmospheric interference from dust and particulate matter.

In addition to the impacts from the facility proper, roads and utility rights-of-way servicing the facility would also affect soils and drainage. Each right-of-way selected would be the subject of an additional environmental analysis. Approximate rights-of-way routes are discussed below under biological resources and cultural resources.

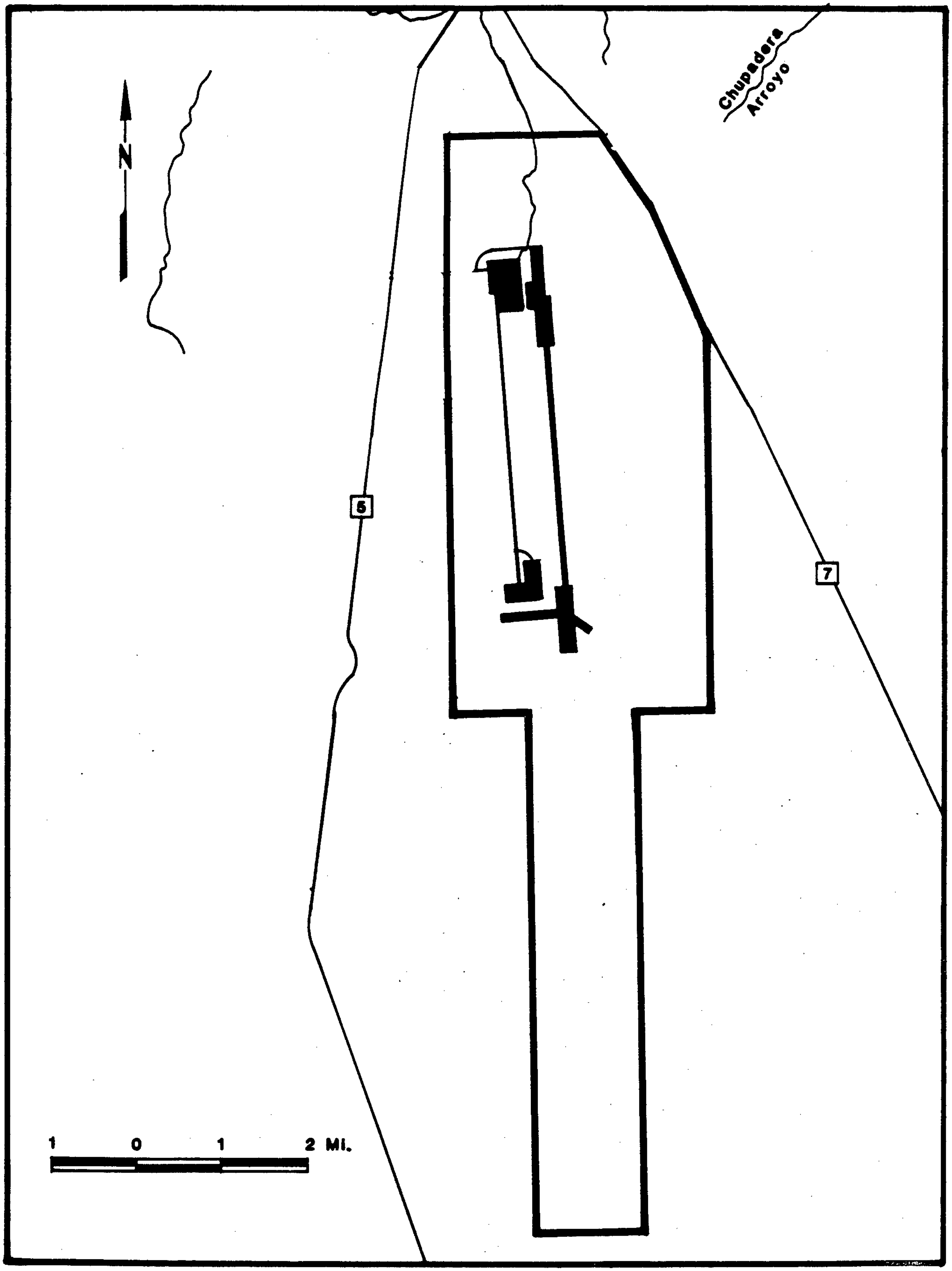


Figure IV-1. Drainage Pattern and Preferred Facility Orientation at the Stallion Site.

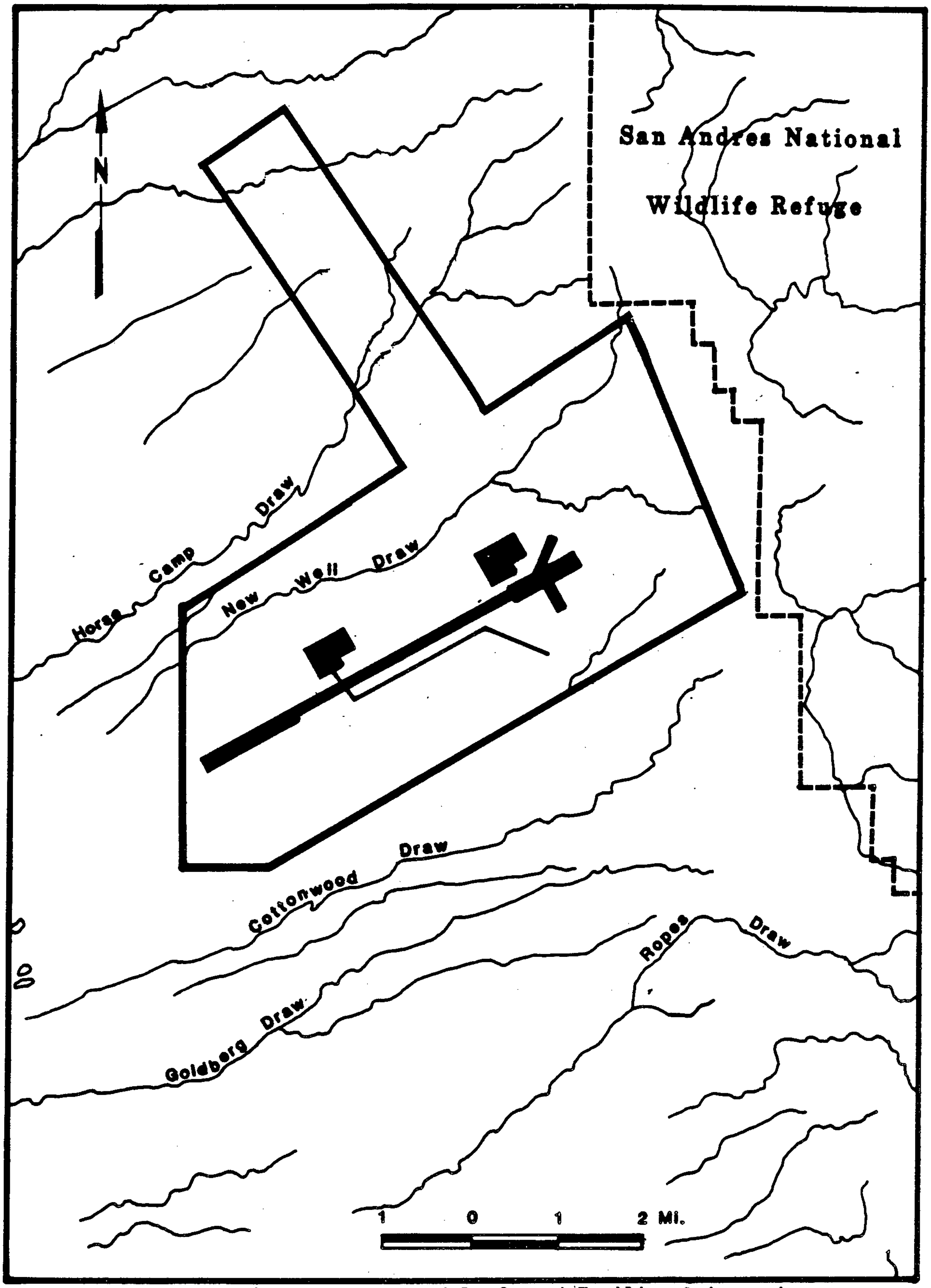


Figure IV-2. Drainage Pattern and Preferred Facility Orientation at the North of NASA Site.

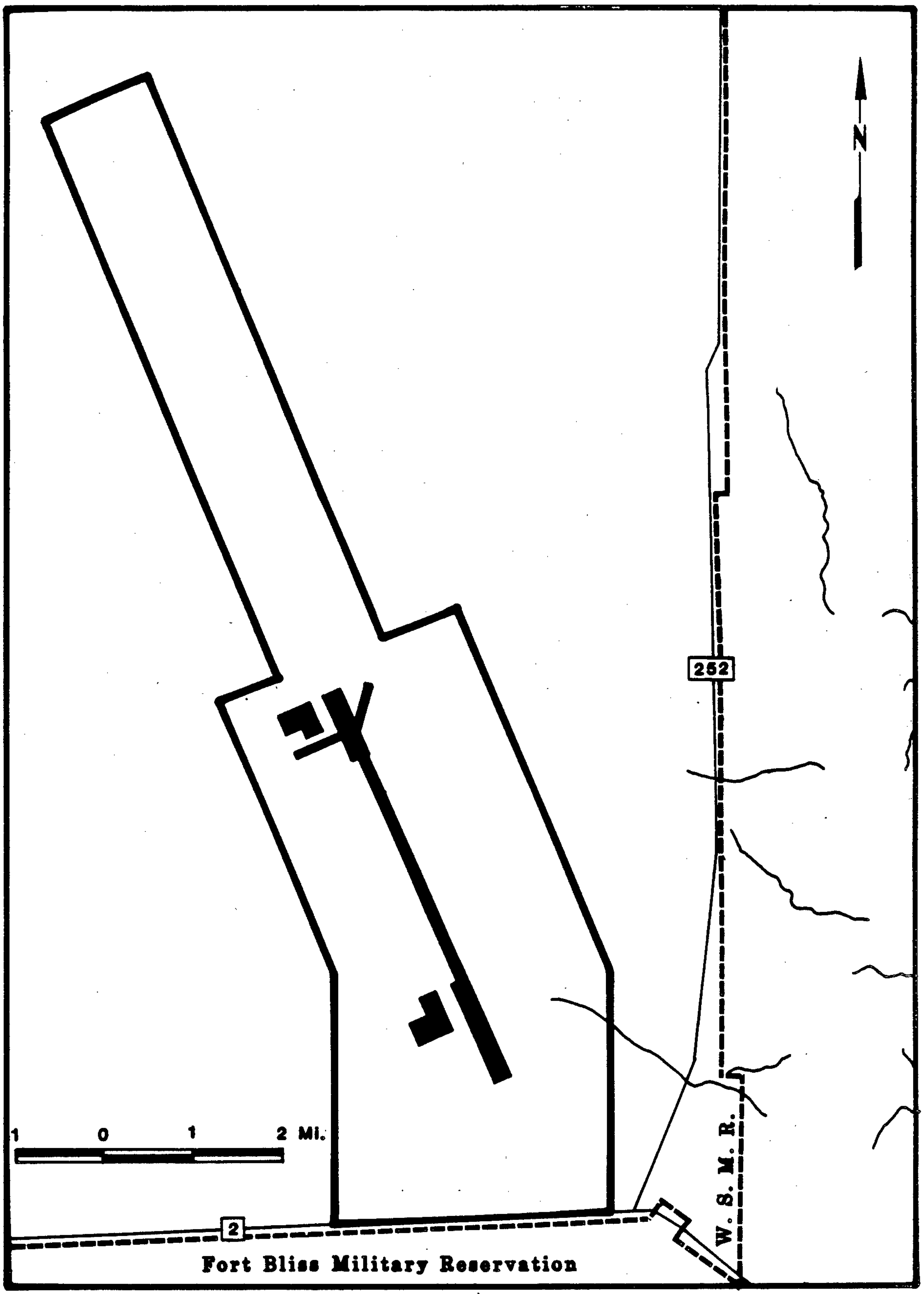


Figure IV-3. Drainage Pattern and Preferred Facility Orientation at the Orogrande Site.

D. Air Quality

1. General

There are three types of air pollution sources that would be associated with the GBFEL-TIE project. These sources are: (1) dust emissions due to construction; (2) emissions such as carbon monoxide (CO), sulfur oxides (SO_2) nitrogen oxides (NO_2) and hydrocarbons due to the operation of heavy equipment at the construction site; and (3) power generation for the project which would produce the same type of pollutant emissions as for the heavy equipment. It is considered that the first two types of pollutant emissions, i.e., construction dust and heavy equipment, would be short-term effects in the immediate area. Pollutant emissions due to power generation would affect the immediate area intermittently during the operating phase.

In addition, space heating and commuter traffic would add to the project emissions. Space heating would occur during the winter months only and would result in only minor emissions. Engine exhausts would emit carbon monoxide, hydrocarbons and nitrogen oxides. The total quantity of the pollutants cannot be predicted precisely because total fuel consumption, total vehicles and vehicle use time is not established. However, these emissions would be dispersed over a wide uninhabited area, and thus would not be expected to significantly affect the area's air quality.

2. Dust Emissions due to Construction

Airborne dust emission would occur from the operation of vehicles and from excavation by heavy equipment. These emissions would continue during the construction phase but would be expected to have no significant effect on areas outside of WSMR. The fugitive dust could be minimized by spreading water and/or dust suppressants on the construction areas and construction access roads. The amount of water required to control fugitive dust would depend upon construction activities and climate conditions. However, it is estimated that this amount would not exceed the 1,400 acre feet per year that would be required during the operation phase. Water and/or standard dust suppressants are commonly used during major construction projects and are not expected to have a significant effect on area wildlife and plant communities or the quality of ground water supplies.

3. Emissions due to Operation of Heavy Equipment

The construction of buildings, roads, laser installation, etc. would require the use of heavy equipment. As mentioned previously, there would be emissions of particulates, carbon monoxide, sulfur oxides, nitrogen oxides and hydrocarbons from the operation of these vehicles. The amount and concentration of the emissions would depend on duration of equipment operation, types and numbers of vehicles and climatic conditions such as temperature, wind speed and wind direction. It is expected that the environmental effects: (1) would be temporary and would subside after cessation of construction activities; (2) would be widely dispersed in relatively isolated and remote areas of WSMR; and (3) would have no significant long-term effect on the environment.

4. Emissions due to Electric Power Plant Operation

The operation of four 5-megawatt natural gas/diesel oil operated electric generators would produce emissions of particulates, carbon monoxide, sulfur oxides and nitrogen oxides. These four generators might be needed as stand-by units and would supply emergency power only when electric power is not available from existing power utility sources; however, the four generators would be operational during all experimental testing. The maximum total number of hours that the generators could be expected to be operational would be 500 hours per year, assuming six tests per day for a 14-day test series with 10 test series per year. It should be noted, however, that one to two tests per day would be the most probable test scenario, and thus anticipated emissions would be much less. The anticipated hourly emissions from these four generators and the annual emissions under the most probable case (i.e., 140 hours) test scenarios are presented in Table IV-1. Diesel engines or gas turbines would produce similar emissions. These emissions could be slightly reduced by using dual fired (natural gas) engines.

Table IV-1

Emission Factors for Stationary Large Bore Diesel Engines

Type of Emission	Emission Rates grams/KWH	Emission Rates Pounds/Hr*	Total Annual Emissions (tons) 2 Tests/Day**
NO_2	15.0	661.4	46.3
CO	3.9	172.0	12.0
SO_2	4.3	189.6	13.3
Particulates	1.34	59.1	4.1

*Assumes four 5-megawatt generators
**Assumes generators would operate 0.5 hr/test, 14-day test series, 10 test series per year

Source: U.S. EPA, 1979(52) and Geo-Marine, Inc.

A dispersion model by PTMAX (an interactive computer program of USEPA's UNIMAP series) analyzes the maximum short term concentration of emissions from a point source as a function of atmospheric stability and wind speed. It indicated the highest ground level concentrations (GLC) which could occur during the most adverse weather conditions. Table IV-2 presents the data generated by PTMAX for comparison with Federal Secondary Air Quality Standards. These data indicate that no Federal air quality standard would be contravened due to the operation of the stand-by power generators. Thus, the Bosque del Apache NWR or other PSD Class I areas would not be significantly affected by the proposed project. Although NO_2 concentrations appear extremely high, it should be noted that these levels are hourly averages and the generators normally would be operating less than 200 hours

Table IV-2

Hourly Ground Level Concentrations of Emissions from Stand-by Power Generators*

Parameter	GLC**	Federal Secondary Standard
Nitrogen dioxides (NO_2)	773.0	100 (Annual arithmetic mean)
Carbon monoxide (CO)	201.0	40,000 (1-hour average)
Sulfur dioxides (SO_2)	221.6	365 (24-hour average)
Particulates	69.1	60 (24-hour average)

*All data presented in micrograms per cubic meter (ug/m^3)
**Hourly average Ground Level Concentrations produced by all four 5-megawatt generators per hour under "worst case" climatic conditions

per year, or approximately three percent of the time within a year (23 micrograms per cubic meter). Consequently, the annual arithmetic mean concentration of NO_2 would be expected to be far below the Federal Standard of 100 micrograms per cubic meter (ug/m^3). A copy of the PTMAX calculations and assumptions is contained in Appendix C of the DEIS.

Stand-by power requirements for the high power phase would be expected to be the same as the low power phase. At this time, however, neither the exact power requirements nor the power source for the high power phase of the GBFEL-TIE project is known. Therefore, estimates of air pollutant emissions from generation/energy storage devices cannot be made. Such emissions would be a factor in selecting the power source for the second phase.

It is anticipated that no significant long-term adverse impact on air quality would result from construction or operation of the GBFEL-TIE facility at any of the three proposed sites. Mitigation measures (dust suppressants and reduced equipment operation, where applicable) will be implemented to minimize adverse impacts to the maximum extent practicable.

E. Noise

Construction noise would be similar to that of other carpentry and concrete construction with heavy equipment, generators, compressors, various power tools, etc. This impact would be of relatively short duration and near pre-project conditions would return upon cessation of construction activities.

Construction workers could be impacted; however, WSMR complies with noise emission standards and has a comprehensive Hearing Conservation Program which identifies hazards, establishes control measures with possible worst source control/examination, provides hearing protection, provides audiometric testing and instructs in the care and use of hearing protection equipment(1).

As discussed previously, the Antelope WSA is located within seven km of the Stallion site. Increased noise levels could be detected at the Antelope WSA during the construction phase depending upon climatic conditions, time of day/night, and type of construction activity. However, significant adverse effects on this area would not be expected since the distance would attenuate most of the noise.

Noises generated by construction equipment and by the stand-by power generators (during the operational phase) would adversely affect some wildlife species. Pronghorn, in particular, are extremely sensitive to human disturbances and the construction activities could result in further displacements among the pronghorn populations. Swainson's hawks, which are known to nest near the Stallion site, would also avoid the project vicinity, thereby potentially increasing the demands on and competition for available resource requirements in other nearby areas.

The San Andres NWR, which is adjacent to the North of NASA site, supports one of the last remaining populations of desert bighorn sheep. This species is also extremely sensitive to man-induced changes and activities. Construction noise could cause the sheep to avoid the project vicinity, thus eliminating a large portion of their present range. In addition, due to the potentially extended duration of construction, noise and associated disturbances could induce physiological damages to the sheep(53).

The White Sands National Monument and other environmentally sensitive areas are far enough away from the Orogrande site that noises from construction and operation of the proposed GBFEL-TIE would be attenuated. Wildlife in the immediate vicinity would be affected (e.g., disruption of courtship/nesting rituals). The magnitude of the effects would vary during different seasons, time of day and with different distances from the noise sources. Similar effects would occur at the North of NASA and Stallion sites.

Operation of either the low or high power phase of the GBFEL-TIE facility would not include any commercial or industrial noise sources more severe than that of an auxiliary electrical generating plant and required cooling water and vacuum pumps. Most noises would fall in the category of domestic to light industry and would be associated with periodic maintenance and landscape activities. Significant noise levels would not be a product or by-product of the project. It is also expected that noise baffles would be utilized to further reduce noise levels, if necessary.

F. Biological Resources

1. Vegetation

Construction of the proposed GBFEL-TIE at any of the sites would result in an irretrievable loss of habitats. The office space, parking lots, sewage lagoons, laser test cell, and beam director would require approximately 2,500 acres. Construction staging areas, if needed, would also require grading and clearing of additional habitats. The amount of construction staging area that would be required, if any, would be proposed to the GBL project office by the construction contractor(s). The GBL project office will then closely coordinate with the WSMR Environmental and Natural Resources Office (ENRO) to ameliorate additional habitat losses. Although exact area requirements for structures and roads are not yet known, for the purposes of comparison, it is assumed that the total site would be cleared and/or fenced and thus eliminated as available habitat for certain wildlife species, especially large mammals.

The approximate acreage that would be lost at each site under this assumption, is presented in Table IV-3, by habitat type. This table also provides an estimate of the amount of vegetative biomass produced by each habitat type. This provides an indication of the productivity that would be "lost" at each

Table IV-3

Vegetation Communities That Would Be Lost At Each Site And The Associated Biomass Productivity

Site/Vegetation Type	Area (acres)	Annual Productivity (pounds/acre)	Estimated Total Annual Vegetative Biomass (tons)
Stallion			
Sand sagebrush-soaptree yucca	7,804	200-600	780-2,340
Sand sagebrush	207	200-600	20- 60
Alkali sacaton-tobosa	8,889	400-700	1,780-3,110
Inert	327	0	0
TOTAL	17,227		2,580-5,510
North of NASA			
Mesquite-sand dunes	12,922	50-100	320- 650
Shrub-grassland	1,164	200-500	120- 290
Juniper-sand dunes	62	200-500	6- 20
Arroyo riparian*	202	50-100	5- 10
Hills grassland	1,163	200-500	120- 290
TOTAL	15,513		570-1,260
Orogrande			
Mesquite-sand dunes	15,127	50-100	380- 760
Sand sagebrush	576	50-100	10- 30
Grassland*	144	400-700	30- 50
Broom snakeweed*	64	400-700	10- 20
Creosotebush	80	50-100	2- 4
TOTAL	15,991		430- 860

*These communities were not specifically identified and assigned a productivity value by the U.S. Army (1985); thus, they were placed in a comparable category based upon species composition and soil type.

Source: U.S. Army, 1985(1) and Geo-Marine, Inc.

site. The most significant impact to vegetation communities would occur at the Stallion site due to the losses that would be incurred within the grassland communities. As discussed previously, these habitats are very sensitive and provide potential habitat for numerous species such as pronghorn and Baird's sparrow. In addition, the majority of the additional land required for the ground target range at Stallion would be comprised of grasslands. While the acreage that would be eliminated at each site is similar, the amount of annual vegetative biomass that would be lost is much greater at Stallion (about 5,500 tons) than at North of NASA (about 1,300 tons) or Orogrande (less than 1,000 tons).

The loss of the alkali sacaton tobosa grasslands at Stallion for the laser facility would represent a reduction of about 16 percent of similar habitat on WSMR. The hills-grasslands communities at North of NASA that would be eliminated represent approximately 10 percent of this habitat type presently available on WSMR; the mesquite-sand dunes comprise about eight percent of available similar habitat. The mesquite sand dunes communities eliminated at Orogrande represent about 11 percent of available similar habitat at WSMR.

The ground target range at North of NASA would eliminate about 200 acres of arroyo riparian habitat, which is a scarce and valuable community in the desert ecosystem. This habitat type supports a diverse population of wildlife species and provides a migratory corridor for numerous species. Fencing of the ground target range would preclude the continued use of these corridors.

Construction of power lines, railroad spurs, roads and pipelines would also eliminate or alter the areas' vegetation communities. Transmission line rights-of-way (ROW) would be temporarily cleared and graded; however, the contractor(s) would be required to reseed the ROW as prescribed by WSMR ENRO(54). An unimproved road for inspection and maintenance would be allowed to remain without reseeding. Roads, on the other hand, would result in an irretrievable loss of certain habitats. The exact route that any of these facilities would take within the possible corridors illustrated previously (Section II. Comparison of Alternatives) is not presently known and would depend upon several variables, including construction limitations (e.g., canyons), institutional constraints (e.g., other public and private lands) and environmental considerations. These routes would be coordinated through the WSMR ENRO and in some cases may require a separate environmental analysis to assess specific impacts and develop mitigative measures. Table IV-4 provides an indication of the amount of vegetation that would be affected by construction of powerlines, roads, water pipelines and possible railroad spurs to each of the three sites. The data in this table assume the shortest practical distance required to construct each facility ROW, but are not conclusive as to final configuration.

As indicated by these data, the Stallion and North of NASA sites would require at least three times more land for construction of these facilities, than Orogrande, primarily due to the remoteness of the sites.

Normal operations of the GBFEL-TIE at any site would have no significant impact upon the area's vegetation. Ingress and egress to the facility would be restricted to existing or newly constructed paved and/or dirt roads.

Any accidental fires and spills, on the other hand, would have detrimental effects to the habitat communities within the immediate area regardless of site. Fires could be ignited by explosions at capacitor banks, tank farms

Table IV-4

Potential Habitat Losses, by Site, due to Powerline, Road, Water Pipeline and Railroad Construction

Facility	ROW (m)	Stallion Length* (km)	Stallion # Acres	North of NASA Length* (km)	North of NASA # Acres	Orogrande Length* (km)	Orogrande # Acres
Power transmission	30	50	370	25	190	16	120
Road	25	3	19	38	230	2	12
Railroad	30	43	320	36	270	14	100
Water pipeline	8	44	87	23	45	32	64
Total			800		740		296

*These are estimated shortest practical distances and not necessarily representative of final configuration.

Source: Moya, 1986(54), General Research Corp., 1986(2), and Geo-Marine, Inc.

(area reserved for storage tanks), or other components of the laser device. Similarly, leaks of potentially hazardous chemicals could result from such explosions. The exact magnitude of the effects of such catastrophes on the area's vegetation is not quantifiable, but would depend upon several variables including size and type of explosion, type and amount of leaks and/or fires, location of fire/leak, season in which the accident occurred, responsiveness and efficiency of the emergency response team to activate WSMR's Spill Prevention Control and Countermeasure Plan (SPCCP) and Installation Spill Contingency Plan (ISCP), and other biotic (general productivity) and abiotic (climatic conditions) factors. McLaughlin and Bowers(55) investigated the effects of a burn in a similar desert-grassland community and reported that, after two years, the density and cover of all the plant species were still only nine percent and 16 percent, respectively, of that in the surrounding unburned plant communities.

2. Reptiles and Amphibians

Potential habitats for the barred tiger salamander occur in the extreme eastern portion of the North of NASA site within the foothills of the San Andres Mountains. However, the proposed GBFEL-TIE facility would be constructed in the western areas of the site where the terrain is more level, and thus better suited for the laser facility. Consequently, construction activities would not affect this species, if it does in fact inhabit the area.

Elimination of grasslands at the Stallion site would affect populations of the yellow box turtle, which is the only turtle species known or presumed to occur in the vicinity of WSMR. The number of turtles that could successfully move into other nearby areas would depend upon several factors including the time of year construction was performed; quality, suitability, and carrying capacity of nearby habitats; current status of turtle populations; and distance of suitable habitats from construction sites.

Burrowing or less mobile reptiles and amphibians, such as spadefoot toads and black-headed snakes, may be crushed at all sites during construction activities. Other more mobile species, such as western coachwhip and checkered whiptail, would avoid the immediate area of disturbance. However, elimination of habitats at each of the sites could result in the loss of up to 35 lizards per hectare (14/acre) of habitat destroyed, based upon herpetofauna densities from similar habitat types(1). The potential losses, therefore, would be about 11,200 at Stallion, 10,360 at North of NASA, and 4,200 at Orogrande.

Normal operation of the laser facility would not significantly affect reptile and amphibian populations, with the possible exception of firing at ground targets. Reptiles, in particular, may use the backstop structures constructed for the ground targets as resting or "sunning" locations. Those reptiles and amphibians hit directly by the laser beam or indirectly by backscattering or reflectance would be injured or killed. Lead and concrete shielding would be installed to contain ionizing radiation outside of the facility to less than 0.002 rads per hour (r/h). This concentration would be further reduced with distance. Additionally, ionizing radiation would occur only for the duration of each laser run (i.e., 60 seconds); there would not be any residual ionizing radiation to the outside environment after cessation of each test.

Accidental fires or spills, as discussed previously, would cause additional losses to the herpetofauna either directly (e.g., burned) or indirectly (e.g., loss of habitat). Again, the magnitude of these effects would depend upon numerous biotic and abiotic factors.

3. Fish

The only fish that has been reported on WSMR is the White Sands pupfish (Cyprinodon tularosa), which is endemic to the Salt Creek drainage basin and associated drainages and springs. The pupfish's habitat areas are 47 km from the Orogrande site and separated from the North of NASA and Stallion sites by mountain ranges. Thus, the pupfish would not be affected by the construction or operation of the proposed GBFEL-TIE.

4. Birds

Since birds are usually mobile, they would be able to avoid the immediate construction areas. However, breeding and nesting rituals would be interrupted each year that construction continues. This disruption may have significant impacts on the local populations of some species. Those species expected to be breeding and thus disturbed, are presented by site in Table IV-5.

Some birds (e.g., mourning doves) would attempt to breed again in another location if disturbed; however, other species (e.g., golden eagle, Swainson's hawk, etc.) may not make another attempt, thereby potentially reducing the local populations of these species.

Elimination of feeding and nesting habitats would also indirectly reduce bird populations. The U.S. Army(1) reported that bird densities within semi-desert shrub areas range from a low of 0.046 birds per acre to a high of 0.896 birds per acre. Table IV-6 presents the estimated number of birds based upon these

Table IV-5

Breeding Bird Species Presumed or Known to Occur at or near the Proposed GBFEL-TIE Sites

Species	Potential Occurrence*		
	Stallion	North of NASA	Orogrande
Swainson's hawk	3	2	2
Red-tailed hawk	3	3	3
Golden eagle	2	2	1
Prairie falcon	2	2	2
American kestrel	2	2	2
Wild turkey	1	2	1
Scaled quail	2	2	2
Gambel's quail	2	2	2
Mourning dove	2	2	2
Greater roadrunner	2	2	2
Common barn owl	1	2	3
Great horned owl	2	2	2
Northern flicker	1	2	1
Say's phoebe	2	2	2
Western kingbird	2	2	2
Chihuahuan raven	2	2	2
Cactus wren	3	3	3
Northern mockingbird	3	3	3
Curve-billed thrasher	2	2	2
House finch	2	2	2

*1 = little or no chance
2 = good chance due to suitable habitat
3 = known to breed in vicinity

Source: Oberholser, 1974(23); U.S. Army, 1985(1); and Geo-Marine, Inc.

Table IV-6

Potential Losses to Bird Populations due to Habitat Reduction

Site/Facility	Requirement* (acres)	Potential Bird Losses** Minimum	Maximum
Stallion:			
Laser	17,227	790	15,430
Other	800	40	720
Total		830	16,150
North of NASA:			
Laser	15,513	710	13,900
Other	740	30	660
Total		750	14,560
Orogrande:			
Laser	15,991	740	14,330
Other	300	10	270
Total		750	14,600

*From Tables IV-3 and IV-4
**Minimum density = 0.046 birds/acre;
Maximum density = 0.896 birds/acre

Source: U.S. Army, 1985(1) and Geo-Marine, Inc.

reported densities, that would be lost, by site, due to habitat reductions caused by construction of the laser facility. It should be noted that these estimates represent maximum numbers based upon the area that would be fenced. Other habitats within the area would remain undisturbed and thus the losses presented in this table would be much less.

Birds that fly directly into the laser beam would be injured or killed. However, the chances of this occurring would be extremely remote, especially considering the safety mechanisms that would be incorporated into the laser system that would immediately cease or preclude the lasing process if objects greater than 1.0 cm in diameter are detected near the beam path. On the other hand, individual birds that utilize the ground target structures for feeding or resting may be injured or killed from backscattering of the beam's energies.

Raptors, such as golden eagles and red-tail hawks, use powerline poles for perching sites and occasionally for nesting sites. If the spacings between conductors are inadequate, the birds could become entangled or electrocuted. Measures to mitigate these potential consequences are discussed in the following section.

As was discussed previously (IV. F. 2. Reptiles and Amphibians), accidental fires, although unlikely, could occur and would destroy valuable wildlife habitat. Destruction of these habitats would result in subsequent reduction in wildlife populations due to reduced prey base and/or other food sources (i.e., seeds, stems, etc.), stress and overcrowding, and direct death caused by the fire. The magnitude of these impacts would depend upon the weather conditions at the time of the fire, location of the fire, type of fire and efficiency and response time of the fire control and prevention plan.

5. Mammals

The potential impacts to mammals from construction activities would be similar to the impacts to both herpetofauna and birds. That is, the burrowing species such as ground squirrels and pocket gophers, may be killed while the more mobile species (i.e., jackrabbit, pronghorn, etc.) would flee the immediate area. Some of the smaller rodents would move back into the project area. However, larger mammals such as pronghorn and gemsbok would probably permanently avoid the immediate project area. In addition, any fence that would be placed around the perimeter of the facility and ground target ranges would preclude the reentry of such species.

The loss of habitats would result in additional irretrievable losses in mammal populations. The U.S. Army(1) reported densities of small rodents from five different habitat types. The minimum density (0.27 individuals/acre) occurred in climactic black grama grasslands; the maximum density reported in a habitat type that would be representative of the proposed alternative sites was 0.57 individuals per acre. This density was reported for the four-wing saltbush/mesquite community. Table IV-7 provides an indication of the potential losses of small mammals, by site, that would occur due to construction of the laser facility and ancillary structures (e.g., power and water transmission lines, railroads, and roads). Again, these are maximum numbers; small mammals would still have access to the fenced areas and thus these losses would be significantly reduced.

No impacts to mammals would be expected to occur as a result of the normal operations of the proposed GBFEL-TIE, except for the possible direct or

Table IV-7

Potential Losses to Small Mammal Populations due to Habitat Reduction

Site/Facility	Requirement* (acres)	Potential Mammal Losses** Minimum	Maximum
Stallion:			
Laser	17,227	4,650	9,820
Other	800	220	460
Total		4,870	10,280
North of NASA:			
Laser	15,513	4,190	8,840
Other	740	200	420
Total		4,390	9,260
Orogrande:			
Laser	15,991	4,320	9,120
Other	300	80	170
Total		4,400	9,290

*From Tables IV-3 and IV-4
**Minimum density = 0.27 individuals/acre;
Maximum density = 0.57 individuals/acre

Source: U.S. Army, 1985(1) and Geo-Marine, Inc.

indirect contact with the beam energies near the ground target structures, as discussed previously for herpetofauna and birds.

Several studies recently prepared concerning various laser projects proposed in the the New Mexico area have indicated that cumulative impacts to wildlife from laser propagation are negligible(56,57,58,59,60,61). However, none of these or other studies have addressed potential impacts to wildlife from lasers with the high energy levels that would be expected from the GBFEL-TIE. As an indication, Table IV-8 provides a quantitative description of the cumulative impact of all lasers used on WSMR. As can be seen from these data, quail are more likely to come into contact with hazardous radiation, while deer and mountain lions receive negligible effects. It should be noted that all WSMR laser activity was included in these calculations; again, however, the proposed GBFEL-TIE would be much more powerful than these lasers.

Table IV-8

Probable Numbers of Wildlife Receiving Hazardous Radiation Per Year from WSMR Laser Activity

Species	Probable Number Receiving Hazardous Radiation	Estimated 1980 WSMR Population
Antelope	0.004	400
Bighorn sheep	0.0	30
Bobcat	0.582	200
Coyote	1.323	500
Deer	Negligible	3,500
Dove	0.653	2,000
Feral Horse	0.004	150
Gemsbok	0.008	300
Golden Eagle	0.015	35
Hawk (all species)	0.101	200
Mountain Lion	Negligible	75
Quail (all species)	14.646	31,760
Turkey	0.0	75

Source: U.S. Army, 1980(57) and 1985(12)

Accidental fires would have similar effects upon mammals as on birds. Reductions in populations of small birds and small mammals would indirectly adversely affect the larger carnivores by reducing their prey base.

6. Threatened and Endangered Species

Federally listed threatened or endangered species would not be expected to be impacted by the proposed project at the Orogrande site. The Sneed pincushion cactus and Lloyd hedgehog cactus grow at high elevations within the Franklin and Jarilla Mountains, respectively. No portion of the proposed project would require construction of facilities in the higher elevations in these mountain ranges where these species normally grow. No Aplomado falcons are known to occur in New Mexico and thus no impacts to this species would be expected.

The interior least tern requires beaches and sandbars for resting and feeding, and thus would not be affected by construction or operation activities at any of the proposed sites. Suitable habitat may occur along the Rio Grande; consequently, interior least terns, if they are present, may be affected by the construction associated with supplying surface water from the Rio Grande alluvium.

Bald eagles are transient species which have been reported near to Lake Lucero. Consequently, it is possible that bald eagles could occur at a given time over any of the three sites(62). Construction activities at any of the sites should not adversely affect bald eagles; however, they may be affected by power transmission lines, particularly if the conductor spacings are inadequate, as discussed previously. The large size of the power lines that would be required (i.e., 345 Kv) would require large spacings between the conductors, and thus should not present a problem to eagles or other raptors. Additional measures to reduce these potential effects are discussed in the following sections.

The whooping crane usually travels along a major drainage system (e.g., Rio Grande) during its migration. Therefore, it is improbable that whooping cranes would occur within or near any of the proposed project areas. This is particularly true of the Orogrande site. However, whooping cranes often flock with sandhill cranes, and sandhill cranes have been reported to fly over WSMR. Whooping and sandhill cranes would be susceptible to entanglement/electrocution by power lines constructed across the Rio Grande Valley for the North of NASA and Stallion sites.

Falcon eyries have recently been discovered in the Oscura Mountains, approximately 26 km east of the Stallion site. It is not known at present if these are peregrine or prairie falcon eyries(14). Elimination of portions of the grasslands and the consequent reduction of prey items would adversely affect either species of falcons. Potential feeding and nesting habitat of the peregrine falcon occurs at both the Stallion and North of NASA sites. Peregrine falcons have also been reported at Lake Holloman approximately 32 km from the Orogrande site. Construction operations and increased activities during the operational phase may disturb peregrine falcons, if they are present, at any site, but should not adversely impact the species.

Three species protected by the State of New Mexico would probably be affected if the Stallion site is selected: Swainson's hawk, Baird's sparrow and McCown's longspur. The playas and grasslands at the Stallion site are preferred habitat types of the latter two species. However, no specific survey for either species has been conducted. Swainson's hawk has recently been reported to nest near the Stallion site. Reduction in suitable habitat, increased activities and additional powerlines may result in significant adverse effects to this species. Swainson's hawks have also been observed at the other two sites, but no nests have been reported from the North of NASA site. During recent field reconnaissance, a raptor nest, believed to be that of a Swainson's hawk, was recorded near the southern end of the Orogrande site.

Construction and operation of the proposed project at the North of NASA site may adversely affect the desert bighorn sheep which primarily inhabit the San Andres NWR. These animals tend to avoid areas of human disturbance, and thus, the proposed project may further limit their restricted range. Additionally, chronic, low level stress caused by construction, operation and maintenance activities, particularly during daytime hours, may cause physiological damages to the sheep(53).

The Trans-pecos rat snake and gray vireo are two other state endangered species which probably inhabit the extreme eastern portion of the North of NASA site. Construction activities could destroy some individual rat snakes, especially since this species is nocturnal and would be underground at the time construction activities would probably be conducted(63,64). Gray vireos would avoid the immediate construction areas, and thus would not be significantly affected directly by these activities; however, loss of habitat would result in reduced local populations of the gray vireo.

Potential habitat for the Organ Mountains chipmunk may occur in the San Andres Mountains near the North of NASA site, although no specific survey has been conducted. Still, no significant impacts to this species, if it occurs, would be expected since construction and operation of the laser facility would be limited to those areas which are not expected to support suitable habitat for the chipmunk.

There is little or no probability that any species contained on the New Mexico endangered species list would be affected by the proposed project if the Orogrande site would be utilized, with the possible exception of Swainson's hawk. Swainson's hawks have been reported near the Orogrande site and would avoid the immediate construction area.

7. Other Unique and/or Environmentally Sensitive Resources

The primary impacts to unique or sensitive resources as a result of the proposed GBFEL-TIE project would include potential effects to the seeps and springs at the North of NASA site and the elimination of some grasslands at the Stallion site. Development of well fields in the Jornada del Muerto Basin or in the Rio Grande Alluvium would not be expected to significantly affect seeps and springs in the San Andres Mountains. However, fences may preclude the use of some of these resources by wildlife, particularly large mammals. These seeps and springs provide valuable habitat for a variety of wildlife species, as discussed previously in Section III. As mentioned previously, the New Well site at the North of NASA would be displaced. This valuable water source would have to be replaced by water catchments outside of the GBFEL-TIE area.

Elimination of grasslands at the Stallion site and the use of fences, which would further decrease the amount of grasslands available, may have significant adverse effects upon the local populations of pronghorn. Current herd population for pronghorn is approximately 400 head, with a buck/doe/fawn ratio of 56/100/47. Pronghorn antelope production varies with season. Populations are heavily influenced by dry seasons which result in low forage values and a decreased fawn survival rate. Any elimination of available habitat would impact the herd, and when combined with noise and occupational impact, could potentially impact this herd beyond recovery(72).

A portion of the fence around the North of NASA site would be close to the San Andres NWR's western boundary. Actual surveys of the proposed project boundary have not been conducted; however, it should be stressed that no fences would be constructed on or across the refuge. In addition, no utilities (e.g., road, powerlines, etc.) would be constructed on the San Andres and Bosque del Apache NWRs, White Sands National Monument or other such lands. Consequently, these environmentally sensitive areas would not be directly affected by the construction activities, except for potential increases in noise levels, as discussed previously. Operation of the GBFEL-TIE would also not be expected to cause any significant adverse effects to these areas.

G. Cultural Resources

The Stallion and North of NASA sites were surveyed for archeological resources using a 14 percent sample. The Orogrande area was intensively surveyed during the Borderstar 1985 Environmental Assessment. Projections based on sample survey data indicate the probable magnitude of potential adverse impacts at the three alternative sites as a result of the proposed construction and operation of the GBFEL-TIE. These projections were developed using a predictive model based upon results from the present and previous studies. This section is a synopsis of results which are contained in Appendix B of the DEIS.

The predictive model results can be summarized as follows:

1. The Orogrande and Stallion alternatives are roughly equal in terms of relative densities of various kinds of cultural remains. Orogrande is characterized by greater numbers of small lithic and/or ceramic sites, greater ceramics diversity, and possibly by more abundant fireusing features. The greater diversity of ceramics may indicate the presence of hidden residential features.
2. The North of NASA alternative represents an entirely different situation, with site densities, sizes and complexity which overshadow those of the other alternatives. Much of the area appears to represent the cumulative record of extensive, recurrent occupation of the alluvial fan area.

3. In all three areas, areas of increased slope (the alluvial fans) are characterized by increased site area, artifact density and diversity. Archaic and Multicomponent sites especially increase in number and extent on the fans. In the North of NASA area, the Middle fan zone is generally the most complex of the three zones defined, with densities dropping off somewhat on the Upper fan (Archaic site area, however, increases on the Upper fan).

Figures IV-4 and IV-5 and Table IV-9 summarize the predictive results by comparing the three sites without reference to the environmental strata. It is clear that the North of NASA area differs markedly from the Stallion and Orogrande alternatives.

The total site area recorded at the Orogrande site during the Border Star survey may underestimate the true site area by 20-50 percent, due to the surveyors' inability to record small sites located entirely between the transects. However, all major sites have been identified and tabulated.

Table IV-9 presents projected cultural remains which would be impacted by each alternative, assuming 10 km2 of construction activities. This 10 km2 includes the area occupied by the facility and its ancillary support (buildings, parking lots, etc.). In addition to total sites and site area, total site area statistics for sites of low-moderate or higher artifact density (>=0.2/m2, <1.0/m2 or 1 artifact per 5 m2) and for high density sites (>=1/m2) are presented to provide a framework for assessing the potential data recovery efforts required. Similar site area figures are provided for sites with Lithic diversities that have at least six types present and for ceramic diversities that have at least three types represented.

The data in Table IV-9 indicate that the North of NASA alternative represents the greatest potential impact and a massive mitigation effort -- over 3,000,000 square meters of site area, including over 1,000,000 square meters of high-density site area and 2,000,000 square meters of high-diversity site area.

The Stallion and Orogrande alternatives would be roughly equal in terms of potential impact. The Orogrande area has less high-diversity site area but more sites and more high-density site area, and may have more fire-using features. The Stallion alternative, on the other hand, appears to have fewer sites but contains a higher incidence of Archaic and Multicomponent site areas.

The higher numbers of sites in the Orogrande area may indicate that cultural resources are scattered in more, perhaps smaller, packages.

Utility rights-of-way and roads represent additional potential impacts to cultural resources, which must be considered further prior to selection of exact rights-of-way. A separate environmental analysis would be required to assess potential impacts from their construction and maintenance since the current investigations did not include utility rights-of-way. Areas expected to be impacted by these facilities are presented in Table IV-10.

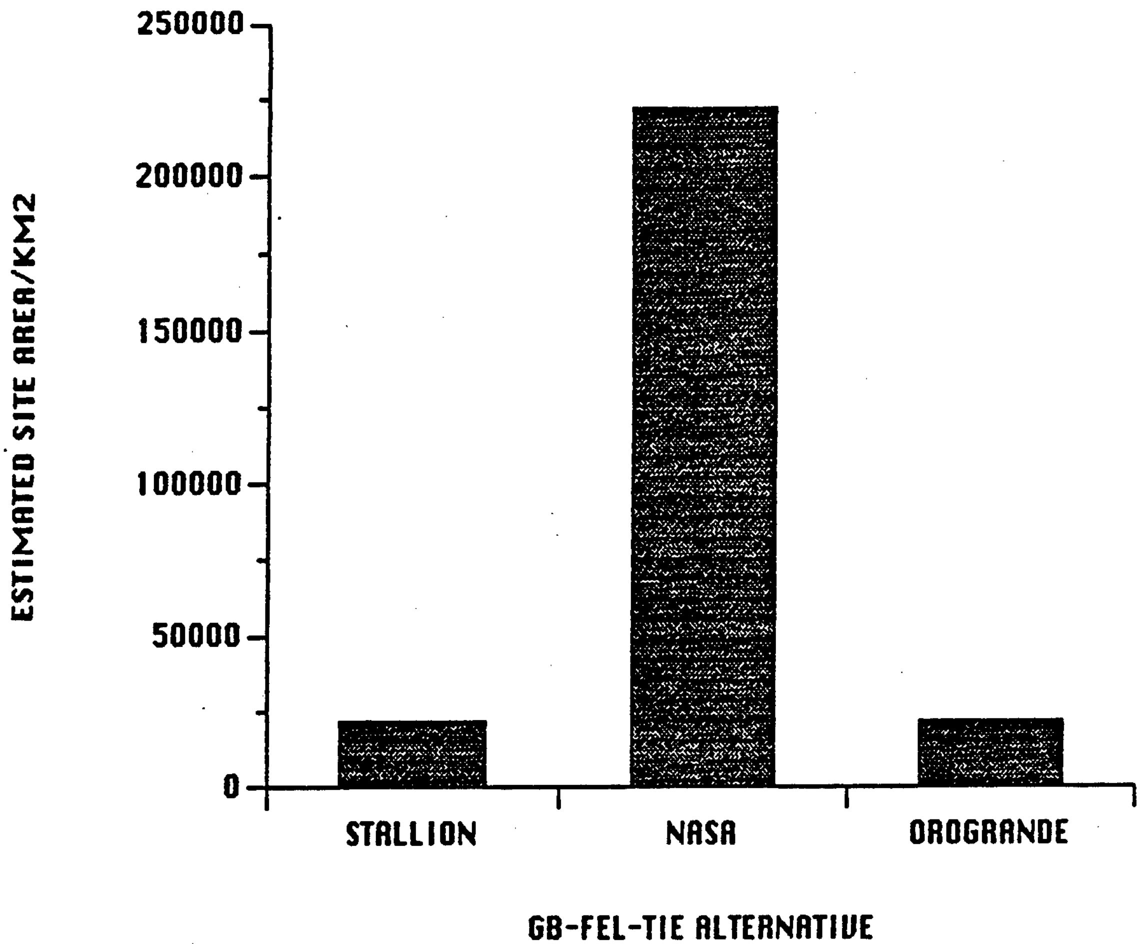


Figure IV-4. Estimated Site Area per Square Kilometer.

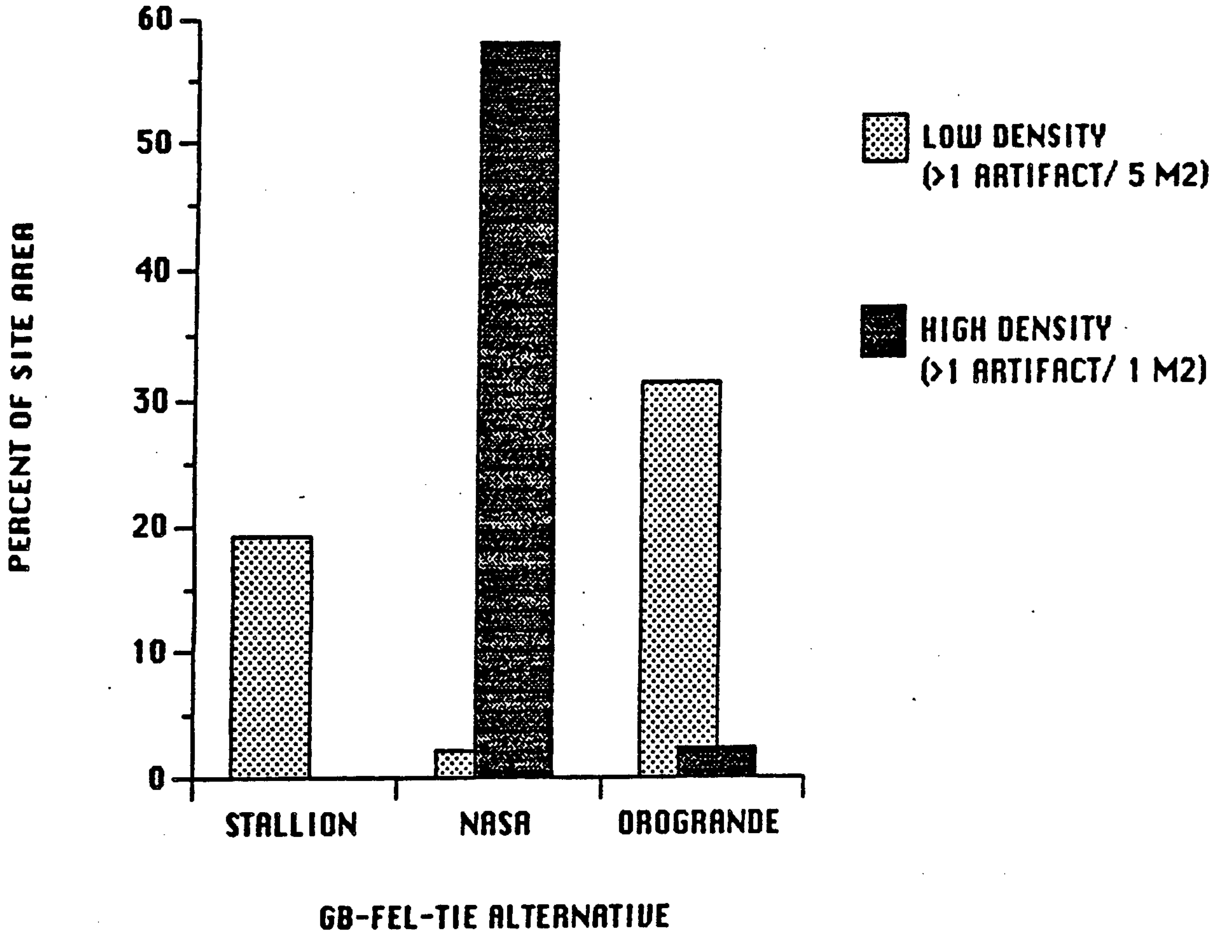


Figure IV-5. Estimated Site Area Percentage by Density Class.

Table IV-9

Projected Impacts of a Hypothetical 10 sq km Facility on the Three Alternatives

Area	Total Sites	Total Site Area (m2)	Site Area (m2) Artifact Density* >=0.2<1.0	Site Area (m2) Artifact Density* >=1.0	Site Area (m2) Artifact Diversity** Lithic>=6	Site Area (m2) Artifact Diversity** Ceramic>=3
Stallion	37	219,390	12,060	0	20,640	12,307
North of NASA	64	3,042,420	1,480	1,081,600	2,987,818	2,438,490
Orogrande	132	214,450	67,400	5,090	49,117	1,590

*Artifact Density - site area in 10 km block projected to contain >=0.2 and less than 1.0 artifacts/m2. Density of remaining site area has an artifact density of <0.2/m2.

**Artifact Diversity - site area in 10 km block projected to contain sites with >=6 types of lithics or >=3 types of ceramics

Table IV-10

Utility Cultural Impact*

	ROW (m)	Stallion Length (km)	Stallion Area (acre)	North of NASA Length (km)	North of NASA Area (acre)	Orogrande Length (km)	Orogrande Area (acre)
Power transmission	30	50	370	25	190	16	120
Water	8	44	87	23	45	32	64
Road	25	3	19	38	230	2	12
Railroad	30	43	320	36	270	14	100
Total Area Impacted			800		740		300
Hypothetical Percent Area Affected		0.0216		0.2219		0.0214	
Hypothetical Impact Area (acres)		17		160		6	

*Right-of-way (ROW) = width of right-of-way
Length = minimum length of utility right-of-way from source to facility
Area = minimum area or utility right-of-way assuming length and width

H. Socioeconomic Resources

The socioeconomic impacts of large scale projects are generally associated with the number of workers who come into an area in response to recently available jobs and where those workers choose to live. The local/non-local mix can be highly variable and difficult to predict. It depends on the size and skill level of the local labor pool, competition for workers from other area construction projects, the existence of "locals-first" hiring practices and efforts to promote long distance commuting.

Incoming workers will settle where housing and other amenities are available. Two general assumptions underlie estimates of where those workers will settle. The first assumption is that the population of a place is a surrogate measure of the availability of housing/amenities and thus communities will attract incoming workers in proportion to their population. The second assumption is that the farther a community is from the work site the less attractive it will be as a place to settle.

Factors specific to each project can greatly affect the actual settlement pattern of incoming workers. Among these are such actions as the provision of temporary dormitory housing for workers at the construction site, encouraging long distance commuting by using van pools and labor buses, the provision of special temporary housing by individual communities, or other inducements by local communities.

It should also be noted, as the preceding paragraphs indicate, that given the uncertainties that surround the determining factors, it is impossible to precisely predict the number of people who will be attracted into the area by GBFEL-TIE and just where these people will settle.

However, the procedures followed, the models with their attendant assumptions, the specific multipliers and parameters chosen, reflect widely used and generally accepted approaches. The estimates generated, while not exact, allow for a comparison of the relative socioeconomic effects associated with each site considered. Based on the information available, these projections are the most reasonable estimate of expected impacts.

GBFEL-TIE related employment estimates and schedules for construction and operation are based on figures provided to Geo-Marine, Inc. by USASDC, Fort Worth District Corps of Engineers and WSMR. The GBFEL-TIE related employment estimates and construction schedule were presented previously in Table I-1.

These estimates, along with employment data obtained from WSMR, U.S. Census and local public sources, were used to estimate the number of workers that would be expected to move into the study area in response to the implementation of GBFEL-TIE.

A "gravity model" was used to estimate where the incoming population would settle. The calculations and assumptions made for the population impact and gravity models are contained in Appendix D. Key assumptions made for these models were: (1) construction personnel would generally drive at least 160 km (100 miles) to a work site; and (2) residence distribution for the operation/supervisory personnel would be similar to that of current WSMR civilian personnel. In-migrating population distribution factors produced by the gravity model are presented by county in Table IV-11.

Table IV-11

Distribution Factors for Construction, Operation and Secondary[a] Workers and Attendant Dependents

	Site					
	Orogrande		North of NASA		Stallion	
County	Construction & Secondary	Operations	Construction & Secondary	Operations	Construction & Secondary	Operations
Bernalillo	*	*	*	*	.654	.307
Dona Ana	.190	.234	.433	.831	*	*
Lincoln	.007	.002	*	*	.045	.045
Otero	.105	.175	.037	.009	*	*
Sierra	*	*	.006	.001	.020	.013
Socorro	*	*	*	*	.166	.536
Torrance	*	*	*	*	.014	.008
Valencia	*	*	*	*	.101	.091
El Paso	.698	.588	.524	.157	*	*
	1.000	0.999**	1.000	0.998	1.000	1.000

*indicates not applicable
**may not total 1.000 due to rounding
[a]Those workers necessary to fill the employment created by the primary jobs for sales and services.

1. Projected Impacts of Increased Population

a. Introduction

Based on estimates of currently available construction workers, it is projected that sufficient construction labor would be available locally in the study area to accommodate 60 percent of blue collar construction labor force needs in the early years of the project. However, to fully meet project requirements, the remaining 40 percent of the blue collar construction workers are projected to be non-local. In peak years, during Phase II, it is projected that 50 percent of the blue collar work force would be non-local. The greatest impacts would be in the area of skilled, electrical, mechanical and general construction workers. As indicated earlier, local labor would be projected to satisfy only an estimated 20 percent of the demand for scientific/technical/supervisory construction and operation personnel.

b. Stallion Site

Table IV-12 provides a yearly estimate range of in-migration by construction, secondary and operation workers and attendant dependents for each site. As can be seen from Table IV-12, the expectation, based on the assumptions of the model, is that incoming workers would settle in six of the nine study area counties if the Stallion site is chosen. The construction would draw approximately 3,300 to 4,100 new persons into the area at its peak. The bulk of these, about 2,000, are predicted to settle around Albuquerque, approximately 100 miles from the site. Over 25 percent (900 to 1,100) are predicted to settle in the Socorro area. About 300 to 400 would be predicted

Table IV-12

Estimated Distribution of GBFEL-TIE
Related In-migrating Population

County	1987	1988	1989	1990	1991	1992	1993
				OROGRANDE			
Dona Ana	40 - 61	296 - 355	295 - 396	235 - 313	554 - 705	666 - 832	568 - 709
Lincoln	0 - 1	9 - 11	8 - 10	5 - 6	16 - 20	19 - 23	15 - 19
Otero	25 - 39	174 - 212	184 - 250	156 - 209	337 - 431	410 - 512	355 - 444
El Paso	131 - 194	1027 - 1210	962 - 1269	711 - 935	1850 - 2345	2201 - 2751	1839 - 2299
Total*	200 - 300	1510 - 1790	1450 - 1920	1110 - 1460	2760 - 3500	3300 - 4120	2780 - 3470
				NORTH OF NASA			
Dona Ana	108 - 174	743 - 910	809 - 1106	706 - 950	1467 - 1880	1790 - 2237	1566 - 1957
Otero	6 - 8	49 - 57	41 - 52	25 - 32	83 - 104	96 - 121	77 - 97
Sierra	1 - 1	8 - 9	6 - 8	4 - 5	13 - 16	15 - 19	12 - 15
El Paso	82 - 113	706 - 811	592 - 758	372 - 476	1194 - 1501	1393 - 1741	1122 - 1402
Total*	200 - 300	1510 - 1790	1450 - 1920	1110 - 1460	2760 - 3500	3300 - 4120	2780 - 3470
				STALLION			
Bernalillo	109 - 154	907 - 1050	790 - 1022	528 - 682	1566 - 1975	1840 - 2299	1501 - 1876
Lincoln	9 - 13	68 - 80	65 - 87	50 - 66	124 - 158	148 - 185	125 - 156
Sierra	4 - 5	29 - 33	26 - 34	18 - 24	50 - 64	60 - 74	49 - 61
Socorro	54 - 91	334 - 423	409 - 572	393 - 536	710 - 918	883 - 1104	797 - 997
Torrance	2 - 3	20 - 23	18 - 23	12 - 16	35 - 44	41 - 51	33 - 42
Valencia	19 - 29	150 - 177	142 - 188	106 - 140	272 - 345	324 - 405	271 - 339
Total*	200 - 300	1510 - 1790	1450 - 1920	1110 - 1460	2760 - 3500	3300 - 4120	2780 - 3470

*Rounded to nearest ten

to settle in the Belen area in Valencia County, while Lincoln County might acquire between 150 and 175 new persons. Smaller numbers of persons could be expected to settle in Sierra and Torrance counties as indicated. Alamogordo, Las Cruces and El Paso would not be likely to have workers and their families settle there if the Stallion site is chosen.

Of the above numbers, incoming operations workers are predicted to desire to live closer to the site, with approximately 30 percent predicted to live in Albuquerque, almost 50 percent in Socorro and 10 percent in Valencia.

c. North of NASA Site

In contrast to the Stallion site, if the North of NASA site is chosen, most of the incoming population is predicted to be more or less evenly divided between Las Cruces and El Paso. Alamogordo might acquire 100 or more new people during construction, with perhaps 10 during operations.

d. Orogrande Site

If the Orogrande site is chosen, about 66 percent of the population is predicted to gravitate toward El Paso. Las Cruces would also receive a substantial percentage (20 percent), while the Alamogordo area would receive about 12 percent of the expected incoming workers. Lincoln County might receive a few incoming workers.

2. Housing

For purposes of assessing the need for housing, it was assumed that each incoming worker accompanied by his dependents would require a single dwelling unit. Single workers were assumed to require one dwelling unit for each two workers. As can be seen from Table IV-13, available housing stocks are adequate to meet the projected demand at both the Orogrande and North of NASA sites. If the North of NASA site is chosen, the impact on the Las Cruces area housing market would be severe but within the bounds of available stocks. For the Stallion site scenario, there could be a projected major housing deficit in the Socorro area of about 270 units during the peak year. This prediction assumes no additional housing becomes available by that time; it is possible that additional housing would in fact be available by 1992. Deficits would also be expected in the Valencia area, although the projected deficits would not be large. Table IV-14 shows the range of housing unit demand allocated by county for each project year.

3. Transportation Systems and Services

The location of the proposed action in the study area would not produce significant or lasting impacts on available transportation facilities and services. Existing facilities are flexible and could expand to meet short-term demands.

If the proposed action is placed at the Stallion site, the highway system would see the greatest impacts, due to daily worker travel to the site during work hours. Additional truck and service vehicle traffic would be noticeably increased. Rail, bus, and freight services could be readily expanded to accommodate demands of the project. Air passenger and freight services could be provided from the Albuquerque Airport. No additional significant transportation impacts would be expected.

Table IV-13

Estimated Maximum Dwelling Units Required in FY1992 (Peak Year)

County	Approximate Units Available	Units Required: Orogrande	North of NASA	Stallion
Bernalillo	3,150	-	-	580
Dona Ana	1,300	330	1100	-
Lincoln	unknown	5	-	70
Otero	900	240	20	-
Sierra	700	-	3	20
Socorro	400 (appr.)	-	-	670
Torrance	unknown	-	-	10
Valencia	unknown	-	-	140
El Paso	6,500	920	370	-
		1,500	1,500	1,500

Source: U.S. Census of Population and Housing, 1980; Reevaluation of Socorro's Socioeconomic Resources, the Socorro Economic Development Commission, Socorro, New Mexico, October 1986

If the proposed action is placed at the North of NASA site, the greatest impact would be due to access roads and highways. Because of its remote location, improved facilities would have to be constructed to the site to accommodate construction and worker access and travel.

If the Orogrande site is selected, available transportation facilities and services would be adequate to accommodate project demands. Required services would be readily available from the Alamogordo, Las Cruces and El Paso urban areas. Access facilities exist to accommodate increased demand resulting from the proposed action.

4. Labor Force and Employment

The proposed action would provide sustained, long-term construction employment (i.e., 2+ years) compared to other types of construction work that generally last less than two years. The project would produce an economic ripple based upon salaries paid and the total dollar amount of the local expenditures for construction materials.

Employment levels in the construction industry would see definite increases. The proposed action is considered a fairly long-term construction project and for skilled workers, sustained employment could be expected during construction phases.

Labor force and employment increases would be positive during construction. However, increased unemployment would occur when the project is fully completed. This withdrawal could create site-related negative impacts on some of the communities, due to a loss of income and perhaps a loss of population.

Table IV-14

Estimated Distribution of GBFEL-TIE
Related Housing Needs by Year and County

County	1987	1988	1989	1990	1991	1992	1993
OROGRANDE							
Dona Ana	14 - 21	106 - 126	107 - 143	78 - 104	196 - 248	240 - 334	197 - 268
Lincoln	0 - 0	3 - 4	3 - 4	2 - 2	6 - 7	7 - 5	5 - 4
Otero	8 - 13	62 - 75	66 - 89	52 - 69	118 - 150	146 - 237	122 - 187
El Paso	46 - 67	370 - 434	355 - 465	239 - 314	660 - 835	805 - 920	646 - 753
Total*	70 - 100	540 - 640	530 - 700	370 - 490	980 -1240	1200 -1500	970 -1210
NORTH OF NASA							
Dona Ana	37 - 58	263 - 319	288 - 390	233 - 313	511 - 653	634 -1102	535 - 866
Otero	2 - 3	18 - 21	16 - 20	9 - 11	30 - 38	36 - 24	28 - 21
Sierra	0 - 0	3 - 3	2 - 3	1 - 2	5 - 6	6 - 3	4 - 3
El Paso	29 - 40	257 - 295	225 - 288	128 - 164	433 - 545	522 - 367	403 - 322
Total*	70 - 100	540 - 640	530 - 700	370 - 490	980 -1240	1200 -1500	970 -1210
STALLION							
Bernalillo	38 - 54	329 - 380	297 - 383	180 - 232	565 - 712	684 - 584	534 - 497
Lincoln	3 - 5	24 - 29	24 - 32	17 - 22	44 - 56	54 - 67	44 - 55
Sierra	1 - 2	10 - 12	10 - 12	6 - 8	18 - 23	22 - 22	17 - 18
Socorro	18 - 30	116 - 146	141 - 196	128 - 174	243 - 313	305 - 669	268 - 516
Torrance	1 - 1	7 - 8	7 - 9	4 - 5	12 - 16	15 - 14	12 - 12
Valencia	7 - 10	54 - 63	52 - 69	36 - 47	97 - 122	118 - 140	95 - 114
Total*	70 - 100	540 - 640	530 - 700	370 - 490	980 -1240	1200 -1500	970 -1210

*Rounded to nearest ten

If all the construction personnel were let go at the same time at Orogrande or North of NASA, the effects might not be too noticeable overall, given the size of the southern New Mexico - El Paso economy. Unemployment will increase fractionally, housing occupancy rates may decline slightly, business resulting from the project-generated payroll will decline. Some construction people will move on to the next job in another area. Some who were in-migrants will like the area and stay on. Much depends on the level of construction activity at that time.

A more serious impact would occur in the smaller towns of Socorro and Valencia counties if the Stallion site is chosen. At the close of construction, a substantial number of persons would probably move on as the local labor market would be unable to absorb them. Facilities built to accommodate new business would become redundant. However, the operations personnel and spinoff jobs generated would still be in the area providing continuing support to the local economy.

5. Income Levels

It is estimated that the proposed action would produce about $50 million per year (for the peak year) in wages for construction labor. Disposable personal income would be distributed throughout the study area in proportion to the settlement pattern of the worker populations. Annual payroll estimates for the operations phase approach $20 million.

It is expected that, where possible, wages and benefits would parallel local levels and that no great differentials in wages and incomes would be observed. However, a tight labor market may result in an upward pressure on wage rates during the early phases of the project. Total income produced as a result of operation and maintenance would be less than that from construction activities and would therefore have less effect on the local economy.

Incomes to support and service business would be increased through construction phases. Personal and business income in the area would produce a ripple through the local economy, due to secondary employment and spending resulting from the project.

Generally positive impacts would be expected for income levels that would result from the proposed project. General upward pressures on wage rates may result in slightly increased costs for goods and services. This would principally affect those persons on fixed incomes.

6. Public Services and Institutions

a. Religion

Area churches should have little difficulty meeting the spiritual needs of the incoming workers and their families. Association with a particular congregation is largely a matter of personal choice and of "feeling at home". For this reason, and because of the likelihood that newcomer churchgoers would be well distributed among existing churches, the probability of a disruptive impact is quite low.

b. Education

Based on the in-migrating population estimated previously, impacts on local public educational systems are estimated at 1,500 new students in the peak year FY92. Using a generally accepted pupil-teacher ratio of 22:1 and 30 students per classroom, this would translate into a projected demand for an additional 68 teachers and 50 new classrooms throughout the study area if all existing schools in the area were operating at capacity. The projected peak year allocation of incoming students is shown in Table IV-15. This table also shows the relative impact to the local school system expressed as a percentage increase in annual enrollment resulting from the proposed GBFEL-TIE. Table IV-16 shows the anticipated range of distribution of incoming school children by project year.

Table IV-15

Estimated Numbers of GBFEL-TIE Related
Incoming School Children Allocated by County

County	Stallion 1992		North of NASA 1992		Orogrande 1992	
	(a)**	(b)	(a)**	(b)	(a)**	(b)
Bernalillo	825	0.8	-	-	-	-
Dona Ana	-	-	850	3.2	310	1.2
Lincoln	70	2.3	-	-	10	*
Otero	-	-	45	0.4	195	1.6
Sierra	25	1.9	5	*	-	-
Socorro	430	12.9	-	-	-	-
Torrance	20	1.1	-	-	-	-
Valencia	150	1.8	-	-	-	-
El Paso	-	-	620	0.4	1005	0.8
Total	1515		1515		1515	

a. Estimated number of incoming school children
b. Estimated percent increase in enrollment due to influx of (a)
* Less than 0.1%
\- Not applicable
**Rounded to nearest 5

Table IV-16

Estimated Distribution of GBFEL-TIE
Related School Children by Year and County

County	1987	1988	1989	1990	1991	1992	1993
				OROGRANDE			
Dona Ana	15 - 24	107 - 129	107 - 146	93 - 125	204 - 260	247 - 309	214 - 267
Lincoln	0 - 0	3 - 4	3 - 3	2 - 2	6 - 7	7 - 8	5 - 7
Otero	9 - 15	64 - 78	68 - 94	62 - 84	126 - 161	154 - 193	131 - 170
El Paso	49 - 74	368 - 437	343 - 457	278 - 368	671 - 853	304 - 1005	682 - 853
Total*	70 - 110	540 - 650	520 - 700	440 - 580	1010 - 1280	1210 - 1520	1040 - 1300
				NORTH OF NASA			
Dona Ana	42 - 68	273 - 338	302 - 418	284 - 384	551 - 708	678 - 847	602 - 753
Otero	2 - 3	17 - 20	14 - 18	91 - 12	29 - 37	34 - 43	28 - 35
Sierra	0 - 0	3 - 3	2 - 3	1 - 2	5 - 6	5 - 7	4 - 5
El Paso	30 - 42	249 - 287	203 - 261	141 - 181	422 - 531	495 - 618	403 - 504
Total*	70 - 110	540 - 650	520 - 700	440 - 580	1010 - 1280	1210 - 1520	1040 - 1300
				STALLION			
Bernalillo	40 - 57	321 - 374	274 - 358	203 - 263	559 - 706	660 - 825	546 - 682
Lincoln	3 - 5	24 - 29	23 - 32	20 - 26	45 - 58	55 - 68	47 - 58
Sierra	1 - 2	10 - 12	9 - 12	7 - 9	18 - 23	22 - 27	18 - 23
Socorro	21 - 37	125 - 161	157 - 222	160 - 219	274 - 355	343 - 428	313 - 392
Torrance	1 - 1	7 - 8	6 - 8	5 - 6	12 - 16	15 - 18	12 - 15
Valencia	7 - 11	54 - 64	51 - 68	42 - 55	99 - 126	119 - 148	101 - 126
Total*	70 - 110	540 - 650	520 - 700	440 - 580	1010 - 1280	1210 - 1520	1040 - 1300

*Rounded to nearest ten

(1) Stallion Site

Substantial actual increases would accrue principally to the Albuquerque area school districts. Relative impacts would not be beyond the system's capacity to tolerate. Socorro area schools would be faced with a considerable actual impact from 300 to 400 students (and relative impact of 9 to 12 percent increase in maximum enrollment) during the peak years. According to the Superintendent of Socorro Public Schools, 500-600 students could be absorbed with no problem. Also, Socorro is in the process of building another Junior High School which will be in use in 1987.

(2) North of NASA Site

Substantial actual increases would be shared by Las Cruces and El Paso public school districts. Relative impacts would constitute a three percent annual increase in enrollment for the Las Cruces area school districts.

(3) Orogrande Site

Substantial actual increases would be shared by Las Cruces, Alamogordo and El Paso districts. Expected relative impacts do not exceed 1.6 percent annual increase for any school district.

c. Health Facilities

The incoming construction personnel would have a similar impact on area health facilities. During peak construction phases, the estimated incoming population would generate a demand for an additional six physicians and 16 hospital beds, if all existing health care facilities were at capacity.

Should the Stallion site be selected, the and Albuquerque area could supply most major medical facilities and services required by the additional workers. However, incoming personnel to the Socorro area may place additional demands on the currently inadequate number of physicians.

If the North of NASA site is chosen, the resulting demand for health facilities and services would be met principally by the Las Cruces and El Paso urban areas. Existing facilities and services should absorb the additional demand created by the incoming workers living in those areas. Incoming personnel may place additional demands on the currently inadequate number of physicians.

If the Orogrande site is selected, health and medical facilities and services available in the Alamogordo, Las Cruces and El Paso urban areas should absorb the additional demand created by the proposed project. Incoming personnel may place additional demands on the currently inadequate number of physicians.

d. Fire and Police Protection

There would be general increases in law enforcement requirements due to the increase in local trips plus home-based work trips, regardless of the site chosen. Additional total traffic to and from the site, increased truck traffic and possible additional accidents would result in an increased need for traffic control. Increased fire protection requirements and other law enforcement requirements would result from increased population. Based on national standards for community services, it is estimated that a demand for an additional five police officers and four firemen would be generated by the proposed project during the peak construction phase.

Selection of the Stallion site would place the greatest impacts upon Socorro and Albuquerque. Although the greatest effects, in terms of numbers of workers, are predicted to occur in Albuquerque, Socorro is predicted to experience the greatest relative impacts and might require the addition of one to two police officers.

If the North of NASA site was selected, the urban areas of Las Cruces and El Paso would feel the demand for fire and police protection increases expected to be associated with the additional worker population. The systems in each community could collectively serve the additional population.

If the Orogrande site is selected, impacts upon fire and police protection would be absorbed in the Alamogordo, Las Cruces and El Paso urban centers.

I. Water Supply

1. General

Due to climate and a complex structural geology, water, particularly potable water, is a highly prized commodity. All existing surface water and much of the ground water rights have been appropriated. Water from the Colorado River basin is presently being diverted into the Rio Grande basin by the U.S. Bureau of Reclamation's San Juan-Chama project(6). Although all of this diverted water is currently contracted or committed to potential contractors within the state, sufficient water for GBFEL-TIE is expected to be available for sale, over the short term, since the present needs of many contractors are less than the contract amounts. Any significant long term water use must consider these facts and the structure of the water supply available.

Potential consequences resulting from each source of water supply for the proposed GBFEL-TIE project are evaluated below for the three alternative site locations. Treatment for excessive tds levels may be required at all sites to provide drinking water, particularly if local aquifers are utilized. However, treatment requirements would be minimal and would probably be accomplished by commercially available activated charcoal filter units.

In a declared boundary underground reservoir, the New Mexico State Engineer has the responsibility to oversee all water use permit applications. Before granting a permit, he must establish that the proposed appropriation is not contrary to conservation of water within the state and is not detrimental to the public welfare. He must also insure that the rights of other appropriations from the same basin are not impaired. By definition, he cannot knowingly issue a water use permit that would violate this mandate. Since the proposed GBFEL-TIE is a temporary experiment (through the 1990's), any potential adverse effect on water supply may be construed as a short-term consequence that would ultimately return to or near pre-project conditions, if the State Engineer grants a ground water appropriation permit.

The GBFEL-TIE water requirement of 1,400 acre ft per year would impact the reserves of any ground water reservoir, the depletion of which is a function of the recharge rate and other user rates. It could impact other users and other projects ranging from agricultural to scientific. Project water use might impact local seeps and springs (e.g., North of NASA) by lowering the water table levels, however, development of well fields within the Jornada del Muerto Basin would not be expected to affect seeps and springs in the San Andres Mountains.

2. Stallion Site

a. Surface Water

San Juan-Chama water from Elephant Butte Reservoir could be piped about 80 km northeast to the Stallion site. Approximately two-thirds of that distance, however, would be outside WSMR proper, and thus would involve external cooperation. For this option, an intake structure at Elephant Butte would also be required. Elephant Butte water is potentially renewable from the upper Rio Grande River system, and if all other contracted demands were met, the consequence of water consumption with regard to other users for the GBFEL-TIE project would be minimal. The 1,400 acre feet per year demand by the GBFEL-TIE project to be pumped from Elephant Butte would be replaced (in the Elephant Butte Reservoir) by diversion of an equal amount of water from the Colorado River Basin, under authority of the San Juan-Chama project.

b. Ground Water

Two potential water sources under consideration at the Stallion site are ground water from wells in the Rio Grande Valley and from the local Stallion site. The former would require pipelines and pump stations. Treatment may be required for either source to reduce the tds to within acceptable levels for the GBFEL-TIE. Depletion of ground water near the Stallion site is occurring gradually as a result of an annual usage rate of 25-30 acre feet per year by the Stallion Range Camp. However, because of high salinity (about 3,000 ppm) this water is not of sufficient quality without desalinization for human, livestock or extensive agricultural use. Thus, the withdrawal of 1,400 acre feet per year could adversely affect this aquifer and its users, although the magnitude of the effects cannot be quantified at the present. As per New Mexico law, the State Engineer would be petitioned to issue a permit after determining the availability of unappropriated water.

3. North of NASA Site

a. Surface Water

Surface water from the Rio Grande valley could be piped northeastward to the North of NASA site in a unique situation, as defined by the State Engineer. A well would be sunk in the valley nearest the proposed project site, and this water would be pumped the remaining 40-45 km to the site. Although technically this water is ground water, it is replaced by water released into the Rio Grande (surface water) and defined to be the same in terms of water rights(6). There is a hydraulic connection between the Rio Grande and the aquifer. When flowing, Rio Grande water permeates down to the aquifer where it remains available even when the river flow is minimal. The well would be required since the Rio Grande flow is undependable, and year-round availability would be necessary for the proposed GBFEL-TIE. Under San Juan-Chama authority (as in the Elephant Butte alternative for the Stallion site), the project water requirements (1,400 acre ft/year) would be replaced in the Rio Grande River by diversion from the Colorado River basin. Thus, the impact of this water source on the local permanent water supply would be negligible.

b. Ground Water

Construction of two to six supply wells were proposed south of the Jornada Reserve Headquarters area for the North of NASA site. Test wells would be drilled to establish aquifer thicknesses, pump rates and water quality. At the North of NASA site, little information is available on ground water reserves. However, from NASA well production, there is reason to believe sufficient reserves are available. The project demand would probably affect at least a local lowering of the water table. As in all cases of ground water usage, if the State Engineer considers that an applicant would permanently impact the water supply, the other appropriators or the public welfare of the State, the application would be denied.

4. Orogrande Site

a. Surface Water

No surface water is available that is considered practical for the Orogrande site.

b. Ground Water

Two potential ground water sites and plans are considered for the Orogrande site. A well field in Soledad watershed could be used to directly supply the Orogrande site. This alternative would require State Engineer approval and thus, if allowed, would be implied to have negligible impact on state water supply. This is the most cost effective alternative water supply for the Orogrande site.

Using the same well field but connecting with the existing water main from the WSMR post headquarters is a second alternative at the Orogrande site, also requiring the approval of the State Engineer. Approximately 8.7 million acre feet are in storage in the Soledad Canyon watershed. About 2.3 million acre feet are recoverable for use. The estimated annual recharge is about 750 acre feet. The GBFEL-TIE project demands alone (1,400 acre feet annually) would have a depletion impact. However, the 2.3 million acre feet under present/predicted consumption rates would have a life expectancy of almost 900 years, and the aquifer would be expected to return to or near pre-project conditions within 10 years after cessation of the GBFEL-TIE project. Local ground water at the Orogrande site is another consideration. However, available recent data is limited but it is estimated by the Corps of Engineers that as many as 20 wells may be needed to provide the necessary project water supply requirements.

J. Solid Waste

Construction wastes such as scrap lumber and concrete would be buried within a landfill constructed on-site. The landfill would be situated within soil associations that are suitable for such purposes. Location of the landfill would require coordination with the WSMR ENRO and New Mexico Health and Environment Department, Environmental Improvement Division. Use of this landfill would be required to avoid significantly reducing the capacity of WSMR's main landfill, which is presently expected to reach its capacity within the next 50 years(65). No hazardous or toxic wastes (e.g., used oil filters) would be placed in the landfill. The landfill would be closed out, covered and reseeded upon completion of construction activities.

Solid wastes generated during the operation and maintenance of the proposed program would be collected, transported and disposed of by local, approved and licensed contractor(s) in accordance with State of New Mexico regulations.

Burning of refuse would not be conducted during either the construction or operational phases.

K. Other Wastes and Hazardous Materials

Table IV-18 presents a list of the wastes, and estimated quantities of each, which would be produced by various components and subsystems of the proposed GBFEL-TIE. As can be seen from this table, several of these compounds are considered hazardous or toxic. These wastes would be collected and disposed of by approved and licensed contractor(s) in accordance with State of New Mexico and USEPA regulations. No hazardous wastes would be stored on-site for longer than 90 days.

Argon is a normal component of atmospheric air. Running the accelerator will activate some of the argon in the air around the accelerator and produce Argon 41. Since Argon 41 has a half life of over an hour, no one can enter the accelerator room until the level of radioactive Argon 41 is decreased. To allow personnel to reenter the accelerator facility shortly after a test (approximately 45 minutes), the room air with the Argon 41 will be exhausted to the atmosphere. To do this safely the Argon 41 must be diluted with other air to keep the exposure level below the 20 millirem/hr or 200 millirem in any one week maximum exposure as required by Federal regulations. This will be accomplished by exhausting the Argon 41 from a stack high enough to allow natural mixing to dilute the Argon 41 to the safe level mentioned above. A fence would be placed around the stack to assure that personnel would be kept at a safe distance from any potentially hazardous emissions.

The use of benzene as an electron beam focuser in the accelerator may be required instead of the helium/argon mixture. However, only two pounds of benzene would be required for every 1,000 beam activations. Disposal of benzene, if its use becomes necessary, would be according to applicable EPA disposal requirements and practices(68).

Although significant energy is transferred to the photon beam, as much as 95 percent of the original energy would remain with the electron beam as it enters the electron beam dump. Radioisotopes could be produced in the water used for cooling the graphite and aluminum plates that absorb the electron beam. This water would be filtered through an ion exchange system to remove the radioisotopes. During periodic maintenance, the filters would be replaced and stored in the beam dump vault, described below.

The beam dump would include a storage facility or vault to store hardware or parts of the laser components (i.e., accelerator, wiggler) which have become radioactive (at low levels) during the lasing experiments. The beam dump and vault would be shielded from the other laser components by concrete and lead walls. The beam dump and vault would also have limited access and a radiation monitoring and protection system to obviate potential radiation hazards to program personnel.

This area would remain as a long-term storage facility after completion of the proposed experiments. All activated components would have only a small portion of their mass radioactive and thus, the radioisotopes would be sealed

Table IV-17

Types and Estimated Quantities of Industrial Wastes Expected to be Produced by the GBFEL-TIE

Activity	Estimated Quantities (per year)	Wastes Generated	Disposal Considerations at Estimated Quantities to be Generated
Vacuum pumps	200 gallons	hydrocarbon	Solid waste[a]
Piping and Plumbing Shop	200 pounds	scrap metal	Solid[a] and hazardous
Maintenance and Repair of various components	210 gallons	iron	New Mexico Water Quality Standards
		copper	New Mexico Water Quality Standards
		aluminum	New Mexico Water Quality Standards
		titanium	New Mexico Water Quality Standards
		lead	Hazardous (>5 mg/liter)*
		samarium	Hazardous (>5 mg/liter)*
		cobalt	Hazardous (>5 mg/liter)*
		silicon dioxide	New Mexico Water Quality Standards
		chromium	Hazardous (>5 mg/liter)*
		tungsten	New Mexico Water Quality Standards
		silicon	New Mexico Water Quality Standards
		polyethylene	Solid waste**
		polystyrene	Solid waste**
		polyvinyl chloride	Solid waste**
		beryllium	Hazardous*[b]
Photography lab	200 gallons	sodium hyposulfate	
		organic dyes	
		suspended silver compounds	Hazardous (>5 mg/liter)*
Cooling tower water	2,230 gallons	water with dissolved solids	New Mexico Water Quality Standards
Closed loop cooling systems	100 pounds	copper sulfate	Solid waste
	100 pounds	benzotriazole	New Mexico Water Quality Standards
	100 pounds	benzoic acid	New Mexico Water Quality Standards
Filters and Lubricating devices	300 pounds	oil contaminated cloth and paper products	Solid waste**
Cleaning fluids	100 gallons	isopropanol	Hazardous[c]
	50 gallons	methanol	Hazardous[c]
	50 gallons	methylene chloride	Hazardous[b]
	200 pounds	sodium sulfonate	New Mexico Water Quality Standards
	800 gallons	freon 113	New Mexico Water Quality Standards
	100 pounds	sodium sterate	New Mexico Water Quality Standards
	50 gallons (10 molar)	hydrochloric acid	Hazardous[b]
	50 gallons	sodium hydroxide	Hazardous[b]
	50 gallons	turpentine	Hazardous[c,b]
	800 gallons	trichloroethylene	Hazardous[b]
	100 gallons	acetone	Hazardous[b]
	100 gallons	ethanol	Hazardous[b]

*Must be disposed of as hazardous waste if concentration exceeds 5 milligrams per liter.
**Can be treated as solid waste refuse as long as intact (not residual).
[a]Lead in waste oil can be as high as 100 mg/liter before hazardous waste requirements may be required.
[b]These compounds are considered hazardous via their toxic nature.
[c]These compounds are hazardous based upon their susceptibility to ignition.

Sources: General Research Corporation, 1986(66); Lawrence Livermore National Lab, 1986(67); and Geo-Marine, Inc.

within the materials' matrix. Consequently, the ion level of radioactivity that would be expected to be produced would not require that the beam dump or vault be cooled or hermetically sealed after cessation of the project.

L. Safety and Radiation Hazards

1. General

Safety procedures would be considered and adhered to for both the construction phase and the operational (testing) phase of the GBFEL-TIE project. Minimum standards for safety procedures would be regulated by Occupational Safety and Health Administration (OSHA) Code of Federal Regulations (CFR), Title 29, Chapter XVII, Parts 1910 and 1926. The GBFEL-TIE project safety standards in accordance with regulations of the U.S. Army and the American Conference of Governmental Industrial Hygienists (ACGIH).

During the operational phase three types of safety procedures would be considered: (1) internal safety procedures, i.e., within the laser installation; (2) automatic laser safety procedures; and (3) external safety procedures, i.e., outside the laser containment area including air space.

2. Internal Safety Procedures

Internal safety procedures are applicable to the laser containment installation, i.e., linear accelerator, wiggler, electron beam dump and diffraction tunnel.

There would be two sources of radiation produced. When the accelerator is running, prompt radiation would be produced by the electrons which collide with an object and are slowed down. This type of radiation consists of the entire electromagnetic spectrum up to the wavelength associated with the maximum energy of the accelerator, which for this case would be in the short or hard gamma ray wavelength. The most common wavelength generated would be in the gamma ray region. Some of this radiation would be generated in the accelerator central beam tube, the wiggler central beam tube and the transport tube connecting the accelerator components. Most of the radiation would be generated in the beam dump. Those components that could produce radioactivity or which could become radioactive would be contained in shielded (i.e., iron, concrete, and/or lead) underground vaults to prevent emissions of ionizing radiation to the outside environment.

The prompt radiation could also induce radioactivity in materials close to the source of its production. Gamma rays produced could liberate neutrons from materials and produce radioisotopes. The lifetime of these isotopes would vary from a few seconds to many years, depending on which isotope is produced, but all would be at low levels of radioactivity. The materials which have the greatest chance of being activated are carbon, iron and aluminum. As discussed previously, hardware or materials that become radioactive would be stored in the beam dump vault.

3. Automatic Laser Safety Procedures

Light from the laser could be reflected or scattered in two ways: (1) diffuse scattering from small particles such as dust, clouds and rain; or (2) specular scattering from mirror-like surfaces such as a piece of polished metal or some insects. An object detection system would be incorporated to identify objects or particles that have the potential to cause diffuse or specular reflection before they enter the laser beam. Two types of detection schemes will be available: (1) a radar located at the FEL site to detect larger objects (objects 1.0 centimeter in diameter) and (2) a laser located at the site to detect smaller objects.

The radar system would be operated before and during each FEL test firing. Upon detection of an object, this system would automatically abort or preclude operation of the FEL beam. There is no current expectation that a detection system more sensitive than this radar will be necessary for safe operation. However, if a requirement to detect smaller objects becomes necessary, a low power, long wavelength laser can be incorporated at the site. The beam from this laser would travel the same path as the FEL beam but would be larger in diameter. As objects enter the beam, light is reflected back and an automatic shut-off system can be triggered within less than a microsecond.

4. External Safety Procedures

All keep-out zones (i.e., security and/or safety) would be fenced and would be routinely guarded and checked during operation of any subsystem which could produce injuries. Keep-out zones would be large enough to guarantee no human injury from radiation, accidental gas emissions, diffuse photon scatter, or potential electrical hazards (Figure IV-6). All chemical (e.g., POL, diesel fuel, etc.) and supply storage locations and evaporation ponds would be within the main fences along the perimeter of the site.

The beam energies would be captured or absorbed by the ground target structures and converted to heat during ground target testing. The target containment building would be designed to capture enough of the direct specular reflection from the target frame so that an observer beyond the eye safety distance would receive less than the prescribed safe level of exposure(2).

For airborne targets, the FEL would begin to fire only when the test target is above an angle of 45 degrees to the local horizon during air target tests(2). Sufficient air space would be restricted to allow the laser beam to exit the airspace above 60,000 feet MSL (Figure IV-7).

The eye safe limit for diffuse scattering could be met by a keep-out radius of approximately 1.0 km centered on the beam directors and any ground based targets.

The eye safe distance from small (i.e., 1.0 cm in diameter) specular reflectors is one km. There would be no safe keep-out distance for a larger specular reflection; the system must be designed to operate in concert with a tight air space control system which would cause termination of atmospheric propagation if a large object enters the vicinity of the beam.

Careful analysis indicates that persons exposed to scattered laser energy outside the one km saefty zone would not be injured. In addition, the probability that an individual looking at the scatterer would receive laser energy would be less than 5 x 10-7. The methodology used in these analyses as well as the assumptions made in the calculations are described in Appendix E.

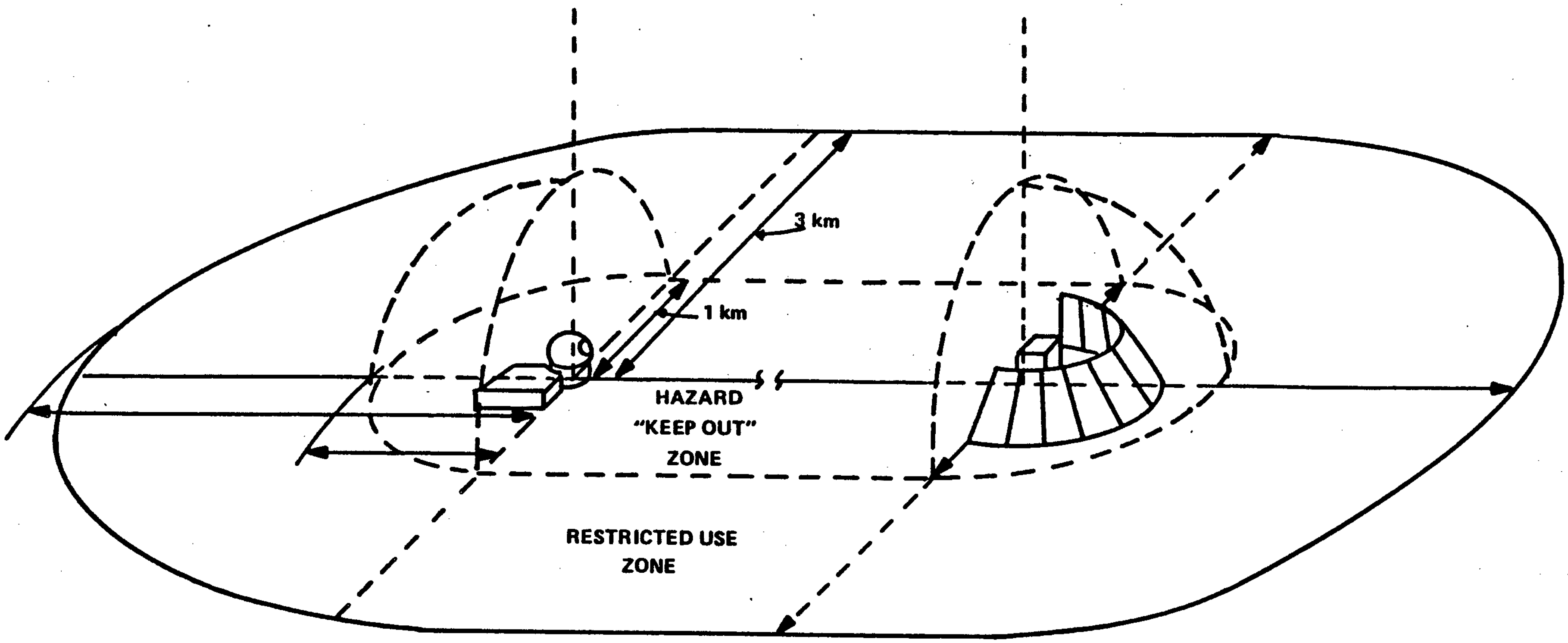


Figure IV-6. Illustration of Safety Zones.

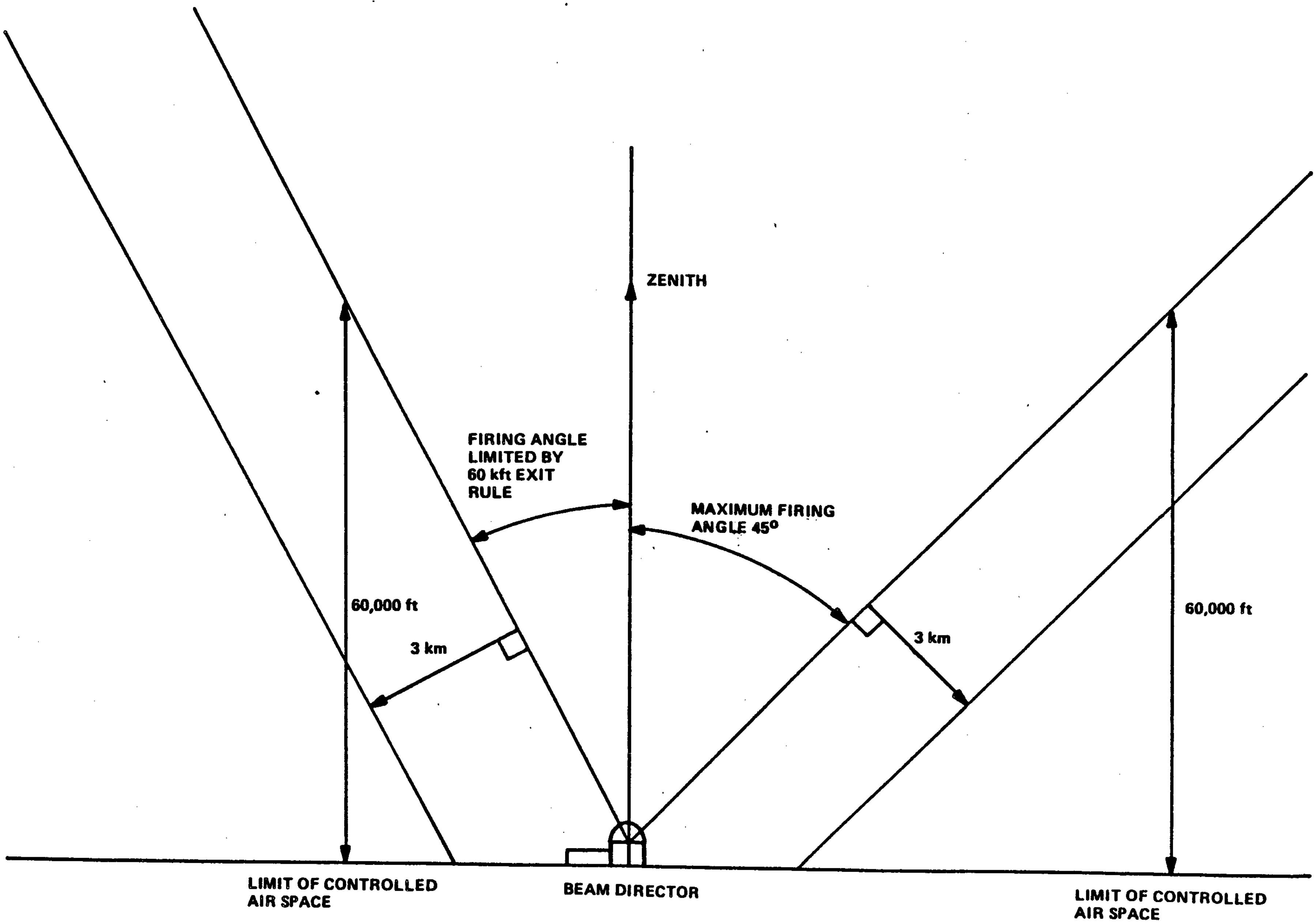


Figure IV-7. Illustration of Safety Zones - Aerial Buffer.

In order to keep fixed and rotary wing aircraft out of the danger zones during test firing of the FEL, WSMR Regulation No. 70-3 would be enacted(69), which establishes procedures by which all tests are scheduled, executed and controlled. Air restrictions could affect other existing and/or proposed programs at WSMR.

5. Optical Interference

The lighting for the GBFEL-TIE facility does not appear to present a threat to optical astronomy at any of the proposed sites. Analysis of scattered light for observers situated at the present observatory at Sacramento Peak, and at proposed observatory sites at South Baldy and Capilla Peak, indicate that the luminance of scattered light would not be more than 3.07 x 10^{-7} Candela/m^2 at the zenith, and is usually much less. This compares with a natural sky zenith luminance of 2 x 10^{-4} Candela/m^2. Estimations for the light levels of local towns shows that their light, rather than the GBFEL, would be the dominant artificial light source in the area.

M. Radio Frequency Interference

Specialized scientific equipment at WSMR facilities, such as the NASA Telemetry and Data Relay Satellite System (TDRSS), other projects such as those by the Office of Test Directorate (OTD), and off-range facilities such as the Very Large Array (VLA) radio telescope are sensitive to radio frequency interference; however, USASDC's study of the RFI potential indicates that the design and shielding of the GBFEL equipment will be sufficient to prevent disruption of or interference to the radio sensitive electronics near any of the proposed GBFEL-TIE sites.

The safety requirement for operating personnel is 100 watts per square meter of radio frequency energy. While there is no current evidence that the GBFEL-TIE would produce this much RFI, shielding would be included in the design to limit the RF field to this level within the buildings containing any possible RF sources. Path losses, blockage by mountains, and shielded rooms and buildings would significantly attenuate any RF energy so that it does not interfere with sensitive equipment in the area.

The laser beam itself would not produce interfering levels of radio frequency energy. There are a very limited number of ways in which a one micron laser beam can produce RF energy in its propagation through atmosphere. If the laser beam is very intense, it would cause the air to break down and produce a plasma. Once this plasma is created, the laser would no longer be able to propagate through the atmosphere. The laser beam associated with the GBFEL-TIE is specifically designed to minimize the possibility of such an atmospheric breakdown. The size of the beam is scaled up so that the power density of the beam is much too low to disassociate the atmosphere.

The only observed radiation from the atmospheric propagation of a laser beam has been an afterglow that may accompany an intense pulsed beam. The effect may be caused by several phenomena, but is primarily due to the decay of excited molecular states of water and oxygen in the air by the beam's electric field. This afterglow contains extremely low energy which is in very narrow optical frequency bands. There is no evidence to indicate that this radiation would interfere with any neighboring instrumentation.

Experience with other accelerators indicates that there should be little problem with RFI. The Stanford Linear Accelerator could not be detected during operation by a very sensitive radio telescope with a 90 ft. diameter parabolic antenna located one km from the accelerator. An accelerator at Los Alamos National Laboratory was tested using equipment capable of detecting signals of a few femtowatts (10-15 watt) per square meter and no RFI was measured within a kilometer of the accelerator.

An analysis of the potential GBFEL-TIE interference was performed assuming the RF energy level within the facility was 100 watts per square meter (the safety limit for operating personnel). It was also assumed that shielding of 120 decibels (db) could be realized with the combinations of a shielded room (80 db) and a grounded building (40 db). This analysis addressed interference levels at cities surrounding the candidate GBFEL-TIE sites as well as several technical facilities in the area. Details of this RFI study are presented in Appendix H.

An assessment of the interference with surrounding cities from the proposed GBFEL-TIE candidate sites is given in Table IV-18. A sensitive receiver in this range can detect signals at -110 dBw per square meter. As illustrated, the most stressing case (Orogrande site to the Village of Orogrande at 1 MHz frequency range) is less than -175 dBw per square meter or 65 dBw per square meter below the receiver threshold (assuming a 20 dBw per square meter or 100 watts per square meter RF energy level within the facility).

Table IV-19 illustrates the attenuation of RFI noise at 50 MHz from each candidate site to the VLA radio telescope. Again, it was assumed that a 100 watt per square meter or 20 dBw per square meter RF energy level was within shielded buildings. The VLA is sensitive to energy levels as low as -188 dBw per square meter. As illustrated, the most stressing site is at Stallion and the energy level is only -280 dBw per square meter, or approximately 90 dBw below the interference threshold of the radio telescope.

The analysis also addressed the NASA TDRSS facility. Path loss from the closest prospective site (North of NASA) to the NASA facility exceeds 100 db. In addition, shielding can be designed to provide up to 120 db of attenuation in the 2 to 20 GHz frequency range (80 db shielded room and 40 db from a grounded building). The safety requirements coupled with the shielding and path losses reduce the potential RFI from the GBFEL-TIE to well below the sensitivity of the TDRSS ground station or satellites.

N. Energy Conservation Potential

The GBFEL-TIE would utilize energy conservation measures to the maximum extent practicable, in order to conserve national petroleum reserves and reduce operational costs. Such measures would include use of open air heat exchangers instead of the evaporative towers during the cooler months; adequate insulation to reduce space heating requirements; and proper design, construction and operation of equipment and facilities to insure that fuel consumption is as efficient as it can be. In addition, employees would be encouraged to implement strategies to conserve energy such as turning off lights when not in use, wearing adequate clothing in winter months and car pooling to and from work.

Table IV-18

Estimated Radio Frequency Attenuation from Site to City*
(dBw)

NORTH OF NASA TO LAS CRUCES

Attenuation Due To:	1 MHz	100 MHz	1000 MHz
Shielding	120	120	120
Free Space Losses	90	90	90
Diffraction Losses	0	5	25
Total	210	215	235

STALLION TO SOCORRO

Attenuation Due To:	1 MHz	100 MHz	1000 MHz
Shielding	120	120	120
Free Space Losses	90	90	90
Diffraction Losses	0	0	15
Total	210	210	225

OROGRANDE TO OROGRANDE

Attenuation Due To:	1 MHz	100 MHz	1000 MHz
Shielding	120	120	120
Free Space Losses	75	75	75
Diffraction Losses	0	0	0
Total	195	195	195

OROGRANDE TO ALAMOGORDO

Attenuation Due To:	1 MHz	100 MHz	1000 MHz
Shielding	120	120	120
Free Space Losses	95	95	95
Diffraction Losses	0	10	40
Total	215	225	255

*Rounded values (see Appendix H for calculation)

Table IV-19

Estimated Attenuation of 50 MHz Noise*
(dBw)

VLA at 50 MHz

Loss	Stallion	North of NASA	Orogrande
Shielded Room	120	120	120
Obstacles	20	20	20
Spherical Earth	20	40	60
Free Space	110	120	120
Side Lobes	30	30	30
TOTALS	300	330	350

*Rounded values (see Appendix H for calculation)

O. Airspace Impacts

Any requirement to further restrict airspace in the regions adjacent to the GBFEL-TIE site will be accommodated on an as-needed call-up basis similar to that currently applied to airspace around WSMR itself. This airspace would be restricted to general and commercial aviation only during such times that aerial or space-borne targets are used.

P. Cumulative Effects

As mentioned previously, the U.S. Air Force has prepared a Legislative EIS concerning the potential location of the SICBM program at WSMR. This project is still in the preliminary stages of planning and design and thus, the potential cumulative effects of the SICBM and GBFEL-TIE programs cannot be accurately assessed at present. Beneficial and/or adverse socioeconomic effects could be influenced by the SICBM, depending upon its timing and construction/operation needs.

Construction and operation of the proposed GBFEL-TIE at the Stallion site would further reduce valuable and productive grasslands which, in turn, could significantly reduce WSMR's pronghorn population. Displacement of the programs presently utilizing the Stallion area could result in additional habitat losses. The type and magnitude of these losses would depend upon the new location of the programs. The WIT areas, in particular, could require extensive land clearing on other, relatively undisturbed, areas.

Power transmission lines constructed across the river valley to serve the Stallion site may result in the loss of whooping cranes during the migration season. In light of their present endangered status, individual losses to whooping cranes would be considered significant.

Siting the proposed GBFEL-TIE at North of NASA may result in significant adverse effects to the desert bighorn sheep. Because of their limited numbers and the current environmental stresses they are experiencing, the loss of an individual sheep could result in the potential loss of the entire herd.

Construction of a powerline across the Rio Grande valley to serve the North of NASA site would have similar effects on whooping cranes as that described above for the Stallion site.

Construction and operation of the proposed GBFEL-TIE at the Orogrande should not add significantly to the cumulative environmental effects of WSMR programs. This area has been used for previous programs and is situated within a habitat type that is presently predominant of Ft. Bliss and the southern half of WSMR.

Displacement of the Border Star Joint Field Training Exercises would not present significant environmental effects, since it is presently anticipated that these exercises could still utilize Ft. Bliss which is commonly and heavily used for such programs. In addition, the Border Star exercises are periodic.

MITIGATION MEASURES

V. MITIGATION MEASURES

This section describes those measures which would be implemented at any of the alternative sites to ameliorate potential adverse consequences that would result from the proposed GBFEL-TIE program. These measures are described, by resource, in the following paragraphs.

A. General

Any major modifications to the proposed project will require prior approval from the Commander, WSMR, and may require an amendment or supplement to this EIS. Power generation, storage, and transmission for the high power phase will be addressed by a separate environmental analysis. Existing disturbed areas will be used to the extent possible to obviate additional construction activities (e.g., clearing and grading).

Any mishaps such as fires and spills will be immediately reported to the Commander, WSMR. A post-accident report which describes measures taken to ameliorate the impacts, as well as those measures implemented to minimize the potential of a similar accident recurring, will be prepared by the GBFEL-TIE program manager for submission to the Commander, WSMR.

B. Soils and Geology

Disturbance of topsoils will be kept to a minimum. Cleared areas will be protected from erosion during construction. Any area subject to wind erosion will be seeded or otherwise stabilized upon completion of construction activities. Reseeding will be coordinated through the WSMR Environmental and Natural Resources Office (ENRO) to assure that proper species and timing are utilized. Soil borings will be conducted at the selected site to determine the suitability of ancillary structures such as temporary landfills and sewage lagoons. Special construction and engineering techniques (e.g., liners) will be implemented to mitigate any unsuitability.

Borrow pits and/or spoil sites may be required by project design and construction. If required, the use of borrow pits and/or spoil sites will be held to the minimum necessary to accomplish the project. Upon completion of construction, these borrow pits and/or spoil sites will be properly restored by grading and drainage to prevent ponding or erosion and allowed to revegetate back to a natural condition.

C. Air Quality

A stationary air quality monitoring station will be established at the selected site to assure that state and Federal standards are not contravened. Parameters to be monitored will include, but not be limited to, sulfur oxides (SO_x), nitrogen oxides (NO_x), particulates, carbon dioxide (CO_2), carbon monoxide (CO), ozone (O_3) and argon (Ar). Data obtained from this station would also be used to model potential air quality impacts that may result during the high power phase. This station will be located downwind of the proposed laser facility in the direction of the prevailing winds. The station will be established at the earliest practical time during the construction phase, to provide an adequate set of background data for future modelling.

Construction areas will be kept wet, to the extent practical, to ameliorate fugitive dust.

D. Water Quality and Supply

All domestic and industrial waste waters will be disposed of in sewage treatment facilities maintained by GBFEL-TIE personnel. These facilities would be separate, if required. Routine checks and maintenance of these facilities will be required in order to assure proper and adequate treatment. Periodic inspection of these facilities will be conducted and documented in inspection reports which will be submitted to the Commander, WSMR. The operation and maintenance will be conducted in accordance with the New Mexico Utility Operators Certification Requirements.

Conservation measures (e.g., closed loop and open air cooling systems) will be implemented to the maximum extent practical to preclude any unnecessary waste of water supplies.

All stock tanks, seeps, springs and semi-permanent streams and lakes will be considered off-limits.

Storage tanks for petroleum, oils and lubricants (POL), as well as other potentially toxic materials will not be located within 0.25 miles of any stock tank, seep, spring, semi-permanent stream or lake. POL and other toxic material storage tanks will be enclosed by containment levees and inspected daily for potential leaks or spills. Tanks will be constructed and maintained in accordance with Resource Conservation and Recovery Act (RCRA) regulations. All leaks or spills in excess of five gallons will be immediately reported to the Commander, WSMR.

E. Solid Waste

Solid waste generated during operation of the proposed program will be collected and disposed of by an approved and licensed contractor(s), in accordance with State of New Mexico regulations. Construction wastes such as waste lumber or concrete will be buried on-site. No toxic or hazardous materials will be buried in this landfill. The landfill will be closed-out, covered and reseeded upon completion of construction activities. Burning of refuse is prohibited.

Other wastes such as spent cutting oil and cleaning fluids or those produced by filtering systems (e.g., vacuum pump oil, cooling water, etc.) will be transported and disposed of by local, approved contractor(s), in accordance with State of New Mexico and USEPA regulations.

F. Biological Resources

Construction and operation of the GBFEL-TIE at any of the sites under consideration would have adverse impacts to biological resources at WSMR. As indicated in Section I (Subsection D. Environmentally Preferred Alternative) these adverse impacts can be minimized by the selection of the Orogrande site. However, even in this case there would be impacts directly attributable to the GBFEL-TIE. Therefore, in accordance with the Council on Environmental Quality's regulations for implementing NEPA located at 40 CFR 1505.2(c), the U.S. Army Strategic Defense Command has agreed to fund a program for the monitoring and mitigation of these adverse impacts.

The goal of the program will be to ascertain the actual project-induced impacts on wildlife and the effectiveness of various mitigation measures including, but not limited to, water source replacement and habitat restoration and improvement. To achieve this goal, specific mitigation measures, along with research questions and monitoring efforts will be developed by an inter-agency Mitigation Oversight Team (MOT). The MOT will consist of one representative member each from USASDC, WSMR, the U.S. Fish and Wildlife Service (USFWS) and the New Mexico Department of Game and Fish (NMDGF). Additional personnel having particular expertise may be invited to contribute as needed. Mitigation measures and research efforts identified by the MOT will be executed by USASDC. The MOT will convene periodically to review progress and to suggest modifications and make recommendations.

Funding for these efforts will be provided by USASDC, to include the transfer of funds to WSMR, USFWS and NMDGF for participation in the program. Discussion with these agencies have indicated that the total expenditures that would be required by the USASDC for successful execution of the wildlife mitigation program should not exceed $1,000,000.

Items which have been identified to date as requiring consideration include utilization of water catchments and habitat recruitment by wildlife, differential revegetation rates under natural and induced situations, use of ground target structures as nesting sites, prevention use of lagoons containing metal salts or biocides by waterfowl and piscivorous animals, and identification and buffering of any Swainson's hawk nesting sites within the Orogrande project area.

1. Vegetative Communities

Impacts to the area's wildlife habitats will be minimized by utilizing previously disturbed/developed lands to the extent practical, including parallel construction of transmission lines, roads and railroads. If construction staging areas are required to be located in areas that have not been previously cleared or graded, the locations of the work area will be approved by the GBL project office in coordination with the WSMR ENRO.

Construction staging areas and transmission line rights-of-way will be reseeded or revegetated as soon as possible after completion of the line. Coordination with the WSMR ENRO will be conducted in order to assure that proper timing and species types are utilized.

Open fires on WSMR are prohibited. Accidental fires will be immediately reported to the WSMR Fire Department in order to activate WSMR's Fire Prevention and Control Plan.

2. Wildlife

Scheduling the construction of transmission lines, roads, railroad spurs, etc. and determination of their routes will be coordinated through the WSMR ENRO to avoid unique or environmentally sensitive resources to the maximum extent practical.

Water catchments will be constructed outside of the test area to enhance wildlife resources where deemed necessary, to compensate for lost or displaced existing water resources. Construction will be coordinated through WSMR ENRO.

Power transmission line conductors will be adequately spaced, as prescribed by the Raptor Research Foundation(70) in order to preclude raptor entanglement and/or electrocution.

Specific field surveys for threatened or endangered species will be conducted in those areas that would be potentially affected and that provide potential habitat for such species prior to construction activities. The survey will be coordinated through the WSMR ENRO, New Mexico Department of Game and Fish (Santa Fe) and the U.S. Fish and Wildlife Service (Albuquerque). The results of this survey will be incorporated in subsequent NEPA documentation.

Fences will be routinely checked to insure that they have not incurred any damages that would allow entrance of large mammals (e.g., gemsbok, pronghorn) during test runs.

G. Cultural Resources

As specified in WSMR's Memorandum of Agreement (MOA - Appendix G, DEIS) with New Mexico's SHPO, a 100 percent survey will be conducted at the selected project area to identify and evaluate the existing archeological/cultural resources. Eligibility of these resources to be included on the National Register will also be determined and, where appropriate, listing will be requested.

Mitigation of impacts to these resources may require excavation, analysis and archival curation. A mitigation plan will be developed in cooperation with the WSMR ENRO, New Mexico SHPO and the Advisory Council on Historic Preservation in the event such measures are required. All resources recovered will be identified, labelled and archived by WSMR and/or local universities and museums.

Routings of fences, transmission lines, communication cables, roads, railroads, etc. will be coordinated through the WSMR ENRO in order to avoid additional archeological/cultural sites to the maximum extent practical.

Any additional sites that are discovered by construction crews during field operations will be immediately reported to the GBL project office. Construction activities will cease or by-pass these areas until inspection and subsequent course of action is coordinated with the WSMR ENRO.

H. Socioeconomic

To the extent that construction contractors would utilize local workers, additional demands placed upon local utilities, schools, recreation facilities, law enforcement, etc. would be minimized.

Detailed socioeconomic impact planning will be addressed in the Tier II analysis.

The Defense Economic Adjustment Program can help communities that expect problems in providing essential public services to new residents brought by the GBFEL-TIE project. Requests can be made to the Department of Defense by state or local officials.

I. Health and Safety

Lead, iron and concrete shields will be utilized within the laser facility to reduce potential ionizing radiation of program personnel. All control rooms for the facility would be sufficiently shielded through the use of lead, iron, concrete and earthenworks to insure proper health and safety. Hourly dosage levels would be limited to less than 0.002 rads for any personnel outside the test cell by this shielding. This amount is within Federal dosage limits. The shielding at similar facilities consists of ten inches of iron, twelve feet of air, twelve inches of reinforced concrete and a minimum of twelve feet of earth.

The shielding provided is also adequate to protect aviation. At any altitude above the GBFEL-TIE facility, the ionizing radiation would be attenuated to a level of no more than 0.002 rads per hour by the protective lead and concrete shields. Interference with navigational aids contained in the aircraft would also be precluded. Airspace above the GBFEL-TIE will be restricted; scheduling of tests will be coordinated through WSMR National Range (NR) Directorate.

Other electromagnetic interferences will be mitigated by shielding and the fenced areas. Those components which generate radio frequency (RFI) and electromagnetic interference (EMI) would be contained within a Faraday cage to reduce or eliminate interference outside of the test facility. The combination of this type shielding and the distance from any of the three sites to residential areas would preclude interference with televisions, radios and computer equipment operated in the area around WSMR. Warning signs will be posted at the laser facility for persons wearing pacemakers, since magnetic fields greater than 5.0 gauss may cause these devices to malfunction. In addition, close coordination will be required to insure that such equipment at existing program facilities near the selected site is either not operating or are adequately protected during test operations, to obviate losses of pertinent data and/or equipment. Other components, such as the accelerator, would be shielded with materials that have magnetic properties (e.g., iron, steel) to capture and dissipate magnetic pulses that would be produced during operation of the accelerator.

Only for the duration of the test run (i.e., maximum of 60 seconds) would there be a potential to produce electromagnetic or ionizing radiation. The only source of residual ionizing radiation would be potentially activated components of the laser equipment which would be shielded from the outside environment.

A radiation detection warning system and personnel exposure badges will be implemented. This system will include radiation monitors on all gas and fluid lines which exit the facility, as well as monitors on all entrances and exits to areas where radiation activated components may occur.

A gas detection system will be utilized to detect and measure ozone (O_3), benzene (C_6H_6), carbon monoxide (CO), smoke and carbon dioxide (CO_2) levels.

No access to the test cell will be permitted until 20 minutes after cessation of the test and upon receipt of analyses from ozone sensors to confirm that concentration of ozone within the test cell is no more than 0.1 parts per million (ppm). Access to the accelerator for maintenance, etc. would be restricted until concentration of benzene has reached acceptable levels. The detection system for the last three parameters (i.e., CO, smoke and CO_2) would provide an early warning system for accidental fires in relatively inaccessible areas such as the accelerator and wiggler.

Additional radiation monitors would measure the level of any activated gases or dust to ensure that the beam dump vault is within acceptable ranges for ionizing radiation.

"Voltage on" indicators and mechanical interlocks will be installed to prevent high voltage electrocution accidents from occurring.

Both automatic and manual photon beam shutters will be on all subsystem entrances and exits.

A vacuum leak and coolant flow leak detection system will prevent operation of the laser in case of vacuum pumps and cooling systems failure.

All pressurized gas systems will have blow out disks and venting systems to prevent overpressure.

Construction contractors will be required to strictly adhere to Occupational Safety and Health Administration (OSHA) regulations.

Safety Standard Operating Procedures (SSOP) will be formulated and published to insure that all program personnel are protected to the maximum extent practical. The SSOP will include, but not be limited to, noise protection, eye safety, gas detection/monitoring system, keep-out zones and electrocution precautions. The SSOP will be coordinated with WSMR and provided to all GBFEL-TIE personnel.

WSMR has established a comprehensive Hearing Conservation Program consisting of five major parts: (1) identify and post noise hazard situations; (2) use engineering/administrative control measures against noise; (3) provide hearing protection; (4) provide audiometric testing; and (5) instruct personnel in proper use of protection equipment. This program will be implemented and strictly adhered to during the construction and operation phases of the proposed project.

J. Radio Frequency Interference

Special containment building design and construction, high performance line filters, shielding, natural attenuation, etc., will all be employed to prevent radio frequency interference (RFI) from the GBFEL-TIE. Any radar equipment employed will be chosen to operate in a frequency range outside the bands used by sensitive equipment in the area.

PUBLIC INVOLVEMENT

VI. PUBLIC INVOLVEMENT

A. Scoping Meetings

Public comments concerning the GBFEL-TIE project were solicited from Federal, state and local agencies and from the general public prior to initiation of the Draft EIS. Agencies were invited by letter to an agency scoping meeting held in Albuquerque, New Mexico on 14 July 1986. Notification was given in the local newspapers announcing four Public Scoping Meetings at Socorro, Alamogordo and Las Cruces, New Mexico and El Paso, Texas on 15 July, 16 July, 17 July and 21 July 1986, respectively. Copies of the agency letter and the public notices were presented in Appendix F of the DEIS.

Handouts were presented to each attendee at each of the meetings (see Appendix F, DEIS). The purpose of these handouts was to briefly but concisely inform attendees of the purpose of the GBFEL-TIE, as well as the proposed applications and potential impacts. The agenda of each meeting, all of which were moderated by USASDC, consisted of a brief welcome and introduction, an explanation of the purpose of the scoping meeting, a brief description of the project and types of potential impacts that would be considered. All general discussion periods were followed with a comment and suggestion period to allow for increased attendee input. A court stenographer recorded all the proceedings and discussions verbatim. These transcripts are available for review at the Fort Worth District Corps of Engineers office. Comments and suggestions, including questions brought forth at the meetings as well as USASDC responses, are included in these transcripts. The agenda and significant discussion themes for each scoping meeting are summarized in the following paragraphs.

1. Agency Scoping Meeting, Albuquerque, NM - 14 July 1986

The agency meeting for Federal, state and local agencies with potential input into the GBFEL-TIE Draft EIS was held at Room 6008 of the Old Federal Building, 517 Gold Street SW., Albuquerque, New Mexico. The meeting, which took place between 1:20 PM and 2:15 PM, had 28 representatives in attendance. The introduction and presentation by USASDC was made and the meeting was opened for comments, suggestions and questions.

The significant issues or concerns identified during this meeting included:

- Corps of Engineers jurisdiction
- Permit applications
- Seismicity
- Physical requirements of GBFEL-TIE facility
- Impact of utility right-of-ways on public and private lands
- Conflicts with other public programs
- Airspace requirements and restrictions
- Water resources
- EIS time schedule
- Socioeconomic effects

2. Public Scoping Meeting, Socorro, NM - 15 July 1986

There were 45 persons in attendance at the Socorro Public Meeting held at the Socorro County Courthouse between 7:30 PM and 8:18 PM. After the USASDC introduction and presentation regarding the proposed GBFEL-TIE project, an invitation was extended to make comments or statements in response to the proposed GBFEL-TIE project.

The significant issues discussed were as follows:

- o Seismicity
- o Physical size of laser facility
- o Radio frequency interference
- o Project related bidding and contracts

3. Public Scoping Meeting, Alamogordo, NM - 16 July 1986

The Alamogordo Public Meeting, held at the Civic Center Room, 1st and Florida Streets, started at 7:40 PM and ended at 8:45 PM. There were 185 persons in attendance. As at previous scoping meetings, a comment and question session followed the introductions and presentation.

The significant issues and concerns discussed were as follows:

- o Technical feasibility of SDI program
- o Effects upon SALT talks
- o Offensive use of experiment
- o Safety hazards including radiation and hazardous gases
- o Seismicity
- o Power requirements and potential sources
- o Airspace requirements and control
- o Potential labor force requirements
- o Source of construction supplies

4. Public Scoping Meeting, Las Cruces, NM - 17 July 1986

The Las Cruces Public Meeting, held in the City Council Chamber, 200 N. Church St., had a total of 175 attendees. The meeting commenced at 7:30 PM and adjourned at 8:50 PM. After introduction of the local dignitaries and officials present and the GBFEL-TIE presentation, the meeting was opened to comments and questions.

The significant topics identified included:

- o Effects on local housing
- o Electrical power source and requirements
- o Air pollution and health problems
- o Project duration
- o Work force requirements
- o Water resource conservation
- o Research benefits
- o Economic effects

5. Public Scoping Meeting, El Paso, TX - 21 July 1986

There were 95 persons in attendance at the El Paso Public Meeting. The meeting, which was held in the City Council Chamber, Room 2 of the Civic Center Plaza, started at 1930 hrs and concluded at 2100 hrs. Several dignitaries and officials were introduced prior to and immediately after the presentation. A period of public comments and questions followed.

The significant issues and concerns discussed were:

- o Potential power sources
- o Storage and transportation of radioactive by-products
- o Potential atmospheric impacts
- o Economic and technical feasibility of project
- o Worst case scenarios
- o Effects of transportation
- o Water resources

B. Agency Coordination and Agreements

The Department of the Army (DA) White Sands Missile Range (WSMR) recognizes the effect that on-going mission activities could have on existing wildlife and historical resources. To ameliorate any potential impact to these historical and natural resources, the DA closely coordinates with those agencies which regulate and protect these resources.

1. New Mexico State Historic Preservation Office (SHPO)

The DA WSMR has agreed that any mission or activity shall be conducted in accordance with a multi-point Memorandum of Agreement with New Mexico SHPO. The complete memorandum of agreement was presented in Appendix G of the DEIS. The document essentially consists of an agreement to:

a. Treat historical properties according to their significance, balanced against public values and the military mission.
b. Adhere to a comprehensive historic preservation plan.
c. Implement a cultural and historical resource protection program.
d. Implement a public education program.
e. In conjunction with SHPO implement a research administration plan.
f. Provide specific materials for comment and review.
g. Require archeological contractors to adhere to given stipulations.
h. Share data with SHPO.

2. Fish and Wildlife Service

Considering the potential impact the GBFEL-TIE facility construction and operation may have on natural resources, cooperation and coordination with the U.S. Fish and Wildlife Service and the New Mexico Department of Game and Fish Department was solicited and encouraged. Each of these agencies was informed, by letter, of the proposed project. The purpose and operation of the GBFEL-TIE were briefly explained and a request was made from each agency for information concerning threatened and endangered species that may occur at any of the three sites and could potentially be impacted by either the construction or operation. Additionally, any other data concerning impacts that the proposed GBFEL-TIE could have on existing resources were requested. Responses to these requests are incorporated as Appendix A.

C. Public Review and Comment

Public comments concerning the DEIS were solicited from Federal, state and local agencies and from the general public after a Notice of Availability was published in local newspapers. The notice also announced four public meetings at Socorro, Alamogordo and Las Cruces, New Mexico and El Paso, Texas on 20 October, 21 October, 22 October and 23 October 1986, respectively.

Handouts were available for every attendee at each meeting. The handout summarized the information on the purpose of the GBFEL-TIE, proposed applications and potential impacts presented in the DEIS. The handout also contained a blank form to complete and turn in before the meeting for those persons wishing to make a public statement. The agenda of each meeting, all of which were moderated by USASDC and U.S. Army Corps of Engineers Fort Worth District, consisted of a brief welcome and introduction, an explanation of the purpose of the public meetings, a brief description of the project and a summary of the types of potential impacts that were considered. After the general introduction and briefing comments were made, the public was allowed to present comments both written and orally. The deadline for submitting comments on the DEIS was originally established as 18 November 1986, but was later extended to 21 November 1986. Comments received or postmarked before 21 November 1986 were addressed and are included in this FEIS.

A court stenographer recorded all the proceedings and discussions verbatim. These transcripts are available for review at the Fort Worth District Corps of Engineers office. The agenda and significant discussion themes for each public hearing are included in the following paragraphs.

1. Public Meeting, Socorro, NM - 20 October 1986

There were 181 persons in attendance at the Socorro Public Meeting held at the Macey Conference Center, New Mexico Institute of Mining and Technology. The meeting was held between 7:30 PM and 10:30 PM. After the introduction and presentations, persons wishing to make a public statement regarding the DEIS were asked to present their comments either in writing or verbally.

The significant issues discussed were as follows:

- Site selection process
- Housing
- Schools
- Economy
- Site boundaries
- Radiation hazards
- Radio frequency interference
- Conflicts with VLA project
- Light pollution
- Employment opportunities
- Water supply
- Bighorn sheep

2. Public Meeting, Alamogordo, NM - 21 October 1986

The Alamogordo Public Meeting was held at the Alamogordo High School cafeteria, 103 Cuba Avenue, between 7:30 PM and 8:25 PM. There were 84 persons in attendance. The same format was followed as in the previous meeting.

The significant issues and concerns discussed were as follows:

- o Water supply
- o Water quality
- o Wildlife
- o Power production
- o Socioeconomic considerations
- o Mission conflicts with other programs
- o Archeology
- o Orogrande as a preferred site

3. Public Meeting, Las Cruces, NM - 22 October 1986

The Public Meeting at Las Cruces was held at the Best Western Motel, 901 Avenida de Mesilla, between 7:30 PM and 8:25 PM. A total of 117 persons attended the meeting. After the introduction and presentation of the proposed GBFEL-TIE project, the meeting was opened to the public for written or verbal statements.

The significant issues and concerns discussed were as follows:

- o Cultural resources
- o Preference of "no action"
- o Air quality
- o North of NASA as a preferred site
- o Light pollution
- o Socioeconomic considerations
- o Railroads
- o Electrical supply
- o Air space restrictions
- o Nuclear strike by the USSR
- o Water supply

4. Public Meeting, El Paso, TX - 23 October 1986

Ninety-four persons attended the Public Meeting held in El Paso, Texas at the Airport Hilton, 2027 Airway. The meeting was held between 7:30 PM and 8:55 PM. The same format was used as in the previous meetings.

The significant topics discussed included:

- o Laser safety
- o Electrical interference
- o Ecology
- o Radioactivity
- o Water supply
- o Wildlife
- o Socioeconomic considerations
- o Lack of identification of a preferred site
- o Cultural resources
- o Preference of "no action"
- o Nuclear strike by the USSR
- o Laser operations
- o Nuclear powered laser
- o Endangered plants
- o Air space restrictions
- o Highway restrictions

D. Responses to Comments

Comments from each person that made an oral statement were excerpted and are presented, in sequential order, on the following pages. Responses to each comment are presented adjacent to each comment.

As mentioned previously, written comments which were received or postmarked by 21 November 1986 were reviewed and addressed. These letters are presented on the pages following the oral comments. Responses for each comment contained in each letter (i.e., written statement) are presented adjacent to the letter.

		Comment	Response
Tony Gallegos (for Sen. P. Dominici)	0-1.1	The site selection process is continuing, as it should. It should be done in such a way that best ensures the success of this important defense initiative. I will insist that it be done fairly and that all sites be considered objectively. If the Stallion site wins, I will be very pleased, but in all events because we have White Sands Missile Range, we are the winners. And while New Mexico wins, our defense research improves and science engineering and technology will make great strides forward.	Thank you for your comment.
R.W. Tacker Socorro County Economic Development Commission	0-2.1	Briefly, we wanted to offer some new evidence. We had read the EIS in detail and we felt that there were a couple of areas that perhaps take too conservative an approach. One is the area of housing. You had not looked at the possibility of housing that is available in Magdalena and there is some considerable temporary housing available.	This section has been revised in the FEIS to include data received since the DEIS was prepared (pp. IV-29 and IV-30 of the FEIS).
	0-2.2	We felt that you perhaps were not aware that Socorro was building a new Junior High facility which will be completed by next year, which will free up the current Junior High facility which could certainly be used for a couple of more years to take care of a sudden impact.	This section has been revised in the FEIS to include data received since the DEIS was prepared (pp. IV-33 through IV-35 of the FEIS).
	0-2.3	We also felt that the impact on the entire area would not be as severe as we might get, looking at big numbers. The number of 2,000 temporary workers as you say here tonight is certainly a top. And you need to read that EIS and understand that those 2,000 pepple are not going to live in Socorro County.	The FEIS has been revised based upon projections of a gradual influx of workers (pp. IV-26 through IV-28 of the FEIS). However, as stated in the FEIS these workers are predicted to distribute themselves within several counties, including Socorro, if the Stallion site were selected.
	0-2.4	The Stallion site will benefit a greater area of New Mexico.	Thank you for your comment.
Hal Sims Economic Development Commission in Carrizozo	0-3.1	We want to come here and show our unilateral support for this project. We have adequate housing, labor and we welcome the project that is as rewarding as this is to develop in White Sands Missile Range.	Thank you for your comment.
	0-3.2	I cannot say anything more positive about it other than we support this project and also the support of Socorro.	Thank you for your comment.

		Comment	Response
Dennis Sidebottom Superintendent of Carrizozo Schools	0-4.1	At one time Carrizozo School housed about 400 students. Right now we have 286 and we feel like there will be a number of people who will opt to live in Carrizozo. It could be fairly adjacent to Stallion and we feel we could handle probably another 125 students. I think that's something that your group needs to take a look in the EIS and we felt like that information would be valuable.	The socioeconomic assessment has been revised to reflect new data received since the release of the DEIS and is incorporated in the FEIS (pp. IV-33 through IV-35).
Harold C. Dotson, Jr.	0-5.1	One of the two areas that we would like to bring out that were not mentioned was Socorro is the site of the new State Fire Training Academy which I believe would be an asset.	Thank you for your comment.
	0-5.2	Also, I would like to point out that Socorro did absorb the VLA Project which is apparently the same size as the project that you're now contemplating. They absorbed that and any economic problems whatsoever.	Thank you for your comment.
Charles Madeville Socorro	0-6.1	I was curious if there is any economic subsidy available to the communities in involvement of this project to prepare for the impact in the city?	Please see Comment and Response W-2.1.
	0-6.2	Is it true that the entire project will be within the existing boundaries of the Missile Range that there wouldn't be any attempt to expand further than where those boundaries are now?	The entire laser facility would be contained within the WSMR boundaries. Ancillary facilities (e.g., power lines) would require easements across other private and public lands, as described in the FEIS (Section I, Subsection D).
Jean Roath San Antonio	0-7.1	I am afraid that the support for this is not as unanimous as some of the citizens have indicated. Many of us believe that in the need for jobs. We want jobs but we do not want jobs at any price. Jobs which expose our workers to radiation hazards is too high a price to pay, too high a price for our workers and too high a price for our community. The protection of our environment is essential.	Thank you for your comment.
Danny Lopez	0-8.1	Prior to coming here tonight I read the Draft EIS. I don't feel any problems with it at all and I look forward to having this SDI project come to Socorro.	Thank you for your comment.

Commenter	No.	Comment	Response
Patrick Crane National Radio Astronomy Observatory	0-9.1	While several features of the design of the VLA reduce its sensitivity to radio-frequency interference, because of its ability to detect extremely weak cosmic radio signals (the weakest detected so far is about -234 dBW/M2), the VLA is still sensitive to very low levels of interfering signals. The power levels involved in the low-power and especially in the high power phases of the project are so high that leakage at radio frequencies of only a small fraction of the total power could interfere with the operation of the VLA.	Section M, pp. IV-45 and IV-46 of the FEIS discusses the RFI problem and what is expected to be the effect of the GBFEL-TIE operation on the VLA. The GBFEL-TIE design would include shielding to prevent even a small fraction of the energy used from leaking to the environment. In addition to the design, monitoring of RFI would be a feature which would be incorporated in the operation of the system to prevent future leaks from developing.
	0-9.2	But what if we find that while the low-power phase of the project may be compatible with the operation of the VLA, the high-power phase is not? Much more information on the characteristics of such devices and the proposed mitigation measures is needed to address our concerns.	Both phases of GBFEL-TIE are discussed in Section M, pp. IV-45 and IV-46. The analysis conducted and previous experience indicates that there would not be a RFI problem during either phase. Minimum RFI emissions are a design requirement for the project. We believe the noise levels discussed in Section M are possible with reasonable engineering design and facility construction.
	0-9.3	Other components such as the induction linear accelerator proposed for the high-power phase of the project or the wigglers and beam dumps used in either design could be significant generators of radio-frequency interference.	The sources of RF have been identified and are discussed in Appendix H. As stated in the Appendix, any generated RF would be attenuated by adequate shielding to preclude interfering with neighboring facilities.
	0-9.4	The summit of South Baldy is one of the premier astronomical sites remaining in the Southwest. The summit has a direct line of site to the Stallion site. Consequently, low levels of radio frequency emission from the Stallion site could interfere with millimeter and submillimeter radio telescopes by South Baldy.	Since the levels of RFI which an observatory on Mount Baldy could tolerate are not yet available, we could not judge the degree of interference. The spectrum of RF generated would peak at the klystron frequency, 500 MHz, and decrease with increasing frequency. Very little RF energy is anticipated, but any RFI in the millimeter and submillimeter wavelengths from a GBFEL at Stallion would be reduced by at least 225 db (80 db shielded room, 40 db shielded building, and 105 db propagation loss) at Mount Baldy.
	0-9.5	The DEIS discusses only the safety aspects of this phenomenon, neglecting the potential for light pollution.	The requested data has been incorporated into the FEIS, p. IV-45.

		Comment	Response
	0-9.6	Two optical astronomical observatories are located on Sacramento Peak east of Alamogordo. The potential for light pollution at these observatories should be addressed. Section IV.L.3 Automatic Laser Safety Procedures discusses an object detection system which could be a source of radio-frequency interference at the VLA and on South Baldy.	Please see p. IV-45 for a discussion of the light pollution potential. We recognize the potential for RFI from radar equipment. The object detection system radar frequency would be selected to avoid interference with any radio telescope site.
	0-9.7	A test of the linear accelerator by itself could be a significant source of radio-frequency interference. How much time will be spent on such ancillary, but essential activities?	You are correct in recognizing that much of the test time would be spent perfecting the operation of subcomponents such as the accelerator. We do not agree that an accelerator would be a significant source of RFI because of the shielding which must surround the accelerator and its power supply. It is not known the exact amount of time which would be spent on the system checks. Past experience would indicate that at least 10 times as much time is spent in system checks as in experiment operation.
	0-9.8	One mitigation measure that might help would be to conduct the tests on airborne and space targets, especially at azimuths that avoid the VLA and other astronomical facilities on South Baldy and Sacramento Peak.	Most RFI produced would come from the operation of the laser power supplies. It is expected that extremely low levels of RF energy would be in the same path as the laser beam or produced by the laser beam and ground target interactions. Thus, we would not expect any reduction in RFI from the use of space or airborne targets. However, the possible interference with other facilities would be a consideration for all tests which may produce RFI. Section M, pp. IV-45 and IV-46 has been expanded in the FEIS to address VLA and other RFI concerns.
	0-9.9	We find that the Draft Environmental Impact Statement inadequately addresses our concerns about the potential for radio-frequency interference, electromagnetic interference and light pollution associated with the proposed project.	New and revised data concerning RFI, EMI, light pollution and other potential effects on sensitive optical equipment have been incorporated into the FEIS (pp. IV-45 and IV-46).
Udell S. Vigil	0-10.1	I had talked to several people who have read the EIS and I have gotten various reactions to it, but most favorably the people I talked to who had read the EIS and I have commented myself, are strongly for the Stallion site being considered as the site for the project.	Thank you for your comment.

		Comment	Response
James Jones Socorro	0-11.1	A large number of people who will live in other regions somehow move once the construction phase is done. Many of them decide that they like it here and then it may become difficult for them to find employment. So, the long term may not be as big a boom for new employment opportunities.	This concern is discussed in the FEIS (pp. IV-30 through IV-32).
Paul Kregbiel	0-12.1	The people of Socorro have good stable jobs in Socorro and we want to be careful not to be in that way interfering.	Thank you for your comment.
Patrick Lewis Magdalena	0-13.1	I think that the housing of 600 people, if they move here they're not going to move in overnight. It's a gradual time when they leave and I think lots of times people get excited; where are we going to put everybody. I'm sure Socorro can do that.	The FEIS has been revised to reflect the fact that population changes will occur over a period of time.
Charles A. Zimmerly Socorro County Commission (for Rep. B. Richardson)	0-14.1	Having seen the EIS I feel that all the areas of concern have been adequately addressed for the citizens of Socorro County, Valencia, Sierra, Catron and Bernalillo.	Thank you for your comment.
	0-14.2	Location of the Free Electron Laser Project at Stallion site would greatly benefit people in several communities including Socorro, Belen and Albuquerque.	Thank you for your comment.
	0-14.3	Locating the facility at the Stallion site would add the Third Congressional District as a participant in SDI research. It would also greatly benefit the surrounding communities. I strongly support locating this project at the Stallion site.	Thank you for your comment.
Jim McCord	0-15.1	My main concern is the long term impact on the town, (considering) the likelihood (that) once SDI gets started will continue.	This concern is discussed in the FEIS (pp. IV-30 through IV-32).
Steven Shore Astrophysics Department at New Mexico Tech	0-16.1	We request that consideration by given in the final EIS to the astronomical impact of laser tests and the effects of normal, non-test related nighttime operations at WSMR.	Potential light pollution has been addressed in the FEIS (p. IV-45).
	0-16.2	Induced Raman scattering will have an effect on spectroscopic observations of faint sources, and airflow induced from laser operations may also affect both photometry and spectroscopy. These are small effects compared with those introduced by the rapid and possibly uncontrolled growth of the populations of Socorro and Magdalena.	Light from Raman scattering and airflow from the laser are expected to be extremely small. We concur that they are insignificant compared with the impact of population growth. The potential light interference is discussed in the FEIS (p. IV-45).

	Comment	Response
0-16.3	Both of these towns are very close to, and line of sight from, the peak at South Baldy. Increases both in street lighting and of commercial lighting will seriously damage the viability of the mountain as a potential observatory site.	The FEIS has been revised to address potential light pollution (p. IV-45).
0-16.4	We request that specifications be made explicit for the shielding of all exterior lighting on all access roads leading to the GBFEL test facility, and on all exterior lights set up at the facility.	Although no significant effect on astronomical facilities would be expected from security and other lighting systems, some mitigation measures such as shorter poles, ground level lighting and directional lights could be incorporated into the facility design to ameliorate potential light pollution effects. Such analysis will be made part of the design process.
0-16.5	We also request a modeling of wind patterns to include the effects of dispersal of dust raised during the construction phase.	Dispersed dust is expected to remain within or near WSMR and thus is not considered to be a significant problem. These potential effects will be further reduced by the use of dust suppressants. Construction activities would not be expected to significantly exacerbate the natural dust conditions at WSMR. Therefore, a dispersion model was not deemed necessary.
0-16.6	Please provide an estimate of diffuse background produced by operations of the laser (not just scattering from centimeter-sized particles).	Effective operation of the laser tests requires minimum interaction with diffuse scatterers such as dust. Therefore, the test would not be performed in a dense diffuse scattering environment. The energy scattered in normal operation has been determined to be no safety hazard. The anticipated diffuse energy would be significantly less than 1% of the beam energy. The scattered energy would be at the laser frequency. Since no receivers sensitive to this frequency have been identified in the area, a detailed analysis is not required.

0-16.7	Please provide more information on the characteristics of the airborne targets.	The airborne targets (balloons, drones, rockets) would be designed to reflect the minimum amount of light or would be designed to reflect as much energy as possible into cleared sky space above the target. They would not be illuminated with a full power laser beam, for most tests. The airborne targets are used to provide dynamic testing of the tracking and adaptive optics components. We can not eliminate the possible destruction of an airborne target as a demonstration. Such destructive tests would not occur more often than a few times during the entire life of the project.
0-16.8	Please provide an indication of how the test firing pattern will be directed relative to the Magdalena mountains (altitude planning).	The flight path of airplane and drone type targets will be over the White Sands Missile Range. This will result in the laser being directed toward the center of the range. For high altitude targets, such as satellites, the firing pattern will be limited to 45 degrees from vertical. In all cases the firing patterns will be restricted so that the beam will exit WSMR property at an altitude in excess of 60,000 ft.
0-16.9	We request a clarification on the fraction of time that (nighttime) tests will be conducted.	We do not know the ratio of nighttime to daytime tests. To develop high performance adaptive optics it would be necessary to operate the laser under different atmospheric conditions. There is no special advantage or disadvantage to the laser from night operation. The time of day when least turbulence occurs is in the early morning just before dawn. The most turbulence is usually found in the late afternoon. These times of day would be the most frequent for tests.
0-16.10	In addition, the astronomical community has shown considerable interest of the mountains both at Sacramento Peak and the Magdalenas as potential locations of millimeter wavelength observatories. From the Draft EIS, it is difficult to evaluate what effect the laser operations will have on such instruments.	Please see Response 0-9.4.
0-16.11	Finally, please address the possible interference of GBFEL operations, especially the accelerators, with normal VLA and VLBA operations.	Please see Response 0-9.1.

		Comment	Response
	0-16.12	We strongly urge that the integrity of this instrument be given highest priority in your thinking on the question of siting.	These potential conflicts and effects were taken into consideration during the selection of the preferred alternative, along with several other socioeconomic, physical, and environmental parameters.
Edward Pencak	0-17.1	When the whole country hears 2,000 jobs are going to be open, ten times that many people turn up. So, you probably would see that happen, 20,000 unemployed people turn up in this town. I think the whole thing of this is going to be a mass of unemployment rather than any increased employment at all.	Our analyses indicate that about 60% of the job opportunities could be accommodated by the local labor force and that 40% would migrate into the area. It should also be noted that this would be a gradual influx. It is also expected that those unemployed persons that migrate into area and are not successful in obtaining a job at the GBFEL-TIE would leave to seek employment elsewhere.
Unidentified Speaker	0-18.1	I have discussed here about availability of water on the north end of White Sands, that water is not very deep and pretty close to the west side of Artesia. I think you have a lot more water potential there than what you maybe realize.	The sections concerning potential water supplies have been revised and include identification of the most cost effective alternative water supply for each site (pp. IV-36 through IV-38 of the FEIS).
Angel T. Meloro Mayor of Socorro	0-19.1	I, as Mayor of Socorro, let me say that the entire city of Socorro stands behind you 100%. Anything we can do to enhance the implementation of Strategic Defense Initiative, all you need to do is ask, we're here for your service.	Thank you for your comment.

		Comment	Response
Michael Olguin State Representative Socorro and Valencia Counties	0-20.1	Five years from now we'll be facing the type of things that happen in Silver City, involving New Mexico that we have numerous homes here, we have vacant buildings. I think that's the kind of concern we need to look at as community viewers here in Socorro.	This consideration is addressed in the FEIS (pp. IV-30 through IV-32).
	0-20.2	I do want to say, I think the support is here for the project.	Thank you for your comment.
Unidentified Speaker	0-21.1	I think you need to say something about treating water for domestic use.	In-line chlorination of the water would be utilized for domestic water supplies.
	0-21.2	The other thing has to do with standard air pollutants. You have two different tables and different values.	Table III-5 of the FEIS (p. III-24) has been revised in response to this comment.
	0-21.3	All the talk about economic benefits, those are relatively short term.	We agree that the majority of the direct economic benefits would be short-term (i.e., less than seven years); however, as stated on p. IV-32, the operations personnel and spin-off jobs that would be generated would provide continuing support to the local economy after cessation of the construction activities.
	0-21.4	And what we need to think about is some things like major species that become endangered through building this project at one site or the other. I think it would be a real loss, it would be an awful heavy price to pay. That will be a forever thing, not just a two year thing.	Threatened or endangered species were given special consideration during the preparation of the EIS. Extensive efforts would be made to avoid all potential adverse effects to these species.
Unidentified Speaker	0-22.1	I would like to observe that the city and county are 100 percent behind this.	Thank you for your comment.
	0-22.2	One point I want to make is a connection with the long term commitment to this project.	Potential effects to socioeconomic resources from premature termination of the project are discussed on p. IV-32).
	0-22.3	The second thing I would like to point out is that the boom and bust that's been mentioned by various speakers tonight. We're going to, during the construction phase, end up with 2,000 jobs. Then the first test phase and then possibly with this future jobs and then possibly a second construction phase with up to 2,000 jobs. And so employment is going to play a role in this community and I don't think that we can support that.	Please see Response 0-2.3.

		Comment	Response
Bob Hemphill Mayor of Carrizozo	0-23.1	There will be very little impact due to the remoteness of the site and the terrain on either side of the site. The displacement of the bighorn sheep and of the problem would be a concern from sheep will have a much larger area as you can continue down the mountain towards the south end of the mountain.	Implementation of the project at Stallion or Orogrande would not adversely impact bighorn sheep within the San Andres National Wildlife Refuge. Construction and operation of the GBFEL-TIE at the North of NASA site, on the other hand, could have significant adverse consequences to the sheep population.
	0-23.2	The indirect adverse effects on schools, law enforcement, recreation facilities, I think will be minimal. These projects are known to increase and decrease. If it were to reach such a size as 2,000. Socorro, Magdalena, San Antonio, Carrizozo, the cities in this area can absorb that type of gradual rise and that kind of decline.	The socioeconomic analyses have been revised in the FEIS to reflect a gradual influx.
Alex Thyssen City Councilman City of Socorro	0-24.1	We could all be here to support your project and as the Mayor of Socorro said, the government of America is 100 percent behind you.	Thank you for your comment.
David Summers	0-25.1	I feel that there is a possibility that we will be endangering (VLA and various optical observatory facilities) which will possibly affect enrollments.	Please see Response 0-9.1.
Burt Taylor	0-26.1	Just for the sake of jobs, then it will be better to locate your project someplace else and we can continue our development of research development in Socorro County. Place it somewhere else.	The purpose of and need for the proposed GBFEL-TIE is discussed in the FEIS (pp. I-1 through I-5); this project is not being proposed ". . . . just for the sake of jobs". However, various socioeconomic parameters were considered during the selection process, including labor force. Also, please see Response 0-9.1.
Unidentified Speaker	0-27.1	Bear in mind that part of an impact statement process is to educate us, the public also, towards what is going on. I just want you folks to know that I think there's a lot of people here, you're aware of, that possible problems that has to resolve in a national problem.	Thank you for your comment.
Eugene B. Hecker	0-28.1	I worked for about ten years for Hughes Aircraft in Fullerton, California, on a ten MEV (million electron volts) Linear particle accelerator. We ran this thing for six days a week, eight hours a day. We had no problems with radiation whatsoever. No one has developed any sideline effects from it. I don't think that the radiation would have posed any problems whatsoever, the way we had it contained, they can contain it much better here.	Thank you for your comment.

		Comment	Response
Unidentified Speaker	0-29.1	My understanding of the 1972 Missile Treaty, I interpret that to mean no testing and that it has only been very recent that that has changed.	The 1972 ABM Treaty does not ban testing.
Unidentified Speaker	0-30.1	We can reasonably accommodate 500 to 600 students. We have a present site that we can utilize that will not add any cost to you. We don't foresee any problems with teachers. Magdalena Superintendent, she absolutely commented they can accommodate 150 students. The impact of the students would be very minimal and the cost would be very minimal.	This information has been incorporated into the FEIS and utilized in assessing potential consequences (pp. IV-33 through IV-35).
Unidentified Speaker	0-31.1	This is the question concerning the sewer system and the impact increasing population in Socorro's water ability to handle that. It's already stressed to the limit.	The influx of people into Socorro, if the Stallion site were selected, would place an additional demand on the public sewage system. During the peak years of influx, which for the Stallion site would be during phase II (FEIS, Table IV-12), the sewage system may be at maximum capacity. Recent conversations with City of Socorro officials indicate that no significant problems with the sewage system would be expected, however.
Ron Schotter Tularosa Basin Group Sierra Club	0-32.1	In the area of water supply we would like to urge you to consider desalinization as a water supply for the project.	The FEIS identifies the water supply alternatives for each alternative site. Desalinization is not not considered necessary at this time due to the relatively good water quality of these supplies. Desalinization of poorer quality sources is not desirable due to higher costs of such operations. Water conservation methods (e.g., air cooling) would be incorporated to the extent practicable.
	0-32.2	We noted that particularly in the area of North of NASA site that the New Mexico Fish and Wildlife Department's long term study on mountain lion was not addressed there.	Data from the mountain lion study has been incorporated into the FEIS (please see p. III-42).
	0-32.3	The standby power production, if indeed the Orogrande site turns out to be the site, we feel that the potential air pollution from fossil fuel generated standby power could be a problem for the basin. And we would urge you to look into gas turbine as indeed the generating source there, rather than coal fire or oil fire boilers.	Dual fired and/or gas-fired generators are being considered to produce stand-by electricity. The oil-fired generators described in the DEIS were used as a "worst case" scenario to determine maximum emissions. It should be noted that even using oil-fired generators in these calculations projected emissions would not exceed Federal and State standards.

		Comment	Response
	0-32.4	We were indeed very glad to see that you had on the first cut, eliminated the potential of nuclear generation for standby which I'm sure would be uneconomical anyway.	Thank you for your comment.
	0-32.5	Generally we found the EIS to be very comprehensive and well done and no substantive deletions in it.	Thank you for your comment.
Ed Buck	0-33.1	I would just like to make a comment on the material that we've received today, which is the only material that I've seen. I think it extremely short and scant for our comments this evening.	The information provided at the public meetings was only the Summary Sheet from the DEIS. Copies of the EIS can be requested from the address presented on the Summary Sheet, as indicated in the public meetings hand-out. The FEIS is being mailed to all meeting attendees who filled out the attendance record card at the public meeting and to others who have requested it.
	0-33.2	We've always cooperated with Holloman and with the military, but when you show us a slide here of all the counties that are going to benefit, after we've donated most of the land to these people and families that are here, we feel like we deserve this project instead of having another project going to Dona Ana County. We'd certainly like to have it. We welcome it and we're anxious and excited to have it.	Thank you for your comment.
	0-33.3	I would like to ask if there will be any small nuclear explosions over this Missile Range?	There would not be any nuclear explosions associated with the GBFEL-TIE project.
Clois Ratliff Alamogordo Chamber of Commerce	0-34.1	The only question that we had, specifically, about the impact statement is that major beneficial impact of the economics of it really wasn't addressed as fully as we would like to see it.	The socioeconomic analyses have been revised in the FEIS.
	0-34.2	Request that more emphasis would be placed on the Orogrande project.	Thank you for your comment.
	0-34.3	That the concern that the dollars that are distributed to New Mexico to the counties that are in this region would be addressed.	Thank you for your comment.

		Comment	Response
Gerald V. Wingo Alamogordo Chamber of Commerce	0-35.1	Any impact in Stallion area, selection of that site would impact the air to ground weapons delivery training of not only the 479th Tactical Training Wing here, but it impacts an allied nation training agreement where they're training now, approximately 14 separate nations.	Airspace-related conflicts were considered in the selection of the preferred site.
	0-35.2	The second paragraph concerns North of NASA site. I take exception and I wish the final would address other areas. As far as an aircraft flying, there again, I relay back to 49th Tactical Fighter Wing, 479th and other National Guard units in the area. That is designated flying air space called yonder. It is located entirely within White Sands Missile Range. They are allowed supersonic maneuvering for normal training. But, it is also the only area which they are allowed live ammunition firing. This is extremely important for an air superiority Air Force unit, which the 49th Tactical Fighter Wing is, which is 20% of U.S. Air Defense superiority here in the United States.	Please see Response 0-35.1.
	0-35.3	The statement, quote "Additionally, Holloman Air Force Base uses this air space (Orogrande) for approach patterns of various aircraft". I believe the staff needs to look into this more by checking with air space management both 49th Tactical Fighter Wing and the 479th Tactical Training. They do not allow any aircraft farther out than nine nautical miles from this air base. If you draw the line due east, and that's the reason it is nine miles, it coincides with the north edge of McGregor Range. There is no operations directed down there. They do not penetrate that air space past the nine-mile point.	The FEIS has been corrected accordingly.
	0-35.4	The other impact as far as aircraft control is concerned, is what is commonly called the VFR corridor. It is exactly over the highway from El Paso to Alamogordo. What is not depicted in the EIS is, in fact, if there is a cylinder over Orogrande site or a cone over Orogrande site it's not depicted to relay.	It is likely that no additional airspace will need to be restricted, although this cannot be stated with absolute certainty. Should the need arise, this airspace shall be restricted only on an as-needed call-up basis when aerial targets are used.

		Comment	Response
	0-35.5	Through my knowledge and through conversations with all the individuals at Holloman there has never been a conflict with any aircraft requiring an air corridor. I think a possible deficiency as far as the identification of potential conflicts, in the EIS at North of NASA as to delineation of the exact problem as far as aircraft control that far south.	Please see Response 0-35.4.
Bobby L. Moore	0-36.1	I'd like to commend you all on those environmental impact studies. I think you did a fine job, it seems as though you've researched it very much.	Thank you for your comment.
	0-36.2	We would just like to say, like we stated in the El Paso once again, Alamogordo wants you. We want the Orogrande site.	Thank you for your comment.
Charles Anderson	0-37.1	I have never read a report that I had a higher regard for than the report that you put out. I read every word of it and I think it speaks well as the approach to a thing like this devoid of political consideration.	Thank you for your comment.
	0-37.2	If there is anyway I could help or any of us here, I think you'll find willing participants ready to respond in any manner possible and I commend you.	Thank you for your comment.
Michael Shyne	0-38.1	I was real puzzled as to why the area of the archeological site North of NASA was ten times the size of the area of Stallion or Orogrande.	The cultural resources at North of NASA are apparently significantly more extensive than those that occur at Stallion or Orogrande (FEIS, pp. III-54 through III-56).
	0-38.2	Can you give me some idea about the importance of the quality of water for this project. Quality meaning like parts per million of the solids.	The quality of the water supply is an important consideration in the selection process. The source for each site, however, should provide the required amount of water with the desired quality (i.e., less than 700 ppm TDS).
Don Carroll Mayor of Alamogordo	0-39.1	We feel that the Orogrande site would be a preferable site for the location of this installation.	Thank you for your comment.

		Comment	Response
Keith Burn	0-40.1	We don't really believe that the presence of a significant archeological site at North of NASA should do anything to discredit the site because we have the means right here in Las Cruces to be able to deal with them.	A contract has recently been awarded by the U.S. Army Corps of Engineers for professional services needed to insure compliance with laws relating to cultural resources.
Henry Hughes	0-41.1	I'm in favor of the "no action" alternative. The Strategic Defense Initiative has been heralded by President Reagan as a way to rid the world of nuclear weapons, but it is not.	Thank you for your comment.
	0-41.2	The proposed laser facility would degrade the air quality of the Southern New Mexico as is stated in the Draft Environmental Impact Statement.	As stated in the FEIS (pp. IV-6 through IV-8) effects on air quality would be temporary and contained within the immediate vicinity, and would not exceed Federal or State air quality standards.
	0-41.3	Further, this SDI program damages our overall economy by increasing the federal deficit and taking money away from other programs which have more tangible benefits.	This EIS is being prepared for the purpose of site selection for the proposed GBFEL-TIE. National economic and/or policy questions are beyond the scope of this document.
Tommy Tomlin Las Cruces City Council	0-42.1	The City of Las Cruces has a long history of involvement with the America's defense efforts. We stand ready as a community to help. Obviously, that commitment is not universally held as a total thing, but certainly the City Council you find that very few items that come before a government body.	Thank you for your comment.
Kurt S. Anderson	0-43.1	Our concern in the present instance is with the existence of a new large facility which may or may not have extensive lighting. As near as I could tell the question of light pollution is not addressed in the existing EIS Draft and we would like to see it so addressed.	The FEIS has been revised to include a discussion of potential light pollution (p. IV-45).
Dana Miller	0-44.1	In your Draft Statement you addressed socioeconomic kinds of impact and it seems to me on reading this that you've covered the subject quite well without drawing too many conclusions.	Thank you for your comment.
R.A. Willem Dona Ana Nuclear Freeze Campaign	0-45.1	I wish to say that I favor the "no option".	Thank you for your comment.
	0-45.2	It comes down to this, SDI is a further escalation of the arms race, that if not checked will inevitably lead to the extinction of human and most other forms of life.	Please see Response 0-41.3.

		Comment	Response
Hotch Manning Las Cruces Chamber of Commerce (for Mary Thompson)	0-46.1	Review of the criteria for the site indicates a need for a rail spur. It is not clear to me why this is so. Neither White Sands Missile Range nor White Sands test facility have rail service and they function quite well. It is also not clear what weight this criteria carries. It would seem to me that it is far more critical to consider the impacts on existing uses and viability, for example, than a rail spur that may or may not be needed.	The rail spur may be needed for transporting large amounts of construction materials, heavy equipment, and/or large components of the beam director, accelerator, or other parts of the laser facility. While the spur is not a selection criterion, it is addressed in the EIS in the spirit of full disclosure because of the varying environmental impacts that would be associated with construction of a railroad spur at each site.
Tamie A. Smith	0-47.1	I would like to support the comments made by Henry Hughes and Raymond Willem.	Thank you for your comment.

		Comment	Response
Tom McNamara	0-48.1	I would like to ask you or ask you to point out in your next draft if it hasn't been pointed out yet the anticipated load of electrical supply for the City of Las Cruces or for all the cities. In other words, if you build a facility North of NASA I hope you take into account that White Sands will increase, their demand will increase. Las Cruces will increase.	The increase in population of Las Cruces, as identified in the socioeconomic analysis, will not produce power demands in excess of the supply capabilities of the existing power grid. Please see also p. VI-134, letter from El Paso Electric Company.
Harold Daw New Mexico State University	0-49.1	We're very keenly interested in protecting our research capability at the University. So I'd further urge that the particular issue in light pollution be addressed.	Potential light pollution has been addressed in the FEIS (p. IV-45).
Klaus Wittern	0-50.1	I believe the term "research" is not a very appropriate term to use because we haven't done it yet. I think you could, as much as possible, refrain from the term "re" because that in the latin word in the latin language basically means to duplicate or, you know, find out one more time.	Thank you for your comment.
Jeanne Swarthout New Mexico State University	0-51.1	We are concerned that there is insufficient evidence to evaluate cultural resources adequately on the three alternatives at this time.	Please see Response W-4.5.
William L. Madden	0-52.1	It makes a statement that possible additional restricted air space will be required. It doesn't say how much. And I think that you need to take a very hard look at that.	Please see Response 0-35.4.
Christine Anne Kray	0-53.1	I support the statements made by Doctor Willem and Mr. Hughes.	Thank you for your comment.
Dana Donovan	0-54.1	You point out that there are over 700 churches in the area of all denominations that can take in the people. I would like you all to approach the Bishop of the Roman Catholic Diocese here and the Bishop of the Episcopal Diocese, also the Methodist, Presbyterian and all major Protestants and ask them for their opinions on this research project.	The general public has had the opportunity to comment on the project before preparation of the EIS began and again between the DEIS and FEIS. Also, please see Response 0-41.3.
	0-54.2	I caution you all about throwing pell mell into this site thinking that the university can snap their fingers and take care of your problems.	Thank you for your comment.

Commenter	No.	Comment	Response
	0-54.3	The third thing I would like to point out is nowhere in this Draft EIS that I've seen any statement in regard to a nuclear strike by the Russians, first strike by the Russians in this area. I'd like to know what is the Army's prediction for the possibility of a first strike by the Soviet Union before this is operational as a research testing center as a way of knocking it out. I'd like to see what kind of megaton you think would be aimed here. And the impact of various communities giving all three test sites.	The ground based laser facility we plan to build at WSMR is not designed as a weapon but as a research facility. It does not seem reasonable that the planned GBFEL-TIE research facility could be so threatening to the Soviets as to precipitate a first strike against United States.
John Stowe	0-55.1	We know for a fact that within 14 miles that there is available water in the Jornada Basin through the Moongate Water District. When you compare water supply options, however, you only talk about the 48 kilometers pipeline. It will not be tremendously less costly to acquire water from within the 14 mile from this side and shouldn't these costs be compared with other sites.	The water supply discussion has been revised in the FEIS (pp. III-67 through III-72) to include recent additional data. These discussions also now identify the most cost effective alternative water supply for each proposed site.
	0-55.2	Also, there is a huge water basin that was not mentioned in the study. It runs parallel to the Organ Mountains. That is available. There are two wells put down in the late 30's that could be grandfathered in that in that have the capacity to handle the needs.	Please see Response 0-55.1.
Joseph Theil Department of Health Bureau of Radiation Control	0-56.1	The data base presented in the draft environmental impact assessment is inadequate to judge the adequacy of the laser safety calculations presented to protect the public health and safety.	A new eye safety section has been written for the FEIS and is included as Appendix E. This section utilizes the same calculations used in the DEIS but bases the Maximum Permissible Exposure threshold on the more readily available ANSI standard values. The specific GBFEL parameters used to establish the safety zones cound not be included in the appendix for security reasons.
	0-56.2	The specific MPE's used for safety calculations are wavelength dependent. They have not been specifically identified within the document.	The MPE's ANSI Standard for 1.06 microns are used. Please see Response 0-56.1.
	0-56.3	The use of collecting optics in use by an inadvertent observer has not been addressed at all in the document.	The section on the effect of collecting optics is included in the eye safety Appendix E of the FEIS.

		Comment	Response
	0-56.4	You should have some sort of discussion of the electrical interference on the power grid or the transfer functions that might be involved due to the instantaneous high peak power demands.	Project power will be contracted from a commercial supplier, through a competitive procurement action by the Army. This contract must be approved by New Mexico public utility authorities, who will not do so if existing utility consumers will suffer a lower level of service (such as interruptions or brownouts).
	0-56.5	It appears to us in our review of the document that no on site ecology was done in this particular report. It was done by reference to literature that other people have already done on White Sands. The only site ecology that was done appears to be vegetation and simply just by maps.	It was decided after the scoping process that on-site ecological studies would not be incorporated because: (1) there was enough information available from previous WSMR documents to adequately compare the areas' flora and fauna; (2) on-site evaluations of extant habitats could provide an indication of the species composition of the wildlife population; (3) no person, group or agency identified the need for original field surveys during the scoping meetings and subsequent correspondence.
William Munyon El Paso Society of Friends	0-57.1	I would ask you if you're contemplating radioactive power generation. If you are going to import a lot of radioactivity, at least, are you going to need high level radiation waste dumpage and if you are, since there are no currently available high level radiation dump sites available in the United States, is that radiation then going to be stored on this site indefinitely.	There are no plans to generate power that would result in radioactive wastes. Some components of the laser device would become radioactive at low levels. These would be stored in the electron beam dump vault for an indefinite period as described on pp. IV-39 and IV-41 of the FEIS.
	0-57.2	Secondly, what kind of pollution do you envision or do you imagine will be done with the water that you use.	The sources of wastewater and the potential "pollutants" are described on pp. I-22 and IV-39 of the FEIS.
	0-57.3	The third thing here that I disagree with Representative Coleman (see Comment W-48) that this community looks forward eagerly to the construction of this site.	Thank you for your comment.
Celeste Benjamin El Paso Women's Political Caucus	0-58.1	The El Paso Women's Political Caucus has determined the need to express its opposition to funding an activity that (supports) research and development of nuclear arms and other sophisticated weapons within the United States, especially when such governments have major negative environmental impacts.	Thank you for your comment.

		Comment	Response
	0-58.2	The potential as stated in the Oraft includes possibly changing the water table. At this time our water is excellent and we understand from your draft that the possibility for the salt contamination exist with the drilling of these wells in this program.	Please see Table II-3 on p. II-11 of the FEIS. It should also be noted that the New Mexico State Engineer would not issue a well drilling permit if the proposed withdrawal would pose a significant threat to other water users in the area and State of New Mexico.
	0-58.3	The loss of animals such as bighorn sheep, antelope and birds would result in additional irretrievable losses in mammal population.	As stated in the FEIS (pp. IV-12 through IV-21), there would be losses to wildlife populations. Two purposes of the EIS are to (1) identify the site that would experience the least amount of losses to the fauna and (2) develop mitigation measures to ameliorate or avoid those losses.
Fernando Fuentes White Sands Missile Range	0-59.1	There is a little history regarding the procurement of the land at McGregor and the availability of quite a bit of water in the area even though McGregor Range is being provided water from El Paso up to McGregor.	The section concerning potential water supplies has been revised in the FEIS (pp. II-6 through II-9).
Carlos Restrepo	0-60.1	No consideration appears to have been given to the possible socioeconomic impacts of the negative test outcome.	The potential effects of termination of the proposed project are discussed on pp. IV-30 through IV-32 of the FEIS.
	0-60.2	The second is that I don't see, also, in that EIS any kind of modeling that will allow you to set up some sort of contingency plan and economic reserve to take care of any negative outcome of a test upon the population on economic structure of the centers population centers that are close to either one of the sites that you're looking at.	Requests made to the Department of Defense by local or State officials for help in providing public services are reviewed and granted under the Defense Economic Adjustment Program.
Glenn DeGarmo	0-61.1	One of the expectable factors at my point of view, at least, in the EIS is a modeling or scaling of the relative environment impact associated with the alternatives that are being evaluated, with the subsequent identification on what the preferred alternative is. This is usually presented in the draft. That is not done in this case. And to the degree that it is not, the critical public is, to that degree, unable to comment knowledgeably on what it is that you are proposing to do.	The USASDC did not state a preferred alternative in the DEIS because such identification had not been made prior to its release. Several factors, including the EIS, were considered during the selection process. While the USASDC concurs that a preferred alternative is often identified in the Draft EIS, the Council on Environmental Quality's (CEQ) regulations do not require that a preferred alternative be identified in the Draft (40 CFR 1502.14). The FEIS does identify a preferred alternative, however.

		Comment	Response
	0-61.2	As a second point it is fairly clear that the Orogrande site and the Stallion site have considerably less potential for damage and destruction of nonrenewable archeological resources that are associated with the three alternatives.	Thank you for your comment.
	0-61.3	There is no information as to how the Army proceeds to mitigate that impact (to historic resources).	General mitigation measures for historic resources are described on page V-4 of the FEIS. The specific mitigation plan for historic resources will be developed in cooperation with the New Mexico SHPO, Advisory Council and WSMR ENRO after a 100% survey of the preferred alternative site is completed and the historic resources are identified.
Joseph Weissmiller	0-62.1	First, I'd like to say that I agree wholeheartedly with Congressman Coleman (see Comment W-48) on this welcoming and assessment of this project as it related to El Paso/Las Cruces and Alamogordo.	Thank you for your comment.
	0-62.2	Gentlemen, I submit that time is money and the location of this facility 100 miles from the closest full service airport versus 50 miles will result in unnecessarily inefficiency and costly logistic delays. I submit that if all of their items were equal, and certainly they aren't, the Orogrande site is vastly superior from the standpoint of overall excessability to air service and related cost benefit.	Thank you for your comment.
Roy Griffen El Paso Peace Coalition	0-63.1	We obviously go for the "null option".	Thank you for your comment.
	0-63.2	SDI programs funnel federal money away from governmental programs designed to improve the quality of life and to provide subsistence income for millions of Americans.	Please see Response 0-41.3.
	0-63.3	The Free Electron Laser Facility at White Sands Missile Range further endangers nearby population by placing a first strike target close enough to significant population to destroy them in the event of a strike by the USSR.	Please see Response 0-54.3.
	0-63.4	The employment gains are temporary and will create higher unemployment after construction is completed.	This consideration is discussed on pp. IV-30 through IV-32 of the FEIS.

Commenter	No.	Comment	Response
	0-63.5	Should Congress decide that the Free Electron Laser Project should be terminated 2,500 construction jobs could be lost in a relatively short period of time, leaving the affected community with a worse unemployment situation that wouldn't have existed without the program.	Anticipated unemployment effects if a premature termination is required are discussed on pp. IV-30 through IV-32 of the FEIS.
	0-63.6	The SDI test program will ultimately lead to the first full power defense facility. The EIS does not address any of the dangers associated with a deployment phase.	While the goal of the Strategic Defense Initiative is to develop technologies and systems for defense against enemy missiles, the proposed GBFEL-TIE is an experiment to test methods of propagating a laser beam. There are no present plans for deployment of the GBFEL-TIE at WSMR or any other location.
	0-63.7	I get, by implication here (page IV-37), that there is going to be a long term radioactive storage facility. There is no mention of how radioactive this will be, the danger of water resources, how long it will remain radioactive and environmental impact of the storage facility.	The FEIS (p. IV-39) states "This area [the beam dump vault] would remain as a long term storage facility after completion of the [proposed] experiments". The level of radioactivity would be very low and because the beam dump would be encased by concrete and lead walls, no radioactive effects on water resources would be expected.
	0-63.8	What kind of a shut-off system are we talking about. How long does it take to activate after a large object is detected. If a beam is deflected how far away is	The shut-off system which would be implemented would meet the minimum requirements of detecting objects close to the beam and turning the high power beam off before the object can enter it. Preliminary calculations indicate that a computer controlled object detection system which operated only as fast as a home computer could detect an object traveling 2,000 miles per hour when it is just an inch away from the GBFEL-TIE laser beam, and could shut off the beam before the object enters it.
Larry Morales Junior	0-64.1	The FBI gave amnesty to some Mafia figures who were evading Mussolini and Hitler. And the FBI gave amnesty in order to smuggle in these documents. I want to know if any of these documents are part of this laser program.	The USASDC is unaware of any such documents but can assure you that they have not played a role in the site selection process and/or design of the GBFEL-TIE.
	0-64.2	I believe that time is too precious to waste. So, let us establish these star wars systems as quickly as possible so that we can protect ourselves against all possible war. Thus, we can expand in the developments of space and use ideas such as particle accelerators to launch space shuttles into orbit.	Thank you for your comment.

		Comment	Response
Tim Channell Texas Nuclear Freeze Campaign	0-65.1	It doesn't clearly outline what purpose radioactive material will have in this particular weapons system. And if it in fact will be used at this site any kind of radioactive material.	Radioactive materials would not be used in the laser experiments, but would be a by-product of them. These materials would be stored in the beam dump vault as described in the FEIS (pp. IV-39 and IV-41). Some small quantities of Argon 41 may be emitted to the atmosphere.
	0-65.2	It is my understanding that one of the possible lasers that might be used may be a nuclear power laser. I'm not sure if this system is going to be used in your present research.	The proposed experiments would utilize a free electron laser which does not require nuclear explosions or nuclear power generation facilities.
Kevin von Finger	0-66.1	Let me first say that, given the time constraints on this, the Environmental Impact Statement is one of the best I've seen.	Thank you for your comment.
	0-66.2	Lack of a preferred alternative causes myself and probably other people to question what are the selection criteria. What will be the criteria by which you will select the preferred site.	Please see Response 0-61.1. The preferred alternative has now been identified in the FEIS (pp. II-21 through II-23).
	0-66.3	The Orogrande site in terms of environmental impact is by far the best selection. NASA site probably being the worst.	Thank you for your comment.
	0-66.4	I suggest you put that into the draft, because looking at your impact and looking at the selection criteria, your weighted selection of criteria in the draft copy here we have public, it's hard to tell exactly which site per selection of criteria rates over another site.	Please see Response 0-61.1.
	0-66.5	What will happen if there is a drought. What kind of impacts are we going to have in terms of surface water. Bosque del Apache, if we started drilling wells in Bosque, are we going to have problems with water for wildlife during droughts.	The indirect effects of GBFEL-TIE water withdrawals during a drought would depend upon several variables including the time of year, duration of the drought, previous withdrawal rate and precipitation and recharge of the period prior to the drought. Water wells would not be drilled within the Bosque del Apache NWR; although the most cost effective alternative water supply for the Stallion site is the Rio Grande alluvium, any water withdrawn from the alluvium would be replaced on a 1:1 basis by the San Juan-Chama Project. Therefore, no effect on wildlife would be expected.

		Comment	Response
	0-66.6	As a mitigation measure, I suggest that if there is a drought of seeps and springs that some other catchment system of piping water up to areas for wildlife be implemented.	Water catchment systems have been incorporated as part of the mitigation plan (please see pp. V-2 and V-3 of the FEIS).
	0-66.7	And I'm not sure the statement suggests that there may be a drawdown that drilling wells may destroy seeps and the springs. I'm not sure that's true. But, I would like to see a little better evaluation of that impact on wildlife.	This potential impact applies only to the North of NASA site. Since the most cost effective alternative water supply for this site has been identified as the Jornada Experimental Range Headquarters well field, the potential for affecting seeps and springs on the San Andres foothills is no longer considered to be significant. In addition, water catchments would be constructed that would tend to offset losses to or exclusion from any unidentified seep/spring.
Meg Ryerson	0-67.1	What provision has been made for protecting the desert and for protecting endangered plants.	Mitigation measures for vegetation include reseeding denuded soil; restricting grading and clearing to the smallest areas practicable; and implementing WSMR's Fire Prevention Control Plans. As described in Section V, the general mitigation plan involves controlled research on the effectiveness of these measures. A survey of the construction area will be conducted for all threatened or endangered species including plants that are of concern at the site, and measures will be taken to avoid effects to these species to the extent practicable.
Miguel Martinez	0-68.1	Overall I'm strongly in favor of the Strategic Defense Initiative Program from a scientific point of view.	Thank you for your comment.
	0-68.2	It was mentioned that if the Orogrande site was selected it would bring a lot of personnel from other areas rather than from here. I want to indicate the area has a vast potential of local scientific and technological (personnel) that cannot come back because of the limited amount of high technical work. So, a site like this would retain alot of them here.	Thank you for your comment.
	0-68.3	Hospital facilities, schools, cultural activities, airports, things to go back and forth. This is already here and as a gentleman brought up the government and the taxpayer would save millions of dollars over the long term if it (GBFEL-TIE) was located here (Orogrande) as compared to other areas.	Thank you for your comment.

		Comment	Response
Charles Hurd	0-69.1	I'm very much in favor of SDI.	Thank you for your comment.
	0-69.2	Should Orogrande or the Socorro area be chosen would water come from the east or would it come from the west.	The FEIS has been revised to identify the most cost effective alternative water supplies (p. II-6).
	0-69.3	Would any possibility occur of harm to cattle in say a 30 mile area of the section?	No significant adverse effects on livestock would be expected as a result of the construction or operation of the proposed GBFEL-TIE.
	0-69.4	Will the airline or airplane corridor that is currently about a mile wide from El Paso to Alamogordo be closed or will it be any significant amount of time or will they still allow small planes to fly up and down the corridor?	Please see Response 0-35.4.
	0-69.5	I would be concerned if that road (Highways 54 and 306) might be closed or travel limited.	It is not anticipated that the GBFEL-TIE would require temporary closure of these or other public highways.
Arves E. Jones	0-70.1	The vast majority of the people in El Paso, I believe, are highly in favor of the Orogrande site for your laser program.	Thank you for your comment.
Jay W. Sharp	0-71.1	What sort of ranking have you given to those sites from the environmental point of view. It strikes me that whenever you issue the final report, it's too late then to really respond from the environmental point of view, should one be selected (preferred alternative. We wouldn't really have the opportunity to express those views.	Please see Section II-C, p. II-21, which discusses the Environmentally Preferred Alternative. One purpose of the Draft EIS was to obtain comments on all alternatives under consideration, in order to to assist USASDC making an informed decision about the alternatives.
	0-71.2	Will you also be more explicit on what you will do in terms of mitigation?	The mitigation section of the FEIS has been revised to include specific plans to ameliorate potential impacts and/or enhance environmental resources in the project vicinity.
Vernon Haverstick	0-72.1	I worked at White Sands Missile Range for 30 years. And, I'm familiar with all the sites that are discussed here and I just want to say that if I were selecting a site I would have picked Orogrande.	Thank you for your comment.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
LAS CRUCES DISTRICT OFFICE
1800 Marquess Street
Las Cruces, New Mexico 88005

IN REPLY REFER TO:
1797 (030)
1600

NOV 1 0 1986

U.S. Army Corp of Engineers
Attention: SWFPL-R
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300

Gentlemen:

Resource Specialists with the Bureau of Land Management's (BLM's) Las Cruces District have reviewed the Draft Environmental Impact Statement (EIS) for the Proposed Ground Based Free Electron Laser Technology Intergration Experiment on the White Sands Missile Range (WSMR) and have the following comments and concerns.

1. The public lands adjacent to the WSMR studied in the Draft EIS are administered by the BLM's Las Cruces District. Our major concern is the potential impacts to the public lands outside of the WSMR. The Draft EIS describes the need for ancillary facilities outside the WSMR. Page I-36, Section F, states that "It is possible that construction of some of these facilities would require a separate environmental analysis." A separate environmental analysis would definitely be required (per the National Environmental Policy Act) prior to any construction on public lands administered by the BLM. Also, if the proposed ancillary facilities are not in accordance with the BLM land use plans, amendment of the plans would have to be considered (as required under the Federal Land Policy and Management Act of 1976) in conjunction with the preparation of the environmental analysis.

Since ancillary facilities such as power transmission lines, water lines, roads, and railroads which would affect BLM administered land are only covered by a general analysis in the Draft EIS, the Final EIS should more clearly state that additional site-specific plan amendments/environmental documents will be prepared, with full public review, when site-specific actions are proposed .

W-1.1 NEPA requires another environmental evaluation for any major construction activities on public lands. Further, considerations to the Federal Land policy and Management Act (1976) would have to be made regarding any use of BLM lands. This would include evaluation of environmental impacts resulting from ancillary facilities such as transmission lines.

2. On page V-3 under item G, Cultural Resources reference is made to WSMR's Memorandum of Agreement (MOA) with New Mexico's State Historic Preservation Officer (SHPO). If the MOA between the SHPO and WSMR takes into account direct and indirect impacts, we have no problem with the wording on this page. If the MOA doesn't discuss indirect impacts, then the wording on this page needs to detail how indirect impacts to cultural resources will be mitigated. Assessment of indirect impacts is required under 36 Code of Federal Regulations (CFR) 800 on all Federal Projects.

W-1.2 Indirect impacts such as utilities crossing public land would be treated in the same manner as direct impacts on WSMR lands. Specific treatments would be developed in conjunction with the land holding agency or owner.

3. The title for Figure I-2 on page I-3 should be "WSMR and associated U.S. Department of the Interior co-use areas." The WSMR extension areas are covered by a memorandum of understanding (MOU) dated February 16, 1973, between the Department of the Army and the U.S. Department of the Interior (BLM and WSMR).

4. On page 3 of the Summary, under item Number 5, permits (Potential Permit Requirements for GBFEL-TIE) add:

Type of Permit	Process Requiring Permit
ROW Reservation (BLM)	Distribution/Transmission Lines, pipelines, other access of Public Land needs.

Public land needs should be identified as early as possible. Processing of a right-of-way application and associated planning/environmental processes could take considerable time.

5. Mining activity in the Jarilla Mining District located in the Jarilla mountains northwest of Orogrande may affect air quality and cause seismic disturbance during periods when explosives are used. Also, in BLM's rangeland management program, certain rangeland improvement practices such as brush control or prescribed burns may have a short term effect on air quality.

6. After reviewing the biological resources Section F, it is apparent that few inventories have been completed. The species lists are incomplete and there are no population density figures. We suggest that Table IV-8 be modified or an additional table be prepared showing an estimated number of individuals of each species lost from the 1980 population because of habitat loss.

We believe that the overall evaluation of the effects of the proposed actions on peregrine falcon is incomplete. Based on inventory data collected by BLM all around WSMR, the proposed Orogrande site is the closest to an area regularly frequented by peregrine falcons. Peregrines are frequently reported at Lake Holloman and probably use the portions of the Tularosa Basin near Lake Holloman. In 1984, a BLM Las Cruces District employee found a peregrine falcon at Lake Holloman which had apparently been electrocuted by a transformer on a newly constructed powerline. The electrical facilities involved with the proposal project, therefore, seem to be a greater threat to peregrine falcons at the Orogrande site than at the other two sites.

Thank you for the opportunity review and comment on the Draft EIS. We look forward to working with WSMR on the planning, environmental, and right-of-way requirements for those facilities discussed in our concerns nos. 1 and 4.

Sincerely,

H. James Fox
District Manager

cc:
SO (934)
Attn: J.W. Whitney

W-1.3 This correction has been made to the indicated figure (Figure I-2).

W-1.4 This correction has been incorporated into the permit table in the summary section in the FEIS.

W-1.5 Thank you for your comment.

W-1.6 These activities would have to be coordinated among USASDC, the Orogrande Mining District and BLM during the operational phase of the experiment.

W-1.7 Please see Response 0-56.5. In addition, information concerning threatened and endangered species was requested from U.S. Fish and Wildlife Service, New Mexico Game and Fish and WSMR-Environmental and Natural Resource Office. This information, with literature from the scientific community, was used to develop the figures found in the EIS.

W-1.8 The discussion concerning threatened or endangered species has been revised in the FEIS to include the possibility of peregrine falcons occurring near the Orogrande site. It should be noted, however, that no sighting of peregrine falcons have been recorded within WSMR (71). Potential losses to falcons and other raptors due to electrocution and/or entanglement would be mitigated by proper conductor spacing on the power transmission lines.

FORCE MANAGEMENT AND PERSONNEL

THE OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-4000

MEMORANDUM FOR REBECCA GRIFFITH, SWFPL-R, U.S. ARMY CORPS OF ENGINEERS

SUBJECT: Defense Economic Adjustment Program Insert to GBFEL-TIE, EIS

The following paragraph should be inserted on page V-4, Section H:

> The Defense Economic Adjustment Program can help communities that expect problems in providing essential public services to new residents brought by the GBFEL-TIE proposal. Requests are made to the Secretary of Defense by local or state officials.

I hope this will do the trick. Please keep me informed on the progress of this proposal and appropriate local and state comments related to the impact of the employment on the communities nearby.

David A. MacKinnon
Senior Project Manager
Office of Economic Adjustment

W-2.1 The noted paragraph has been inserted into the Final EIS. (p. V-4).

LEAGUE OF WOMEN VOTERS OF EL PASO
EL PASO, TEXAS

October 23,1986

TO: ARMY LASER PROJECT HEARING COMMITTEE MEMBERS

FROM: THE LEAGUE OF WOMEN VOTERS OF EL PASO

RE: INFORMATIONAL MATERIALS ON THE LEAGUE'S POSITION ON THE ENTIRE "STAR WARS" PROJECT

W-3.1 Please see Response O-41.3

CONTACT: Bobbie Williams 581-3706

International Relations

Promote peace in an interdependent world through cooperation with other nations, strengthening of international organizations, arms control measures and the resolution of conflict without the use of military force.

The commitment to promoting peace in an interdependent world is rooted deep in League history. Though founded in the "back-to-normalcy" days of post-World War I, the infant League categorically rejected a policy of isolationism as "neither wise nor possible for this nation." A continuing commitment to international cooperation as an essential path to world peace has woven together the League's Trade, Development and United Nations positions, though the history of each position reflects crucial issues that have arisen over the years. League action in support of freer trade began in the depression years of the early thirties, support for the United Nations in the early forties and support of aid to developing countries during the nation-building period of the early fifties.

In the sixties, the League played an important role in creating the climate for normalization of U.S. relations with the People's Republic of China. Once the essentials of the League's China position—cultural relations, trade and participation in the United Nations—were realized and members agreed that the position did not address the remaining major obstacles (e.g., Taiwan), the position was dropped from the national program. This decision does not, however, preclude the League's taking action on China issues under other IR positions, where applicable.

Adoption of League positions on Arms Control and on Military Policy and Defense Spending during the 1982-84 study of National Security added new dimensions to League efforts to promote peace. These more recent positions are also bound to each other by a common thread—the importance of efforts to minimize the risk of war and to settle conflicts by nonmilitary means. On the basis of the new Arms Control position, the League has supported negotiations to reduce the risk of war and increase global stability, including measures to prevent the spread of nuclear weapons to outer space and to halt nuclear weapons testing and deployment. League action on military policy and defense spending issues has included efforts to prevent the development and deployment of nuclear weapons that are particularly destabilizing (i.e., are extremely vulnerable or increase incentives to attack first).

Arms Control

Position in Brief: ***Action to reduce the risk of war through arms control measures.***

The League's History

The League's decision to seek member agreement on arms control objectives, avenues and criteria as the first step in the 1982-84 National Security study was intended to add focus and direction to the League's existing support for "efforts to reduce the risk of war, including negotiations on disarmament and arms control" under the UN position. In the course of the study, League members examined previous arms control agreements, U.S.-Soviet relations, the strategic nuclear balance and methods of achieving arms control agreements.

Once the position was reached, League action in support of arms control measures was immediate and effective, particularly on the issues of antisatellite (ASAT) weapons and ballistic missile defense ("space weapons"). In 1984, the League played a key role in legislative efforts to bar U.S. testing of antisatellite weapons against objects in space as long as the Soviet Union refrains from such testing. The League also actively worked for a funding cap, at Fiscal Year 1984 levels, on the Strategic Defense Initiative—the package of programs related to ballistic missile defense. Other arms control measures supported by the League included negotiations of a bilateral, mutually verifiable freeze on the testing, production and deployment of nuclear weapons to be followed by reductions; the merger and resumption of strategic and intermediate-range nuclear weapons negotiations; and a comprehensive test ban treaty.

The League's Position

Statement of Position as Announced by National Board, December 1983:

The League of Women Voters of the United States believes that arms control measures are essential to reduce the risk of war and increase global stability. Toward that end, the U.S. government should give the highest level of importance to arms control efforts that:

- limit or reduce the quantity of weapons;
- limit proliferation and prohibit first use of nuclear weapons;
- prohibit first use and possession of chemical, biological and radiological weapons; and

- reduce tensions in order to prevent situations in which weapons might be used.

While these objectives should receive the highest level of attention, the U.S. government also should negotiate measures that inhibit the development and improvement of weapons, particularly nuclear weapons that increase incentives to attack first in a period of crisis.

As a long-term goal, the League supports the worldwide elimination of nuclear weapons.

The League of Women Voters recognizes that peace in an interdependent world is a product of cooperation among nations and therefore strongly favors multilateral negotiations. Given the potential for worldwide proliferation of nuclear technology, efforts involving all countries are essential to limit the spread of nuclear weapons and to protect commonly held nuclear-weapons-free regions such as the seabed and outer space. Multilateral efforts are appropriate as well to achieve bans on the possession of chemical, biological and radiological weapons.

The League of Women Voters believes, however, that for arms control to be effective, bilateral efforts also are necessary. Bilateral efforts may be especially appropriate in negotiations to limit and reduce quantities of weapons. The League believes that unilateral initiatives are not the most appropriate means to achieve arms control.

The League does not support tying progress in arms control to other issues. The League believes that arms control is too important in and of itself and too crucial to all nations to be linked to other foreign and military policy goals.

The League of Women Voters believes that arms control measures should be evaluated in terms of the following factors:

Equity The terms should be mutally beneficial, and each nation's security and interests should be adequately protected. Equity does not necessarily require equality in numbers of weapons but may be achieved through a relative balance in total capabilities.

Verifiability Each party should be able to insure that other parties comply with the terms of the agreement, whether using national technical means (satellites, seismic sensors, and electronic monitors) or on-site inspection. The League believes it is extremely important to ensure compliance, recognizing that absolute certainty is unattainable.

Equity and verifiability are critical in efforts to limit and reduce quantities of weapons and to prohibit the possession and spread of nuclear weapons.

Confidence-building Each party should be assured of the political or military intentions of other parties. Fostering confidence is vital in efforts to prohibit the first use of weapons and to reduce tensions.

Widespread agreement All appropriate parties should participate in and approve the results of the negotiating process. However, the League recognizes that, in specific cases, progress can be achieved even though some key parties do not participate.

Environmental protection The quality of the earth's environment should be protected from the effects of weapons testing or use. Environmental protection has special significance in negotiations to prohibit the possession of chemical, biological and radiological weapons and to limit the proliferation of nuclear weapons.

Continuity Negotiations should build on past agreements and should be directed toward future negotiations whenever feasible. Innovative thinking and new approaches should, however, be encouraged when appropriate.

Further Guidelines

League support of arms control measures includes action on proposals, negotiations and agreements.

The League supports efforts to achieve *quantitative limits or reductions* that focus on nuclear warheads, missiles and other delivery systems, antiballistic missiles, conventional weapons or troop levels.

The League advocates *limits on the spread or proliferation of weapons* to inhibit transfers of nuclear technology or weapons from one nation to another or to a geographic region such as the seabed or outer space.

The League's pursuit of *bans on the possession or use of weapons* may apply to existing weapons or to those not yet developed.

The League seeks *to reduce tensions* through better means of communication, exchange of information or prior notification of military tests and maneuvers in order to avoid the risks of miscalculation or accident. Other League-supported measures to reduce tensions and create a climate of trust among nations include scientific and cultural exchanges, conflict resolution training and strengthening the United Nations.

The League supports efforts to *inhibit the development and improvement* of weapons through qualitative limits, including limits on the testing of weapons. These constraints may be selective or comprehensive in their application.

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The League supports efforts to *inhibit the development and improvement* of weapons through qualitative limits, including limits on the testing of weapons. These constraints may be selective or comprehensive in their application.

GREATER LAS CRUCES ECONOMIC DEVELOPMENT COUNCIL

November 6, 1986

Colonel James F. McNulty
GBFEL-TIE Project
Strategic Defense Command
U.S. Army
WSMR, NM 88002

Dear Colonel McNulty:

The Greater Las Cruces Economic Development Council, in association with the City of Las Cruces and Dona Ana County, wishes to officially comment on the "Draft EIS" done for the GBFEL-TIE Project. Please consider this document as our official comment. What follows is our view of consideration which may be significant.

1.) A consortium of five universities including the University of Chicago, the University of Washington, Princeton University, Washington State University, and New Mexico State University are participating in the construction of a 3.5 meter primary mirror telescope project in the Sacramento Mountains south of Sacramento Peak (See Exhibit I). With an investment of $10 million in the project, the <u>astronomers are concerned about light pollution from the Ground Based Free Electron Laser Facility</u> in proximity to the telescope. The concern is about the security and other exterior lighting of the facility, as well as any significant development in the Alamogordo/Orogrande area which would degrade the present sky environment.

2.) <u>It has come to our attention that there is a strong possibility that hard rock mineral mining (gold, nickel, silver) may resume in the Orogrande Mining District in the short to mid term</u> (See Exhibit II). As recently as this summer, core samples have been drilled in the immediate vicinity of WSMR in the

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W-4.1 From studies conducted recently, lighting from the GBFEL-TIE facility does not appear to pose any significant effect on optical astronomy at any of the sites. This information has been incorporated into the FEIS (p. IV-45).

W-4.2 It is expected that no mining interest would be impacted by GBFEL-TIE. The Orogrande district, while located in proximity to the Orogrande site, would not be directly affected by GBFEL-TIE projects; blasting activities may have to be coordinated among USASDC and the Jarilla and Orogrande Mining Districts during the operational phase.

Colonel James F. McNulty
November 6, 1986
Page 2

Jarilla Mountains. The preferred mine type would be open pit with possible crusher and haul trucks as well as blasting activity. This schedule would be accelerated if the world price of gold increases significantly. We believe this activity could be within several miles of the proposed Orogrande FEL Site. A contact person regarding this is Mr. William Tipton, Bureau of Land Management, telephone number (505)525-8228, or Mr. Richard Hahman, Consulting Geologist, telephone number (505)523-9336.

W-4.3 GBFEL-TIE activities would be coordinated with WSMR activities to minimize any impacts. Possible conflicts with WSMR programs and activities are discussed on pp. I-25 and I-27 of the FEIS. It is erroneous to say that there are no conflicts at the North of NASA site, however. Data indicates that there would be potential conflicts at that site also (see p. I-26 of the FEIS).

3.) The EIS indicates that there are a number of mission type activities at the Stallion and Orogrande Sites which would have to be relocated, whereas, there are no conflicts at the North of NASA Site. It is our concern that the Free Electron Laser Facility be developed with as little impact as possible on the present mission activities of White Sands Missile Range, since WSMR is a major area employer and mission conflicts could cause loss of jobs (See Exhibit III).

W-4.4 Thank you for the information. The section on water have been revised in the FEIS on pp III-68 through III-72.

4.) In considering the water supply options for the North of NASA Site, the ground water option (See Exhibit IV) indicates a relatively small draw down for wells in the Jornada Reserve but that if the State Engineer considers than an applicant would permanently impact the water supply, the application would be denied. The possibility of this happening is considered to be small. However, another alternative exists with the Moongate Water Company in the Jornada Basin which has an allocation of 2,100 acre feet of water of which more than 1,400 acre feet are available (See Exhibit V). In considering the ground water supply option for the Orogrande Site, two options are considered; a well field in the Soledad watershed with a direct water line to the Orogrande Site, and using the same watershed but connecting to the existing water main from WSMR post headquarters. These options do not indicate the fact that any extensive use of water from the Soledad watershed would accelerate the falling water table on the main post at WSMR and endanger the saline-potable water interface as well as possibly aggravate the water draw down and "slumping" problem already occur- in the Hueco Basin (See Exhibit VI).

5.) All three of the potential sites have significant archaeological findings which will require investigation. Further independent archaeologists disagree that on the basis of the survey's findings that a determination can be made that the North of NASA Site is by far more archaeologically significant than the other two sites (See Exhibit VII). However, the Cultural Resources Management Division of New Mexico State University, which recently completed the archaeological investigations for the Goodyear-Celluron Transcontinental Pipeline without construction delays, is available locally to perform site investigations (See Exhibit VIII).

6.) It has also come to our attention that the Orogrande Site may be in the "look angle" of the NASA TDRSS Facility. Possible effects on communications should be studied as it relates to TDRSS operations with its first satellite in geosynchronous orbit above the Atlantic.

7.) The EIS discussed meeting power demand for the low and high power phases from the existing grid of transmission lines which are adequate to meet the required power. It is noted that construction of transmission lines to any of the sites would be provided by the power company as revenue productive.

8.) The EIS paragraph on visibility states that strong northeast winds lasting up to six hours may cause a considerable amount of gypsum particulates to be carried from White Sands National Monument and transported southwestward

W-4.5 Data derived from the survey were intended to project the likely impact on cultural resources in each of the three areas. Complete evaluation of all sites within a 60 square mile area, as indicated in Exhibit VII of your letter, is clearly beyond the scope of an EIS. The study identifies the relative impact to cultural resources in terms of density, diversity, and area of resources. Upon selection of a site for this facility, all affected resources would be located and evaluated, and a specific mitigation plan (including avoidance) would be developed in consultation with State and Federal oversight agencies.

The data indicate that cultural resource impacts on the North of NASA alternative are significantly greater than the other two alternatives. Significance of the resources impacted would be determined after location and testing for quality of information, and not on the basis of comparison with Chaco Canyon or Mesa Verde, as Exhibit VII suggests.

W-4.6 New data concerning potential conflicts at all three sites have been incorporated into the FEIS. Additionally, specific analysis has been conducted on potential interferences with the NASA TDRSS facility. Results indicate no impact on TDRSS would be expected due to siting the GBFEL-TIE at Orogrande.

W-4.7 Thank you for your comment.

to affect visibility in the main post area. The significant high winds of the late winter - early spring period are from the northwest and these winds would carry gypsum to the southeast toward Orogrande. The wind direction effect can be seen on the gypsum dunes at the White Sands National Monument. The environmental effect of such blowing gypsum particulates on laser testing at the Orogrande Site should be considered (See Exhibit IX). Regarding gypsum deposits, it should be noted in the EIS that the "dune lands" in the Orogrande area are markedly different in elemental composition than the "dune lands" at the North of NASA location. Whereas, gypsum deposits in the Tularosa Basin are crystalline in nature (a function of leeching in the poorly drained Tularosa Basin), gypsum at the North of NASA location is found primarily "cemented" in rock (See Exhibit X). Wind speeds in excess of 12 miles per hour in the Tularosa Basin suspend crystalline gypsum in the air. The effects of this phenomenon should be taken into account as it would effect facility testing schedules, operating costs and potentially constitute a safety hazard to operators and pedestrians from "raman scattering."

W-4.8 These potential effects have been and will continue to be taken into consideration.

9.) Although the live firing environment at WSMR has possibly changed over the past seven years, in the late 1970's a study was done that indicated there was a possibility of an unplanned missile impact in the Orogrande vicinity (See Exhibit XI). I bring this to your attention because at one point in time, the factor was considered to be significant by another government agency, namely the Nuclear Regulatory Commission. Although GBFEL does not include a nuclear reactor, it is a generator of high grade radioactive material. We feel this factor should be included in the EIS.

W-4.9 Unplanned missile impacts can occur at any of the three sites and have been considered during the selection process. However it should be noted that the NRC had different selection criteria and that the GBFEL-TIE would not be a generator of high grade radioactive material.

10.) In the economic analysis related to the "Existing Environment," the effects on road closures due to other mission type activity should be estimated as this relates to both construction and operation costs of the facility (See Exhibit XII). Also in this same area, under "Environmental Consequences," the cost to and the delays caused by FEL testing at all sites should be considered as this relates to possible delays and additional costs in other mission program areas.

We appreciate the opportunity to submit this document for your consideration and look forward to the "Final Environmental Impact Statement." Please do not construe any of these comments as a criticism of the project but rather as an indication of our sincere interest and support.

White Sands Missile Range is an important economic factor in the economy of Las Cruces and Dona Ana County. Therefore, it is our hope that the FEL will be built with the least disruption possible to the WSMR operations and at the most practical site based upon objective technical considerations.

Sincerely,

J. Andy Kissner
Executive Director

JAK:dr

Enclosures

W-4.10 Potential conflicts of GBFEL-TIE with WSMR projects are described on pp. I-25 and I-27 of the FEIS. It would be expected that coordination with WSMR would mitigate many effects of GBFEL-TIE on WSMR programs through range scheduling procedures. Potential impacts of range activities on GBFEL-TIE construction are being considered in site selection.

EXHIBIT I

Page C-4 - LAS CRUCES BULLETIN - Wednesday, August 20, 1986

NMSU part of consortium

NM to be site of new 'world class telescope'

A consortium of five universities, including New Mexico State University, has received a $3.74 million federal grant to help build a powerful new telescope in New Mexico.

The 140-inch telescope will be located on Apache Point, a 9,200-foot mountain in the Sacramento Mountains.

The five universities involved are University of Chicago, New Mexico State University, University of Washington, Princeton University and Washington State University.

When it begins operation in 1988, the telescope will be the first large telescope designed for rapid instrument changes and for fully remote use by astronomers thousands of miles away. According to Dr. Donald York, University of Chicago, the unusual design will allow it to study new phenomena and to operate in ways impossible for any existing telescope.

Dr. Kurt Anderson, NMSU, said the Apache Point telescope will be "3.5 meters in diameter (140 inches). That's big. It will be the second largest in the world managed exclusively by universities."

Anderson described the telescope as "fully computer controlled. Normally, an astronomer won't be in the building with the 'scope, but in a building next door, connected by 100 feet of computer cable. But if you are connected by 100 feet, you might as well be connected by 100 miles or 1,000 miles." Princeton and Chicago astronomers will do their observing from their offices via phone lines or satellite links.

Dr. Dennis Darnall, associate dean of the College of Arts and Sciences, commented. "Certainly this is a world-class telescope with unique features. It will increase the visibility of our astronomy department and be a drawing card for faculty and student research." Astronomy department head Dr. Herb Beebe said NMSU's user time will be "important as we hire new faculty and attract graduate students." Beebe predicted availability of the new telescope will help the department to develop into "a world-class astronomy department with breadth and depth. Now we're small and relatively new. But we've grown academically, and now we're growing physically."

Anderson explained that user time will be divided among consortium members with some outside time allotted.

The mirror is being made in Tucson Anderson said. "The glass is from Japan and the mirror will be made with a new technique: lumps of glass will be melted and poured into a mold. This mirror will be deeply cut to be high-powered like a fast lens on a camera. Pouring into a mold means less cutting to shape the mirror."

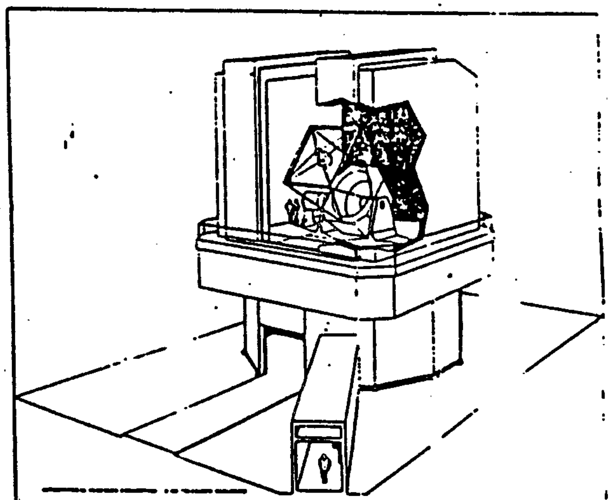
The $3.74 million grant from the National Science Foundation is only 40 percent of the $10 million total cost. Participating universities will share remaining construction costs and operating expenses in varying amounts.

"This has been a mutual project from the beginning," Anderson said. The project dates back about five years with the official consortium formed in January, 1984. "Universities with similar interests got together."

The University of Washington and Washington State University are designing the telescope, its optics, and the telescope pointing system. University of Chicago and Princeton University are creating the instrumentation.

NMSU is in charge of site development. According to Anderson, the parking areas and an access road have been completed. The concrete foundation for the telescope and power lines will be installed by the end of summer.

[illegible] of the telescope and [illegible] mirror also is underway [illegible] the Apache Point installa[illegible] is expected to be oper[illegible] in early [illegible].



Apache Point Telescope

REPORT ON THE OROGRANDE MINING DISTRICT, OTERO COUNTY, NEW MEXICO

BY

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4227 LOST LANE
LAS CRUCES, NEW MEXICO 88005

NOVEMBER 7, 1986

DISCLAIMER

The writer has no financial interest, either expressed or implied, in the Orogrande mining district. The reader should be aware that because of serious time constraints the writer has spent one day in the district. Therefore, this report was prepared for the Greater Las Cruces Economic Development Council primarily from published and unpublished material in the writer's personal library.

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Report on the Orogrande Mining District, Otero County, New Mexico.

By

W. Richard Hahman, Sr., P.G., C.P.G.

SUMMARY

The Orogrande mining district in the Jarilla Mountains, Otero County, New Mexico, was a producing district (turquoise) before the coming of the Spanish explorers. Serious prospecting began in 1879 and development work was underway by 1883. Early production figures are not available; however, from 1904 through 1966 the district produced over 2 million dollars in iron, cooper, gold, silver and lead (North, 1982). These figures do not include turquoise. From 1904 through 1966 the district produced approximately 16,000 troy ounces of gold. Assuming a price of $400.00 per troy ounce, the current value of the past gold production is $6,400,000.00.

While production from the district essentially ceased in 1967, the Orogrande mining district has remained under active mineral exploration through the present. The current price of gold and the potential for byproduct and coproduct mineral values make this district attractive for exploration and possible development. To date, the writer knows of no large tonnage mineral deposits in the district but the potential for them to be present does exist. Assuming favorable ore grades, modern mining and milling techniques also make it possible to mine several smaller tonnage deposits simultaneously. It is reasonable to assume that this option is under consideration by the current leasee.

Therefore, assuming current metal values remain the same or improve, the potential does exist for the commencement of mining operations in the Orogrande district in the near future. The close proximity of an active mining operation to the Ground Based Laser experiment located at the Orogrande site would in all probability prove deleterious to the laser research program. Prohibition of exploration and mining in the Orogrande district would deprive our country of future valuable mineral resources.

INTRODUCTION

The Orogrande mining district, is situated at the south end of the Jarilla Mountains in the east half of the Tularosa Basin, Otero County, south-central New Mexico (Figure 1). The Jarilla Mountains, a series of arid, north-south trending hills approximately 5 miles wide (east-west) and 10 miles long (north-

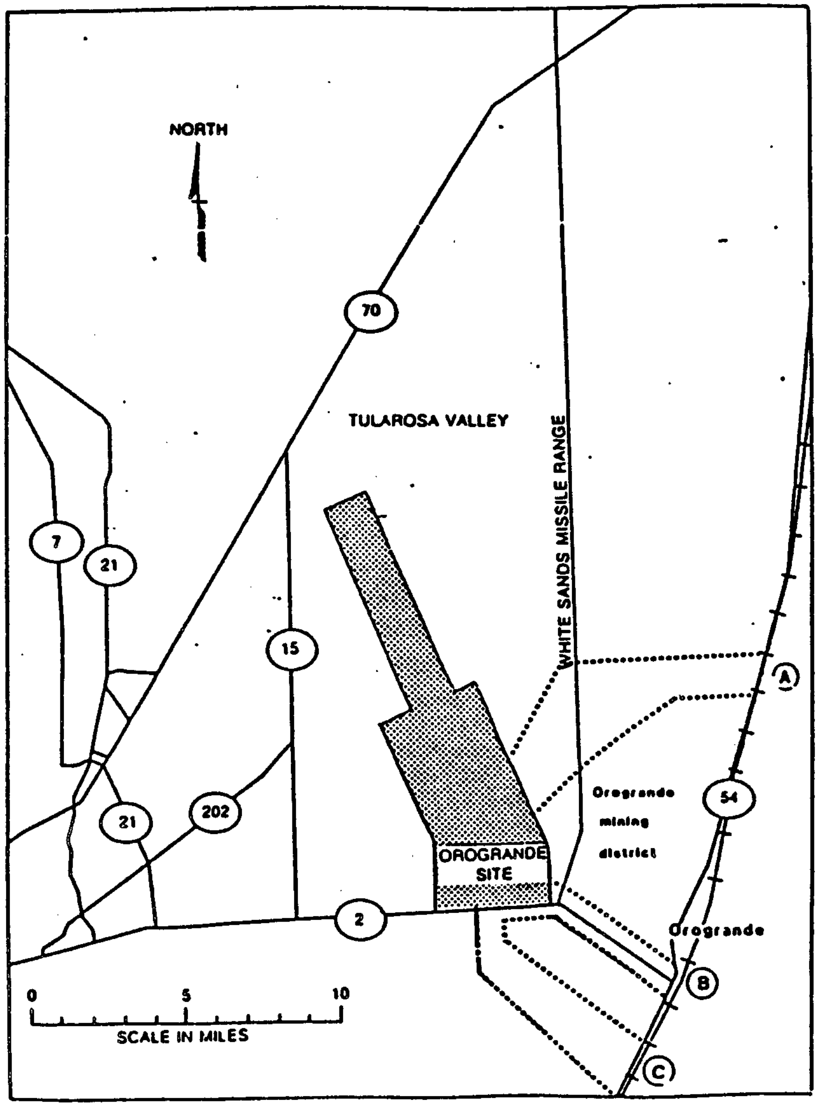

Figure 1: Location map showing the location of Orogrande Mining District, Orogrande GBFEL-TIE site, and railroad access corridors. Modified from Draft EIS.

south), rise some 800 to 1200 feet above the surrounding basin floor. The hills are dissected by numerous gullies, and arroyos which drain into the surrounding basin. The vegetation is composed primarily of cactus, creasote bush, yucca and grasses. The district may be reached via dirt roads trending northwest from the town of Orogrande on U.S. Highway 54.

For a more detailed discussion of the geology and mineral resources of Jarilla Mountains and the Orogrande mining district the reader is referred to the references cited at the end of this report.

DISCUSSION

Geologically, the Jarilla Mountains may be described as an eroded dome. The actual doming was caused by Tertiary Eocene, 47.1± 1.8 m.y. (Beane and others, 1975), igneous intrusive rocks intruded into upper Paleozoic sediments. These Paleozoic sediments often form steeply dipping hogbacks and exhibit extensional faulting caused by the doming of the igneous intrusives.

The igneous intrusive rocks have been divided into three types (North, 1982; Beane and others 1975, Schmidt and Craddock 1964). The oldest igneous intrusive rocks in the district are granodiorite and quartz latite which have been intruded by a younger monzonite to quartz monzonite stock. Younger dikes cut both the igneous intrusive and sedimentary rocks in the district, (Figure 2).

North (1982) lists the main sedimentary units of the district as the Pennsylvanian Gobbler Formation, the Pennsylvanian-lower Permian Laborcita Formation and the lower Permian Hueco Formation. These sedimentary units are composed primarily of limestone with minor amounts of sandstone and shale. These sedimentary units are the primary host rocks of the ore deposits of the district.

The ore deposits of the district may be divided into two types, placer and lode. Small gold placer deposits may be found in the Quaternary alluvium in the district. These deposits are assumed to have formed from the erosion of the lode deposits, the gold being concentrated in the alluvial stream and valley fill.

The lode deposits may be divided into three types by metal content, iron, base metal and precious metal deposits. However, all these deposits have been classified by previous workers (see references) as contact metasomatic skarn deposits. Gangue minerals in a skarn deposit are composed almost entirely of lime-bearing silicate minerals derived from limestones and dolomites which have been hydrothermally altered by large amounts of silica, aluminum, iron and magnesium. The more common skarn minerals are quartz, garnet, epidote and calcite to name but a few.

North (1982) reports that the most important ore minerals of the district are chalcopyrite and native gold. The silver is apparently contained in the chalcopyrite, pyrite (?) and galena (?). Minor zinc and tungsten mineralization has also been reported. The ore minerals of the iron skarn deposits are magnetite and hematite.

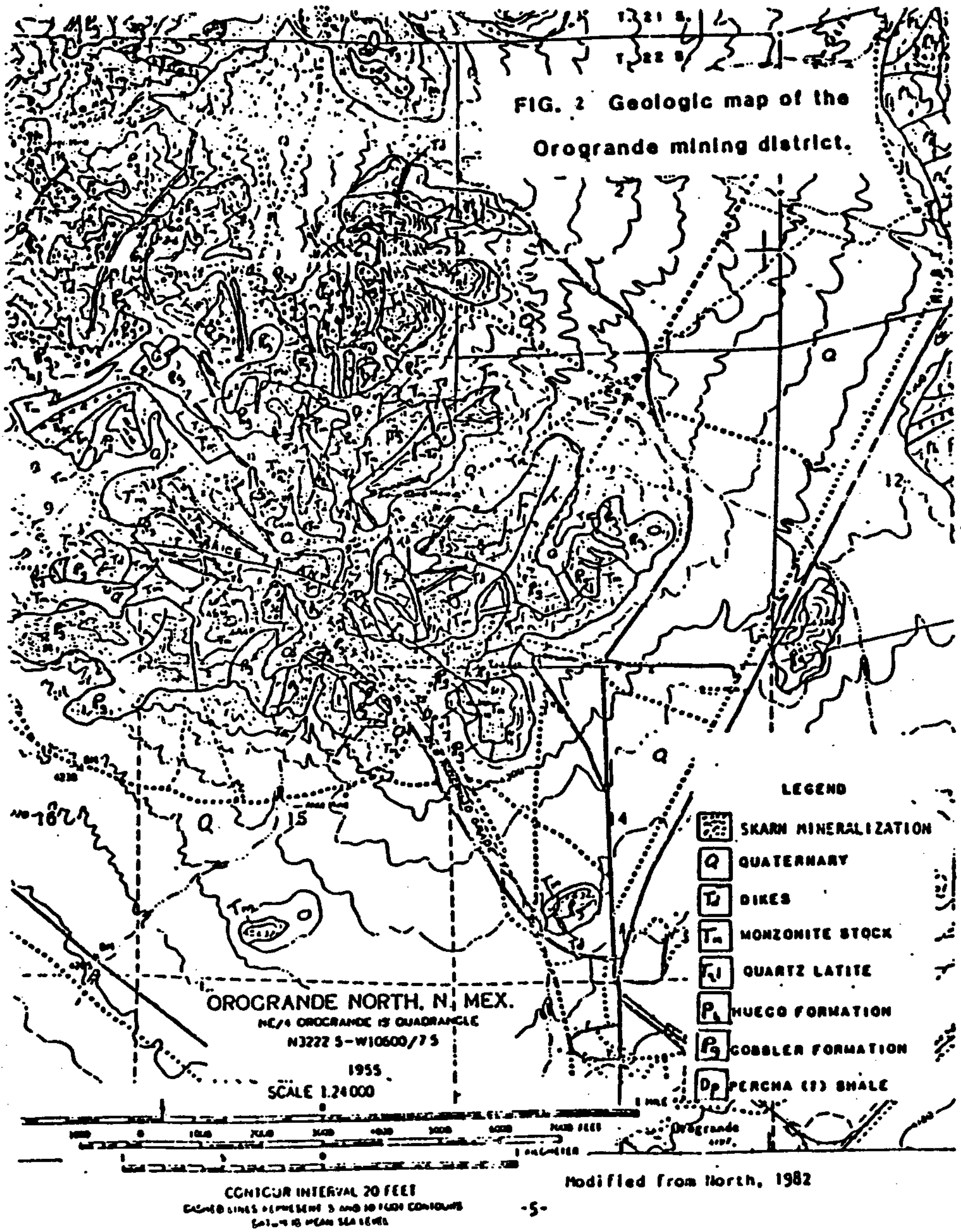

FIG. 2 Geologic map of the Orogrande mining district.

Modified from North, 1982

-5-

Turquoise, a supergene alteration mineral of copper, is found in the district. [illegible] ograde district since before the coming of the [illegible]

[illegible] st mining in the district was done by the Indians [illegible] ous prospecting in the district commenced in 1879 and by 1881, numerous prospects were in the development stage (North 1982). [illegible] at various levels of activity from 1883 through 1966. [illegible] production figures are not available, but from 1904 through 1966 the district produced approximately 1.5 million dollars in gold, silver, copper and lead and over [illegible],000 in iron (North, 1982).

Since 1967 the district has been under active exploration by various companies seeking additional skarn ore bodies or ore body extensions and for low-grade large tonnage porphyry copper deposits in the igneous intrusions (W.D. [illegible], personal communication 1986). Figure 3 is a claim map of the district [illegible] claims. Table 1, (North 1982) lists the patented [illegible] patent dates plus the owner at the time of patent. The claims in the Orogrande district appear to abut the White Sands Missile Range and possibly the Fort Bliss Military Reservation. The claims in the Orogrande district are [illegible] under mining lease and an active exploration program is in [illegible] communications, 1986). The exploration program is directed [illegible] sufficient tonnage to support a mining operation.

CONCLUSIONS

[illegible] ioration reports with the lithology and assay data [illegible] have been and are being conducted by the mining companies, make, it very difficult to draw definitive conclusions concerning the [illegible] grande mining district.

In the early 1970's there was considerable exploration activity directed at the igneous intrusive [illegible] in search of large tonnage, low-grade porphyry copper/molybdenum deposits. With the collapse of the base metal prices and the [illegible] prices, the exploration emphasis shifted to gold [illegible] is still on gold.

It is [illegible] professional opinion, based on the facts at hand, that [illegible] Orogrande [illegible] district has good potential for the discovery of additional skarn type base and precious metal deposits down dip in the Paleozoic sedimentary rocks along the flanks of the igneous intrusive bodies. These skarn ore [illegible] values and coproduct and byproduct base metal [illegible] exploration targets for the mining companies. To [illegible] ore bodies in the district but as has been pre- [illegible] discovery is definitely there. The district [illegible] 0 troy ounces of gold and over 45,000 troy ounces [illegible] g a price of $400.00/ounce for gold and $5.00/ [illegible] llar value is $6,400,000.00 for gold and $225,000.00

-6-

Figure 3

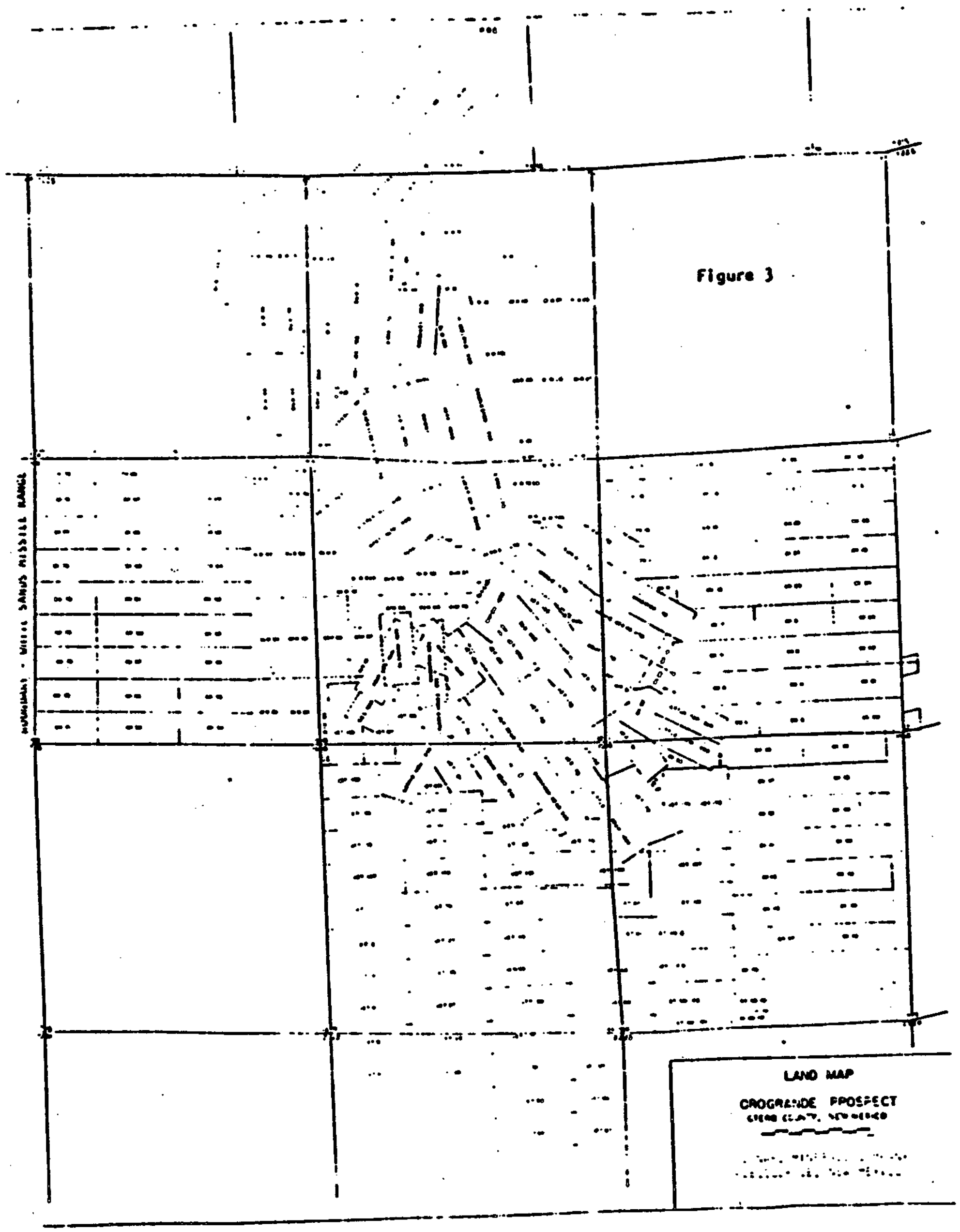

Table 1

Mineral Surveys in the Orogrande Mining District

NAME	SURVEY #	PATENT DATE	OWNER AT TIME OF SURVEY
Grizzly Bear Lode	534	3/13/1890	Jarilla Mining Company
Cinnamon Bear Lode	535	6/ 6/1890	" " "
Brown Bear Lode	536	6/ 6/1890	" " "
James Fisk Lode	591	9/ 4/1891	Southwestern Mining & Smelting Co
Iron Duke	592	8/19/1891	" " " " "
Providence	593	9/ 4/1891	" " " " "
Lone Star	594	3/19/1891	" " " " "
Lucky Group	984	11/26/1906	J.R. Burton
Alabama	1089	6/15/1903	Alabama Gold and Copper Mining Co
Nannie Baird Group	1170	5/16/1905	Jarilla Mining Company
Annie Rooney Lode	1171	no application	" " "
Little Annie Lode	1172	" "	" " "
Garnet Group	1180	1905	St. Louis United Copper Mining Co
Garnet Lode	1244	1/16/1908	Jarilla Mining Company
Emma Lode	1245	6/22/1907	" " "
Parallel Lode	1246	6/22/1907	" " "
Iron Queen Lode	1247	6/22/1907	" " "
Pasadena Lode	1248	6/22/1907	" " "
Fannie Lode	1249	6/22/1907	" " "
Adah Lode	1250	10/25/1907	" " "
Iron King	1251	12/ 5/1907	" " "
Macon Group	1252	3/ 3/1908	" " "
Copper King Group	1253	1/15/1908	" " "
Seven Come Eleven	1254	1/16/1908	Electric Mining & Milling Co.
Little Joe Group	1269	5/21/1907	Jarilla Copper Co.
Little Bear Lode	1333	5/26/1910	Minna Dieter
Raton Lode	1363	6/29/1911	Jarilla Copper Co.
Charleston Mine } Philadelphia Mine }	1434	10/ 1/1914	" " "
Horse Shoe Lode	1435	7/21/1915	Copper Hill Mines Co.
Copper Hill } Mont Alto }	1498	5/ 6/1913	W.H. Parrott
Contact	1714	———	Burro Mountain Copper Co.
Iron Duke Lode	1720	8/20/1926	" " " "
Luara Lode	1721	12/16/1926	Wm. L. Rutherford
Mary N. Fraction	1805	not patented	Oro Iron Co.
Cinco de Mayo	1815	———	" " "
Iron Drone Lode	1816	———	J.H. Parker, W.H. Winter
Virginia Group	1915	9/27/1925	

From North, 1982

for silver. When comparing ounces of gold and silver to the total ore tonnage produced, 136,816 (North, 1982), by the district the average overall ore grade for gold is 0.116 oz./ton and for silver is 0.33 oz./ton. The total copper production was 5.7 million pounds, (North, 1982), yielding approximately 42 pounds of copper to the ton or an average ore grade of 2.08% copper. It should be pointed out that the cutoff grade for heap, cyanide leach gold ore in the western U.S. mines ranges from 0.05 oz./ton to 0.15 oz./ton depending on the ore tonnage present. Therefore, the average gold ore grade for the district falls well within current mining grades. These ore grades offer good incentive to the mining industry to locate either extensions of known ore deposits or new deposits of sufficient tonnage, smaller seperate deposits may be mined simultaneously, that are currently concealed by alluvium or overlying sedimentary rocks or igneous sills (?).

The writer feels the above data in this report well supports the hypothesis that mining activity will start up in the Orogrande district in the near term. The advent of mining activity, with all the construction, blasting and heavy equipment movement, in the immediate vicinity of the Ground Based Laser experiment located at the Orogrande site will be detrimental to the laser project. In addition, there will be considerable competition for water as the ground water in the Orogrande area is quite saline and not suitable for either the laser project or mining operations.

The United States currently needs all the mineral resources that can be established inside the continental boundaries for its own economic and military security. Hence, the mineral resources of the Orogrande mining district should be permitted to be developed.

Respectfully submitted,
November 7, 1986

REGISTERED PROFESSIONAL
OREGON
W. Richard Hahman, Sr.
No. 2?3

W. Richard Hahman, Sr., P.G., C.P.G.
Las Cruces, New Mexico 88005

AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS
CERTIFICATE NUMBER
2764
AIPG
W. RICHARD HAHMAN SR.
CERTIFIED PROFESSIONAL GEOLOGIST

-9-

REFERENCES CITED

Beane, R.E., L.E. Jaramillo C, and M.S. Bloom, 1975, Geology and base metal mineralization of the southern Jarilla Mountains, Otero County, New Mexico: New Mexico Geological Society Guidebook, 26th Field Conference, Las Cruces Country, p. 151-156.

North, R.M., 1982, Geology and ore deposits of the Orogrande mining district, Otero County, New Mexico: New Mexico Bureau of Mines & Mineral Resources unpublished report for the 3rd New Mexico Mineral Symposium, November 1982, p. 21.

Schmidt, P.G. and C. Craddock, 1964, Geology of the Jarilla Mountains, Otero County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 82, p. 55.

U.S. Army Strategic Defense Command, 1986, Draft Environmental Impact Statement of the proposed Ground Based Free Electron Laser Technology Integration Experiment, White Sands Missile Range, New Mexico: U.S. Army Corps of Engineers, Huntsville, Alabama; Fort Worth, Texas.

-10-

required to move to other areas of GBFEL-TIE would be located at Stallion. In [illegible] Missile Command's Multiple Launch Rocket System (MLRS) [illegible]
[illegible]
target [illegible] area, located at the southern end of the Stallion site, for missile firings. Some of the missiles launched from the MLRS could conceivably contain live munitions.

The only potential conflict that would occur at the North of NASA site would involve the possible interference with NASA's Telemetry Data Relay Satellite System (TDRSS). Radio frequency (RF) and electromagnetic (EMI) interference generated by the GBFEL-TIE could be contained by proper shielding to preclude disturbances to the TDRSS.

The air space over the Orogrande site is utilized by drones for approaching missile launch sites and impact areas located along Nike Boulevard (WSMR Range Road 2). Scheduling in accordance with WSMR range control procedures would be required in order to assure that drones are not flown into the area during laser test runs. Additionally, Holloman AFB uses this air space for approach patterns of various aircraft. The area encompassed by the proposed GBFEL-TIE Orogrande site is also used for field training exercises conducted by the [illegible] Readiness Command and other agencies. Such exercises in this area would possibly be precluded if the Orogrande site is selected. Firings at various launch sites along Nike Boulevard require the road to be closed for periods ranging from one to two hours. These closures occur frequently, often more than once daily. Such closures may interfere with construction and operation of the proposed GBFEL-TIE. The Office of Tests Directorate (OTD) uses a laser range near the Orogrande site for tests involving laser sensors and infrared investigations. The RFI and EMI provided by the GBFEL-TIE could conflict with OTD's programs; however, RFI and EMI could be contained by proper shielding and schedule coordination to preclude disturbances to OTD's programs.

F. Controversial or Unresolved Issues

The primary unresolved issue remaining to date is the selection of the site for the proposed GBFEL-TIE. It is presently anticipated that a preferred alternative site will be identified in the Final EIS (FEIS). The analyses contained in this document as well as the comments to be received from agencies and the general public will facilitate this decision.

The other unresolved issues concerning this proposed project include:

- transmission line, road and railroad routes
- alternative water supplies
- power generation/energy storage devices

General analyses of the impacts of such rights-of-way are included in this document insofar as they are pertinent to selection of a project site. The specific routes of the various facilities would be identified after the final site selection has been made. It is possible that construction of some of these facilities would require a separate environmental analysis.

The final selection for water supply would also be made after the final site selection and after the Record of Decision has been filed. More detailed investigations may be required concerning the availability of water and technical, environmental and economic feasibility of the potential supply.

EXHIBIT IV

CHEMICAL ANALYSES OF WATER FROM WELLS IN THE RIO GRANDE VALLEY AND ADJACENT INTERMONTANE AREAS OF SOUTHERN NEW MEXICO 2

Analyses by New Mexico Department of Public Health (NMDPH), Terminal Testing Laboratories, Inc. (TTL), as noted in each case in remarks column. Chemical constituents in parts per million, unless otherwise stated.)

EXPLANATION

Location: See text for description of well numbering system.

Owner or Name: The owner or name of the well at the time of the sampling visit.

Abbreviations Used: RSC, residual sodium carbonate; ALK, Alkalinity; B, boron; Mn, manganese; Al, aluminum.

Location	Owner or Name	Date Collected	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na) and Potassium (K)	Sodium (Na)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids - Parts per million	Hardness as $CaCO_3$: Calcium-Magnesium	Hardness as $CaCO_3$: Non-Carbonate	Percent sodium	Sodium absorption ratio	Specific conductance (micromhos at 25°C)	pH	Remarks
[illegible]	USDA - Jornada Range, Middle Well	9-3-63	19	-	232	226	169	131	93	0	1368	33	.6	0	2073	1500	-	-	-	2610	7.3	[illegible]
[illegible]	USDA - Jornada Range, Western Well	9-3-63	5	-	400	7	139	135	136	0	1064	102	0	0	1600	1030	-			2156	7.1	[illegible]
[illegible]	USDA - Jornada Range, Maquro Well	9-3-62	6	-	60	33	64	56	119	0	233	33	3	6	505	393	-	-	-	643	7.6	[illegible]
[illegible]	New Mexico State Univ. Ranch, Wagner Well	9-3-63	30	-	32	16	100	93	139	0	196	30	3	2	510	134	-	-	-	713	7.35	[illegible]
[illegible]	USDA - Jornada Range, South Well	11-10-66	-	26	113	33	160	132	89	0	690	22	1.0	3.7	1235	490	-	-	-	1630	8.3	[illegible]
[illegible]	USDA - Jornada Range South Well	9-3-62	13	-	103	36	177	160	113	0	669	30	1.0	15	1130	403	-	-	-	1536	7.55	[illegible]
[illegible]	Brown Ranch	11-10-66	-	10	33	36	97	93	162	6	236	63	.33	6.6	663	285	-	-	-	935	8.6	[illegible]
[illegible]	I. A. Brown	9-3-62	13	-	30	36	103	100	191	0	256	46	.6	6	673	276	-	-	-	930	7.6	[illegible]
[illegible]	NASA Apollo Test Facility, Well B	3-63	10	13	133	18	-	300	190	0	630	168	1.1	-	1730	367	-	-	-	-	7.3	[illegible]
[illegible]	NASA Apollo Test Facility, Well C	3-63	10	05	160	116	-	300	216	0	362	133	1.6	-	1607	630	-	-	-	-	8.3	[illegible]
[illegible]	NASA Apollo Test Facility, Well A	3-63	-	05	-	-	-	-	99	0	713	110	2.1	-	-	340	-	-	-	-	-	[illegible]
[illegible]	USDA - Jornada Range, Taylor Well	9-3-63	10	-	116	67	103	102	183	0	306	163	1.0	30	1375	565	-	-	-	1700	7.35	[illegible]
[illegible]	USDA - Jornada Range Taylor Well	11-10-66	-	1.7	119	63	131	167	136	5	393	126	1.13	10	1295	573	-	-	-	1100	8.6	[illegible]

"Geology and Ground Water Resources of Central and Western Dona Ana County, NM", Water Resources Research Institute; Hydrologic Report 1.

EXHIBIT V

MOONGATE WATER CO. INC.
MW
382-5645

[illegible] Economic Development Council
[illegible] West Picacho
P. O. Drawer [illegible]
Las Cruces, NM 88004

[illegible]

[illegible] either the Primary, 1400 acre feet, and/or the Secondary, or Back-up supply, for the support systems, such as housing, construction, etc.

Water is available from Moongate Water Co., Inc., also the Rio Grande River surface water, and the Elephant Butte Reservoir.

Moongate Water has a total of 2100 acre ft. of water rights. We are presently using approximately 700 acre ft., which leaves 1300 acre ft. available. Moongate Water has also just completed a 7 mile water main extension running North on Holman Road, using 6" diameter Class 160 PVC pipe. This means that water is now available for a distance of 9 miles on Holman Road from Hwy 70, leaving a distance of approximately 14 miles to the SDI site. After obtaining all right-of-ways, clearing of land, etc., MOONGATE CAN HAVE A 6" WATER MAIN TO THE SITE AND BE ABLE TO SUPPLY WATER WITHIN APPROXIMATELY 90 DAYS.

By purchasing water rights from someone North of Elephant Butte Reservoir, water can be either pumped out of the Rio Grande or out of Elephant Butte Reservoir, to the site North of NASA either as Primary or Secondary.

Moongate Water Co., Inc. feels that the site north of NASA is the best site for this project, and stands ready, willing and able to start running pipe to supply the water needs of SDI.

[illegible]

[signature]

EXHIBIT VI

Las Cruces Sun-News
Thursday, October 30 1986

El Paso sinks as water is pumped from under it

EL PASO, Texas (AP) — The city of El Paso is sinking as water beneath the ground is pumped out, a new geological survey says.

The U.S. Geological Survey report says some bench marks have dropped 2½ inches to 5 inches since the early 1950s.

Larry Land, a hydrologist for the Geological Survey in Austin, said the gravel, sand, silt and clay underneath the far West Texas city are somewhat fluffy. As ground water is pumped out, the pressure on the sediments is reduced and they tend to collapse, he said.

"As water levels go down, the land's surface has got to go down," Land said.

The report said that since the turn of the century, when pumping of ground water in El Paso began in earnest, water levels in the Hueco Basin aquifer have dropped as much as 110 feet east of the Franklin Mountains and 150 feet beneath downtown El Paso.

Water levels have dropped as much as 125 feet in the downtown area in a separate, shallow aquifer within the sand and clay deposited by the Rio Grande, the report said.

Please see El Paso, Page 2A

El Paso—

From Page 1A

The study was done for the Geological Survey by Land and C.A. Armstrong in response to a proposed U.S. Bureau of Reclamation project to extend and re-line a network of canals that supplies Rio Grande water to El Paso Valley farmers.

There was concern that the effort to reduce seepage from the canals would reduce the amount of water going back into the aquifer enough to cause land to sink even more, Land said. But he said it appears seepage from the canals contributes little to recharging the aquifer.

The Bureau of Reclamation since has abandoned the canal project, but Land said the sinking of the city is inevitable and wouldn't be much worse if the canals were extended and rebuilt.

Land said, however, the Bureau of Reclamation's decision means the Geological Survey will not go ahead with a second phase of its El Paso study.

The Hueco Basin in the El Paso area has been replenished by ground water from the Hueco Basin in New Mexico and from runoff from the Franklin and Hueco mountains as well as rain seeping through the soil. Until the turn of the century, a significant amount of water seeped out of the aquifer to flow to the Rio Grande.

But pumping of ground water changed the direction of the flow, causing the Rio Grande and the canal system to become additional sources of water for the aquifer.

Seepage from the river to the aquifer has been increasing because of ground water pumping.

EXHIBIT VII

CULTURAL RESOURCES MANAGEMENT DIVISION

November 5, 1986

TO WHOM IT MAY CONCERN:

There are two serious problems with the statements made in the EIS in regard to cultural resources. First, the data generated to date are clearly inadequate for an assessment of the likely impact on cultural resources of the use of any of the three alternative sites. This matter is not one that requires the need for argumentation. A careful reading by anyone with the vaguest familiarity with cultural resources of the materials submitted will reveal the clear indications by those that prepared the statement for the EIS that their data were inadequate for the task at hand. In short, there are no extant data concerning cultural resources on which a meaningful evaluation of the three alternatives could be based.

Second, the EIS grossly overestimates the difficulties with the "NASA alternative". It is true that sites in this area are larger. Whether more effort would be required to mitigate numerous small sites or fewer large ones is a completely open

1

EXHIBIT VII

question in the absence of the research topics that should have been, but were not, included in the EIS. Most importantly, the concept of a "large site" is used as if such sites represented a major barrier to the project. The sites in question are not ones that compare to those at Chaco Canyon or Mesa Verde. They are, by southwestern standards, quite mundane sites that would require a relatively limited effort to mitigate if an impact to them was necessary for the successful development of the project.

Sincerely,

Fred Plog

Fred Plog
Director, Cultural Resources Management Division
Research Director, Goodyear/Celeron Archaeological Research Laboratory

2

EL PASO BusinessReview

EXHIBIT VIII

Most advanced archaeological research lab opens at NMSU

by Jane Thomas

The most advanced archaeological research laboratory in the world has opened in Las Cruces.

Corporate officers from Goodyear Tire and Rubber Co., its subsidiary Celeron Corp., and Continuum Corp. recently met in Las Cruces with New Mexico State University officials and invited guests to open the new Celeron/Goodyear Archaeological Research Laboratory near the NMSU campus.

Goodyear, through Celeron, in cooperation with NMSU and Continuum Corp. is responsible for the new lab.

The NMSU Cultural Resources Management Division, headed by Dr. Fred Plog, received a grant from Goodyear Celeron in 1985 to conduct all archaeological survey and excavation work along the course of the 1700-mile Celeron Pipeline and to establish the archaeological research laboratory.

The Celeron Pipeline — known to many as the All-American Pipeline — is the nation's longest heated crude oil pipeline. Phase I of the project — stretching from Santa Barbara, Cal., to McCamey, Texas, is within 15 miles of completion. Environmental clearance is now underway for Phase II, 450 miles from McCamey east to the Houston area. When it is completed, the pipeline will transport crude oil 1,768 miles from the California coast to the Gulf coast of Texas. It will be more than twice the length of the famous Trans-Alaskan Pipeline.

800 years old — Artist's sketch depicts the reconstruction of an 800-year-old headdress found in a burial site near Gillespie Dam in Arizona by archaeologists from New Mexico State.

Artifacts uncovered by the archaeological crews along the course of the pipeline are stored in the new research laboratory and analyzed there by the most revolutionary computer process yet developed for archaeological research.

NMSU's role in the project began with assistance in obtaining the more than 80 governmental agency approvals required in Phase I of the project — a major component of the approvals being the guarantee that sites to be impacted by pipeline construction would be protected.

The actual archaeological activities of the project included:

Survey—locating the sites that might be impacted by construction;

Resurvey—finding routes for the pipeline that avoided costly study by future archaeologists;

Excavation of those sites that must be destroyed because no alternative route could be found; and

Interpretation of the sites and the artifacts gleaned from them.

The sheer magnitude of the project presented major challenges to his staff, Plog said at the lab opening. Consistent field and lab methods had to be maintained to produce valid results — location of sites and the artifacts found in each

Please see RESEARCH page 46

Research

Continued from page 1

had to be mapped — and hundreds of thousands of artifacts had to be recovered, inventoried, stored and analyzed.

The NMSU Cultural Resources staff, aided by the University of California, Santa Barbara, and Texas A & M University in their own home environments, actually recovered physical evidence of human occupation in more than 400 sites — with many sites yet to be explored. More than 400,000 artifacts, the oldest of which date back to 8,000 B.C., are now stored in the new lab.

Three of the significant sites found include:

The Muleshoe Village site in east-central Arizona, dated approximately 1,000 A.D. It contained a burial site, projectile points, shell pendants, pots and information on eight structures.

The Gillespie Dam site southwest of Phoenix, dated approximately 1150 A.D., where archaeologists excavated three burial sites. The sites contained copper bells, the single largest collection of ... from southern Arizona ... 100,000 cotton, corn, bean and squash seeds, jewelry, and cloth woven of the finest thread known from the prehistoric southwest.

Fort Bliss sites contained pre-ceramic structures and burials revealing important information on pre-sedentary occupation of our El Paso area.

As significant as the finds themselves, of course, is the work of analyzing, dating and curating the items. To analyze the collection of artifacts, the laboratory utilizes an artificial intelligence computer system used for the first time in the U.S. The system was developed for this project by Dr. Art Karschmer of the NMSU Computing Research Laboratory.

The computer system uses a video camera, structured light, a digital scale, digital calipers and voice synthesizers in its analysis process as well as a bar code system to identify and keep inventory of the artifacts. It is able to instantly measure dimensions of a given artifact and provide a visual reconstruction of the entire original object. As analysis proceeds from one artifact to another, the system is able to discover mistakes or validate that the analysis is correct.

This technology, said Plog, provides a yet unequaled standard of precision in the observations of the physical characteristics of artifacts as well as minimizes, if not eliminates, the problem of bias created when humans with different training and different emotional states measure artifacts and provides archaeologists with a sophisticated data base management system to support timely analysis of hundreds of thousands of artifacts.

"Simply put, the Celeron Project has indeed succeeded," Plog said. "This project has allowed us to go where no archaeologist has gone before and do what no archaeologist has done before. And our findings now provide a basis for ... of the southwestern United States ... before ..."

In addition to his explanation of the NMSU role in the project and the laboratory, Plog also formally thanked Oren Shaffer, vice president and treasurer of Goodyear, and expressed special appreciation to the two men with whom he worked most closely in the project, Ron

Lab director — Dr. Fred Plog, director of the Cultural Resources Management Division at NMSU, headed the entire archaeological project along the 1,700-mile Celeron Pipeline project and now directs the Celeron/Goodyear Archaeological Research Lab near the NMSU campus.

Hinn, president, chief operating officer and project manager, Celeron Pipeline Corp., and Ken Topman, president of Continuum Corp. — the corporation charged with the overall coordination of the cultural resources aspects of the pipeline project.

Dr. James E. Halligan, president of NMSU, also thanked Goodyear and Celeron and expressed pride in the work of NMSU's Cultural Resources Management Division and Computing Research Laboratory.

The Celeron/Goodyear Archaeological Research Laboratory is located at 785 Telshor Blvd. in Las Cruces and is staffed by scholars and scientists from the NMSU Cultural Resources Management Division and Computing Research Laboratory under Plog's direction.

vary from a few seconds to many years, depending on which isotope is produced, but all would be at low levels of radioactivity. The materials which have ... stored in the beam dump vault.

3. Automatic Laser Safety Procedures

Light from the laser could be reflected or scattered in two ways: (1) diffuse scattering from small particles such as dust, clouds, and rain; or (2) specular scattering from mirror like surfaces such as a piece of polished metal or some insects. An object detection system would be incorporated to identify objects or particles that have the potential to cause diffuse or specular reflection before they enter the beam path. Detection of potential diffuse scatterers would be accomplished by using a low power, long wavelength laser beam which travels the same path as the FEL beam, but with a greater divergence. As objects enter the "detection" beam, light is reflected back to the beam director and an automatic shut-off system is triggered within less than a microsecond.

Larger objects (i.e., greater than 1.0 cm2) which have the potential to produce specular reflection are detected by a continuous short wavelength radar. This radar system would be operated before and during each test. Firing arc upon detection of an object, would automatically abort or preclude generation of the FEL beam.

4. External Safety Procedures

All keep out zones (i.e., security and/or safety) would be fenced and would be routinely guarded and checked during operation of any subsystem which could produce injuries. Keep out zones would be large enough to guarantee no human injury from radiation, accidental gas emissions, diffuse photon scatter, or potential electrical hazards. All chemical (e.g., POL, diesel fuel, etc.) and supply storage locations and evaporation ponds would be within the main security fences guarding the perimeter of the site.

The beam energies would be stopped by absorption by the target board and backstop and converted to heat during ground target testing. The beam would not go closer than one degree to the horizon for most ground targets.

For airborne targets, the FEL would begin to fire only when the test target is above an angle of 45 degrees to the local horizon during air target tests(2). Sufficient air space would be restricted to allow the laser beam to exit the airspace above 18,293 meters msl.

The eye safe limit for diffuse scattering could be met by a keep-out radius of approximately 1.0 km centered on the beam directors and any ground based targets.

The safe distance from small specular reflectors represented by a 1.0 square centimeter (cm2), perfectly reflective flat object would be approximately six km with absolute worst case assumptions. For realistic cases, one km, is judged adequate. There would be no safe keep out distance for a large specular reflection; the system must be designed to operate in concert with a tight air space control system which would cause termination of atmospheric propagation if a large object enters the vicinity of the beam.

EXHIBIT X

We will be forwarding material critical to this exhibit when it is available to our office.

EXHIBIT XI

ii

ABSTRACT

The New Mexico Public Service Company is considering locations for new power plants, and one site under consideration for a nuclear power plant is about 11 miles south of Alamogordo and 6 miles east of the eastern boundary of White Sands Missile Range.

The purpose of this report is to investigate the possible consequences of placing a nuclear power plant at such a location.

A nuclear power plant located at the proposed site would place a very heavy burden upon WSMR in taking those necessary precautions to keep malfunctioning missiles and drones from impacting in or near the plant. This could result in a significant increase in cost and manpower requirements; destruction of non-malfunctioning test vehicles; delay and difficulties in bringing new projects to WSMR; and a large urban buildup at the eastern boundary of the missile range, with its inevitable serious consequences.

The Nuclear Regulatory Commission considers the probability of an object impacting upon and penetrating the protective domes of a nuclear power plant to be unacceptable if it exceeds 10^{-7} per year. This study indicates that the probability of WSMR objects impacting at the nuclear site, with sufficient momentum to perforate a reinforced concrete barrier, 5000 psi strength and four feet thick, is 1.0×10^{-5} per year, which is 100 times as great as the specified level.

required to move to other areas if GBFEL-TIE would be located at Stallion. In addition, U.S. Missile Command's Multiple Launch Rocket System (MLRS) program [illegible] approval to use the Stallion [illegible] Impact Target (Fall) area, located at the southern end of the Stallion site, for missile firings. Some of the missiles launched from the MLRS could conceivably contain live munitions.

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- alternative water supplies
- power generation/energy storage devices

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The final selection for water supply would also be made after the final site selection and after the Record of Decision has been filed. More detailed investigations may be required concerning the availability of water and [illegible] feasibility of the potential supply.

City of Las Cruces

October 21, 1986

Colonel James F. McNulty
Project Manager, GBFEL-TIE Project
Strategic Defense Command
United States Army
White Sands Missile Range, NM 88002

Dear Colonel McNulty:

The City Council of the City of Las Cruces, New Mexico, at their meeting of October 20, 1986, directed that I express to you their concern with the technical studies involved with the Ground Based Free Electron Laser - Technology Integration Experiment (GBFEL-TIE) draft Environmental Impact Statement (EIS). They strongly support further study and research on these sites.

The technical merits of the north of NASA site were not fully discussed in the GBFEL-TIE draft EIS, and our Economic Development Council feels that there are inconsistencies in judgments regarding the desirability of the considered New Mexico sites.

The City Council believes that the significance of this project to the residents of our region, as well as Las Cruces itself, warrants further consideration and re-evaluation for consideration of the north of NASA site.

Thank you.

Sincerely,

David M. Steinborn
Mayor

dw

W-5.1	Additional analyses have been conducted and the results have been incorporated throughout the FEIS.
W-5.2	Thank you for your comment.
W-5.3	Please see Response W-5.1

P O DRAWER CLC
AN EQUAL OPPORTUNITY EMPLOYER
LAS CRUCES, NEW MEXICO 88004
PHONE 505 526 0000

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New Mexico State Senate

Santa Fe

Member
CORPORATIONS
RULES
RE-EVALUATION
Vice Chairman:
INDUSTRIAL & AGRICULTURAL
FINANCE AUTHORITY OVERSIGHT
Member
NATIONAL CONFERENCE OF
STATE LEGISLATURES
ARTS TOURISM & CULTURAL RESOURCE
TASK FORCE:
Member:
EL PASO ELECTRIC CO.
RATE MODERATION
FIREARMS PREEMPTION
STATUTE REVIEW

November 5, 1986

Strategic Defense Command

SUBJECT: SDI Site, North of NASA, Dona Ana County, New Mexico

Dear Colonel McNulty:

I cannot speak for the entire legislative delegation of Dona Ana County; however, most of us are supportive of the selection of the above referenced site for SDI.

Recently, it was clearly ascertained in negotiations with the USSR that this research project is of extreme value to our country. Delay in putting it into effect should be kept to a minimum. — W-6.1 Thank you for your comment.

In my opinion, Las Cruces, Dona Ana County and the state of New Mexico will support you in every way possible. In reading the feasibily study on the sites, it was at once apparent to anyone familiar with this area that many items either had been overlooked, or given only a cursory glance. — W-6.2 Thank you for your comment.

I encourage you to look once more - more thoroughly - and to choose the obviously superior site - North of NASA in Dona Ana County. — W-6.3 Please see Response W-5.1

Yours very truly,

ELLEN LIVELY STEELE

ELS/in

JUDITH & HAROLD REYNOLDS
1817 COLLEGE AVE.
ALAMOGORDO, NM
88310

9 NOV 86

To: Corps of Engineers
From: Harold C. Reynolds
1817 College Ave.
Alamogordo, NM
88310

Subject: Ground Based Free Electron Laser Technology Integration Experiment

The impact of 2500 construction workers and their families on our little community would be devastating, both when they arrive and when they leave. Also, your project would have a serious impact upon the water supply underground in our area.

We believe that Las Cruces can handle the impacts of your project much better than we can.

Therefore we request that you locate your project at the NASA site north-east of Las Cruces.

Harold C. Reynolds

W-7.1 Our predictions are that if the Orogrande site were selected, many of the people would live in Las Cruces and El Paso, in addition to Alamogordo. This distribution and the gradual influx of workers would mitigate any adverse effect on Alamogordo's socioeconomic resources.

W-7.2 The degree of impact on water resources is discussed in the FEIS, Chapter IV.

W-7.3 Thank you for your comment.

W-7.4 Thank you for your comment.

MOONGATE WATER CO. INC.
382-5845

November 7, 1986

U. S. Army Corps of Engineers
Fort Worth District
P. O. Box 17300
Fort Worth, TX 76102-0300
ATTN; SWFPL-R

REF: SDI Site, North of NASA

Dear Sirs:

Moongate Water Co., Inc. has the resources to supply the water needed for PHASE I. We are able to supply the Primary, 1400 acre feet, and/or the Secondary, or Back-up supply, for all the support systems.

Moongate Water Co., Inc. supports the proposed site North of NASA, approximately 23 miles North on Holman Road, off of Highway 70 East, for the following reasons:

A. Water availability
B. Housing
C. Airport
D. Commercial and industrial area
E. Buffer zone
F. Road links
G. Land for future expansion
H. Support from Las Cruces
I. Security
J. Railroad
K. Economics

W-8.1 Thank you for your comment.

A. Water availability. Water is available from Moongate Water Co., Inc., also from the Rio Grande River surface water, and the Elephant Butte Reservoir.

Moongate Water has a total of 2100 acre ft. of water rights. We are presently using approximately 300 acre ft., which leaves 1800 acre ft. available. Moongate Water has also just completed a 7 mile water main extension running North on Holman Road, using 6" diameter Class 160 PVC pipe. This means that water is now available for a distance of 9 miles on Holman Road, North of Hwy 70, leaving a distance of approximately 14 miles to the SDI site. After obtaining all right-of-ways, and clearing of land,

W-8.2 The sections concerning potential water supplies have been revised and include identification of the most cost effective alternative supply for each site (pp. IV-36 through IV-38 and Table II-3 of the FEIS).

Cont'd

P.O. Box 243 • Organ, New Mexico 88052

<u>MOONGATE CAN HAVE A 6" WATER MAIN TO THE SITE AND BE ABLE TO SUPPLY WATER WITHIN APPROXIMATELY 90 DAYS.</u>

By purchasing water rights from someone North of Elephant Butte Reservoir, water can be either pumped out of the Rio Grande or out of Elephant Butte Reservoir, to the site North of NASA either as Primary of Secondary.

B. <u>Housing</u>. Moongate Water feels that by opening an area approximately 9 miles long and 4 miles wide on Holman Road, where water is available, we have provided you with a very desireable area for temporary construction housing as well as permanent residential sites. Development of this area would provide a feasible residential support area for the proposed SDI site.

W-8.3 Thank you for your comment.

C. <u>Airport</u>. A small existing airport approximately 18 miles South of the proposed site could be easily expanded to provide commercial as well as passenger service.

W-8.4 Thank you for your comment.

D. <u>Commercial and industrial area.</u> Both sides of Holman Road could be commercially zoned for motels, restaurants, stores, and office buildings with an additional area to the north available for industrial use. This will provide a very good area for any support systems that need to be in close proximity to the site.

W-8.5 Thank you for your comment.

E. <u>Buffer zone</u>. The aforementioned private land is located in an area that allows for a 2 mile buffer zone between the private land and the NASA site on the East; a 14 mile buffer zone between private land and the SDI site to the North; and the Jornada Experimental Range providing a substantial buffer zone on the West.

W-8.6 Thank you for your comment.

F. <u>Roads</u>. At the present time there are many existing dirt roads which can be paved in order to provide a highway network linking other NASA sites, Holman Road, Highway 70, I-25, Radium Springs, Upham, and Rincon. The possibility of a Hwy 70 Southern By-pass will provide quick access from the Hilton Hotel, the New Mexico State University, central Las Cruces, and points south. Additionally, a Northern By-pass for Hwy 70 will give quick access to all points North of Las Cruces.

W-8.7 Thank you for your comment.

G. <u>Land for future expansion.</u> The future availability of land is evident as the majority of land belongs to the BLM, the military, the Jornada Experimental Range, and the State of New Mexico, making the acquisition cost very reasonable.

W-8.8 Thank you for your comment.

H. <u>Support from Las Cruces.</u> The reception and support from the Las Cruces area for this proposal is excellent. Federal, state, county, and city

W-8.9 Thank you for your comment.

Cont'd

personnel, area business leaders, including construction companies, banking institutions, realtors, retail merchants, and numerous service organizations-American Legion, VFW, Lions Club, Kiwanas Club-have voiced their support and approval for the construction of the SDI installation in this region.

I. <u>Security</u>. Security will be a much easier task because of the mountain range to the east and the fact that the site would be surrounded by government land. Therefore, it would be no problem to place check points and/or guard houses on the roads.

W-8.10 Thank you for your comment.

J. <u>Railroad</u>. A railroad spur could be provided just north of Rincon. The terrain from Rincon east to the site is fairly flat, minimizing the cost of laying track for the approximate 26 miles.

W-8.11 Thank you for your comment.

K. <u>Economics</u>. Placing the SDI site here would be an economic shot in the arm for the City of Las Cruces and the County of Dona Ana by making a wide range of jobs available, developing the land, improving and creating highway networks, and in many other ways too numerous to list. The establishment of the site in this location would result in the permanent enhancement of this entire area.

W-8.12 Thank you for your comment.

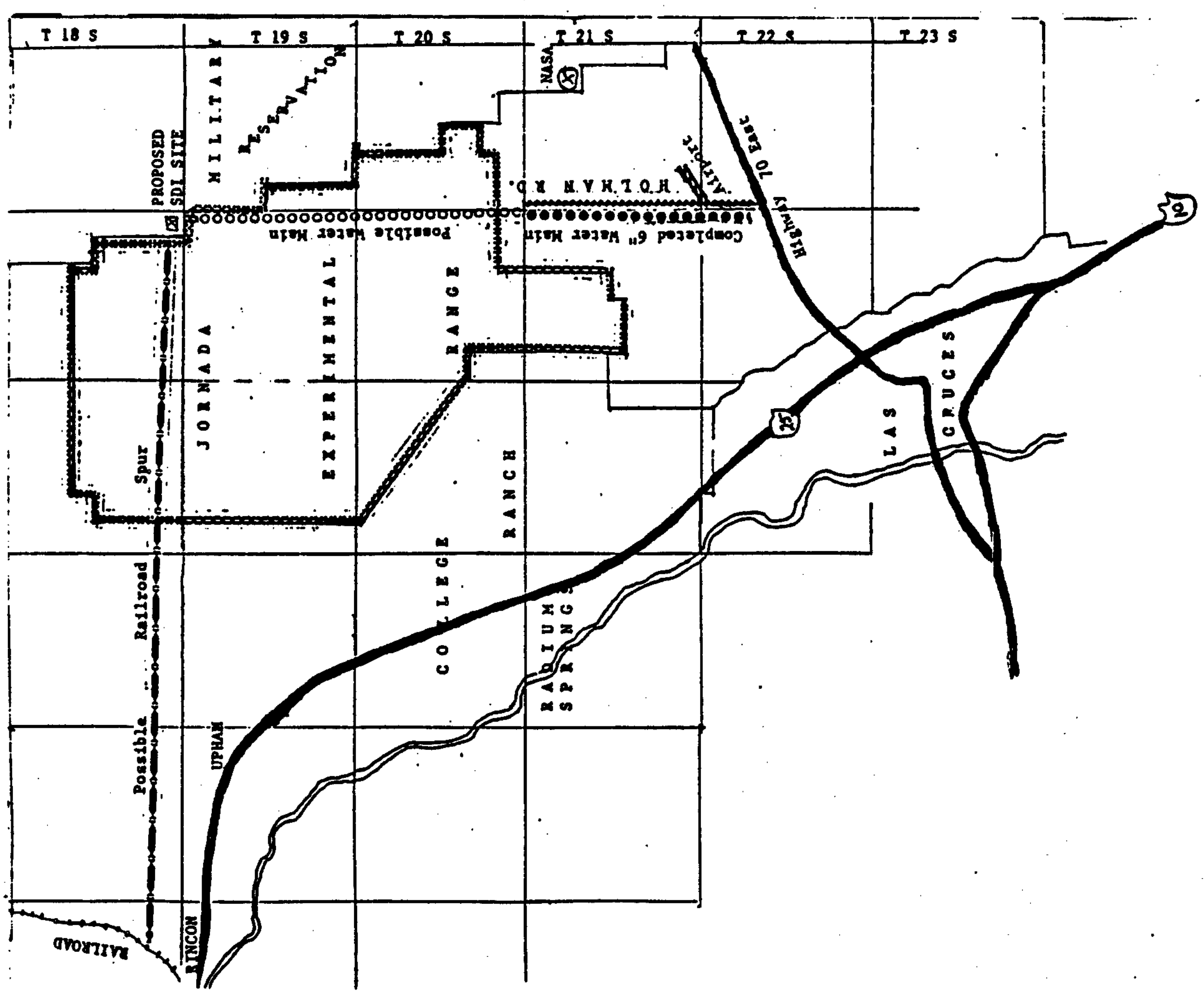
In summation, Moongate Water Co., Inc. realizing the importance of the SDI project in our country's overall defense system, would like to add their support to the Greater Las Cruces Economic Development Council, the City of Las Cruces, and the County of Dona Ana for the location of the SDI site North of NASA. Because of the aforementioned reasons, we feel that this is the most advantageous of the sites now under consideration. We stand ready, willing and able to begin construction of the pipeline to supply the water needs of SDI.

W-8.13 Thank you for your comment.

Sincerely,

Louis A. Gariano
President

/tog
enc/ Map of area
cc/Senator Pete Domenici



T 18 S
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PROPOSED SDI SITE
MILITARY RESERVATION
NASA
HOLMAN RD.
Airport
Highway 70 East
Completed 6" Water Main
Possible Water Main
JORNADA EXPERIMENTAL RANGE
COLLEGE RANCH
RADIUM SPRINGS
LAS CRUCES
Possible Railroad Spur
UPHAM
RINCON
RAILROAD

November 17, 1986

District Manager
U.S. Army Corps of Engineers
Fort Worth District
Attn: SWFPL-R (Mz Griffith)
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Mz Griffith:

Inclosed are my comments to the Draft Environmental Impact Statement of the Proposed Ground Based Free Electron Laser Technology Integration Experiment, White Sands Missile Range, New Mexico, September 1986.

My comments concern two (2) aspects of the draft EIS that cause me to evaluate the document as an inadequate response to the Army's responsibility under applicable law and regulation to adequately identify the location of the action it proposes, the environmental consequences of that action, and the proposed mitigation of those consequences. The comments principally are concerned with the historic resources to be effected by the proposed undertaking.

1. NO SPECIFICATION OF A PREFERRED ALTERNATIVE:

The data in the draft are sufficient to conclude that there are substantial numbers of historic resources of probable Nation Register quality in all three of the identified alternative locations. However, no preferred location is identified, and concerned members of the public are prevented from focusing their review and comments on the character and magnitude of the effects of the proposed undertaking.

W-9.1

The CEQ regulations (40CFR1502.14e) do not require identification of a preferred alternative in the draft if such a preference does not yet exist. It has been USASDC's intent from the outset of the NEPA process to carefully consider environmental and other factors bearing on site selection in a through and balanced fashion.

Given this commitment to informed, balanced decision making, USASDC believed it would have been premature to determine a site preference before the relevant information--including public comments on the Draft EIS--was available. In this regard, the public is given a meaningful opportunity to help influence the site selection, rather than being forced to comment on a premature determination.

In my opinion, failure to identify a preferred alternative is a violation of the spirit and intent of 40 CFR 1502. This Federal regulation makes several references to a "preferred alternative;" and one presumes its intent is to cause the public to be informed as accurately as possible about the intentions of a Federal Agency complying with that regulation. Clearly, without such identification the public is not well informed of those intentions, and it is thereby prevented from commenting effectively upon them. Equally clearly, the broad, underlying intent of public disclosure inherent in the EIS process is thereby subverted.

Even a casual reader of the draft EIS would conclude that selection of the Orogrande alternative very probably would result in the least environmental damage and the least effect to historic resources. It also appears that the cost of constructing supporting utilities (power lines, roads, etc) would be substantially lower at this location. That this location was not identified as the preferred is both surprising and disturbing.

W-9.2

Thank you for your comment.

That the Army failed to identify the Orogrande alternative (or another preferred alternative) suggests several things, none of which are a credit to the Army as an agency supported by the tax paying public: 1) The Army has not done sufficient analysis of the environmental consequences of the locational alternatives to permit identification of a preferred alternative. In this event, the draft EIS is premature and contrary to the clear analytical and public disclosure intentions of the National Environmental Policy Act and its implementing regulations. 2) the Army has identified its preferred alternative, but it does not choose to disclose its choice in order to diffuse public criticism. Such action clearly would be contrary to public disclosure requirements of the EIS process; 3) the Army intends to make its locational decision out of public view and to announce this decision in the final EIS when there is no opportunity for public review and response to that decision. Again, such action would be contrary to the intent of public disclosure. 4) The Army may have chosen to select its preferred alternative without regard to the environmental consequences of that alternative.

W-9.3 A preferred alternative was not identified in the DEIS because one had not been selected. The Council on Environmental Quality's regulations for implementing NEPA state that a preferred alternative may be included in the DEIS, if one is available. Also, please see Response W-9.1.

In my opinion, the public deserves a thoughtful and rational explanation of the facts that prevented selection and disclosure of a preferred alternative. And, I request that explanation.

2. LACK OF SPECIFICITY CONCERNING PROPOSED MITIGATION MEASURES:

Para G, Section V, Cultural Resources: This section does not evidence that the Army intends to mitigate the substantial effect on historic resources that probably will result if any of the three identified alternatives is selected. This section contains language so vague and noncommittal that readers are uncertain whether any responsible mitigation is proposed. There is a commitment to conduct a 100% percent [discovery] archaeological survey, and there is a statement that utility corridors somehow will be designed to avoid historic resources. There is little else to be gleaned from the draft.

W-9.4 The 100% survey would be conducted in order to identify the extant historic resources at the preferred alternative site. Identification of these resources is required before a detailed mitigation plan can be developed. The preliminary surveys conducted at each site provided a basis of comparison only. The FEIS states that a mitigation plan will be developed and coordinated through WSMR ENRO, New Mexico SHPO, and Advisory Council. The mitigation plan would contain avoidance of historic resources as the first strategy but may require surface collection, excavation and curation. It will be developed in full compliance with the existing Programmatic Memorandum of Agreement (PMOA) between WSMR, New Mexico SHPO and the Advisory Council on Historic Preservation (appendix G of the DEIS)

For example, the comment that historic resources "may require excavation, analysis, and archival curation" (emphasis mine) does not describe any mitigation program that can be reviewed and evaluated; further, it does not even acknowledge those data reported in the draft that evidence a substantial number of historic resources in all three alternative areas. The statement does not evidence any commitment to any mitigation.

Some of the important questions that need to be answered are : 1) Does the Army propose to conduct a professional, responsible, adequate mitigation program? 2) Who will be responsible for such a program? 3) What is the general mitigation strategy? Note that a response that says something like "mitigation is being planned" would be evasive and non-responsive.

W-9.5 A contract has recently been awarded by the U.S. Army Corps of Engineers for professional services needed to insure compliance with laws relating to cultural resources. The U.S. Army SDC and White Sands Missile Range would share the responsibility for this program. The general strategy would be to avoid historic resources to the maximum extent practicable; however, as indicated in the FEIS excavation and archival curation may be required.

The statement that "Any additional sites that are discovered by construction crews during field operations shall be immediately reported..." provides further evidence that the Army has not thoughtfully identified the mitigation problems associated with the non-renewable historic resources in the project area(s). It statement is evasive, and/or it evidences a naive assumption that construction crews will

W-9.6 The USASDC will have an archeologist(s) on-site during construction which requires grading or clearing previously undisturbed areas to assure that impacts to cultural resources are minimized to the maximum extent practicable.

recognize historic resources and that those crews will stop construction work to report those resources when they are recognized. This assumption is contradicted by actual experience except in those cases where construction work is monitored by trained archaeologists with the authority to stop construction work. What "in field" monitoring will be conducted by what personnel having the requisite authority to insure that this commitment is in fact honored?

Given that no preferred alternative is identified and that there is no commitment to mitigate the effects of the proposed undertaking, I cannot provide critical evaluation and comment about the environmental effects of, and the appropriateness of the mitigation for, the proposed action. The draft EIS discloses of little more than the action is proposed for one of three possible locations, that damage to historic resources will occur, and that no specific mitigation strategy is proposed. The draft represents an inadequate disclosure of 1) the effects of the undertaking at an unspecified location and 2) the proposed mitigations to those (undisclosed) effects.

W-9.7 The Identification of a preferred alternative and disclosure of impacts have been in accordance with CEQ regulations.

3. RECOMMENDATIONS:

Accordingly, it is requested that a revised draft EIS be developed and circulated for review in accordance with Para (a), 40 CFR 1502.9 which stipulates that "If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft..." And, the agency "...shall make every effort to disclose and discuss...all major points of view on the environmental impacts of the alternatives including the proposed action."

W-9.8 All available pertinent information has been disclosed; this material is sufficient to enable meaningful analyses in support of an informed site selection decision. A revised DEIS has not been prepared.

Also, a Federal regulation that specifically is concerned with historic resources [36 CFR 800, Para 800.1 (2)(iv) (September 2, 1986)] stipulates that "The Agency Official...should seek and consider the views of the public when taking steps to identify historic properties, evaluate effects, and develop alternatives." The draft EIS contains no evidence that this stipulation has been met. There likewise is no evidence that the other stipulations of this regulation are to be honored. Will the Army comply with the cited and the other provisions of 36 CFR 800? If the answer to this question is "yes," then explain the strategy by which that compliance will be achieved, and explain how public involvement will be facilitated.

W-9.9 Sample surveying was accomplished prior to the implementation of the revised 36 CFR 800 rules, including paragraph 1(c)(2)(iv). Future actions will comply with the new 36 CFR 800 regulations; however, consultation has already been undertaken for White Sands Missile Range programs (see Appendix G of the DEIS).

If the Army determines that the opinions, requests, and recommendations documented by these comments are not valid, then it is requested that the bases of the Army's determination be made public by reference to specifically identified, and interpreted, language and sections of applicable Federal environmental and historic resources laws and regulations.

W-9.10 Please see Responses W-9.1 through W-9.9

Glen D. DeGarmo, Ph.D.
5721 North Stanton St.
El Paso, TX 79912

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS
FORT BLISS, TEXAS 79916-5000

REPLY TO
ATTENTION OF

14 NOV 1986

ATZC-DEH-E

SUBJECT: Draft EIS of the GBFEL-TIF, WSMR, New Mexico, Sep 86

District Engineer
U.S. Army Corps of Engineers
Fort Worth District
ATTN: SWFPL-R (Ms Griffith)
P.O. Box 17300
Fort Worth, Texas 76102-0300

1. Pursuant to your request for comments, the following is provided in response to subject EIS.

a. GENERAL COMMENT: The Draft Environmental Impact Statement (EIS) of the Proposed Ground Based Free Electron Laser Technoloy Integration Experiment (GBFEL-TIF), White Sands Missile Range (WSMR), New Mexico, Sep 86 is evaluated as an inadequate public disclosure document. It does not disclose a preferred alternative as discussed in Para (e), 40 CFR 1502.14; it does not adequately disclose the relative impacts associated with the various alternatives as discussed in para (b), 40 CFR 1502.14; and it does not identify appropriate mitigation measures as discussed in Para (f), 40 CFR 1502.14.

W-10.1 Please see Response O-61.1 and Response W-9.1. In addition, para (b) 40 CFR 1502.14 is adhered to since impacts are described for each site throughout Chapter IV of the FEIS and summarized in Chapter II. Mitigation measures are discussed in chapter V of the Draft and Final EIS as is allowed by para (h), 40 CFR 1502.16.

(1) A reasonable person would interpret Para (e) of 40 CFR 1502.14 as requiring the proponent of a proposed action to make all practical efforts to identify a preferred alternative: Agencies shall "Identify the agency's preferred alternative or alternatives, if one or more exists..." Given the amount of effort that evidently has been expended to produce the EIS, it is unreasonable to think that the Army has not identified one of the alternatives as preferred. For example, given the data described in the EIS the Orogrande alternative easily is evaluated as probably resulting in the least damage to biological and historic resources. This alternative also apparently would result in the least costly construction effort. If this alternative is not the preferred, then the Army should explain the uncertainties and inadequacies in the data that have prevented its selection (or the selection of another not so obvious alternative).

W-10.2 Please see Response O-61.1 and Response W-9.1

(2) In complying with Para (a), (b), and (d), 40 CFR 1502.16 which require discussion of ""Direct effects and their significance," "Indirect effects and their significance, and "The environmental effects of the alternatives..." a critical and expected element of an EIS is a matrix of "scores" that disclose the proponent agency's evaluations of the relative severity of predicted impacts of the alternatives with respect to various classes of environmental resources.

W-10.3 Relative impacts on all resources are displayed in Tables II-1 through II-3 and Table II-6 of the FEIS. Physical, biological, historic and socioeconomic resources are even further reduced to an overall impact evaluation in Table II-7 and thoroughly discussed in Chapter IV by resource and site.

There is no such matrix, or even a summary synthesis statement, that discloses the results of the Army evaluations of relative direct and indirect impacts. If there have been no such evaluations, then the Army is deficient in its analysis of the effects of the alternatives. If there have been such evaluations, then the Army is deficient for not disclosing the results of its evaluations. In either case the public is denied an important element of disclosure concerned with the predicted effects of the different alternatives.

(3) The EIS is deficient for inadequately disclosing the mitigations proposed for the various impacts expected from the proposed action as required by Para (h), 40 CFR 1502.16. There is no disclosure of the short-term mitigations or of the long-term mitigations that may include monitoring and subsequent remedial action. In fact, there is no clear commitment to conduct any specific mitigations at all. Thus, the interested public cannot comment effectively on whether or not the undisclosed mitigations will be effective responses to the proposed action at an undisclosed location.

W-10.4 The mitigation section has been revised to incorporate data received and coordinated through the USFWS, NMGF and WSMR ENRO. A specific mitigation plan for historic resources and other sensitive resources will be prepared after specific surveys have been conducted to determine the presence or absence of such resources as well as their significance. These surveys should be conducted prior to commencement of construction activities.

b. SPECIFIC COMMENTS:

(1) There is no disclosure of the impacts expected from probable expansion of the required facilities to accommodate the high energy phase of the proposed experiments. Figures 1-4 through 1-6 depicting the orientation of the proposed facilities, do not indicate the direction in which the lasers will fire or the direction of expansion of facilities needed for the high energy phase. The EIS is deficient in that it does not discuss the additional and subsequent impacts that would occur if the expansion is in fact required. For example, there is no discussion of whether or not the direction of fire and the expansion would impact on the field training activities conducted on Fort Bliss. Neither is there discussion of the expected impacts on the San Andres National Wildlife Refuge or the Jornado Research Station. Note that the selection process will result in a "lock in" with regard to the placement of required expansion. Thus, the public is being asked to provide comment about a proposed action whose preferred location is not disclosed and whose impacts resulting from probable expansion at the selected alternative are not discussed.

W-10.5 Potential impacts that would be expected to occur as a result of the high power phase have been addressed as explained on page I-1. The entire facility including the second phase structures will be contained within the area illustrated in the DEIS. The long areas extending from the laser facility depicted in Figures I-4 through I-6 are the ground target ranges which provide a direction of firing for the laser. These figures have been explicitly labelled in the FEIS to preclude further confusion.

(2) Ref. para 7, pg I-19: maximum instantaneous power requirements are stated to be 1,000 megawatts. Can this power be supplied without disrupting other electrical users in the region. For example, what will happen to sensitive electronic equipment such as computers when this high level peak demand is made?

W-10.6 The maximum power requirement would occur in the second phase at which time a power storage and/or generation facility might be constructed to supply this instantaneous demand. No disruptions to other electrical users would be expected even if grid power is used due to power company staility constraints.

(3) Ref. para 10(2)c: Is desalinization of salty groundwater no longer a feasible alternative to importing freshwater? Desalinization would be a possible mitigation measure to reduce impacts of additional mining of the finite freshwater supplies of the region.

W-10.7 Desalinization is not considered necessary. The 1400 acre-feet of water is the maximum amount that would be used. Water conservation measures such as closed loop cooling system and air exchange cooling systems would be utilized whenever practicable.

(4) Ref. para E, pgs I-30 to I-36: What conflicts are not resolvable? For example, the Orogrande alternative is suggested to be in conflict with field training exercises. However, such exercises have been conducted on White Sands

W-10.8 The referenced paragraphs do not state that these issues are unresolvable; they were, however, unresolved at the time the DEIS was released. There is no expected impact to field training exercises of Ft. Bliss if the Orogrande site is utilized for the GBFEL-TIE.

only once in the recent past; previous major field exercises have been conducted successfully on adjacent Fort Bliss using the 350,000 acres of existing maneuver area. There appears to be no unresolvable conflict unless there are 1) undisclosed aspects of the laser tests that would preclude field maneuver on adjacent areas of Fort Bliss or 2) the equipment and facilities are sensitive to degradation caused by field training. Are either of these possibilities present?

(5) Ref. pgs III-68, III-69, and IV-33 through -35, Water Resources: The expected impacts of the action's water requirements, especially during drought need to be discussed. Specifically the mining of water needs to be evaluated for the effect on: 1) the Bosque del Apache National Wildlife Refuge and the Rio Grande River, both of which are important wildlife areas, 2) farms in the Rio Grande Valley, 3) the Jornada Experimental Station, 4) the Soledad watershed which could lose perennial springs and streams important for the survival of local wildlife. Mitigation measures for each identified impact should be discussed.

W-10.9 Please see Responses 0-66.5 through 0-66.7

(6) Ref. pg IV-9, Section F: Pseudo-riparian (also called arroyo riparian) habitat is extremely important to many species of desert wildlife, and it is one of the least extensive types of habitat in the region. Discuss the impacts of the various alternatives on this critical habitat type.

W-10.10 The FEIS has been revised to incorporate this discussion (p IV-11 of the FEIS).

(7) Ref. para G, pg V-3, Cultural (sic) Resources: The discussion of historic resources in the EIS is an inadequate disclosure of the effects of the proposed action and of a responsive proposed mitigation. It clearly is evident that a substantial historic resource is present in each of the alternative areas. Yet, there is no disclosure of either a general or a specific proposed mitigation strategy for the non-renewable historic resources.

W-10.11 Please see Response W-9.4 and Response W-9.8.

(a) The statement that these resources "may require excavation, analysis, and archival curation." does not disclose any mitigation strategy. The statement is vacuous as a proposed mitigation, for it does not even acknowledge that mitigation will be conducted.

W-10.12 Please see Response W-9.4

(b) Further, the statement that "Any additional sites that are discovered by construction crews during field operations shall be immediately reported..." is misleading. For, it proposes that construction crew personnel are trained to recognize historic resources when they are encountered and that those personnel will report such resources when encountered; general experience with construction crews on other projects causes these propositions to be dubious, unfounded, and misleading at best. The statement does not represent a responsible mitigation proposal.

W-10.13 Please see Response W-9.6

(c) Finally, Para 800.1 (2)(iv), 36 CFR 800, September 2, 1986 states that "The Agency Official...should seek and consider the views of the public when taking steps to identify historic properties, evaluate effects, and develop alternatives." Since the EIS does not evidence public involvement in the discussion of the historic resources, of the locational alternatives, or of a mitigation strategy, it does not satisfy the quoted requirement. Accordingly,

W-10.14 Please see Response W-9.9

it is requested that such public involvement be solicited and that a mitigation strategy be developed that adheres to professional standards of quality. The resultant draft mitigation strategy should be circulated for critical review and comment.

2. If you have any questions on these comments, contact Mr Rab, Chief, Environmental Management Office, DEH, at AUTOVON 978-7930/5502.

FOR THE COMMANDER:

JOSEPH P. KISH
Colonel, EN
Director, Engineering and Housing

NATIONAL RADIO ASTRONOMY OBSERVATORY
POST OFFICE BOX O SOCORRO, NEW MEXICO 87801-0387
TELEPHONE 505 772-4011 TWX 910 988-1710

21 October 1986

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102-0300
ATTN: SWFPL-R

Gentlemen:

As Frequency Coordinator at the Very Large Array radio telescope (VLA) of the National Radio Astronomy Observatory (NRAO), I have the following comments on the Draft Environmental Impact Statement for the proposed Ground Based Free Electron Laser Technology Integration Experiment at White Sands Missile Range:

1. The potential for radio-frequency interference, electromagnetic interference, and light pollution is addressed only briefly in Section I. Health and Safety of Chapter V. Mitigation Measures. The particular concerns of the NRAO are not mentioned, although we provided extensive documentation to Mr. Hathorn of the Corps as specified at the scoping meeting and met for several hours with representatives of Mission Research Corporation who studied this question for the Corps.

We are concerned because the VLA is the premier radio-astronomical facility in the world today, and we anticipate that it will remain a forefront scientific instrument for several decades. While several features of the design of the VLA reduce its sensitivity to radio-frequency interference, because of its ability to detect extremely weak cosmic radio signals (the weakest detected so far is about -234 dBW/m^2), the VLA is still sensitive to very low levels of interfering signals. The power levels involved in the low-power and, especially, the high-power phases of the project are so high, that leakage at radio frequencies of only a small fraction of the total power could interfere with the operation of the VLA.

W-11.1 Please see Response 0-9.1, Response 0-9.4, and Response 0-9.9.

Furthermore, the high-power phase of the project is planned as an upgrade of the low-power phase. But what if we find that while the low-power phase of the project may be compatible with the operation of the VLA, the high-power phase is not?

W-11.2 Please see Response 0-9.2

Much more information on the characteristics of such devices and the proposed mitigation measures is needed to address our concerns.

2. One of the primary observing bands of the VLA extends from 1340 to

1730 MHz, which includes seven allocations for radio astronomy, most notably a primary allocation in the band 1400-1427 MHz and an international footnote (number 718) requesting all practicable protection in the band 1330-1400 MHz.

AVIATION WEEK AND SPACE TECHNOLOGY recently published a technical survey of free-electron lasers (18 August 1986). According to several articles, the most advanced radio-frequency-type free-electron lasers (Boeing Aerospace and Los Alamos), such as envisioned for the low-power phase, operate at a radio frequency of 1.3 GHz, with pulse rates of order 10 MHz and peak power levels of hundreds of MegaWatts. Such a device potentially could produce significant radio-frequency interference throughout the VLA observing band.

Similarly, other components such as the induction linear accelerator proposed for the high-power phase of the project or the wigglers and beam dumps used in either design could be significant generators of radio-frequency interference.

W-11.3 Please see Response 0-9.3

3. Approximately 50 square miles of the Magdalena Mountains west of Socorro have been set aside as a scientific reserve for atmospheric and astronomical research (U.S. Public Law 96-550). The summit of South Baldy is one of the premier astronomical sites remaining in the Southwest. Two optical observatories - the Joint Observatory for Cometary Research and the Digital Astronomy Observatory - already operate there, and the summit is being actively considered and investigated as a site for future telescopes operating at millimeter, submillimeter, infrared, and optical wavelengths.

The summit has a direct line of sight to the Stallion Site. Consequently, low levels of radio-frequency emission from the Stallion Site could interfere with millimeter and submillimeter radio telescopes on South Baldy. Infrared and optical telescopes would be directly affected by light pollution from the facility and by light scattered from the laser beam itself. Diffuse scattering by atmospheric gases and dust could be a significant source of light pollution at nearby astronomical sites. (The DEIS discusses only the safety aspects of this phenomenon, neglecting the potential for light pollution.) Furthermore, one of the goals of the project is to develop an understanding of three other atmospheric phenomena - atmospheric turbulence, thermal blooming, and stimulated Raman scattering - that scatter and reradiate light.

W-11.4 Please see Response 0-9.4

4. Similarly, two optical-astronomical observatories are located on Sacramento Peak east of Alamogordo - the Sacramento Peak Observatory of the National Solar Observatory and the Apache Point Observatory of the Astrophysical Research Consortium, which is now under construction. The potential for light pollution at these observatories should be addressed.

W-11.5 Revisions have been made to the FEIS (p IV-45) to address light pollution concerns.

5. Section IV.L.3 Automatic Laser Safety Procedures discusses an object detection system: Diffuse scatterers would be detected using a low-power, long-wavelength laser which would be another source of light

W-11.6 Please see Response 0-9.6

pollution. Larger objects would be detected using a continuous short-wavelength radar which could be a source of radio-frequency interference at the VLA and on South Baldy.

6. Although the time scheduled each year for actual tests would be small, much more time would be spent on such activities as testing and checking out various components. For example, a test of the linear accelerator by itself could be a significant source of radio-frequency interference. How much time will be spent on such ancillary, but essential, activities?

W-11.7 Please see Response O-9.7

7. One mitigation measure that might help address concerns 3, 4, and 5 would be to conduct the tests - on airborne and space targets, especially - at azimuths that avoid the VLA and other astronomical facilities on South Baldy and Sacramento Peak.

W-11.8 Please see Response O-9.8

We find that the Draft Environmental Impact Statement inadequately addresses our concerns about the potential for radio-frequency interference, electromagnetic interference, and light pollution associated with the proposed project. Naturally, our concerns are greatest regarding the Stallion Site because of its proximity to the VLA and to South Baldy.

W-11.9 Please see Response O-9.9

Sincerely yours,

Patrick C. Crane

Patrick C. Crane
Frequency Coordinator

PCC/pcc

cc: K. Anderson (N.M.S.U.)
T. Gergely (N.S.F.)
S. Greene (W.S.M.R.)
P. Napier
R. Ekers
S. Shore (N.M.I.M.T.)
R. Sramek
P. Vanden Bout

11

I have the following comments to the Draft E/S, Proposed Ground Based Free Electron Laser Experiment:

Neither I nor the reviewing public can evaluate this E.S. as it doesnot identify a preferred alternative, does not rate the sites according to site selection criteria & relative environmental impacts, nor disclose mitigation measures. Your original draft contained a matrix comparing the sites which identified the Orogrande site as the most preferable, both environmentally & technically. this matrix should be provided the public. Request that a revised draft be developed & circulated in accordance with the National Environmental Policy Act regulations, paragraph (a), 40 CFR 1503.9, which states that "If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare + circulate a revised draft..." And, the agency "shall make every effort to disclose and discuss ... all major points of view on the environmental impacts of the alternatives including the proposed [preferred] action."

Thank You

Kevin von Finger
Ecologist

W-12.1 Please see Response O-61.1, Response W-10.1, Response W-10.3 and W-10.4.

W-12.2 The preliminary (PDEIS) was for in-house review only and contained a matrix that presented weighted scores for various parameters. It contained a number of inaccuracies which had to be corrected before it was suitable for public review. This matrix was not included in the DEIS that was released to the public because the scores were extremely preliminary and studies that were on-going at the time were expected to result in revisions to some of the "scores".

W-12.3 Please see Response W-9.8

DEPARTMENT OF THE ARMY
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS
1114 COMMERCE STREET
DALLAS, TEXAS 75242-0216

REPLY TO
ATTENTION OF

13 NOV [illegible]

SWDPL-R

SUBJECT: Ground Based Free Electron Laser Technology Integration Experiment, Draft Environmental Impact Statement

Commander, Fort Worth District
ATTN: SWFPL-R

1. Reference letter SWFPL-R, 9 Oct 86, subject: Draft Environmental Impact Statement, which furnished copies of subject report for review by this office.

2. SWD comments are enclosed for guidance in completing the Final EIS.

3. Questions should be referred to Dr. Walt Gallaher or to Mr. Harold Green, SWDPL-R.

FOR THE COMMANDER:

Barry G. Rought

BARRY G. ROUGHT, P.E.
Chief, Planning Division

2 Encls
1. SWD comments
2. Endangered Species Act
   Compliance Procedures

CF:
Ms. Rebecca Griffith, SWFPL-R
Mr. Hector Vela, SWDOC
Mr. Arthur Denys, SWDED
Mr. Al Hutchison, SWDCO

SWD Comments on Draft EIS for GBFEL-TIE

1. General. The report is thorough and well written.

W-13.1 Thank you for your comment.

2. General. As you are aware, analysis and discussion on possible impacts on endangered and threatened species is incomplete. We know you lacked adequate time to complete these actions prior to circulating the Draft EIS. However, as discussed with Ms. Griffith, you must complete the Informal Consultation Process with the Fish and Wildlife Service, for the selected site, and document the results in the Final EIS. If Formal Consultation is required, the implications should be discussed.

W-13.2 Construction and operation of the proposed GBFEL-TIE at Orogrande, which has now been identified as the preferred site, would not be expected to impact any Federally listed species. Therefore, formal consultations should not be required. However, it should be noted that a survey will be conducted to determine the presence or absence of state protected and category 2 species within the site.

3. Section I, Controversial or Unresolved Issues, page I-36. Discussion in the final paragraph states that the specific water supply sites and routings will be selected after the alternative is selected and after the Record of Decision is signed. In view of the serious potential environmental impacts involved in some of the water supply alternatives, the major impacts of the components should be discussed in the Final EIS.

W-13.3 The most cost effective alternative water supply for each site has been identified in the FEIS. (see Chapter II). However, the exact routing of the pipeline would have to be addressed in a separate environmental analysis.

4. Section III.

a. Discussion of Orogrande Site, page III-38. Discussion mentions numerous small playas in the northern portion of the project and that it supports grassland communities. The value of these sites should be discussed.

W-13.4 The FEIS has been revised to reflect relative values of various habitat types.

b. Regional Culture History, page III-52. The second sentence of paragraph G1 implies that the Paleoindian period began about 1.8 million years ago. This date is closer to the beginning of the Pleistocene rather than the close. The third sentence also lumps the Paleoindian and archaic periods into the same type of subsistence. This should be revised.

W-13.5 The FEIS has been revised accordingly.

5. Section IV, Reptiles and Amphibians, page IV-11. Discussion implies that if the grasslands habitat of the yellow box turtle is partially destroyed by the project at the Stallion site, some of the displaced turtles may be able to move into adjacent areas. Normally, suitable habitat in the adjacent site would already be occupied. Discussion should be revised accordingly.

W-13.6 This comment implies that adjacent suitable habitat is at or above maximum carrying capacity. The FEIS (p IV-12) includes carrying capacity as one of the variables which would effect the turtles' ability to migrate to other areas. However, without site specific data concerning this and other variables it is impossible to accurately quantify the effects. Consequently, we believe that some turtles may be able to migrate to other suitable habitat, although we concur that some individuals may be lost.

ENDANGERED SPECIES ACT (ESA) COMPLIANCE PROCEDURES

<u>Informal Consultation</u>

1. Request of Fish and Wildlife Service a list cf endangered, threatened or proposed species and/or its habitat which may be in the vicinity of the proposed action and which might be affected.

2. If there are no such species/habitat, FWS will advise. This completes the required coordination. If such species are present, the service will provide a list (and their habitat), usually within 2 weeks.

3. If FWS indicates species may be present, Corps must prepare a Biological Assessment of the impact of proposed action on listed species/habitat (within 180 days, or as agreed between agencies). Biological Assessment is sent to FWS with a Conclusion.
If Corps concludes that proposed action would adversely affect a listed species, Formal Section 7 Consultation should be requested.

4. FWS prepares an Biological Opinion of impact on listed species. If FWS agrees with Corps' Biological Assessment of no jeopardy, ESA requirements are satified. If FWS disagrees with Corps Biological Assessment and Conclusion of no effect, it will indicate adverse affects and advise that Formal Section 7 Consultation procedures should be initiated. (time required for Opinion varies, but is generally within 45 days if no adverse impacts are anticipated)

<u>Formal Consultation</u> Process generally requires a minimal of 190 days from the date initiation is requested. Formal Consultation may result in:

a. possible Recovery plan for listed species

b. recommendation that action not be undertaken at site

P.O. Box 571
Organ, NM 88052-0571
(505-382-5136)

November 12, 1986

Fort Worth District
Corps of Engineers
Box 17300
Fort Worth, Texas 76102
ATTN: SWFPL-R

Dear Sir or Madam:

We have reviewed the Draft EIS of the proposed ground based free electron laser technology integration experiment at White Sands Missile Range. While the scope of the EIS is impressive, we are concerned that the potential for air pollution from the power plant is not adequately addressed in the draft (Page IV-6).

The PTMAX model calculations show at least a potential for contamination by nitrogen oxides (NOx) above standards, depending on how long the power plant is in operation. There seems to some uncertainty at this point as to how long the power plant would be operated during a test day or over a year. A more detailed evaluation of the potential impacts and mitigation measures should be included in the final EIS. We would like to see the following questions addressed:

1) How would the concentration of pollutants change if different assumptions from those on Page c-i are used in the PTMAX model? Stack temperature, for example, would vary somewhat in real life, and NOx emissions would be affected.

2) Would the 24-hour standard for nitrogen dioxide (see Page III-5) be violated under any of the operating conditions envisioned? My calculations, from data in the draft, show that it could be violated if the power plants were operated for six two hour tests on one day.

3) What effect would emissions have on air quality in wildlife refuges and populated areas near the GBFEL-TIE site? The PTMAX analysis in Appendix C shows that the high concentration could travel quite far from the site. If these results are not realistic then perhaps a more sophisticated analysis is needed.

4) What types of air pollution control equipment could be used, if necessary, to reduce emissions so that no standards would be violated?

Thank you for considering our concerns.

Sincerely,

Henry B. F. Hughes
M.Eng., Environmental Engineering

Bonney F. Hughes
M.S., Environmental Toxicology

W-14.1 Thank you for your comment.

W-14.2 As indicated in the FEIS (page IV-7) the anticipated amount of time that the generators would be expected to be operating is 200 hours per year (or less). The annual arithmetic mean for the GLC of NO_x emissions, therefore, would be 17.7 ug/m^3 (773.0 ug/m^3 X 200 hrs/8,760 hrs/yr). These emissions are far below the 100 ug/m^3 standard.

W-14.3 The assumptions used in the PTMAX model were worst case assumptions. If any concentrations would change in real life, they would probably be less than those presented in the DEIS.

W-14.4 The 24-hour standard for NO_x could be violated under this scenario. However, the most probable test scenario would be no more than two tests per day, in which case the standard would not be violated.

W-14.5 The maximum ground level concentration (GLC) as presented in Appendix C of the DEIS is 773.0 ug/m^3 of NO_x at 0.33 kilometers from the source. This concentration would obviously be reduced with distance. This maximum concentration would be contained within WSMR boundaries at all three sites.

W-14.6 The intent of the project is to use or design equipment which would not violate any standards. The first adjustment is operational. If the air conditions and past operation create a condition which has potential to exceed the standard, then equipment with emissions would not be operated, and the experiment would be postponed until better conditions occurred. The FEIS considers diesel engines as the back-up power source because this would be a worst case scenario. The actual system design may not use diesel engines. If diesels are used their emissions can be reduced by burning fuels such as natural gas, by using catalytic combustors to remove unburned hydrocarbons, and/or additions of exhaust gas scrubbers to remove NO_x and sulfur compounds. Although these measures could be implemented as a fix to a problem, we feel that the limited time the standby power system is on would be most economical.

If on-site electrical storage for the Phase II peak power demand is chosen, instead of using power directly from the transmission time, the storage facility would be oversized to include emergency shut down power. This would eliminate all on-site emissions.

US Department of Transportation
Federal Aviation Administration

Memorandum

AIR ROUTE TRAFFIC CONTROL CENTER
8000 Louisiana Blvd., NE.
Albuquerque, New Mexico 87109

Subject: INFORMATION: Ground-Based Free Electron Laser Technology Integration Experiment

Date: NOV 03 1986

From: Air Traffic Manager, Albuquerque ARTCC, ZAB-1

Reply to Attn of: FTS 476-0530
GEWitt:505-823-0530
ZAB-530 (7400)

To: U.S. Army Corps of Engineers
Fort Worth District

Mr. John Hyndman, Office of Directed Energy, White Sands Missile Range, briefed the FAA's Albuquerque Air Route Traffic Control Center concerning the three remaining sites that are being considered for the ground installation for this project. He described the nonrestricted airspace that would be affected by the laser pattern for each of the three sites.

We are submitting the following information which Albuquerque Center wishes to be considered in your deliberations toward making a final site selection:

The most undesirable site from an aviation standpoint based on existing traffic volume and commonly used routes of flight is the Oro Grande site. This particular site would affect more nonrestricted airspace than the other sites. In addition, this will be at a much lower altitude than the other sites. This site would have a very detrimental impact on the VFR flyway that is consistently used to fly into Alamogordo and Holloman AFB airports from El Paso, Texas, area.

W-15.1 This information was considered as one of the criteria during the selection process.

The Stallion and North of NASA sites would be less of an impact on aviation than Oro Grande; however, the Stallion site has more potential for being a problem to ATC because of its close proximity to a heavily used east/west jet route (J74) that overlies Socorro, New Mexico. During periods of thunderstorm activity, Albuquerque Center periodically coordinates with WSMR for airspace in the Stallion area so that en route aircraft can avoid thunderstorm activity. The North of NASA site will have the least impact concerning aviation activity.

W-15.2 Thank you for your comment. Also, please see Response W-15.1.

If we can be of any further assistance concerning the air traffic airspace issues of this project, please contact Glen Witt, Assistant Manager, Airspace and Procedures (FTS 476-0530 or Commercial 505-823-0530).

Dean L. Gensamer
Dean L. Gensamer

cc:
ASW-530

STATE OF NEW MEXICO
OFFICE OF THE GOVERNOR
SANTA FE
87503

TONEY ANAYA
GOVERNOR

November 19, 1986

U.S. Army Corps of Engineers
Forth Worth District
P. O. Box 17300
Forth Worth, Texas 76102-0300

Attention: WSFPL-R

Re: Ground-Based Free Electron Laser Technology Integration Experiment
State of New Mexico Comments on Draft Environmental Impact Statement

This letter and the accompanying memoranda from concerned State agencies constitute New Mexico's official comments on the Ground-Based laser project proposed for White Sands Missile Range. My personal reservations about the wisdom of the President's entire SDI program (reservations which are shared privately by a number of scientists at Los Alamos National Laboratory) were made quite clear during Col. McNulty's briefing in October, and are perhaps of little relevance to the EIS process. Nonetheless the irony of the fact that New Mexico, which "hosted" the first atomic explosion, should now be called upon to provide a home for the technological "fix" designed to make nuclear weapons "obsolete" is inescapable. The irony is compounded by the fact that a new offensive weapon system (the "Small ICBM program") being planned by the Air Force is a potential competitor for the same site. In neither of these matters does the State have a real choice. The EIS process may allow us to influence, to a degree, a decision on location, but serious consideration of the "no action" alternative seems hardly within our power to affect.

As our Economic Development and Tourism Department points out in its memorandum there are obviously short run socio-economic employment benefits to be derived from the construction phase of the project, and a relatively few more "permanent" jobs lasting for the duration of the experiment (assuming it will be funded according to plan). The number of current New Mexico residents employed during the operational phase is likely to depend in part on the site chosen. But infrastructure and other socio-economic costs associated with both construction and operations appear to be inadequately assessed, particularly as regards differential impacts among the sites. To cite an example, it is relatively easy to describe impacts of school enrollment increases in the counties potentially affected in terms of percentages or phrases like "not beyond the system's capacity to tolerate" (IV-30). It would be more difficult, but more helpful, if the document could model how influxes of new students during each phase of the project and abrupt decreases at the end of that phase might affect school district planning.

W-16.1 This EIS is being conducted for the purpose of site selection for the proposed GBFEL-TIE. National economic and/or policy questions are beyond the scope of this document.

W-16.2 The socioeconomic gravity and allocation models have been revised in the FEIS (Appendix D) to incorporate new data concerning the gradual influx of construction and operation personnel. The potential impacts based up the revised models are presented in Chapter IV of the FEIS (pp. IV-26 and through IV-36).

Letter from Governor Anaya
November 19, 1986
Page 2

Projects of this nature, dependent on shifting Administration notions of appropriate "defense strategy" and Congressional appropriations, tend to subject the communities that would receive them to typical "boom-and-bust" phenomena. The recent competitiveness demonstrated by the potential host communities to get chosen suggests as well the emphasis of the document: both pay much more attention to the short-term upside effects than to uncertainties and later downside impacts.

W-16.3 The FEIS has been revised to discuss potential long term impacts to socioeconomic resources. (p. IV-32).

Letters or memoranda attached from the New Mexico Interstate Stream Commission, the Departments of Game and Fish, Energy and Minerals, and Natural Resources, the Historic Preservation Division and the Environmental Improvement Division all suggest, directly or indirectly, that the construction timetable for Phase I development of the GBFEL-TIE project may be highly unrealistic. These comments suggest first that a good deal more work will be required in some areas <u>before</u> a site is selected. EMD's review raises disturbing questions regarding adequacy of the EIS's assessment of power requirements, availability and project experiment impacts on system reliability, as well as on costs to ratepayers. Game and Fish notes severe deficiencies in the document's assessment of impacts on fauna, and Natural Resources notes omitted endangered plant species. Moreover, <u>following</u> site selection, detailed investigations will be required to determine water supply availability and feasibility, and to identify cultural resources (a 100% survey). Furthermore, it will be necessary to obtain easements and rights-of-way for power and water corridors, permits for compliance with water quality regulations, etc. These issues are discussed fully in the attachments.

W-16.4 These comments are specifically addressed where they appear in the following letters and memoranda.

The State of New Mexico appreciates the cooperative attitude the Corps and the Army Strategic Defense Command have displayed thus far in planning for the GBFEL-TIE project. We trust the official comments of the State will receive careful consideration in the preparation of the Tier I FEIS. Although a new administration will be in office by that time, I am confident that the concerned agencies will continue to want to review plans for the project for consistency with their statutory and regulatory mandates.

W-16.5 Thank you for your comment.

Sincerely,

TONEY ANAYA
Governor

TA/jrb/tq

Attachments:
(1) Letter from Economic Development & Tourism Department
(2) Letter from Interstate Stream Commission
(3) Letter to USACE from Department of Game & Fish
(4) Letter from Energy and Minerals Department
(5) Memorandum from Natural Resources Department
(6) Memorandum from Historic Preservation Division
(7) Letter from Environmental Improvement Division

STATE OF NEW MEXICO

Economic Development & Tourism Department

Toney Anaya
Governor

Joseph M. Montoya Building
1100 St. Francis Drive
Santa Fe, New Mexico 87503
Phone: 827-0300

Dr. Larry Adcock
Cabinet Secretary

November 17, 1986

Mr. John Brown
Review Coordinator
Office of the Governor
State Capitol Building
Santa Fe, New Mexico 87501

RE: Environmental Impact Statement for the Proposed Ground Based Free Electron Laser Technology Integration Experiment

Dear John:

The Department has been requested to provide review and comment for the Ground Based Free Electron Laser Technology Integration Experiment to be based at the White Sands Missile Range, New Mexico.

We fully understand that many factors must be considered with regard to the final selection of the project site. We are also aware that selection of any one of the three proposed sites will have major economic impact in New Mexico.

Our review of the OROGRANDE, NASA and STALLION sites from a strictly economic impact perspective would indicate that the OROGRANDE and NASA sites would favor the El Paso, Texas area. The STALLION site would appear to have the greatest economic impact for New Mexico. All other considerations being near equal this Department would recommend the STALLION site.

The Department also feels that the Economic impacts associated with the other two sites are improperly distributed. We feel that the distribution of the impacts are questionable at best. In the EIS the majority of the proposed 3000 new jobs and federal investment in excess of $2.5 billion will benefit El Paso, Texas. There should be more documentation of how the distribution scenario was established.

W-17.1 Thank you for your comment.

W-17.2 A thorough discussion of the methods used to derive this distribution was presented in the DEIS, Appendix D. It should be noted, however, that the model has been revised and is incorporated into the FEIS (Appendix D). However, the distribution of the personnel and thus "impacts" are not changed substantially.

NEW MEXICO INTERSTATE STREAM COMMISSION

BATAAN MEMORIAL BUILDING
STATE CAPITOL
SANTA FE, NEW MEXICO 87503

November 17, 1986

Mr. John Brown
Governor's Office
Executive-Legislative Bldg.
Santa Fe, New Mexico 87503

Re: Draft Environmental Impact Statement of the Proposed Ground Based Free Electron Laser Technology Integration Experiment - U.S. Army Corps of Engineers

Dear John:

This letter is to supplement our November 14, 1986 letter on the same subject.

Three sites for the proposed experiment are identified in the environmental impact statement: Stallion Site, North of NASA Site and Orogrande Site. The north of NASA Site could require a long pipeline to the Rio Grande and a well to provide water needed for the experiment. The drilling of a well at a location closest to the north of NASA Site will require consideration of important permit issues.

W-18.1 Thank you for your comment.

From the data in the environmental impact statement it appears that water for the Stallion Site could be obtained from the Rio Grande, but a long transmission line and pumping plant(s) will be required to convey the water from the river to the Stallion Site.

W-18.2 Thank you for your comment.

The Orogrande Site may prove to be the easiest site to supply with water on the basis of costs and permit issues.

W-18.3 Thank you for your comment.

The Environmental Impact Statement, page I-36, states that the final selection for a water supply would be made after the final site selection and after the Record of Decision has been filed. Further, that more detailed investigations may be required concerning the availability of water and technical, environmental and economic feasibility of the potential supply. Also, depending on the final site selection, issues may arise concerning rights-of-way and easements that would be required for

W-18.4 The most cost effective alternative water supply for each site is identified in the FEIS. Close coordination will be maintained with the State Engineer throughout the EIS and permitting processes.

Mr. John Brown
November 17, 1986
Page Two

water transmission lines. As indicated in my November 14 letter, continued close coordination between the Corps of Engineers and the State Engineer will be necessary in providing the water supply needed when the site for the experiment is selected.

Sincerely,

Philip B. Mutz
Interstate Stream Engineer

PBM:bmm

GOVERNOR
TONEY ANAYA
DIRECTOR AND SECRETARY
TO THE COMMISSION
HAROLD F. OLSON

State of New Mexico

DEPARTMENT OF GAME AND FISH

STATE CAPITOL
SANTA FE
87503

November 14, 1986

Ms. Rebecca Griffith
U.S. Army Corps of Engineers
Fort Worth District
P. O. Box 17300
Fort Worth, Texas 76102-0300

ATTN: SWFPL-R

Dear Ms. Griffith:

I have reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Ground Based Free Electron Laser Technology Intergration Experiment (GBFEL-TIE) at White Sands Missile Range (WSMR). My concerns were initially outlined in written correspondence to you dated September 17, 1986, and have not changed significantly. Inasmuch as the major areas of interest to my department are on wildlife and its habitat, I have confined my assessment of the DEIS to those subjects.

W-19.1 Thank you for your comment.

The biological resources portion of the DEIS is inadequate and thus unacceptable as a NEPA document. In particular, the document fails to adequately assess the biological values of the sites under consideration, fails to discuss potential irreversible and irretrievable lossess to wildlife and its habitat, fails to state the environmental impacts of the project, and fails to propose and thus discuss mitigation for environmental losses.

W-19.2 The FEIS has been revised to include a description of relative values of the habitats found at each site. Irreversible and irretrievable losses to wildlife populations are discussed on pages IV-12 through IV-21 of the FEIS. In addition, unless a species becomes extinct, losses to floral or faunal populations are not irreversible. The discussion of mitigation measures has been revised in the FEIS (pp. V-2 through V-4) to incorporate suggestions and recommendations discussed with NMGF, USFWS, and WSMR on 17 November.

It is insufficient to have based the entire wildlife assessment on information contained in the WSMR Installation Environmental Assessment (1985). In projects of this magnitude, it is essential that a reasonable amount of base line data on wildlife be collected by the sponsoring agency. The conspicuous lack of site-specific biological inventory data, which severely hinders an objective evaluation of what the losses would be if wildlife and its habitat were eliminated in the project area, is of major concern. Statements such as "although no specific survey for birds has been conducted for WSMR, a total of 312 species are presumed to occur within the range; common passerine birds that are expected to occur at the sites; other small mammals that presumably occur with the three sites"; etc., are meaningless and provide little information on species numbers and distribution.

On page IV-18, paragraph 6, it states that chronic low level stress caused by construction, operation, and maintenance activities <u>may cause</u> (emphasis added) physiological damage to desert bighorn sheep in the San Andres Mountains. I would like to emphasis that disturbances, whether directed toward bighorn or not, have been documented to cause reactions adverse to population welfare.

In addition to all of the former concerns, I am especially bothered over the restricted use areas and resultant loss of access into the San Andres National Wildlife Refuge and vicinity that will occur if the North of NASA site is selected. My department, in cooperation with WSMR and the U.S. Fish and Wildlife Service is conducting simultaneous, long-term studies on mountain lion, bighorn sheep and mule deer interactions in the San Andres Mountains (see attachments). The objectives of this study are to determine the distribution, movements and population dynamics of mountain lions, and the effects of lion predation on bighorn sheep and mule deer. Currently, 55 mule deer, 20 bighorn sheep and 10 lions are carrying functional radio transmitters. An additional 7 lions have been marked with ear tags. A significant portion of our operating budget has been committed to this research effort, and every effort must be made to protect this investment.

Your attention is directed to a recent Sikes Act reauthorization bill approved by the U.S. Senate (S. 1352) regarding improved fish and wildlife management practices on military bases. Senate Bill 1352 amends the statute to give fish and wildlife better standing on Department of Defense lands. It requires base commanders to make fish and wildlife habitat improvements an integral part of resource management plans now in force, and directs qualified managers to be used to integrate fish and wildlife into each base's resource program.

W-19.3 Please see Response O-56.5. In addition, the USASDC believes that the information provided is adequate to allow an informed decision on site selection.

W-19.4 Thank you for your comment.

W-19.5 After discussion with representatives of the NMGF, WSMR ENRO, and USFWS on 17 November 1986, The USASDC believes that land access to the SANWR would not be restricted by the proposed GBFEL-TIE. Air access may be restricted at certain times during lasing experiments. However, these schedules can and will be coordinated with NMGF and USFWS to ameliorate potential conflicts during air reconnaissance, inventory, and trapping activities.

W-19.6 Thank you for your comments.

In closing, my assessment remains that the DEIS is unsatisfactory for documenting the fauna of the project area. What is needed in the document is in-depth field information from each proposed alternative site containing both plant and animal data so that biological alternatives and relative impacts can be considered. A laundry list of animals that are found on WSMR and may or may not occur in the proposed project areas, in my mind, does not constitute a valid NEPA document. Thank you for the opportunity to comment. If you have any questions, please contact Andrew Sandoval of my staff at (505) 827-7994.

W-19.7 Please see Response O-56.5

Sincerely,

Harold F. Olson
Harold F. Olson
Director

AVS/ju
Att. 2

xc: John R. Brown (Office of Policy Analysis)
Chris Ingram (Gulf South Research Institute)
Michael J. Spear (Regional Director, USFWS)
Patrica Hoban (SANWR Manager, USFWS)
Daisan Taylor (Wildlife Biologist, WSMR)
William H. Baltosser (Chief, Biological Ser., NMGF)
Craig Nordyke (SW Area Supervisor, NMGF)

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT
525 Camino de los Marquez
Santa Fe, New Mexico
87501

TONEY ANAYA
GOVERNOR

November 14, 1986

Mr. John Brown
Governor's Office
Executive-Legislative Building
Santa Fe, New Mexico 87503

Dear Mr. Brown:

The staff of the New Mexico Energy and Minerals Department has reviewed the draft Environment Impact Statement on the Proposed Ground Based Free Electron Laser Technology Integration Experiment and submits for consideration the following comments:

The proposed date of early 1987 for commencement of construction is unrealistic and unfair to the public given the magnitude of the environmental, socio-economic, and financial resources required at both the state and local levels. EMD staff believes that a project of this size requires more than six to eight months, from the time the Tier I EIS is issued until the commencement of construction, to adequately address the many complex issues involved in a project such as this one. Also, staff is concerned that many of the most controversial issues relating to this project are planned for review and analysis in the Tier II EIS, which will be available only after the start-up of construction. In these comments, EMD staff focuses its attention on only one of these controversial areas, that being the project's power requirements.

There are expected to be between 280 and 840 tests per year, conducted at various times during the day and night. Instantaneous peak pulse power requirements for the low and high power phases, while not presently known, are estimated to be 300 to 1,000 megawatts. Those peak loads are in addition to the 20 megawatt on-site standby capacity required to protect the facility in the event of a peak load outage. Power requirements of this magnitude and duration could adversely impact both EPE ratepayers and ratepayers across the state.

To begin to determine the potential impact on electric ratepayers, EMD staff believe it is helpful to put this project in perspective by identifying some operational and financial parameters. For example, this project could require

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W-20.1 The USASDC believes that the schedule permits adequate time for review and planning. Current projections allow an interval of at least two years' duration between the onset of construction and initiation of testing.

W-20.2 Referring to the annual number of tests (280-840): These are not all full power tests requiring the peak pulse power. Testing will comprise system and sub-system check-out, beam alignment, device diagnostics, and low power beam diagnostics.

W-20.3 The assertion that this project would require construction of 300 to 1000 megawatts of additional generating capacity (with concomitant adverse effects on rate payers) is incorrect for several reasons:

1) There is considerable excess generating capacity in the commercial grid.

2) Only the base load (60-100 megawatts) will add to the peak system demand of the supplying utility. This will serve to balance generating resources and could likely have a positive rather than a negative effect on rate payers.

3) The pulse loads will be of short duration. If this demand is served from the commercial grid, it will be provided by the inertia of the combined utility system; only a percentage of the peak pulse power will be generated by the contracted supplier.

W-20.4 The issue of adverse effects on rate payers is one which the project will continue to address in the technical and feasibility analyses of supplying the peak pulse load from the commercial grid. No issue has yet become ripe for decision; as stated in the EIS, we have included several options (such as on-site generation and energy storage devices) as part of this analysis.

W-20.5 The project is prepared to accept the cost of static VAR compensators or other equipment required to protect transmission facilities and preclude deterioration of service to existing customers of the power grid.

up to 1000 megawatts of peak power, whereas in 1985, El Paso Electric Company, the utility which currently serves the missile range had a peak system load of 877 megawatts. Thus, instantaneous peak load could increase by approximately 115 percent. The value of the generating capacity that might be needed for the peak loads could range from approximately $420 to $750 million at 300 megawatts to $1.4 to $2.5 billion at 1,000 megawatts. Under conceivable rate making treatment, the monthly demand charge for instantaneous peak demand requirements could be as much as $9.6 million, or given the project's very low load factor of 0.05 to 0.15 percent, roughly $11 to $33 per kilowatt hour. Obviously, this would be unacceptably high.

Additionally, there is the question of what these one-minute power surges could do to system reliability. Who would be required to pay for the remedial action schemes to protect the transmission facilities? Who would pay in the event that the power surges actually damaged generation and/or transmission facilities? These are some of the numerous issues that would be of concern to the New Mexico Public Service Commission in a Certificate of Convenience and Necessity proceeding. And yet the Commission was not even specifically requested to participate in the review of this draft EIS. A CCN Proceeding typically takes six months to a year, and according to the PSC, EPE has not yet made a commitment to make available the power required for the instantaneous peak pulse tests, yet construction on the project is scheduled to begin in just a few months.

In closing, EMD staff suggests that the Tier I EIS discussion of the impacts of power generation and transmission requirements was inadequate given the size of the project. EMD hopes that the Tier II EIS will provide in-depth analysis of the economic and environmental impacts of the project's power requirements, including definitive information on the possible impacts over the life of the project of instantaneous peak power surges on the transmission system and the reallocation of costs to ratepayers resulting from the required availability of hundreds of megawatts of generation and transmission capacity at various times of the day and night. The Tier II EIS should also provide detailed descriptions of how these peak loads will be met, by whom, and under what contractual provisions. In addition, EMD believes that the Corps of Engineers should seek the direct participation of the New Mexico Public Service Commission.

Thank you for providing EMD with the opportunity to comment on this document.

Sincerely,

PAUL L. BIDERMAN
Secretary

PLB/vb

W-20.6 Your statement that El Paso Electric has not made an application for CCN is correct from the standpoint that no supplier has been selected. The power service contract will be awarded on a competitive basis under the government procurement regulations and laws.

Upon the procurement of a service contract for power supply, the project staff will work closely with the supplier to address the technical and economic issues of design as they relate to the required electrical facilities for the project. The New Mexico Public Services Commission (NMPSC) will have an active role as we formulate our final decision on the power issue. Plans are to interface with the required agencies in New Mexico to formulate our Tier II EIS as soon as Tier I is finalized.

W-20.7 The GBFEL-TIE project office shares the concerns expressed in the last paragraph of your letter and will make every effort to accommodate and respond to them. Our policy is to be as cooperative and informative as possible on all issues of this project. We anticipate that the NMPSC will have a very active role as the project continues to progress and that the NMPSC will appreciate the schedule of this project and assist us to meet SDI's goals. The GBFEL-TIE project office plans to contact NMPSC during the last week of January 1987 to set up a meeting to elaborate on the project schedule and goals.

TONEY ANAYA
GOVERNOR

STATE OF NEW MEXICO
NATURAL RESOURCES DEPARTMENT
Santa Fe 87503
(505) 827-7835

LEO GRIEGO
SECRETARY

MEMORANDUM

TO: John Brown
Office of the Governor

FROM: Leo Griego, Secretary
Natural Resources Department

SUBJ: Comments

DATE: November 20, 1986

Attached is the response of the Natural Resources Department (NRD) to the Draft Environmental Impact Statement of the Proposed Ground Based Free Election Laser Technology Integration Experiment. NRD comments have focused on the impacts to rare and endangered plant species. In addition, the local Soil & Water Conservation District should be worked with closely to emphasize appropriate conservation measures. Please let me know if you have any questions.

Attachment

W-21.1 Thank you for your comment.

"The Natural Resources Department Is An Equal Opportunity Employer"

IMPACT TO RARE AND ENDANGERED PLANT SPECIES BY THE PROPOSED GROUND BASED FREE ELECTRON LASER AT WHITE SANDS MISSILE RANGE

The Draft EIS on this project correctly adresses the federally endangered species of the Snead pincushion cactus and Llyod hedgehog cactus as potentially occurring within the project boundary. However, they dismiss the Snead's pincushion cactus on the ground that it occurs at higher elevations in the mountains and will not be effected by the construction of the laser facility. Although Coryphantha sneedii (Snead's pincushion cactus) usually occurs on limestone mountain ridges it can also occur on relatively flat lower elevation outcrops of limestone. The proposed Orogrande site is most likely to contain such outcrops, and if such limestone breaks occur at that site they should be surveyed before construction is undertaken. The EIS also correctly includes the grama grass cactus (Pediocactus papyracanthus) as potentially occurring within the project boundary. However, they make no mention of mitigation measures for this species should it occur at one of the sites. The Grama grass cactus, although not protected federally, is on the New Mexico State Endangered Plant List and should receive consideration in this project. It is most likely to occur in the grassland portions of the Stallion Station site. Finally, there was no mention of the potential occurrence of Coryphantha scheerii (Scheer's pincushion cactus) or Opuntia arenaria (Sand Prickly Pear) in the EIS. Although these species are not reported on the missile range they has been collected on sandy soils in mesquite sand dunes near El Paso. It is quite possible that they could occur at Orogrande or the NASA site. Like the grama grass cactus, the Scheer's pincushion cactus and the sand prickly pear are only candidates on the federal list, but both are fully protected by the New Mexico Endangered Plant Law. All three of these species (grama grass cactus, sand prickly pear and Scheer's pincushion cactus) should receive consideration in this proposal.

W-21.2 No limestone outcrops were observed during recent field reconnaissance trips to the Orogrande site.

W-21.3 If the grama grass cactus occurs at the Orogrande site (the preferred alternative), it would most likely be within the small isolated grassland communities that are located in the northern portion of the ground target range. The immediate area surrounding the cactus could be easily avoided. Surveys for potential threatened or endangered species will be conducted prior to implementation of the GBFEL-TIE.

W-21.4 This information has been incorporated into the FEIS (Table III-11).

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HISTORIC PRESERVATION DIVISION

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TONEY ANAYA
GOVERNOR

CLARA APODACA
CULTURAL AFFAIRS OFFICER

THOMAS W. MERLAN
DIRECTOR

November 14, 1986

MEMORANDUM H-330

TO: Mr. John Brown
Office of Policy Analysis
Office of the Governor

FROM: Daniel E. Reiley
Staff Archaeologist
Historic Preservation Division

SUBJECT: Ground Based Free Electron Technology Integration Experiment - Draft Environmental Impact Statement

At the request of the Fort Worth District, Corps of Engineers, I have reviewed the "Draft Environmental Impact Statement of the Proposed Ground Based Free Electron Laser Technology Integration Experiment: White Sands Missile Range, New Mexico" in order to evaluate the adequacy of the consideration given to the effects of the proposed undertaking on significant cultural resources.

The evaluation of cultural resources expected to occur within each of the three alternative locations described in the DEIS is based on a 13 to 14 percent sample archaeological survey of the Stallion and North of NASA sites, and 10 to 15 percent sample survey data developed for the Border Star-85 exercise at the Orogrande site. I consider the level of survey performed to be adequate to provide information necessary to assess the relative impacts on expected cultural resources for each of these alternatives. The sample surveys have located at all three locations archaeological sites which can be considered eligible for inclusion in the National Register of Historic Places for their potential to yield important archaeological information.

W-22.1 Thank you for your comment.

Using data generated by the sample surveys, a predictive model has been developed to describe the type, size and density of the cultural resources expected to occur within each of the proposed alternative sites. I believe this model to provide a reasonable approximation of the magnitude of potential adverse effects to cultural resources which would result from locating the laser

W-22.2 Thank you for your comment.

facility at each alternative. This model does not provide an adequate inventory of all of the cultural resources which would actually be affected by locating the laser at a selected site. Inventory data would need to be provided through an intensive inventory survey of land areas to be directly and indirectly affected by construction of the laser and related facilities. The need to conduct a 100% inventory survey of the selected project area is appropriately discussed in the DEIS.

W-22.3 As noted in your comment, the USASDC has agreed to conduct a 100% survey of the selected site to locate, identify, and evaluate all historic resources. This information will be used to develop a specific mitigation plan which will be coordinated through New Mexico SHPO, Advisory Council, and WSMR ENRO.

From the model of expected archaeological sites, it is apparent that there will be adverse effects to significant archaeological resources at all three locations which cannot be avoided through project redesign or relocation. Efforts to mitigate identified adverse effects on significant sites through the recovery of important archaeological data from affected sites will be required prior to initiating any construction activity which would impact the sites. In comparing the relative impacts to cultural resources which could be expected to occur at the three alternative locations, it is also apparent that resulting impacts at two of the locations would be similar, while impacts at the third, the North of NASA location, would be considerably greater, and require a correspondingly greater effort to mitigate adverse effects. While the two remaining locations appear to contain similar numbers and types of cultural resources, the much greater length of the waterline, powerline, railroad and road access corridors required for the Stallion Site could greatly increase the number of affected cultural resources if this site were to be selected.

W-22.4 Thank you for your comment.

Therefore, on the basis of the predictive model developed from the results of sample surveys of the alternative areas and information presented in the DEIS, it is my opinion that construction of the Free Electron Laser project at the North of NASA alternative would have the greatest impact on significant archaeological resources. I believe that construction at the Orogrande Site would result in the least effect on archaeological resources. My determination that construction of the facility at the Orogrande Site will have less of an effect than would construction at the Stallion Site is based on an expectation that the number of sites encountered in the much greater length of utility corridors required for the Stallion Site will more than compensate for the slightly smaller number of archaeological sites predicted to occur at the Stallion Site itself.

W-22.5 Thank you for your comment.

HEALTH ENVIRONMENT department

STATE OF NEW MEXICO

ENVIRONMENTAL IMPROVEMENT DIVISION
P.O. Box 968, Santa Fe, New Mexico 87504-0968
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TONEY ANAY
GOVERNOR

DENISE D. FC
DIRECTOR

November 14, 1986

Mr. John Brown
State Clearinghouse for Environmental Review
Department of Finance and Administration
State Capitol Building
Santa Fe, New Mexico 87503

Re: Ground Based Free Electron Laser Technology Integration Experiment - (GBFEL - TIE) DEIS 230ER

Dear John:

EID staff have reviewed the above-mentioned document and have several comments to submit relating to out statutory and regulatory mandates. These comments do not address the issue of need for the project or other strategic defense considerations.

From the perspective of the Environmental Improvement Division, all of the sites under consideration involve the same environmental regulatory requirements, and would result in roughly the same environmental impacts. Therefore, there is no environmentally preferable site from our point of view. Other agencies (e.g. State Engineer's Office, Natural Resources Department, Game and Fish Department, Economic Development and Tourism Department) may be aware of environmental or other considerations which would favor location at one site over another.

W-23.1 Thank you for your comment.

Ground and Surface Water Quality

There is no mention made in the document of the New Mexico Water Quality Control Commission Regulations. The Commission's regulations apply to any discharges that may take place during either construction or operation of the project. This includes industrial or domestic wastewater discharged into a watercourse, a lagoon, a leach field, a land application site or any other location.

W-23.2 This information has been incorporated into the FEIS Summary Section 6.

Specific instances in the DEIS which should refer to compliance with the Commission regulations include the following:

- Summary sheet, page 3, item #5: Permits:

Under the list entitled "Potential Permit Requirements for GBFEL-TIE", several different sections of the Water Quality Control Commission Regulations should have been cited. In particular, Section 1-201, Notice of Intent; Section 1-202, Filing of plans and specifications; Section 1-203, Reporting and cleanup of spills

W-23.3 This information has been incorporated into the FEIS Summary Section 6.

below the surface of the ground including the probable need for an approved discharge plan; and Part 4, Utility operator certification should be included.

o Page I-20 Industrial Wastewater

More information should be provided about the quality of the industrial wastewater. It is extremely important that this industrial wastewater be disposed of in conformance with New Mexico Water Quality Control Commission regulations, especially since the intended discharge is to lagoons from which there may be seepage that may impact ground water. However, there is no mention of these regulations and the need to comply with them. The wastewater should be analyzed to determine whether or not it contains a regulated hazardous waste as indicated to some extent in Table IV-16. If so, the NM Hazardous Waste Act and Regulations must be complied with.

o Page I-24 Domestic Wastewater

It is stated that up to 25,000 gallons per day of domestic wastewater would go to commercially available treatment package plants, but no mention is made of the ultimate disposal of the sewage effluent. There should be a commitment stated to dispose of the effluent in conformance with New Mexico regulations. A NPDES permit will also be required.

During the construction phase of the project, the plan calls for the use of portable latrines to be "... serviced by approved and licensed contractor(s)." The statement is made the "All sewerage waste would be disposed off-site in accordance with State of New Mexico regulations." Disposal of this portable latrine waste is not adequately detailed in the DEIS for it to be evaluated for conformance with New Mexico regulations. Presumably, disposal of this waste will require a discharge plan under the Water Quality Control Commission Regulations.

o Page V-1 Mitigation Measures - Water Quality and Supply

It should be specifically stated that all wastewaters will be disposed of in conformance with State of New Mexico regulations. In order to assure adequate operation and maintenance, a specific commitment should be made to abide by the New Mexico Utility Operators Certification requirements.

Occupational Health and Safety and Radiation Protection

The DEIS adequately addresses radiation safety, such that both ionizing and non-ionizing radiation are kept well within state and federal dosage limits.

The DEIS also mentions the federal Occupational Safety and Health Administration regulations for non-iodizing radiation (29 CFR 1910.97, 1926.54 and 1926.102). The

W-23.4 The project will conform to all applicable Federal and State regulations governing the disposal of wastewater. Neither the evaporation pond for the evaporative cooling towers nor that for the closed loop heat exchange system is expected to contain any wastes other than those discussed. The purpose of these ponds is to reduce these liquid effluents to more transportable form which could be disposed of in any environmentally safe and approved manner. The project will conform to the appropriate testing requirements necessary to determine potentially hazardous wastes in these ponds.

W-23.5 The project will conform to the applicable Federal and State regulations governing the disposal of sewage effluent.

W-23.6 The contractor(s) that would be utilized has not been selected and thus the exact disposal methods that the contractor(s) would use cannot be described at present. However, the USASDC will thoroughly evaluate and investigate the previous compliance records of potential contractors during the bidding process prior to making a selection to assure that the selected contractor(s) will comply with all New Mexico regulations including The Water Quality Control Commission Regulations and New Mexico Utility Operators Certification Requirement, if appropriate.

W-23.7 The commitment has been stated in the FEIS. (p. V-2).

W-23.8 Thank you for your comment.

New Mexico Environmental Improvement Division Occupational Health and Safety Bureau does not have jurisdiction at White Sands Missile Range, however, we would also like to point out that the Food and Drug Administration Laser Standard (21 CFR 1040,10 et seq.) may also be applicable to this project. There is an existing interagency agreement between the Department of Defense and the FDA that DOD lasers will comply with the FDA Laser Standards except for reasons of national security.

W-23.9 The FDA Laser Standard will also be adhered to, if applicable.

Air Quality

There appear to be no adverse effects on air quality as a result of this project. We recommend standard dust suppression techniques during construction to reduce particulate emissions.

W-23.10 Thank you for your comment. The USASDC is committed to utilize standard dust suppression techniques during the construction phase.

Solid Waste

There are currently three landfills located in the White Sands area of Dona Ana County. Two landfills are registered by the U.S. Army and the third is registered by NASA. The most active of the three landfills is the U.S. Army South landfill and is the one referred to in the DEIS. This landfill currently receives small amounts of paper wastes and construction / demolition wastes. In 1982, this landfill was registered for 60 acres with a life expectancy of 50 years.

W-23.11 Thank you for you comment.

The DEIS states that the registered landfill will not be used during construction of the GBFEL-TIE but rather that construction wastes would be disposed of on site. This approach meets with Section 108.D of the New Mexico Solid Waste Management Regulations. According to the DEIS hazardous and toxic wastes are not to be disposed of at this temporary site. Any hazardous waste which is generated either during construction or operation of the project must be permanently disposed of in accordance with the New Mexico Hazardous Waste Regulations, and may not be disposed of at any of the registered landfills.

W-23.12 Thank you for your comment. As stated in the FEIS (p. V-2), no hazardous or toxic materials would be disposed of in the on-site landfill.

Thank you for the opportunity to comment on this document. If you have any questions, please call Sharon Murray at 827-2839, or contact individual bureaus within EID for further information.

Sincerely yours,

Denise D. Fort
Director

cc: Maxine Goad, GWHW
Ray Sisneros, CSB
Dave Hanna, SWQ
John Vimont, AQB
Jenny Chapman, EEG
Mike Brown, RPB
Districts I, III and IV

DEPARTMENT OF AGRICULTURE (USDA)
AGRICULTURAL RESEARCH SERVICE (ARS)

Comments: Draft Environmental Impact Statement (DEIS)
Dated September 1986

Ground Based Free Electron Laser (GBFEL)
White Sands Missile Range (WSMR), New Mexico

- General. There appears to be some confusion as to the eastern boundary of the Jornada Experimental Range (JER) as operated by USDA-ARS. Withdrawal orders indicate that JER encompasses areas within Townships 17, 18, 19, and 20 South, Ranges 3 and 4 East; DEIS maps show the eastern boundary terminating along Range 2 East.

  Public Land Order (PLO) 833, dated May 21, 1952, while providing for Department of Army withdrawal of approximately 2.4 million acres of land (including a portion of JER), which order to take precedence over the JER Executive Orders (EO's), also provides for return of such to USDA when no longer needed by the Army. Further, while PLO 833 is to take precedence over the JER EO's, the PLO is to otherwise not affect the EO's.

  The DEIS needs to clarify the property boundary issue.

  W-24.1 The appropriate figures in the FEIS have been corrected to reflect this comment.

  W-24.2 The correction has been made to all appropriate figures in the FEIS.

- General. The DEIS identifies the U.S. Forest Service (USFS), occupant and operator of the JER. (For examples, see drawings I-22, I-28, and I-33.) The USFS is no longer the holding agency. Drawings and text should be changed to reflect USDA-ARS as holding agency.

- Page I-13 (Radio Frequency). The impact, if any, of radio frequency interference needs to be assessed. The U.S. Geological Service, for, example, has monitoring stations located in the area to measure wind movement.

  W-24.3 Discussions concerning RFI and EMI have been revised and incorporated into the FEIS (pp IV-45 and IV-46).

- Page I-18 (Airborne Targets). The DEIS mentions a need to provide for impact areas. Will ground surface impact areas be designated only within the WSMR? How will this impact JER?

  W-24.4 The project intends to use current available WSMR impact and launch areas for all airborne experiments. If the current launching impact areas affect JER then the project would increase this impact by the number of added launches required for the experiments. The number of experiments conducted on airborne target would be small compared to the number using ground or space targets.

- Page I-19 (Test Sequence). A statement is made that airborne targets are presently not expected to contain live munitions or explosives. This statement implies that there may be future consideration of such. How wil. this be addressed environmentally?

  W-24.5 The current rules which apply to any airborne target containing live explosives used on WSMR would also apply to such targets if the program uses any. Any environmental restriction, requirements, or regulations applicable to such targets would be carefully followed.

- Page I-19 (Power Requirements). What is impact of first phase testing on existing power? Will testing contribute to power failure thereby requiring back-up systems for present users?

  W-24.6 It is the current intention to power the phase I testing with no discernible impact to other users. All project power equipment would be isolated from direct connection to the power grid by line filters and surge protectors. Separate substation and transmission lines are planed for the site. Testing would not contribute to additional power failures beyond the number already expected from past electrical system performance.

- Page I-20 (Water Requirements). It is estimated that the GBFEL project will demand up to 1,400 acre-feet of water per year or approximately 456 million gallons. If this amount is appropriated from the Jornada basin, the potential exists for drying up ARS present water wells. In that regard, ARS would oppose installation of the two to six supply wells in the Jornada Reserve Headquarters area. (p. IV-34).

  W-24.7 The USASDC would not drill wells within the Jornada Reserve Headquarters, and would make every effort to place the wells in a location that would not significantly affect the ARS wells, as required by New Mexico water law.

In addition, concerning the North of Nasa site, ARS would oppose the corridor B route for water pipeline installation, i.e., the route through JER. Construction could disturb vegetative growth, disrupt soils and alter drainage patterns--all of which are being studied by ARS in their existing state.

W-24.8 Construction of any right-of-way across ARS lands would be closely coordinated with ARS to assure that potential adverse effects are avoided to the maximum extent practicable.

o Page I-25 (Power Transmission Lines). For reasons stated above, under Water Requirements, ARS would oppose the corridor B and C routes for construction of power transmission lines.

W-24.9 Please see Response W-24.8

o Page I-30 (Road and Railroad Requirements). ARS preference for road routing is corridor A. A major road constructed in a north-south direction (i.e., corridor B) would cross the USDA-ARS/DOD co-use area of Pastures 19 and 20 and would impact the following installations in Pasture 20:

W-24.10 Please see Response W-24.8

1. The 640-acre Gravelly Ridge enclosure was established in 1934. This area is valuable to research as it has not been grazed for over 50 years. It provides a benchmark for measurement.
2. Twelve runoff plots were established in 1983. Approximately 4 years of data have been accumulated.
3. One 18-acre watershed and flume were established in 1977. Approximately 10 years of data have been accumulated.
4. A set of contour water harvesting strips were established in 1976. Approximately 11 years of data have been accumulated.
5. Rootplowed and seeded areas exist with approximately 15 years of data having been accumulated.
6. A tebuthiuron-treated area of 320 acres exists with approximately 4 years of data having been accumulated.
7. Brush treatment and cattle/rodent exclusion plots were established in 1940. Approximately 17 years of data have been accumulated.

Any road extending south from the North of Nasa site would have an impact on drainage patterns and would disrupt the ecology and vegetative patterns of downslope pastures, disrupting established levels of stability.

W-24.11 Please see Response W-24.8

Use of existing JER roads would be opposed as the Jornada would be split in two, with livestock programs impacted, cancelling ongoing behavioral studies.

W-24.12 Potential conflicts were identified and considered throughout the evaluation of all sites and the decision-making process. Potential conflicts that may arise for facility rights-or-way (e.g. water and power lines) will be addressed in a separate environmental analysis, as stated in the FEIS.

o Page I-36 (Controversial or Unresolved Issues). Mention is made of the eventual need to resolve conflicts with programs on adjacent lands. It is believed that conflicts need to be identified and addressed at this point in time rather than at a future time.

Comment	No.	Response
The JER is a unique installation with a clearly stated mandate, dating back to 1912. There are no other stations in the western United States which have compiled over 70 years of records of rainfall, stocking, rates, and vegetation. The continuity of records is important, particularly for the development and validation of land use models. As stated earlier, the disruption to research areas which would occur as a result of construction of facilities and supporting infrastructure on the North of Nasa site would seriously impact the ARS research mission. Further, the general increase in activity and the need for increased security measures may impact ongoing research.	W-24.13	These potential effects and conflicts have been considered during the selection process.
o <u>Page IV-8 (Biological Resources)</u>. Not only should permanent habitat loss be addressed but also the impact on adjacent land areas should species choose to reestablish habitats in these adjacent areas.	W-24.14	The success of wildlife species in re-establishing in adjacent areas would depend upon several variables as described in the FEIS. If the adjacent areas are suitable, and are not presently at carrying capacity, then some individuals may be able to successfully migrate; however, the effect of this migration on the adjacent habitats would not be expected to be significant. On the other hand, if carrying capacity and other variables would not satisfy particular life requisites, individuals of various wildlife species would be lost.
o <u>General (Environmental Consequences)</u>. The DEIS should address facilities and programs displaced by the North of Nasa site. Approximately 12,260 acres of grazing land will be permanently lost, or one half of Pasture 19's grazing capacity. Phase two of GBFEL would result in additional pasture loss.	W-24.15	This information has been incorporated into the FEIS (p. I-26). It should be noted, however, that the project area depicted in the FEIS is the total area that would be required for both phases; therefore, phase two would not result in additional pasture losses.
In addition, one of the existing water wells would be displaced. Required for replacement would be a water well, storage tanks, pipeline, and drinking troughs. Goldenburg Spring, in the general vicinity of the North of Nasa site, may also be displaced.	W-24.16	Water catchments for wildlife and livestock would be constructed at various locations to replace the water supply that would be disrupted (ie, New Well). It is presently anticipated that Goldenburg Spring would not be affected.
The choice of the North of Nasa site for GBFEL would affect the use of aerial photography in research. Further, aerial spraying in the brush management program may be impacted.	W-24.17	Aerial photography over the facility project area would be precluded. However, aerial photography of adjacent areas would not be expected to be affected, provided proper coordination through WSMR National Range and USASDC is conducted. The same is true for aerial spraying.

New Mexico
WILDERNESS STUDY COMMITTEE

2724 Veranda Rd NW
Albuquerque, NM
87107

U S Army Corps of Engineers
Fort Worth District
Attention: SWFPL--R
Box 17300
Fort Worth, Texas

Engineers:

Wilderness values adjacent to the Stallion site and mountain wildland values to the north of NASA site are too great to sacrifice when the proposed facility can more easily be constructed somewhere else.

Sincerely,

Jan A. Cummings
Secretary, NMWSC

W-25.1 Thank you for your comment.

The Rio Grande Chapter of the Sierra Club
Southwestern New Mexico Regional Group
1101 3rd Street, Las Cruces, N.M. 88005

November 17, 1986

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX. 76102-0300

ATTN: SWFPL-R

Dear Sirs:

Following are comments requested on the Environmental Impact Statement of the proposed Ground Based Free Electron Laser Technology Experiment Planned for White Sands Missile Range, New Mexico.

The National Board of Directors of the Sierra Club recently adopted a policy in which the Sierra Club:

(a) Opposes the unilateral pursuit of space-based weapons systems beyond basic research to keep current on what is and what is not feasible;

W-26.1 Please see Response 0-41.3

(b) Calls upon Congress to limit appropriations for the Strategic Defense Initiative accordingly;

(c) Opposes any abrogation of relevant arms control agreements;

(d) Calls upon the Soviet Union, the United States, and all other nations to expand the 1967 Outer Space Treaty and negotiate a mutually verifiable multi-lateral ban on the production, testing, and deployment of weapons in space.

Based upon the above policy this entity of the Sierra Club must protest the installation of this facility in any of the three locations proposed for the following reasons:

Under <u>Purpose and Need</u>, I-1, it is stated that GBFEL-TIE would be divided into two stages - low and high power phases. The Sierra Club fears that stage two may result in the use of X-Ray lasers which transform the energy of a nuclear explosion into a focused beam aimed at targets thousands of miles away. Also, under stage two the Army may wish to use nuclear reactors to provide power generation for space based SDI stations. Quite naturally, after the Army has invested considerable funding into stage one of the project, it would be very difficult not to go ahead with stage two at the same location. We object to nuclear proliferation in space as well as in New Mexico whether it be by X-Ray lasers powered by nuclear explosion or non-nuclear lasers powered by nuclear reactors in space, or on the ground. Your final EIS should address the problem if stage on research shows that the only feasible method for stage two research is to employ nuclear energy.

W-26.2 The proposed experiments would utilize a free electron laser which does not require nuclear explosions or nuclear power generation facilities. This response pertains to both Phase I and II.

Under Power Requirements, I-19, it is stated that peak pulse power requirements for the low and High power phases are not presently known but current estimates run from from 300 to 1,000 megawatts. This will require either numerous high KVA power lines to run to the site from various locations or substantial generation facilities available on a standby basis at the research facility. We object to the environmental damage that will be sustained by power lines crossing wilderness or other pristine natural areas to supply the project, or the air and solid waste pollution caused by usage of a high megawatt power plant with its attendant demands for cooling water. It is noted that a separate EIS might be called for to assess power requirements for the high power phase. Prominent SDI scientist James Jonson has said that Star Wars may require energy equivalent to "a substantial fraction of the output of the eastern U.S. power grid." If this is the type of power need for phase two of the GBFEL-TIE project we believe the public is not being fully informed of the envirnmental consequences of this project.

W-26.3 Wilderness or other pristine natural areas would be avoided to the maximum extent practicable. Selection of the Orogrande site would greatly facilitate this commitment because no such areas have been identified in the vicinity of the Orogrande site and the transmission lines required would be much shorter than those that would be required for Stallion or North of NASA. Air and solid waste pollution could be ameliorated by the use of energy storage devices rather than power generation plants. This option is still being considered, as discussed in the FEIS. The 1,000 megawatt demand is the maximum amount expected to be required for the phase two GBFEL-TIE; Dr. Ionson's comment did not specifically refer to GBFEL-TIE, which is only one research facility as part of the SDI research program.

Under WSMR Constraints, II-1, it is stated that "significant portions of the White Sands Missile Range such as White Sands National Monument and San Andres National Wildlife Refuge are not freely usable for major new facilities or activities." We wish to mention in the strongest possible terms that White Sands National Monument is not a part of the White Sands Missile Range. The National Monument was established in 1933 considerably predating the Missile Range. The present testing schedule at the Missile Range consists of closures of Highway 70, the only access road to the Monument, on the average of two or more hours each day. Add the testing schedule of GBFEL-TIE and access to this unit of the National Park System will be significantly reduced. Use of the North of NASA site will seriously impact the San Andres Wildlife Refuge while the Stallion site impacts the Bosque del Apache National Wildlife Refuge and two Bureau of Land Management Wilderness Study Areas.

W-26.4 This correction has been made in the FEIS. The BLM wilderness study areas are not established at this time, but are proposed for inclusion for the system. These areas were discussed in the FEIS (pp III-46 and IV-21).

In summation, we believe that the current activities at White Sands Missile Range are already severely impacting the environment both within and along the edges of the Range. We believe that any proposal in which the ultimate environmental consequences are still unknown until further research is completed, should not be added to the present over-taxed environment of this area.

W-26.5 Thank you for your comment.

We appreciate the opportunity to comment on the draft impact statement.

Sincerely yours,

Benjamin J. Zerbey

Benjamin J. Zerbey
Group Chairman, SWNMRG,
Sierra Club

Woman's Club

Carrizozo, New Mexico 88301

November 19, 1986

U. S. Army Corps of Engineers
Ft. Worth District
Box 17300
Ft. Worth, Texas 76102-0300

SUBJECT: Star Wars Test Site

The General Federation-New Mexico Federation, Carrizozo Woman's Club endorses Stallion Site as the testing site for the Star Wars project.

Our community, although small, has much to offer. We not only have an ideal climate - we also have a fine medical clinic, dentist office, EMT services, seven churches, an active senior citizen center, recreation center with bowling alley and swimming pool, excellent school system, low real estate costs, low tax base, and some of the finest people to be found anywhere! Organizations include Lion & Lioness Club, Rotary, Extension Club, Oddfellows & Rebekkahs, Knights of Columbus, Masons and Eastern Star, as well as Woman's Club. We need economic growth in our area and we feel that this project would benefit us greatly.

Stallion Site would be an ideal location because it is located between two mountain ranges, not to mention all the other assets it has.

Please give this serious consideration. We appreciate it!!

Sincerely,

Sue Stearns

Sue Stearns, President

cc: Congressmen Skeen, Domenici, Bingaman

W-27.1 Thank you for your comment.

DEPARTMENT OF THE ARMY
U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002-5014

REPLY TO
ATTENTION OF

20 NOV 1988

STEWS-PL-A

SUBJECT: Draft Environmental Impact Statement (DEIS) for the Ground Based Free Electron Laser (GBFEL)

District Engineer
Fort Worth District
U.S. Army Corps of Engineers
P. O. Box 173000
Fort Worth, TX 76102-0300

1. White Sands Missile Range review of the subject report has identified several areas that were not addressed or fully evaluated. It is recommended that the enclosed WSMR comments be considered during preparation of the final Environmental Impact Statement for GBFEL or prior to initiating site construction.

2. WSMR - Providing Leaders the Decisive Edge.

FOR THE COMMANDER:

James A. Chernault
JAMES A. CHERNAULT
COL, IN
Deputy Commander

Encl

DEPARTMENT OF THE ARMY

U.S. ARMY WHITE SANDS MISSILE RANGE
WHITE SANDS MISSILE RANGE, NEW MEXICO 88002

REPLY TO ATTENTION OF

STEWS-IS-N 17 November 1986

MEMORANDUM FOR THE ENVIRONMENTAL QUALITY COORDINATOR

SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

1. Reference:

a. The National Environmental Policy Act (NEPA), 42 USC 4341, Amended by PL 94-52, July 3, 1975; PL 94-83, August 9, 1975.

b. Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures, 40 CFR 1500-1508; 43 FR 55990; November 29, 1978; Corrected by 44 FR 873, January 3, 1979, effective July 30, 1979; revised by 51 FR 15618, April 25, 1986,

c. Army Regulation 200-2, Environmental Effects of Army Actions, 15 March 1985.

d. MFR, IS-N, 27 August 1986, subject: GBFEL-TIE DEIS Review/Comment (Sep 86 DEIS).

2. National environmental policy as established in NEPA (reference 1a), implemented through 40 CFR (reference 1b), and supplemented through codified Army Regulation (AR 200-2, reference 1c) provides the basis for the following comments.

a. 40 CFR 1502.1 - Purpose.

(1) The subject document does not address how each of the various alternatives discussed (i.e., siting alternatives, utility alternatives, etc.) will avoid or minimize adverse impacts or enhance the quality of the human environment. For example:

(a) Since the areal requirements and specific engineering requirements for the ground target range are unknown, the ecological impacts associated with any of the alternate sites cannot be assessed (DEIS VI-9, paragraph 1).

(b) DEIS, pp IV 21 and 24, states that since actual utility corridors are presently unknown, adverse impacts to cultural resources cannot be assessed. Therefore, the comparative potential for minimization of adverse impacts with any particular utility route cannot be determined.

Enclosure 1

W-28.1 Ground target range requirements (areal and engineering) would be similar at each site. The orientation of these ranges are depicted in several Figures in Chapter I of the FEIS. It was assumed that the entire laser facility, including the ground target range, would be fenced, thereby eliminating the area as habitat for larger wildlife species (ie, large mammals, in particular). As such, the relative potential impacts can be compared.

W-28.2 The DEIS states that the"...exact route..." is not presently known. However, potential corridors for the utility facilities are presented in Figures I-11 through I-12, and I-15 through I-17 of the DEIS. The lengths of each transmission line would vary depending upon the site selected. However, the width of the right-or-way would be the same for all three sites. Therefore, given the density of cultural resources comparative analysis of potential effects can be made.

STEWS-18-M
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

(2) The subject document does not present a clear, concise assessment supported by evidence that the necessary environmental analyses have been carried out.	W-28.3	Please see Response W-9.8
(a) The DEIS, V-3, recognizes the requirement for field surveys to determine the occurrence of threatened or endangered species prior to site selection. However, no such surveys have been performed and the proposed GBFEL-TIE schedule appears to leave little time for such an undertaking (DEIS, 1-10).	W-28.4	Information on potential impacts to threatened, endangered, protected species has been a key factor in the site selection process. Upon selection of a site, appropriate surveys will be done to locate such species habitat that might be affected by the project. Measures to avoid such habitat or other means to mitigate impacts will then be developed in consultation with the U.S. Fish & Wildlife Service and/or N.M. Department of Game & Fish.
(b) AR 200-2 (Appendix B) and 40 CFR 1502-16(e) require consideration of the energy requirements and potential conservation methodologies associated with any federal action. While base and peak power requirements for this action are mentioned, along with descriptions of possible power sources, the evaluation of energy conservation potential is not provided (including the applicability of an Energy Resource Impact Statement IAW AR 200-2 and 11-27).	W-28.5	Additional discussions of potential energy conservation methods have been incorporated into the FEIS (p. IV-46).
(c) DEIS, II-9 (Existing Programs) states that the potential impacts of GBFEL-TIE program on existing and future WSMR programs have been determined and evaluated. Review of Section I does not support this statement. Program conflicts are mentioned and briefly described, but they are not evaluated with evidence of supporting analyses. IAW 40 CFR 1502.1.	W-28.6	The discussion concerning potential program conflicts has been expanded in Section I of the FEIS.
b. 40 CFR 1502.2 - Implementation		
(1) The subject document does not discuss impacts in proportion to their significance since differential levels of impact cannot (in many cases) be determined due to lack of baseline data or necessary analyses (see also, 40 CFR 1508.27).	W-28.7	The relative values and significance of effects have been expanded in Chapter III and IV of the FEIS.
(a) DEIS, IV-9, states that the most significant impact to vegetative communities would occur at the Stallion site due to the loss of grasslands. However, the DEIS does not establish how much of each habitat type within each site will be lost (DEIS, II-36). It also does not explain why the loss of grassland habitat is considered more significant than the loss of other vegetation types.	W-28.8	Revisions have been made to the FEIS to reflect this comment.
(b) Since no field surveys have been conducted to determine the occurrence of threatened or endangered species within each alternative siting location (DEIS, V-3), it is doubtful that the discussions of this issue are adequate.	W-28.9	Please see Response W-28.4
(2) The DEIS clearly states that more study is needed to assess unknown parameters in relation to issues such as threatened or endangered species (V-3), utility rights of way (IV-21 and 24), and power sources (I-25).	W-28.10	As indicated in Section I (p. I-1), a tiered approach is being used to continue environmental studies on potential GBFEL-TIE impacts.

2

STEWS-IS-N
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

(3) The subject document does not state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of the Act and other environmental laws and policies.

c. 40 CFR 1502.4 - Major Federal Actions Requiring the Preparation of Environmental Impact Statements.

(1) Subject document does not clearly define the proposed projects.

(a) For example, spatial requirements have not been determined for utility Row routes (p. IV-21, paragraph 6, p. IV-24, paragraph 1-4), "security areas" (p. IV-19, paragraph 5) and any required "temporary work areas" (p. IV-9, paragraph 1). Due to this lack of information, resource impacts from each activity, for each site, cannot be assessed.

(b) Subject document does not properly define the proposed project as per the document title: "Draft Environmental Impact Statement of the Proposed Ground Based Free Electron Laser Technology Integration Experiment." The document should assess the total project and all its ramifications: "Connected actions, which means that they are closely related . . . should be discussed in the same impact statement. Actions are connected if they . . . are interdependent parts of a larger actions and dependent on the larger actions for their justification" (40 CFR 1508.25: Scope). The subject document text alludes in several instances, to actions requiring "separate environmental analysis." (p. IV-21, paragraph 6, p. IV-24, paragraph 1-4). Yet, the actions (utility routes, water sources, and power generation/energy storage) are interdependent parts of the larger action (GBFEL-TIE program).

(c) Assessment of many issues which qualify under 40 CFR 1508.25 as being within the scope of the DEIS has been omitted, including: connected actions (e.g., utility corridors, water sources, power generation/energy storage); cumulative actions (e.g., the possible requirement to eliminate, move, or reduce some ongoing WSMR missions to accommodate the GBFEL-TIE); and similar actions.

(2) The subject document attempts to relegate decisions on several issues integral to the siting process to a time frame after the siting ROD is filed (I-36). Per comments on an earlier draft of the DEIS (reference 1d), issues such as utility routes, alternative water supplies and power generation/energy storage devices are so closely related to the siting decision as to be part of it. These issues are, obviously, portions of the GBFEL-TIE program and, as such, cannot be assessed separately (IAW 40 CFR 1502.4(a)). There would be no need to consider utility routes, alternative water supplies or the necessity of power generation/energy storage devices at WSMR at this time were it not for the GBFEL-TIE program.

3

W-28.11 The EIS evaluates various alternative sites, power sources, water supplies, and other essential components of the proposed GBFEL-TIE, the purpose and need of which is discussed in Section I of the EIS. The EIS further discloses all anticipated impacts and recommends mitigation and monitoring measures in an attempt to develop the best balance between essential considerations of national policy and the conservation of the Nation's natural resources. The requirements of Sections 101 and 102 (1) of the Act, therefore, have been satisfied.

W-28.12 Please see Responses W-28.1 and W-28.2

W-28.13 Some of the referenced actions would require competitive bids to be submitted by private and/or public entities. Since there has been no selection of such contractor(s), exact routes cannot be determined. However, comparisons among the three sites of relative potential effects can be made. In addition, as stated in the FEIS, subsequent tiers of environmental analyses for such facilities would be conducted.

W-28.14 Please see Response W-28.13. Cumulative impacts have been addressed and incorporated into the FEIS (pp IV-48 and IV-49).

W-28.15 Please see Response W-28.13

STEWS-IS-N
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

d. 40 CFR 1502.14 - Alternatives including the proposed action.

(1) The subject document does not present the environmental impacts of the proposal and the alternatives in a comparative form which sharply defines the issues and provides a clear basis for choice among the options by the decision maker and the public. The evaluations of significance employed throughout the document are largely qualitative and unsupported by scientific research or sources IAW 40 CFR 1501.2(6) and 1502.24 (e.g., DEIS, III-64-66). Significance, as applied within the DEIS, rarely takes both context and intensity into account (40 CFR 1508.27). For example: baseline levels of service and regions of influence are not quantified or explained; ambient noise levels are not quantified for affected outdoor environments, etc.

W-28.16 Alternatives are presented in a comparative form in Tables II-1 through II-3 and Table II-6). References used to draw conclusions have been cited throughout the FEIS as required by 40 CFR 1502.24; the EIS was prepared IAW 40 CFR 1502.6. Baseline levels of service and region of influence are discussed in the FEIS; ambient noise level data are non-existent at WSMR.

(2) The no action alternative is not addressed as an examination of the status quo IAW AR 200-2 (Appendix B).

W-28.17 The FEIS has been revised to reflect this comment.

e. CFR 1502.16 - Environmental Consequences

(1) The subject document does not assess the short-term affects of ground and surface water drawdown due to GBFEL-TIE usage versus the long-term affects on the surrounding region not having access to that water.

W-28.18 The water supplies that have been identified in the FEIS as the most cost effective would not significantly affect the long term use of the supply by the surrounding region with the possible exception of the North of NASA. However, it should be noted that a water permit would not be granted by the State Engineer, if such long term adverse effects would be anticipated.

(2) The subject document does not assess the long-term effects of the GBFEL-TIE experiment should it fail or is terminated. Page IV-33, paragraph 2, specifies that the proposed GBFEL-TIE is a temporary experiment (". . . any potential adverse effect on water supply may be construed as short term consequence that would ultimately return to pre-project conditions . . ."). No indication is made of after-action, long-term impacts if/when GBFEL-TIE ceases to operate. Conversely, the matter of successful experimentation and the future use of the GBFEL-TIE facilities is not addressed, either.

W-28.19 Revisions to the socioeconomic discussion, including long term effects, have been made to the FEIS.

(3) The subject document does not include discussions of possible conflict between GBFEL-TIE and the objectives of several Federal, regional, State and local land use plans IAW 40 CFR 1502.16(c). For example: potential conflicts exist between GBFEL-TIE at the North of NASA site and the Jornada Experimental Range, and the San Andres National Wildlife Refuge.

W-28.20 These revisions have been incorporated into the FEIS.

(4) The subject document does not include a discussion of the energy conservation potential of the various potential sources of power generation (backup and prime) and energy storage possibilities, or the mitigation measures associated with power requirements IAW 40 CFR 1502.16(e). Furthermore, it is possible an Energy Resource Impact Statement is required in compliance with AR 200-2, Appendix B, paragraph B-7a.

W-28.21 A discussion of energy conservation potential has been incorporated into the FEIS (p. IV-46).

(5) The subject document does not identify and discuss specific mitigation applicable to the affected environmental elements at each alternative site (40 CFR 1502.16(f)). Rather, the DEIS addresses mitigations associated with some portions of the GBFEL-TIE regardless of final siting.

W-28.22 The discussion of mitigation measures has been revised in the FEIS to incorporate recommendations made during a meeting with WSMR, USFWS and NMGF on 17 November 1986.

STEWS-ES-M
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

f. 40 CFR 1502.22 - Incomplete or unavailable information (as changed by 51 FR 15618, April 25, 1986).

(1) Much information relevant to adverse impacts is unavailable (e.g., peak power requirements for low and high power testing; I-25; availability of water and technical, environmental, and economic feasibility of the potential water supply, I-36; specific requirements for the ground test range; I-3 and 6, etc.).

(2) The DEIS does not provide a summary of "credible" scientific evidence available to them for assessing possible adverse effects where data gaps exist. The DEIS References section is largely a list of personal communications rather than references to a body of published scientific research.

(3) The proponents of GBFEL-TIE have not stated in the DEIS that the cost of obtaining the missing information would be too high or that they don't know how to obtain it. Rather, the implication is that their program schedule does not provide sufficient time to carry out the necessary research (DEIS, I-10 and 36). Such scheduling violates 40 CFR 1501.1 and 1501.2.

(4) Finally, 51 FR 15618 requires agencies preparing statements to try to obtain missing information if making a "reasoned choice" among options for carrying out the project depends on the information and the costs to obtain it are not exhorbitant. The subject document offers no indication that such attempts were made.

g. 40 CFR 1502.23 - Cost-Benefit Analysis

The subject document does not utilize economic analyses to compare the cost of siting the GBFEL-TIE facility at any given location with the benefits gained by use of that particular location instead of the others. For example, comparing use of the Orogrande site versus the North of NASA site: would the cost of mitigating the GBL conflicts with WSMR projects located at Orogrande warrant siting the facility at North of NASA, in spite of high cultural mitigation costs, or would the benefits offered by the Orogrande site be great enough that they overcome the associated costs.

3. Other Comments

a. Page 3, Section 5: This section addresses the possible need for various air emissions including hazardous emissions permits. If such permits may be required, then further discussion of the emissions and their impact on the environment are necessary.

b. Page E-1, Section 1.A: This section indicates "tiering" will be utilized for future phases. In order for tiering to be used, the Environmental Impact Statement must comply with NEPA, i.e., be a programmatic assessment.

5

W-28.23 Please see Responses W-28.1, W-28.2, and W-28.13

W-28.24 Please see Response W-28.16

W-28.25 The USASDC has identified that data gaps exist relevant to utility corridors and, consequently, has provided an assessment of the alternative corridors at each site for these facilities as they may affect biological and cultural resources. It is also stated repeatedly that a tiered approach has been adopted in order to focus the analyses on the issues which are ripe for decision (IAW 40 CFR 1502.20), and that additional environmental analyses will be conducted under appropriate circumstances.

W-28.26 Please see Responses W-28.16 and W-28.25

W-28.27 40 CFR 1502.23 requires presentation of a cost-benefit analyses only "If a cost-benefit analysis... is being considered for the proposed action..." Further this section states "For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis..."

W-28.28 Potential air quality impacts, as they are presently expected, are discussed on p. IV-6 through IV-8 of the FEIS. If Argon 41 is required to be vented, it would be at extremely low levels and would be further reduced by mixing it with air. The argon/air mixture would then be vented through a tall flue stack to assure that the ground level concentrations were below threshold limit values. A fence would also be constructed around the stack to further reduce the chances of personnel or wildlife of coming into contact with these emissions (p.IV-39, FEIS).

W-28.29 NEPA does not require that an EIS be a programmatic assessment in order to use tiering; rather, it uses programmatic EISs as an example for when tiering could be used. In fact, 40 CFR 1502.20 states that "Tiering may also be appropriate for different stages of actions."

STEWS-IS-N
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

c. Page I-5 through I-9: The land area descriptions given in paragraph D.1. on page I-5 are different than those shown in Figure I-4, I-5 and I-6. This must be corrected.	W-28.30	The land area descriptions provided on page I-5 of the DEIS are close approximations, as are the areas depicted in the referenced figures. Distortions in the figures which occur during reproduction and constant shrinking and swelling of paper, could produce errors in the scale of the maps which may have indicated an inconsistency between the figures and the narrative.
d. Page I-24: There is no indication if the treated cooling water or residue are considered a hazardous waste. There also is no indication whether or not the proposed storage tanks are to be above or below ground. These two items can be very important considerations in programming and facility siting and should be discussed.	W-28.31	It is presently anticipated that the treated cooling water would not constitute a hazardous waste. Various storage facilities would be required and both surface and subsurface tanks would be expected to be constructed. However, as stated in the FEIS, all tanks would be constructed and operated in strict compliance with state and Federal regulations (eg., RCRA).
e. Page I-36, Section F: These issues are basic to site selection and must be assessed prior to site selection to be able to make an informed decision.	W-28.32	Please see Responses W-28.2, W-28.13, and W-28.25
f. Page III-14: It is stated that WSMR air quality is very good relative to established ambient air quality standards. This statement is true and should be used as a benchmark for determining the effect of the project on the local air quality. Not ambient air quality standards.	W-28.33	Air quality effects must be assessed in comparison with air quality standards to support conclusions of impact significance.
g. Page III-23: The second paragraph cites air pollution from commuter traffic on WSMR but does not discuss the impact of 2,500 personnel (Page I-19) commuting to GBFEL-TIE. A discussion of this impact must be provided.		
h. Page III-23: Section 2, paragraph 2: States that New Mexico has no Class II PSD Areas. According to New Mexico Environmental Improvement Division, all of the proposed GBFEL-TIE areas are Class II PSD classification.		
i. Page III-64, Section D: Alamogordo is not a major airport and does not have connecting flights to any airport except Albuquerque.	W-28.34	The FEIS has been revised to include this discussion. (p. IV-6).
j. Page III-65, Section 10a: The statement that "All denominations are presented" is not accurate. Cities like El Paso have <u>most</u> <u>major</u> denominations. Cities like Alamogordo do not have most major denominations.	W-28.35	The correction has been made in the FEIS.
k. Page IV-5, Section D.1: This section admits there will be an effect to the local air quality from power generations but it does not discuss these effects and plans for mitigation.	W-28.36	The FEIS has been revised to clarify any potential misinterpretation.
l. Page IV-5, Section D.2: It is stated that fugitive dust could be minimized with water or dust suppressants. If one or both of these methods are to be used then it should state that. The impacts of each method must be discussed.	W-28.37	The correction has been made in the FEIS.
m. Page IV-6, Section 3: This section states that construction activities will have "minimal long term effects". If the effects are "minimal long term" then there must be some effect. Delineation and explanation of these effects are needed.	W-28.38	Air quality effects from stand-by power generation are presented in Tables IV-1 and IV-2 and discussed on pp. IV-6 through IV-8 of the FEIS.
	W-28.39	The FEIS has been revised to include the concern about dust suppressants (page IV-6).
	W-28.40	The FEIS has been revised to reflect this comment (page IV-6).

6

STEWS-18-N
SUBJECT: GBFEL-TIE Review/Comment (Sep 86 DEIS)

n. Page IV-6, Section 4: This section states that the stand-by generations would be required during all experimental testing. This appears to be contradictory to other indications that stand-by generating facilities will be needed only during the high power phase.

o. Page IV-38: The first sentence continued from Page IV-37 uses the phrase "many years". How many?

p. Page IV-33: The second paragraph states that GBFEL-TIE is a temporary experiment and the water supply will return to pre-project conditions. Since water withdrawal is presently above rechange, how can this occur?

q. Page V-1, Section C: This section addresses monitoring to meet State and Federal Air Quality Standards. Since it was earlier noted that the air quality in the study areas is much lower than State or Federal standards and the installation of monitoring equipment indicates the possibility of exceeding the standards then a significant impact to air quality can be expected. Mitigation of the impacts to the air quality should be discussed.

r. NEPA requires NO ACTION ALTERNATIVE to be treated and discussed comparing it to other alternatives throughout the document. This is not the case in the Environmental Impact Statement.

4. Based on the above, recommend the subject document be revised.

ROBERT J. ANDREOLI
Environmental Engineer

DAISAN E. TAYLOR
Wildlife Biologist

7

W-28.41 Stand-by generation may be required for both phases during lasing experiments to accommodate a safe shut-down in emergency situations. Generation and/or storage facilities may be used during the high power phase to provide the instantaneous demand (up to 1,000 megawatts) during lasing experiments in this second phase.

W-28.42 As stated in the FEIS, the lifetime would depend upon the isotopes that are produced. Some components will be active for milliseconds while others are active indefinitely. For example, the half time of aluminum 26 is 26,000 years. Long term radioactive components will not be produced in large quantities, but will be maintained and retired in conjunction with approved safety standards so there is no significant health or environmental hazard.

W-28.43 Water resources and requirements are discussed in Section III, pp. III-67 to 72. Permit requirements are discussed in Section IV, pp. IV-36 to 38.

W-28.44 Establishment of an air quality monitoring station was included as part of a mitigation program. The purpose of this station is described on the FEIS (page V-1)

W-28.45 Please see Response W-28.17

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1580
ALBUQUERQUE, NEW MEXICO 87103-1580

REPLY TO ATTENTION OF

SWACO-R

4 November 1986

SUBJECT: Draft Environmental Impact Statement - Proposed Ground Based Free Electron Laser Technology Integration Experiment, WSMR

U.S. Army Corps of Engineers
Ft Worth District
ATTN: SWF (Ms. Rebecca Griffith)
P.O. Box 17300
Ft Worth, TX 76102-0300

1. Reference is made to the Draft Environmental Impact Statement of the Proposed Ground Based Free Electron Laser Technology Integration Experiment, White Sands Missile Range (WSMR), New Mexico, dated September 1986.

2. Regulations pursuant to Section 404 of the Clean Water Act (33 CFR 330.5(a)(26)) describe a nationwide permit for discharges of dredged or fill materials into certain waters that are located in closed basins or above the headwaters of waters of the United States. A summary of the provisions of this permit describing the Corps regulatory program is enclosed for your information. Other nationwide permits that could apply are utility lines, minor road crossings and discharges less than 10 cubic yards.

W-29.1 Thank you for your comment.

3. The three project sites are located in a closed basin. The project can be constructed provided it does not result in the loss or substantial adverse modification of more than one acre of waters of the United States, including wetlands. The officer responsible for the project must insure compliance with all conditions of the permit.

W-29.2 Thank you for your comment.

4. For discharges which cause the loss or substantial adverse modification of one to ten acres of such waters, including wetlands, notification is required in accordance with the enclosed procedures. Discharges resulting in the loss or substantial adverse modification of more than ten acres of these waters will require an individual Section 404 permit.

W-29.3 Thank you for your comment.

5. Should you have any questions regarding these regulations, please feel free to write or call Ms. Annie S. Bell or Mr. Andrew Rosenau at (505) 766-2776.

FOR THE COMMANDER:

Robert E. Meehan
Robert E. Meehan, P.E.
Chief, Construction-Operations Division

Encl
as stated

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

NOV 14 1986

Colonel Albert J. Genetti
Fort Worth District Engineer
U.S. Army, Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Colonel Genetti:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act (NEPA), Region 6 of the U.S. Environmental Protection Agency (EPA) has completed its review of the Draft Environmental Impact Statement (EIS) for the U.S. Army Strategic Defense Command's proposed construction and operation of a Gound Based Free Electron Laser Technology Integration Experiment (GBFEL-TIE) at White Sands Missile Range (WSMR), New Mexico.

The Draft EIS was prepared by the U.S. Army Corps of Engineers (COE) in response to a request from the U.S. Army Strategic Defense Command under the authority of the Strategic Defense Initiative Organization. The purpose of the project is to test and evaluate the potential propagation of a ground based free electron laser beam through the atmosphere to desired diagnostic targets without significant reductions in the beam's quality and energy levels. The EIS is only concerned with the site selection process.

The project is to be located at one of three potential sites totally within the WSMR. These sites include: 1) north of the NASA White Sands Test Facility; 2) south of the Stallion Range Camp; and 3) west of the Orogrande Range Camp.

The experiment would be conducted in two phases, a low power phase and a high power phase. Construction of the low power laser facility is planned to begin in early 1987 and is projected to be completed within two to three years. Modification of this facility for the high power phase experiments would commence in the early 1990's depending upon results of the low power tests and completion of a supplemental EIS.

The EIS explains that the design and operational requirements of the high power phase would be determined as a result of the low power phase experiments; therefore, the potential effects of the second stage cannot be fully evaluated at present. Consequently, the Draft EIS addresses the potential impacts expected to occur with implementation of the low power phase. Information concerning the high power phase is provided wherever it is appropriate to the site selection process. In compliance with Section 1508.28(b) of the Council on Environmental Quality Regulations (CEQ) regarding "Tiering", a supplemental EIS will be prepared prior to implementation of the second phase. Page 1-1 of the Draft Statement explains that the NEPA and CEQ requirements will be fully complied with for the high power phase.

The following comments are offered for your consideration.

AIR QUALITY COMMENT

Our review indicates the proposed action may be subject to the Prevention of Significant Deterioration (PSD), and the National Emission Standards for Hazardous Air Pollutants (NESHAP) air emission related permitting requirements. The Final EIS should fully explore each of the above air quality regulations and demonstrate appropriate coordination has been initiated to ensure timely application with the State Air Pollution Control Agency and satisfactory compliance with the regulatory requirements. Since the construction phase of this project is in close proximity to several PSD Class I areas, we request that the State's views on the potential air quality impacts be solicited and their response included in the Final EIS.

W-30.1 Although no permit applications have been filed, coordination with New Mexico EID was initiated on 14 July 1986. The New Mexico EID has reviewed the DEIS and did not anticipate any significant problem concerning air quality. (Please refer to comment and Response W-23.10). In addition, emissions that may require PSD or NESHAP permits would be associated with power generating plant for peak demand and/or mirror coating facilities, which would occur during the second phase, if they would be needed at all.

In addition to the above air quality comment, we also note the following discrepancies needing correction within the Final Statement:

a) Under Section D (Air Quality), Part 1 (General), the 2nd Paragraph states, "The Code of Federal Regulations (CFR)(10) defines..." Please note that this reference should be to Volume 40 of the CFR.

W-30.2 The correction has been made in the FEIS.

b) Page IV-7 indicates NO_x concentration are not expected to exceed annual air quality standards. We ask that the Final EIS verify that the modeling analysis included all NO_x sources that could affect the project area.

W-30.3 The only other potential sources of NO_2 that could be identified were minor emissions associated with space heaters and from vehicular traffic. Both of these are discussed in the FEIS (p. IV-6).

SITE SELECTION COMMENT

Our review leads us to conclude that the Orogrande site within the WSMR is an appropriate candidate for the preferred siting location. Pages II-4 and II-5 of the Draft EIS provides a matrix analysis of the associated potential impacts for each of the three alternative site locations. Areas assessed include physical, biological and cultural resources. The analysis indicates that the Orogrande site should have the least potential to adversely impact soils, threatened or endangered species, archeological/

historical sites and socioeconomic resources. Although none of the three alternative site locations have been identified which would incur significant adverse environmental impacts, the Orogrande site exhibits the least inherent potential for such occurrence. We therefore conclude that selection of the Orogrande site as the preferred siting location would be most favorable from the prespective of EPA's environmental review.

W-30.4 Thank you for your comment.

We classify your Draft EIS as LO (Lack of Objections). Specifically, we have no objection to the implementation of the low power phase of the GBFEL-TIE. Our rating is conditioned upon your agency fully complying with the requirements under Section 1508.28(b) of the CEQ Regulations regarding "Tiering". Tiering will require preparation of a supplemental EIS fully addressing the associated impacts of the high power phase of the GBFEL-TIE prior to its implementation. Additionally, we ask that the supplemental air quality impact information as identified in our above comments be included in the Final Statement. At this planning stage, we concluded that the Orogrande site is an appropriate candidate to be recommended for selection as the preferred siting location.

W-30.5 Thank you for your comment.

Our classification will be published in the Federal Register according to our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act.

We appreciate the opportunity to review the Draft EIS. Please send our office one (1) copy of the Final EIS at the same time it is sent to the Office of Federal Activities, U.S. Environmental Protection Agency, Washington, D.C.

Sincerely yours,

Frances E. Phillips

Frances E. Phillips
Acting Regional Administrator (6A)

Department of Agriculture | Service | Region | Albuquerque, NM 87102

Reply To: 1950

Date:

Ms. Rebecca Griffith
ATTN: SWFPL-R
US Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300

Dear Ms. Griffith:

Our review of your DEIS of the Proposed Ground Based Lazer, White Sands Missle Range, New Mexico, did not highlight any conflicts between your proposal and our ability to achieve our Forest Service mission in Region Three. We appreciate being involved in the review of this and any other projects that may affect our management.

W-31.1 Thank you for your comment.

Sincerely,

John W Russell

JOHN W. RUSSELL
Director of Land
Management Planning

FS-6200-28(7-82)

407 KIM RD.
EL PASO, TEXAS 79902
OCTOBER 24, 1986

U.S. ARMY CORPS OF ENGINEERS
FT. WORTH DISTRICT
BOX 17300
FT. WORTH, TEXAS 76102-0300
ATTN: SWFPL-R

GENTLEMEN:

REGARDING THE HEARING CONCERNING THE GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT AT WHITE SANDS MISSILE RANGE NEW MEXICO —— HELD LAST NIGHT OCTOBER 23, 1986 IN EL PASO — AT WHICH TIME I DID NOT VOICE A STATEMENT, BUT IF I HAD DONE SO, IT WOULD HAVE BEEN AS FOLLOWS:

WE HAVE TO COPE WITH HIGH TECH AND ALL ITS PROBLEMS. IT'S HERE IN THIS PART OF THE UNITED STATES, AND UNIQUELY, NEW MEXICO AND WEST TEXAS ARE IN A POSITION TO ABSORB THE LASER RESEARCH AND ITS TESTING. SEVERAL COLLEGES IN THIS AREA HAVE BEEN GRADUATING SCIENTISTS FOR MANY YEARS, AND THE STREAM OF TRAINED HIGH TECH PEOPLE GROWS AND GROWS. THE RESEARCH FACILITIES AT THESE UNIVERSITIES CAN BE INCORPORATED IN THE LASER RESEARCH PROGRAM.

W-32.1 Thank you for your comment.

THE LOCATION OF THE TEST SITE COULD BE ADEQUATELY PROVIDED AT ANY ONE OF THE SITES UNDER CONSIDERATION, BUT OPERATIONALY, THE OROGRANDE SITE, IN MY OPINION, IS FAR BEST. THE TONE OF PEOPLE'S NEEDS IN A RESEARCH ENVIRONMENT HAS TO BE UNSURPASSED IN ORDER TO ACCOMPLISH THE GOAL OF RESEARCH SOLUTIONS. THIS IS THE FRINGE BENEFIT OF THE OROGRANDE SITE BECAUSE OF ~~IT~~ BEING WITHIN 40 MILES OF COSMOPOLITAN EL PASO.

W-32.2 Thank you for your comment.

WATER SUPPLY OF THE HUECO BOLSON AT THE OROGRANDE SITE CONSISTS OF 6,000,000 ACRE FEET FROM UNDERGROUND AQUIFERS, ACCORDING TO STUDIES OF THE U.S. GEOLOGICAL SURVEY. EL PASO RECEIVES 90% OF ITS WATER NEEDS FROM THIS SOURCE, AND ONLY 10% FROM THE RIO GRANDE WATER WELLS AT OROGRANDE COULD TAP THE UNDERGROUND SUPPLY FROM POTABLE AQUIFERS ALONG WITH INDUSTRIALLY USABLE BRACKISH AQUIFERS.	W-32.3	The most cost effective water supply alternatives have been revised in the FEIS.
ABOUT 20 MILES FROM THE OROGRANDE SITE IS THE POWER SOURCE OF EL PASO ELECTRIC COMPANY AT NEWMAN, NEW MEXICO.	W-32.4	Thank you for your comment.
WE HAVE TO RELY ON RESEARCH TO DISPOSE OF POSSIBLE CONTAMINATES FROM THE OVERALL PROGRAM. PUBLIC CONCERN IS RESPECTED AND CONSIDERED, BUT ALSO, THE PUBLIC HAS TO HAVE CONFIDENCE THAT THE ELIMINATION OF DANGERS CAN BE MADE.	W-32.5	Thank you for your comment.
ACCORDING TO THE SLIDE SHOW AT THE HEARING, LESS ENVIRONMENTAL CHANGES WILL OCCUR AT THE OROGRANDE SITE.		
I WOULD RECOMMEND THE OROGRANDE SITE.	W-32.6	Thank you for your comment.

YOURS VERY TRULY,

JOHN A. FERGUSON, P.E.

Dr. Arnold H. Rots
501 Melody Lane
Socorro, NM 87801

U.S. Army Corps of Engineers
Ft. Worth District
Box 17300
FT. WORTH, TX 76102-0300
ATTN.: SWFPL-R

November 12, 1986

RE: Draft EIS GBFELTIE at WSMR

Dear Sir:

After considering your predictions in connection with the basing of the Ground Based Free Electron Laser Technology Integration Experiment at Stallion Site and taking into account the remarks made at the hearing last month here in Socorro, I am left with very uneasy feelings on a great many points, but especially concerning the socio-economic impact on this community of the establishment of such a project at Stallion Site. In this letter I would like to discuss some relevant issues and share with you the concerns I have on the basis of some simple common sense projections.

W-33.1 You are projecting large fluctuations in work force: from 1500 to 300, back to 1500 and to 300 again - all in about three year cycles; all numbers accurate within a factor two. And this is assuming that the project will continue to be funded. It seems unlikely to me that more than 5% of the work force can be recruted locally. But it seems equally unlikely that the remainder will live in Albuquerque, as you expect. Admittedly, considering the current buying patterns in this area, the projected employment increase in the Socorro area will not generate as many jobs as might be expected in a closed system economy, but it seems reasonable to assume that the net gain will be 2500 jobs for the construction phases and 600 jobs for the testing phases. Including dependents, we are then looking at total population increases of 5000, respectively 1500 people - on a current Socorro population of 7000 to 8000! In addition we may assume, as pointed out by Mr. Pencak, that the start of the construction phases will attract more unemployed people than will be hired, who will not all leave.

So what may we expect to happen? Planned boom and bust in repeated cycles, I am afraid. At the start of the first construction phase the number of available jobs in the Socorro area will almost double, the population will increase substantially (50 to 60%, or so), probably with increased unemployment due to "employment fortune seekers", a dramatically increased demand on the housing market, and a soaring demand on infra structure services. The first test phase will then bring new people to town, soaring unemployment for the laid-off construction workers (which will not all leave), a slump in the cheaper housing market, but probably an increase in the demand for more expensive housing - as well as a reduced tax base to pay for the infra structure services expanded in the construction phase. And then it starts all over again for the high power phases; until finally the whole project is terminated and everybody except the unemployed leaves.

W-33.1 Please see Response O-2.3 In addition, the distribution of the incoming population was calculated using generally accepted gravity and allocation models as explained in Appendix D of the FEIS.

I think we will be left with a lot of problems in this town: soaring housing prices, followed by severe slumps, expanded services that cannot be paid for by the tax base, increased crime, etc. Some have made the argument that this town has managed to absorb a large project before: the VLA. I think the comparison is rather frivolous and irrelevant. The VLA work force was built up steadily over a few years, injected less money into the community, never exceeded 100 jobs by much, and has been steady (and will be steady) for a number of decades. In addition I am concerned that steady employers like the VLA and NMIMT will experience great difficulty attracting new employees during the boom cycles, primarily (but not exclusively) due to the severe housing problems. Another concrete question that has come up is whether the figures that you quote for available housing do actually take into account projections including new VLBA personnel.

In summary, the conclusion seems inescapable to me that the basing of the GBFELTIE at Stallion Site has very serious, if not unacceptable, socio-economic consequences for Socorro; a few merchants and audacious speculators may make a fortune out of it, but the town as a whole will suffer severely. It also seems to me that your draft EIS glosses over these problems because it lacks adequate analysis and is based on some very questionable premises. I would hope that the issue will be dealt with more responsibly in the final document.

I thank you in advance for your attention to these points,

Yours Sincerely,

Arnold H. Rots

W-33.2 Thank you for your comment.

W-33.3 The available housing projections were obtained from local realtors, Chambers of Commerce, and Boards of Realtors. Since the composition, number, and distribution of potential VLBA personnel are presently unknown, it is impossible, at present, to accurately assess this cumulative impact.

W-33.4 The socioeconomic gravity and allocation models have been revised in the FEIS to reflect new and/or revised data.

New Mexico Tech
Astrophysics Research Center
Department of Physics

Socorro, NM 87801
(505) 835-5328

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300
ATTN: SWWFPL-R

22 October 1986

Gentlemen:

As director of the Astrophysics Research Center (ARC) at New Mexico Institute of Mining and Technology, I wish to comment on the Draft Environmental Impact Statement for the proposed Ground Based Free Electron Laser Technology Integration Experiment at White Sands Missile Range.

W-34.1 Please see Responses 0-9.1 through 0-9.7.

Our institution is currently engaged in the evaluation of several sites in New Mexico for the location of a modern 3.5 meter optical and infrared telescope. One of the prime sites is in the Magdalena Mountains, near South Baldy peak. The others being considered are Capilla Peak and Sacramento Peak. The consortium of universities involved with the survey, including Minnesota, Virginia, Rutgers, Indiana, and University of New Mexico, is devoting considerable care to the selection of the site for this project. The observatory is planned to begin with a single instrument, and possibly expand to include a cluster of telescopes, perhaps as many as four or five in the 3.5 meter class. The principal criterion for the preliminary selection of the three sites is their very low sky brightness; other criteria are low levels of air pollution (especially important for infrared measurements), low current population (for light pollution) and potential for long term (one or two decade) population stability. We are seriously concerned about the impact of the development of the Stallion Site in particular, and of the WSMR in general, on future use of astronomical sites in central and southern New Mexico.

W-34.2 Please see Response 0-9.1 through 0-9.7.

We request that consideration be given in the final EIS to the astronomical impact of laser tests and the effects of normal, non-test related night-time operations at WSMR.

The frequency at which the laser is currently designed to operate, between 0.5 and 1 micron, is the primary window for astronomical measurement both at the proposed facility and at the existing observatories in the Magdalenas. Induced Raman scattering will have an effect on spectroscopic observations of faint sources, and airglow induced from laser operations may also affect both photometry and spectroscopy. These are small effects compared with those introduced by the rapid and possibly uncontrolled growth of the populations of Socorro and Magdalena. Both of these towns are very close to, and line of sight from, the peak at South Baldy. Increases both in street lighting and of commercial lighting will seriously damage the viability of the mountain as a potential observatory site.

W-34.3 Potential light interferences have been included in the FEIS (p. IV-45).

W-34.4 Potential effects of light pollution are discussed in the FEIS (p. IV-45).

We request that, at minimum, in addition to other considerations, specifications be made explicit for the shielding of all exterior lighting on all access roads leading to the GBFEL test facility, and on all exterior lights set up at the facility. We also request a modelling of wind patterns to include the effects of dispersal of dust raised during the construction phase, an estimate of diffuse background produced by operation of the laser (not just scattering from centimeter-sized particles), more information on the characteristics of the airborne targets, and an indication of how the test firing pattern will be directed relative to the Magdalena mountains (altitude of target, and direction would be most helpful in our planning). The draft EIS also indicates that tests will be conducted at night, and we request a clarification on the fraction of time that such tests will be conducted.

In addition, the astronomical community has shown considerable interest in the mountains both at Sacramento Peak and the Magdalenas as potential locations of millimeter wavelength observatories. From the draft EIS, it is difficult to evaluate what effect the laser operations will have on such instruments.

Finally, I would like to add my voice to that of Dr. P. C. Crane of the VLA in regard to the possible interference of the GBFEL operations, especially the accelerators, with normal VLA and VLBA operations. This is the most important radio telescope in the world, one which is critical as well to the research done by our group and our collaborators around the world, and we strongly urge that the integrity of this instrument be given highest priority in your thinking on the question of siting.

I look forward to your response to these concerns in the near future.

Sincerely yours,

Steven N. Shore
Director, ARC

W-34.5	Please see Response 0-16.4
W-34.6	Please see Response 0-16.5 and 0-9.6
W-34.7	Please see Response 0-16.7 and 0-16.8
W-34.8	Please see Response 0-9.4
W-34.9	Please see Response 0-9.4
W-34.10	Please see Response 0-16.12

ATTEN: DEVELOPERS OF THE ATOMIC BOMB
c/o U.S. ARMY CORPS OF ENGINEERS
FT. WORTH DISTRICT
BOX 17300
FT. WORTH, TEX 76102-0300

TO THE RESEARCH STAFF:

CERTAIN RELIABLE SOURCES OF THE SCIENTIFIC COMMUNITY HAVE DOCUMENTED INFORMATION CONCERNING MAFIA LEADERS DURING THE WORLD WAR WHO WERE GIVEN POLITICAL ASYLUM OR A FORM OF DIPLOMATIC IMMUNITY FROM THE F.B.I. WHO WERE WORKING FOR THE UNITED STATES OF AMERICA. IN RETURN THE MAFIA LEADERS WOULD HAVE TO HAND OVER CERTAIN MATERIALS TO THESE AMERICAN AUTHORITIES.

THE MAFIA USED THEIR UNDERGROUND CONNECTIONS IN AREAS OF THE AXIS TO SMUGGLE THESE MATERIALS AWAY FORM THE NAZI DICTATOR AND MUSSOLINIAN FORCES WHO WERE TRYING TO PUT AN END TO THE WHOLE MAFIA ORGANIZATION.

CAN YOU VERIFY THESE DOCUMENTED SOURCES? ARE THEY TRUE DID THE MAFIA ORGANIZATION SMUGGLE THRU THE AXIS POWERS CERTAIN MATERIALS TO BUILD THE ATOMIC BOMB AND CERTAIN OTHER MATERIALS AS WELL AS INTERNAL RECONNAISSANCE TO ASSISTING IN SMUGGELLING PERSONNEL . WHICH IN EFFECT SET THE STAGE FOR OTHER SCIENTIFIC DEVELOPMENTS HERE IN THE STATES AND THE REST OF THE WORLD.(WHAT HAPPEN TO THE MAGNETIC ACCELERATOR TO LAUNCH BUZZ BOMBS ETC., ETC..)

W-35.1 Please see Response 0-64.1.

IT IS MY HOPE TO BECOME A MILITARY RESEARCH SCIENCE OFFICER IN THE APLICATIONS OF SPACE TRAVEL/DEVELOPMENTS AND TO GET INTO COMMUNICATIONS AS A MOVIE DIRECTOR OR PRODUCER WHILE CONTINUING ON INTO NATIONAL POLITICS.

IF YOU COULD PROVIDE ME WITH THE MUCH NEEDED INFORMATION VERIFYING THESE SCIENTIFIC BREAKTHRUS. WHICH WERE IN FACT SMUGGLED THRU THE UNDERGROUND NETWORK THRU THE AXIS DURING THE WORLD WAR. SO THAT I COULD USE SUCH INFORMATION TO BRING ABOUT IN A MORE DRAMATIZED MOVIE PRODUCTION ONCE I OBTAIN THE FINANCES TO DO SO.

W-35.2 Thank you for your comment.

THANK YOU

LARRY MORALES JUNIOR
c/o 117 N.E 7 th street
MORTON. TEX 79346

Dear Col McNulty

Hypothesis:

Let it be given that SDI is a grand waste of money (unless of course teflon, or microcomputers, or their ilk are discovered/invented in the research program)

Question: The question ~~[illegible]~~ settles out that the primary question is how to waste one's money most profitably for the american economy

- short term
- long term (mostly neglected in the study)

A. what will be done with the site after shutdown most profitably?

B. What use can the water delivery system be put to?

C. Where will the money do the most good to stimulate the local economy - and has the local economy sufficient ~~might~~ or momentum to effectively profit from the money? Or is it money down a dry hole?

W-36.1 Post GBFEL-TIE facility utilization is unknown at this time.

W-36.2 It would be anticipated that any water delivery system would be utilized by WSMR following closure of the GBFEL-TIE facility.

W-36.3 Please see Response 0-41.3

For this reason I would like to see much more modeling and theorizing and projecting the impact on the local socio-economic base

Perry Plummer
P.O. Box 6651
Las Cruces, NM
88006

W-36.4 The gravity and allocation models used in predicting socioeconomic effects are widely used and generally accepted among professional sociologists. New data have been incorporated into these models which should increase the accuracy of these predictions.

P.O.Box 940
Magdalena, NM 87825
14 November 1986

Mr. Paul M. Hathorn
Environmenatl Resources Branch
Fort Worth District
P.O.Box 17300
Fort Worth, Texas 76102-0300

Dear Sir:

I enjoyed the scoping meeting held in Scorro NM. It was interesting to hear the input from the various city representatives.

As was pointed out, when the site selection is announced by the media, a small panic might arise.People will come from all over with the hope of being employed.Look at the labor market and see the layoffs that are occuring in the silicone valley and the auto industry. Prices of property will go up and what little renting is available will soon be gobbled up. So how to face the problem?

As i stated before, a trailer village could be set up similiar to the China Lake Pro jectand The early days of the Hanford Project. They are moving perfabricated school buildings off of the Alamo Navajo Reservation that could be made into housing for the single men and women.At Magdalena, the Bureau of Indian Affairs have vacated the various domotaries that the students lived in while going to school here. The have just completed their new school and these buildings are now available. So if you choose the Stillion Site, there may be a quick source of housing until the trailer village gets set up. One or two large busses could be usee to take workers to the site from here.

But which ever view you take 2000 persons with possible families is going to be a big problem.

Please keep me posted as to your nextmeeeting.

Sincerely yours
Eugene Hecker
Eugene Hecker

W-37.1 The socioeconomic analysis has been revised in the FEIS to reflect the gradual influx of personnel that would be expected and the assisted project impacts. (pp. IV-26 through IV-36).

W-37.2 The models used in the socioeconomic analysis indicate that in-coming persons would distribute themselves to several communities. However, it is still predicted that a housing deficit would occur in the town of Socorro, even with revised data provided by the Socorro Economic Development Commission (pp. IV-29 and IV-30).

November 16, 1986

U.S. Army Corps of Engineers
Fort Worth District
Box 17300
Fort Worth, TX 76102-0300
attn: SWFPL-R

I would like to request a copy of the complete Draft Environmental Impact Statement concerning the Ground Based Free Electron Laser Technology Integration Experiment at the White Sands Missile Range in New Mexico. In addition, I would like to request a copy of the Final Environmental Impact Statement upon publication.

I would like to express my opposition to the construction of this free electron laser test facility at White Sands because of the adverse environmental impacts that the facility would clearly have upon the wildlife of the area, and the depletion of water supplies that would be accelerated by this project. In addition, I believe that a realistic Environmental Impact Statement for free electron laser research must also look to the future, and begin to address the longer range environmental impacts of the deployment of a full-scale operational free electron laser - which would require construction of massive facilities in many desert areas of the country and associated large-scale demands for electric power generation. The negative environmental impacts of such a decision must be examined now.

I strongly urge that this sort of assessment be included in the final EIS for this project.

Sincerely,

Jim Heaphy

Jim Heaphy
c/o Progressive Space 1
1724 Sacramento #9
San Francisco, CA 941[illegible]
(415)673-1079

W-38.1 Thank you for your comment.

W-38.2 The EIS provides data to the public and DOD decision makers to allow an informed decision on site selection. National policies and/or economics of the SDI program are not part of this EIS. Deployment decisions will be made later by a future President and U.S. Congress, if the technology tested by GBFEL-TIE and other programs are deemed feasible.

INSPIRATION GOLD INCORPORATED
A SUBSIDIARY OF
INSPIRATION RESOURCES CORPORATION

Globe-Miami Highway
P.O. Box 1559
Claypool, Ariz. 85532

Telephone: (602) 473-7150
Telex: 71-298071
Telecopier: (602) 473-7055

November 17, 1986

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102-0300

Attention: SWFPL-R

Re: Oro Grande Candidate Site
Draft EIS, Ground Based Free
Electron Laser Technology
Integration Experiment

Gentlemen:

I am writing on behalf of Inspiration Gold Incorporated, a wholly owned subsidiary of Inspiration Resources Corporation, an international mining corporation. Inspiration Gold currently has claims in the Oro Grande District owned by the B.O.W. Corporation of El Paso, Texas, under lease. Inspiration Gold is conducting extensive exploration activities on these claims and intends to eventually conduct mining operations on these claims, if results of exploration warrant. We wish to notify you of these activities, in so far as the draft EIS does not address possible mining operations in the Oro Grande Mining District. We have also checked with the Bureau of Land Management office in Las Cruces, New Mexico, and they report that there should be no impact by your proposed activities in the Oro Grande Mining District, but we would prefer some assurance in this regard directly from your office.

W-39.1 The FEIS has been revised to include data concerning the Orogrande Mining District. (p. IV-1).

I am enclosing copies of maps from the draft EIS showing the approximate position of our leased claims and a claim map at larger scale showing the B.O.W. claim group in more detail.

W-39.2 Thank you for this information.

Very truly yours, ms

Keith J. Droste

Keith J. Droste
Sr. Exploration Manager

KJD/ms
cc: J. Timmers
W. Burns, B.O.W.

PLAINS ELECTRIC GENERATION AND TRANSMISSION COOPERATIVE, INC.

Albuquerque Headquarters
2401 Aztec Road, NE, P.O. Box 6551
Albuquerque, New Mexico 87197
Phone (505) 884-1881

Escalante Generating Station
P.O. Box 577
Prewitt, New Mexico 87045
Phone (505) 876-2271

File: CS-500 WSMR/SDI Laser Site

November 17, 1986

Ms. Rebecca Griffith
U.S. Army Corps of Engineers
Box 17300
Ft. Worth, Texas 76102-0300

Dear Ms. Griffith:

In reviewing the Draft Environmental Impact Statement for the Ground Based Free Electron Laser Technology Integration Experiment it was noted that specific corridors and the associated impacts of the corridors for the electrical transmission lines to supply power to the Experiment have not been included in the draft document. Will this information be included in the final document or in a supplement?

Sincerely,

Robert A. Winfield
Manager of System Planning

RAW:hev:109

W-40.1 Potential corridors are depicted in the FEIS; however exact routes cannot be determined until an electrical power transmission/supply contractor(s) is selected. This selection would be made only after a competitive bid process is conducted and additional NEPA documentation is provided.

Guy and Kaylene Brown
Star Route, Box 43B
Clovis, New Mexico 88101

November 8, 1986

U.S. Army Corps of Engineers
Ft. Worth District
Box 17300
Ft. Worth, TX 76102-0300

ATTENTION: SWFPL-R

Gentlemen:

As property owners in Carrizozo, New Mexico we would like to express our opinion regarding the proposed location of the Ground Base Free Electron Laser Technology Integration Experiment at White Sands Missile Range Stallion Site near Carrizozo, New Mexico. We are very much in favor of the location near Carrizozo, New Mexico. The business it would generate in Carrizozo would be tremendous. The lagging economy would be helped very much in that jobs and money spent in the community would have positive far-reaching effects on the community. W-41.1 Thank you for your comment.

We can see nothing but positive effects coming from locating a project of this type at the Stallion Site, therefore, we would very much like to see the project located near Carrizozo. W-41.2 Thank you for your comment.

Thank you for your consideration.

Sincerely,

Kaylene Brown

Kaylene Brown

Guy W. Brown

Guy W. Brown

Joseph A. Martinic
602 Fitch St.
Socorro, N.M. 87801

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102-0300
ATTN: SWFPL-R

Acting as a private citizen, here are several comments I believe important enough to submit concerning the Draft EIS for the GBFEL-TIE.

1 Proximity of the Stallion Site to The Irving Langmuir Laboratory, the Very Large Array, and other radiation measurement devices facilities was not mentioned. There exists a real possibility for a wide variety of problems arising from the GBFEL itself, the associated laser and radar safety control systems, power systems and nighttime area lighting (including construction floodlighting). It is likely to assume that operations at the other sites might affect these facilities also, plus those at Sacramento Peak. Pending astrophysical projects may also be compromised by the GBFEL.

W-42.1 Please see Responses 0-9.1 through 0-9.6

2 Necessary relocation of existing projects at WSMR could also affect other astrophysical instruments. For example, moving control radar to the northern extension areas could affect the VLA due to lowered horizons at those possible locations.

W-42.2 Potential conflicts for each site are addressed in the DEIS and have been revised in the FEIS. There are no plans to relocate radar into WSMR extension areas as a result of the proposed project.

3 Re-radiation from targets is not delinisted. No effects of fromreflectance of safety laser or radar is considered.

W-42.3 Please see Response 0-16.7 and Appendix E of the FEIS.

4 Access corridor maps for the Stallion Site ignore the possibility for routing parallel to US 380 and WSMR 7.

W-42.4 The access corridors presented do not represent the exact route for the facility. These corridors were illustrated to represent the shortest distance from the desired source (water, power, etc.). to the proposed site while considering physical (mountains) and ecological (Bosque del Apache NWR) constraints.

5 Mention of construction-caused air degradation fails to address rock crushing operations necessary for both on-site and access route uses. Location of suitable resources and the consequences of use are evidently ignored.

W-42.5 Aggregate requirements and potential sources are described in the FEIS (p I-20).

6 Dislocations of local resources (eg. rebar, cement, lumber) for the GBFEL are bound to impact the affected communities. Cost-of-living effects should be considered in the DEIS.

W-42.6 Increases in cost for goods and services are addressed in the FEIS (p. IV-32).

7 Analysis of housing needs fails to note that regardless of location of residence, there will be large temporary housing areas as close as practical to any construction project. For the Stallion Site, San Antonio would likely become a trailer haven for many of those ostensibly living in Bernalillo County. Complications like this should be considered for all sites.

W-42.7 The gravity and allocation models, which represent the best available estimate, indicate that the incoming personnel would distribute themselves to several communities. This self-allocation would minimize potential temporary housing needs, although Socorro would experience a housing deficit as discussed on page IV-29 of the FEIS.

Comment	No.	Response
8 Closures of highways are mentioned as affecting construction of the GBFEL, but it seems that construction itself would tend to increase traffic conjestion, especially trucking of large items. Since this directly impacts travelling, it should be covered in the DEIS.	W-42.8	Effects on transportation system and service are discussed in the FEIS (pp. IV-29 and IV-30).
9 This project is considered necessary for national security. Though the beam may be visually invisible, certainly there may be future efforts to restrict public access to "view" this experiment. Why is this not considered?	W-42.9	All significant components of the laser, except for the beam director, would be underground. The beam director would be enclosed so that the adaptive optics and other subcomponents could not be viewed from the outside.
10 Though the expressed purposes of these experbments are well deliniated, the very nature of the device lends to speculation on other avenues of experimentation. Some of the likely possibilites have repercussions that should be addressed now, as more important constraints might need be applid. For example, dispersion from an orbiting reflector could be valuable as a method of cloud density measurement free by ground based instruments. Another unaddreased concern is the easy redirection of higher energy by downlinks. After all, there can be no guarantee that the purposes of this experiment will not evolve, but rather, that we attempt to cover all bases for all effects.	W-42.10	There are presently no plans to expand or change the expressed purposes of the GBFEL-TIE as presented in the FEIS.
Though personally opposed to the intents of the SDI, I feel that there could be a silver lining if this experiment produces information beyond what the designers initially envision. I do believe there could be beneficial repercussions outweighing the net economic losses. (This experiment will <u>cost</u> how much?)	W-42.11	Thank you for your comment.

Thank you for reading this,

Joseph A. Martinic

El Paso Electric Company
Mesilla Valley Division
P.O. Box 910
Las Cruces, New Mexico 88004
(505) 526-5551

November 17, 1986

Ms. Rebecca Griffith
U. S. Army Corps of Engineers
Fort Worth District
Box 17300
Fort Worth, Texas 76102-0300

Dear Ms. Griffith:

PROPOSED GROUND BASED FREE ELECTRON LASER
TECHNOLOGY INTEGRATION EXPERIMENT-WHITE
SANDS MISSILE RANGE, NEW MEXICO

The El Paso Electric Company fully supports the GBFEL-TIE project at White Sands Missile Range and appreciates having had the opportunity to comment separately on the Draft Environmental Impact Statement (EIS).

W-43.1 Thank you for your comment.

The analysis of the availability of electric power is well-addressed in the Draft EIS. We have high capacity transmission lines fully capable of supporting the power requirements for the base facility load of this project at either of the three alternative sites under consideration.

W-43.2 Thank you for your comment.

As stated in the Draft EIS, consideration must be given to possible methods of serving the ultimate peak pulse power requirements for this project. El Paso Electric has technological resources it can share concerning pulse power loads and our Executive Level Task Force remains ready to assist SDC Officials in any way possible.

W-43.3 Thank you for your comment.

If you have any questions or if we can be of any assistance, please call me or Mr. Frank Vajil at (505) 526-5551.

Sincerely,

L. M. Downum
Vice President

cc: Colonel James F. McNulty, U. S. Army
Project Manager, Ground Based Laser Program

U.S. Army Corps of Engineers
Ft. Worth District
Box 17300
Ft. Worth, Texas 76102-0300
Attn: SWFPL-R

15 Nov. 1986

Re: Ground Based Free Electron Laser
Draft Environmental Impact Statement

Dear Sirs,

This letter transmits the comments of the Tularosa Basin Group of the Sierra Club on the proposed action. These comments are in two sections. These are 1.Comments made at the Oct. 21 1986 meeting at Alamogordo and 2. Several items which have occured since the meeting.

1.(a) We wish to urge that the GBFEL utilize the saline ground water as the project water source thus taking a lead in advancing the technology of desalinzation through this project

(b) There is a Mountian Lion study under way which is being conducted jointly by Fish & Game agency and WSMR. This study would impact only the North of NASA and Stallion sites.

(c) Stand-by power generation could be provided by on site gas turbin units. These units would produce less air pollution than coal or oil fired generators. This air pollution issue would have its greatest impact at the Orogrande site as it is "up wind" of Alamogordo, which experences winter inversions which are currently due to the wood chip burner and home fire places.

(d) The decision not to utlize nuclear power to provid the on site generation was welcomed.

2.(a) Regarding the issue of fugitive light in the Alamogordo area as it relates to the NMSU observatory in the Sacramento Mts. East of Alamogordo, the Club urges that lighting systems to be utlized are compatiable with the requirements of the observatory should the Orogrande site be selected.

(b) If areas of BLM or National Forest lands which are currently open to the public are to be withdrawn, what are these areas?

In conclusion, the Tularosa Basin Group of the Sierra Club feels that the Orogrande site would have the smallest impacts to both the natural and human environments. Thank you for receiving these comments.

Norm Martin

Norm Martin
Box 207
Alamogordo, N.M. 88311

W-44.1 Please see Response 0-32.1

W-44.2 If the preferred site Orogrande is selected, the multi-year mountain lion/mule deer/bighorn sheep studies conducted in the San Andres Mountains should not be affected.

W-44.3 Gas turbine generators are still considered a viable alternative for stand-by power during lasing experiments.

W-44.4 Thank you for your comment.

W-44.5 Lighting is not expected to be a problem. Also, please see response 0-16.4.

W-44.6 No BLM or National Forest lands are expected to be withdrawn from public use as a result of the proposed GBFEL-TIE.

W-44.7 Thank you for your comment.

LEONARD MINERALS COMPANY
3224 [illegible] CANDELARIA N. E.
ALBUQUERQUE, NEW MEXICO [illegible]
[illegible]

November 3, 1986

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102-0300

Re: Orogrande Candidate Site,
Draft EIS, Ground Based Free
Electron Laser Technology
Integration Experiment

Att: SWFPL-R

Gentlemen:

Your September 1986 Draft EIS for the Ground Based Free Electron Laser Technology Integration Experiment (GBFEL-TIE) proposed for location in the White Sands Missile Range, New Mexico does not identify the currently active Orogrande Mining District located adjacent to the Orogrande Candidate Site (OCS) and does not address the impact of the proposed construction and later experiments at the laser facility on mining activity in the Orogrande Mining District. For example, the impact of controlled access B as shown on Figure I-20 of the Draft EIS is not addressed even though it obviously would have adverse impact on mineral exploration and development in the Orogrande Mining District. Would a GBFEL-TIE at the OCS result in other adverse impacts on mining activity in the Orogrande Mining District?

A number of companies, including Leonard Minerals Company, have been conducting exploration programs in the area immediately east of the OCS including geological, geochemical and geophysical surveys, drilling, excavation, construction and property acquisition targeted toward the development of open pit and/or underground mines. How can the mineral interest owners or the Corps of Engineers assess the impact on the Orogrande Mining District of a GBFEL-TIE at the OCS from a Draft EIS that does not acknowledge the existence of this adjacent mining district?

Very truly yours,

Ben Donegan

Ben Donegan
Regional Manager

BD/nn

W-45.1 The corridor you describe (Fig. I-20, access B) merely denotes one possible corridor which a rail spur might utilize.

W-45.2 It would be anticipated that no significant impact on mining activities from GBFEL-TIE activities would occur outside of project areas, as discussed in the FEIS page IV-1.

October 30, 1986

U.S. Army Corps of Engineers
Ft. Worth District
Box 17300
Ft. Worth, TX 76102-0300
ATTN: SWEFPL-R

Dear Members of the Corps:

Reference is made herein to the draft EIS for the Ground Based Free Electron Laser Experiment at the White Sands Missile Range in New Mexico. A copy of the EIS requested at the Socorro hearing on October 25, 1986, arrived yesterday.

I have two chief concerns as follows:

1) No mention is made in the EIS of the effect of the proposed Stallion Site for the GBFEL on the historic Trinity Site where the first atomic bomb was exploded on July 16, 1942. This 51,500 acre area became a National Historic Landmark under direction of the National Park Service in 1975. Although the Trinity Site is just east of the proposed Stallion Site, the impact of the GBFEL-TIE could be severe in the long run.

W-46.1 Some structures of the GBFEL-TIE may be visible from the Trinity Site and/or McDonald ranch; however no significant adverse effect on the visual aesthetics would be expected.

Similarly Launch Complex 33 where the first captured German V-2 rockets were fired after World War II and which helped propel the U.S. into the Space Age is also a National Historic Landmark. This site is closer to the North NASA area.

W-46.2 Launch complex 33 is approximately 18 km from the Orogrande site. Therefore, this historic landmark would not be impacted by the proposed GBFEL-TIE.

Events which occurred on these sites played outstanding roles in making the U.S. a world leader in nuclear weapons and rocket space technology. They should be preserved at all costs.

2) No mention is made in the draft EIS of possible testing of neutral particle beams at the WSMR. These beams have been produced and are generally reported to be key to SDI objectives. They should certainly be included in the EIS if they are to be tested as a part of the WSMR program.

W-46.3 The testing of neutral particle beams is not part of the GBFEL-TIE project.

Thank you for your attention to these matters and others brought out in the Socorro meeting. I would appreciate receiving a copy of the final EIS.

Sincerely,

Marvin Wilkening

Marvin Wilkening
Professor of Physics Emeritus
1218 South Drive
Socorro, NM 87801

MW/bmr

JAMES E. HALLIGAN, PRESIDENT

Box 3Z/Las Cruces, New Mexico 88003-0026
Telephone(505) 646-2035

NEW MEXICO STATE UNIVERSITY

November 21, 1986

U. S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300

ATTN: SWFPL-R

Gentlemen:

Personnel at New Mexico State University have reviewed the Draft Document of the EIS for the Ground Based Laser Project. Two possible environmental actions have been identified that may impact on the operation of New Mexico State University's College Ranch. These two actions are: (1) construction of water lines across NMSU College Ranch (page I-22) which will either disturb or destroy ongoing range research and may interrupt livestock research and operations, and (2) drilling of two to six supply wells on Jornada Experimental Range which will lower the water level under the Jornada Basin and will possibly influence the production of water from domestic and livestock wells on the NMSU College Ranch (page IV-34).

It is recognized that only one of these two actions will probably take place if the north of NASA site is chosen. However, we recommend that an East to West corridor along the north edge of the Jornada Experimental Range be used for all utilities, road, and railroads (as shown by corridor A on pages I-28 and I-33). These access routes will have least impact on research and operational activities on the College Ranch. It is also recommended that the necessary water be obtained

NMSU
1888 Centennial Celebration 1988

0101-13-861114-01

W-47.1 Thank you for your comment.

outside the Jornada Basin so there is the least impact on producing wells in the basin.

If you have any questions concerning the College Ranch operations, please let us know.

Sincerely,

James E. Halligan

cc: Dr. William B. Conroy
Dr. John Owens
Dr. Reldon F. Beck

W-47.2 The most cost effective alternative water supply for the North of NASA site is identified as the development of a well field south of the Jornada Reserve Headquarters. However, the USASDC would make every practicable attempt to develop a well field in such a manner to minimize potential effects to the JER and other local users.

STATEMENT OF U.S. REPRESENTATIVE RONALD D. COLEMAN

PUBLIC HEARING ON THE GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT, U.S. ARMY STRATEGIC DEFENSE COMMAND

PUBLIC HEARING

EL PASO, TEXAS OCTOBER 23, 1986

I APPRECIATE THE OPPORTUNITY TO PRESENT TESTIMONY ON THE PROPOSED SITES OF THE U.S. ARMY GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT TO BE CONDUCTED AT WHITE SANDS MISSILE RANGE, NEW MEXICO IN CONJUNCTION WITH THE STRATEGIC DEFENSE INITIATIVE. I ALSO WANT TO WELCOME COL. JAMES McNULTY OF THE ARMY STRATEGIC DEFENSE COMMAND TO EL PASO. LET ME PREFACE MY REMARKS BY STATING THAT IT IS OUR HOPE THAT THE FINAL SITE SELECTION AND RECORD OF DECISION ON THE FREE ELECTRON LASER EXPERIMENT WILL BRING YOU TO EL PASO OFTEN.

W-48.1 Thank you for your comment.

THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARED FOR SITE SELECTION FOR THE GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT PROPOSES THREE SITES WITHIN THE EXISTING BOUNDRIES OF WHITE SANDS MISSILE RANGE. OF THOSE THREE SITES, I BELIEVE IT IS GENERALLY AGREED UPON BY THE EL PASO COMMUNITY THAT THE OROGRANDE SITE IS THE BEST NOT ONLY FOR EL PASO BUT THE ARMY AS WELL.

THE ARMY IS TO BEGIN CONSTRUCTION OF THE PROJECT IN EARLY TO MID 1987 AND WILL CONTINUE CONSTRUCTION INTO 1989. OF THE $2 BILLION EXPECTED TO BE SPENT ON THE PROJECT, APPROXIMATELY $200 MILLION WILL BE FOR CONSTRUCTION OF THE NECESSARY FACILITIES AT THE SITE. FOR THE THREE YEARS IN WHICH CONSTRUCTION OF THE FACILITIES WILL BE ON GOING IN PREPARATION FOR THE 1990 EXPERIMENT,

El Paso

A LABOR FORCE OF 2,500 WILL BE NECESSARY. THIS INCLUDES 2,000 FOR CONSTRUCTION AND 500 FOR OPERATIONAL NEEDS. THE 500 OPERATIONAL PERSONNEL WILL CONTINUE ON INTO 1992. THE ARMY EIS DRAFT ESTIMATES THAT THE NEED FOR 2,500 PERSONNEL TRANSLATES INTO 4,000 PEOPLE INCLUDING FAMILIES. AT LEAST 60 PERCENT OF THE NECESSARY LABOR FORCE IS EXPECTED TO COME FROM THE SURROUNDING COMMUNITIES WITH THE BALANCE MOVING INTO THE AREA. THEREFORE, THE FINAL SELECTION MUST TAKE INTO ACCOUNT THE AVAILABILITY OF ADEQUATE LABOR, HOUSING, TRANSPORTATION, EDUCATION FACILITIES, AND HEALTH CARE, AS WELL AS RECREATIONAL AND CULTURAL FACILITIES. FURTHER, THE SITE MUST MEET ENVIRONMENTAL CONCERNS AND BE ABLE TO PROVIDE ADEQUATE ENERGY AND WATER RESOURCES.

I BELIEVE THE OROGRANDE SITE WILL BEST MEET THESE NEEDS. WITH THE PROXIMITY TO EL PASO, LAS CRUCES, AND ALAMOGORDO, THE OROGRANDE SITE WILL BE PROVIDED WITH THE NECESSARY RESOURCES AT A MUCH SHORTER DISTANCE THAN AVAILABLE AT THE OTHER TWO SITES.

THE OROGRANDE SITE WOULD BENEFIT FROM A LARGE POOL OF EXISTING LABOR FAMILIAR WITH GOVERNMENT AND MILITARY CONSTRUCTION. OVER THE PAST FOUR YEARS EL PASO CONSTRUCTION FIRMS AND WORKERS HAVE HANDLED $100 MILLION IN MILITARY CONSTRUCTION FUNDING AT FT. BLISS. THE EIS SHOWS THAT EL PASO COULD PROVIDE 69 PERCENT OF THE NECESSARY LABOR WITH THE REST AVAILABLE FROM SURROUNDING COMMUNITIES. FURTHER, OROGRANDE IS MUCH CLOSER TO A LARGE POOL OF AVAILABLE LABOR THAN THE OTHER TWO SITES. THIS WOULD SURELY LOWER COSTS SINCE COMMUTING AND TRANSPORTATION OF SUPPLIES WOULD BE FAR MORE COST-EFFICIENT.

THE EIS SHOWS THAT OF ALL THREE LOCATIONS, THE OROGRANDE SITE WOULD BENEFIT FROM THE GREATEST AVAILABILITY OF HOUSING. FURTHERMORE, WHEN COMPARED WITH THE OTHER SITES, YOU FIND THAT EL PASO NOT ONLY CAN PROVIDE THE NECESSARY HOUSING, BUT ALSO AT A LOWER COST. EL PASO HAS OVER 12,000 AVAILABLE UNITS AND RENTAL AND PURCHASE COSTS ARE AMONG THE LOWEST OF ANY OF THE SITES. NEITHER OF THE OTHER TWO SITES HAS THIS LEVEL OF AVAILABLE HOUSING AT A COST AFFORDABLE AND IN FACT THE STALLION SITE WOULD EXPERIENCE A HOUSING SHORTAGE.

THE EIS DRAFT ESTIMATES THAT THE SURROUNDING COMMUNITIES COULD EXPECT AN INCREASE OF 1,400 STUDENTS DURING THE CONSTRUCTION PHASE AND 600 THEREAFTER. THE EIS DRAFT SHOWS THAT OF ALL THREE SITES, ONLY THE OROGRANDE SITE HAS ACCESS TO THE NECESSARY AMOUNT OF EDUCATION FACILITIES WITH THE LEAST IMPACT ON LOCAL SCHOOL DISTRICTS.

THE ARMY EIS ESTABLISHES A HEALTH CARE NEED OF 150 PHYSICIANS PER 100,000 POPULATION AND 400 HOSPITAL BEDS PER 100,000 POPULATION. WITHIN THE SURROUNDING COMMUNITY OF OROGRANDE, I BELIEVE THAT EL PASO, LAS CRUCES, AND ALAMAGORDO PROVIDE THE NECESSARY NUMBER OF PHYSICIANS AND HOSPITAL BEDS AND AT A MUCH CLOSER PROXIMITY THAN IS AVAILABLE TO THE OTHER TWO SITES.

THE OROGRANDE SITE APPEARS TO BE THE BEST SITUATED FOR TRANSPORTATION NEEDS AND SERVICES. INTERSTATE 10 PROVIDES ADEQUATE HIGHWAY TRANSPORTATION BETWEEN EL PASO AND LAS CRUCES AND TO POINTS EAST AND WEST. THE EL PASO AREA IS SERVED BY MAJOR RAIL LINES FOR FREIGHT AND TRAVEL. AND, EL PASO HAS THE LARGEST AIRPORT AND AIR FREIGHT FACILITIES IN THE REGION WITH THE MOST NATIONAL FLIGHTS.

ENVIRONMENTAL CONCERNS AND ENERGY AND WATER RESOURCES ARE ALSO IMPORTANT ISSUES IN DETERMINING A FINAL SITE. OROGRANDE APPEARS TO BE SUFFICIENT WITH RESPECT TO THESE CONCERNS. BY PLACING THE FREE ELECTRON LASER AT OROGRANDE THE LEAST PROBLEMS WOULD BE POSED TO VEGETATION AND ANIMAL LIFE. THE LEAST HAZARDS WOULD EXIST FOR ENDANGERED SPECIES. AND, THE ARMY EIS SHOWS THAT IN TERMS OF WATER RESOURCES, OROGRANDE WOULD BE THE MOST COST EFFICIENT OVER THE LONG RUN. FINALLY, THE SITE COULD PROVIDE THE NECESSARY ENERGY NEEDS, WITH THE LEAST INTERFERENCE TO THE LOCAL COMMUNITIES.

THE ARMY EIS FOR THE GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT MAKES THE CASE FOR OROGRANDE. CERTAINLY, THE EL PASO COMMUNITY WOULD BENEFIT THE MOST FROM SELECTION OF THE OROGRANDE SITE, BUT THEN EL PASO HAS THE MOST TO OFFER IN TERMS OF LABOR, HOUSING, EDUCATION, TRNASPORTATION, HEALTH CARE, AND QUALITY OF LIFE. WHEN THE COST OF ENERGY, WATER RESOURCES, CONSTRUCTION, AND TRANSPORTATION ARE FACTORED, I BELIEVE THE OROGRANDE SITE WOULD BE THE MOST COST EFFICIENT. AND, I BELIEVE THERE IS STRONG COMMUNITY SUPPORT FOR THE ARMY'S EXPERIMENT AT WHITE SANDS AS THERE HAS BEEN FOR THE ARMY AT FT. BLISS AND WHITE SANDS.

I WOULD LIKE TO CLOSE MY TESTIMONY BY STATING THAT I WILL CONTINUE TO STRONGLY SUPPORT THE EXPERIMENT REGARDLESS OF WHICH SITE IS CHOSEN. AS A MEMBER OF THE HOUSE APPROPRIATIONS COMMITTEE AND THE SUBCOMMITTEE ON MILITARY CONSTRUCTION, I LOOK FORWARD TO WORKING CLOSELY WITH COL. McNULTY AND THE ARMY TO ENSURE THAT THIS PROJECT IS GIVEN EVERYTHING IT NEEDS TO BE A SUCCESS. I HAVE SUPPORTED NEARLY $10 BILLION FOR RESEARCH,

DEVELOPMENT, AND TESTING FOR THE STRATEGIC DEFENSE INITIATIVE, AND I CONSIDER THE GROUND BASED FREE ELECTRON LASER TECHNOLOGY INTEGRATION EXPERIMENT TO BE A KEY PART IN THAT PROGRAM.

THANK YOU VERY MUCH FOR ALLOWING ME THE OPPORTUNITY TO TESTIFY THIS EVENING.

LIST OF PREPARERS

VII. LIST OF PREPARERS

As is the case for most multidisciplinary studies, numerous persons have provided valuable input throughout the preparation and conduct of this EIS. These persons include environmental and engineering staff members of the U.S. Army Corps of Engineers, Fort Worth District and Huntsville Division; U.S. Army White Sands Missile Range, Environmental and Natural Resources Office; U.S. Army Strategic Defense Command, WSMR and Huntsville; General Research Corporation, Huntsville; and Teledyne-Brown, Huntsville. The Cultural Resources Study and Cultural Preliminary Report were accomplished by Prewitt and Associates, Inc. The following is a list of those persons having primary responsibility of the preparation of this document.

Name	Experience	Area of Responsibility
Mr. Ruben G. Garza	13 yrs environmental studies, Geo-Marine, Inc.	Climate, Geology, Air, Air Access and Safety Procedures
Mr. John Hoffmann, P.E.	10 yrs environmental studies, Geo-Marine, Inc.	Noise, Public Involvement Water Resources
Mr. Chris Ingram	8 yrs environmental assessments and impact statements, Gulf South Research Institute	Project Description, Biological Resources, Mitigation
Dr. Roger Powell	20 yrs in socioeconomic and transportation analyses, 10 yrs in EIS services, Powell Associates	Socioeconomic and Transportation
Mr. Harold Leggett	6 yrs in biological resource assessment, toxicological investigations, water and wastewater management, Gulf South Research Institute	Biological Resources
Mr. James Hoover	10 yrs in socioeconomic interpretation and evaluation, Gulf South Research Institute	Socioeconomic and Transportation
Dr. Kent McGregor	10 yrs remote sensing, North Texas State Univer.	Habitat Mapping
Dr. Lloyd Fitzpatrick	20 yrs habitat evaluations North Texas State Univer.	Vegetation Identification
Oran F. Bailey	36 yrs soils and vegetation identification	Vegetation Identification

REFERENCES

VIII. REFERENCES

1. U.S. Army. 1985. Installation Environmental Assessment. U.S. Army White Sands Missile Range, New Mexico. Prepared by U.S. Army Corps of Engineers, Ft. Worth District, Ft. Worth, Texas.

2. General Research Corporation. 1986. GBFEL TIE Environmental Impact Statement, Annex A. Draft Copy 25 July 1986. Huntsville, Alabama.

3. Moya, Jim. 1986. Personal communication between Mr. Moya, U.S. Army SDC, WSMR and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 7 August 1986.

4. U.S. Army. 1986. Site Selection for Ground Based Free Electron Laser-Technology Integration Experiment (GBFEL-TIE)(U) Volumes I and II. May 1986. U.S. Army Strategic Defense Command, Huntsville, Alabama.

5. U.S. Army. 1986. Disposition Form concerning geotechnical considerations for environmental assessment, GBFEL-TIE, White Sands Missile Range, NM, from Melvin Green, Geotechnical Branch to Environmental Resources Branch. U.S. Army Corps of Engineers, Ft. Worth District, Ft. Worth, Texas. 15 July 1986 et seq.

6. U.S. Army. 1986. Disposition Form concerning surface and ground water availability for GBFEL-TIE, from Mr. Bill Huntley (Albuquerque District) to Mr. Marty Hathorn (Ft. Worth District). U.S. Army Corps of Engineers, Albuquerque District, Albuquerque, New Mexico. 7 August 1986.

7. Neher, R., O.F. Bailey, W. Anderson, D.R. Robertson, H.D. Galt and D.L. Stoneman. 1970. Soils and Vegetation Inventory of WSMR. U.S. Department of Agriculture Soil Conservation Service, West Region. Portland, Oregon.

8. Soil Conservation Service. January 1976. Soil Survey of White Sands Missile Range, New Mexico. In cooperation with the U.S. Department of Army and New Mexico Agricultural Experiment Station. U.S. Department of Agriculture.

9. New Mexico Health and Environment Department. 1983 and 1984. Air Quality Bureau Annual Report 1983 and 1984. Environmental Improvement Division, Santa Fe. EID/AIR-86/1.

10. Code of Federal Regulations. 1976. 40 CFR 50.26. Office of the Federal Register. 1 July 1976. page 4.

11. U.S. Army. 1984. Environmental Impact Assessment for Border Star 1985, Joint Readiness Exercise, Ft. Bliss, Texas and New Mexico, White Sands Missile Range, New Mexico and Specified Adjoining Lands. Prepared for U.S. Readiness Command, MacDill AFB, Florida by Gulf South Research Institute, Baton Rouge, Louisiana.

12. U.S. Army. 1985. Final Environmental Assessment of Test and Evaluation Programs of the SGT. YORK and CHAPARRAL Air Defense Systems, White Sands Missile Range, New Mexico. Prepared by Gulf South Research Institute, Baton Rouge, Louisiana.

13. Avco Research Laboratory. 1986. Environmental Assessment of the EMRLD Beam Quality Demonstrator at White Sands Missile Range, New Mexico. Prepared by Gulf South Research Institute, Baton Rouge, Louisiana.

14. Taylor, Daisan. 1986. Personal communication between Ms. Taylor (WSMR-ENRO) and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 22 July 1986.

15. U.S. Army. 1983. Natural Resources Management Plan, U.S. Army White Sands Missile Range, New Mexico.

16. Hall, E.R. 1981. The Mammals of North America. John Wiley and Sons, New York. 2 volumes.

17. U.S. Fish and Wildlife Service. 1984. Endangered species of Arizona and New Mexico. Region 2. Albuquerque, New Mexico.

18. U.S. Fish and Wildlife Service. 1986. Letter to Mr. Michael Mocek, Chief, Planning Division, U.S. Army Corps of Engineers, Fort Worth District, from Mr. Michael Donahoo, Acting Field Supervisor, Ecological Services, USFWS, Albuquerque, dated 29 August 1986 (included in Appendix A).

19. New Mexico Department of Game and Fish. 1985. Handbook of Species endangered in New Mexico, Santa Fe.

20. Taylor, Daisan. 1986. Personal communication between Ms. Taylor, WSMR ENRO and Mr. Harold Leggett, Gulf South Research Institute, Baton Rouge, Louisiana, on 8 September 1986.

21. New Mexico Native Plant Protection Advisory Committee. 1984. A Handbook of Rare and Endemic Plants of New Mexico. University of New Mexico Press, Albuquerque.

22. Spellenberg, Richard. 1986. Personal communication between Dr. Spellenberg, Department of Biology, University of New Mexico (Albuquerque) with Mr. Harold Leggett, Gulf South Research Institute, Baton Rouge, Louisiana, via Ms. Daisan Taylor, WSMR ENRO, on 8 September 1986.

23. Oberholser, H.C. 1974. The bird life of Texas. E.B. Kincaid, Jr. (ed.). University of Texas Press, Austin and London.

24. U.S. Bureau of Land Management. 1985. New Mexico Statewide Wilderness Study. Volume 1: Draft Environmental Impact Statement and Volume 2: Appendices, Wilderness Analysis Reports. U.S. Department of the Interior, New Mexico State Office, Santa Fe. May 1985.

25. Hoban, Patricia. 1986. Personal communication between Ms. Hoban, USFWS, San Andres NWR and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 21 July 1986.

26. Taylor, Kriste. 1986. Personal communication between Ms. Taylor, Steinborn, Inc. Realtors, Las Cruces, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 16 August 1986.

27. Harris, Elmer. 1986. Personal communication between Mr. Harris, County, Planner, Dona Ana County, Las Cruces, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 17 August 1986.

28. Lindsay, Imogene. 1986. Personal communication between Ms. Lindsay, Secretary, New Mexico Employment Security Department, Economic Research and Analysis Bureau, Albuquerque, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 18 August 1986.

29. Crane, C. Patrick. 1986. Personal communication between Mr. Crane, National Radio Astronomy Observatory, Socorro, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 19 August 1986.

30. Deomondstein, Bert. 1986. Personal communication between Mr. Deomondstein, El Paso Industrial Development Corporation, El Paso and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 20 August 1986.

31. Brusuelas, Richard. 1986. Personal communication between Mr. Brusuelas, Executive Director, New Mexico Health Systems Agency, Albuquerque, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 21 August 1986.

32. Massey, Stephen. 1986. Personal communication between Mr. Massey, Economic Development Specialist, Southeastern New Mexico Economic Development District, Roswell, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 25 August 1986.

33. El Paso Chamber of Commerce. 1986. Personal communication between El Paso Chamber of Commerce, El Paso, Texas and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 25 August and 4 September 1986.

34. Jordan, Monte. 1986. Personal communication between Mr. Jordan, Acting State Director, Bureau of Land Management, U.S. Department of Interior, Santa Fe, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 27 August 1986.

35. Williams, James D. 1986. Personal communication between Mr. Williams, Demographer, Cooperative Extension Service, New Mexico State University, Las Cruces, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 28 August 1986.

36. Kissner, Andy. 1986. Personal communication between Mr. Kissner, Executive Director, Greater Las Cruces Economic Development Council, Las Cruces, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 28 August 1986.

37. Carlson, Jerry. 1986. Personal communication between Mr. Carlson, Executive Director, El Paso Apartment Association, El Paso, Texas and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 3 September 1986.

38. Meyer, Nancy. 1986. Personal communication between Ms. Meyer, Meyer Real Estate, Socorro, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 3 September 1986.

39. Boyle, Julianna. 1986. Personal communication between Ms. Boyle, Data, Bank, Bureau of Business and Economic Research, University of New Mexico, Albuquerque, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 3-4 September and 10 September 1986.

40. Black, L.R.. 1986. Personal communication between Ms. Black, Executive Director, Truth or Consequences Chamber of Commerce, Truth or Consequences, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 4 September 1986.

41. Dorr, Gail. 1986. Personal communication between Ms. Dorr, Executive Director, Socorro County Chamber of Commerce, Socorro, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 4 September 1986.

42. Wingo, Gerald V.. 1986. Personal communication between Mr. Wingo, Executive Director, Alamogordo Chamber of Commerce, Alamogordo, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 4 September 1986.

43. Bennett, Wayne. 1986. Personal communication between Mr. Bennett, Southeastern Realty, Alamogordo, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 4 September 1986.

44. Moore, Bob. 1986. Personal communication between Mr. Moore, President, Alamogordo Chamber of Commerce, Alamogordo, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 5 September 1986.

45. Mitchener, Becky. 1986. Personal communication between Ms. Mitchener, Theodorson Agency, Inc., Las Cruces, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 5 September 1986.

46. Hendrick, Sandra. 1986. Personal communication between Ms. Hendrick, Bureau of Business and Economic Research, University of New Mexico, Albuquerque, New Mexico and Dr. Roger Powell, Powell Associates, Arlington, Texas, on 9 September 1986.

47. U.S. Department of Census. 1983. County and City Data Book, Washington, D.C.

48. U.S. Bureau of Census. 1980, 1983. Decennial Census. Washington, D.C.

49. New Mexico Health Systems Agency. 1986. SAC-CII 7 District Health Plan. Albuquerque.

50. Bureau of Business and Economic Research. 1983. Population, Employment and Income for Counties in New Mexico. Historical Data: 1970-1980 and Projections: 1980-2000. University of New Mexico, Albuquerque.

51. Cunico, John. 1986. Personal communication between Mr. Cunico, U.S. Army Corps of Engineers, Albuquerque District, and Mr. John Hyndman, U.S. Army SDC, WSMR, on 4 September 1986.

52. U.S. Environmental Protection Agency. 1979. Supplement No. 9 (AP-42) for Compilation of Air Pollutant Emission Factors, 3rd Edition. (including supplement 1-7) Tables 3.3.3-1 and 3.3.4-1. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

53. Sandoval, Andrew. 1986. Personal communication between Mr. Sandoval, New Mexico Department of Game and Fish, Santa Fe, and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 14 August 1986.

54. Moya, Jim. 1986. Personal communication between Mr. Moya, U.S. Army SDC, WSMR, and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 25 July 1986.

55. McLaughlin, S.P. and J.E. Bowers. 1982. Effect of a wildfire on a Sonorra Desert plant community. Ecology 63(1)1982:246-248.

56. U.S. Army. 1975. Environmental Impact Assessment, High Energy Laser Test Facility. U.S. Army White Sands Missile Range, New Mexico.

57. U.S. Army. 1980. A Quantitative Analysis of Laser Impacts on Wildlife at White Sands Missile Range. Supplement to the Installation EIA. U.S. Army White Sands Missile Range, New Mexico.

58. U.S. Air Force. 1980. Environmental Assessment for Airborne Laser Laboratory (ALL) Cycle III, Phase 5. A Finding of No Significant Impact (FONSI). U.S. Air Force Weapons Laboratory, Kirtland AFB, New Mexico.

59. U.S. Air Force. 1982. Environmental Assessment for Reactivation of the Sandia Optical Range (SOR) - RACHL. A Finding of No Significant Impact (FONSI). U.S. Air Force Weapons Laboratory, Kirtland AFB, New Mexico.

60. U.S. Air Force. 1986. Environmental Assessment for the Construction and Operation of the NPB Validation Facility. A Finding of No Significant Impact (FONSI). U.S. Air Force Weapons Laboratory, Kirtland AFB, New Mexico.

61. U.S. Army. 1980. Nonionizing Radiation Protection Special Study No. 25-42-0332-80. Laser Range Finder (LRF) on the Ford Aerospace and Communications Corporation (FACC) Version of the Division Air Defense (DIVAD) Gun System. U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland.

62. Taylor, Daisan. 1986. Personal communication between Ms. Taylor (WSMR-ENRO) and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 14 April 1986.

63. Stebbins, R.C. 1966. A Field Guide to the Western Reptiles and Amphibians. Houghton-Mifflin Company, Boston.

64. Tennant, A. 1974. The snakes of Texas. Texas Monthly Press, Austin.

65. Hyndman, John. 1986. Personal communication between Mr. Hyndman, U.S. Army SDC, WSMR, and Mr. Chris Ingram, Gulf South Research Institute, Baton Rouge, Louisiana, on 7 August 1986.

66. General Research Corporation. 1986. Letter to LTC. Frank Chapuran, U.S. Army SDC, Huntsville, from Mr. Stephen Kosovac, General Research Corporation, dated 28 July 1986.

67. Lawrence Livermore National Laboratory. 1986. Letter from LLNL to Mr. John Jack, General Research Laboratory, Huntsville, Alabama dated 5 September 1986.

68. Jack, John. 1986. Personal communication between Mr. Jack, General Research Corporation, Huntsville, Alabama and Mr. Harold Leggett, Gulf South Research Institute, Baton Rouge, Louisiana, on 8 September 1986.

69. U.S. Army. 1984. Daily Operations Scheduling, Execution, and Control. WSMR Regulation No. 70-3, Change 1. U.S. Army White Sands Missile Range, New Mexico.

70. Raptor Research Foundation. 1981. Suggested Practices for Raptor Protection on Powerlines, The State-of-the-Art in 1981. Department of Veterinary Biology, University of Minnesota, St. Paul.

71. U.S. Army Material and Test Evaluation. 1986. Addendum Life Cycle Environmental Assessment of the Multiple Launch Rocket System Terminal Guidance Warhead; Validation/Maturation Phase Test Program. Site Specific Environmental Assessment at White Sands Missile Range. Prepared through Dynaspan Services Company, WSMR, by Gulf South Research Institute, Baton Rouge, LA.

72. Taylor, Daisan. 1986. Personal communication between Ms. Taylor (WSMR-ENRO) and Mr. Harold Leggett, Gulf South Research Institute, Baton Rouge, Louisiana, on 15 September 1986.

ACRONYMS & ABBREVIATIONS

Acronyms and Abbreviations

ABM - anti-ballistic missile

ACGIH - American Conference of Governmental Industrial Hygienists

AFB - Air Force Base

BLM - U.S. Bureau of Land Management

bp - before present

BS-85 - Borderstar 1985

CFR - Code of Federal Regulations

COE - Corps of Engineers

DEIS - Draft Environmental Impact Statement

DOD - Department of Defense

EID - New Mexico Environmental Improvement Division

EIS - Environmental Impact Statement

EMI - electromagnetic interference

ENRO - WSMR Environmental and National Resources Office

EPA - U.S. Environmental Protection Agency

FAA - Federal Aviation Administration

FEIS - Final Environmental Impact Statement

FEL - Free Electron Laser

GBFEL-TIE - Ground Based Free Electron Laser Technology Integration Equipment

GLC - ground level concentrations

gpd - gallons per day

gpm - gallons per minute

HELSTF - High Energy Laser Site Test Facility

ISCP - Installation Spill Contingency Plan

km - kilometers

LLNL - Lawrence Livermore National Laboratory

m - meters

MAF - million acre feet

Acronyms and Abbreviations (cont'd)

MMD - mean mixing depth

MOA - Memorandum of Agreement

MOPA - Master Oscillator/Power Amplifier

MVA - megavolt amperes (closely approximates megawatt)

NASA - National Aeronautics and Space Administration

NMGF - New Mexico Department of Game and Fish

NR - WSMR National Range Command

NWPS - National Wilderness Preservation System

NWR - National Wildlife Refuge

OSHA - Occupational Safety and Health Administration

PDEIS - Preliminary Draft Environmental Impact Statement

POL - petroleum, oils and lubricants

ppm - parts per million

PSD - Prevention of Significant Deterioration

RCRA - Resource Conservation and Recovery Act

RFI - Radio Frequency Interference

RFL (RF Linac) - Radio Frequency Linear Accelerator

ROW - Right-of-Way; pl. Rights-of-Way

SDI - Strategic Defense Initiative

SHPO - State Historic Preservation Officer

SPCCP - Spill Prevention Control and Countermeasures Plan

SRC - Stallion Range Camp

SRS - Stimulated Raman Scattering

SSOP - Safety Standard Operating Procedures

tds - total dissolved solids

ug/m3 - micrograms per cubic meter

USAEHA - U.S. Army Environmental Hygiene Agency

Acronyms and Abbreviations (cont'd)

USAF - U.S. Air Force

USASDC - U.S. Army Strategic Defense Command

USDA - U.S. Department of Agriculture

USDA-SCS - U.S. Department of Agriculture - Soil Conservation Service

USDI - U.S. Department of the Interior

USFWS - United States Fish and Wildlife Service

WIT - Warhead Impact Target Area

WSA - Wilderness Study Area

WSMR - White Sands Missile Range

GLOSSARY

Glossary

Abiotic - not produced by or as a result of life or living processes

Anode - the positively charged lead of an electrical circuit

Aquifer - an underground layer of relatively porous rock, sand, mineral containing water

Artifacts - any object made by human work, especially those of earlier man

Atmospheric turbulence - See turbulence

Azimuth - distance (in degrees) in a clockwise direction from the north point

Basalt - lava

Bifacial - flint tools that are worked on both sides to produce a sharp edge

Bifacial debris - residual material which resulted from the work of bifacial flint tools

Biotic - produced by or as a result of life or living processes

Cathode - the negatively charged lead of an electrical circuit

Ceramics - objects which are manufactured or related to clay, earthenware, pottery

Electrons - one of the three common particles of the atom. It is the smallest of the three and carries a negative electrical charge

Faraday cage - self contained room with walls comprised of copper screening; the walls intercept radio frequency and electromagnetic waves as they are generated

FEL - acronym for free electron laser; this type of laser uses electrons in a strong electromagnetic field to increase the light beam intensity

Hectare - unit of surface measure in metric system, equal to 10,000 square meters (1 hectare = 2.47 acres)

Herpetofauna (Herpetiles) - reptiles (lizards, snakes) and amphibians (toads, frogs)

Hyperbolic mirror - specially designed, convex shaped mirror used in conjunction with other mirror systems to direct the laser beam toward the wiggler or power amplifier

Infrared spectrum - invisible light waves just beyond the red end of the visible spectrum and includes several bands or groups of wavelengths such as radar, x-ray and gamma

Ionization - a state of matter characterized by free electrically charged particles

Glossary (cont'd)

Kilometer - unit of length in metric system, equal to 1,000 meters (1 kilometer = 0.62 mile)

Laser - acronym for light amplification by stimulated emission of radiation

Megawatt - one million watts or about 1,300 horse power

MOPA - abbreviation of Master Oscillator/Power Amplifier; this is a technique which uses a low power laser (the master oscillator) to drive a high power light amplifier.

Multicomponent site - an archeological/cultural site which exhibits more than a single type of artifact, usually indicative of several occupational sequences

Optic apertures - an aperture is an opening through which light passes; a typical optic aperture is the opening in the end of a telescope

Parabolic mirror - specially designed bowl-shaped mirrors used in conjunction with other mirror systems to direct the laser beam toward the wiggler or power amplifier

Playa - a large depression which creates a semi-permanent or intermittent lake which has no drainage from the lake; playas usually provide valuable habitat for numerous wildlife species

Porphyry - igneous rock, such as lava, that contains large distinct crystals

Prompt radiation - radiation which occurs during an event such as while an accelerator is running but which stops quickly

Rad - a dosage of absorbed ionizing radiation usually used to measure amounts of x-ray radiation received

Rem - a measure of dosage of ionizing radiation such as x-ray or gamma-ray radiation

Sedimentary - rock or soil formation formed by deposition of sediments, usually in layers

Seismicity - the degree to which a region is subject to earthquakes

Socioeconomic - dealing with the social and economic resources of an area

SRS - Stimulated Raman Scattering is a non-linear optical phenomena caused by intense light. The effect causes the loss of energy in the main beam by conversion to other wavelengths

Thermal blooming - phenomenon that produces the shimmering effect observed on hot days as one looks across an asphalt parking lot; produced when air becomes heated and its density and, consequently, its index of refraction, changes

Topography - the physical features and characteristics of an area

Glossary (cont'd)

Turbulence (atmospheric turbulence) - phenomenon which produces the twinkling effect of stars; caused by air acting as a moving lens which alternately points the star light in different directions

Uplink - the process where a light beam is propagated from the ground to a space target, while the beam is corrected for optical aberrations caused by its travel through air

Water hammer - the sound produced in waterpipes or other vessels when high pressure water flow is shut off too quickly

Wiggler - the part of the FEL which controls the oscillation behavior (wigglers) of the free electrons which in turn causes the energy to produce light.

bp - before present; an archeological term used to express time

Zenith - point in the sky directly overhead

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APPENDICES

APPENDIX A

Correspondence

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO ATTENTION OF:

July 23, 1986

Planning Division

Mr. John Peterson
Field Supervisor
Ecological Services
U.S. Fish and Wildlife Service
Onate Hall, Room 137
P.O. Box 4487
Albuquerque, New Mexico 87106

Dear Mr. Peterson:

The U.S. Army Corps of Engineers, Fort Worth District, is presently preparing an Environmental Impact Statement (EIS) on the proposed Ground Based Free Electron Laser Technology Integration Experiment (GBFEL-TIE) at White Sands Missile Range (WSMR), New Mexico. The EIS is being prepared for the Strategic Defense Command (SDC), the proponent of the GBFEL-TIE.

The purpose of the GBFEL-TIE is to develop and evaluate scalable laser technologies for potential use in future defense systems. Presently, three sites, as illustrated on the attached map, are being considered as possible locations for the GBFEL-TIF. The facility, including ancillary structures and security areas, would encompass an area 2 miles by 10 miles. Power transmission lines (345kv) would have to be constructed to serve either of the three sites, although transmission line routes have not been identified at present.

The SDC proposes to begin construction in mid-1987 after completion of the Final EIS. Construction would require approximately 3 to 4 years. The experiments would be conducted in two phases: the medium power phase would be conducted for approximately 2 years, and the high power phase would have a duration of about 3 years. The experiment would primarily involve directing a laser beam at various ground, air, and/or space diagnostic targets. The duration of each test run would be less than 2 minutes. The laser beam's wavelength would be in the near infrared range (1.06 microns); the energy output of the beam, however, is classified.

This letter is a formal request for any information you may have concerning threatened or endangered species that may occur in or near any of the three sites and which could potentially be impacted by the construction and/or operation of the proposed project. This information should also include those species presently considered as Category 2 species. I would also like to solicit your present opinion concerning the potential for biological assessments under Section 7 consultation for any species, as well as concerns you may have about any potential environmental impacts at each of the three alternative sites.

In addition, it is our understanding that the USFWS may be conducting field surveys for protected species (e.g., peregrine falcons) in the Franklin, Organ, and/or San Andres Mountains. Any preliminary data from these surveys that you could provide would be greatly appreciated.

Our present schedule requires an in-house draft EIS by mid-August; therefore, I would apppreciate your prompt attention to this request. If you have any questions or require additional information, please do not hesitate to call Mr. Paul M. Bathorn at (817) 334-2095.

Thank you for your continued cooperation and assistance. We are looking forward to your response.

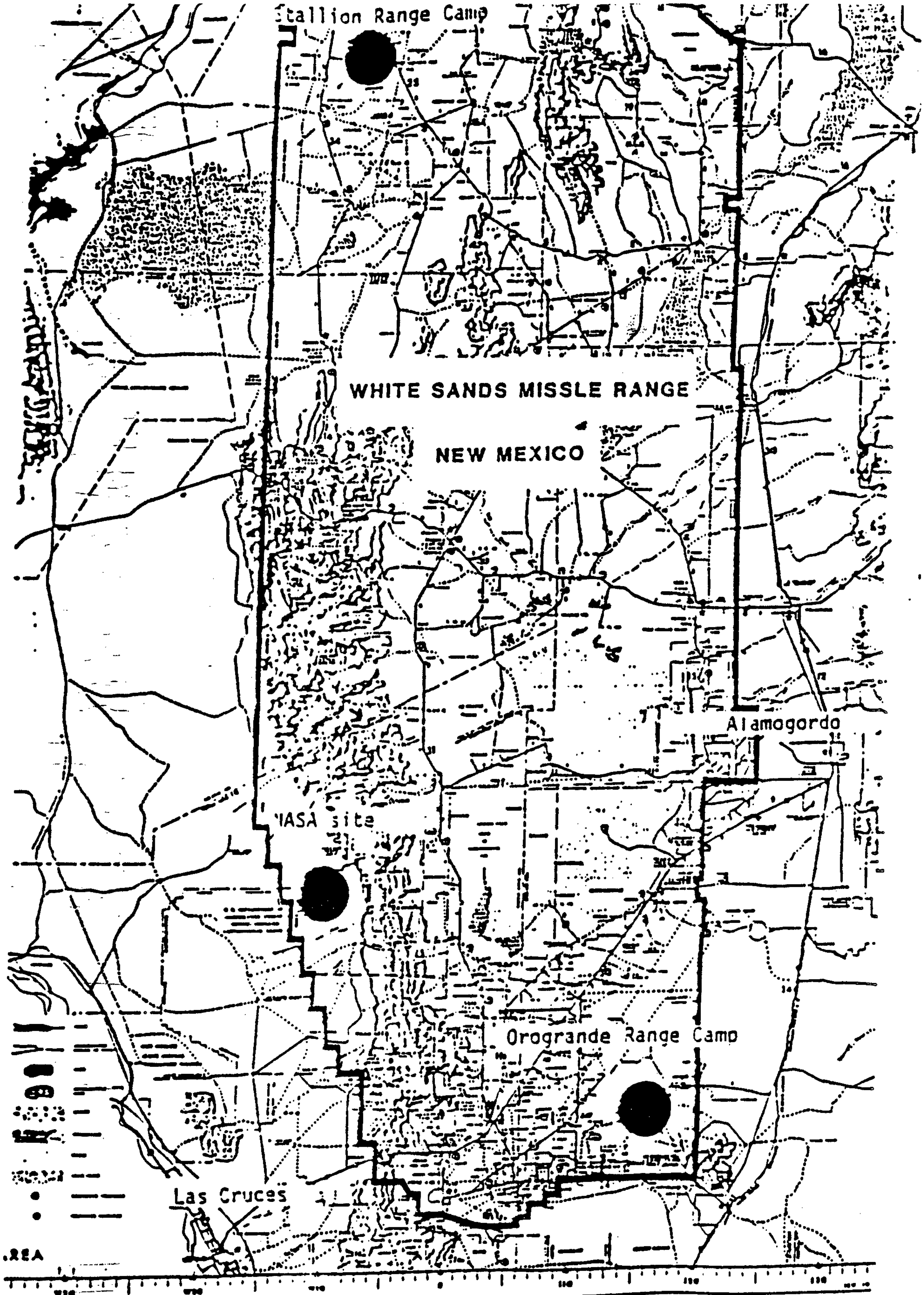
Sincerely,

Michael J. Hocek, P.E.
Chief, Planning Division

Enclosure
Copy Furnished:
Commander
U.S. Army Engineer Division, Huntsville
ATTN: HNDED-CS (Whitehead)
P.O. Box 1600
Huntsville, Alabama 35807

Mr. Ruben G. Garza
Geo Marine, Inc.
1316 Fourteenth Street
Plano, Texas 75074

Mr. Chris Ingram
Gulf South Research Institute
P.O. Box 14787
Baton Rouge, Louisiana 70898



POTENTIAL GROUND BASED LASER SITES

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF:

July 23, 1986

Planning Division

Mr. John Hubbard
New Mexico Game and Fish Department
State Capitol
Santa Fe, New Mexico 87503

Dear Mr. Hubbard:

The U.S. Army Corps of Engineers, Fort Worth District, is presently preparing an Environmental Impact Statement (EIS) on the proposed Ground based Free Electron Laser Technology Integration Experiment (GBFEL-TIE) at White Sands Missile Range (WSMR), New Mexico. The EIS is being prepared for the Strategic Defense Command (SDC), the proponent of the GBFEL-TIE.

The purpose of the GBFEL-TIE is to develop and evaluate scalable laser technologies for potential use in future defense systems. Presently, three sites, as illustrated on the attached map, are being considered as possible locations for the GBFEL-TIE. The facility, including ancillary structures and security areas, would encompass an area 2 miles by 10 miles. Power transmission lines (345kv) would have to be constructed to serve either of the three sites, although transmission line routes have not been identified at present.

The SDC proposes to begin construction in mid-1987 after completion of the Final EIS. Construction would require approximately 3 to 4 years. The experiments would be conducted in two phases: the medium power phase would be conducted for approximately 2 years, and the high power phase would have a duration of about 3 years. The experiment would primarily involve directing a laser beam at various ground, air, and/or space diagnostic targets. The duration of each test run would be less than 2 minutes. The laser beam's wavelength would be in the near infrared range (1.06 microns); the energy output of the beam, however, is classified.

This letter is a formal request for any information you may have concerning threatened or endangered species that may occur in or near any of the three sites and which could potentially be impacted by the construction and/or operation of the proposed project. I would also like to solicit any concerns that you may presently have about any potential environmental impacts at each of the three alternative sites.

Our present schedule requires an in-house draft EIS by mid-August; therefore, I would appreciate your prompt attention to this request. If you have any questions or require additional information, please do not hesitate to call Mr. Paul H. Hathorn at (817) 334-2095.

Thank you for your continued cooperation and assistance. We are looking forward to your response.

Sincerely,

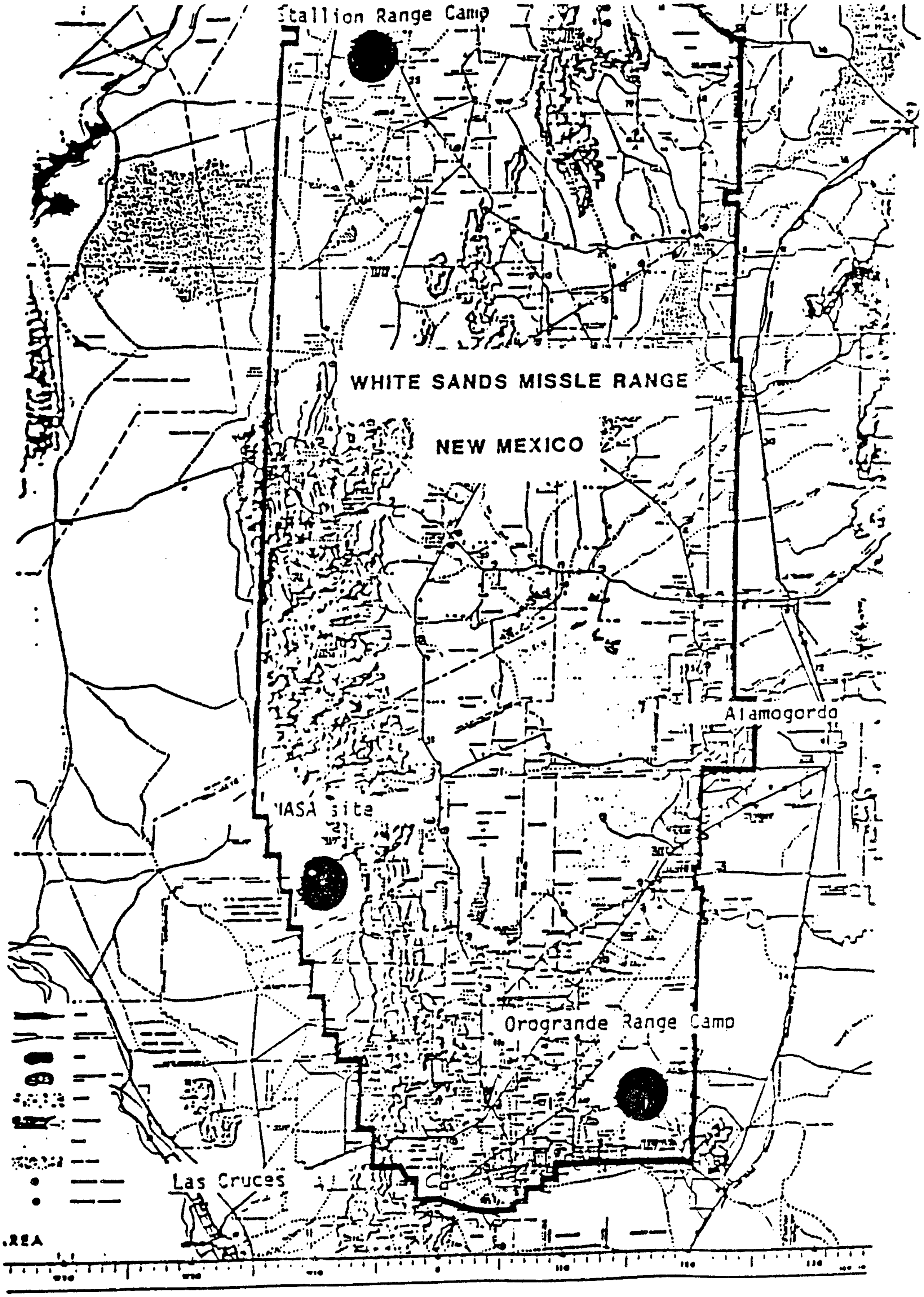
Michael J. Mocek, P.E.
Chief, Planning Division

Enclosure

Copy Furnished:
Commander
U.S. Army Engineer Division, Huntsville
ATTN: HNDED-CS (Whitehead)
P.O. Box 1600
Huntsville, Alabama 35807

Mr. Ruben G. Garza
Geo Marine, Inc.
1316 Fourteenth Street
Plano, Texas 75074

Mr. Chris Ingram
Gulf South Research Institute
P.O. Box 14787
Baton Rouge, Louisiana 70898



POTENTIAL GROUND BASED LASER SITES

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Field Supervisor
Ecological Services, USFWS
Post Office Box 4487
Albuquerque, New Mexico 87196

Cons. #2-22-86-I-111

August 29, 1986

Mr. Michael J. Mocek, P.E., Chief
Planning Division
Corps of Engineers, U. S. Army
P. O. Box 17300
Ft. Worth, Texas 76102-0300

Dear Mr. Mocek:

This responds to your letter dated July 23, 1986, requesting information on the effects of the Ground Based Free Electron Laser Technology Intergration Experiment (GBFEL-TIE) on species Federally listed or proposed to be listed as threatened or endangered. The proposed action involves the contruction of an experimental ground based free electron laser system. Elements of this system include a linear particle beam accelerator and laser beam tube up to several miles in length enclosed in an underground tunnel; a beam director resembling an astronomical observatory and telescope to aim the laser at various ground, air, and/or space diagnostic targets; security areas; power supply; and other support facilities. In addition, a 345 kV power transmission line would be constructed to supply power to the GBFEL-TIE. Construction of the facility would occur in two phases. Ultimate development would occupy an area of two miles by ten miles and require significant electrical power and water resources (80 - 100 megawatts base load and 1,400 acre-feet/year, respectively).

Three sites are being considered for the GBFEL-TIE on White Sands Missile Range (WSMR) in south-central New Mexico: 1) north of the NASA site west of the San Andres Mountains in Dona Ana County, 2) south of the Stallion Range Camp in the northwestern portion of WSMR in Socorro County, and 3) near the Orogrande Range Camp in the southeastern portion of WSMR in Otero County.

We have used the information in your request to narrow the enclosed list of species occurring in the project area to those which may be affected by your proposed action.

As you requested, the list has been expanded to include both Category 1 and Category 2 candidate species. Candidate species have no legal protection under the Endangered Species Act and are included in this document for planning purposes only. Category 1 species are those species for which the Service has substantial information to support their listing as endangered or threatened. The development and publication of proposed rules for these species is anticipated. Category 2 species are those species for which current information indicates that proposing to list as endangered or threatened may be appropriate, but for which conclusive biological data are not currently available to support proposed rules.

Information relating to the Section 7 consultation process has been enclosed for your use in project planning. We suggest you contact the New Mexico Department of Game and Fish and the New Mexico Heritage Program for information concerning fish, wildlife and plants of State concern.

The Service is particularly concerned with impacts on nesting raptors in the San Andres and Oscura Mountains, interruption of migration routes of large mammals, alteration of natural drainage patterns, increased water and wind erosion, and direct habitat losses due to project construction and operation. Two of the proposed alternative sites are located in proximity to National Wildlife Refuges (NWR) administered by the Service. The Stallion Range Camp site is within 11 miles of Bosque del Apache NWR, while the NASA site is less than 4 miles from San Andres NWR. The proposed 345 kV transmission line could have significant adverse impacts on wildlife resources, depending on the site selected for the GBFEL-TIE and the powerlines length and alignment. The environmental impact statement for the project should include this component in its evaluation of impacts, especially with regard to its potential effect on eagles, cranes and other large birds.

If we can be of further assistance, please call our office at (505) 766-3966 or FTS 474-3966.

Sincerely yours,

Michael J. Donahoo

Michael J. Donahoo
Acting Field Supervisor

Enclosures

cc: (w/cy encls)
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Heritage Program, New Mexico Natural Resources Department, Santa Fe, New Mexico
Regional Director, FWS, Wildlife Enchancement, Albuquerque, New Mexico

ENDANGERED SPECIES ACT
SECTION 7 CONSULTATION PROCESS

Section 7 of the Endangered Species Act requires that all Federal Agencies consult/confer with the U.S. Fish and Wildlife Service or National Marine Fisheries Service (hereafter referred to as Service) regarding endangered species. This consultation is necessary to insure actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed or proposed endangered or threatened species or adversely modify or destroy critical habitat of such species. The purpose of these requirements is to identify and resolve, at the early planning stage, potential conflicts between the action and these species and their critical habitat. The following explains the processes used to comply with these requirements.

For Section 7 consultation purposes actions are placed in two categories: one consisting of major construction actions significantly affecting the quality of the human environment and a second consisting of non-construction actions. A major construction action is defined as a construction action which will require preparation of an EIS. Actions not requiring an EIS are treated as non-construction category actions.

CONSULTATION PROCESS

NON-CONSTRUCTION ACTIONS. For actions in this category it is incumbent upon the Federal action agency to assess whether its action may affect endangered and threatened species. If no effect is evident, there is no need for further consultation. However, if it is determined the proposed action may affect listed species, the Federal action agency shall initiate formal Section 7 consultation with the Service.

While not required, a list of listed or proposed species found in the vicinity of the proposed action may be obtained from the Service by the Federal agency or their agent.

CONSULTATION PROCESS

CONSTRUCTION ACTIONS. For proposed actions in this category, the Federal agency or their agent requests from the Service information on any species listed or proposed to be listed that may be affected by the action. The Service will provide this information within 30 days after receiving the request.

Based on the list provided by the Service, the Federal action agency, or their delegated agent, conducts a biological assessment of the total area affected by the proposed project to identify impacts upon those species as a result of the proposed action. This assessment shall be completed within 180 days after receiving a list of species from the Service. If the assessment is not initiated within 90 days after receipt of the species list, the accuracy of the list should be verified before conducting the assessment.

Biological assessments should include as a minimum:

(1) An on-site inspection of the area affected by the proposed action including a detailed survey of the area to determine if listed or proposed species are present and if suitable habitat exists for expanding the existing population or potential reintroduction of the population;

(2) Interviews with recognized experts on the species involved including personnel of the Service, State conservation departments, universities, and others who may have data not yet found in scientific literature;

(3) A review of literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements;

(4) An analysis of direct and indirect effects of the proposed action on the individuals and population of the involved species and their habitat;

(5) An analysis of alternative actions that may promote conservation of the species;

(6) Other relevant information; and

(7) A written report documenting the assessment results.

If the Federal action agency determines that its proposed action may affect listed species, that agency initiates formal Section 7 consultation with the Service. If the Federal action agency determines that there will be no effect, there is no need for further consultation. However, the Service would appreciate the opportunity to review the biological assessment.

PROPOSED SPECIES AND PROPOSED CRITICAL HABITAT. If the proposed Federal action is likely to jeopardize species proposed for listing as endangered or threatened, or adversely modify proposed critical habitat, Section 7 requirements are met by conferring with the Service. Information similar to that listed below for formal consultation is needed from the action agency when conferring with the Service on proposed species and proposed critical habitat.

FORMAL CONSULTATION INFORMATION NEEDS

Requests for formal consultation should include information necessary for the Service to determine impacts on listed species as follows:

(A) DESCRIPTION OF ACTION.

(B) DESCRIPTION OF THE ACTION AREA AFFECTED. INCLUDES ALL AREAS AFFECTED DIRECTLY OR INDIRECTLY BY THE FEDERAL ACTION, NOT MERELY THE IMMEDIATELY AREA INVOLVED IN THE ACTION.

(C) STATUS OF THE SPECIES AND IT'S CRITICAL HABITAT IN THE AREA AND WHAT THE AFFECTED AREA PROVIDES FOR THE SPECIES.

(D) AN ASSESSMENT OF HOW THE LISTED SPECIES OR CRITICAL HABITAT WILL BE AFFECTED AS A RESULT OF THE FEDERAL ACTION.

(E) OTHER RELEVANT INFORMATION

DickM/me: 2/13/85
February 2: DickM (ESA-SEC7)

Species List

Department of the Army
Fort Worth District, Corps of Engineers
Technology Integration Experiment
White Sands Missile Range
Dona Ana, Otero and Socorro Counties, New Mexico

August 26, 1986

Listed Species

Whooping Crane (Grus americana) - Roosts on gravel bars and islands in Rio Grande from October through Fevruary. Feeds in cultivated fields and wetlands within several miles of the Rio Grande.

Authorities: James Lewis, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103, (505) 766-3974 and Roderick Drewien, c/o Bosque del Apache National Wildlife Refuge, P.O. Box 1246, Socorro, NM 87801, (505) 835-1828.

Bald Eagle (Haliaeetus leucocephalus) - Winters along the Rio Grande and occurs as a migrant statewide. Roosts in large trees which may or may not be close to their feeding areas. Bald eagle feeding areas include rivers, reservoirs, and ponds.

Authorities: Steve Hoffman, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103, (505) 766-3974 and John P. Hubbard, New Mexico Department of Game and Fish, Villagra Bldg., Santa Fe, New Mexico 87503, (505) 827-7438.

American Peregrine Falcon (Falco peregrinus anatum) - The peregrine falcon prefers areas with steep rocky cliffs in close proximity to water. Since dense bird populations provide the primary food source for the peregrine falcon, areas in which these bird concentrations are found are also important habitat. It has a lower preference for forest and grassland biomes.

Authority: John P. Hubbard, New Mexico Department of Game and Fish, State Capitol, Santa Fe, New Mexico 87503, (505) 827-2438.

Aplomado Falcon (Falco femoralis septentrionalis) - An endangered bird, is currently not found in New Mexico but may be introduced into historic range in the State. Historic range includes Catron, Chaves, Dona Ana, Eddy, Grant, Hidalgo, Lea, Lincoln, Luna, Otero, Sierra, and Socorro Counties. This species is found in open woodland, savanna or grassland habitats.

Authority: Steve Hoffman, U.S. Fish and Wildlife Service, P. O. Box 1306, Albuquerque, New Mexico 87103, (505) 766-8063.

Interior Least Tern (Sterna antillarum athalassos) - This species nests on sandy beaches on shorelines of streams, rivers and lakes and has been sighted on Bosque del Apache National Wildlife Refuge.

Authority: Steve Hoffman, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103, (505) 766-3972.

Sneed Pincushion Cactus (Coryphantha sneedii var. sneedii) - Occurs in southeastern Dona Ana County and northwestern El Paso County (Texas) in the southern Organ Mountains, Bishop's Cap, and Franklin Mountains. This species usually prefers limestone ledges in desert and grassland biomes from 4,300 to 5,400 feet elevation.

Authority: Saustrup, A. and M.C. Johnston. 1977. Report on status of Coryphantha sneedii var. sneedii. Rare Plant Study Center, U. T. at Austin.

Lloyd's Hedgehog Cactus (Echinocereus lloydii) - This species occurs in the Chihuahuan Desert in the Jarilla Mountains near Orogrande, Otero County and in Carlsbad National Park, Eddy County. It has also been reported in Eddy County, 30 miles west of Artesia and in the east Potrillo Mountains, Dona Ana County. It is associated with dry rocky hills, slopes, limestone and granite outcrops at approximately 5000 feet elevation.

Authority: Jim Johnson, U.S. Fish and Wildlife Service, Office of Endangered Species, P. O. Box 1306, Albuquerque, New Mexico, (505) 766-3972.

Proposed Species

None

Candidate Species

Category 1

None

Category 2

White Sands pupfish	(Cyprinodon tularosa)
Ferruginous hawk	(Buteo regalis)
Swainsons hawk	(Buteo swainsoni)
"Western" snowy plover	(Charadrius alexandrinus nivosus)
White-faced ibis	(Plegadis chihi)
Mountain plover	(Charadrius montanus)
Long-billed curlew	(Numenius americanus)
Western yellow-billed cuckoo	(Coccyzus americanus occidentalis)
Southern spotted owl	(Strix occidentalis lucida)
Occult bat	(Myotis lucifugus occultus)
Southwestern cave bat	(M. velifer brevis)
Spotted bat	(Euderma maculatum)
Organ Mountains chipmunk	(Eutamias quadrivittatus australis)
Arizona prairie dog	(Cynomys ludovicianus arizonensis)
White Sands pocket gopher	(Geomys arenarius brevirostris)
White Sands woodrat	(Neotoma micropus leucophaea)
New Mexican jumping mouse	(Zapus hudsonius luteus)
Grama grass cactus	(Pediocactus papyracanthus)
Alamo beard tongue	(Penstemon alamosensis)
Gypsum scalebroom	(Lepidospartum burgessii)
Organ Mountain Evening Primrose	(Oenothera organensis)
Nooding cliff daisy	(Perityle cernua)
Gray sibara	(Sibara grisea)
Curleaf needlegrass	(Stipa curvifolia)
Dune unicorn plant	(Proboscidea sabulosa)

Critical Habitat

Whooping Crane (Grus americana) - An area of land, water and air space in Socorro County, New Mexico with the following components: all areas at or below 4,600 feet in elevation within Bosque del Apache National Wildlife Refuge (Federal Register, May 15, 1978: 43FR 20938 - 20942).

GOVERNOR
TONEY ANAYA
DIRECTOR AND SECRETARY
TO THE COMMISSION
HAROLD F. OLSON

State of New Mexico

STATE GAME COMMISSION
JAMES H. KOCH, CHAIRMAN
SANTA FE
A. H. GUTIERREZ, JR., M.D.
CARLSBAD
CHRISTINE DIGREGORIO
GALLUP
THOMAS P. ARVAS, O.D.
ALBUQUERQUE
JAKE ALCON
ALBUQUERQUE

DEPARTMENT OF GAME AND FISH

September 17, 1986

Mr. Michael J. Mocek
U. S. Army Corps of Engineers
P. O. Box 17300
Ft. Worth, Texas 76102

Dear Mr. Mocek:

This letter is in response to your request for information regarding state-listed threatened and endangered species that may be negatively impacted by the construction and/or operation of the proposed Ground Based Free Electron Laser Technology Integrated Experiment (GBFEL-TIE) at White Sands Missile Range (WSMR).

During the initial phase, the proposed project would involve the construction and operation of an accelerator that produces a high energy stream of electrons used to generate a laser beam, and a long buried tunnel to transport the laser energy to optical devices. A beam director to aim the laser at selected targets, several support buildings and security areas also would be required. Phase two would involve a larger, more powerful laser device that would require a 345 kV power transmission line, approximately 1,400 acre-feet of water annually and would occupy an area two miles by 10 miles.

Three sites within WMSR are being considered for the GBFEL-TIE project: 1) north of the NASA facilities along the west side of the San Andres Mountains, 2) south of the Stallion Range Camp in the northwestern portion of WSMR, and 3) in the vicinity of the Orogrande Range Camp in the southeastern portion of WSMR.

Our records indicate the following threatened and endangered species as occurring within, or in close proximity to the proposed project area: (1) desert bighorn sheep (Ovis canadensis mexicana); (2) black-tailed prairie dog (Cynonmys ludovicianus); (3) Colorado chipmunk (Eutamias quadrivittatus australis); (4) White Sands pupfish (Cyprinodon tularosa); (5) Trans-Pecos rat snake (Elaphe subocularis); and (6) gray vireo (Vireo vicinior).

I have some strong reservations regarding the proposed site located north of the NASA facilities along the west side of the San Andres Mountains. This area is located within 4 miles of the San Andres National Wildlife Refuge, the primary function of which is to protect and perpetuate the endangered desert bighorn sheep. The San Andres bighorn are the only indigenous population remaining in New Mexico. Consequently, they represent a very valuable resource to the citizens of the state. Presently, this population has reached a very delicate balance between survival and extinction. My concerns are further compounded by the fact that less than 125 free-ranging desert bighorn occur in the entire state.

The current status of our knowledge of desert bighorn sheep is that it is a very sensitive species and has great difficulty adjusting to encroachment of many man related activities. Bighorn sheep biology revolves about the retention of its annual production of juveniles on the home range of the adults, rather than their dispersal from such home ranges, and the exploitation of plant communities that are stable in time and space. Habitat utilization is dependent on social organization and living traditions that if altered, affect bighorn ecology far more significantly than if a similar alteration involved mule deer (Odocoileus hemionus).

Disturbances, whether directed toward bighorn or not, have been observed to cause reactions adverse to population welfare. Bighorn have been known to abandon the use of historic ranges where human activity increased suddenly over a short time.

The proximity of the site proposed for the GBFEL-TIE project north of NASA to currently occupied bighorn habitat on the San Andres National Widlife Refuge is of concern. In addition to possibly depriving bighorn use of the west slope of the mountain range, human activities in this area might also cause abandonment of the Brushy Mountain lambing areas, which have been identified as critical habitat for this species.

This project also has the potential to negatively impact important big game species such as mule deer, gemsbok (Oryx gazella), pronghorn antelope (Antilocapra americana), and mountain lion (Felis concolor) that occur throughout WSMR. An assessment of potential impacts on these species and appropriate mitigative measures need to be addressed in the draft environmental impact statement.

I am equally concerned about the water (1,400 acre-feet/year) and electric power requirements (345 kV transmission line) of this project. The environmental impact statement should address water infiltration rates, ground water movements, projected drawdown of the water bearing aquifer and what impacts this may have on water sources in the montane areas. The power transmission line could also have significant adverse impacts on wildlife. Construction and maintenance activities may adversely impact nesting raptors, as they are very sensitive to disturbances especially during the breeding season. Overhead wires also pose a serious threat to birds in the form of electrocution and collisions. The frequency of collisions with overhead wires is directly related to the proximity of powerlines relative to feeding areas. Electrocutions usually result from poor transmission line design.

I would appreciate the opportunity to review the draft environmental impact statement when it is completed. If you have any questions, please contact Andrew Sandoval of this office at (505) 827-9912.

Sincerely,

Harold Olson

Harold F. Olson
Director

avs

cc: John R. Brown (Office of Policy Analysis)
Michael J. Spear (Regional Director, USFWS)
Patricia Hoban (SANWR Manager, USFWS)
Daisan Taylor (Wildlife Biologist, WSMR)
Craig Nordyke (SW Area Supervisor, NMGF)

APPENDIX B

Archeological Survey and Report

(Included in Draft EIS)

APPENDIX C

PTMAX Air Emission Model

(Included in Draft EIS)

APPENDIX D

Socioeconomic Analysis Gravity and Allocation Models

Population Impacts and Gravity Models
for Socioeconomic Analysis, GBFEL-TIE, WSMR

The construction and operation of major Department of Defense related developments on WSMR has drawn workers and their dependents into the area in the past. The magnitude of the in-migration associated with the proposed GBFEL-TIE would depend on the project schedule and the need for nonlocal employees.

Employment data from WSMR, U.S. Census and local public sources have been applied to an algorithm to estimate the in-migrating population (Figure D-1). The in-migrating population consists of direct or primary workers (nonlocal construction and operations) associated with particular developments and indirect or secondary workers (i.e., those workers necessary to fill the employment created by the primary jobs for sales and services) and the dependents associated with primary and secondary workers (Table D-1).

The relationship between variables in the algorithm are based on available empirical data (Mountain West Research, 1975) and models (Murdock, et. al., 1979) developed for social impact assessment studies. All of the variables in the algorithm can be calculated by the known values of primary (direct) construction employment and primary (direct) operations employment.

The assumptions for the relationships between variables in the algorithm determine the values of total in-migrating population calculated from a given set of primary employment figures. Obviously, different assumptions yield different estimates of in-migration. The assumptions made in the present instance are based on previous empirical work and professional judgement relative to local applicability. As new data are developed and the assumptions refined, new values should be calculated prior to the discussion of estimated in-migrating populations. The assumptions regarding the relationship between values are presented below.

1. During FY87-90 60 percent of the blue collar construction phase work force would be filled by local workers; 40 percent by nonlocal workers. During FY91-93 50 percent of the blue collar construction work force would be filled by local workers, 50 percent by nonlocal workers.

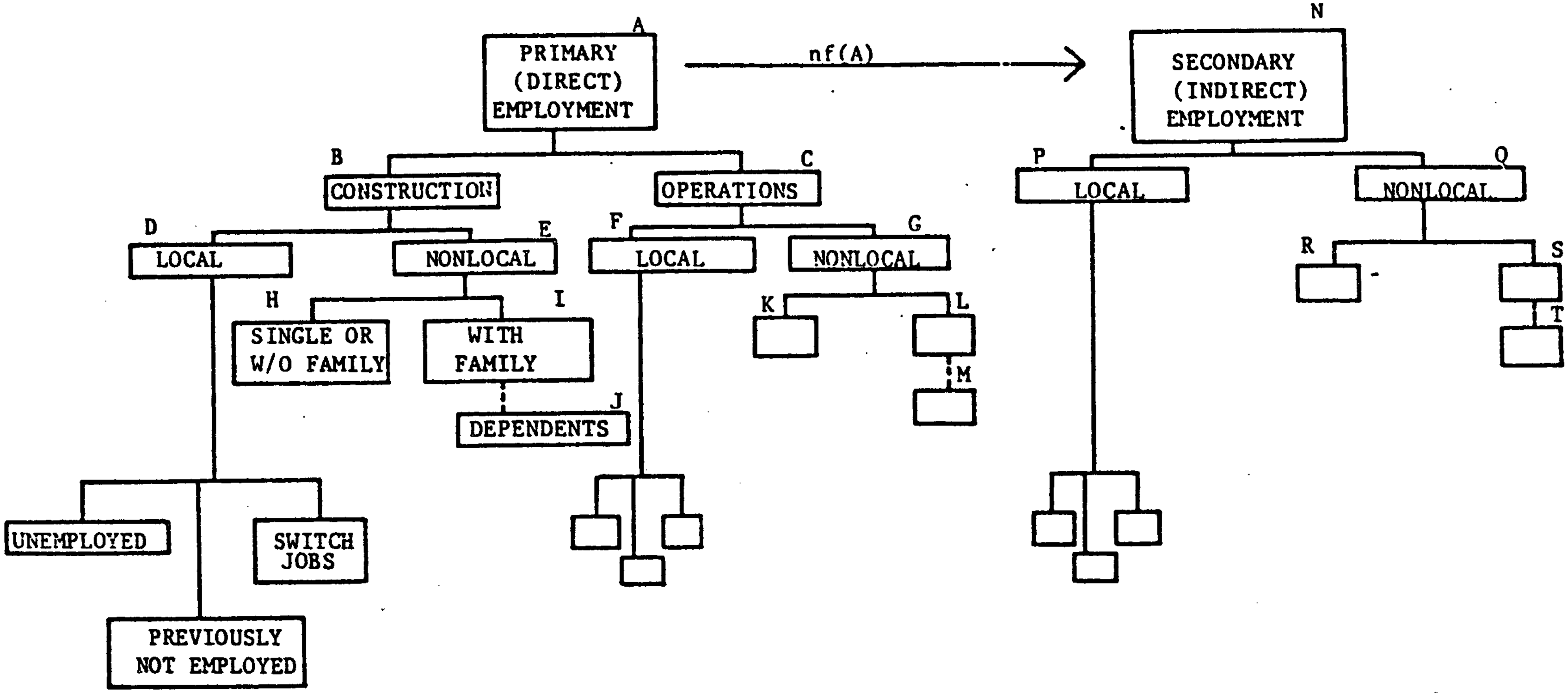
2. 20 percent of the scientific/technical/supervisory operations work force would be local; 80 percent would be nonlocal

3. 51 percent of the nonlocal blue collar construction phase workers would be single or without their families; 49 percent would have families or dependents

4. the number of dependents of nonlocal construction workers is 1.8 times the number of such workers

5. 20 percent of the scientific/technical/supervisory operations work force would be single or without families; 80 percent would have families or dependents

Figure D-1. POPULATION IMPACT MODEL



ASSUMPTIONS FOR CALCULATION:

1. D = .6B & E = .4B
2. F = .2C & G = .8C
3. H = .51E & I = .49E
4. J = 1.8I
5. K = .2G & L = .8G
6. M = 2.3L
7. N = .5B + 1.1C
8. P = .75N & Q = .25N
9. R = .2Q & S = .8Q
10. T = 2.35

Table D-1

Manpower Profile Estimate

	FY87	PHASE I FY88	FY89	FY90	PHASE II FY91	FY92	FY93
Construction	100-130	1060-1200	800-1000	330-410	1410-1760	1600-2000	1200-1500
Operations	25-50	100-150	200-300	250-350	300-400	400-500	400-500
Total	125-180	1160-1350	1000-1300	580-760	1710-2160	2000-2500	1600-2000

6. the number of dependents of nonlocal scientific/technical/supervisory operation workers is 2.3 times the number of such workers

7. the number of total (local and nonlocal) secondary workers is a function of primary construction workers and primary operations workers; the number of secondary workers is the sum of 50 percent of blue collar construction workers plus 110 percent of operations workers.

8. the number of nonlocal secondary workers would be 25 percent of the total calculated number of secondary workers

9. 20 percent of the nonlocal secondary workers would be single or without families; 80 percent would have families or dependents

10. the number of dependents of nonlocal secondary workers is 2.3 times the number of such workers

Assumption #1 is based on the proportion of local and non-local workers observed at similar projects throughout the United States. The Corps of Engineers Institute for Water Resources (Dunning 1981) concluded, based on a sample of 51 major construction projects, that:

a) approximately 70 percent of the national construction workforce on Corps projects is composed of local workers;

b) projects in the western United States have a higher proportion of non-locals than projects elsewhere in the country; and

c) for regions with smaller populations, the proportion of non-locals employed on a project is greater.

The proportions of local/non-local workers assumed in this analysis were chosen in an attempt to reflect these conclusions. They are further substantiated in a study conducted by North Dakota State University (Leholm et al. 1976) that the proportion of non-local workers at electric generating facility construction projects in the western United States was 50 percent. It should be recognized, however, that any modification in the level of effort or time table of the present project would modify impacts. Of particular importance would be the effect of additional new construction projects in the study area that might significantly increase the demand for construction workers. In this case, a higher percentage of in-migrating construction workers would be expected.

GBFEL-TIE related projected in-migrating populations were distributed among the counties within the region of impact using a gravity model of spatial allocation (Figure D-2). The boundary for the model was set by a 100 mile travel distance from each of the three sites. There are three separate allocations - one for each site. It was assumed that local workers would commute up to 100 miles to fill construction jobs. One hundred miles was also assumed to be the maximum distance from which the in-migrating work force generally would drive from their new place of residence to a work site.

The gravity model is based on two variables: size of place and distance between place and work site. The relationship between a worker's place of residence and place of work can generally be stated as follows:

- o the larger the place, the more attractive it is to reside, and
- o the closer the place, the more attractive it is to reside.

The size of place is in essence a proxy for numerous desirable community amenities and services, i.e., schools, shopping, housing, cultural activities, etc. Size is also a proxy for the ability of a community to muster resources (credit, expertise, etc.) to deal with incoming population and resulting impacts. If a community decides to prepare for the influx by arranging needed facilities (particularly housing), it may attract a much larger share of the incoming population than indicated by the model. Proximity to work is a measure of convenience.

The traditional method for the calculation of distribution factors based on size of place is based on the assumption that the population of incorporated places of 500 or more population is the best surrogate value for desirable community amenities and services. In the present case, it was assumed that the largest town in each of the counties was the market and service center for that county and would, therefore, contain facilities commensurate with the county population. Therefore, in making the spatial allocation calculations the county population was assigned to the largest town. The largest town was also the nodal point for measuring the distance by road to the various sites.

In most development projects the distance elasticity factor (exponent b) is lower for construction and secondary workers than for operations workers. The assumption is that the latter will seek residence closer to their place of employment than the former since there is an expectation of long-term employment. Because of the construction/operations scheduling information supplied at the time the Draft Environmental Impact Statement (DEIS) was being written, the judgement was made that construction and operations personnel would tend to allocate themselves in a similar manner. Accordingly, the distance elasticity factor used for both groups was the same (b=1.5).

Recently, revised manpower estimates and project schedules were received from USASDC which required rethinking this assumption. Additionally, information supplied by the WSMR Public Affairs office estimated the approximate work force distribution of WSMR main post personnel. Most of the personnel who live off-post were held to be civilian, professional or technical workers. This information indicated that approximately 44 percent of these personnel live in El Paso, 50 percent in Las Cruces and 6 percent in Alamogordo.

A distance elasticity factor based on this information was empirically derived and used to allocate the Orogrande and North of NASA operations work force. This factor (b=3.5) approximates the distribution for El Paso and Las Cruces but under represents the expected (6 percent) number at Alamogordo. The projected number for Alamogordo is 1 percent. This indicates that more people than the model predicts are willing to incur the inconvenience of additional travel in order to live in Alamogordo.

Figure D-2

Gravity Model of Spatial Allocation

$$w_{ij} = \frac{\dfrac{P_i}{d^b_{ij}}}{\displaystyle\sum_{i=1}^{N} \dfrac{P_i}{d^b_{ij}}}$$

where:

- w_{ij} = the proportion of workers settling in place i from plant j
- P_i = population in place i
- d_{ij} = distance from place i to plant j
- b = the extent to which distance inhibits settlement, referred to as distance elasticity

where:

- b = 1.5 for construction and secondary workers (Source: Sunbelt Research Corporation, March 1980)
- b = 3.5 for operations workers at Orogrande and North of NASA (Source: Elasticity figure calculated from settlement pattern of WSMR current civilian staff)
- b = 2.9 for operations workers at Stallion (WSMR elasticity figure judgementally modified)

Source: Construction Worker Profile Final Report. A Study of the Old West Regional Commission by Mountain West Research.

There is an additional factor which is probably involved, but which is unquantifiable. The perceived attractiveness of Las Cruces and Alamogordo as places to live, compared to El Paso, is greater than their relative population size would indicate.

Information concerning the disposition of past construction project work forces at WSMR was not available. Accordingly, the distance elasticity factor of b=1.5 was retained where making allocation projections of incoming construction and secondary workers.

Since the Stallion area differs considerably from the southern end of the WSMR, it was felt to be more reasonable to utilize factors from previous studies which were felt to be applicable. Accordingly, distance elasticity factors used in the gravity model to project the distribution of incoming population were b=1.5 for construction and secondary workers and b=2.9 for operations workers.

The distribution factors applied to the estimates for in-migrating populations for each site are shown below in Table D-2.

Table D-2

Distribution Factors for Construction, Operation and Secondary Workers and Attendant Dependents

	Site					
	Orogrande		North of NASA		Stallion	
County	Construction& Secondary	Operations	Construction& Secondary	Operations	Construction& Secondary	Operations
Bernalillo	-[1]	-	-	-	.654	.307
Dona Ana	.190	.234	.433	.831	-	-
Lincoln	.007	.002	-	-	.045	.045
Otero	.105	.175	.037	.009	-	-
Sierra	-	-	.006	.001	.020	.013
Socorro	-	-	-	-	.166	.536
Torrance	-	-	-	-	.014	.008
Valencia	-	-	-	-	.101	.091
El Paso	.698	.588	.524	.157	-	-
	1.000	0.999[2]	1.000	0.998	1.000	1.000

[1] "-" indicates not applicable
[2] may not total 1.000 due to rounding

References

Dunning, C.M. 1981. Report of Survey of Corps of Engineers Construction Workforce. Institute for Water Resources, Fort Belvoir, VA. June

Leholm, A., F. Leistritz, and J. Wieland. 1976. Profile of Electric Powerplant Construction Workforce. Department of Agricultural Economics, North Dakota State University, Fargo, ND.

Mountain West Research, Inc. 1975. Construction Worker Profile. Final Report, A Study for the Old West Regional Commission. December.

Murdock, S.H., Weiland and Levstritz. 1979. An Assessment of the Validity of the Gravity Model for Predicting Community Settlement Patterns in Rural Energy-Impacted Areas in the West. University of Florida.

Murdock, S.H., et. al. 1979. Texas Assessment Modelling System (TAMS). User Manual-Technical Report No. 79-2. Texas Agricultural Experiment Station, Texas A&M University, College Station.

Sunbelt Research Corporation. 1980. Analysis of Major Lignite and Non-Lignite Development, Employment, and Population Growth in Northwest Louisiana. March.

APPENDIX E

Eye Safety Calculations

Appendix E

Eye Safety Analysis

1.0 Introduction

The possibility of exposure and damage to the eye is a potential hazard associated with lasers. With a large scale laser, such as the GBFEL-TIE, the scattered energy as well as the laser beam itself can be a safety hazard. The eye is the organ most susceptible to laser damage. If the laser energy is not at sufficient levels to hurt the eye, then it is not a hazard to other parts of the body.

2.0 Exposure Limits

Optical radiation is usually absorbed in a thin layer of tissue in the eye and its damaging effects are largely thermal in nature. Tissue repair processes are limited and therefore result in a definite exposure threshold; that is, an exposure level exists below which no adverse change will occur and no real risk exists. Of course, the threshold can vary with the individual and with environmental conditions. However, if the safety level is set well below these variations, then the exposure conditions are not hazardous.

These hazard thresholds are set by taking measurements from laboratory animals, such as a rhesus monkey, and establishing the ED50 dose. The ED50 dose is the exposure dose that results in a 50 percent probability of an ophthalmoscopically visible lesion in 50 percent of the exposures in a group of animals. The Maximum Permissible Exposure (MPE) is then established as the safety level below which exposure is not hazardous. This MPE is generally 10 times smaller than the ED50 dose.

For the purpose of this analysis, the MPE values used are from the American National Standard for the safe use of lasers (ANSI A136.1-1980 amended 1986). For the operating wavelength and waveforms of the GBFEL-TIE these standards specify a MPE of $5 \times n^{-1/4}$ microjoules per square centimeter, where n is the number of laser pulses.

3.0 Laser Energy Scattering

Once the MPE levels have been established, it is necessary to evaluate all the possible sources of scattered energy. These scatterers can be categorized as diffuse scatterers, which spread the laser energy into a large volume, and specular scatterers, which reflect a more coherent and directional beam of energy.

3.1 Diffuse Targets

Most of the scatterers that may reflect laser energy will be diffuse scatterers. These scatterers include aerosols in the atmosphere such as clouds, the atmosphere itself, dust particles and other particulates, plants, animals, the ground and rough non-reflective surfaces on the targets. For purposes of analysis, instead of addressing each of the types of scatterers a "worst case" was assessed. This "worst case" assumes that a diffuse scatterer, as large as the laser beam, reflects all the laser energy. The following is the geometrical optics question for the reflected energy in this case:

$$\text{(Radiant Exposure)} = \frac{\text{(Beam Energy) (Scatterer reflectance)}}{\text{(Area of the scattered energy)}}$$

or symbolically

$$H = \frac{\Phi\rho}{\pi r^2}$$

If the radiant exposure (H) is replaced by the MPE, the equation can be solved for the "safe range" or the range at which the reflected energy is equal to the maximum permissible energy.

$$r = \left(\frac{\Phi\rho}{\pi \cdot \text{mpe}}\right)^{1/2}$$

For the anticipated beam power densities, both Phase I and Phase II will have safe ranges less than 1 km.

3.2 Specular Scatterers

Smooth highly reflective objects can scatter a significant portion of a laser beam. Some specular scatterers that have been considered are rain, space debris, air vehicles, ground vehicles and reflective surfaces on the test targets. Reflections from large scatterers would be mitigated with operational safety procedures. That is, ground and air vehicles would be cleared from the area before laser operation. Radar and ground security would alert the operators to any unauthorized intrusion into the safety buffer zones and the laser would automatically be shut down. The laser would also not operate in adverse weather conditions. Any space debris over 1 cm in diameter would be tracked and accounted for so the laser would not operate when there is a hazard of illuminating these scatterers. This leaves small unintentional objects and the test targets to consider.

3.2.1 Small Unintentional Targets

Since objects larger than 1 cm in diameter can be detected and thereby operationally guarded against, a 1 cm diameter scatterer is considered in the specular scatterer hazard analysis. Most of the smooth surfaces will be curved and therefore will spread the energy in a broad direction. For this analysis, the more stressing case of a nominally flat surface is considered with a correction term for the degree of "flatness". A geometrical optics equation for the radiant exposure from a specular scatterer is:

$$H = \frac{\text{(Beam energy)(Atmos. Atten.) (Reflectivity)(Area of reflector)(Flatness)}}{\text{(Area of beam at reflector)(Area of scattered beam at eye)}}$$

or symbolically

$$H = \frac{4\,\Phi\, e^{-k(r_1+r_2)}\rho\, d_r^{\,2}\, e^{-(2\pi\sigma)^2}}{\pi\left(\alpha+2r_1\left(\frac{1.22\lambda}{\alpha}\right)\right)^2\left(d_r+2r_2\left(\frac{1.22\lambda}{d_r}\right)\right)^2}$$

Consistent with the "worst case" analysis, we assume the beam is not spread or attenuated through the atmosphere. The safe range is then:

$$r_2 = \left(\left(\frac{4 \Phi d_r^2 \rho^{e^{-(2\pi\sigma)^2}}}{\pi \, mpe \, \alpha^2} \right)^{1/2} - d_r \right) \frac{d_r}{2x1.22\lambda}$$

Most scatterers will be destroyed by the incident laser beam. Those that survive will generally have the surface degraded to a diffuse reflector. If a scatterer were to survive a few laser pulses with it's surface intact, it would not generally remain oriented toward a viewer for more than a few milliseconds. Nevertheless, in order to be conservative on the side of safety, for this analysis we assumed an extremely large number of 150 pulses that may reach the viewer. In addition, we made a very conservative estimate of the anticipated reflectivity (80 percent) and surface flatness (one-third of a wavelength). Using these assumptions, the above equation gives the result that the safe range for specular reflections would be less than 1 km. That is, if an observer located beyond 1 km from the beam were to look at reflection of the laser, that observer would not receive more than the Maximum Permissible Exposure.

Although laser reflections more than 1 km from the reflecting object would not be hazardous, a further calculation was done to estimate the likelihood someone beyond 1 km away would even be exposed to the reflection. The analysis to this point assumes that if a specular scatterer does encounter the beam that it is oriented at exactly the right angle to reflect the energy into someone's eye. This is a very unreasonable assumption. If a scatterer enters the laser beam it could be oriented so that energy can be scattered in any direction. The probability of exposure to this reflected energy is a function of the distance from the scatterer and the area of the eye. For a viewer beyond 1 km from the scatterer the probability is very low, less than 1 in 2 million.

3.2.2 Reflection from Test Targets

The largest source of potential reflected energy would be from scatterers on the test targets themselves. This problem will be controlled through proper design of the test targets. Most of the surfaces will be diffuse or curved so that the reflected energy will be highly divergent. The reflective surfaces may be oriented so that scattered energy will reflect into an absorptive protecting material. Large reflective targets can be enclosed in a light tight facility to prevent reflected energy from producing a hazard.

4.0 Telescopic Viewing

If the scattered laser energy is viewed with a telescope or binoculars there will be more radiation on the eye due to the larger aperture of the telescopic device. For specular reflectors within the line-of-sight this radiation may be damaging. However, the probability of reflected energy being in the direction of the telescopic device is still well below one in a million. If this probability is coupled with the probability of the telescope being pointed toward the scatterer, the chances of damaging exposure decrease to less than 1 in 10 billion.

The design for the test targets will incorporate the possibility of telescopic viewing. Ground targets will be shielded to preclude telescopic viewing. Airborne test targets will be designed to be diffuse or curved scatterers. For a typical missile size target viewed with a 6 inch telescope the safe range is still well below one kilometer.

5.0 Safety Zones

In keeping with the above analyses, a 1 km keep-out zone (Figure E-1) will be established around the facility. No personnel will be allowed in this zone during laser operations.

A 3 km controlled access zone will be established primarily to serve as a security buffer around the 1 km keep-out zone. A 3 km aerial buffer will also be established as shown in Figure E-2. Any aircraft or bird entering this airspace will result in a shutdown of the laser beam.

All analyses indicate that the GBFEL-TIE can be operated in a manner that will not present any eye safety hazards to the general population or the operating personnel. The following points summarize the safety analysis for the GBFEL-TIE:

1. Hazard zone - 1 km
   Controlled access zone - 3 km
   Aerial buffer zone - 3 km

2. The test targets and procedures will be designed to preclude a safety hazard beyond the designated safety zones.

3. Outside the 1 km zone there is no eye safety hazard.

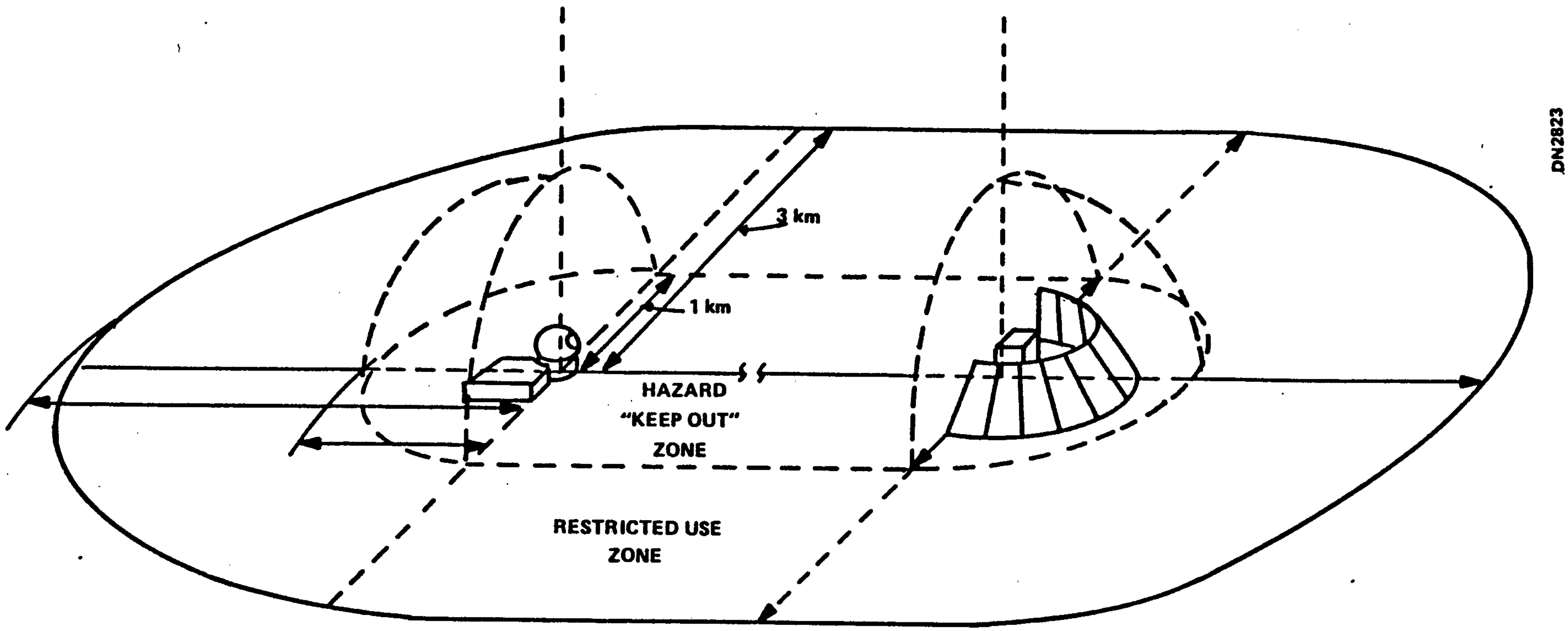


Figure E-1 Illustration of Safety Zones

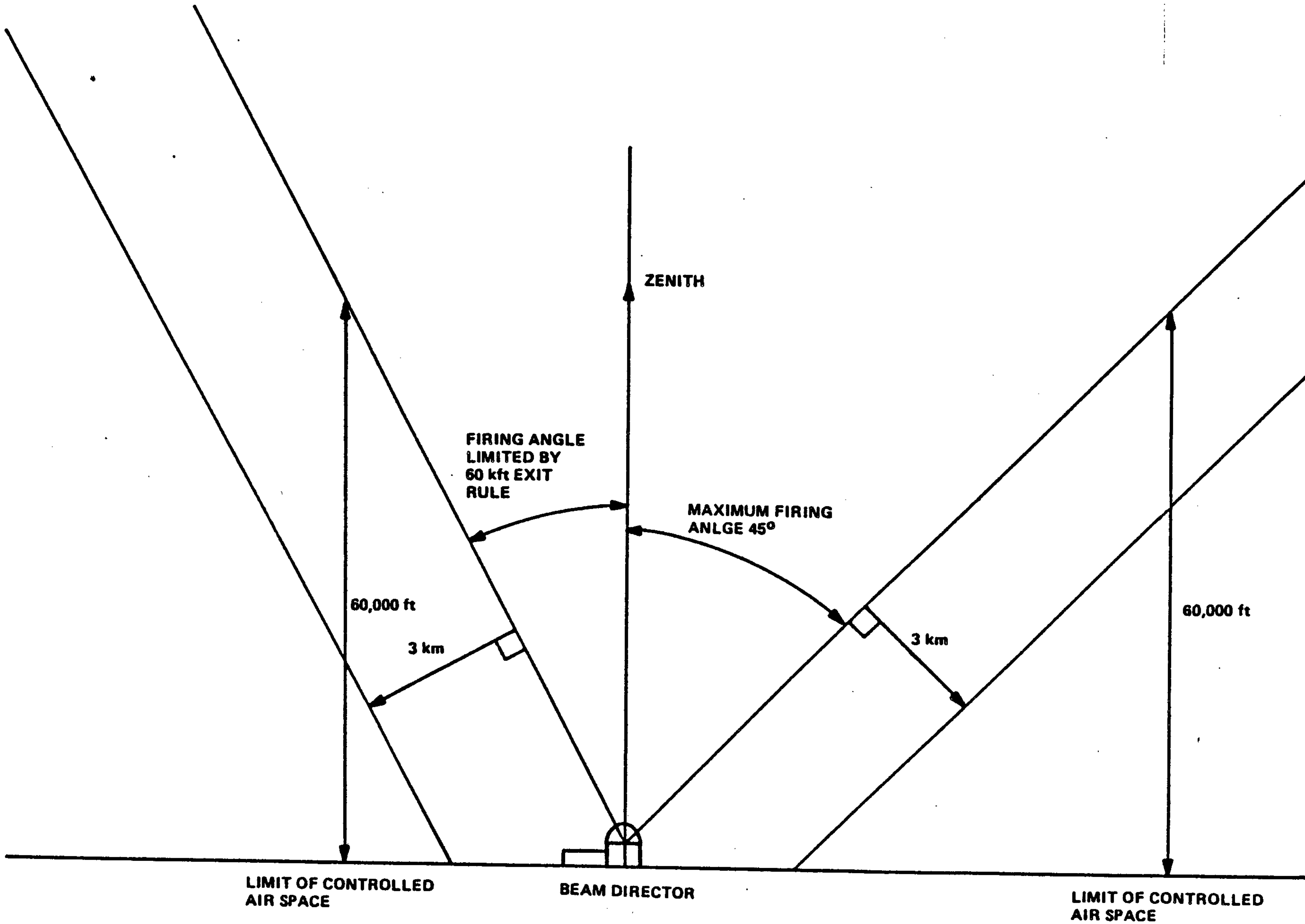


Figure E-2 Illustration of Safety Zones - Aerial Buffer

APPENDIX F

Public Involvement

(Included in Draft EIS)

APPENDIX G

Memorandum of Agreement
between WSMR and New Mexico SHPO
(Included in Draft EIS)

APPENDIX H

RFI STUDY

RFI Study

1. Introduction and Summary of Results

1.1 Results

Given the currently available information it does not appear that the operation of the GBFEL TIE equipment will result in any increase in the local background RFI noise. The need to shield the equipment to meet personnel safety requirements for ionizing radiation and the maximum allowable rf radiation (USAS C95.1-1966) result in more RFI shielding than would be necessary for a system designed to suppress RFI for more normal environments, i.e. a data processing complex.

We base this conclusion on two important assumptions,

1) the RFI shielding is properly maintained and

2) a RF leak detection monitoring and correction system is included in the design of the facility.

1.2 Objective/Purpose

The question answered in this document is:

"What is the potential for radio frequency interference from the operation of the GBFEL TIE linear accelerators and power equipment"?

If RFI is produced by GBFEL TIE equipment, it could disturb local television and radio receivers. Since the GBFEL TIE will be located on White Sands Missile Range (WSMR), it could also interfere with the data gathering equipment of other government programs.

One of the most important projects within the potential RFI environment of the GBFEL TIE is the Very Large Array (VLA) radio telescope. In addition to the VLA the Tracking and Data Receiving Satellite (TDRS) near the candidate North of NASA site may is sensitive to RFI. Several projects on WSMR may be affected but no data on their RFI tolerances is currently available. Therefore the effect of an extreme worst case potential GBFEL TIE RFI against the requirements set by the VLA and TDRS is used in the analysis. Enough data and references to allow other facilities to determine the potential impact of RFI from the GBFEL TIE equipment is included in Section 3.

1.3 Approach to the Problem

We began by assuming the worst case noise source to be a RF level equal to the maximum safety limit (100 w/square meter), {The latest safety standard is 40 w/square meter. However, since this standard has not yet been formally accepted by the Army, the previous 100 w/square meter is used in this analysis} which would be the worst case RFI conditions at the GBFEL TIE facility. Then we calculate the propagation losses which would reduce any leakage of this radiation to determine if the level of interference would be significant at the VLA facility, or elsewhere. We assume only minimum losses from each possible loss source. For example, our caluculation ignores the losses due to wave length or antenna mismatch. Our calculation of the losses due to diffraction over the earth used only the single highest ridge and not all those in the path. We have under estimated the RFI losses and therefore have made the effect of any GBFEL TIE generated RFI worst.

We have included simple estimates of the noise produced by equipment similar to that of the GBFEL TIE, and all available information on the noise produced by operating accelerators. From this past experience, there is no reason to expect the GBFEL-TIE should create an RFI problem.

We assume the facility will be designed and operated in a manner consistent with OSHA and Army safety and proper maintence practice. Additionally, we assume any shielding used will be maintained and tested for leakage to prevent hazards to personnel. Although these levels such as 40 watts per square meter are permitted by the safety regulations, these levels are not acceptable to the GBFEL-TIE design staff. The design staff will try to minimize all energy losses. The amount of energy required to exceed this safety level would result in a drastic loss of power to the GBFEL system. If even half the allowed value of RF energy escapes an additional 80 kilowatts of power would be needed to operate the GBFEL.

Potential noise sources associated with construction have not been addressed in this document. These may include noise generated by improperly shielded ignition systems, arc welding, brush arcing, and other noisy electrical equipment. The control of these sources must be left to the construction contractor.

2. The potential RF sources

In the following sections, the descriptions of the varied equipment which are potentially part of the GBFEL TIE are presented to prepare for the discussion of the potential for RFI impact from the GBFEL TIE project.

2.1 Accelerators

There are two types of accelerators, RF and induction. They have similarities in their power supplies but are different in the methods they use to accelerate electrons. Their potential for interference is also different. The noise sources fall into three categories; those common to both types of accelerators, and those specific to one or the other accelerator type.

The common components are:

1) the electrical substation,

2) the electrical components which condition the power grid (static Voltage Amperage Reactance (VAR) compensators),

3) the power line filters which prevent frequencies other than 60 Hz from entering or leaving the facility power lines,

4) the step down transformers to adjust the line voltage to that required by the High Voltage Direct Current (HVDC) power supplies, the designs would be different for each type of accelerator but would have similar RFI problems,

5) pulse forming networks; both types of accelerator have them, although each is different.

The components peculiar to the RF accelerator are:

1) the pulse frequency controller,

2) the RF generators, Klystrons at 1.3 GHz or 433 MHz,

3) wave guides,

4) RF accelerator cavities

The components peculiar to the Induction accelerator are:

1) the magnetic pulse compressors, which contain transformers, blumleins, and trigger networks.

The most important potential sources of RFI are leakage through the line filters and emissions from the RF generators, the klystrons. These components could be at ground level, and if they are, they would at least be housed in metal buildings similar to the Butler Buildings used for warehouses. The commerically available structures can provide excellent shielding. Figure 2-1 shows the performance of a equipment designed to reduce RFI. This performance is typical for simple commerically available shielding.

The klystrons provide the free-electron laser with the energy to accelerate the electrons. They provide the most intense source of radio frequency energy. Small RFI leaks in their shielding or the waveguides connecting them to the accelerator structures can produce unacceptable and unsafe RF levels. The impact of these leaks depends of the frequency of the klystrons. If these are outside the sensitive listening bands of the receiver then the problem will be minimal. Table 2.1 is a table of the energy distributions out of the main frequency of typical klystrons. The energy in frequencies other than the main frequency is very small. Thus any RFI from the klystrons at frequencies other than its fundamental will be at very greatly reduced levels.

Line filters are a common component of ordinary electrical power systems. They are often used on high voltage DC power lines to reduce the RFI produced by the electronics used to convert AC to DC current and back to AC. It is important to prevent leakage from the line filter into the rest of the power lines because the noise from this can

SUMMARY OF RADAR HARMONIC LEVELS (DECIBELS BELOW FUNDAMENTAL)

Tube type \ Harmonic	2	3	4	5	6	7	8	9	10
Magnetron:									
Mean	78.1	71.7	77.1	86.0	87.2	91.9	99.3		
Range, high/low	57/103	45/100	62/93	67/114	76/96	81/96	83/114		
Number of samples	77	59	34	23	17	7	5		
Klystron:									
Mean	71.3	78.2	76.9	73.9	82.3	87.2			
Range, high/low	38/119	57/105	56/101	59/111	73/89	72/97			
Number of samples	44	27	21	8	7	4			
Tetrode and triode:									
Mean	83.2	76.0	99.6	90.0	96.7	100.2	106.2	97.2	100
Range, high/low	74/93	72/81	93/108	79/98	83/108	93/112	98/113	93/100	100/100
Number of samples	14	13	10	11	9	9	3	4	2

TABLE 2-1

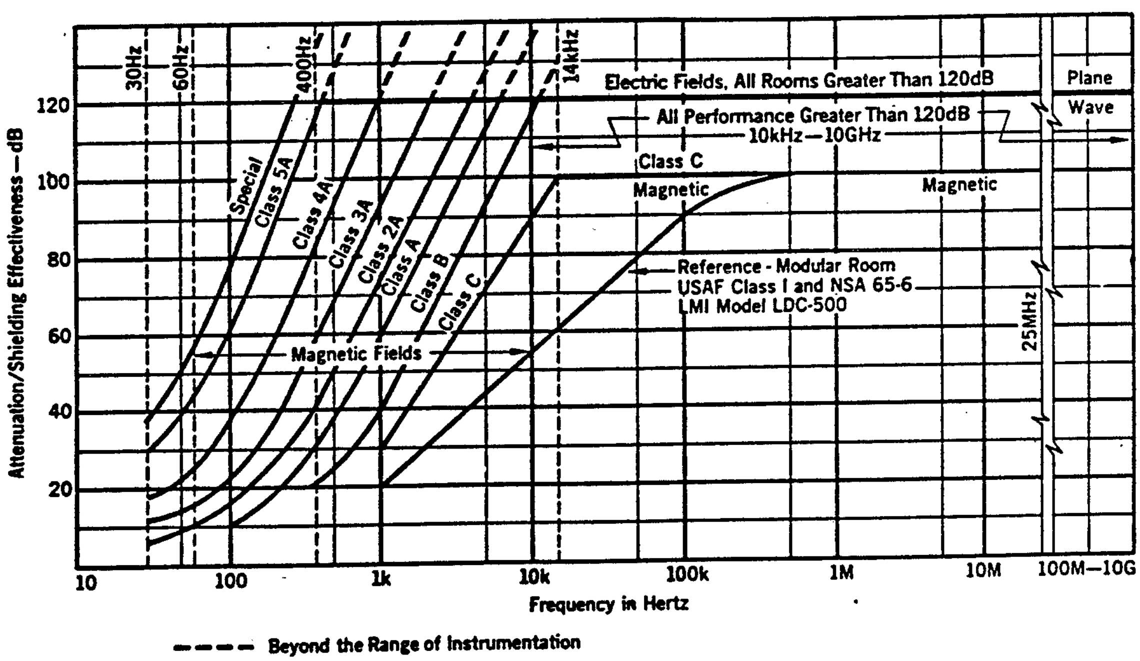


FIGURE 2-1

be carried by the power line long distances. High performance line filters are available from many sources and are highly effective. Commercial devices are available which reduce unwanted noise power by 100 db for frequencies above 14 kHz.

The term db is used to make the discussion of ratios easier. Db is an abbreviation for decibel. A decibel is equal to ten times the logarithm of the ratio of the power to one watt. Ten db is equal to 10 watts. If we reduce power by 100 db this equals dividing the power value by 10 billion.

2.2 Gain Generator

The wiggler is the component of an FEL which produces the laser light. It is similar for both types of accelerators, but will be longer in the case of the Induction device. The wiggler would not produce RF noise unless the electron beam collides with the beam tube walls. The small diameter of the wiggler's beam transport tube acts as a RFI filter because it appears as a wave guide with a high frequency cutoff. The inside diameter of the beam transport tube in the wiggler is less than .2 inches. This means that it has a cut off frequency of 34.6 GHz. For frequencies less than this the attenuation will be greater than 60 db per inch of length. All wiggler designs are hundreds of inches long.

It is reasonable to conclude that no RF energy will leave the wiggler section and therefore none will remain in the optical beam as it traverses the remainder of its path to the atmosphere.

2.3 Beam Dump

Once the electrons have left the wiggler they are removed from the optical beam path and are captured in the electron beam dump. This component has been questioned as one potential source of RF radiation, because the eleotrons are decelerated and therefore could generate RF through bremsstrahlung radiation.

The electrons which enter the beam dump have a narrow velocity distribution and lose most of their energy on their first collision. Most beam dumps trap the electrons in a block of carbon which has aluminum plates on both sides. This entire structure is contained in a steel tank to reduce the radiation produced by any activated species. The tank is a sealed structure with water circulation between the layers of aluminum. The front of the tank is sealed from the accelerator vacuum by a beryllium widow. Therefore the probability of any particles or energy escaping from the beam dump is, by design, very small.

Our calculations indicate that this steel vessel has greater than 120 db RFI suppression. As discussed later in this document, RFI measurements made on other accelerators, which have less robust beam dumps, show no sign of RFI leakage.

2.4 RFI Measurements from Three Accelerators

The data available about RFI associated with accelerator or laser facilities is presented here. We have included this information not as proof that the GBFEL TIE facility will be a low noise source, but as an example of what has been accomplished. The low noise level of current systems has been accomplished through normal accelerator and laser design, not with efforts to suppress RFI.

2.4.1 Stanford Linear Accelerator Data

There is no quantitative data from SLAC but we discussed some of their RFI experience with Dr Roger McConnell, formerly the SLAC engineer responsible for the design of their RF power system and now an expert consultant in the area of systems design to suppress RFI. Dr. McConnell has experience with the SLAC 50 MHz, 300 kv, 20 kw, RF accelerator cavities. After building the first one of this type for the SLAC facility he performed an informal test for RFI. A deep space radio telescope with a 90 foot diameter parabolic antenna is located 3/4 of a mile from the location where the RF cavity was in test. The power into the RF cavity was modulated with a 400 Hz signal. When the telescope pointed at the cavity, the telescope failed to detect any RF signal from the accelerator cavity. No special RFI shielding was used beyond that provided by the accelerator structure.

We can only conclude that the individual RF power supplies and their accelerator components can be electomagnetically quiet.

2.4.2 Livermore Data

Recent measurements made at Livermore on their Advanced Test Accelerator indicate that the peak electric field is nearly constant (slowly decreasing with frequency) at .05 V/m/MHz from 20 to 100 MHz. These measurements were made outside the radiation shield.

The ATA is not designed to provide a low noise RFI environment and has no special RF shielding. Further, the current at which the ATA operates is approximately three times that planned for the GBFEL, although the power and beam energy are greater for the GBFEL. The particular design of the ATA uses spark gap driven switches to fire the magnetic compressors. The design proposed for the GBFEL TIE will not use spark gaps but much quieter magnetic switches.

2.4.3 VLA measurements of the Los Alamos

VLB Array memo No. 401 by J. Oty documents data taken at the Clinton P Anderson Meson Facility located at Los Alamos. Frequencies from 50 MHz to 11.2 GHz were searched for noise from the accelerator. The equipment was able to measure signals down to a few femtowatts per square meter (one millionth of one billionth of a watt). These measurements were made within a kilometer of the accelerator. No RFI noise was detected.

3.0 Attenuation of RF Energy Over a Propagation Path

The energy from an electromagnetic source can reach a receiver in three ways. First, a free space wave travels directly from the source to the receiver. A second is the energy can be reflected from the source to the receiver. The third is the ground wave which follows the surface of the earth.

Figure 3.1 show how each of the different ways are related to the visible horizon.

3.1 Line-of-Site Propagation - Radar Horizon

The free space wave can reach the receiver only along the direct line-of-sight from the source. Therefore the receiver must be above the "radar horizon" or the point at which the radar energy directly from the source touches the curved surface of the earth. Due to atmospheric refraction the radar horizon is beyond the optical horizon or

$$d = 2*h*a*k$$

where d is the distance in meters
h is the height of the source (10 m)
a is the radius of the earth (6373 km)
k is the effective-earth's-radius factor (4/3).

Using the parenthetic values for the GBFEL-TIE the distance to the radar horizon is about 13 km. Any RF sources from the GBFEL-TIE will therefore radiate directly into neighboring receivers only at facilities within 13 km of the site. A more detailed analysis of the interference under these conditions is discussed in Section 4.

3.2 Reflected Propagation - Ionospheric and Tropospheric Effects

The ionosphere is that region of the atmosphere surrounding the earth that is ionized. During the day the ionized layers exist between about 90 and 1000 km above the earth's surface. The ionization layers between 200 and 400 km will reflect radio waves in the frequency range up to 40 MHz. The free space attenuation for these large distances will result in little or no noise from the GBFEL-TIE being received via reflection from the ionosphere. For a reflective layer 200 km high the free space loss is over 120 db (see equation in following section).

Tropospheric scattering results from the small random irregularities or fluctuations in the index of refraction of the atmosphere. These fluctuations will scatter energy in the frequency range of 200 MHz up to 10 GHz. The transmission losses for this type of propagation are very high. The path loss that is in addition to the normal free space loss is:

$$L = \frac{7.2 \times 10^{32} k_o{}^{1/3} T_h Cn^2}{d^{11/3}}$$

where k_o is the free space wave number
T_h is the half power beam width
Cn is the structure constant for the index of refraction fluctuations
d is the transmission distance.

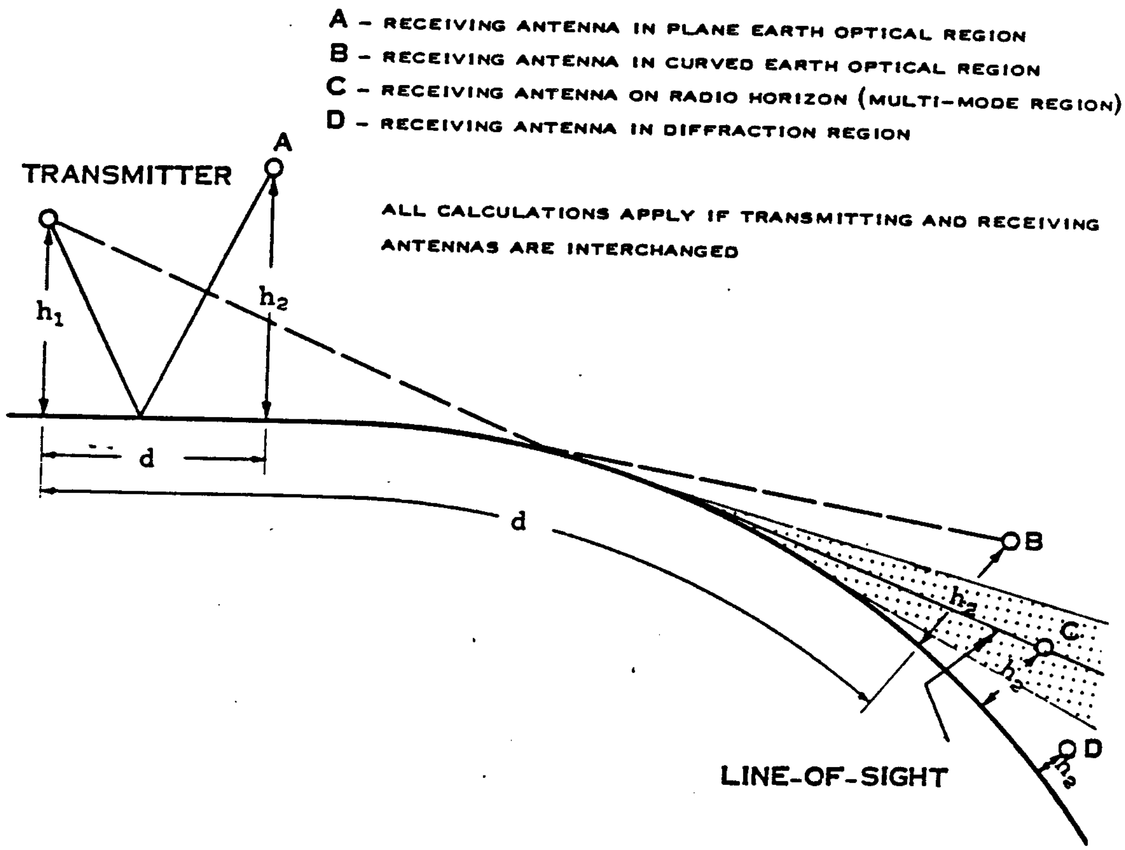


Figure 3–1 Diagram of Propagation Regions

For 3 GHz frequency this loss is over 105 db.

3.3 Surface Waves - Propagation by Diffraction

When antennas are located on or close to the ground propagation of the surface wave is the primary received energy in the frequency range from a few kilohertz up to several megahertz. In addition to the free space loss there are transmission losses due to diffraction from a spherical Earth surface and an irregular terrain which will include different kinds of obstacles.

3.4 RFI Attenuation Calculations

The following paragraphs will illustrate the methods used to calculate losses for the free space, spherical Earth, and obstacles.

Free Space Attenuation The power generated by a RF source will decrease with distance from the source due to the divergence of the electromagnetic radiation. The power density at a distance R meters from a radar that radiates a power of P_t watts is:

$$P_r = \frac{P_t}{4\,(PI)\,R^2}$$

Diffraction Over a Spherical Earth For determining diffraction attenuation relative to free space beyond the horizon, an approximate formula may be used over a smooth Earth (reference CCIR report 715)

$$20 \log \frac{E}{E_o} = F(d) + G(h_1) + G\,(h_2) \quad \text{dB}$$

where

E:	the received field-strength
E_o:	the field-strength in free space at the same distance
d:	the distance between the extremities of the path
h_1 & h_2:	the heights of the source and receiver above the spherical Earth

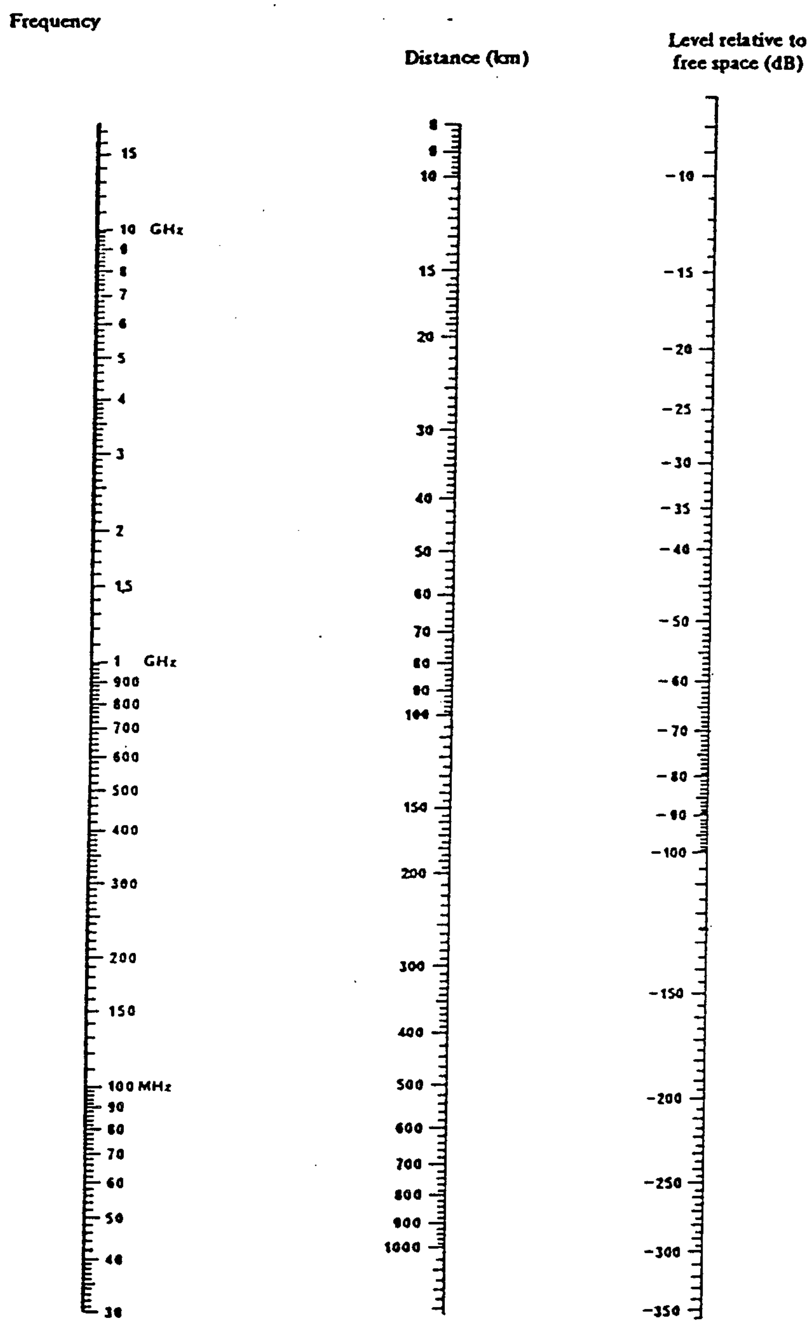
The functions F, (influence of the distance) and G, (height-gain) are given by the nomogram in Figure 3-2.

Diffraction Over an Obstacle For the terrain in the White Sands area a geometry such as illustrated in Figure 3-3 can be used. With this terrain the geometrical parameters are lumped together in a single dimensionless parameter v (reference CCIR report 715):

$$v = h\sqrt{\frac{2}{\lambda}\left(\frac{1}{d_1} + \frac{1}{d_2}\right)}$$

where

h	is the height of the top of the obstacle above the straight line joining the two ends of the path.
d_1 & d_2	are the distances of the two ends of the path from the obstacle.



Diffraction by a spherical earth — Attenuation due to distance

Figure 3-2

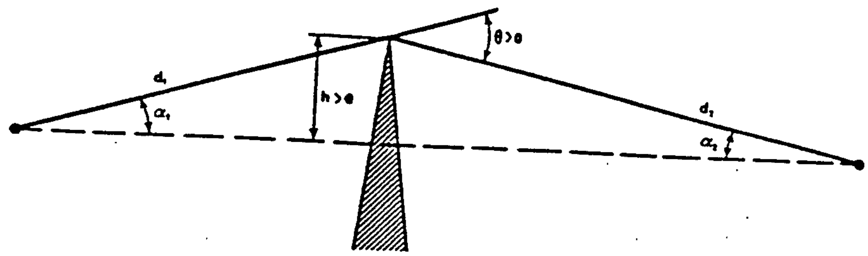


Figure 3-3

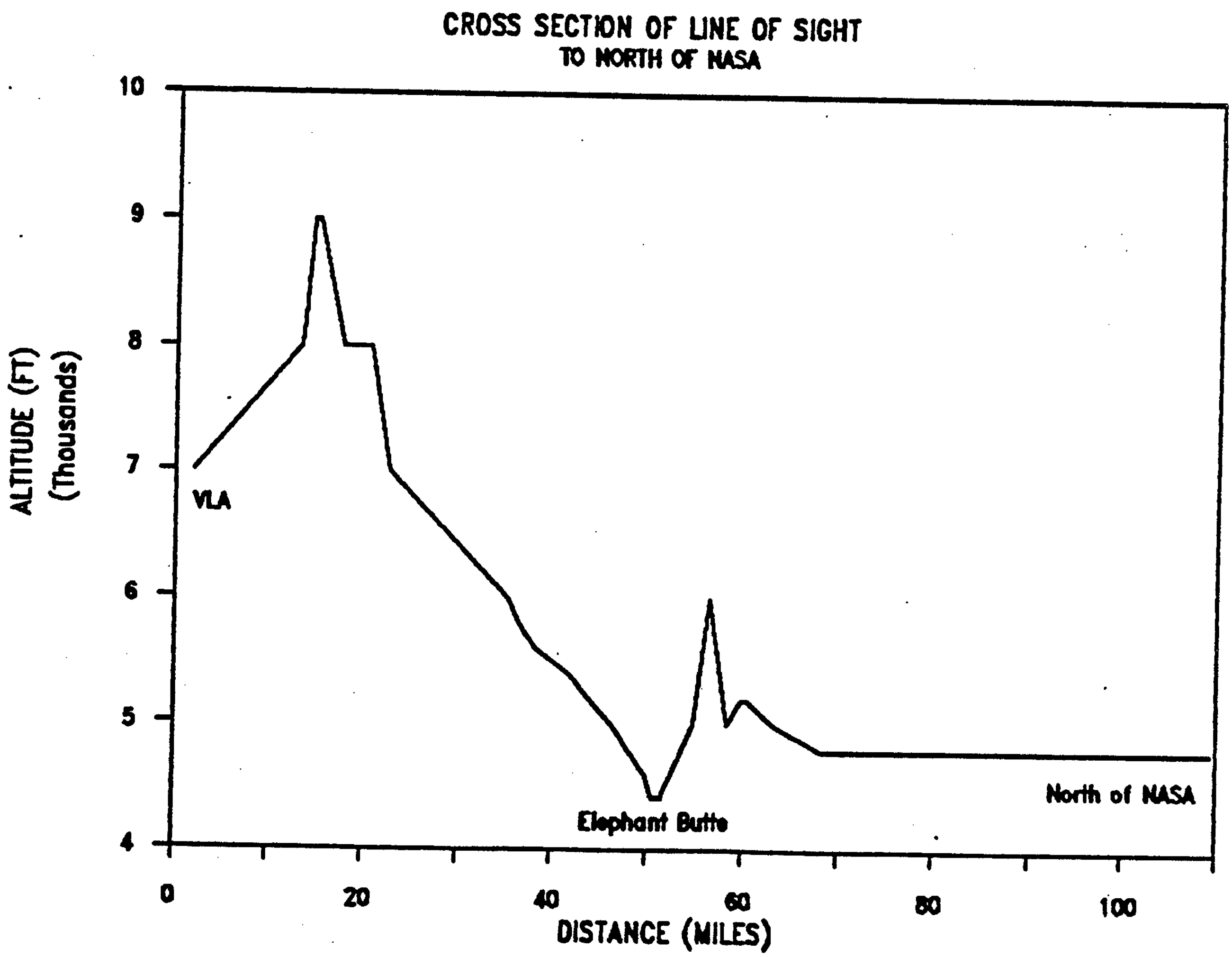


Figure 3-4

For v more positive than -1 an approximate value can be obtained from the expression:

Figures 3-4 through 3-6 show a cross section of the ground elevation between each GBFEL site and the VLA. These were used to estimate the RFI attenuation due to the difraction over an obstacle. Only the single highest point in each path was used to determine the loss for that path.

4.0 Potential for Conflicts

The methodology discussed in Section 3 was utilized to analyze the interference of the GBFEL-TIE. As a point of reference, it was assumed that the GBFEL-TIE would have the maximum radio frequency energy for personal operation, 100 watts/square meter, or 20 dbw/m^2. It is important to realize that this level is at least ten times greater than would be tolerated by the GBFEL TIE operators. A detailed assessment of the possible interference with the surrounding cities, the Very Large Array (VLA) Radio Astronomy Observatory, and the NASA TDRS facility were performed and are discussed in the following subsections.

4.1 Conflict with Surrounding Cities

High performance receivers utilized in some cities are sensitive to only micro-volts per meters, therefore they require a noise level of no greater than -110 dbW/m_2 in populated areas to preclude interference (Pan American Special Investigation Report 508, and A GRC review of high performance FM rercievers). Table 4-1 illustrates attenuation that can be expected for energy in the frequency range of 1 to 1000 MHz when the GBFEL-TIE is located at the candidate site closest to the city. This frequency range covers all the radio and television transmission frequencies. For the most stressing case (1 MHz from the Orogrande site at Orogrande), the resulting noise level is less than -175 dBw/m_2. This is 65 dbw/m_2 below what a sensitive receiver can detect.

4.2 Conflict with the VLA

The Very Large Array (VLA) radio telescope is extremely sensitive to very low levels of interfering signals. The telescope array has receiver bands from 73 MHz to 92 GHz. The most stringent interference requirements are at the low frequency bands. The VLA must have noise levels below -188 dbw/m_2 at 73 MHz to avoid interfering with the radio observations.

Table 4-2 contains a chart of the attenuation of 50 MHz noise if the site were located at North of Nasa, Orogrande, or Stallion. The attenuation factors included were shielding, propagation losses, and the antenna sidelobe loss (The Very Large Array: Design and Performance of a Modern Synthesis Radio Telescope, IEEE VOL. 71,NO.11,Nov 1983).

As illustrated, the closest and most stressing case is at Stallion, and the expected noise level is approximately -276 dbw/m_2. Again, this is

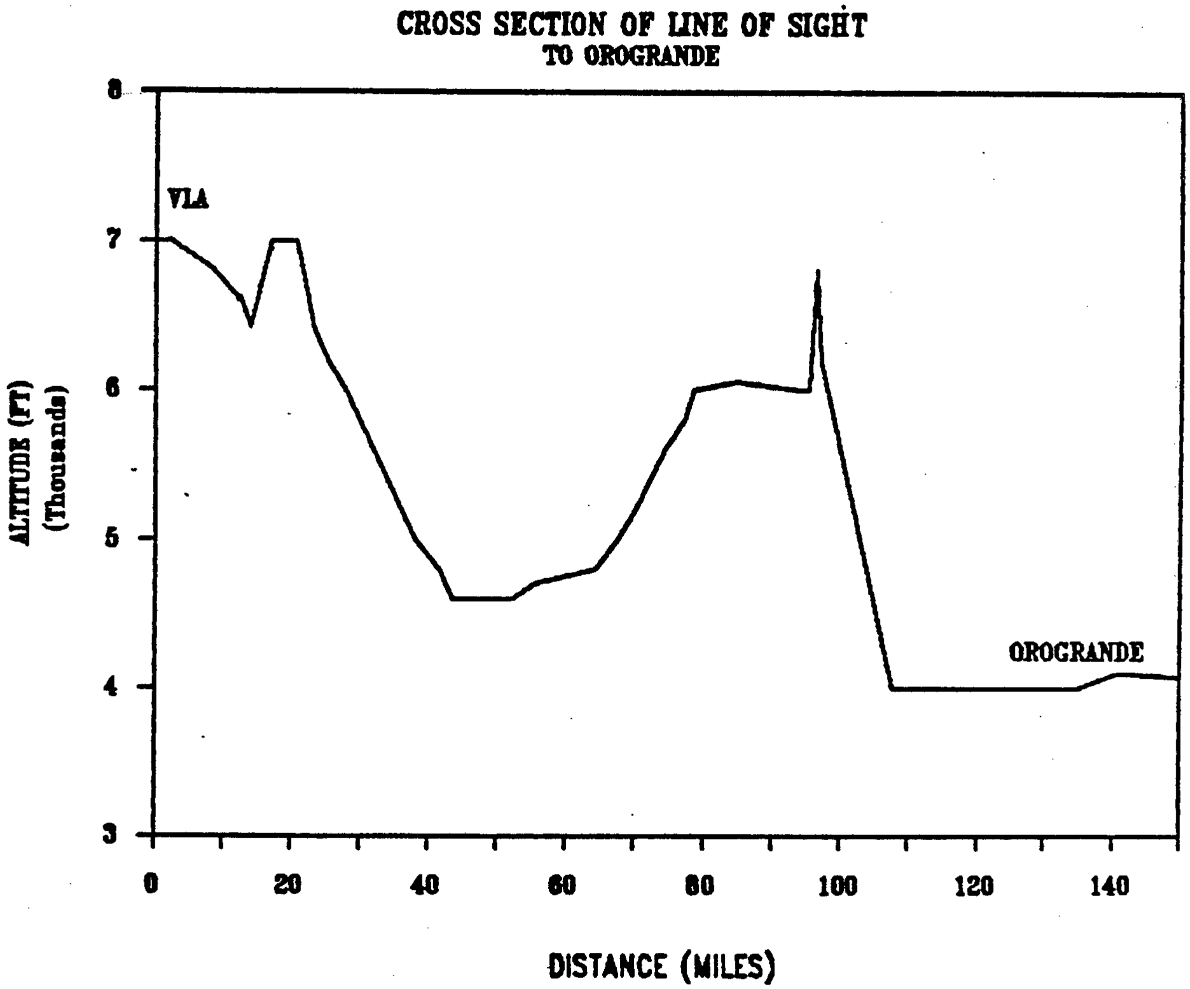

CROSS SECTION OF LINE OF SIGHT
TO OROGRANDE
VLA
OROGRANDE
ALTITUDE (FT)
(Thousands)
8
7
6
5
4
3
0
20
40
60
80
100
120
140
DISTANCE (MILES)

Figure 3-5

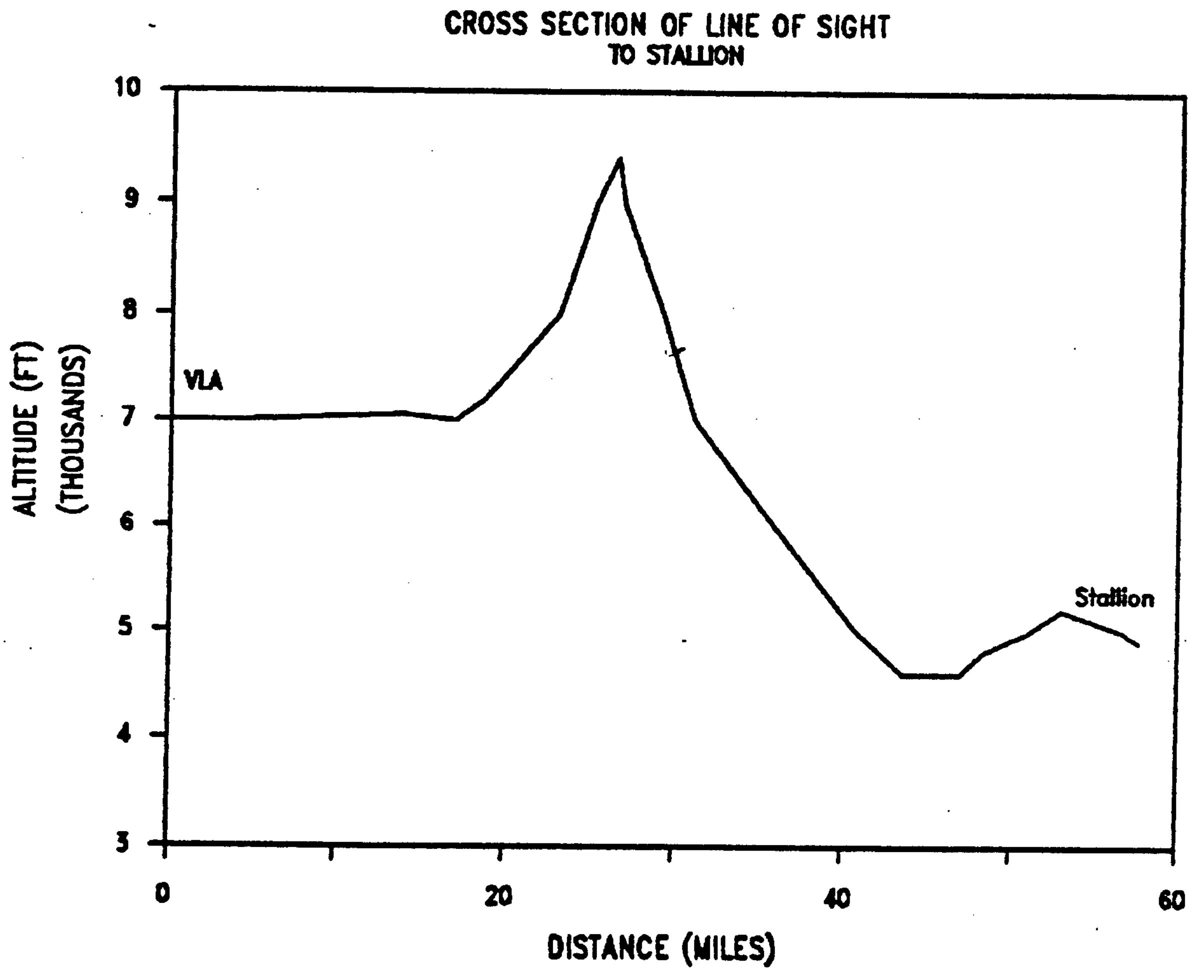

CROSS SECTION OF LINE OF SIGHT
TO STALLION
10
9
8
7
6
5
4
3
ALTITUDE (FT)
(THOUSANDS)
VLA
Stallion
0
20
40
60
DISTANCE (MILES)

Figure 3-6

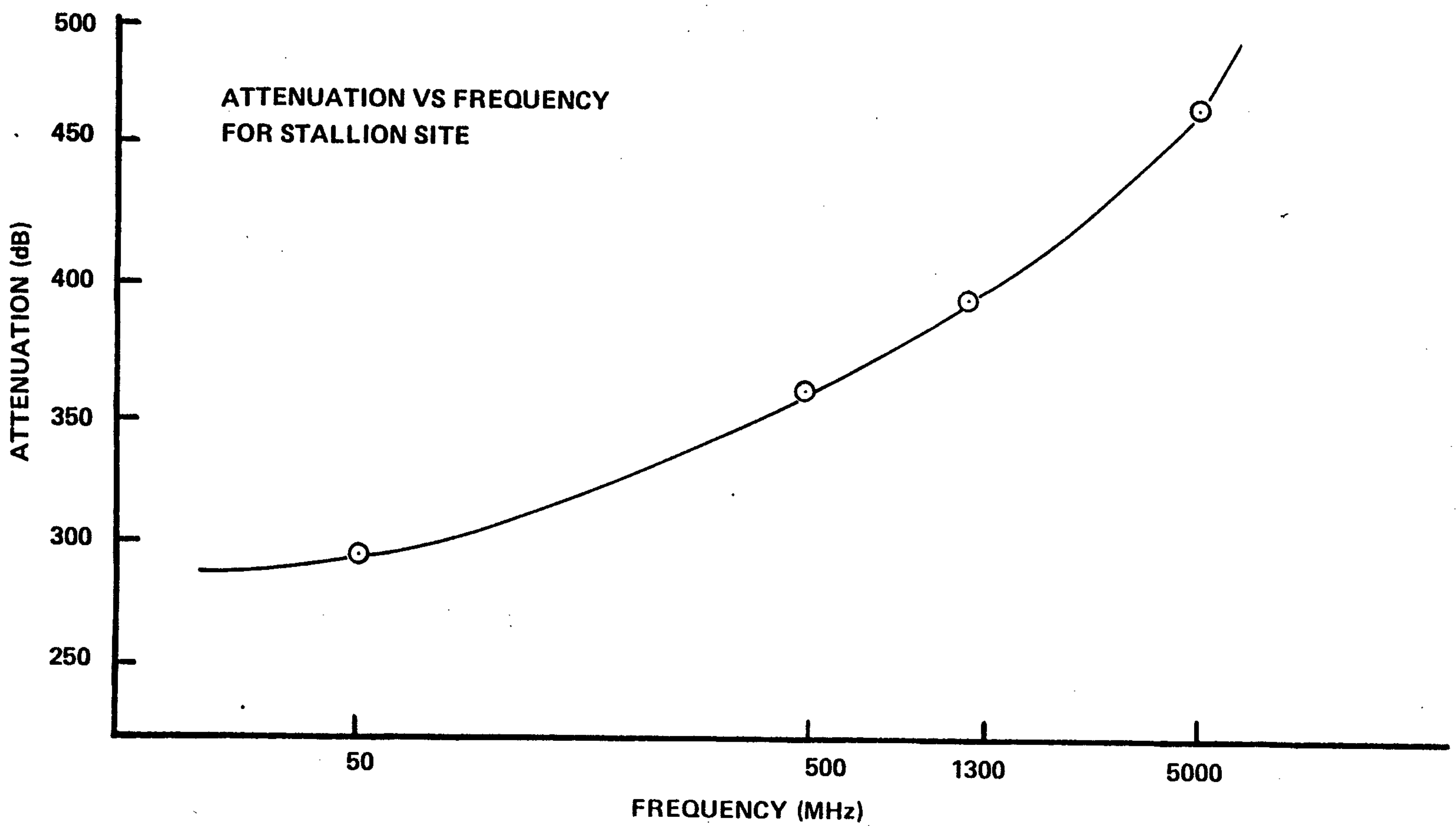

ATTENUATION VS FREQUENCY
FOR STALLION SITE
ATTENUATION (dB)
500
450
400
350
300
250
50
500
1300
5000
FREQUENCY (MHz)

Figure 4-1

TABLE 4-1

NORTH OF NASA TO LAS CRUCES ATTENUATION DUE TO:	1 MHz	100 MHz	1000 MHz
SHIELDING	120	120	120
FREE SPACE LOSSES	90	90	90
DIFFRACTION LOSSES	0	5	27
TOTAL	210	215	237

STALLION TO SOCORRO ATTENUATION DUE TO:	1 MHz	100 MHz	1000 MHz
SHIELDING	120	120	120
FREE SPACE LOSSES	90	90	90
DIFFRACTION LOSSES	0	0	17
TOTAL	210	210	227

OROGRANDE TO OROGRANDE ATTENUATION DUE TO:	1 MHz	100 MHz	1000 MHz
SHIELDING	120	120	120
FREE SPACE LOSSES	75	75	75
DIFFRACTION LOSSES	0	0	0
TOTAL	195	195	195

OROGRANDE TO ALAMAGORDO ATTENUATION DUE TO:	1 MHz	100 MHz	1000 MHz
SHIELDING	120	120	120
FREE SPACE LOSSES	95	95	95
DIFFRACTION LOSSES	0	12	38
TOTAL	215	227	253

VLA AT 50 MHz

LOSS	NORTH OF NASA	OROGRANDE	STALLION
SHIELDED ROOM	120	120	120
OBSTACLES	21	16	21
SPHERICAL EARTH	42	62	17
FREE SPACE	116	118	110
SIDE LOBES	28	28	28
TOTALS	327	344	296

TABLE 4-2

significantly below the noise level that would interfere with the radio telescope observations. Figure 4-1 contains a plot of the attenuation of noise from the Stallion site as a function of frequency across the sensitive frequency range. The 50 MHz case is the more stressing case, yet is still below the required noise level.

4.3 Conflicts with the NASA TDRS facility

Table 4-3 was taken from data in a TRW report to NASA on the potential interferance from the GBFEL TIE. The table shows the expected path loss and the amount of additional RFI suppression required to eliminate any interference. If we add the additional RFI attenuation due to shielding (120 dB), the GBFEL is at least 5 dB below the maximum limit. If we include the frequency of the TDRS recievers, we should derive added protection because the GBFEL TIE would produce less energy at the higher frequencies where the TDRS equipment operates.

ESTIMATED RFI LIMITS

LOCATION	BAND	PATH LOSS	LIMIT dBW_{ic}	DUE TO	LIMIT dBW_i/Hz	DUE TO
STALLION RANGE	S	−139	−50	RAIN	−82	TDRS
	K	−119	−49	RAIN	−94	RAIN
OROGRANDE	S	−123	−66	RAIN	−92	RAIN
	K	−99	−69	RAIN	−114	RAIN
NORTH OF NASA	S	−100	−89	LOCATION	−115	LOCATION
	K	−104	−64	RAIN	−109	RAIN

TABLE 4−3